

**A tale of two
economies:
the regional impact of
Australia's resources
boom**

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Introduction

Strong world demand for mining commodities, and associated increases in commodity prices and incomes, has been a major driver of economic growth for the past two years in the resource-rich States – particularly Western Australia and the Northern Territory. However, for the remainder of Australia, and particularly Victoria, these developments are a mixed blessing. Although Victorians are sharing in the income gains of the resources boom, rising commodity prices have driven up the exchange rate, with adverse consequences for Victorian exporting and import-competing firms. At the same time, labour and capital are being absorbed by the resource-intensive States.

This paper uses a computable general equilibrium (CGE) model to examine the regional impacts of the resources boom. This section discusses some of the features of the Australian and State economies since the boom began, and the channels through which commodity prices influence these characteristics. To be robust, modelling should be able to explain some of these stylised facts. The remainder of this paper sets out the modelling approach and results, and discusses some of the longer-term implications of stronger world demand for mining commodities.

Developments in commodity prices

The recent strength in resource commodity prices reflects strong demand growth in the world economy, particularly from the rapid industrialisation of the Chinese economy, and constrained supply capacity in most resource-producing countries. The supply-side response has been limited by under-investment in mining in the late 1990s and early in the current decade. This is in contrast to previous episodes of rising commodity prices, which were the result of supply shocks, often associated with military conflict. As such, the current upswing in commodity prices has been more gradual and sustained. Rising commodity prices have already generated a substantial increase in Australia's terms of trade. Overall the current commodity price boom represents the largest cumulative rise in Australia's terms of trade since the early 1970s.

Prices for Australia's major resource commodities since 2002-03 are presented in Table 1. This shows that the price boom became broadly-based from 2003-04. For some commodities, particularly non-ferrous metals, there were significant price increases in the previous year. However, prices for iron ore and energy commodities, which account for about half of all resources exports, did not take off until 2004-05.

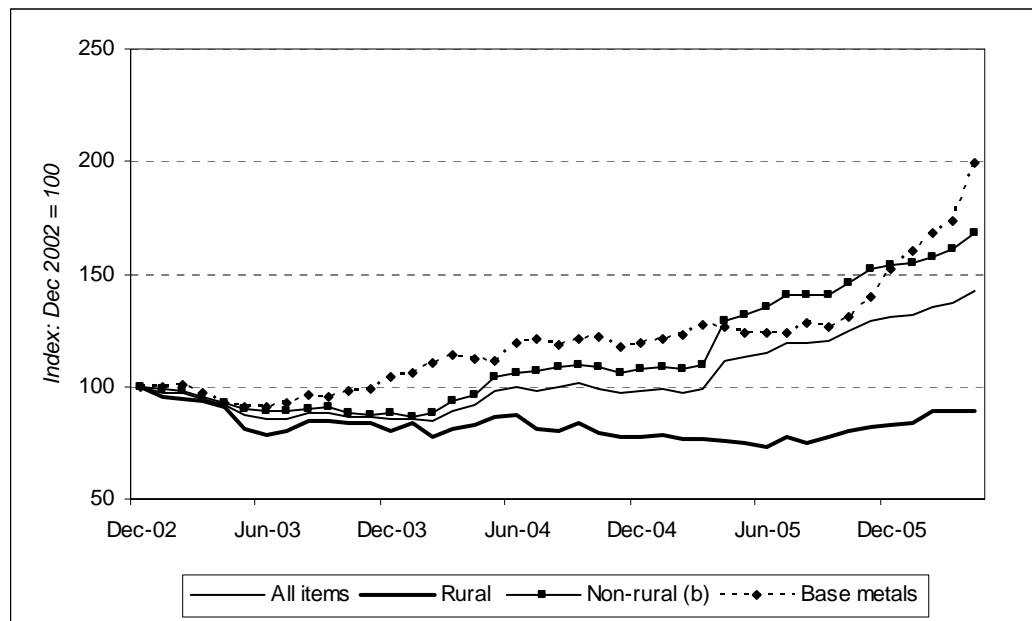
The RBA Index of Commodity Prices (see Chart 1) demonstrates the differential price changes for different commodity groups in the last three years. While prices of rural (agricultural) commodities are currently lower than at the end of 2002, the Australian dollar price of base metals has doubled over the same period.

