Australia's Major Terms of Trade and Resource Shocks, 1800-2012: Sources and Impacts

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1

1. Introduction

In the 2000s the Australian economy has experienced the combination of a significant commodity boom and a comparably large terms of trade shock. (Figures 1 & 2) While the two seem naturally to go together, most of Australia's comparably large resource booms have occurred in the absence of terms of trade shocks. The long-running wool boom of the 19th century, the two shorter lived gold rushes of the 1850s and at the turn of the 19th century are cases in point. Conversely, comparable but smaller terms of trade shocks in the 1920s and 1950s had significant cyclical impacts on the economy but were not accompanied by resource booms.

The combination of the two is a powerful force for change and this has provoked debate. The focus of concern is the so-called "Dutch disease", the notion that the expansion of the mining sector will cause the de-industrialisation of the economy as labour and capital are transferred from manufacturing and other trade exposed sectors to mining and that this loss of industry and skills will not be reversible when the mining boom ends. This then leads to proposition that policymakers should intervene, by somehow forcing the currency lower or otherwise protect selected industries, to stand in the way of these forces of change.

The idea that a commodity price shock will cause structural change is founded on well established trade theory and has been expounded in a number of well known papers.[1] Those expositions also note that there can be an income effect which partially offsets the transfer effect. And, if the assumption in the standard Heckscher-Olin trade model that labour and capital are not mobile between countries is relaxed, that income effect then becomes more significant.

Theory can frame the discussion, but it is an empirical question as to whether a commodity boom has the negative effects supposed by some, or not. And while the 2000s episode is unique, the historical experience has much to inform us on this question. The commodity booms in the 19th century saw at times spectacular growth of the commodity sectors of the economy. For brief periods, that growth was at the expense of other sectors as labour and capital resources were competed away. However, by far the dominant experience was that the growth of the commodity sectors contributed to significant growth in other sectors of the economy, including manufacturing.

This paper proceeds as follows. The theoretical framework for the discussion is first set out. Then the broad trends over the period 1800-2012 are discussed before a more detailed discussion of the three phases identified. The lesson to be drawn from this historical perspective are then discussed in conclusion.

2. Theory and Measures of Structural Change

The standard Heckscher-Olin trade model has been used by a number of authors to evaluate the impact of an expansion of a commodity sector on an economy in response to a positive price shock.[2] These models have three sectors – a commodity traded sector, non-commodity traded sector (manufacturing), and non-traded (services) and two factors of production – capital and labour. Under this model, there is a resource

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[1] See for example; Gregory (1976); Corden and Neary (1982).
[2] Gregory (1976); Corden and Neary (1982). A good textbook exposition can be found in Feenstra and Taylor (2010).

movement effect and a spending effect. The price shock raises the price of commodities relative to the price of non-traded goods and other traded goods sectors which raises the value of the marginal product of labour and capital employed in the commodity sector. In response, the commodity sector attracts labour and capital from the other sectors via the mechanism of higher wages and higher returns, producing resource movement to the commodity sector. This effect would be expected to see a lift in its share of output in an economy. The lift in returns to labour and capital boost the real income in the economy which will lead to an increase in demand for both non-traded services and for other traded goods. This will tend to lead to a rise in prices for non-traded goods relative to traded goods (real exchange rate appreciation) which for the non-traded sector will partially offset the rise in commodity prices. For the other traded sector, resources will be attracted away by both the commodity sector and the non-traded sector, while demand will be satisfied by imports. This leads to the notion of the so-called "Dutch disease", that is, that a positive commodity price shock can lead to de-industrialisation.

A key assumption of the standard Heckscher-Olin model is that while final outputs can be traded between countries, capital and labour inputs do not move. If we consider the commodity-producing country and a second country with two sectors (non-commodity traded goods and non-traded services) and relax this assumption for labour, theory tells us that the rise in the real wages induced by the commodity shock will attract an inflow of labour to the commodity-producing country.[3] This inflow of labour will lower the marginal product and real wage in the commodity producing country until the gap is closed. The increase in labour supply will increase output in the country and the additional labour will favour the labour intensive sectors of the economy. Assuming that the commodity-producing sector is capital intensive and the other sectors are labour intensive, which is the stylised case for Australia, this inflow will favour the other traded sectors and the non-traded sector. That is labour inflows will tend to work counter to the resource effect implied by the Heckscher-Olin model. The movement of capital has analogous effects to that of labour. So if we allow for capital movement, high returns will attract capital and this will favour the capital intensive sector. So whereas movement of labour favours the labour intensive sectors, the net effect of inflows of both labour and capital on the industry structure will be an empirical question. However, this additional capital will increase output in the country, so in conjunction with positive effect from the influx of foreign labour, it is clear that we should expect to observe an increase in the growth rate of the economy. That is, this effect can potential work counter to the notion of de-industrialisation.

