ECONOMIC IMPACTS OF THE WA HISMELT PROJECT:

FULL REPORT

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EXECUTIVE SUMMARY

For this study, we conducted an MMRF-Green simulation of the impacts of the construction and operation of the WA HIsmelt Project (WAHP). The Project has two phases. In Phase 1, a commercial HIsmelt plant is constructed and becomes operational. The smelter produces pig iron initially for export. In Phase 2, a second HIsmelt plant is constructed and becomes operational. After three years, a steel plant is built, which takes all of the pig iron from the second HIsmelt plant and some from the first plant. We assume that all of the steel produced is sold for export. Also in Phase 2, licenses for the HIsmelt technology are sold overseas, yielding a stream of foreign income credits for the Australian economy.

Economic model

MMRF-Green is a multi-sector dynamic model of the Australian economy covering the six states and two territories. It models each region as an economy in its own right, with region-specific prices, region-specific consumers, region-specific industries, and so on. Since MMRF-Green is dynamic, it is able to produce sequences of annual solutions connected by dynamic relationships. The model also includes enhanced capabilities for environmental analysis, and a regional disaggregation facility that allows results for the six states to be disaggregated down to 56 sub-state regions.

As each state and territory is modelled as a mini-economy, MMRF-Green is ideally suited to determining the impact of region-specific economic shocks. It has already been used to address a wide range of issues, including the economic impacts of various large export-oriented projects, the effects of global trading in greenhouse emission permits, and the effects of changes in state and federal tax rates.

A number of enhancements have been made to the existing model to facilitate simulations of the WAHP. These involved building into the model's theory and database, two new industries representing the WAHP's pig iron and steel plants. The new industries are located in WA. Apart from the pig iron used in steel production, both plants produce exclusively for export.

Modelling Assumptions

Based on estimates provided by the WAHP operators, we assume the following values for production and investment in the Project:

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Iron										
Production ($Am)*				117	176	195	195	195	312	371
Investment ($Am)*	2	161	181	6	0	2	161	181	6	20
Steel										
Production ($Am)*										
Investment ($Am)*										

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Iron										
Production ($Am)*#	390	390	390	390	390	390	390	390	390	390
Investment ($Am)*	20	20	20	20	20	20	20	20	20	20
Steel										
Production ($Am)*				254	381	423	423	423	423	423
Investment ($Am)*		203	229	20	20	20	20	20	20	20

* Constant (2001) prices.

All of the production to 2013 is exported. In 2014, exports are valued at $235 million, and the steel plant purchases $155 million worth of iron. In every year after 2014, exports are valued at $140 million, with $250 million worth of production sold to the steel plant.

The Phase-1 iron plant starts up in 2004 with export sales worth $117 million. These increase to $195 million in 2006. In 2011, when the Phase-2 plant has reached full production, total sales of pig iron are worth $390 million. We assume that sales to this value are maintained in every year after 2011. In other words, in a typical long-run year (2020), total iron production from the WAHP is worth $390 million. Of this, $140 million come from exports and the rest from internal sales to the associated steel producer. The steel producer starts up in 2014 with sales worth $254 million. Sales increase to $423 million in 2016. We assume that sales to this value are maintained in every year after 2016.

Capital expenditure associated with the Phase-1 plant is valued at $350 million. Phase-2 capital expenditure on the second iron plant and the steel plant has a total value of $440 million. We assume that annual investments worth $40 million are required to maintain the Project's net capital after initial construction is finished.

In addition, we assume:

- that the return to capital in the WAHP[1] is in line with WAHP estimates (see below),
- that company tax payments are in line with WAHP estimates (see below); and
- that 50 per cent of the return to capital after depreciation and tax is available for domestic private consumption, with the remaining 50 per cent going overseas.[2]

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Iron										
Return to capital ($Am)*				21	50	60	60	60	60	60
Tax payable ($Am)*					7	11	11	12	13	20
Steel										
Return to capital ($Am)*										
Tax payable ($Am)*										

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Iron										
Return to capital($Am)*	60	60	60	50	81	97	97	97	97	97
Tax payable ($Am)*	24	26	27	38	11	11	11	12	12	12
Steel										
Return to capital($Am)*				-10	38	54	54	54	54	54
Tax payable ($Am)*				1	7	8	9	10	10	11

* Constant (2001) prices.

Finally, we assume that all of the license income comes from sales overseas, yielding the following income stream before tax:

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
License income ($Am)*						46	93	173	258	352

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
License income ($Am)*	489	265	275	285	294	311	322	337	351	365

* Constant (2001) prices.

[1] Return to capital is equivalent to earnings before interest, tax and depreciation.

[2] Information from the Project operators state that the projection is a joint venture involving Australian and overseas-based companies. It would seem that overseas companies comprise about 45 per cent of the ownership, with Rio Tinto (51 per cent) and Smorgan Steel (5 per cent) making up the rest. The operators claim that "all income will flow back to Australia". Our guess is that, given the ownership structure, only a portion of the overall return to capital (after depreciation) will come back to Australians. We assume 50 per cent.

The federal government taxes this income at the rate of 30 per cent. All of the remaining income is available for domestic private consumption.

Effects on Output and GSP

Table I shows the effects of the WAHP on selected macroeconomic variables in a typical long run year (i.e., 2020). The numbers in this table are expressed as deviations ($m, constant prices or thousands of persons) from an underlying base. They show that the Australia-wide effects of the WAHP are small relative to the overall size of the project. This is due to crowding out effects on employment and exports (see Section 2 of the main report). Additional employment demand associated directly and indirectly with the WAHP causes the national real wage rate to increase. This inhibits employment throughout the economy [By assumption, the WAHP has no long-run effect on the number of hours worked Australia-wide.] WAHP exports cause the exchange rate to strengthen. This reduces the competitiveness of Australia's traded-goods industries, crowding out other exports and encouraging imports.

At the state level, WA gains strongly from the WAHP. In the base case, real GSP in WA is valued at around $75 billion (2001 prices) in 2020. Thus, in that year, the addition of $563 million worth of iron and steel exports from the WAHP is equivalent to 0.75 per cent of WA's GSP. The application of this 0.75 per cent additional production causes an increase in WA GSP of 0.57 per cent in 2020. This implies a multiplier for the WA economy on stimulation of commodity exports from the WAHP equal to 0.76 (=0.57/0.75).

The simulated multiplier estimate is small compared to typical estimates derived from static input/output models. It is comparatively small for three reasons: (1) because of crowding out effects in WA arising from a higher national real wage rate and a stronger currency (see above), which are generally not captured in static input-output models; (2) because the WAHP relies relatively little on intermediate inputs (except iron ore, coal and chemicals) sourced from inside the state ; and (3) because the WA economy receives only a small proportion of the income from license fees

Most WA sectors are stimulated by increases in demands for their products in the expanded WA economy (see Tables 10 and 12 of the main report). The most trade-exposed sectors in the WA economy, and the ones that rely least on WA for absorption of their product, are the rural industries and the non-iron ore mining industry. Consequently, these sectors gain least in terms of output and employment from the stimulation due to the WAHP. The industries with the least direct international exposure are those in the service sector. Apart from the WAHP and industries with direct linkages to the WAHP, service industries have the largest percentage gains in output and employment.

The WAHP has slightly adverse effects on the rest of Australia (macro effects - Tables 8 and 9; industry effects - Tables 11 and 12). Why are the aggregate percentage-change effects in WA so large compared with the (negative) percentage-change effects for the rest of Australia? The large WA effect is a reflection of the smallness of the WA economy. In our typical long-run year, the WA economy is about ten per cent of the Australian economy. A small region can attract a significant percentage increase in its capital and labour without causing large percentage increases in the economy-wide demand for resources. Thus the WA economy can enjoy considerable additional growth without generating significant negative feedback from wage rates, capital costs and the exchange rate.

Table I: Macroeconomic Variables (absolute deviations from base)

Variable		2020
Real private consumption	Aus	280.4
($million, 2001 prices)	WA	58.9
	Rest	221.5
Real investment	Aus	109.9
($million, 2001 prices)	WA	60.4
	Rest	49.4
Real international exports	Aus	-14.5
($million, 2001 prices)	WA	270.0
	Rest	-284.5
Real international imports	Aus	121.6
($million, 2001 prices)	WA	62.4
	Rest	59.2
Real total value added (GDP/GSP)	Aus	247.6
($million, 2001 prices)	WA	278.9
	Rest	-31.3
Employment (persons)	Aus	-0.1
(thousand persons)	WA	2.4
	Rest	-2.5

Effects on Employment

In 2020, the stimulation to WA's GSP is accommodated by 0.81 per cent more employment (hours worked) and 1.75 per cent more capital (see Table 8 in the main report). In our model, employment is measured in terms of hours worked, not persons employed. So the percentage increase in employment represents a percentage increase in hours worked. To derive an estimate of the effect on numbers of persons employed, we assume that the WAHP does not affect industry ratios of employed persons to employed hours. Under this assumption, the 0.81 per cent increase in hours worked translates into roughly a one per cent increase in persons employed.[3] Based on this calculation, in 2020 around 6,900 additional full and part-time jobs have been created in WA (see Table I). Most of these additional jobs are located in service industries, notably trade, finance and public services (see Table 12 of the main report).

Effects on state and federal taxes.

Table II shows the impacts of the WAHP on government finances in the final year of the simulation. All numbers are in $million (constant 2001 prices)

[3] The percentage change in total hours worked in WA is less than the percentage change in persons employed because of differences in industry weights used to compile the two macro indexes.

Table II: Government Revenue (absolute deviations from base)

	2020
Total revenue	
Federal	149
State - WA	45
State - ROA	6
Direct taxes	
Federal	140
State - WA	1
State - ROA	0
Indirect taxes	
Federal	7
State - WA	23
State - ROA	2
Interest received	
Federal	2
State - WA	1
State - ROA	0
Commonwealth grants	
Federal	0
State - WA	19
State - ROA	3

As can be seen from this table, around 45 per cent of the additional revenue to the WA government in each year comes from additional Commonwealth grants. In our simulation, WA's share in those grants increases in line with the increase in its nominal GSP relative to the average nominal GSP of the rest of Australia.

Net Gain for Australians

The net gain to Australians arising from the WAHP in any year can be measured as the sum of changes in:

1. real private and public consumption; and
2. the real current account balance in the balance of payments.

Item 1 represents the additional real goods and services directly purchased by Australians. Item 2 measures the benefits from consumption foregone to reduce Australia's reliance on foreign borrowings.

Table III shows the simulated net gains to Australians arising from the WAHP. In 2020, the net gain is estimated to be $446.3 million in 2001 prices. Of this, $307.6 million is direct consumption, with $138.8 million of consumption foregone to reduce Australia's foreign liabilities.

In calculating the change in consumption, we assume that consumption expenditure is determined by household disposable income (HDI) (see subsection 5.1.3 in the main report). In calculating changes in HDI due to the WAHP, we take account of the before-tax factor income generated directly and indirectly by the Project, the tax paid on that income (which reduces the income available for consumption), and the amount of income that flows overseas. In 2020, real factor income directly generated by the project amounts to $465 million (2001 prices). This consists of $365 million from license sales, $80 million from capital earnings (after depreciation but before tax and interest) and $20 million from salaries. After taking account of taxes and income that goes overseas, the total amount available in 2020 for consumption is $276 million

(2001 prices). This is very close to the final increase in real consumption of $280.4 million. The difference is the change in real HDI *indirectly* generated by the Project.

The change in real current account balance in 2020 shown in Table III reflects, to a large degree, the improvement in the balance on income account caused by foreign credits from WAHP license sales. In 2020, these amount to $365 million in 2001 prices. Against this, we deduct about $60 million of WAHP earnings returned overseas to give an overall net improvement in the income-account balance of $300 million. The simulated change in the real current account balance in 2020 is $153 million. This implies a simulated deterioration in the real trade account balance of $147 million (=$300m - $153m).

Table III: Net Gain to Australians (absolute deviations ($m, constant 2001 prices) from base)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Change in real private consumption	0.4	30.3	38.2	17.0	24.8	49.4	101.4	141.6	159.7	206.6
Change in real current account balance	-2.3	-179.9	-198.1	-20.1	-20.4	-15.3	-172.3	-165.2	46.6	94.8
Total	-1.9	-149.5	-160.0	-3.1	4.3	34.0	-70.9	-23.6	206.3	301.4

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Change in real private consumption	265.5	260.8	263.0	244.9	248.2	257.5	264.0	269.7	275.2	280.4
Change in real current account balance	160.9	-68.4	-85.6	127.5	108.2	105.5	117.5	130.5	141.9	153.4
Total	426.4	192.4	177.4	372.4	356.4	363.1	381.5	400.2	417.1	433.8

1. INTRODUCTION

We use the MMRF-Green model[4] to simulate the impacts of the construction and operation of the WA HIsmelt Project (WAHP). The Project has two phases. In Phase 1, a commercial HIsmelt plant is constructed and becomes operational. The smelter produces pig iron initially for export. In Phase 2, a second HIsmelt plant is constructed and becomes operational. After three years, a steel plant is built, which takes all of the pig iron from the second HIsmelt plant and some from the first plant. We assume that all of the steel produced is sold for export. Also in Phase 2, licenses for the HIsmelt technology are sold overseas, yielding a stream of foreign income credits for the Australian economy.

The report is structured as follows. Section 2 contains a description of some of the key mechanisms via which increased final investment and export demand associated with the WAHP affects the national economy. Attention is focussed on the limitations of input-output analysis; the methodology most commonly used to quantity the economic impact of large-scale projects. We argue that MMRF-Green with its fuller supply-side specification can provide a more balanced assessment of the costs and benefits of demand expansion arising from the WAHP.

MMRF-Green is described in Section 3. Section 3.1 contains an overview of the standard model. Section 3.2 reviews the enhancements required to model the impacts of the WAHP. In making projections of the WAHP-impacts, we first produce a base case, i.e., a business-as-usual forecast for the development of the economy over the period 1997 to 2020. Details of the base case are given in Section 4. Next we produce revised forecasts including shocks through time to represent the construction and production phases of the WAHP. The effects of these shocks are reported in Section 5 as deviations between the values of variables in the revised forecast and their values in the base case.

2. KEY MECHANISMS VIA WHICH EXPANSION IN FINAL DEMAND AFFECTS THE ECONOMY

Increased final demand (investment and exports) associated with the WAHP affects the economy in a variety of ways. First, there are the direct demand effects experienced by the producers of the final goods and services. These are followed by a succession of indirect demand effects, which are first felt when the final producers purchase more intermediate inputs from other industries, and construct and install new plant and equipment. These initial indirect demand effects set in train further rounds of indirect effects as firms supplying the intermediate inputs to more directly impacted industries, and constructing their fixed capital, raise their own production levels in order to meet the increased demand, etc.

At each stage of the process, induced income effects may augment the direct and indirect demand effects. These occur when the households supplying the additional labour, and the owners of the newly utilised fixed capital, spend their increased incomes on final goods and services. As before, these expenditures set off further successive rounds of indirect demand effects, and hence further induced income effects.

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[4] MMRF-Green is a dynamic multi-regional, multi-sectoral model of the Australian economy. It produces projections for the annual time paths of variables describing macroeconomic conditions for the national economy and for the economies of the six states and the two Commonwealth territories; various aspects of activity in region-specific industries; and greenhouse gas emissions disaggregated by region-specific source. MMRF-Green is derived from the MMR (Meagher and Parmenter, 1993) and MMRF models (Peter *et al.*, 2001 (forthcoming)).

The sequence of demand effects described above arises from the linkages between industries in the chains of production and distribution of goods and services. The input/output model is designed to capture these inter-industry linkages. As such, it has become a commonly used tool for analysing the effects of increased final demand on the economy.

The input/output calculations generally assume that there are no supply-side constraints on the economy. Labour and capital are assumed to be available with perfect elasticity of supply. There is no trade-balance constraint, nor any constraint on government borrowing. Accordingly, additional final demand is accommodated by increased domestic output, without any crowding out of other elements of domestic demand. Hence, in the typical input/output calculation, an increase in demand generates an increase in domestic output that is bigger than the direct increase in demand. It also generates a move towards surplus in the balance of trade; the increase in exports being only partially offset by increases in the demand for imports induced by the indirect expansion of domestic aggregate demand.

Modern multi sectoral models, such as MMRF-Green, allow for the inclusion of the constraints absent from the input/output calculations. Generally, input/output calculations can be specified in such models as a special case. Moreover, the modern models include more general specifications of the behaviour of consumers, producers, investors, etc. than those allowed in the input/output model. An assumption underlying the input/output model is that, for each industry, fixed amounts of all intermediate inputs and primary factor inputs are required in order to produce a unit of output. This rules out all possibilities for producers to economise in the use of one input by using more of others i.e., it rules out any possibility of industries adjusting their input structures to changes in relative prices. In modern multi-sectoral models, substitution possibilities are incorporated so that the behaviour of agents in the model economy is sensitive to changes in relative prices as well as to quantity variables. For example, in MMRF-Green if import prices rise relative to the prices of domestically produced goods, purchasers substitute domestic goods for imports. Similarly, if wages rise relative to the cost of employing capital, capital/labour ratios tend to rise.