Table 1: Resource commodity prices

Commodity	Units	2002-03 ^(a)	2003-04 ^(a)	2004-05 ^(a)	Dec-05	2002-03 to 2003-04	2003-04 to 2004-05	2002-03 to Dec 2005
						% change	% change	% change
Alumina	A\$/t	278.0	278.6	311.5	354.4	0.2	11.8	27.5
Aluminium	US\$/t	1360.7	1568.4	1806.9	2248.5	15.3	15.2	65.2
Gold	US\$/oz	334.2	389.3	422.5	509.4	16.5	8.5	52.4
Iron Ore	A\$/t	29.4	27.1	35.5	52.3	-8.0	31.0	77.5
Steaming Coal	A\$/t	44.5	41.0	59.6	67.3	-7.9	45.3	51.3
Coking Coal	A\$/t	69.1	58.3	86.1	146.0	-15.7	47.8	111.3
Crude Oil	US\$/t	26.3	29.3	41.2	51.7	11.7	40.4	96.8
Uranium	US\$/lb	10.2	14.9	22.2	36.3	45.8	49.0	254.7
Copper	US\$/t	1595.1	2333.3	3149.8	4577.5	46.3	35.0	187.0
Lead	US\$/t	445.0	700.1	964.1	1119.3	57.3	37.7	151.5
Zinc	US\$/t	774.8	962.0	1170.9	1822.1	24.2	21.7	135.2
Silver	USc/troy oz	461.0	579.9	694.9	865.3	25.8	19.8	87.7
Nickel	US\$/t	7673.2	12263.0	14971.0	13438.3	59.8	22.1	75.1
Gas	A\$/t	333.0	274.8	302.1	367.9	-17.5	9.9	10.5
Iron and Steel	A\$/t	516.9	630.6	867.9	719.0	22.0	37.6	39.1

Source: ABARE Australian mineral statistics, DTF calculations

Note: (a) Average price over the financial year

Chart 1: RBA Index of commodity prices^(a)

Source: Reserve bank of Australia

Note: (a) Australian dollar prices. All indices re-based to December 2002 = 100.0.

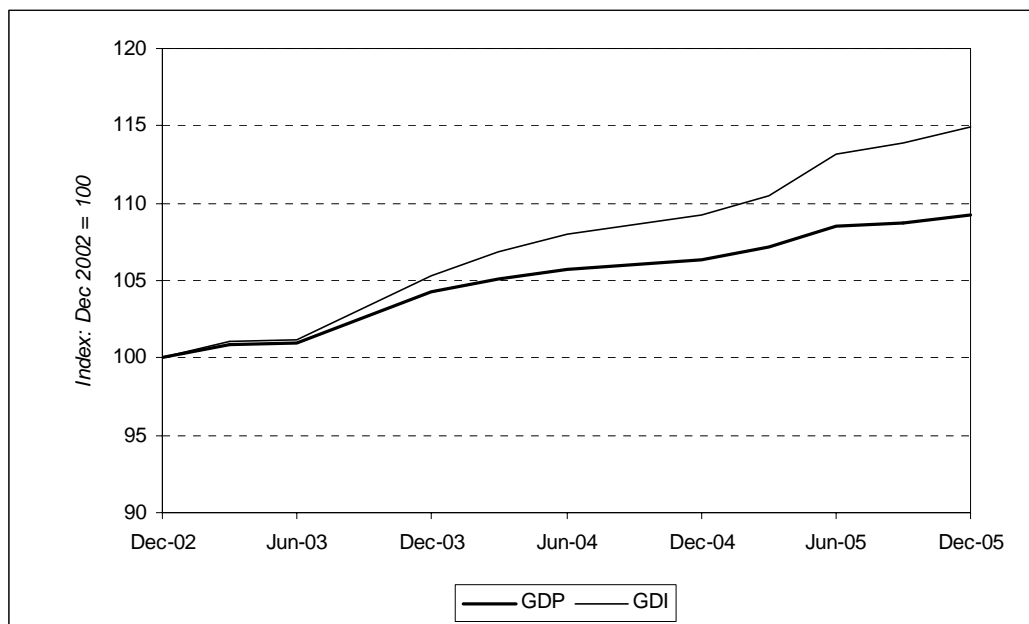
(b) Includes base metals.

Impacts on the Australian economy

Australian real gross domestic product (GDP) growth has been steady, but relatively subdued, averaging about 2.5 per cent in through-year terms since the end of 2004. However, gross domestic income (GDI), which measures the purchasing power of the total incomes generated by domestic production¹, has grown quite strongly over this period, averaging 4.4 per cent in through-year terms (see Chart 2).

¹ Real gross domestic product (GDP) is a measure of the total volume of goods and services produced in an economy. Gross domestic income (GDI) is equal to real GDP plus the trading gain (or less the trading loss) resulting from changes in the terms of trade.

