

The Resources Boom and the Australian Economy: A Sectoral Analysis

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The increase in Australia's terms of trade since the mid 2000s gave rise to a surge in resource investment, an appreciation of the exchange rate, and a reallocation of labour and capital in the economy. This article examines the impact of the resources boom on the Australian economy in terms of three broadly defined sectors: the resources sector, the 'other tradable' sector and the non-tradable sector. While not all parts of the economy have benefited, the process of adjustment has proceeded much more smoothly than has been the case in previous terms of trade booms.

Introduction

Strong global demand for commodities, much of which has come from Asia, has driven commodity prices and Australia's terms of trade to historically high levels. The overall process of macroeconomic adjustment to the terms of trade boom has proceeded much more smoothly than has been the case in previous terms of trade booms;¹ over the past eight years, inflation has remained within the target range, or not too far from it, and growth has generally not been too far from trend. This is perhaps all the more notable given the difficult economic conditions internationally over recent years, with incomes in Australia growing faster than in most other advanced economies and the unemployment rate remaining relatively low.

A key contributor to the relatively smooth adjustment of the macroeconomy to the rise in the terms of trade has been the flexibility of the exchange rate. The high nominal exchange rate has acted as a timely

mechanism for facilitating the reallocation of labour and capital across industries, notwithstanding that this has made conditions difficult in some industries. Other factors contributing to the relatively smooth macroeconomic adjustment include inflation expectations remaining well anchored and greater flexibility in the labour market relative to earlier terms of trade booms. The combination of these factors means that while demand for labour, and the growth of wages, was higher in the resources sector, this did not lead to a significant increase in wage inflation across the economy as a whole.

Not all parts of the economy have benefited from this change in relative prices. While the resources sector has benefited greatly, those parts of the tradable sector not directly exposed to the terms of trade boom have experienced a reduction in competitiveness due to the exchange rate appreciation. Further, all industries have faced increased domestic cost pressures due to competition for domestic factors of production (which has been offset to some extent by lower costs of imported inputs due to the exchange rate appreciation). This has created challenges for industries that have not been directly exposed to the resources sector and have not experienced a significant increase in the price of their output.

* The authors are from Economic Group. This article draws on two RBA Research Discussion Papers: Rayner and Bishop (2013) and Plumb, Kent and Bishop (forthcoming) (which is based on Plumb, Kent and Bishop (2012)).

1 See Battellino (2010) for a discussion of earlier terms of trade booms in Australia. There have been a number of speeches and papers in recent years on the adjustments of the macroeconomy to the boom in the terms of trade (Henry 2006, 2008; Gruen 2006, 2011; Banks 2011; Connolly and Orsmond 2011; Stevens 2011; Sheehan and Gregory 2012).

In this article we examine the impact of the resources boom on the Australian economy in terms of three broadly defined sectors: the resources sector, the ‘other tradable’ sector and the non-tradable sector. We discuss developments in each of these sectors through the three (overlapping) phases of the resources boom:² the boom in the terms of trade and the appreciation of the exchange rate; the surge in resource investment; and the subsequent growth in the production and export of resources.

Defining the Resources, ‘Other Tradable’ and Non-tradable Sectors

We adopt a broad measure of the resources sector that includes not only the resource extraction sector, but also ‘resource-related’ activity. The purpose of this broader definition is to include all activity that has a direct relationship with the extraction of resources and investment in the resources sector, thereby capturing those parts of the economy most directly affected by the higher prices of resource commodities. The methodology used to measure the resources sector is from Rayner and Bishop (2013) and is summarised in Box A.