An implication of including the additional constraints together with an active price mechanism is that the expansion effects of increases in one element of demand tend to be offset by crowding out of other elements. For example, suppose an expansion of steel exports pushes up the demand for engineering specialists. In the presence of a constraint on labour supply this will bid up wage rates, increasing production costs throughout the economy. Industries heavily exposed to international competition will be unable to pass on these cost increases without losing sales. If a balance of payments constraint is also in place, the expansion in steel exports will put upward pressure on the real exchange rate to prevent the trade balance from moving towards surplus. This encourages imports at the expense of domestic industries. It also reduces the general competitiveness on world markets of Australian export industries.

3 MMRF-GREEN

3.1 The Standard Model

MMRF-Green is founded on the Monash Mult-Regional (MMR) model.[5] The current version of MMRF-Green was built in four stages. In the first stage, MMR was transformed into a dynamic system by the inclusion of dynamic mechanisms taken from the MONASH

[5] A progress report on the development of the MMR model is given in Meagher and Parmenter (1993). In 1996, MMR was adapted for forecasting by the inclusion of enough dynamics to accumulate variables such as capital stocks and foreign debt over medium-run periods. This version was called the MMR Forecasting (MMRF) model.

model. These were added as self-contained blocks, allowing MMRF-Green to include MMR as a special case. The second and stages involved a range of developments designed to enhance the model's capacity for environmental and transport analysis. In the fourth stage, a regional disaggregation facility was added, which allows state-level results to be disaggregated down to sub-state regions.

3.1.1 Overview of MMR

MMR divides Australia into the six states and two territories. There are five types of agents in the model: industries, capital creators, households, governments, and foreigners. The number of industries is limited by computational constraints. Currently, MMRF-Green identifies 42 industry sectors that produce in total 47 products (see Table 1). These industries/products are aggregates of the 116 individual industries recognised in the primary database (see Peter *et. al.*, forthcoming 2001).

For each sector in each region there is an associated capital creator. The sectors each produce a single commodity and the capital creators each produce units of capital that are specific to the associated sector. Each region in MMR has a single household and a regional government. There is also a federal government. Finally, there are foreigners, whose behaviour is summarised by export demand curves for the products of each region and by supply curves for international imports to each region.

MMR determines regional supplies and demands of commodities through optimising behaviour of agents in competitive markets. Optimising behaviour also determines industry demands for labour and capital. Labour supply at the national level is determined by demographic factors, while national capital supply responds to rates of return. Labour and capital can cross regional borders so that each region's stock of productive resources reflects regional employment opportunities and relative rates of return.

The specifications of supply and demand behaviour co-ordinated through market clearing equations comprise the general equilibrium (GE) core of the model. There are two blocks of equations in addition to the core. They describe regional and federal government finances and regional labour markets.

Data requirements for MMR

The GE core of MMR requires a multi-regional input-output table together with values for the elasticities of substitution in the CES nests of the specifications of technologies and preferences. The government finance block requires data on regional and Federal government revenues and outlays. The regional labour market block requires regional demographic, employment and labour force data.

The Australian Bureau of Statistics (ABS) publishes suitable regional data for the government finance and labour market blocks. However, it does not compile multi-regional input-output (IO) tables. Disaggregating the national IO table used in the national GE model, MONASH, created IO data for the GE core. The regional disaggregation of the national IO table involved three steps: (i) splitting of columns using regional proportions of industry outputs and final demands; (ii) splitting of rows using inter-regional trade data available from published sources (e.g., Quinlan, 1991); and (iii) application of RAS procedures to ensure equality in the multi-regional input-output table between the outputs and sales of regional sectors.

For values of primary-factor and domestic-import substitution elasticities, MMR relies on the MONASH national database. There are no reliable estimates of substitution elasticities between domestic products from different regional sources. High numbers are assumed to be appropriate - five times the values for domestic/import substitution elasticities. This means

that different domestic varieties of a good are closer substitutes than are domestic and imported varieties.

Computing solutions for MMR

MMR is a system of non-linear equations. It is solved using GEMPACK, a suite of programs for implementing and solving economic models. A linear, differential version of the MMR equation system is specified in syntax similar to ordinary algebra. GEMPACK then solves the system of non-linear equations as an Initial Value problem, using a standard method, such as Euler or midpoint. For details of the algorithms available in GEMPACK, see Harrison and Pearson (1996).

3.1.2 From MMR to MMRF-Green: Inclusion of MONASH dynamics

There are two main types of inter-temporal links incorporated into MMRF-Green: physical capital accumulation and lagged adjustment processes.

Physical capital accumulation

It is assumed that investment undertaken in year t becomes operational at the start of year t+1. Under this assumption, capital in industry i in state/territory s accumulates according to:

$$K^s_{t+1}(i) = (1 - DEP^s(i)) \times K^s_t(i) + I^s_t(i) \qquad (1)$$

where:

$K^s_t(i)$ is the quantity of capital available in industry i located in s at the start of year t;

$I^s_t(i)$ is the quantity of new capital created for industry i during year t; and

$DEP^s(i)$ is the rate of depreciation in industry i, treated as a fixed parameter.

Given a starting point value for capital in t=0, and with a mechanism for explaining investment through time, equation (1) can be used to trace out the time paths of industry capital stocks.

Investment in industry i in state/territory s in year t is explained via a mechanism of the form

$$\frac{K^s_{t+1}(i)}{K^s_t(i)} - 1 = F^s_{it}[EROR^s_t(i)] \qquad (2)$$

where

$EROR^s_t(i)$ is the expected rate of return on investment in industry i in s in year t; and

$F^s_{it}[\ ]$ is an increasing function of the expected rate of return with a finite slope.

The expected rate of return in year t can be specified in a variety of ways. As in MONASH, in MMRF-Green two possibilities are allowed for, static expectations and forward-looking model-consistent expectations. Under static expectations, it is assumed that investors take account only of current rentals and asset prices when forming current expectations about rates of return. Under rational expectations the expected rate of return is set equal to the present value in year t of investing $1 in industry i in region r, taking account of both the rental earnings and depreciated asset value of this investment in year t+1 as calculated in the model.

Lagged adjustment processes

MONASH contains a number of lagged adjustment processes, but just one is included in MMRF-Green. This relates to the operation of the labour market in year-to-year policy simulations.

In comparative static analysis, one of the following two assumptions is made about the national real wage rate and national employment:

1. the national real wage rate adjusts so that any policy shock has no effect on aggregate employment; or
2. the national real wage rate is unaffected by the shock and employment adjusts.

MONASH's treatment of the labour market allows for a third, intermediate position, in which real wages can be sticky in the short run but flexible in the long-run and employment can be flexible in the short-run but sticky in the long-run. The same idea is applied in MMRF-Green. For year-to-year policy simulations, it is assumed that the deviation in the national real wage rate increases through time in proportion to the deviation in aggregate employment from its base case-forecast level. The coefficient of adjustment is chosen so that the employment effects of a shock are largely eliminated after about ten years. This is consistent with macroeconomic modelling in which the NAIRU is exogenous.

3.1.3 MMRF-Green: Environmental enhancements

MMRF-Green has been enhanced in a number of areas to improve its capability for environmental analysis. These enhancements include:

1. an energy and gas emission accounting module, which accounts explicitly for each of the 42 industries and eight regions recognised in the model;
2. equations that allow for inter-fuel substitution in electricity generation by region; and
3. mechanisms that allow for the endogenous take-up of abatement measures in response to greenhouse policy measures.

Emissions accounting

MMRF-Green tracks emissions of greenhouse gases at a detailed level. It breaks down emissions according to:

1. emitting agent (42 industries and residential);
2. emitting state or territory (8); and
3. emitting activity (5).

Most of the emitting activities are the burning of fuels (black coal, natural gas, brown coal or petroleum products[6]). A residual category, named Activity, covers emissions such as fugitives and agricultural emissions not arising from fuel burning.

The resulting 42 x 8 x 5 matrix of emissions is designed to include all emissions except those arising from land clearing. Emissions are measured in terms of carbon dioxide equivalents, $C0_2$-e. The main sources of data for the matrix of emissions are Fry (1997) and the National Greenhouse Gas Inventory (1997).

[6] Each of these fuels is identified as a separate commodity within the model (see Table 1).

Inter-fuel substitution

Inter-fuel substitution in electricity generated is handled using the "technology bundle" approach (e.g., Hinchy and Hanslow, 1996). Five power-generating industries are distinguished based on the type of fuel used (see Table 1). There is also an end-use supplier (*Electricity Supply*). The electricity generated in each state/territory flows directly to the local end-use supplier, which then distributes electricity to local and inter-state users. The end-use supplier can substitute between the five technologies in response to changes in their production costs. For example, the Electricity supply industry in NSW might reduce the amount of power sourced from coal-using generators and increase the amount sourced from gas-fired plants. Such substitution is price-induced; the elasticity of substitution between the various types of electricity used by the Electricity supply industry in each state is set to 5.

For other energy-intensive commodities used in industry, MMRF-Green allows for substitution possibilities by including a weak form of input-substitution specification. If the price of say, Cement (industry 15), rises by 10 per cent relative to other inputs to construction, the Construction industry (industry 29) will use 1 per cent less Cement and, to compensate, a little more of labour, capital and other materials. In most cases, as in the Cement example, we have imposed a substitution elasticity of 0.1. For three important energy goods, Petroleum products (industry 13), Electricity supply (26), and Urban gas distribution (27), the substitution elasticity in industrial use is 0.25. This input substitution is driven by price changes, and so is especially important in emission-policy scenarios, which makes outputs of emitting industries more expensive.

Endogenous take-up of abatement measures in response to greenhouse policy measures

In base case simulations, non-combustion emissions are modelled as directly proportional to the output of the related industries. In the policy scenarios, we allow for abatement of these emissions. The amount of abatement is directly related to the price of emissions permits (or the level of the carbon penalty). The constants of proportionality are derived from point estimates, from various sources, of the extent of abatement that might arise at a particular tax level.

3.1.4 MMRF-Green: Transport enhancements

Incorporate a multi-product refining industry

MMR makes no allowance for multi-industry products or for multi-product industries. This convention is particularly inappropriate in modelling the petroleum industry, which produces a range of petroleum products used for varying transport purposes. Accordingly, we have introduced into MMRF-Green a multi-product petroleum refining industry. This allows the existing petroleum industry (13 Petroleum products) to produce six products:

1. Petroleum for automotive use only (PetrolAuto);
2. Petroleum for aviation use only, commonly called AvGas (AvGasoline);
3. Aviation turbine fuel (AvTurbine);
4. Diesel for automotive use (Diesel);
5. LPG for automotive use (LPG); and
6. Other petroleum products, which includes kerosene, heating oil, fuel oil, paraffin wax, grease base stock, petroleum jelly and petroleum solvents (PetrolOther).

Improved treatment of motor vehicles in the household demand system

MMRF-Green includes a revised treatment of motor vehicles in the model's household demand system. Under the revised treatment, cars are treated as durables, providing private

transport services to households. The revisions have been implemented via the inclusion of a dummy industry, *41 Private transport services*. Its capital is the stock of motor vehicles used by households for transport. Its intermediate inputs are fuel and materials (repairs, tyres, etc.) used to maintain and to run the private vehicle fleet. The industry sells only to consumers. With the revised treatment in place, consumers do not directly buy motor vehicles, nor do they buy the fuels and materials associated with vehicles. Instead, they purchase private motor vehicle services, which effectively are combinations of the services provided by the vehicle stock, and of the fuel and materials associated with vehicles.

3.1.5 MMRF-Green: Disaggregation to sub-state regions

Few multi-regional models of the Australian economy have the level of sectoral detail supported by MMRF-Green. This detail is usually more than adequate for contributions to public discussions on the effects of changes in policies concerning taxes, trade and the environment. However, people wanting to use MMRF-Green in business and public sector planning are often frustrated by the lack of relevant regional detail. This applies especially to people interested in regional adjustment issues.

It is with these people in mind that we have incorporated into MMRF-Green a tops-down method that enables disaggregation of state-level results for output, employment and greenhouse-gas emissions down to projections for 56 sub-state regions. The method is an adaptation of the regional disaggregation method first devised by Leontief *et al* (1965), in the context of an input-output model, and first applied to sub-state regions in Australia by Adams and Dixon (1995).

The geographic boundaries of the sub-state regions recognised in the MMRF-Green disaggregation facility are based on the Statistical divisions defined in the Australian Standard Geographical Classification (ABS catalogue number 1216.0). Our division structure differs slightly from that of the ABS. We combine the ABS's Darwin and *Northern Territory - balance* divisions into one division, Northern Territory. Similarly, Canberra and *ACT - balance* are combined into one division, Australian Capital Territory. Note that both territories are distinguished as separate regions in MMRF-Green. Hence, the tops-down disaggregation facility provides no additional detail for them. We also adopt a slightly different regional classification for WA than that defined by the ABS. Our WA regions are based on the classification used by the WA department of Commerce. Finally, we identify the energy intensive La Trobe Valley in Victoria as a separate region (region 24), with 23 Gippsland defined to include all areas in the ABS statistical division *Gippsland* other than the La Trobe Valley.

Methodology

The methodology for tops-down regional disaggregation involves firstly classifying each of MMRF-Green's industries (see Table 1) into one of two categories: state and local. State industries produce commodities that are readily traded across sub-state regional boundaries. Examples are most agricultural and mining industries. The regional outputs of industries producing state commodities are assumed to move in line with the statewide percentage rates of change calculated by MMRF-Green.

Local industries produce commodities for which demand within each sub-state region is satisfied mainly from production in that region. Examples include perishable items and services like wholesale and retail trade. The outputs in each region of industries producing local commodities are modelled as depending mainly on demand within the region. In calculating the local demand for the output of local industry j, MMRF-Green takes account of:

1. intermediate and investment demands both by local industries and by state industries located in the sub-state region;

2. the region's household demands, which are a function of population and employment changes and of the change in consumption at the state level;
3. government demand; and
4. (if industry j's output is a margin commodity like transport) the usage of industry j's product in facilitating the flow of local and state commodities within the sub-state region and international export flows out of the region.

This gives our regional calculations a multiplier property: the effect on a sub-state region's overall level of activity of a favourable mix of state industries is multiplied through induced effects on the output and employment of the region's local industries.

In the regional disaggregation we allow for the possibility of some demand for local commodities outside the region of their production, but not from outside the state in which the region is located. This is because our data imply that for almost all commodities there is at least some imbalance at the sub-state regional level between demand and supply.

3.2 Changes required to model the WAHP

To capture the input-output linkages specific to the WAHP, we have modified the model's core database to incorporate a new pig iron industry and a new steel industry in WA. Table 2 lists the shares of intermediate inputs and primary factor inputs for the two new WAHP industries. These are based on shares for the existing iron and steel industries in WA, heavily modified by data supplied by the WAHP operators. For the purposes of the simulations, we have assumed that all sales from the new iron industry are either to export or to the new steel industry, and that all sales from the new steel industry are to export. To avoid increasing the overall size of the model, the new WA industries take the place of two existing WA industries. The existing industries are *42 Dummy* (now *42. WAHP iron plant)* and *8 Brown Coal*[7] (now *8. WAHP steel plant*).

4. BASE CASE PROJECTION

In this section, we discuss the base-case projection used in the report. The section contains two subsections. In Subsection 4.1 we describe the key inputs to the base-case projection. These cover: state and national macroeconomic variables; rates of change in industry technologies; and exports, production and investment for some of the major agricultural, minerals and energy industries. Base-case forecasts for industry output are presented in Subsection 4.2.

4.1. Inputs to base-case projection

We incorporate the views of many specialist organisations into our base-case forecasts. For the forecast years, 1997 to 2008, we use:

- macroeconomic forecasts from Access Economics and state Treasury departments ;
- national-level forecasts of inbound tourism numbers from the Tourism Forecasting Council (TFC) and forecasts of real foreign-tourist expenditure by region from Access Economics;
- national-level assumptions for changes in industry production technologies and in household preferences from CoPS ; and

[7] Our model makes an allowance for a brown coal industry in every state and territory. However, brown coal is only produced in VIC. Thus the existing brown coal industry in WA has zero costs and zero sales.

- forecasts for the quantities of agricultural and mineral exports, and estimates of capital expenditure on major minerals and energy projects from the Australian Bureau of Agricultural and Resource Economics (ABARE) .

For the remainder of the forecast period, 2008 to 2020, we use, in the main, trend annual growth rates from the preceding ten years.

Macroeconomic inputs (Table 3)

Table 3 shows our forecasts for selected macroeconomic variables in terms of average annual growth rates over the period 1997 to 2020. All of these forecasts are either directly imposed or are implied by exogenous inputs.

Real GDP is assumed to grow at an average annual rate of 2.9 per cent (row 8). The regions with the best growth potential in terms of real GSP growth are WA (3.4 per cent per annum annual growth) and QLD (3.3 per cent). The states with the worst growth potential are TAS (2.1 per cent) and SA (2.4 per cent). In general, the forecast growth rates are in line with the long-run growth potential for each economy. Note, however that for QLD and WA the forecast growth rates are below the average rates of the last five years, while for TAS and SA forecast growth is higher than recent experience. Factors such as the Asian financial crisis, the prospect of a prolonged period of slow growth in Japan and a forecast slowdown in the US economy, make it unlikely that the foreign-export-oriented states like QLD and WA can sustain their recent strong performance. On the other hand, we are assuming that some of the negative factors underlying the recent poor performance of SA and ACT, such as declining population growth and the stagnation of some foreign-import-competing industries, will be gradually reversed allowing a pick up in growth for these states.