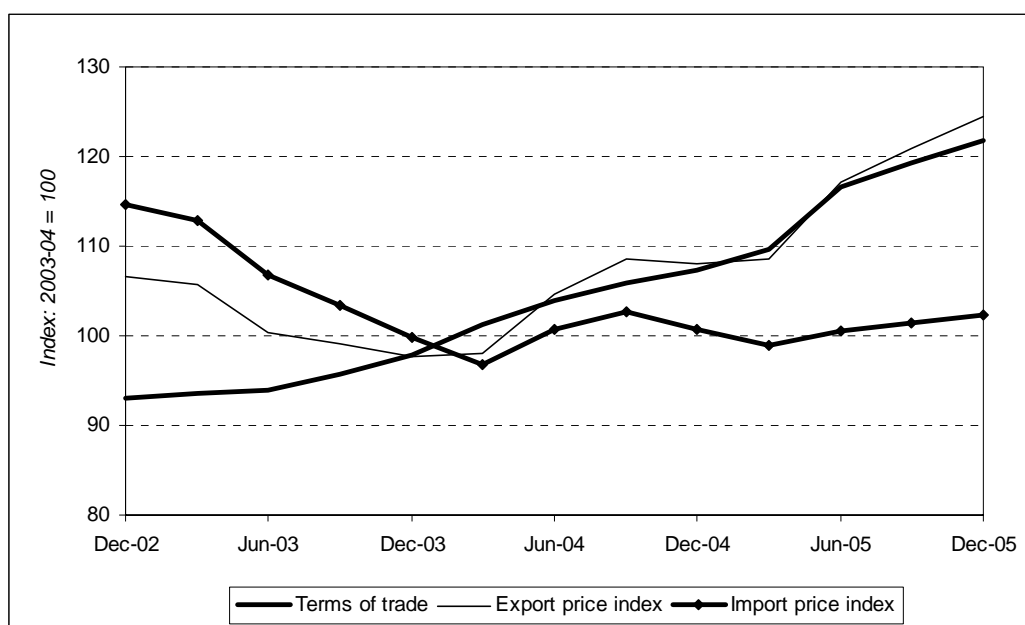
Chart 2: Gross Domestic Product (GDP) and Gross Domestic Income (GDI)^(a)



Source: Australian Bureau of Statistics

Note: (a) Indexed, chain volume measures.

The divergence between GDP and GDI is explained by an increase in the terms of trade – the ratio of the price of Australian exports to the price of imports. As Chart 3 shows, the terms of trade has increased by about 30 per cent over the past three years, boosting national income by about 5½ per cent (RBA, 2006, p.40). This was initially driven by a 13 per cent decline in import prices over the year to December 2003, due to the increased competitiveness of manufacturing in countries such as China and the appreciation of the Australian dollar. However, since the end of 2003, export prices have increased by 27 per cent, accounting for almost all of the gains in the terms of trade of the last two years.

Chart 3: Export and import prices^(a) and the terms of trade

Source: Australian Bureau of Statistics

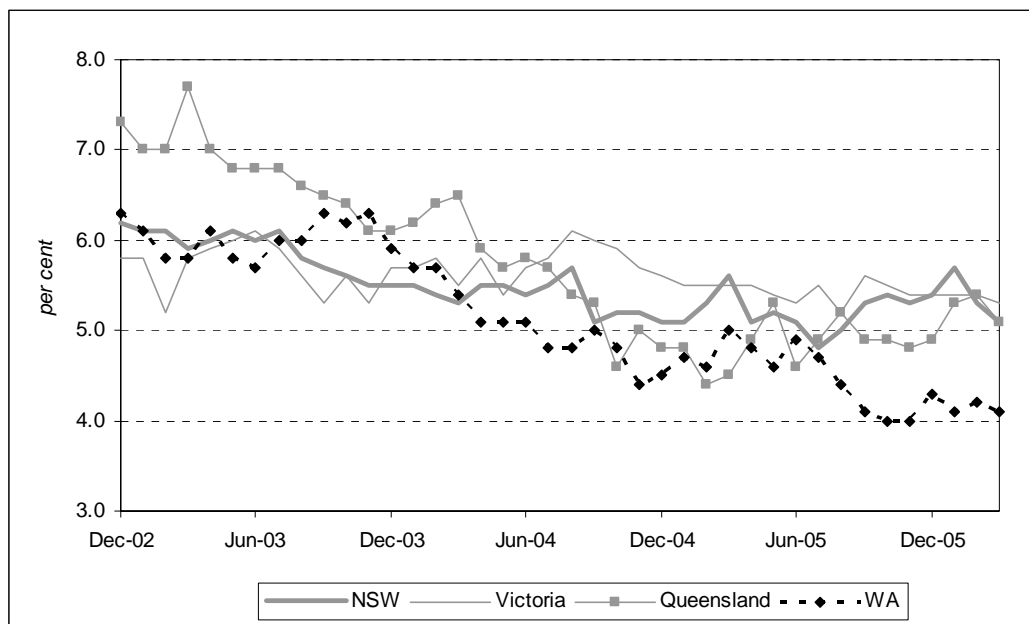
Note: (a) Indices derived from implicit price deflators for imports and exports of goods and services.