The remainder of the economy – the non-resources sector – can usefully be divided into two parts:³

- ‘Other tradable’ sector: comprises industries (or parts of industries) that are significantly exposed to international trade but not directly related to the resources sector, namely agriculture, manufacturing, transport, wholesale trade and accommodation & food services. For each of these industries, exports or competing imports

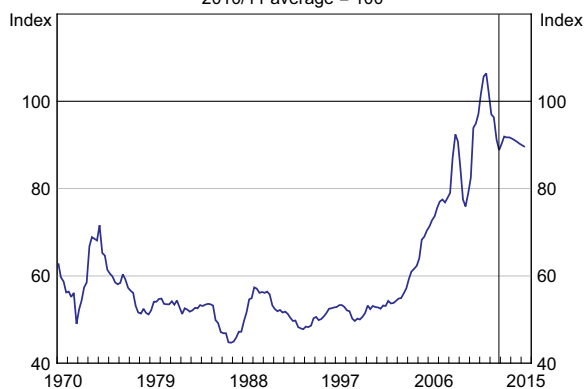
are significant as a share of gross output (greater than 10 per cent).⁴

- Non-tradable sector: comprises industries that typically do not have a significant exposure to international trade, and for which production is not directly linked to the resources sector.

Phase I: The Rise in the Terms of Trade and the Exchange Rate

The rapid urbanisation and industrialisation of emerging economies in Asia – particularly China – has led to a dramatic increase in the global demand for commodities used in steel and energy production. With global supply responding only gradually to the surge in demand, this led to sharp increases in the prices of commodities of which Australia has significant endowments. Consequently, Australia experienced a large increase in its terms of trade, rising by 82 per cent since 2003/04 to reach their highest level on record in September 2011; they have subsequently declined by around 17 per cent (Graph 1).

Graph 1
Terms of Trade*
2010/11 average = 100



* The forecast for the terms of trade is that presented in the February 2013 *Statement on Monetary Policy (SMP)*; the latest reading for the terms of trade is December quarter 2012, which was published after the February *SMP*.
Sources: ABS; RBA

2 To our knowledge, Gregory (2011) was the first to cast the current resources boom as one that takes place in three distinct phases. See also Sheehan and Gregory (2012), which is forthcoming in the *Australian Economic Review*.

3 In the following definitions of the ‘other tradable’ and non-tradable sectors, the share of each industry’s gross value added and employment directly related to the resources sector is removed. For a more detailed description of the resources, ‘other tradable’ and non-tradable sectors, see Plumb *et al* (forthcoming).

4 More precisely, an industry is classified as tradable if more than 10 per cent of its production is exported, or if competing imports account for more than 10 per cent the industry’s total supply in 2008/09. The ‘other tradable’ sector in this article differs slightly from that in Plumb *et al* (2012). In this article, the wholesale trade industry is also included in the ‘other tradable’ sector, reflecting updated information from the 2008/09 input-output tables.

Box A

Measuring the Resources Sector

Our measure of the resources sector is taken from Rayner and Bishop (2013), which builds on the methodology developed by Kouparitsas (2011). This broad measure of the resources sector comprises:

- **Resource extraction.** This includes mineral and gas extraction, and also resource-specific manufacturing (such as the production of metals and refined petroleum). This is very close to the ABS' definition of the mining industry, the only difference being that it also includes resource-specific manufacturing.
- **Resource-related activity.** This includes the provision of intermediate inputs that are used in the current extraction of resources as well as investment that supports the future extraction of resources. In other words, it captures activities that are directly connected to resource extraction, such as constructing mines and associated infrastructure, and transporting inputs to, and taking extracted resources away from, mines. It also captures some activities less obviously connected to resource extraction, such as engineering and other professional services (legal and accounting work, for example).

To estimate the size and industry composition of the resources sector, it is necessary to first estimate all of the final demand (or expenditure) in the economy that is related to resource extraction and investment, and then identify the industries that produce these *final* goods and services. Industries that produce a final good (or service) are those that are responsible for the final steps in the production chain for a given product. For example, resource exports are produced by the resource extraction sector, and

resource-related construction investment (net of capital imports) is assumed to be undertaken by the heavy and civil engineering construction industry.

Input-Output (I-O) tables can then be used to calculate the value and industry composition of *intermediate inputs* required to meet this final demand. For example, I-O tables can be used to calculate the value and industry composition of intermediate inputs required by the resource extraction sector to produce each \$1 of resource exports, and the value and industry composition of intermediate inputs required by the heavy and civil engineering construction industry to undertake each \$1 of resource-related construction investment. After making some simplifying assumptions, this information from I-O tables can then be used to transform the final demand related to resource extraction and investment into a measure of resources sector gross value added (GVA) that can be decomposed by industry. The GVA of an industry is the gross output of that industry less the intermediate inputs it uses to produce that output.