While capital and labour inputs can move, the commodity sector also uses a third factor of production – land (in the case of agricultural and pastoral sectors) and mineral resources (mining) – which is not mobile. Introducing this third factor of production does not change the direction of outcomes in the Heckscher-Olin model outlined above. If we contrast land-intensive pastoral sector with more labour intensive manufacturing, allowing for mobility of labour will clearly favour the manufacturing sector. To the extent that a commodity price shock has induced the inflow of labour, this would be an offset. However, if there is an exogenous labour shock, either government policy provides a subsidy to the movement of labour or external political events cause a movement of labour, that would favour labour-intensive manufacturing. The increased supply of labour will lift output but at the expense of lower marginal product and lower real wages. Taylor and Williamson[4] have observed there has been significant

[3] Feenstra and Taylor (2010) Chapter 5 outlines the theory on movement of labour and capital between countries and discusses some of the empirical evidence.
[4] Taylor and Williamson (1997)

movement of labour between Europe and the New World (US and Australia) in response to the higher real wages offered in the New World which they argued had had reduced real wages in the New World and raised real wages in Europe.

The analysis by Gregory[5] treated a commodity price shock as the reverse of a implementing a tariff regime to support the non-commodity/manufacturing sector which would be at the expense of the commodity traded sector. Whereas a positive price shock would boost real income in the economy, a tariff shock would reduce real income. In theory, allowing for movement of labour and capital, it might to produce an outflow of these factors of production.

The standard way to assess structural change is to observe changes in the shares of activity of sectors of the economy (Figure 3), or shares of inputs of labour and capital (Figure 4). A variation on that is to construct a Structural Change Index (SCI) which provides a measure of the rate at which the shares of sectors of the economy are changing. However, it is not clear that these indices add significantly more to the story. [6] While change in sectoral shares and SCIs provide some guide on structural change, a significant part of the impact that a price shock has is on the size and growth rate of the economy. This structural growth impact can be assessed by comparing the growth of the country benefitting from the price shock relative to other economies. In Table 1, estimates of Australia's comparative growth vis-a-vis European/US growth are provided as guide to this dimension of the structural impact of commodity shocks.

The impact that a commodity price shock has on the economy will depend on its magnitude and duration. In standard finance theory, new investment will take place when the expected present value of the future stream of profits exceeds the capital cost of the new investment. And the future stream of profits is based on expected prices and costs. Typically, there is a lag between the decision to invest in new capital stock and that capital generating output and profits. For mining, it can be in the order of five years for new greenfield developments, while it is shorter for increments to existing mining capacity and it is also shorter for the farm sector. Regardless, there is a lag so that it is future prices that matter, not current prices. It follows that short-term commodity price shocks, and corresponding short-term movements in the term of trade, should not be associated with investment in new capacity in the commodity sector. A rational market will discount extreme highs and lows and expectations for future prices will more closely approximate long-term trends in prices and in the terms of trade. In the 2000s, the commodity price (terms of trade) shock has been sustained but there was a lag before investors accepted that it was not simply a short-term shock and started committing to new projects. In theory then, a short-lived movement in commodity prices might not induce a movement in resources to the commodity producing sector.

If we characterise an economy which exports commodities and imports manufactures, we can think of the long-term trend in the terms of trade as defining a long-term equilibrium relationship between prices of commodities and manufactures. It is deviations from that equilibrium that matter to the comparative returns to capital and labour. If changes in the price of commodities relative to manufactures are seen as short-term, investors are unlikely to respond. Conversely, if the relative price changes are large in

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[5] Gregory (1976)

[6] Connolly and Orsmond (2011) Figure 15 has a set of these SCI measures. Connolly and Orsmond were ambivalent about their value. The author constructed series back to 1800 but also found them less instructive than simple shares.

magnitude and are seen by investors to also be enduring, then we might expect to see a shift in capital resources. That is, for structural change, it is the magnitude and duration of the deviations in the terms of trade from its long term trend which matter more.