Over recent years, real private consumption has grown faster than real GSP in most regions. However, this trend is not expected to continue. As can be seen by comparing rows 1 and 8 in Table 3, we expect that real consumption will grow roughly in line with real GSP in each region over the forecast period.

Growth in real investment (row 2) at the national level is forecast to be a fairly modest 2.9 per cent. This reflects initial conditions. 1998 was a very strong year for investment, and only modest investment growth is required to maintain the historically normal economy-wide investment/capital ratio of three per cent. Forecast differences across regions reflect a combination of different initial conditions and specific assumptions about large projects such as the Comalco aluminium plant in QLD.

Over the past fifteen years real international exports (row 6) and real international imports (row 7) have grown rapidly relative to real value added (row 8) in each region. This reflects several factors: declining transport costs; improvements in communications; reductions in protection in Australia and in our major trading partners; and technological changes favouring the use of import-intensive goods such as computers and communication equipment. All these factors are expected to continue through the forecast period, leading to further increases in the ratios of the volume of international trade to real value added. However, these increases will be comparatively moderate due, in part, to the short-term negative impacts of the Asian crisis.

We are assuming that employment (row 9) in each region will grow at rates that are consistent with long-run productivity trends. Thus, for example, we have productivity growth at an average rate of 1.6 per cent, while in Tas we are forecasting productivity improvement at the rate of 1.4 per cent.

Assumptions for changes in technology and tastes (Table 4)

Table 4 shows our assumptions for changes in the preferences of households and for changes in the production technologies of industries. These are applied uniformly across regions. The numbers are based, in part, on extrapolated trends calculated from a MONASH simulation for the period 1987 to 1997.

Our assumptions for household tastes are summarised in the first column of numbers in Table 4. For example, we assume that consumption of *Financial and business services* will increase at a rate 1.1 per cent a year faster than can be explained on the basis of changes in prices and changes in the average budget of households.

The second column of numbers in Table 4 shows our initial assumptions for the average annual rates of change in the usage of commodities as intermediate inputs per unit of production in industries throughout the economy, and as inputs per unit of capital creation. For example, we assume initially that in each year industries will increase their usage of *Communication services* by 5.0 per cent more than their outputs.

Our initial assumptions for each industry concerning average annual changes in primary-factor usage per unit of output are shown in the final column of Table 4. Primary-factor inputs in MMRF-Green comprise labour, capital and agricultural land. Thus, for example, our initial assumption for *Electricity generation* is that output will increase on average by 3.1 per cent a year relative to the industry's overall usage of primary factors.

ABARE Assumptions for Exports, Production and Capital Expenditure (Table 5)

Table 5 shows selected forecasts for the quantities of agricultural and mineral exports and for real gross investment in the agricultural, mining and non-electricity energy sectors. Only those forecasts based on exogenously imposed inputs are listed. The note na indicates that the forecast was endogenously determined in all years of the forecast period.

The forecasts shown for "Export volumes" reflect ABARE projections to 2005, and exogenously imposed long-term trends for the years 2004-05 to 2020. The forecasts for "Production" reflect ABARE estimates.

The numbers for "Real Gross Investment" are a selection of our base-case forecasts for real gross investment in the mining and energy industries. These numbers are, in the main, endogenous output from MMRF-Green. However, in some years between 2000 and 2010, the endogenous determination of investment is turned off for some of the industries in some of the regions and investment is exogenously set in light of data on expenditure on new projects provided by ABARE. For example in the period 2001 to 2010, investment in the QLD aluminium industry is exogenous and set to reflect the construction of the Gladstone Alumina plant. Over this period, allowance is also made for the construction and start up of the PNG-QLD natural gas pipeline.

4.2. Base-case projections for industry output (Table 6)

Table 6 gives base forecasts for the 41 industries distinguished in the model (we exclude the dummy industry). Recall from Table 3 that the average annual rate of GDP growth is 2.9 per cent. At the Australia-wide level, *Communication services* (industry 36) is the fastest growing industry. This reflects the assumptions that changes in technology through the projection period will favour intermediate usage of these services strongly (column 2 of Table 4) and that rapid productivity growth (column 3 of Table 4) will reduce their prices relative to consumer prices in general. Similar factors explain the relatively strong growth forecast for *Financial and business services* (industry 37). Other industries with relatively strong growth forecasts include *Other transport services* (industry 35) and *Other metal products* (industry 18). These industries participate heavily in the strong growth forecast for

international tourism and manufactured exports. In addition, changes in technology are assumed to favour intermediate usage of *Other metal products* (column 2 of Table 4). Forecasts for agriculture and mining are based on extrapolations of the current views of the ABARE. These include slow growth for *Crude oil* (industry 6), reflecting the run down of the Bass Straight reserves (Table 5). Other industries with relatively weak growth forecasts include *Textiles, clothing and footwear* (industry 10), which is restricted by import competition, and *Cement* (industry 15), which is restricted by adverse shifts in technology in the construction sector.

For most industries, especially services, regional differences in growth forecasts mirror regional differences in the GSP forecasts in Table 3. Hence, growth tends to be relatively strong in WA and QLD and relatively weak in TAS and SA.

Table 6 includes our base forecasts for sectors that are likely to be especially affected by policy responses to Australia's Kyoto commitments. Electricity generation is the most important case. In all regions, forecast growth of *Electricity supply* (industry 26) lags behind forecast GSP growth. This reflects assumptions about electricity-saving technical change that are imposed on the forecasts. For all regions in which it is relevant, we assume that growth in *Electricity generation*–gas (industry 23) will be strong. This restricts growth prospects for other types of electricity generation, especially *Electricity–black coal* (industry 21) in QLD and SA.

5. EFFECTS OF THE WAHP

5.1 Experiment design

5.1.1 Exogenous inputs (Table 7)

Table 7 lists the exogenous shocks that are imposed on MMRF-Green in projecting the effects of the WAHP. They are expressed as cumulative deviations ($million, constant 2001 prices) from base case values.

The Phase-1 iron plant starts up in 2004 with export sales worth $117 million. These increase to $195 million in 2006. In 2011, when the Phase-2 plant has reached full production, total sales of pig iron are worth $390 million. We assume that sales to this value are maintained in every year after 2011. In other words, in a typical long-run year (2020), total iron production from the WAHP is worth $390 million. Of this, $140 million come from exports and the rest from internal sales to the associated steel producer. The steel producer starts up in 2014 with sales worth $254 million. Sales increase to $423 million in 2016. We assume that sales to this value are maintained in every year after 2016.

Capital expenditure associated with the Phase-1 plant is valued at $350 million. Phase-2 capital expenditure on the second iron plant and the steel plant has a total value of $440 million. We assume that annual investments worth $40 million are required to maintain the Project's net capital after initial construction is finished.

Table 7 also lists assumptions for the (before-tax) return to capital and company tax payments. We assume:

- that the return to capital in the WAHP[8] is in line with WAHP estimates,
- that company tax payments are in line with WAHP estimates; and

[8] Return to capital is equivalent to earnings before interest, tax and depreciation.

- that 50 per cent of the return to capital after depreciation and tax is available for domestic private consumption, with the remaining 50 per cent going overseas.[9]

Finally, we assume that all of the license income comes from sales overseas, yielding the income stream before tax shown in Table 7. The federal government taxes this income at the rate of 30 per cent. All of the remaining income is available for domestic private consumption. We assume that the income accrues to states in line with their shares in national private consumption

5.1.2 Implementing the shocks

Investment expenditure

We represent investment in the WAHP as additional construction expenditure in the new WA industries, *WAHP iron plant* (industry 42) and *WAHP steel plant* (industry 8). We shock net investment in each industry in each year by the investment values shown in Table 7. These additional investments are not allowed to affect capital stocks until production begins. Thus, for example, in 2001, 2002 and 2003, the level of capital in the new iron industry is fixed to zero. In 2004, as production comes on stream from the Phase-1 plant so does the additional capital constructed in the preceding three years. This capital has an asset value of $250 million.

Production

It is assumed that production from the WAHP is absorbed completely in each year by either exports or internal sales of iron to steel manufacture. We assume that world prices of iron and steel are unaffected by WAHP supply. We exogenously target the volumes of exports *via* endogenous shifts in Australian supply schedules for iron and steel. The world prices for these commodities are fixed via simulated changes in the positions of the world demand schedules. Thus when Australian supply schedules shift out to achieve the targeted volumes, there are compensating shifts in world demand to maintain world prices.

The endogenous shifts in WAHP supply of iron and steel are achieved by simulated increases in effective capital input. Effective capital input is a measure of physical capital input adjusted for capital productivity. In each year, physical capital input is tied down by the accumulation of net investment, which for the WAHP is exogenously imposed (see above). In our modelling, the WAHP investments alone are insufficient to generate the necessary increase in effective capital input. Thus capital productivity in the WAHP is allowed to increase.

Foreign ownership and company tax

We account for foreign ownership in the WAHP *via* adjustments to household disposable income (HDI) in WA. Without such adjustments the full after-tax return on capital from the WAHP would flow through to HDI and hence to consumption of domestic residents. In our modelling, we exogenously reduce the stimulus to HDI due to the WAHP by 50 per cent of the after-tax return from the Project. This leaves 50 per cent available for domestic consumption.

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[9] Information from the Project operators state that the projection is a joint venture involving Australian and overseas-based companies. It would seem that overseas companies comprise about 45 per cent of the ownership, with Rio Tinto (51 per cent) and Smorgan Steel (5 per cent) making up the rest. The operators claim that "all income will flow back to Australia". Our guess is that, given the ownership structure, only a portion of the overall return to capital (after depreciation) will come back to Australians. We assume 50 per cent.

Company tax payments from the WAHP are introduced directly into the model's government and income accounts.

5.1.3 Key Assumptions Underlying the Deviation Simulations

Financing arrangements during construction

Investments in the WAHP are privately funded.

Labour markets

At the national level, we assume that the deviation in the consumer's real wage rate from its base case forecast level increases in proportion to the deviation in employment from its base case forecast level. The coefficient of proportionality is chosen so that the employment effects of a favourable shock to the economy are largely eliminated after five years. In other words, after about five years, the benefits of a favourable shock, such as the WAHP, are realised almost entirely as an increase in the national real wage rate. This labour market assumption reflects the idea that in the long-run national employment is determined by demographic factors, not individual products or policies. It is also consistent with conventional macro-economic modelling in which the NAIRU is exogenous.

At the regional level, we assume that labour is mobile between state economies. Labour is assumed to move between regions so as to maintain inter-state wage and unemployment rate differentials at their base case levels. Accordingly, regions that are favourably affected by the WAHP project (principally WA) will experience increased employment and population at the expense of other regions.

Public expenditure, taxes and government budget balances

We assume that the shocks associated with the WAHP make no difference to the paths of federal and state real public consumption expenditures. We also assume no deviation in the paths of tax and benefit rates. Government budgets (federal and state) are allowed to move toward deficit or surplus depending on the direct and indirect effects of the WAHP.

Private consumption and investment

Consumption expenditure of the regional household is determined by household disposable income. Since budget constraints are not imposed on the business sector or on governments, regional economies' will run trade deficits/ surpluses to the extent that aggregate regional expenditure levels are greater than/less than aggregate regional incomes. The deficits or surpluses can be held with other agents in other regions, with foreigners or with both regional agents and foreigners.

We assume that in each year, investment in each regional industry will deviate from base in line with the deviation expected rate of return on the industry's capital stock. Investors are assumed to be myopic, implying that expected rates of return move with contemporaneously observed rates of return.

Rates of return on capital

In deviation simulations, MMRF-Green allows for short-run divergences in rates of return on industry capital stocks from their levels in the base case forecasts. Such divergences cause divergences in investment and hence capital stocks. The divergences in capital stocks gradually erode the divergences in rates of return, so that in the long-run rates of return on capital over all regional industries return to their base case levels. Initially, the demand stimulus in WA may increase rates of return for WA firms. This draws capital to WA, thereby driving rates of return back towards their initial levels.

Production technologies

MMRF-Green contains many types of technical change variables. In the deviation simulation we assume that all technology variables, other than those used in the implementation of shocks, have the same values as in the base case simulation.

5.2 Impacts of the WAHP: Macroeconomic and Industry variables

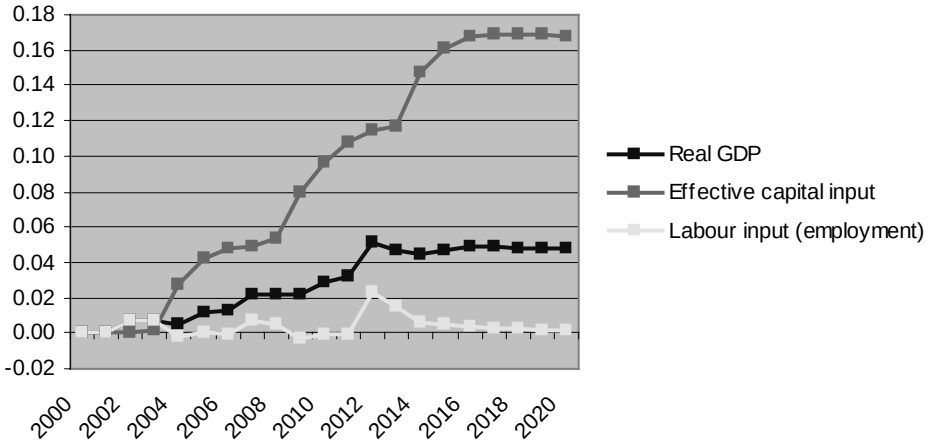
The effects of the WAHP on the main economic variables for Australia are shown in Charts 1-8. These show, for the period 2001 to 2020, deviations of a range of variables in the deviation simulation from their values in the base case. For example, Chart 1 shows that the WAHP would increase national real GDP in 2012 by about 0.05 per cent relative to its base-case value in that year.

More detailed results for WA and the rest of Australia (ROA) are reported in Tables 8 to 14:

- Table 8: macroeconomic variables (percentage deviations)
- Table 9: macroeconomic variables (absolute deviations)
- Table 10: real value added for WA industries (absolute deviations, $million, 2001 prices)
- Table 11: real value added for ROA industries (absolute deviations, $million, 2001 prices)
- Table 12: employment in WA industries (absolute deviations, thousand persons)
- Table 13: employment in ROA industries (absolute deviations, thousand persons)
- Table 14: government budget balances.

Our explanation of the results is given in a series of numbered points. The italicised headings to the numbered points outline the main structure of the explanation.

Chart 1: National Real GDP and Factor Inputs
(percentage deviations from control)



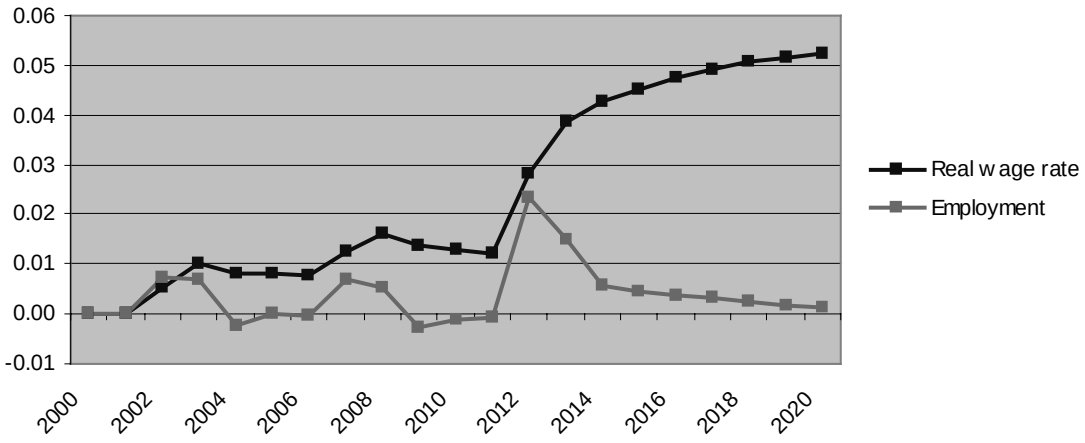
I. *During the initial construction phase of the WAHP, there is relatively little response from labour and capital (Chart 1). However, as each element of the WAHP begins production, effective capital input*[10] *increases. At the end of the simulation, effective capital is 0.16 per cent above its base case level, while employment, after increasing and then falling back three times, has returned to its base case level.* In the first three years of the simulation, capital input in the WAHP is fixed at base-case levels (see subsection 5.1.2). Thus, during this period, economy-wide changes in factor inputs are small, reflecting the effects on investment-oriented industries of the additional Phase-1 investments alone. National employment increases slightly during this period because investment-oriented industries, especially *Construction services* (industry 29), are labour intensive.

The Phase-1 Iron plant starts-up in 2004. In that year, effective capital input rises 0.03 per cent above its base case level. The additional capital, however, fails to stimulate employment. In contrast to the construction industries, the WAHP iron plant and its direct suppliers are capital intensive. Thus, when Phase-1 production replaces Phase-1 construction, effective capital increases strongly relative to base, with little apparent impact on employment.