Table A1 summarises some of the key information derived from I-O tables used to estimate the size and industry value-added composition of the resources sector. The GVA requirements matrix reveals the distribution of industry GVA generated for every \$1 of final demand for a particular industry's output. For example, take column 1 in Table A1: the coefficients in this column can be thought of as the industry value-added content of resource exports. These coefficients will differ for each type of resource

Table A1: GVA Requirements Matrix^(a)
Value of GVA generated for every \$1 of final demand for industry output, 2008/09

	Resource extraction	Construction	Manufacturing	Business services	Transport	Other industries
Resource extraction	0.70	0.07	0.11	0.02	0.07	0.03
Construction	0.02	0.42	0.01	0.01	0.02	0.02
Manufacturing	0.04	0.11	0.45	0.04	0.06	0.06
Business services	0.13	0.25	0.18	0.82	0.22	0.18
Transport	0.03	0.03	0.05	0.02	0.51	0.03
Other industries	0.07	0.11	0.19	0.08	0.11	0.68
Total^(b)	0.99	0.99	0.99	0.99	0.99	0.99

(a) Resource extraction is mining and resource-specific manufacturing; construction is residential building, non-residential building, heavy & civil engineering and construction services; other industries is agriculture, forestry & fishing, manufacturing (excluding resource-specific manufacturing), electricity, gas, water & waste services, transport, postal & warehousing, wholesale trade, retail trade and household services

(b) Total does not equal \$1.00 due to taxes less subsidies on intermediate goods and services

Sources: ABS; Rayner and Bishop (2013)

export but, on average, for \$1 of resource exports in 2008/09:

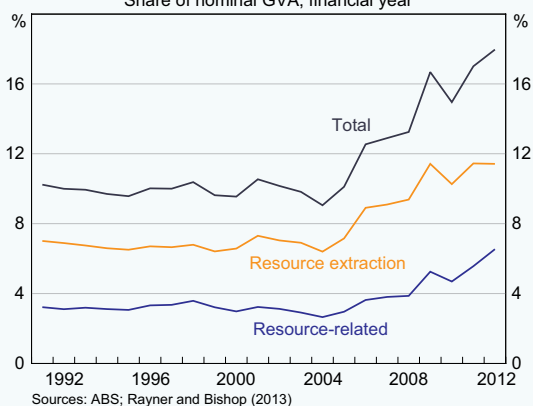
- The resource extraction sector contributed \$0.70 of value added.
- The business services industry contributed \$0.13 of value added.
- The manufacturing, transport and construction industries each contributed around \$0.02–\$0.04 of value added, while the remaining \$0.07 was contributed by other industries, such as utilities and wholesale trade.

These estimates suggest that there are non-trivial spillover effects from demand for Australia's natural resources to activity in domestic industries, outside of the resource extraction industry itself.

Using GVA requirements matrices calculated from I-O tables published at different points in time, it is then possible to transform final demand related to resource extraction and investment into a measure of resources sector GVA (Graph A1). This broader

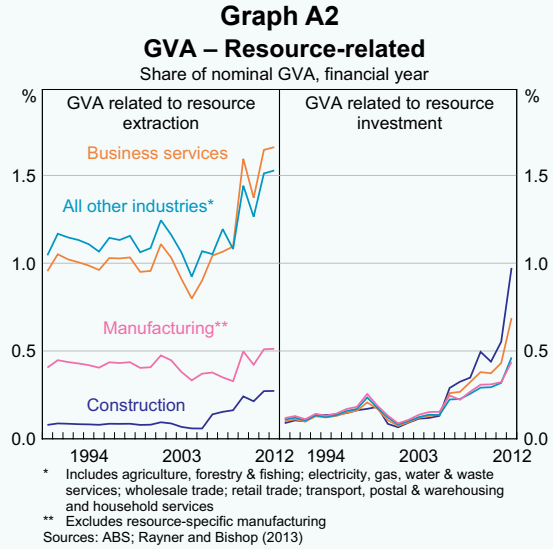
measure of the resources sector accounted for around 18 per cent of nominal GVA in 2011/12, which is double its share of the economy in 2003/04. Resource extraction is estimated to have accounted for around two-thirds of the value of the resources sector in 2011/12 (11½ per cent of GVA). This includes the extraction of the resources themselves and also