Although strong world demand has driven up the price of Australian exports, export volumes have been slow to respond. National export *volume* growth has averaged about 1.4 per cent in annual terms since December 2002. However, the *value* of exports has been growing at double-digit rates since mid 2004. As a result, the purchasing power delivered by a given volume of Australia's production has increased substantially over the past two years. This has facilitated increased demand, including for imports, and income payments to foreign investors (the resources sector has a high rate of foreign ownership), resulting in a relatively large current account deficit.

Although the income gains from the higher terms of trade accrue nationally, different resource endowments across the States imply that there are also some region-specific effects on economic activity.

Regional distribution of commodities

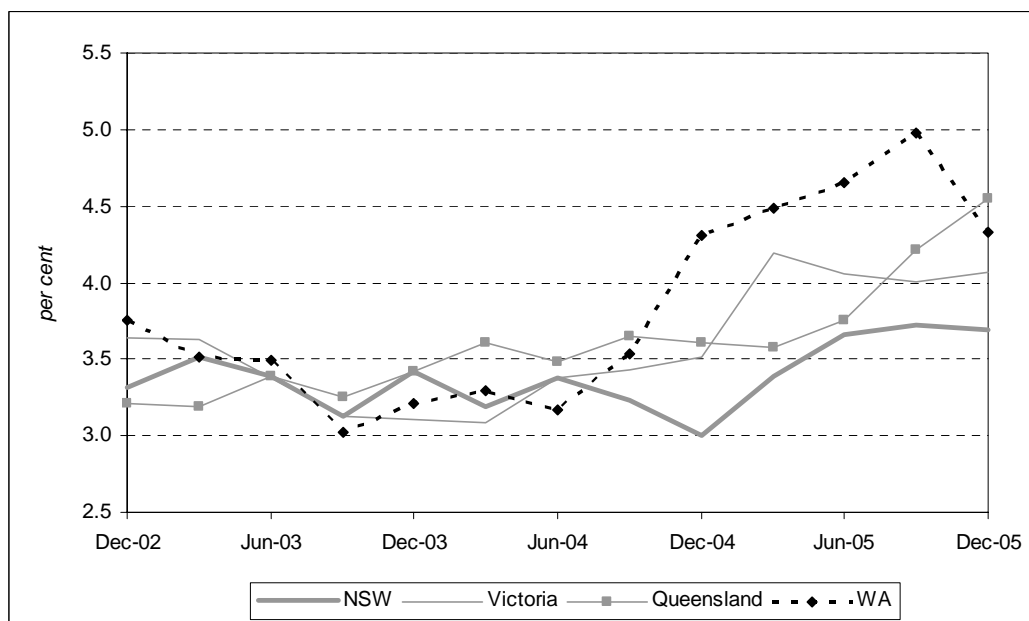
In particular, the past year has seen a significant divergence in economic conditions in Western Australia compared to the other major States. As Chart 4 shows, the unemployment rate has stabilised at between 5 and 5½ per cent for NSW, Victoria and Queensland, while Western Australia's unemployment rate fell below those of the other States in mid 2005, and has since declined to around 4 to 4½ per cent.

Chart 4: Unemployment rate^(a), major States

Source: Australian Bureau of Statistics

Note: (a) Seasonally adjusted, monthly data.

With the unemployment rate at historical lows, wage pressures have emerged in Western Australia. As Chart 5 shows, wages growth in WA has been above that of the other States since mid-2004, although wage pressures are now emerging in Queensland, while Victoria and NSW have seen relatively stable wage growth for the past year.