In the case where the rise in price is for a commodity which accounts for the exports of the commodity producing country, the rise in price will be synonymous with a rise in the terms of trade. In this case the price shock can be expected to boost investment in the commodity sector while the rise in income (profits, tax revenues) will separately provide an immediate boost to spending. A measure of this income effect is provided by real Gross Domestic Income (GDI) or terms of trade-adjusted GDP which measures the purchasing power of an economy's income. Real GDI is highly correlated with spending in the economy. When comparing terms of trade cycles, trough to peak (or converse) moves which capture the extent of change in real GDI would be one valid measure of relative magnitudes (Table 3).

An alternate case is where the country does not export the commodity but has untapped potential. The price shock will provide a stimulus for investment in developing the commodity sector but there will not be a rise in the terms of trade and the immediate boost to income associated with that. Another similar case is where the economy exports and imports a particular commodity in equal amounts. The price shock stimulates an expansion of the commodity sector which leads to the country becoming a net exporter of the commodity but in the short-term, there is no change in the terms of trade.

That is, terms of trade shocks require price shocks but price shocks can occur without a corresponding terms of trade shock. Another way of looking at this is that the combination of a price shock with a terms of trade shock is more potent because of the additional, immediate cyclical impact on activity.

3. Three phases of economic growth

Australia's economic growth story is very much a story of the development of its primary resources. Looking over the period 1800-2012, it can be stylised as having three phases – a high growth phase for commodities 1800-90, a slow growth phase from 1890-1965, and the period of renewed commodity expansion from 1965. Table 2 shows the growth rates for key commodities in these periods and Figures 5, 6 and 7 show the long-term growth in volumes.

The period 1800-90 was a period when the Australian economy expanded significantly relative to Europe/US economies. The prime driver of this was the expansion of its commodity export base, chiefly the wool industry but with the base metals, notably gold from 1850, also playing a significant part. At times, in the short-term their growth did squeeze other sectors. However, contrary to the so-called "Dutch disease" thesis, the growth of these commodity industries was a significant benefit to the non-commodity traded goods sector and to the non-traded sector. From around 1.5% of economic activity in 1800, manufacturing had grown its share steadily to about 10% by 1890. The success of the commodity sector had attracted a significant inflow of labour, with the labour intensive manufacturing sector a beneficiary of that and the economies of scale provided by the lift in the absolute size of the Australian economy.

By contrast, the period 1890-1965 saw economic growth decelerate to be very much in line with growth in Europe/US. It was a period when commodity prices generally moved in line with prices of manufactured goods (Figure 8). Nonetheless, the rate of growth of the pastoral and mining sectors slowed significantly and it was not the major driver of growth in the economy that it had been in the earlier period. With growth at a slower pace than observed for the aggregate economy, this saw a significant

decline in the commodity sector's share of economic activity. While this suggested that Australia was probably becoming less attractive as a destiny for immigration, government policies of assisted migration at least partially offset that and while Australia's population slowed, it was still comfortably ahead of Europe and the US. This was also period when tariff protection for manufacturing was lifted substantially, initially in the first decade and then again in the 1920s and 1930s.[7] This period saw the manufacturing sector, a sector where Australia is at comparative disadvantage, increase its share of economic activity. We could characterise this period as one where growth was skewed to economic opportunities offering lower returns to both labour and capital. Reflecting this, in per capita terms, Australia went from well above the US and Europe to below the US and broadly in line with Europe by the mid 1960s.[8]

The more recent period 1965-2012 has seen the Australian economy return to a higher growth phase, led by commodities, albeit far less dramatic than experienced in the period 1800-1890. Ironically, in contrast with steady trend observed in the period to 1965, commodity prices had shown a steep decline until their sharp reversal in the 2000s (Figure 7). The reason for the resources growth has been the growth of the Asian economies, starting with demand for resources generated by the rise of resource-deficient Japan in the 1960s and 1970s and more recently with the rise of China.[9] This period has seen a significant expansion in the mineral resources export base, led by growth in the bulk commodities of iron ore, coal and natural gas. Base metals have grown at a slower pace, while the pastoral and agricultural resources have continued their relative decline. Overall, the share of primary commodities (agriculture plus mining) has declined slightly from over 12% in the mid 1960s to closer to 10% in 2012 but, given the historical trend decline and the trend for this sector to decline in developed countries, it can be regarded as strongly going against this trend. While this growth arguably provided a scenario favourable to a lift in immigration, immigration has been constrained by government policies in this period although it was allowed to grow significantly in the 2000s at least partly in response to the mining resources boom.