Graph A1
GVA – Resources Sector
Share of nominal GVA, financial year



the processing and refinement of those resources. The large rise in resource extraction as a share of nominal GVA largely reflects higher export prices for resource commodities over the past decade. As the terms of trade boom gathered pace, resource-related activity picked up sharply, rising from an estimated 3 per cent of nominal GVA in the mid 2000s to around 6½ per cent in 2011/12.

Graph A2 decomposes resource-related activity (the lower line in Graph A1) by the industries that contribute to resource extraction and investment. The largest contributions to resource-related activity in 2011/12 came from the business services, construction, manufacturing, transport and wholesale trade industries. While construction and transport have obvious connections to the resources sector, business services (e.g. engineering, legal and accounting services) account for a larger share of resource-related activity. Business services are key inputs to both resource extraction and resource investment. In part, the relatively small share of construction reflects the fact that the construction industry itself draws on a relatively high share of intermediate production from other industries, and that a large share of construction-related resource investment is imported. However, consistent with the significant increase in resource investment since the mid 2000s, resource-related construction increased sharply as a share of nominal GVA.

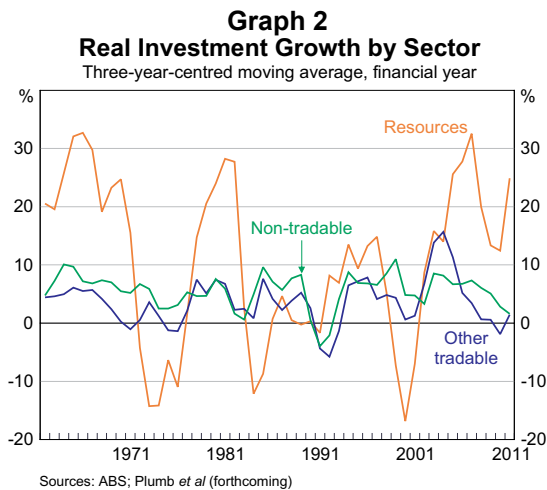


This run-up in the terms of trade has provided a significant boost to the real purchasing power of domestic production, given that a larger volume of imports can be purchased with a given volume of exports. The increase in purchasing power flowing from a rise in the terms of trade can be estimated by comparing real GDP to real gross domestic income (GDI). Since the mid 2000s, growth in real GDI exceeded that in real GDP by around 10 percentage points. However, Australians did not receive all of this transfer of income from the rest of the world, given that part of the resources sector is foreign owned. The distribution of these real income gains across the economy depends, crucially, on how much the exchange rate appreciates in response to the increase in world commodity prices (RBA 2005). Since the terms of trade started to rise in 2003/04, the nominal exchange rate has appreciated by around 25 per cent in trade-weighted terms. The appreciation of the exchange rate means that: the increase in the domestic currency price of commodity exports was less than the increase in world commodity prices; the income of the ‘other tradable’ sector declined; and real income gains flowed to the broader economy via the associated decline in the price of imports.

Phase II: The Surge in Resource Investment

The resources sector globally has responded to the large rise in commodity prices by expanding its productive capacity. In Australia, the growth in investment in iron ore, coal and liquefied natural gas (LNG) extraction has been exceptionally strong over recent years (Graph 2). In aggregate, it appears that around half of the value of these resource investment projects is imported, although this varies somewhat depending on the nature of the project, with LNG projects tending to have a higher imported component.