The pattern repeats itself during the Phase-2 construction periods. The employment-deviations peak in 2012, at a little over 0.02 per cent. This is equivalent to an additional 2100 jobs Australia-wide (see Table 9). The capital-deviations peak in 2016 at 0.16 per cent and remain steady through to the end of the simulation. At the same time, employment returns to its base case levels.

[10] Effective capital input is a measure of physical capital input (the accumulated sum of net investments over past years) adjusted for capital productivity (see subsection 5.1.2).

Chart 2: Real wages and Employment
(percentage deviations from control)



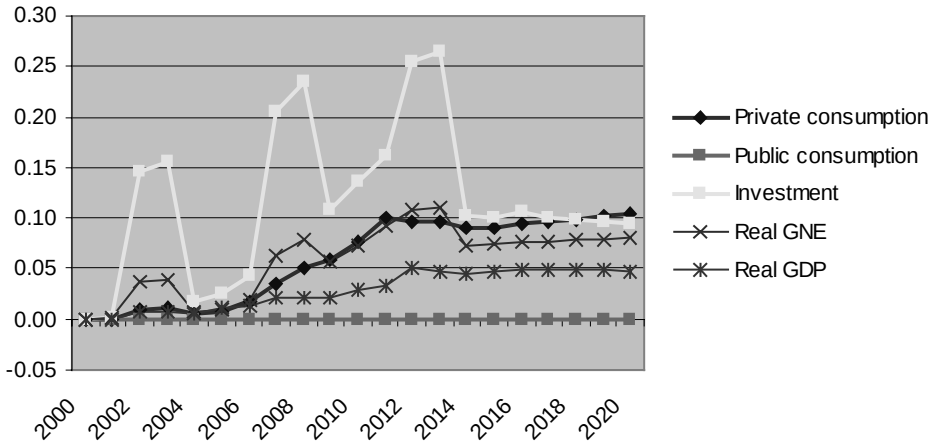
II. *The WAHP allows the real wage rate (Chart 2) to rise over the long-term.* According to the labour-market specification in MMRF-Green (see subsection 5.1.3), if employment is above (below) its base-case level, labour demands an increase (allows a decrease) in the real wage rate. In the construction phases of the WAHP, the real wage rate rises in response to increased demand for labour by the construction industries. Each time WAHP construction ceases, WAHP capital and production expands. The halt in construction reduces the demand for labour, reversing the gains in employment and wages.

Over time, the steady increase in capital brings with it a tendency for employment to rise. If there were no real wage response, then the capital expansion would be accompanied by a steady increase in employment. However, the labour-market specification causes the real wage rate to rise. This strengthens producers' incentives to substitute labour for capital and allows, in the long run, the economy to accommodate the WAHP capital with virtually no employment response.

The wage deviations peak at the end of simulation at a little above 0.05 per cent.

III. *The WAHP causes a long-run increase in real GDP (Chart 1).* Movements in factor inputs largely explain the GDP effects of the WAHP. Despite employment falling back towards its base case level, effective capital input remains elevated above base through the simulation period (Chart 1). This accounts for the long-run gains in real GDP. In 2020, real GDP is 0.04 per cent, or $263 million (see Table 9), above its base case level.

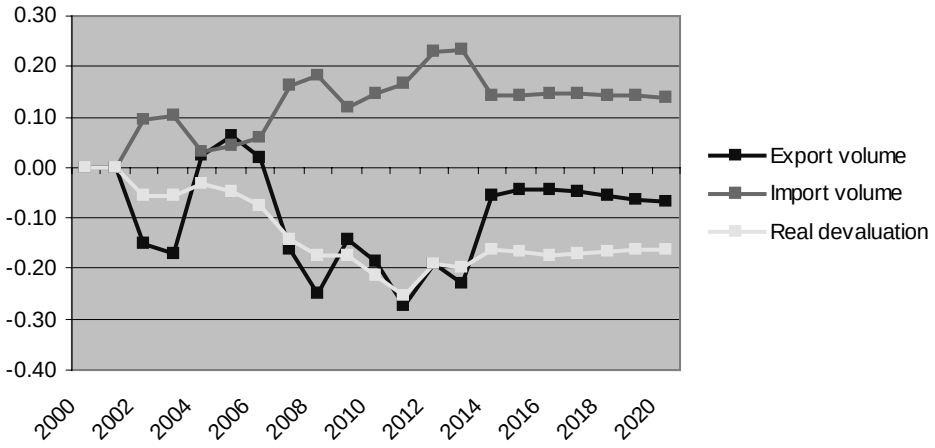
Chart 3: National Real Domestic Expenditure
(percentage deviations from control)



IV. *Construction associated with the WAHP increases national investment (Chart 3) by 0.16 per cent, 0.23 per cent and 0.26 per cent in each of the peak construction years (2003, 2008 and 2012).* Investment remains elevated above its base case path through the remainder of the simulation, reflecting increased replacement requirements associated with a higher capital stock.

V. *Real private consumption increases as a result of the WAHP (Chart 3).* In our simulations, we assume that consumption expenditure of the regional household is determined by household disposable income (HDI) (see subsection 5.1.3). In calculating the change in consumption, we assume that consumption expenditure is determined by household disposable income (HDI) (see subsection 5.1.3 in the main report). In calculating changes in HDI due to the WAHP, we take account of the before-tax factor income generated directly and indirectly by the Project, the tax paid on that income (which reduces the income available for consumption), and the amount of income that flows overseas. In 2020, real factor income directly generated by the project amounts to $465 million (2001 prices). This consists of $365 million from license sales, $80 million from capital earnings (after depreciation but before tax and interest) and $20 million from salaries. After taking account of taxes and income that goes overseas, the total amount available in 2020 for consumption is $276 million (2001 prices). This is very close to the final increase in real consumption of $284 million (or 0.10 per cent as shown in Chart 3). The difference is the change in real HDI *indirectly* generated by the Project.

Chart 4: Trade and the Real Exchange Rate
(percentage deviations from control)

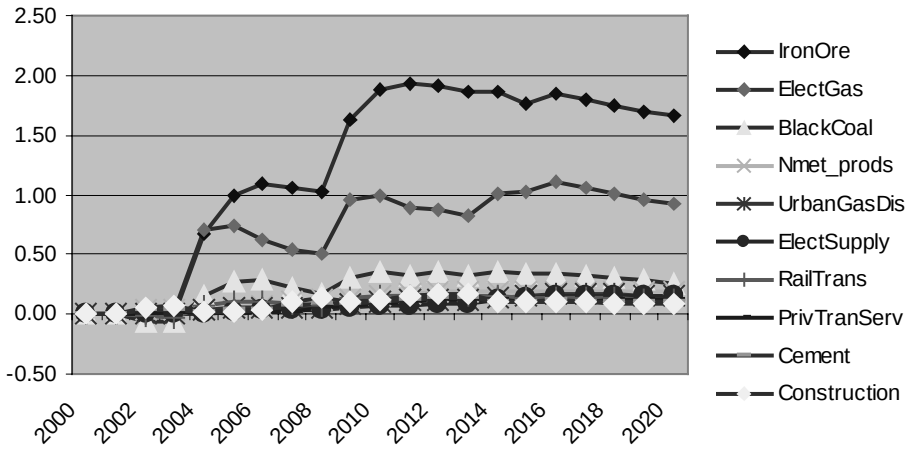


VI. *Real gross national expenditure (GNE)*[11] *(Chart 3) increases by more than real GDP in each of the WAHP construction years, and remains above real GDP over the longer term. Thus, except in 2005, the real trade balance (Chart 4) moves towards deficit in each year of the simulation.* Real public consumption (Chart 3) is assumed to be unaffected by the WAHP. Thus, the deviations in real GNE reflect the sum of deviations in real private consumption and real investment. During the WAHP construction years, real GNE generally increases significantly relative to real GDP. This implies for these years that the real trade balance must move to deficit. Hence, as shown in Chart 4 and Table 9, aggregate exports fall relative to aggregate imports. Each time construction stops there is a tendency for the real trade balance to move towards surplus. However, this is mitigated by relatively strong growth in private consumption due, in the main, to the license income returned to Australians. Hence even when investment is not stimulated, the WAHP causes real GNE to increase by more than real GDP causing aggregate exports to fall relative to aggregate imports.

VII. *Appreciation of the exchange rate (Chart 4) is required throughout the simulation.* The mechanism to achieve the required deterioration in net trade volumes is real appreciation of the exchange rate. This reduces traditional exports of agricultural, mining and tourism products and increases imports. It also causes an improvement in the terms of trade (less supply from Australian exporters increases world prices for Australian products, e.g., wool and coal).

[11] The percentage change in real GNE is the weighted average of percentage changes in real private consumption, real public consumption and real investment.

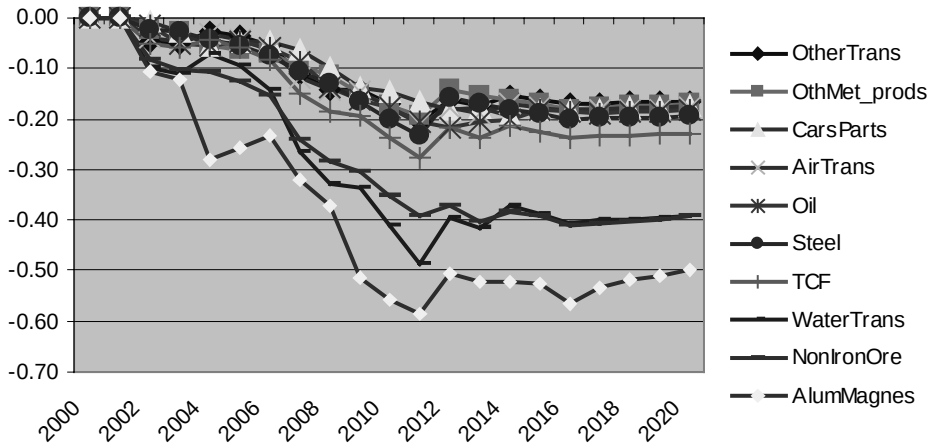
Chart 5: National Industry Production: Winners
(percentage deviations from control)



VIII. *At the national level, only WA oriented industries and industries directly affected by the WAHP experience significant increases in output (Chart 5).* Chart 5 gives national-level industry results for the industries that in the long run gain most from the WAHP (we exclude the WAHP industries themselves from this chart). The chart shows percentage deviations of the industries' outputs from their levels in the base case. The industry that experiences the largest percentage increase in output is *Iron ore* (industry 3). This is necessary to accommodate the additional demand from the WAHP. *Electricity gas* (industry 23) is a small industry, overly represented in the WA economy. Thus the general stimulation to the WA economy due to the WAHP leads to a relatively strong percentage increase in national output for this industry. Most of the remaining industries listed in Chart 5 have strong input/output connections with the WAHP (see Table 2).

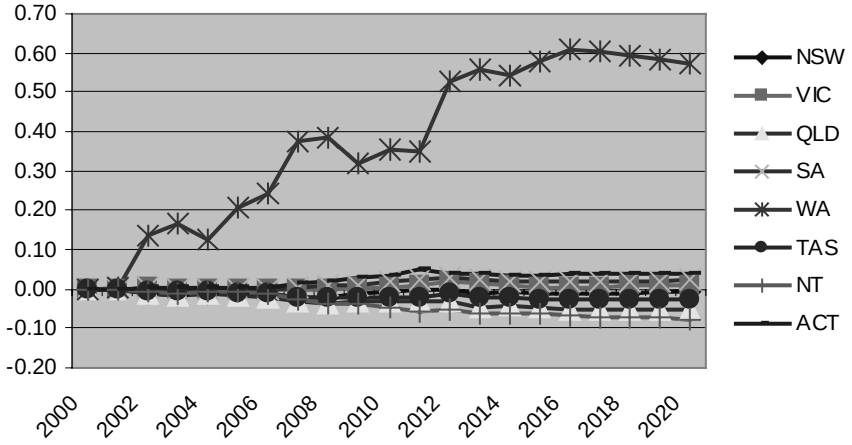
Tables 10 (for WA) and 11 (for the rest of Australia), show deviations in real value added by industry. In WA, outside of the WAHP industries themselves, the largest positive deviations are for *Trade services* (industry 30) and *Finance, property and business services* (industry 37). These industries do not have strong direct connections to the WAHP. However, they are heavily oriented towards local consumption and investment expenditures, which are stimulated by the second-round income effects of the WAHP.

Chart 6: National Industry Production: Losers
(percentage deviations from control)



IX. *Adversely affected industries at the national level are industries crowded out by the WAHP (Chart 6).* The industries most adversely affected by the WAHP are generally industries with high export propensities and/or facing high rates of import penetration on their local markets. Good examples are *Aluminium/alumina & magnesium* (industry 17), *Non-iron ore* (industry 4) and *Water transport* (industry 33).

Chart 7: Real GSP by State/territory
(percentage deviations from control)



X. *State outcomes (Charts 7 and 8) indicate a gain in real GSP for WA of about 0.6 per cent by 2020 (see also Table 8), and a gain in employment, which, at its peak is around 0.4 per cent.* At the state level, WA gains strongly from the WAHP. In the base case, real GSP in WA is valued at around $75 billion (2001 prices) in 2020. Thus, in that year, the addition of $563 worth of iron and steel exports from the WAHP is equivalent to 0.75 per cent of WA's GSP. The application of this 0.75 per cent additional production causes an increase in WA GSP of 0.57 per cent in 2020. This implies a multiplier for the WA economy on stimulation of commodity exports from the WAHP equal to 0.76 (=0.57/0.75).

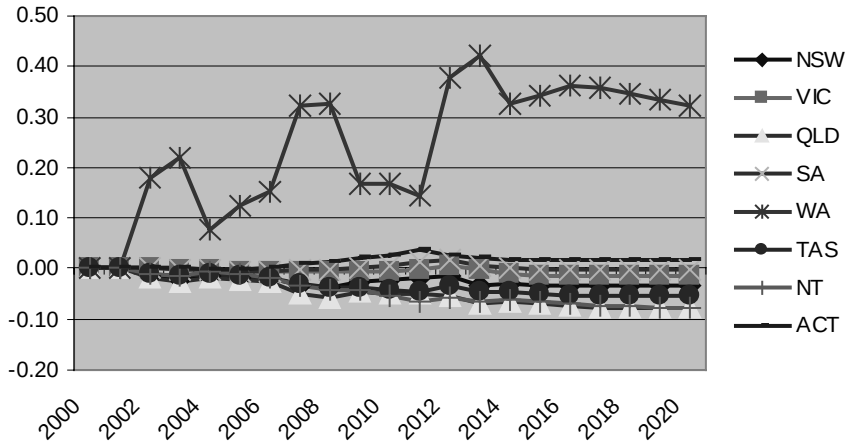
The simulated multiplier estimate is small compared to typical estimates derived from static input/output models. It is comparatively small for three reasons: (1) because of crowding out effects in WA arising from a higher national real wage rate and a stronger currency (see above), which are generally not captured in static input-output models; (2) because the WAHP relies relatively little on intermediate inputs (except iron ore, coal and chemicals) sourced from inside the state[12]; and (3) because the WA economy receives only a small proportion of the income from license fees[13]

Most WA sectors are stimulated by increases in demands for their products in the expanded WA economy (Tables 10 and 12). The most trade-exposed sectors in the WA economy, and the ones that rely least on WA for absorption of their product, are the rural industries and the non-iron ore mining industry. Consequently, these sectors gain least in terms of output and employment from the stimulation due to the WAHP. The industries with the least direct international exposure are those in the service sector. Apart from the WAHP and industries with direct linkages to the WAHP, service industries have the largest percentage gains in output and employment.

[12]Net costs for the WAHP (i.e., total costs less the value of iron sales to the steel plant) consist mainly of capital costs and purchases of iron ore, coal and chemicals. The WA industries producing iron ore, coal and chemicals themselves rely relatively little on intermediate inputs sourced from inside WA.

[13] We assume that this income acrrues to states in proportion to their shares in national consumption. Thus NSW receives around 50 per cent of the licence income, while WA receives around 9 per cent.

Chart 8: Employment by State/territory (percentage deviations from control)



The WAHP has slightly adverse effects on the rest of Australia (macro effects - Tables 8 and 9; industry effects - Tables 11 and 12). Why are the aggregate percentage-change effects in WA so large compared with the (negative) percentage-change effects for the rest of Australia? The large WA effect is a reflection of the smallness of the WA economy. In our typical long-run year, the WA economy is about ten per cent of the Australian economy. A small region can attract a significant percentage increase in its capital and labour without causing large percentage increases in the economy-wide demand for resources. Thus the WA economy can enjoy considerable additional growth without generating significant negative feedback from wage rates, capital costs and the exchange rate.

In 2020, the stimulation to WA's GSP is accommodated by 0.31 per cent more employment (hours worked) and 1.34 per cent more capital (Table 8). In our model, employment is measured in terms of hours worked, not persons employed. So the percentage increase in employment represents a percentage increase in hours worked. To derive an estimate of the effect on numbers of persons employed, we assume that the WAHP does not affect industry ratios of employed persons to employed hours. Under this assumption, the 0.34 per cent increase in hours worked translates into roughly a similar increase in persons employed.[14] Based on this calculation, in 2020 around 2,400 additional full and part-time jobs have been created in WA (Table 9). Most of these additional jobs are located in service industries, notably trade, finance and public services (Table 12).