Chart 5: Wage price index^(a) growth^(b), major States

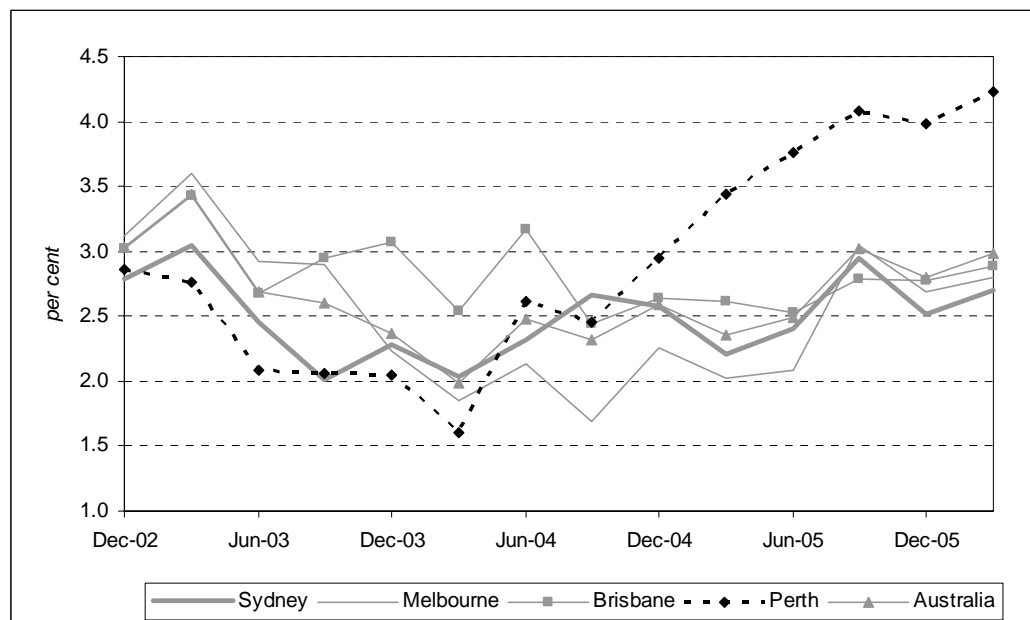
Source: Australian Bureau of Statistics

Note: (a) Private sector, total hourly rate excluding bonuses.

(b) Percentage change on same quarter in previous year.

A similar pattern has emerged in consumer prices (see Chart 6). Since December 2004, inflation in Perth has diverged from the other major capitals and has run at about 1 percentage point higher than the national average in annual terms. Growth in the price of new housing in Perth is responsible for the emergence of this gap.

Chart 6: Consumer price inflation^(a), capital cities^(b)

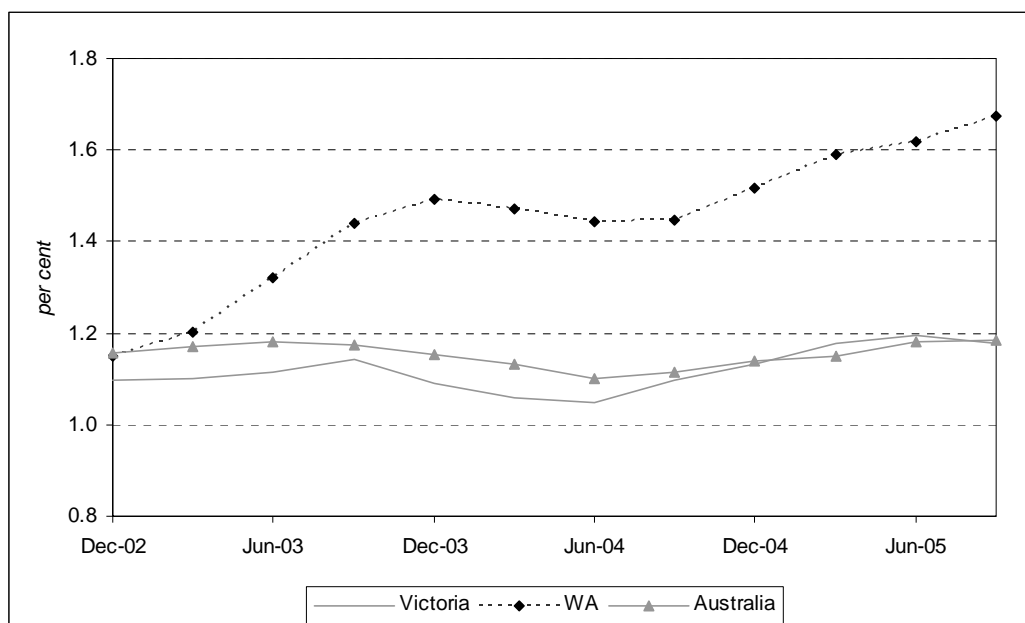


Source: Australian Bureau of Statistics

Note: (a) Consumer price index, percentage change on same quarter in previous year.

(b) The Australian CPI is a weighted average of the eight capital cities.

Demand for housing in Western Australia is being partly driven by interstate movement of labour. Western Australia's rate of net annual interstate migration has shifted from a net loss of around 1 600 people two years ago, to a net gain of around 2 000 people in the year to September 2005. The impact on population growth in Western Australia is shown in Chart 7. This alone is sufficient to add almost 0.25 percentage points to annual GSP growth in Western Australia. In addition, employment in Western Australian mining and construction has increased by 45 000 persons over the past three years, representing close to half of the total employment growth in that State over this period, and private investment in new machinery and equipment in Western Australia rose by 41 per cent over the two years to December 2005.

Chart 7: Population growth^(a)

Source: Australian Bureau of Statistics

Note: (a) Percentage change on same quarter in previous year.

Economic impact

A direct impact of higher commodity prices is to raise the rate of return on capital used in the mining sector. The immediate benefits will be focused in the resource-rich States, due to an increase in mining investment in those States, an increase in the demand for skilled labour and increased mining royalties paid to State governments.

There have, and will continue to be, some immediate positive and negative national effects:

- increased equity prices for, and dividends from, mining companies will raise company tax revenue, household incomes and consumer spending nationally;
- increased supply of investment goods, some of which will be sourced domestically, will be positive for national economic activity; and, on the negative side,
- there will be increased costs for firms that use mining commodities as inputs to their production, and higher consumer prices for commodity-intensive goods such as petrol.