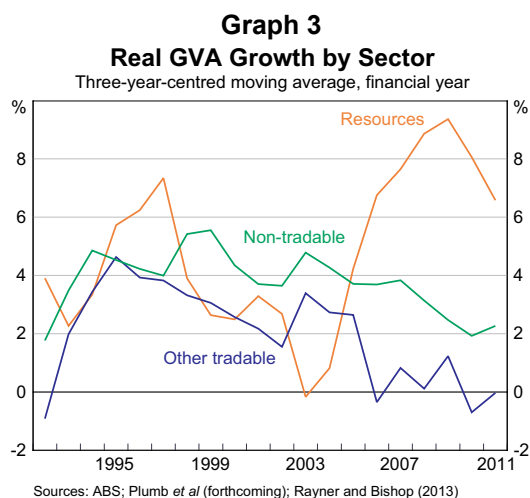
In contrast, investment growth in the ‘other tradable’ and non-tradable sectors has slowed over recent years. Growth in ‘other tradable’ productive capacity has been particularly soft, which may reflect, in part, the high level of the exchange rate, whereas



the slowing in growth in non-tradable capacity may reflect other forces acting on demand and confidence in this sector (see below).

The impact of the surge in resource investment on the output of other sectors

As the surge in resource investment gathered pace, the output of the broader resources sector, as measured by its total GVA, increased strongly (Graph 3). This is particularly notable for the resource-related construction and business services industries, which have supplied a large quantity of inputs required for resource investment and extraction.

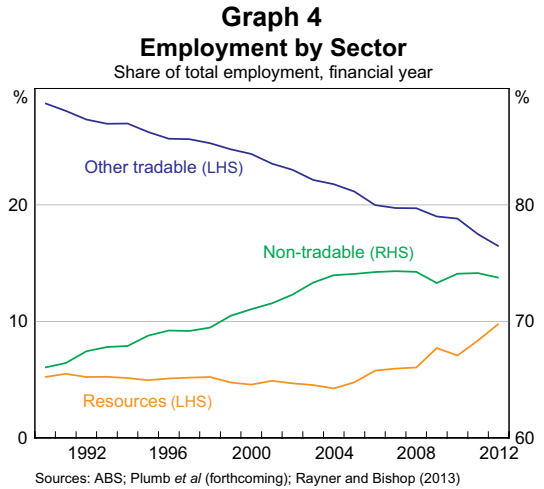


To sustain the growth in the resources sector, factors of production were drawn from the 'other tradable' and non-tradable sectors, and GVA growth in those sectors slowed. In the case of the 'other tradable' sector, total GVA even declined in some years, with particular weakness in parts of manufacturing that do not supply many inputs to the resources sector, such as textiles, clothing & footwear and wood & paper manufacturing. Growth in GVA of the non-tradable sector also slowed, but by less than the 'other tradable' sector. This suggests that the 'income effects' generated by the higher terms of trade (which tend to boost demand for non-tradable goods and services) outweighed the 'substitution effects' created by the fall in the price of tradables goods and services relative to the price of non-tradables (which tend to diminish demand for non-tradables relative to tradables).

It should also be noted that there have been factors other than the large increase in commodity prices and the high exchange rate that have had an effect on economic activity in Australia. For example, the global financial crisis caused significant disruption to financial markets and economic activity, albeit to a much lesser extent in Australia than in the north Atlantic economies. There was also an increase in the rate of household saving from the early 2000s, a slowing in credit growth and a transition to more stable levels of indebtedness and housing prices (relative to incomes). Furthermore, there was a relatively broad-based slowing in Australia's productivity growth from the early 2000s; some but certainly not all of this can be explained by developments in the resources sector (D'Arcy and Gustafsson 2012).

Employment

Following the onset of the terms of trade boom, aggregate employment grew at an above-trend pace. The composition of employment growth also changed significantly (Graph 4). The share of total employment accounted for by the resources sector doubled since the mid 2000s, to be around



9¼ per cent in 2011/12.⁵ Around two-fifths of this growth reflected the expansion in resource investment, which increased the demand for labour in resource-related construction and other industries that provide inputs to these investment projects (such as some types of machinery manufacturing and engineering services). The share of workers employed in the resource extraction sector accounted for only about one-quarter of the overall increase in the resources sector's share of employment since 2004/05, while the remainder has been due to an increase in employment in industries that service the operations of mines (such as transport of output from the mine site to ports, business services and power generation). Once the peak in resource investment has passed and the extraction of resources increases, the share of labour employed in the more labour-intensive resource-related industries is likely to decline and the share employed in the less labour-intensive resource extraction sector is likely to rise further.