[14] The percentage change in total hours worked in WA is less than the percentage change in persons employed because of differences in industry weights used to compile the two macro indexes.

5.3 Impacts of the WAHP: Other variables

Government revenue and budget balance

Table II in the Executive summary shows the impacts of the WAHP on government finances in the final year of the simulation. Table 14 shows the impacts on government borrowing requirements. All numbers are in $million (constant 2001 prices)

As can be seen from Table II, around 45 per cent of the additional revenue to the WA government in each year comes from additional Commonwealth grants. WA's share in those grants increases in line with the increase in its nominal GSP relative to the average nominal GSP of the rest of Australia. Additional collections of direct taxes account for nearly all of the revenue gain for the federal government. Changes on the revenue side largely account for the changes to overall borrowing requirements shown in Table 14.

Net Gain for Australians

The net gain to Australians arising from the WAHP in any year can be measured as the sum of changes in:

1. real private and public consumption; and
2. the real current account balance in the balance of payments.

Item 1 represents the additional real goods and services directly purchased by Australians. Item 2 measures the benefits from consumption foregone to reduce Australia's reliance on foreign borrowings.

Table III in the Executive summary shows the simulated net gains to Australians arising from the WAHP. In 2020, the net gain is estimated to be $446.3 million in 2001 prices. Of this, $307.6 million is direct consumption, with $138.8 million of consumption foregone to reduce Australia's foreign liabilities.

The consumption effects of the WAHP have already been explained in some detail. The change in real current account balance in 2020 shown in Table III reflects, to a large degree, the improvement in the balance on income account caused by foreign credits from WAHP license sales. In 2020, these amount to $365 million in 2001 prices. Against this, we deduct about $60 million of WAHP earnings returned overseas to give an overall net improvement in the income-account balance of $300 million. The simulated change in the real current account balance in 2020 is $153 million. This implies a simulated deterioration in the real trade account balance of $147 million (=$300m - $153m).

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Table 1: Industry Sectors Recognised in MMRF-Green*

Name	Description
1. Agriculture	All primary agricultural activities plus fishing
2. Forestry	All forestry activities, including logging and management
3. Iron ore	Mining of iron ore
4. Non-iron ore	Mining of non-iron ores, including gold and base ores
5. Black coal	Mining of black coal - thermal and metallurgical
6. Crude oil	Production of crude oil
7. Natural gas	Production of natural gas at well
8. Brown coal	Mining of brown coal
9. Food, beverages and tobacco	All secondary agricultural activities
10. Textiles, clothing, footwear	Manufacture of textiles, clothing and footwear
11. Wood and paper products	Manufacture of wood (including pulp) and paper products
12. Chemical prods. excl. petrol	Manufacture of basic chemicals and paints
13. Petroleum products	Manufacture of petroleum products
14. Building prods (not cement & metal)	Manufacture of non-metallic building products excl. cement
15. Cement	Manufacture of cement
16. Iron and steel	Manufacture of primary iron and steel.
17. Aluminium/alumina & magnesium	Manufacture of aluminium and alumina, and of magnesium
18. Other metal products	Manufacture of other metal products
19. Motor vehicles and parts	Manufacture of motor vehicles and parts
20. Other manufacturing	Other manufacturing including electronic equipment
21. Electricity – black coal	Electricity generation from black coal thermal plants
22. Electricity – brown coal	Electricity generation from brown coal thermal plants
23. Electricity – gas	Electricity generation from natural gas thermal plants
24. Electricity – oil prods.	Electricity generation from oil products thermal plants
25. Electricity – other	Electricity generation from other sources (mainly hydro)
26. Electricity supply	Distribution of electricity from generator to end user
27. Urban gas distribution	Urban distribution of natural gas
28. Water and sewerage services	Provision of water and sewerage services
29. Construction services	Residential building and other construction services
30. Trade services	Provision of wholesale and retail trade services
31. Road transport services	Provision of road transport services
32. Railway transport services	Provision of rail transport services
33. Water transport services	Provision of water transport services
34. Air transport services	Provision of air transport services
35. Other transport services	Provision of other transport services
36. Communication services	Provision of communication services
37. Financial/business services	Provision of financial and business services
38. Dwelling ownership	Services of the stock of dwellings
39. Public services	Provision of public services
40. Other services	Provision of other services
41. Private transport services	Services of the stock of private motor vehicles
42. Dummy	Not defined. Used to facilitate impact studies of new projects

* For most of the industries identified in this table there is an obvious correspondence to one or more standard categories in the Australian and New Zealand Standard Industrial Classification (ANZSIC). The exceptions are: industries 21 to 26, which together comprise ANZSIC 3610 *Electricity Supply*; industry 38, which is equivalent to the *Ownership of dwellings* industry in the industrial classification of the official Input/Output statistics; and industries 41 and 42, which are unique to MMRF-Green. Industry 41 produces the services of the stock of private motor vehicles. It is analogous to industry 38, which produces the services of the stock of dwellings.

Table 2: Percentage Cost Shares for the New WAHP Industries*

	Iron Plant			Steel Plant		
	Domestic	Imported	Total	Domestic	Imported	Total
Cost of Intermediate Inputs						
1. Agriculture	0.0	0.0	0.0	0.0	0.0	0.0
2. Forestry	0.0	0.0	0.0	0.0	0.0	0.0
3. Iron ore	15.5	0.0	15.5	0.0	0.0	0.0
4. Non-iron ore	1.3	0.0	1.3	1.2	0.0	1.2
5. Black coal	20.3	0.0	20.3	1.2	0.0	1.2
6. Crude oil	0.0	0.0	0.0	0.0	0.0	0.0
7. Natural gas	1.8	0.0	1.8	0.8	0.0	0.8
8. WAHP steel plant	0.0	0.0	0.0	0.0	0.0	0.0
9. Food, beverages and tobacco	0.0	0.0	0.0	0.0	0.0	0.0
10. Textiles, clothing, footwear	0.0	0.0	0.0	0.0	0.0	0.0
11. Wood and paper products	0.0	0.0	0.0	0.0	0.0	0.0
12. Chemical prods. excl. petrol	10.3	1.5	11.8	1.1	0.7	1.8
13a. Automotive petrol	0.1	0.0	0.2	0.1	0.0	0.1
13b. Aviation gasoline	0.0	0.0	0.0	0.0	0.0	0.0
13c. Turbine fuel	0.0	0.0	0.0	0.0	0.0	0.0
13d. Diesel	0.3	0.0	0.3	0.1	0.0	0.1
13e. LPG	0.0	0.0	0.0	0.0	0.0	0.0
13f. Other petrol products	1.7	0.2	1.9	0.8	0.1	0.9
14. Building prods nec	2.1	1.4	3.5	1.0	0.6	1.6
15. Cement	0.0	0.0	0.0	0.0	0.0	0.0
16. Iron and steel	0.0	0.0	0.0	0.0	0.0	0.0
17. Aluminium, magnesium	0.0	0.0	0.0	0.0	0.0	0.0
18. Other metal products	0.0	0.0	0.0	0.0	0.0	0.0
19. Motor vehicles and parts	0.0	0.0	0.0	0.0	0.0	0.0
20. Other manufacturing	0.8	1.3	2.1	0.4	0.6	1.0
21. Electricity – black coal	0.0	0.0	0.0	0.0	0.0	0.0
22. Electricity – brown coal	0.0	0.0	0.0	0.0	0.0	0.0
23. Electricity – gas	0.0	0.0	0.0	0.0	0.0	0.0
24. Electricity – oil prods.	0.0	0.0	0.0	0.0	0.0	0.0
25. Electricity – other	0.0	0.0	0.0	0.0	0.0	0.0
26. Electricity supply	2.9	0.0	2.9	2.7	0.0	2.7
27. Urban gas distribution	1.2	0.0	1.2	0.6	0.0	0.6
28. Water and sewerage services	0.5	0.0	0.5	0.3	0.0	0.3
29. Construction services	0.1	0.0	0.1	0.0	0.0	0.0
30. Trade services	1.8	0.1	1.9	0.9	0.0	0.9
31. Road transport services	0.5	0.0	0.5	0.2	0.0	0.2
32. Railway transport services	0.0	0.0	0.0	0.0	0.0	0.0
33. Water transport services	0.0	0.0	0.0	0.0	0.0	0.0
34. Air transport services	0.1	0.1	0.1	0.0	0.0	0.1
35. Other transport services	0.4	0.2	0.5	0.2	0.1	0.2
36. Communication services	0.8	0.1	0.8	0.4	0.0	0.4
37. Financial/business services	3.5	0.4	3.9	4.1	0.2	4.3
38. Dwelling ownership	0.0	0.0	0.0	0.0	0.0	0.0
39. Public services	0.0	0.0	0.0	0.0	0.0	0.0
40. Other services	0.0	0.0	0.0	0.0	0.0	0.0
41. Private transport services	0.0	0.0	0.0	0.0	0.0	0.0
42. WAHP Iron plant	0.0	0.0	0.0	58.8	0.0	58.8
Total intermediate costs	66.0	5.1	71.1	74.9	2.4	77.2
Labour	1.6			6.3		
Fixed Capital Cost	27.3			16.4		
Other Costs	0.0			0.0		

* These shares apply at the start of the simulation. The shares change slightly through the simulation in response to changes in relative prices.

Table 3: Macroeconomic Forecasts (average annual growth rates, 1997 to 2020)

	Variable		NSW	VIC	QLD	SA	WA	TAS	NT	ACT	AUS
1.	Real private consumption		2.8	2.6	3.6	2.2	3.7	2.0	2.6	2.8	2.9
2.	Real investment		2.9	2.3	3.7	1.8	4.0	1.1	1.3	1.1	2.9
3.	Real public consumption	-- total	2.6	2.4	3.2	2.2	3.3	2.1	2.5	2.7	2.7
4.		-- regional	2.6	2.3	3.4	2.0	3.5	1.8	2.4	2.5	2.7
5.		-- federal	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
6.	International export volumes		6.0	7.2	5.6	6.2	5.0	5.8	5.3	9.2	6.0
7.	International import volumes		5.7	6.0	6.3	5.8	6.1	5.4	5.5	5.2	5.9
8.	Real GDP/GSP		2.8	2.7	3.3	2.4	3.4	2.1	2.7	2.8	2.9
9.	Aggregate employment		1.3	1.2	1.6	0.8	1.7	0.7	1.6	1.6	1.3
10.	Aggregate capital stock		3.7	3.4	4.0	3.1	4.3	2.2	3.1	3.2	3.7
11.	Consumer real wage		0.4	0.8	0.2	0.5	0.5	0.3	1.2	1.3	0.5
12.	Producer real wage		0.0	0.5	0.0	0.3	0.4	0.1	1.3	1.3	0.2
13.	CPI		2.6	2.2	2.8	2.5	2.5	2.7	1.8	1.7	2.5
14.	Terms of trade		0.1	-0.2	0.0	-0.2	-0.2	0.0	-0.5	-0.8	-0.1
15.	Real devaluation		-0.3	0.2	-0.2	0.1	0.2	-0.2	1.0	1.1	0.0
16.	GDP/GSP deflator		3.0	2.5	3.0	2.7	2.6	2.9	1.7	1.7	2.8

Table 4: Industry Technology and Household Taste Assumptions (average annual percentage changes)

Industry	Household preferences[a]	Technology:	
		Intermediate input-using[b]	Primary-factor using[c]
Agriculture	0.8	0.1	-2.3
Forestry	-0.9	1.7	0.0
Iron ore	-1.3	-0.3	-4.1
Non-iron ore	-0.3	-1.8	-2.4
Black coal	-3.7	0.0	0.0
Crude oil	-1.3	0.0	0.0
Natural gas	1.0	0.5	0.0
Brown coal	-1.3	0.0	0.0
Food, beverages and tobacco	0.7	0.2	-1.3
Textiles, clothing and footwear	0.2	-0.4	-1.7
Wood and paper products	1.4	0.1	-0.2
Chemical products excl. Petrol	4.9	2.8	-0.1
Petroleum products	-2.7	-0.5	0.0
Non-metal construction materials excl. Cement	-1.4	0.6	-1.1
Cement	0.2	-1.2	-0.4
Iron and steel	5.2	2.3	-1.4
Alumina and aluminium	6.7	3.0	-2.5
Other metal products	-1.6	2.0	-0.1
Motor vehicles and parts	1.0	4.3	-0.4
Other manufacturing	2.0	-3.5	-1.8
Electricity generation and supply	0.3	-0.3	-3.1
Urban gas distribution	0.3	0.6	-2.7
Water and sewerage services	-0.5	-0.2	-2.4
Construction services	6.3	1.8	0.0
Wholesale trade, retail trade, accommodation	-3.1	-1.8	0.0
Road transport services	-1.6	0.5	-0.8
Other transport services	-0.2	-0.2	-2.2
Communication services	0.0	5.0	-4.5
Financial and business services	1.1	3.2	-1.8
Dwelling ownership	0.0	0.0	0.3
Public services	-1.3	0.0	-0.4
Other services	0.6	1.6	0.0

(a) Annual rate of shift of consumption function.

(b) Annual rate of change of use of the commodity identified on the left-hand panel per unit of output of industries using the commodity.

(c) Annual rate of change of use of all primary factors (labour, capital and agricultural land) per unit of production of the industry identified on the left.

Table 5: Assumptions for Exports, Production and Real Investment in Agricultural, Minerals and Energy Industries: MMRF-Green*

Variable	NSW	VIC	QLD	SA	WA	TAS	NT	ACT
Export volumes:								
Agriculture	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Iron ore	na.	na.	na.	na.	2.9	na.	na.	na.
Non-iron ore	2.9	2.9	2.9	2.9	2.9	na.	na.	na.
Black coal	2.9	na.	2.9	na.	na.	na.	na.	na.
Crude oil	0.0	-0.5	-0.9	-1.4	0.8	na.	1.9	na.
Natural gas	na.	na.	na.	na.	3.8	na.	na.	na.
Petroleum products	-0.2	0.3	-0.3	0.9	0.7	na.	na.	na.
Alumina and aluminium	3.4	3.4	5.1	3.4	3.4	na.	na.	na.
Production:								
Agriculture	na.	na.	na.	na.	na.	na.	na.	na.
Iron ore	na.	na.	na.	na.	na.	na.	na.	na.
Non-iron ore	na.	na.	na.	na.	na.	na.	na.	na.
Black coal	na.	na.	na.	na.	na.	na.	na.	na.
Crude oil	0.0	-0.5	-1.0	-1.4	0.8	na.	1.0	na.
Natural gas	1.0	3.7	-0.6	-2.4	3.8	na.	11.6	na.
Petroleum products	1.0	1.3	1.6	0.9	1.9	-0.4	na.	na.
Alumina and aluminium	3.4	3.3	5.0	0.0	3.8	na.	na.	na.
Real Investment:								
Agriculture	na.	na.	na.	na.	na.	na.	na.	na.
Iron ore	na.	na.	na.	na.	na.	na.	na.	na.
Non-iron ore	na.	na.	na.	na.	na.	na.	na.	na.
Black coal	-0.6	na.	1.1	-4.3	na.	na.	na.	na.
Crude oil	na.	-1.3	-1.5	-2.8	0.6	na.	2.5	na.
Natural gas	na.	1.3	-2.6	-2.6	2.5	na.	11.2	5.4
Petroleum products	na.	na.	na.	na.	na.	na.	na.	na.
Alumina and aluminium	1.1	0.7	8.2	0.4	2.2	0.2	-2.1	2.8

* The numbers in this table are expressed in terms of average annual percentage growth rates for the period 1997 to 2020. The forecasts for "Export volumes" reflect ABARE projections to 2005, and exogenously imposed long-term trends for the years 2005 to 2020. The forecasts for "Production" reflect ABARE estimates. The numbers for "Real Gross Investment" are our forecasts for real gross investment in the mining and non-electricity energy industries. These numbers are, in the main, endogenous output from MMRF-Green. However, in some years between 2000 and 2010, the endogenous determination of investment is turned off for some of the industries in some of the regions and investment is exogenously set in light of data on expenditure on new projects provided by ABARE. For example in the period 2001 to 2010, investment in the QLD aluminium industry was made exogenous and set to reflect the construction of the Gladstone Alumina plant. Allowance was also made for the construction and start up of the PNG-QLD natural gas pipeline.
na. indicates that growth in the relevant variable/industry was endogenously determined in all years of the forecast period.