Higher commodity prices also have an important indirect effect. Stronger world demand for Australian mining exports puts upward pressure on the exchange rate, making imports relatively cheaper and Australian non-mining exports less competitive. As Commonwealth Treasury economist David Gruen (Gruen, 2006, p.7) has observed, the exchange rate “plays the role of a shock absorber” by “imposing significant restraint on those export and import-competing sectors, including parts of the manufacturing sector, which are not experiencing strongly rising prices for their output or are not directly exposed to the booming sectors of the economy”. This “Gregory effect” or “Dutch disease” implies that the states with a larger share of agricultural, manufacturing and tourism exports are likely to be adversely affected. The effect was first recognised in the 1970s in the context of an earlier

Australian resources boom (Gregory, 1976), and in light of the impact of North Sea oil discoveries on European economies (Corden and Neary, 1982). At the same time, labour and capital are being absorbed by the resource industries, so non-resource industries are faced with higher labour and capital costs.

Methodology

This paper uses a computable general-equilibrium (CGE) model to estimate the impacts of the commodity price boom. CGE modelling allows the direct and indirect effects of the boom discussed in the previous chapter to be considered simultaneously. The model used is the Victorian DTF version of the MMRF-GREEN CGE model. This section discusses the model and its key assumptions, and describes the “shocks”, in the form of export and import price changes for resource commodities, imposed on the model to generate the results in the next chapter.

The model

MMRF-GREEN is a regional CGE model of Australia, which treats each of the six States and two Territories as an economy in its own right, but within the context of certain overarching national economic constraints. There are four types of economic agents: industries, households, governments and foreigners. The 55 industry sectors identified in the DTF version of MMRF-GREEN can produce a variety of products. Capital is sector- and state-specific and, in each State, there is a single representative household and a regional government. There is also a federal government. Finally, there are foreigners, whose behaviour is summarised by demand curves for international exports and supply curves for international imports. The structure of MMRF-GREEN is documented in detail in Adams, Horridge and Wittwer (2002).

The DTF version of MMRF-GREEN was recently updated by the Centre of Policy Studies. This version incorporates trade in electricity between NSW, Victoria, Queensland, SA and Tasmania in a national electricity market (NEM).

The model was used with the following set-up and assumptions:

- (a) A comparative static framework was used, which compares the effect of the price rise to a base-case of unchanged commodity prices.
- (b) The “short run” impact of the price rise was modelled. The short run is defined as being a period over which:
 - (i) industry capital stocks do not adjust to price changes;
 - (ii) the supply of labour in each state is unchanged; and
 - (iii) labour market equilibrium is achieved by movements in the unemployment rate in each region, with wage rates unchanged.

This is consistent with current circumstances of capacity constraints in the mining sector and diverging unemployment rates between the States.

- (c) Attention was given to the treatment of returns to capital in the resources industries. The model is set up to return the capital income from foreign ownership overseas (i.e. it does not flow through into Australian income). Adjustments were made to distribute the Australian share of after-tax capital income to households across the States according to each State's share of GDP. This reflects the fact that resources companies are primarily owned through the share market, and assumes that households in each State hold a similar portfolio of assets.

Commodity price shocks

The modelling estimates the impact of the price rise from 2003-04 to 2004-05 for the commodities listed in Table 1. Since 2004-05, prices for most commodities have continued to rise. However, as the model is defined in year-average terms, the most recent full-year average price changes have been used. This is also the period in which prices for iron ore and energy resources increased significantly. Export and import prices for each commodity were assumed to increase by the same amount. Therefore, products are assumed to be homogeneous, which is a reasonable assumption for most Australian commodities.

To calibrate the shocks in MMRF-GREEN, changes to foreign-currency export prices were calculated by converting price changes in Table 1 to indices in a common foreign currency (the trade-weighted index). Since the model has a more aggregated industry structure than presented in Table 1, weighted average price increases for seven industries in the model database were calculated by weighting the price change for each industry in Table 1 according to its share of exports in each industry in the model (see Table 2).

Table 2: Estimated change in foreign currency commodity prices

MMRF-GREEN industry	% change in world price	MMRF-GREEN industry	% change in world price
Coal ^(a)	50%	Other Metal Ores ^(b)	24%
Oil	36%	Iron & Steel	40%
Gas	12%	Aluminium	8%
Iron Ore	34%		

Source: DTF calculations based on ABARE data and exchange rates from RBA database.

Notes: (a) Includes steaming and coking coal

(b) Includes uranium, copper, lead, zinc, silver and nickel.

The percentage changes in Table 2 were modelled as commodity-specific price shifts in foreign export demand curves. For completeness, the foreign-currency prices of imports of the same commodities were shocked by the same amounts, although this is not likely to have a significant impact on the results, as Australia imports relatively small amounts of resource commodities.