In contrast to the strong employment growth in the resources sector, employment growth slowed in the non-tradable sector (particularly in retail and the parts of construction not exposed to the resources

⁵ These estimates for employment assume that the productivity of a worker who works in a particular industry will be the same if they supply their labour to the resources or non-resources sectors (see Rayner and Bishop (2013)).

sector). This is consistent with labour moving to the resources sector in response to the higher relative wages on offer (see section below), but could also reflect other factors such as the weakness in the housing sector over recent years. The share of employment in the ‘other tradable’ sector has fallen since the mid 2000s (particularly in manufacturing), though this is a continuation of a longer-run structural shift since the 1960s.

Wages

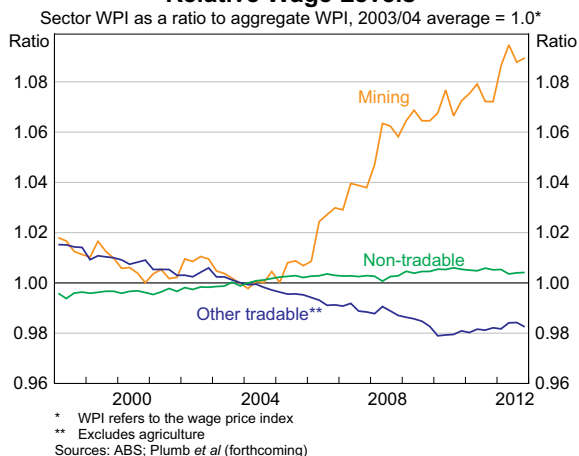
The pace of aggregate wage growth picked up between 2003 and 2008. This reflected considerable pressure on capacity in the economy prior to the global financial crisis, with the unemployment rate declining to its lowest level in more than three decades. When the slowdown associated with the global financial crisis occurred, these pressures on capacity eased and there was a significant moderation in wage growth. Aggregate wage growth subsequently picked up from these earlier low levels as activity recovered.

Wages have risen more rapidly in the mining sector than in the rest of the economy since the beginning of the terms of trade boom, with much of this adjustment occurring between 2004 and 2008. As a result, the relative wage in mining increased by about 9 per cent over the eight years to 2012.⁶ This was by far the largest increase of any single industry, after having trended lower over the decade leading up to the boom (Graph 5). It also appears that relative wages increased in industries complementary to resource extraction, principally resource-related construction and business services.⁷

There was very little movement in the relative wage in the non-tradable sector overall and a decline in the

Graph 5

Relative Wage Levels



‘other tradable’ sector. This has been a key mechanism facilitating the reallocation of labour between sectors, whereby sectors benefiting from output price increases can afford to pay the higher wage rate and so draw labour away from other sectors.

This change in relative wages and the modest adjustment in overall wage growth were helped by the combination of well-anchored inflation expectations and a flexible labour market, particularly in comparison to earlier terms of trade booms. During these earlier booms, inflation was more variable and Australia’s centralised wage-setting system had the effect of spreading wage increases across the economy to occupational categories for which the value of marginal product had not increased. Not surprisingly then, the result was a rise in inflation and unemployment (Gruen 2006; Battellino 2010; Banks 2011). While the adjustment of relative wages during the current boom has been substantial, the need for relative wages to adjust may have been lessened by a number of factors that have increased the supply of labour to the resources sector, such as: the adjustment in participation rates across different regions; the utilisation of skilled labour sourced from offshore by the resources sector; interstate migration; and employment practices such as fly-in fly-out and drive-in drive-out arrangements (see D’Arcy *et al* (2012) for details).