Table 6: Industry Output (average annual growth rates, 1997 to 2020)

Industry	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	AUS
1. Agriculture	1.8	1.8	2.6	2.1	2.6	1.7	1.1	1.4	2.1
2. Forestry	2.7	2.9	3.3	3.0	3.7	2.5	5.4	4.7	3.0
3. Iron ore	2.1	1.8	1.8	3.0	2.7	1.6	1.0	1.0	2.6
4. Non-iron ore	2.2	-0.1	2.6	0.3	2.2	2.7	1.1	0.3	2.1
5. Black coal	2.5	-0.3	2.7	-0.7	2.6	0.9	0.6	0.0	2.6
6. Crude oil	0.0	-0.5	-1.0	-1.5	0.8	0.0	1.0	0.0	-0.4
7. Natural gas	1.1	3.6	2.0	-2.5	3.9	0.0	11.9	0.0	3.4
8. Brown coal	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
9. Food, beverages and tobacco	1.7	2.2	3.5	2.9	3.3	1.7	4.3	4.6	2.6
10. Textiles, clothing, footwear	0.6	1.7	1.6	1.8	3.4	1.5	6.1	7.3	1.5
11. Wood and paper products	1.3	1.8	1.6	2.3	2.8	0.8	8.1	5.5	1.8
12. Chemical prods. excl. petrol	2.9	3.4	3.9	4.8	5.6	3.7	8.4	8.0	3.6
13. Petroleum products	1.1	1.4	1.7	1.0	2.0	-0.4	2.1	2.1	1.4
14. Building prods (not cement & metal)	2.2	2.2	3.1	2.3	3.6	1.6	3.6	3.3	2.6
15. Cement	0.1	0.2	1.2	1.1	1.4	0.2	2.8	2.4	1.0
16. Iron and steel	3.2	4.1	3.8	5.0	4.8	3.7	9.6	9.0	3.6
17. Aluminium/alumina & magnesium	3.6	3.5	5.2	0.0	4.0	3.5	3.5	0.0	4.0
18. Other metal products	3.7	4.7	4.5	4.8	6.2	2.9	6.2	6.3	4.6
19. Motor vehicles and parts	0.8	2.3	2.6	3.7	4.5	1.6	9.4	7.9	2.7
20. Other manufacturing	2.7	2.8	2.8	2.5	4.0	2.1	5.1	4.9	2.9
21. Electricity – black coal	1.2	0.0	-0.9	-5.8	1.7	0.0	2.3	0.0	0.9
22. Electricity – brown coal	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	1.7
23. Electricity – gas	6.2	3.2	11.7	3.6	2.9	0.0	3.2	0.0	7.2
24. Electricity – oil prods.	-0.6	-1.8	-2.1	-6.5	-0.3	-2.8	2.1	0.0	2.7
25. Electricity – other	2.3	2.9	0.8	-6.3	3.8	1.2	2.8	0.0	1.9
26. Electricity supply	1.8	1.8	2.3	1.5	2.3	1.1	2.4	2.3	1.9
27. Urban gas distribution	2.9	2.9	4.7	2.7	3.9	2.3	3.7	3.2	3.2
28. Water and sewerage services	2.4	2.4	2.8	1.9	3.1	1.6	2.7	2.9	2.5
29. Construction services	3.0	2.7	3.8	2.0	4.1	1.5	1.8	1.5	3.0
30. Trade services	1.8	1.9	2.9	1.6	2.8	2.1	2.0	1.7	2.1
31. Road transport services	2.8	3.0	3.5	3.0	3.9	2.5	3.3	2.8	3.1
32. Railway transport services	2.0	1.9	2.0	1.7	2.2	2.2	2.3	1.7	2.0
33. Water transport services	3.0	2.8	2.3	1.8	2.1	1.6	2.4	1.7	3.1
34. Air transport services	2.9	2.9	2.7	1.8	2.3	1.8	2.2	2.2	2.9
35. Other transport services	4.3	5.4	5.1	4.3	4.9	7.2	6.9	8.8	4.9
36. Communication services	8.3	8.7	8.2	7.7	8.4	7.1	8.0	7.2	8.4
37. Financial/business services	5.0	4.8	5.6	4.6	5.8	4.6	5.9	5.8	5.1
38. Dwelling ownership	3.1	3.5	3.1	2.2	3.5	1.6	3.1	3.5	3.2
39. Public services	2.2	2.1	3.0	1.9	3.2	1.7	2.7	2.9	2.4
40. Other services	3.2	3.1	3.9	2.9	4.1	3.0	3.5	3.1	3.3
41. Private transport services	1.9	1.9	1.8	2.5	2.4	1.9	2.8	1.7	2.0

Table 7: Exogenous Shocks (cumulative deviations from base, $ million, 2001 prices)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Iron																				
Production ($Am)*#				117	176	195	195	195	312	371	390	390	390	390	390	390	390	390	390	390
Investment ($Am)*	2	161	181	6	0	2	161	181	6	20	20	20	20	20	20	20	20	20	20	20
Return to capital ($Am)*				21	50	60	60	60	60	60	60	60	60	50	81	97	97	97	97	97
Tax payable ($Am)*					7	11	11	12	13	20	24	26	27	38	11	11	11	12	12	12
Steel																				
Production ($Am)*														254	381	423	423	423	423	423
Investment ($Am)*												203	229	20	20	20	20	20	20	20
Return to capital ($Am)*														-10	38	54	54	54	54	54
Tax payable ($Am)*														1	7	8	9	10	10	11
*License income ($Am)**						46	93	173	258	352	489	265	275	285	294	311	322	337	351	365

* Constant (2001) prices.

All of the production to 2013 is exported. In 2014, exports are valued at $235 million, and the steel plant purchases $155 million worth of iron. In every year after 2014, exports are valued at $140 million, with $250 million worth of production sold to the steel plant.

Table 8: Macroeconomic Variables (percentage deviations from base)

Variable		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Real private consumption	Aus	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.05	0.06	0.08
	WA	0.00	0.10	0.13	0.07	0.10	0.12	0.21	0.22	0.14	0.12
	Rest	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.05	0.07
Real public consumption (state)	Aus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	WA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Rest	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Real public consumption (federal)	Aus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	WA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Rest	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Real investment	Aus	0.00	0.15	0.16	0.02	0.03	0.04	0.21	0.23	0.11	0.14
	WA	0.02	1.22	1.41	0.25	0.24	0.28	1.48	1.61	0.40	0.35
	Rest	0.00	0.01	0.00	-0.01	0.00	0.01	0.04	0.05	0.07	0.11
Real international exports	Aus	0.00	-0.15	-0.17	0.02	0.06	0.02	-0.16	-0.25	-0.14	-0.19
	WA	0.00	-0.18	-0.21	0.47	0.80	0.88	0.69	0.62	1.19	1.41
	Rest	0.00	-0.14	-0.16	-0.10	-0.14	-0.22	-0.40	-0.49	-0.51	-0.62
Real international imports	Aus	0.00	0.10	0.10	0.03	0.04	0.06	0.16	0.18	0.12	0.14
	WA	0.01	0.84	0.96	0.26	0.33	0.39	1.23	1.33	0.59	0.64
	Rest	0.00	0.02	0.02	0.01	0.01	0.02	0.05	0.06	0.07	0.09
Real total value added (GDP/GSP)	Aus	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03
	WA	0.00	0.14	0.17	0.13	0.20	0.24	0.38	0.38	0.32	0.36
	Rest	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.01	-0.01
Employment (hours)	Aus	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.00
	WA	0.00	0.18	0.22	0.08	0.13	0.15	0.32	0.33	0.17	0.17
	Rest	0.00	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.03	-0.02	-0.02
Employment (persons)	Aus	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.00
	WA	0.00	0.19	0.23	0.08	0.14	0.17	0.36	0.37	0.19	0.20
	Rest	0.00	-0.01	-0.01	-0.01	-0.01	-0.02	-0.03	-0.03	-0.02	-0.02
Capital stock	Aus	0.00	0.00	0.00	0.03	0.04	0.05	0.05	0.05	0.08	0.10
	WA	0.00	0.00	0.01	0.28	0.44	0.50	0.51	0.53	0.76	0.89
	Rest	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
Real wage rate (consumer)	Aus	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01
	WA	0.00	-0.09	-0.09	-0.04	-0.07	-0.06	-0.11	-0.07	0.02	0.04
	Rest	0.00	0.01	0.02	0.01	0.02	0.01	0.02	0.02	0.01	0.01

Table continued

Table 8 (continued): Macroeconomic Variables (percentage deviations from base)

Variable		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Real private consumption	Aus	0.10	0.10	0.10	0.09	0.09	0.09	0.10	0.10	0.10	0.10
	WA	0.08	0.23	0.27	0.22	0.23	0.24	0.24	0.23	0.23	0.22
	Rest	0.10	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09
Real public consumption (state)	Aus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	WA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Rest	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Real public consumption (federal)	Aus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	WA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Rest	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Real investment	Aus	0.16	0.25	0.26	0.10	0.10	0.11	0.10	0.10	0.10	0.09
	WA	0.30	1.58	1.81	0.56	0.51	0.53	0.51	0.48	0.46	0.43
	Rest	0.14	0.07	0.05	0.04	0.04	0.05	0.04	0.04	0.04	0.05
Real international exports	Aus	-0.27	-0.19	-0.23	-0.06	-0.04	-0.05	-0.05	-0.06	-0.06	-0.07
	WA	1.44	1.36	1.27	1.84	1.98	2.07	2.04	1.99	1.95	1.91
	Rest	-0.74	-0.60	-0.63	-0.56	-0.58	-0.61	-0.60	-0.60	-0.60	-0.59
Real international imports	Aus	0.17	0.23	0.23	0.14	0.14	0.15	0.14	0.14	0.14	0.14
	WA	0.63	1.49	1.62	0.81	0.79	0.82	0.81	0.79	0.76	0.74
	Rest	0.12	0.10	0.09	0.07	0.07	0.08	0.07	0.07	0.07	0.07
Real total value added (GDP/GSP)	Aus	0.03	0.05	0.05	0.04	0.05	0.05	0.05	0.05	0.05	0.05
	WA	0.35	0.53	0.56	0.54	0.58	0.61	0.60	0.59	0.58	0.57
	Rest	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Employment (hours)	Aus	0.00	0.02	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
	WA	0.14	0.38	0.42	0.32	0.34	0.36	0.36	0.35	0.33	0.32
	Rest	-0.02	-0.01	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03
Employment (persons)	Aus	0.00	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	WA	0.17	0.45	0.50	0.35	0.36	0.38	0.38	0.37	0.36	0.35
	Rest	-0.02	-0.01	-0.03	-0.03	-0.03	-0.04	-0.04	-0.04	-0.04	-0.04
Capital stock	Aus	0.11	0.11	0.12	0.15	0.16	0.17	0.17	0.17	0.17	0.17
	WA	0.93	0.92	0.92	1.20	1.32	1.38	1.38	1.37	1.36	1.34
	Rest	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04
Real wage rate (consumer)	Aus	0.01	0.03	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05
	WA	0.08	-0.10	-0.09	0.00	-0.01	-0.01	0.00	0.02	0.03	0.04
	Rest	0.01	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Table 9: Macroeconomic Variables (absolute deviations from base)

Variable		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Real private consumption	Aus	0.4	30.3	38.2	17.0	24.8	49.4	101.4	141.6	159.7	206.6
($million, 2001 prices)	WA	0.3	25.8	35.2	18.1	25.8	32.2	56.9	59.8	36.8	31.7
	Rest	0.1	4.5	3.0	-1.1	-1.1	17.1	44.6	81.7	122.9	174.9
Real public consumption (state)	Aus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
($million, 2001 prices)	WA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Rest	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Real public consumption (federal)	Aus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
($million, 2001 prices)	WA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Rest	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Real investment	Aus	2.3	180.3	191.9	22.0	31.1	52.9	245.6	279.4	131.9	166.1
($million, 2001 prices)	WA	2.2	169.4	195.6	34.8	34.0	39.0	206.0	224.3	55.3	49.2
	Rest	0.1	10.9	-3.8	-12.8	-2.9	13.9	39.6	55.1	76.6	116.9
Real international exports	Aus	-1.2	-94.8	-105.3	18.6	43.9	20.1	-92.2	-146.5	-75.1	-99.0
($million, 2001 prices)	WA	-0.3	-25.6	-30.0	66.6	112.7	124.7	98.3	88.0	168.6	199.8
	Rest	-0.9	-69.3	-75.4	-48.0	-68.8	-104.6	-190.5	-234.5	-243.7	-298.8
Real international imports	Aus	1.1	85.0	92.8	28.4	39.2	51.7	143.2	161.5	106.3	128.7
($million, 2001 prices)	WA	0.9	70.3	80.3	22.1	27.9	32.4	103.5	111.6	49.8	53.4
	Rest	0.2	14.8	12.5	6.3	11.3	19.3	39.7	49.9	56.5	75.3
Real total value added (GDP/GSP)	Aus	0.5	42.9	45.9	34.5	65.7	78.1	125.3	127.9	120.2	151.8
($million, 2001 prices)	WA	0.8	66.6	81.2	61.6	99.6	118.0	183.0	187.2	156.0	173.3
	Rest	-0.3	-23.7	-35.3	-27.1	-33.8	-39.9	-57.8	-59.3	-35.8	-21.6
Employment (persons)	Aus	0.0	0.7	0.7	-0.2	0.0	0.0	0.7	0.6	-0.2	0.0
(thousand persons)	WA	0.0	1.3	1.6	0.6	0.9	1.2	2.5	2.5	1.3	1.4
	Rest	0.0	-0.6	-0.9	-0.7	-0.9	-1.2	-1.8	-1.9	-1.5	-1.4
Capital stock	Aus	0.0	1.7	41.7	573.6	897.6	1052.1	1120.7	1224.3	1841.1	2262.7
($million, 2001 prices)	WA	0.0	0.9	28.0	566.3	904.6	1059.4	1109.2	1166.9	1724.0	2059.5
	Rest	0.0	0.8	13.7	7.3	-7.0	-7.3	11.5	57.5	117.1	203.2
International trade balance	Aus	0.00	-0.10	-0.12	0.06	0.10	0.10	-0.02	-0.05	0.13	0.16
($billion, current prices)	WA	0.00	-0.09	-0.11	0.06	0.11	0.12	0.01	-0.01	0.17	0.21
	Rest	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.03	-0.04	-0.04	-0.05

Table continued

Table 9(continued): Macroeconomic Variables (absolute deviations from base)

Variable		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Real private consumption	Aus	265.5	260.8	263.0	244.9	248.2	257.5	264.0	269.7	275.2	280.4
($million, 2001 prices)	WA	22.1	60.3	72.2	59.9	61.4	63.7	64.1	62.9	61.1	58.9
	Rest	243.4	200.5	190.8	185.0	186.8	193.8	199.9	206.9	214.1	221.5
Real public consumption (state)	Aus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
($million, 2001 prices)	WA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Rest	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Real public consumption (federal)	Aus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
($million, 2001 prices)	WA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Rest	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Real investment	Aus	198.9	300.3	307.5	120.6	119.5	124.0	118.2	114.8	112.0	109.9
($million, 2001 prices)	WA	41.3	218.8	251.5	78.0	70.6	74.2	71.3	67.3	63.6	60.4
	Rest	157.6	81.5	56.0	42.6	48.8	49.8	46.9	47.5	48.4	49.4
Real international exports	Aus	-150.8	-98.9	-123.1	-10.7	-0.1	0.5	-1.4	-5.9	-10.3	-14.5
($million, 2001 prices)	WA	204.3	191.9	179.8	259.7	280.1	292.9	288.0	282.2	276.1	270.0
	Rest	-355.1	-290.8	-302.8	-270.4	-280.3	-292.4	-289.4	-288.1	-286.4	-284.5
Real international imports	Aus	147.1	204.5	207.5	126.5	125.5	130.2	127.5	125.4	123.4	121.6
($million, 2001 prices)	WA	52.7	125.0	135.9	67.7	66.1	69.0	67.7	65.9	64.1	62.4
	Rest	94.3	79.5	71.5	58.8	59.4	61.2	59.9	59.4	59.3	59.2
Real total value added (GDP/GSP)	Aus	169.1	263.0	246.0	236.0	247.8	255.5	255.0	252.4	249.9	247.6
($million, 2001 prices)	WA	170.7	256.8	271.6	263.2	282.7	295.9	294.4	289.8	284.5	278.9
	Rest	-1.6	6.2	-25.5	-27.2	-34.9	-40.4	-39.4	-37.5	-34.6	-31.3
Employment (persons)	Aus	0.0	2.2	1.5	0.4	0.1	0.0	0.0	0.0	-0.1	-0.1
(thousand persons)	WA	1.2	3.1	3.4	2.4	2.5	2.6	2.6	2.6	2.5	2.4
	Rest	-1.2	-0.9	-1.9	-2.1	-2.4	-2.6	-2.6	-2.6	-2.6	-2.5
Capital stock	Aus	2539.2	2742.4	2868.6	3670.8	4075.5	4341.3	4451.8	4547.2	4635.6	4719.9
($million, 2001 prices)	WA	2203.5	2232.8	2286.8	3055.5	3438.2	3670.3	3745.9	3809.8	3865.0	3913.8
	Rest	335.7	509.6	581.8	615.3	637.3	671.0	705.9	737.4	770.6	806.1
International trade balance	Aus	0.16	0.06	0.03	0.19	0.23	0.25	0.25	0.25	0.25	0.24
($billion, current prices)	WA	0.22	0.12	0.09	0.25	0.29	0.31	0.31	0.31	0.31	0.31
	Rest	-0.06	-0.06	-0.06	-0.05	-0.06	-0.06	-0.06	-0.06	-0.07	-0.07