Caveats

All economic modelling of this type involves simplifying assumptions that impose limitations on the applicability of the results to the real world. The comparative-static nature of the DTF version of MMRF-GREEN model requires that some compromises be made in model set-up. This section discusses how these assumptions might affect the results, and their relationship to real-world observations.

The assumption that industry capital stocks are fixed in the short run is consistent with current capacity constraints in the resources and infrastructure industries in the resource-producing States. However, this assumption implies that investment is unchanged in the short run, which is not necessarily consistent with current strong growth in demand for business investment in Western Australia. Therefore, this simplification means that the results will under-state demand in the resource States. Some of this demand, such as for heavy machinery, is likely to be supplied from manufacturing

industries in other States. Therefore, the results also exclude some second-round effects on non-resource States, which may under-state demand in those States.

Short-run labour market equilibrium assumes that wage rates and the supply of labour in each State do not change. This is consistent with the lack of broad-based wage pressures in the Australian economy, and the recent divergence in unemployment rates across States. However, as discussed earlier, there is some evidence that net interstate migration to Western Australia has increased in the past year, and there are signs of localised wage pressure in Western Australia.

Results

This section presents the results of the model simulation. It should be noted at the outset that the results presented below represent percentage changes in variables compared to what would have happened in the absence of the shocks. Therefore, a negative percentage change may imply a slower rate of growth, rather than an absolute decline. For example, a negative impact on a State's GSP of 0.5 per cent implies that a State which would normally have experienced, for example, 3.5 per cent GSP growth could now be expected to grow at around 3 per cent in that year.

Table 3 shows the simulation results for the impact of the commodity price rises on key macroeconomic variables for each State and Territory.

Table 3: Macroeconomic impact of commodity price increases

	Real GDP/GSP	Real household consumption	Exports (volume)	Employment (hours worked)
	% deviation from baseline			
New South Wales	-0.46	0.39	-6.58	-0.71
Victoria	-0.54	0.39	-6.43	-0.80
Queensland	-0.16	0.39	-1.63	-0.21
South Australia	-0.40	0.42	-5.92	-0.66
Western Australia	0.88	1.13	2.85	1.52
Tasmania	-0.16	0.64	-3.40	-0.24
Northern Territory	2.90	2.39	10.6	4.00
Australian Capital Territory	0.01	0.78	-9.84	0.00
Australia	-0.22	0.49	-2.97	-0.33

Source: MMRF-GREEN simulation

National results

The national impact from the increases in commodity prices of the last financial year is a short-run decline in economic activity (GDP down 0.22 per cent & employment down 0.33 per cent) compared to what they would otherwise have been, while consumption increases (up 0.49 per cent). The lower economic activity is driven by a significant fall in overall exports (down 2.97 per cent).

This result is driven by the relative capital intensity of the resources sector. Commodity exports make up about one third of total Australian exports. While commodity exports increase as expected, this is constrained in the short-term by the capital available to the industry for production. A significant expansion of exports requires additional investment, which is not captured in the modelling and is assumed will only come on-line in the longer term. This effect is particularly strong for the resources industries, which are highly capital

intensive – for example, capital accounts for about 80 per cent of primary factor costs for the coal, oil, gas and iron ore industries, compared to 40 per cent on average across all industries. In contrast, the more labour intensive export industries reduce production in the short term, by shedding labour or reducing their rate of hiring. Hence, national employment is negatively affected.

Higher demand for commodity exports causes the Australian dollar to appreciate by 1.8 per cent in real (price adjusted) terms, reducing the competitiveness of all other goods and services exports. This exchange rate impact appears small in the context of an annual average increase in the TWI of the order of 8 per cent over the past two years. The model results do not incorporate dynamic and expectation effects on the exchange rate, such as those arising in financial markets. Non-commodity exports comprise about two-thirds of all Australian exports and these exports fall by about 10 per cent on average. Thus, overall exports are 3 per cent lower than they would otherwise have been.

Because Australia is a net exporter of commodities, the terms of trade increase by 7.7 per cent. This appears to be a sensible result, considering we are only modelling the rise in commodity prices, and holding other export and import prices constant. The actual rise in the terms of trade was 10 per cent in 2004-05. The model's estimated rise in the terms of trade represents an increase in national income of roughly 1¼ per cent, and results in consumption increasing by 0.49 per cent, despite the fall in economic activity. Higher consumption contributes to a 0.18 per cent increase in imports.

Impacts on industries are as expected. In general the mining industries expand, while most other industries contract. The exporting and import-competing industries outside the resources sector contract by the largest amount. This includes the agriculture sector and the manufacturing sector. One of the few non-mining industries to expand is the "other services" industry, because it sells most of its output to consumers and is mostly non-traded. Some contrasting industry impacts can be seen in Table 4.