6 In this section, mining is defined as resource extraction excluding resource-specific manufacturing.

7 Wages in construction and professional services increased strongly between the mid 2000s and 2012, relative to other industries. While ABS data on wages cannot be disaggregated into resource- and non-resource-related construction and business services, the RBA’s liaison program suggests that the wage data by industry are likely to mask stronger growth in resource-related construction and services and weaker outcomes in construction and services not exposed to the resources sector.

Consumer prices

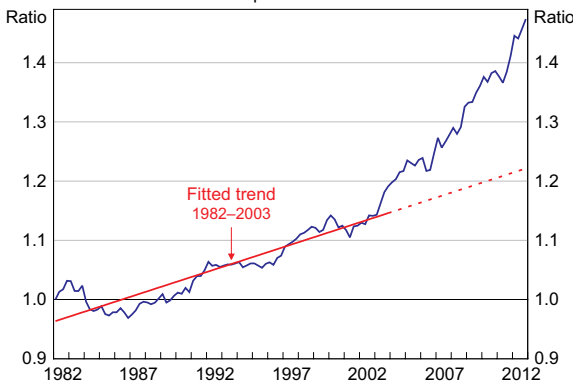
Consumer price inflation has averaged around 2¾ per cent since the mid 2000s. This is within the inflation target of 2–3 per cent, but marginally higher than the average of 2½ per cent over the preceding decade. Even so, this can be considered as a relatively good outcome given the magnitude of the shock to the terms of trade, and also the much higher inflation outcomes associated with previous resources booms in Australia.

While inflation has been well contained, there were large shifts in relative consumer prices. Non-tradables inflation throughout the period of the terms of trade boom was stronger relative to its pre-boom average, as higher domestic cost pressures fed through to prices. At the same time, the higher exchange rate contributed to a noticeable decline in tradables inflation. Hence, the ratio of non-tradable to tradable prices rose much more rapidly after 2003 compared with the trend of the previous two decades (Graph 6).⁸

Phase III: Mining Production and Exports

The response of mining production and exports to the increase in commodity prices followed with some delay, reflecting the time needed to plan, gain approval for, and reallocate scarce productive inputs to enable construction of new infrastructure. For some commodities, there has already been a significant pick-up in production and exports. Since the onset of the terms of trade boom, the volume of iron ore extracted and exported has risen at an annual rate of 11¼ per cent (Graph 7). LNG production has also risen strongly. Coal production has expanded, but at a broadly similar pace to its pre-boom average, in part reflecting a sluggish recovery in coal production from the floods in early 2011. The production phase of the terms of trade boom is expected to gather momentum over the next few years, particularly for LNG, which is expected to increase much more rapidly starting from around 2015.

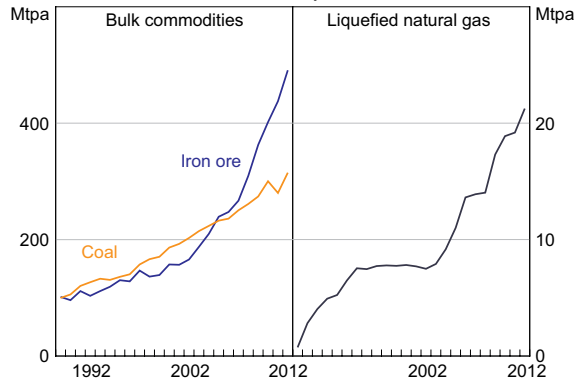
Graph 6
Ratio of Non-tradable to Tradable CPI
March quarter 1982 = 1.0



* Adjusted for the tax changes of 1999–2000; non-tradable CPI is also adjusted for interest charges prior to the September quarter 1998 and deposit & loan facilities to June quarter 2011
Sources: ABS; Plumb *et al* (forthcoming)

8 Other factors have also contributed to higher non-tradables inflation in recent years, such as the significant pick-up in utilities prices (Plumb and Davis 2010) and a slowing in productivity growth during the 2000s. The picture is broadly similar if utility prices are excluded from the calculation. The earlier underlying trend reflects the Balassa-Samuelson effect, whereby productivity tends to rise more rapidly in the tradable sector than the non-tradable sector. So, even though wages will tend to equalise across the sectors over the longer run, unit labour costs rise more rapidly in the non-tradable sector (Balassa 1964; Samuelson 1964).