Table 10:Industry Real Value Added – Western Australia (deviations ($million, 2001 prices) from base)

Industry	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1. Agriculture	0.0	-1.2	-1.3	-1.2	-1.5	-1.8	-3.0	-3.5	-3.5	-4.1
2. Forestry	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
3. Iron ore	0.0	0.0	0.0	5.0	7.6	8.4	8.4	8.4	13.3	15.9
4. Non-iron ore	0.0	-3.1	-4.0	-5.4	-6.2	-6.9	-10.3	-12.0	-13.6	-15.4
5. Black coal	0.0	0.0	0.0	8.9	14.9	17.5	18.0	18.1	26.8	32.5
6. Crude oil	0.0	-0.1	-0.3	-0.3	-0.4	-0.5	-0.6	-0.8	-0.9	-0.9
7. Natural gas	0.0	-0.2	-0.4	-0.5	-0.5	-0.7	-1.0	-1.4	-1.6	-1.9
8. WAHP steel plant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9. Food, beverages and tobacco	0.0	-0.1	-0.1	-0.6	-0.4	-0.3	-0.3	-0.4	-0.8	-0.9
10. Textiles, clothing, footwear	0.0	-0.1	-0.2	-0.3	-0.3	-0.3	-0.4	-0.4	-0.5	-0.5
11. Wood and paper products	0.0	0.0	0.0	-0.9	-0.8	-0.6	-0.4	-0.3	-1.0	-0.9
12. Chemical prods. excl. petrol	0.0	-0.4	-0.4	-0.5	-0.3	-0.1	-0.4	-0.4	-0.3	-0.1
13. Petroleum products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14. Building prods (not cement & metal)	0.0	0.6	0.8	0.7	1.2	1.5	2.2	2.4	2.4	2.7
15. Cement	0.0	0.1	0.1	0.0	0.0	0.1	0.1	0.2	0.1	0.1
16. Iron and steel	0.0	0.0	0.0	-0.6	-0.4	-0.2	0.0	0.0	-0.5	-0.4
17. Aluminium/alumina & magnesium	0.0	-0.7	-0.8	-3.9	-3.3	-2.3	-2.4	-2.5	-4.9	-4.8
18. Other metal products	0.0	-0.3	-0.3	-2.8	-2.4	-1.7	-1.6	-1.7	-3.8	-3.8
19. Motor vehicles and parts	0.0	0.0	0.0	-0.2	-0.2	-0.1	-0.1	-0.2	-0.3	-0.3
20. Other manufacturing	0.1	4.1	4.8	0.3	0.2	0.4	5.1	5.8	0.8	0.7
21. Electricity – black coal	0.0	0.1	0.1	-4.1	-2.8	-1.2	-0.2	0.1	-3.0	-2.2
22. Electricity – brown coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23. Electricity – gas	0.0	0.1	0.2	4.2	4.4	3.8	3.5	3.3	6.4	6.7
24. Electricity – oil prods.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25. Electricity – other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26. Electricity supply	0.0	0.2	0.2	0.2	0.9	1.4	1.8	1.9	2.0	2.6
27. Urban gas distribution	0.0	0.0	0.0	0.4	0.7	0.9	0.9	1.0	1.4	1.7
28. Water and sewerage services	0.0	0.2	0.3	0.6	1.0	1.2	1.5	1.5	1.9	2.2
29. Construction services	0.2	19.6	25.2	9.1	9.0	10.3	30.5	34.8	15.6	13.0
30. Trade services	0.3	22.0	26.3	7.7	11.9	14.8	38.9	41.4	19.0	19.9
31. Road transport services	0.0	1.8	2.2	1.0	2.1	2.6	4.7	4.8	3.4	3.9
32 Railway transport services	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.4	0.5
33 Water transport services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34 Air transport services	0.0	-0.2	-0.2	-0.2	-0.3	-0.3	-0.5	-0.6	-0.6	-0.7
35 Other transport services	0.0	-0.2	-0.2	0.0	0.4	0.5	0.4	0.2	0.4	0.5
36 Communications services	0.0	0.8	1.0	0.9	1.5	1.9	2.8	2.9	2.5	2.8
37 Finance, property and business services	0.1	7.2	9.1	6.2	10.2	12.4	20.4	21.4	17.0	18.8
38 Dwelling services	0.0	0.0	0.1	0.4	0.6	0.8	1.1	1.6	2.1	2.4
39 Public services	0.0	2.5	3.3	1.2	2.3	3.1	5.6	5.5	2.4	1.9
40 Other private services	0.0	0.6	0.8	0.3	0.6	0.8	1.5	1.5	0.9	0.8
41 Private transport services	0.0	0.2	1.0	1.5	1.2	1.3	1.8	2.8	3.0	2.2
42 WAHP iron plant	0.0	0.0	0.0	33.8	50.8	56.6	56.6	56.6	90.4	107.5

Table continued

Table 10(continued): Industry Real Value Added – Western Australia (deviations ($million, 2001 prices) from base)

Industry	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1. Agriculture	-4.6	-4.1	-4.5	-4.0	-4.1	-4.3	-4.1	-4.0	-3.9	-3.8
2. Forestry	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
3. Iron ore	16.7	16.8	16.8	17.3	16.8	18.0	18.0	18.1	18.1	18.1
4. Non-iron ore	-16.8	-18.2	-20.4	-20.3	-21.1	-22.7	-22.8	-23.0	-23.2	-23.3
5. Black coal	35.0	35.5	35.7	37.6	37.8	40.2	40.6	40.8	40.9	41.0
6. Crude oil	-1.0	-1.0	-1.2	-1.3	-1.3	-1.3	-1.4	-1.4	-1.4	-1.4
7. Natural gas	-2.2	-2.6	-2.9	-3.1	-3.3	-3.5	-3.6	-3.8	-4.0	-4.1
8. WAHP steel plant	0.0	0.0	0.0	57.7	86.6	96.1	96.1	96.1	96.1	96.1
9. Food, beverages and tobacco	-1.0	-0.5	-0.5	-0.5	-0.5	-0.6	-0.4	-0.3	-0.3	-0.2
10. Textiles, clothing, footwear	-0.5	-0.5	-0.6	-0.5	-0.5	-0.6	-0.5	-0.5	-0.5	-0.4
11. Wood and paper products	-0.7	-0.4	-0.3	-0.7	-0.6	-0.7	-0.5	-0.3	-0.1	0.0
12. Chemical prods. excl. petrol	0.1	0.0	0.0	0.2	0.2	0.2	0.4	0.5	0.6	0.7
13. Petroleum products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14. Building prods (not cement & metal)	2.9	3.8	4.2	4.2	4.6	5.0	5.1	5.2	5.3	5.3
15. Cement	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.4
16. Iron and steel	-0.2	0.0	0.0	-0.2	-0.1	-0.2	-0.1	0.0	0.0	0.0
17. Aluminium/alumina & magnesium	-4.2	-3.8	-3.9	-4.5	-4.4	-5.0	-4.4	-4.1	-3.9	-3.8
18. Other metal products	-3.4	-2.8	-2.7	-3.3	-3.2	-3.7	-3.3	-3.1	-3.0	-2.9
19. Motor vehicles and parts	-0.3	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2
20. Other manufacturing	0.6	6.2	7.1	1.7	1.6	1.6	1.7	1.8	1.8	1.9
21. Electricity – black coal	-1.0	0.1	0.5	1.1	2.3	2.3	3.0	3.5	3.8	4.0
22. Electricity – brown coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23. Electricity – gas	6.3	6.2	6.0	7.4	7.7	8.6	8.3	8.1	8.0	7.8
24. Electricity – oil prods.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25. Electricity – other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26. Electricity supply	3.0	3.5	3.6	4.7	5.5	5.9	6.2	6.3	6.4	6.4
27. Urban gas distribution	1.8	1.9	2.0	2.4	2.6	2.9	3.0	3.0	3.1	3.1
28. Water and sewerage services	2.2	2.7	2.8	3.3	3.6	3.9	3.9	3.9	4.0	4.0
29. Construction services	10.7	34.8	44.4	22.5	20.4	21.7	21.6	20.9	20.2	19.6
30. Trade services	18.2	51.0	57.1	34.2	35.2	37.4	38.0	37.9	37.6	37.2
31. Road transport services	3.9	7.1	7.6	6.1	6.3	6.8	6.9	6.9	6.9	6.9
32 Railway transport services	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6
33 Water transport services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34 Air transport services	-0.8	-0.8	-0.9	-0.8	-0.9	-0.9	-0.9	-0.8	-0.8	-0.8
35 Other transport services	0.4	0.9	0.8	1.1	1.1	1.2	1.3	1.4	1.4	1.4
36 Communications services	2.8	4.3	4.7	4.6	4.9	5.3	5.4	5.4	5.4	5.4
37 Finance, property and business services	18.3	30.9	34.0	32.9	35.8	38.6	39.3	39.5	39.5	39.5
38 Dwelling services	2.6	2.6	2.9	3.5	4.1	4.5	5.0	5.5	6.0	6.5
39 Public services	0.7	6.2	7.4	5.4	5.7	6.0	6.2	6.2	6.0	5.9
40 Other private services	0.6	1.9	2.2	1.7	1.8	1.9	2.0	2.0	2.0	2.0
41 Private transport services	1.8	1.6	3.0	3.9	3.6	3.6	3.8	3.9	3.8	3.8
42 WAHP iron plant	113.2	113.2	113.2	86.0	72.8	60.9	60.9	60.9	60.9	60.9

Table 11:Industry Real Value Added – Rest of Australia (deviations ($million, 2001 prices) from base)

Industry	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1. Agriculture	-0.1	-5.4	-6.1	-3.8	-5.5	-8.5	-15.6	-19.3	-19.7	-24.2
2. Forestry	0.0	0.0	-0.1	0.0	0.0	-0.1	-0.2	-0.2	-0.2	-0.3
3. Iron ore	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
4. Non-iron ore	0.0	-1.5	-1.7	-0.9	-1.5	-2.4	-4.6	-6.0	-6.3	-8.0
5. Black coal	0.0	-2.2	-2.5	-1.7	-2.6	-4.0	-7.1	-9.1	-9.9	-12.5
6. Crude oil	0.0	-0.2	-0.8	-0.9	-0.7	-0.8	-1.4	-2.3	-3.0	-3.4
7. Natural gas	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.3	-0.3	-0.3
8. Brown coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9. Food, beverages and tobacco	0.0	-2.7	-3.1	-2.0	-3.0	-4.5	-8.4	-10.4	-10.7	-13.2
10. Textiles, clothing, footwear	0.0	-1.6	-1.9	-1.2	-1.8	-2.9	-5.4	-6.9	-7.4	-9.2
11. Wood and paper products	0.0	-0.2	-0.2	-0.1	-0.4	-1.1	-1.6	-2.3	-2.7	-3.3
12. Chemical prods. excl. petrol	0.0	-1.5	-1.7	0.9	1.4	0.6	-1.7	-3.3	-1.8	-2.6
13. Petroleum products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0
14. Building prods (not cement & metal)	0.0	0.2	0.1	0.2	0.3	0.4	0.7	0.8	1.2	1.6
15. Cement	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2
16. Iron and steel	0.0	-0.5	-0.6	-0.4	-0.8	-1.5	-2.5	-3.3	-3.7	-4.8
17. Aluminium/alumina & magnesium	0.0	-0.7	-0.8	0.0	-0.3	-1.1	-2.3	-3.2	-3.1	-4.2
18. Other metal products	0.0	-0.9	-1.1	-0.3	-1.2	-2.5	-4.2	-5.5	-5.8	-7.6
19. Motor vehicles and parts	0.0	-0.1	-0.7	-1.2	-1.0	-1.1	-1.6	-2.6	-3.7	-4.0
20. Other manufacturing	0.0	2.6	3.0	-1.0	-2.1	-3.8	-1.7	-3.1	-9.5	-12.1
21. Electricity – black coal	0.0	-0.6	-0.8	-0.4	-0.6	-0.9	-1.6	-2.0	-1.8	-2.1
22. Electricity – brown coal	0.0	-0.1	-0.1	0.0	-0.1	-0.2	-0.3	-0.3	-0.3	-0.4
23. Electricity – gas	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.2	-0.2	-0.3
24. Electricity – oil prods.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25. Electricity – other	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.2	-0.2	-0.2
26. Electricity supply	0.0	-0.2	-0.3	-0.2	-0.3	-0.4	-0.6	-0.8	-0.7	-0.8
27. Urban gas distribution	0.0	0.0	-0.1	0.0	-0.1	-0.1	-0.1	-0.2	-0.1	-0.1
28. Water and sewerage services	0.0	-0.2	-0.2	-0.1	-0.2	-0.3	-0.4	-0.3	0.1	0.4
29. Construction services	0.0	3.1	-0.1	-2.8	-0.4	4.5	13.2	19.9	28.1	42.2
30. Trade services	-0.1	-6.6	-9.9	-7.9	-9.9	-11.0	-16.9	-17.3	-10.4	-6.8
31. Road transport services	0.0	-1.6	-2.2	-1.3	-1.8	-2.6	-4.7	-5.8	-5.3	-6.0
32 Railway transport services	0.0	-0.1	-0.2	0.3	0.5	0.5	0.4	0.2	0.6	0.7
33 Water transport services	0.0	-0.4	-0.5	-0.3	-0.5	-0.7	-1.3	-1.7	-1.8	-2.3
34 Air transport services	0.0	-1.4	-1.6	-1.1	-1.6	-2.5	-4.8	-6.1	-6.5	-8.2
35 Other transport services	0.0	-2.6	-3.0	-1.9	-2.8	-4.3	-8.1	-10.3	-10.7	-13.3
36 Communications services	0.0	-0.1	-0.2	-0.2	-0.1	0.3	0.9	1.8	3.1	4.7
37 Finance, property and business services	0.0	-3.6	-5.5	-4.3	-5.2	-5.8	-8.3	-7.9	-2.9	0.9
38 Dwelling services	0.0	0.0	0.7	0.9	0.7	0.7	1.9	4.7	9.0	14.6
39 Public services	0.0	-1.1	-1.7	-1.6	-2.0	-0.1	1.4	5.3	10.9	16.8
40 Other private services	0.0	0.1	0.0	-0.2	-0.1	0.7	1.7	3.2	4.8	6.9
41 Private transport services	0.0	0.0	0.5	0.4	0.1	0.3	1.6	3.7	6.2	9.0
42 Dummy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table continued

Table 11(continued): Industry Real Value Added – Rest of Australia (deviations ($million, 2001 prices) from base)

Industry	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1. Agriculture	-28.8	-23.1	-25.2	-22.8	-24.2	-25.7	-25.6	-25.8	-25.8	-25.9
2. Forestry	-0.4	-0.2	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4
3. Iron ore	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1
4. Non-iron ore	-9.9	-8.2	-8.9	-8.4	-9.1	-9.8	-10.1	-10.5	-10.9	-11.2
5. Black coal	-15.3	-13.7	-15.1	-14.8	-16.0	-17.4	-18.2	-19.1	-20.0	-20.9
6. Crude oil	-4.2	-4.6	-4.3	-4.2	-3.9	-4.0	-4.2	-4.3	-4.3	-4.4
7. Natural gas	-0.3	-0.3	-0.3	-0.3	-0.4	-0.5	-0.5	-0.5	-0.5	-0.6
8. Brown coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9. Food, beverages and tobacco	-15.8	-12.7	-14.3	-13.2	-14.3	-15.5	-15.7	-16.1	-16.4	-16.7
10. Textiles, clothing, footwear	-11.2	-8.9	-9.8	-9.1	-9.8	-10.6	-10.8	-11.0	-11.2	-11.5
11. Wood and paper products	-4.1	-0.8	-1.8	-2.6	-3.3	-3.7	-3.9	-4.2	-4.3	-4.5
12. Chemical prods. excl. petrol	-4.3	-1.1	-2.1	-0.9	-1.6	-1.7	-1.9	-2.1	-2.3	-2.5
13. Petroleum products	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14. Building prods (not cement & metal)	2.0	1.8	1.3	1.1	1.1	1.1	0.9	0.9	0.8	0.8
15. Cement	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
16. Iron and steel	-6.0	-4.3	-4.8	-5.0	-5.5	-5.9	-6.1	-6.3	-6.4	-6.6
17. Aluminium/alumina & magnesium	-5.5	-4.8	-5.3	-5.0	-5.5	-5.9	-6.2	-6.5	-6.9	-7.1
18. Other metal products	-9.5	-6.8	-8.0	-8.3	-9.3	-9.9	-10.3	-10.7	-11.0	-11.3
19. Motor vehicles and parts	-4.7	-5.5	-5.5	-6.0	-5.8	-6.0	-6.2	-6.3	-6.4	-6.5
20. Other manufacturing	-15.1	-3.6	-4.6	-10.9	-12.3	-13.4	-13.7	-14.2	-14.6	-14.9
21. Electricity – black coal	-2.4	-2.1	-2.6	-2.5	-2.8	-3.0	-3.1	-3.2	-3.3	-3.4
22. Electricity – brown coal	-0.4	-0.2	-0.3	-0.3	-0.4	-0.5	-0.5	-0.6	-0.6	-0.6
23. Electricity – gas	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4	-0.5
24. Electricity – oil prods.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25. Electricity – other	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3
26. Electricity supply	-0.8	-0.7	-0.9	-0.9	-1.0	-1.1	-1.2	-1.2	-1.2	-1.3
27. Urban gas distribution	0.0	0.0	0.0	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2
28. Water and sewerage services	0.9	1.4	1.3	1.6	1.6	1.8	1.9	2.1	2.3	2.5
29. Construction services	57.8	39.5	29.6	24.2	25.1	25.6	25.3	25.8	26.5	27.4
30. Trade services	-1.0	-5.4	-15.0	-14.6	-17.5	-20.0	-20.2	-20.1	-19.6	-19.0
31. Road transport services	-6.8	-5.4	-7.2	-6.9	-7.7	-8.4	-8.6	-8.9	-9.1	-9.2
32 Railway transport services	0.7	0.8	0.7	0.8	0.6	0.7	0.6	0.6	0.6	0.5
33 Water transport services	-2.7	-2.3	-2.5	-2.3	-2.5	-2.6	-2.7	-2.8	-2.8	-2.9
34 Air transport services	-10.0	-8.6	-9.4	-8.7	-9.4	-10.1	-10.3	-10.6	-10.8	-11.1
35 Other transport services	-16.1	-13.5	-14.9	-13.6	-14.7	-15.9	-16.2	-16.6	-17.0	-17.4
36 Communications services	6.8	5.7	5.2	5.1	5.1	5.4	5.6	5.9	6.1	6.5
37 Finance, property and business services	6.3	7.9	1.1	0.9	-0.7	-1.7	-1.5	-1.1	-0.4	0.4
38 Dwelling services	22.5	33.1	39.3	44.5	48.7	53.0	57.3	61.6	65.9	70.2
39 Public services	25.2	16.9	15.0	15.0	14.9	15.5	16.4	17.4	18.5	19.8
40 Other private services	9.8	7.6	7.3	7.1	7.3	7.6	8.0	8.4	8.8	9.3
41 Private transport services	12.9	16.6	14.3	13.4	12.8	13.1	13.8	14.3	14.9	15.6
42 Dummy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 12:Industry Employment – Western Australia (deviations (thousand persons) from base)