These results are consistent with Australia's recent economic experience as described in the first chapter. GDP and employment growth have been relatively subdued over the past year, despite the commodity price boom. It is also consistent with the fact that Australia's current account deficit has widened in the past year. Though the value of Australian exports has increased strongly, due to higher commodity prices, the volume of exports has not yet responded. Domestic demand and import growth have also been relatively strong.

Table 4: Model results from commodity price increases from 2003-04 to 2004-05, industry output

	Animal Agriculture	Iron Ore	Transport Equipment	Financial Services	Other Services
% deviation from baseline					
New South Wales	-1.48	0.00	-4.06	-0.19	0.06
Victoria	-1.51	0.00	-2.59	-0.17	0.05
Queensland	-1.81	0.00	-4.03	-0.13	0.12
South Australia	-1.28	4.90	-2.24	-0.17	0.08
Western Australia	-1.76	8.52	-5.42	-0.04	0.79
Tasmania	-1.33	4.88	-4.28	-0.21	0.22
Northern Territory	-2.86	0.00	-12.70	-1.28	1.54
Australian Capital Territory	-3.06	0.00	-4.17	-0.28	0.21
Australia	-1.60	8.40	-3.23	-0.18	0.17

Source: MMRF-GREEN simulation

State results

In the short run simulations, Western Australia and the Northern Territory are the only States in which economic activity (as measured by GSP) increases, due to the high resource intensity of their industry structure. Resource commodities make up about 80 per cent of Northern Territory exports and 70 per cent of Western Australian exports. Although these States' other exporting and import-competing sectors contract, their relatively small non-resource share in total exports implies that overall their export sectors and economies expand.

In the short run, economic activity contracts in those States without a large mining sector. The modelling results in Table 3 show that Victorian and NSW GSP are about 0.5 per cent lower. Most industries in these States contract, apart from the mining industries. However, even in these States consumption increases due to higher incomes from the resource sector.

The results for Queensland show a small decline in GSP, which appears somewhat surprising at first because it accounts for more than half of Australia's coal exports. However, Queensland also has large shares of agricultural and tourism exports – both of which are sensitive to exchange rate movements - and a fall in these exports outweighs the rise in commodity exports. While Queensland's GSP declines slightly, it still fares better than the national average, and declines by much less than that for NSW, Victoria and SA. It is likely that the second-round impacts of investment in the mining sector, which are not incorporated in this analysis, would have strong positive impacts on Queensland, offsetting the negative impacts on non-mining exports.

The modelling also shows that the development of the National Electricity Market smooths the impact of the terms of trade shock across the States. Victorian electricity industries

gain from additional demand from the national market as energy-intensive industries expand nationally. In addition, as brown coal is generally not exported, Victorian electricity producers are partly insulated from world coal prices and become relatively more competitive when compared to black coal and gas-fired generators.

The results above have shown that the boom in commodity prices from 2003-04 to 2004-05 has taken approximately 0.5 per cent off the level of Victorian GSP in the short run. This is the short-term effect from one year's price rises. Commodity prices have continued to rise significantly in 2005-06, and the increase is likely to be of a similar or greater magnitude to that in the previous year. This implies there could be another 0.5 per cent reduction in the level of Victorian GSP, with the effect being felt a year later. This result can be interpreted to mean that in the short term (ie. the next two to three years), annual Victorian GSP growth has been reduced by up to half of one percentage point in each year.

Long run implications

The long-run impact of the resource boom has not been formally modelled in this paper, as the results would be determined by assumptions about the future path of commodity prices, which are highly uncertain. Instead, this paper has focused on the impact of price changes that have been observed so far in the "real world". This section discusses some of the issues around long-term commodity prices, and their implications for the national economy and the States.

In the medium-term (three to five years), new investment in mining infrastructure will come on line, increasing the supply of commodities from both Australia and overseas. This should serve to pull commodity prices back down to more 'reasonable' levels reflecting the marginal cost of supply. However, the booming BRIC economies (Brazil, Russia, India and particularly China) are likely to keep demand for commodities high, as mineral consumption tends to increase exponentially in the early stages of development. Expansion of supply into higher cost regions implies that prices are likely to remain above pre-boom levels, provided over-investment does not lead to significant excess capacity.

The long-term impact on Australia, and the non-commodity states such as Victoria, will depend on the future path of commodity prices and the future size of commodity exports from Australia's resource-intensive states. There is some evidence from contract prices for coal and iron ore that continued rises in the terms of trade are coming to an end as supply eventually responds (see, for discussion, RBA, 2006, pp.40-42). However, as long as world demand remains strong, new capacity will see Australian commodity export volumes and GDP expand.

In the long run, labour mobility would result in patterns of net interstate migration shifting to favour the relatively resource-intensive States, reducing disparities in unemployment rates and wage rates between the States. The resource States would also attract investment from the rest of the country. In other words, permanently higher commodity prices are likely to have a net positive impact on the size of the Australian economy, but change both the industry composition and regional distribution of economic activity.

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