Graph 7
Selected Resource Exports
Calendar year



Sources: ABS; Bureau of Resources and Energy Economics; RBA

The strong growth in production and exports of these commodities over recent years has been offset, to a large extent, by weaker performance in other resource commodities, including oil production and ores for metals such as aluminium, copper, gold, lead, nickel and zinc (Connolly and Orsmond 2011). Reflecting these

offsetting developments, the volume of Australia's *total* resource exports increased at an annual rate of 3½–4 per cent over the course of the terms of trade boom. This is a notable slowing from its 1993–2003 average of 5½ per cent, notwithstanding a more than doubling of the capital stock and employment in the resource extraction sector. Nevertheless, the volume of Australia's resource exports is expected to increase at a faster pace in coming years as a result of the large volume of investment.

The high level of the exchange rate and the impact of the global financial crisis on external demand have weighed on exports of non-resource goods and services. Exports of manufactured products from Australia remain well below their 2008 peak, even though the volume of global trade has surpassed its 2008 level. Exports of services have also declined significantly over the past four years, although this also reflects the tightening of conditions for obtaining student visas, and more recently there has been some recovery in exports of tourism. How the economy adjusts in the years ahead will depend, in part, on how the exchange rate responds to economic developments; in particular, to the extent that the exchange rate does not depreciate in line with any unanticipated declines in the terms of trade, this will affect the adjustment in other sectors of the economy, notably the 'other tradable' sector.

Conclusion

Strong growth in Asia is expected to continue to provide significant benefits for the Australian economy. Most notable so far has been the resources boom. This boom is characterised by three overlapping phases. The first saw commodity prices and hence Australia's terms of trade rise significantly over a period of a number of years, and this was accompanied by a sizeable appreciation of the exchange rate. The phase of strongly rising commodity prices has passed, with the terms of trade having peaked in late 2011; although they still remain at a high level. The surge in investment in the resources sector has been in progress for some

years and still has some way to run, with resource investment expected to peak as a share of GDP sometime over the course of this year, but remain quite high for a time. The third phase of increased production and export of resources has also commenced but has much further to run, especially in the case of LNG, for which investment takes place over a number of years before production comes on stream.

The overall process of macroeconomic adjustment to the rise in the terms of trade has occurred relatively smoothly compared with previous episodes; inflation has been consistent with the target, unemployment has remained relatively low and output has grown at close to trend rates. One critical element to the adjustment this time around has been the appreciation of the nominal exchange rate as the terms of trade were rising. The adjustment has also been helped by the anchoring of inflation expectations and the operation of the labour market, whereby wage pressures in industries or regions experiencing strong conditions associated with the resources boom have not spilled over to parts of the economy experiencing weaker conditions.

Not all parts of the economy have benefited from the resources boom. While the resources sector has benefited greatly, those parts of the tradable sector not directly exposed to the terms of trade boom have experienced a reduction in competitiveness due to the exchange rate appreciation. Further, all industries have faced increased domestic cost pressures due to competition for domestic factors of production (which has been offset to some extent by lower costs of imported inputs due to the exchange rate appreciation). This has created challenges for industries that have not been directly exposed to the resources sector and have not experienced a significant increase in the price of their output.

Looking further ahead, there will come a time when the demand for commodities will ease as development of economies in the Asian region continues and the focus of consumption shifts away from goods and towards services. Such a

transformation might appear to be disadvantageous for economies such as Australia that have hitherto been focused on supplying these economies with commodities. However, some Australian service industries, such as education and tourism, and parts of the rural sector have already experienced an increase in demand from Asia, notwithstanding the high level of the exchange rate. Rising demand for household, business and financial services more generally in Asia has the potential to be relatively advantageous for the Australian economy, in part because it is closer to this region than it is to most advanced economies, but also because of its well-developed and relatively open services sector. ✎

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