Industry	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1. Agriculture	0.00	-0.04	-0.04	-0.04	-0.04	-0.05	-0.09	-0.10	-0.10	-0.12
2. Forestry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
3. Iron ore	0.00	0.00	0.00	0.05	0.07	0.08	0.07	0.06	0.11	0.13
4. Non-iron ore	0.00	-0.03	-0.04	-0.05	-0.05	-0.05	-0.09	-0.10	-0.10	-0.11
5. Black coal	0.00	0.00	0.00	0.23	0.21	0.16	0.13	0.12	0.33	0.33
6. Crude oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7. Natural gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8. WAHP steel plant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9. Food, beverages and tobacco	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02
10. Textiles, clothing, footwear	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
11. Wood and paper products	0.00	0.00	0.00	-0.03	-0.03	-0.02	-0.01	-0.01	-0.03	-0.03
12. Chemical prods. excl. petrol	0.00	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
13. Petroleum products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14. Building prods (not cement & metal)	0.00	0.02	0.02	0.02	0.03	0.03	0.05	0.05	0.05	0.06
15. Cement	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16. Iron and steel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17. Aluminium/alumina & magnesium	0.00	-0.01	-0.01	-0.03	-0.03	-0.02	-0.02	-0.02	-0.04	-0.04
18. Other metal products	0.00	-0.01	-0.01	-0.07	-0.05	-0.04	-0.03	-0.03	-0.08	-0.08
19. Motor vehicles and parts	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02
20. Other manufacturing	0.00	0.15	0.18	0.01	0.01	0.01	0.18	0.20	0.02	0.02
21. Electricity – black coal	0.00	0.00	0.00	-0.06	-0.03	0.00	0.01	0.01	-0.03	-0.02
22. Electricity – brown coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23. Electricity – gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24. Electricity – oil prods.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25. Electricity – other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26. Electricity supply	0.00	0.01	0.01	0.01	0.03	0.04	0.04	0.04	0.04	0.05
27. Urban gas distribution	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
28. Water and sewerage services	0.00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
29. Construction services	0.00	0.37	0.46	0.15	0.14	0.16	0.52	0.58	0.23	0.18
30. Trade services	0.01	0.69	0.79	0.20	0.32	0.39	1.09	1.12	0.44	0.46
31. Road transport services	0.00	0.03	0.03	0.01	0.03	0.04	0.06	0.06	0.04	0.05
32 Railway transport services	0.00	0.00	0.00	0.03	0.04	0.05	0.05	0.05	0.07	0.08
33 Water transport services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
34 Air transport services	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01
35 Other transport services	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.01	0.01
36 Communications services	0.00	0.02	0.02	0.02	0.03	0.03	0.05	0.04	0.03	0.03
37 Finance, property and business services	0.00	0.20	0.24	0.15	0.24	0.29	0.47	0.48	0.35	0.37
38 Dwelling services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
39 Public services	0.00	0.06	0.08	0.03	0.06	0.08	0.13	0.13	0.06	0.05
40 Other private services	0.00	0.05	0.06	0.03	0.05	0.06	0.10	0.10	0.05	0.05
41 Private transport services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42 WAHP iron plant	0.00	0.00	0.00	0.02	0.03	0.03	0.03	0.03	0.04	0.05

Table continued

Table 12(continued): Industry Employment – Western Australia (deviations (thousand persons) from base)

Industry	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1. Agriculture	-0.14	-0.12	-0.13	-0.11	-0.11	-0.12	-0.11	-0.11	-0.11	-0.10
2. Forestry	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
3. Iron ore	0.13	0.11	0.11	0.10	0.09	0.10	0.09	0.09	0.08	0.08
4. Non-iron ore	-0.12	-0.13	-0.14	-0.12	-0.12	-0.13	-0.13	-0.12	-0.12	-0.12
5. Black coal	0.28	0.25	0.25	0.28	0.26	0.30	0.28	0.27	0.27	0.26
6. Crude oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7. Natural gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8. WAHP steel plant	0.00	0.00	0.00	0.13	0.20	0.22	0.21	0.21	0.21	0.21
9. Food, beverages and tobacco	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	0.00	0.00
10. Textiles, clothing, footwear	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
11. Wood and paper products	-0.02	-0.01	-0.01	-0.02	-0.02	-0.02	-0.01	-0.01	0.00	0.00
12. Chemical prods. excl. petrol	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
13. Petroleum products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14. Building prods (not cement & metal)	0.06	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09
15. Cement	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16. Iron and steel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17. Aluminium/alumina & magnesium	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.02	-0.02	-0.02
18. Other metal products	-0.07	-0.05	-0.05	-0.06	-0.06	-0.07	-0.06	-0.05	-0.05	-0.05
19. Motor vehicles and parts	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
20. Other manufacturing	0.01	0.21	0.24	0.05	0.04	0.05	0.05	0.05	0.05	0.05
21. Electricity – black coal	0.00	0.01	0.02	0.03	0.04	0.03	0.04	0.03	0.03	0.03
22. Electricity – brown coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23. Electricity – gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24. Electricity – oil prods.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25. Electricity – other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26. Electricity supply	0.05	0.06	0.06	0.09	0.10	0.10	0.09	0.09	0.08	0.08
27. Urban gas distribution	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
28. Water and sewerage services	0.02	0.03	0.03	0.03	0.04	0.04	0.03	0.03	0.03	0.03
29. Construction services	0.14	0.55	0.69	0.32	0.28	0.30	0.30	0.28	0.27	0.26
30. Trade services	0.40	1.31	1.44	0.78	0.79	0.83	0.83	0.81	0.79	0.77
31. Road transport services	0.04	0.09	0.09	0.07	0.07	0.07	0.07	0.07	0.07	0.07
32 Railway transport services	0.09	0.09	0.09	0.09	0.08	0.09	0.09	0.09	0.09	0.08
33 Water transport services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
34 Air transport services	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
35 Other transport services	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
36 Communications services	0.03	0.06	0.06	0.05	0.06	0.06	0.06	0.05	0.05	0.05
37 Finance, property and business services	0.34	0.63	0.68	0.63	0.67	0.71	0.70	0.68	0.66	0.64
38 Dwelling services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
39 Public services	0.02	0.14	0.17	0.13	0.13	0.13	0.14	0.13	0.13	0.12
40 Other private services	0.03	0.11	0.13	0.10	0.10	0.11	0.11	0.10	0.10	0.10
41 Private transport services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42 WAHP iron plant	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Table 13:Industry Employment – Rest of Australia (deviations (thousand persons) from base)

Industry	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1. Agriculture	0.00	-0.19	-0.21	-0.13	-0.19	-0.29	-0.54	-0.66	-0.67	-0.82
2. Forestry	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01
3. Iron ore	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4. Non-iron ore	0.00	-0.02	-0.02	-0.01	-0.02	-0.03	-0.07	-0.09	-0.09	-0.11
5. Black coal	0.00	-0.04	-0.04	-0.03	-0.04	-0.06	-0.11	-0.14	-0.14	-0.18
6. Crude oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01
7. Natural gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8. Brown coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9. Food, beverages and tobacco	0.00	-0.07	-0.07	-0.04	-0.06	-0.10	-0.18	-0.23	-0.22	-0.27
10. Textiles, clothing, footwear	0.00	-0.05	-0.06	-0.04	-0.05	-0.08	-0.15	-0.19	-0.20	-0.25
11. Wood and paper products	0.00	-0.01	-0.01	-0.01	-0.02	-0.04	-0.05	-0.07	-0.08	-0.10
12. Chemical prods. excl. petrol	0.00	-0.02	-0.02	0.01	0.02	0.00	-0.02	-0.04	-0.02	-0.03
13. Petroleum products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14. Building prods (not cement & metal)	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03
15. Cement	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16. Iron and steel	0.00	-0.01	-0.01	-0.01	-0.02	-0.03	-0.05	-0.07	-0.08	-0.10
17. Aluminium/alumina & magnesium	0.00	-0.01	-0.01	0.00	0.00	-0.01	-0.02	-0.02	-0.02	-0.03
18. Other metal products	0.00	-0.03	-0.03	-0.01	-0.03	-0.07	-0.11	-0.14	-0.15	-0.19
19. Motor vehicles and parts	0.00	0.00	-0.02	-0.03	-0.03	-0.03	-0.04	-0.07	-0.10	-0.11
20. Other manufacturing	0.00	0.09	0.10	-0.04	-0.07	-0.13	-0.05	-0.10	-0.30	-0.38
21. Electricity – black coal	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01
22. Electricity – brown coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23. Electricity – gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24. Electricity – oil prods.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25. Electricity – other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26. Electricity supply	0.00	-0.01	-0.01	0.00	-0.01	-0.01	-0.02	-0.02	-0.02	-0.02
27. Urban gas distribution	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28. Water and sewerage services	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00
29. Construction services	0.00	0.06	-0.01	-0.07	-0.02	0.08	0.25	0.38	0.53	0.80
30. Trade services	0.00	-0.21	-0.31	-0.24	-0.29	-0.32	-0.49	-0.50	-0.30	-0.21
31. Road transport services	0.00	-0.03	-0.04	-0.02	-0.03	-0.05	-0.09	-0.11	-0.09	-0.11
32 Railway transport services	0.00	-0.01	-0.01	0.02	0.04	0.04	0.03	0.02	0.05	0.05
33 Water transport services	0.00	-0.01	-0.01	0.00	-0.01	-0.01	-0.02	-0.02	-0.02	-0.03
34 Air transport services	0.00	-0.02	-0.02	-0.01	-0.02	-0.03	-0.06	-0.07	-0.07	-0.08
35 Other transport services	0.00	-0.04	-0.05	-0.03	-0.04	-0.06	-0.12	-0.15	-0.15	-0.18
36 Communications services	0.00	0.00	-0.01	-0.01	-0.01	0.00	0.01	0.03	0.05	0.07
37 Finance, property and business services	0.00	-0.09	-0.13	-0.10	-0.11	-0.13	-0.19	-0.19	-0.09	-0.03
38 Dwelling services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
39 Public services	0.00	-0.03	-0.05	-0.04	-0.05	-0.01	0.02	0.10	0.23	0.35
40 Other private services	0.00	0.01	0.00	-0.02	-0.01	0.03	0.09	0.16	0.25	0.35
41 Private transport services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42 Dummy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table continued

Table 13(continued): Industry Employment – Rest of Australia (deviations (thousand persons) from base)

Industry	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1. Agriculture	-0.98	-0.76	-0.84	-0.75	-0.79	-0.84	-0.84	-0.84	-0.84	-0.84
2. Forestry	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
3. Iron ore	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4. Non-iron ore	-0.14	-0.10	-0.11	-0.10	-0.11	-0.12	-0.12	-0.12	-0.12	-0.12
5. Black coal	-0.22	-0.18	-0.19	-0.18	-0.19	-0.20	-0.20	-0.21	-0.21	-0.22
6. Crude oil	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
7. Natural gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8. Brown coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9. Food, beverages and tobacco	-0.32	-0.24	-0.27	-0.24	-0.26	-0.28	-0.28	-0.29	-0.29	-0.29
10. Textiles, clothing, footwear	-0.30	-0.23	-0.25	-0.23	-0.24	-0.26	-0.26	-0.26	-0.26	-0.27
11. Wood and paper products	-0.12	-0.03	-0.06	-0.08	-0.10	-0.11	-0.11	-0.12	-0.12	-0.12
12. Chemical prods. excl. petrol	-0.05	-0.01	-0.02	-0.01	-0.02	-0.02	-0.02	-0.03	-0.03	-0.03
13. Petroleum products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14. Building prods (not cement & metal)	0.04	0.03	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00
15. Cement	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16. Iron and steel	-0.12	-0.09	-0.09	-0.10	-0.10	-0.11	-0.11	-0.11	-0.11	-0.11
17. Aluminium/alumina & magnesium	-0.04	-0.03	-0.04	-0.03	-0.03	-0.04	-0.04	-0.04	-0.04	-0.04
18. Other metal products	-0.24	-0.16	-0.19	-0.20	-0.22	-0.23	-0.23	-0.24	-0.24	-0.24
19. Motor vehicles and parts	-0.13	-0.15	-0.14	-0.16	-0.15	-0.15	-0.15	-0.15	-0.16	-0.16
20. Other manufacturing	-0.47	-0.10	-0.13	-0.32	-0.36	-0.39	-0.39	-0.40	-0.40	-0.41
21. Electricity – black coal	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
22. Electricity – brown coal	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
23. Electricity – gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24. Electricity – oil prods.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25. Electricity – other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26. Electricity supply	-0.02	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
27. Urban gas distribution	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28. Water and sewerage services	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.01
29. Construction services	1.09	0.69	0.48	0.37	0.38	0.39	0.37	0.38	0.39	0.40
30. Trade services	-0.06	-0.19	-0.47	-0.46	-0.54	-0.60	-0.60	-0.59	-0.57	-0.55
31. Road transport services	-0.12	-0.09	-0.13	-0.12	-0.13	-0.14	-0.14	-0.14	-0.14	-0.14
32 Railway transport services	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.04
33 Water transport services	-0.03	-0.02	-0.03	-0.02	-0.02	-0.03	-0.03	-0.03	-0.03	-0.03
34 Air transport services	-0.10	-0.08	-0.08	-0.07	-0.08	-0.09	-0.09	-0.09	-0.09	-0.09
35 Other transport services	-0.22	-0.17	-0.19	-0.16	-0.18	-0.19	-0.19	-0.19	-0.19	-0.19
36 Communications services	0.10	0.07	0.05	0.04	0.04	0.04	0.04	0.04	0.05	0.05
37 Finance, property and business services	0.05	0.06	-0.10	-0.11	-0.15	-0.17	-0.17	-0.17	-0.16	-0.15
38 Dwelling services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
39 Public services	0.53	0.34	0.29	0.29	0.28	0.29	0.30	0.32	0.34	0.35
40 Other private services	0.49	0.34	0.31	0.29	0.29	0.29	0.30	0.31	0.33	0.34
41 Private transport services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42 Dummy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 14: Additional results (deviations from base)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1 Borrowing requirement (Federal; $m)	0.1	10.7	9.6	1.9	3.4	-4.3	-9.7	-38.6	-78.8	-111.9
2. Borrowing requirement (State - WA, $m)	0.0	-2.7	-3.4	-9.7	-17.6	-20.5	-22.4	-20.4	-25.4	-29.3
3. Borrowing requirement (State - ROA, $m)	0.1	5.9	8.7	6.6	8.6	8.6	12.9	11.8	4.6	0.3

Table 14: Additional results (deviations from base)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1 Borrowing requirement (Federal; $m)	-163.1	-91.9	-101.1	-121.9	-127.5	-136.6	-146.3	-157.7	-168.0	-178.4
2. Borrowing requirement (State - WA, $m)	-27.6	-38.3	-38.7	-47.1	-54.9	-60.1	-60.2	-59.8	-59.4	-58.9
3. Borrowing requirement (State - ROA, $m)	-7.1	5.7	13.5	14.2	17.4	19.4	19.8	19.7	19.4	18.8