It has also been a period where the comparative disadvantage in manufacturing has been transparent. The growth of the primary sector export base has created pressure for a movement in labour and capital resources out of manufacturing to accommodate this growth. The forces driving a structural decline in manufacturing have also been accentuated change by the rise of Asian as a source of imports, displacing US and European manufactures, and the Government decision to substantially reduce tariff protection in the 1980s and 1990s. In short, the equivalent of multiple adverse price shocks to manufacturing. These pressures have overlayed the long-term trend for the relative decline of manufacturing across developed economies, as with rising incomes incremental growth in consumption has shifted to services.

4. A closer look at the period 1800-1890

In part reflecting its low starting base, the wool industry grew at an average 20% per annum 1800-20. This saw pastoral industry share of the economy rise from 3% to 20% (Figure 3). There was some competition between the pastoral and agricultural (non-pastoral) sectors for resources in this period[10] but the agricultural sector, which was then wholly focussed on the domestic market, benefitted from the rise in demand created by the increase in income and population and grew significantly in absolute terms to

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[7] Lloyd (2010)
[8] Irwin (2007) and McLean (2004)
[9] Garnaut (2012)
[10] Sinclair (1976)

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maintain its share of activity. The sector that did decline in this period was the government sector. The provision of prison services for the UK, a government activity, was the principal export of the Australian colonies before the wool industry came along. So its decline could be seen as a desirable development with the wool industry providing a much sounder basis for growth.

In the period 1820-50, from a higher base, the wool industry grew at an average 12% per annum, again providing a significant direct contribution to economy-wide growth of about 7%. However, as a share of the economy, the pastoral sector actually recorded a slight decline. The explanation for this is that the price of wool declined significantly in this period, which suggests also that the terms of trade probably declined.[11] The rise of the wool industry had not been in response to a positive price shock but to the discovery of a low cost resource in the form of land suitable for the production of wool. As Australia's output expanded, it displaced high cost producers in Europe but also contributed to a decline in price. However, the path of its continued expansion indicates that, despite declining prices, it still remained a profitable investment. Involuntary immigration had been the major source of inflow of labour for the Australian colonies in the early decades of the 19th century but opportunities created by the growth of the wool industry started to draw in free migrants. Given the land intensive nature of wool growing, it was more the indirect opportunities presented by the growth of commerce, manufacturing and agriculture sectors in response to the demand generated for inputs into the wool industry and the broader positive income effect. Of a minor note of interest, this period saw the absolute decline of the whaling industry but, the magnitude of the stimulus provided by the expansion of wool, saw this have a negligible effect on the economy.[12]

While wool provided a continuing source of growth for the economy in this period, the first gold rush in the 1850s provided a substantial but short-lived shock to the economy. From almost scratch the gold rush caused the mining sector to expand in two years to represent 25% of the economy and then retreated steadily retreat back to 5% by 1890. The boom generated inflation pressure in the economy and drew resources from other sectors.[13] While causing significant disruption in the short-term, the gold rush drew a significant inflow of people and it this which had the biggest structural impact on the economy. At the height of the boom, much of the increased demand was satisfied by imports. As the gold rush faded, the inflow of labour from overseas receded but it did not reverse. The supply of labour leaving the gold industry created an unemployed pool of labour provided labour for industries able to compete profitably with imports. Victoria, which had been at the epicentre of the gold, adopted high tariffs in 1867 with the twin objectives of raising revenue and stimulating the manufacturing sector.[14] NSW maintained low levels of tariff protection. Interestingly, between 1850-67 the share of manufacturing had risen from 4% to 6.5% and it then rose to 10% by 1890s. However, over the period 1867-90 employment in

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[11] The index of British prices of imported wool show a 40% decline from the early 1820s to circa 1840 and further 40% decline by the late 1840s when recessionary conditions prevailed, giving a cumulative fall of over 60% (Vamplew, 1987, pp 116), while US prices showed a over 50% fall over this same period (US Statistical Abstract; page 209).
[12] Sinclair (1976), page 58.
[13] Sinclair (1976)
[14] Wilson and Shanahan (2012)

manufacturing in NSW grew by 5.9%, almost the same as the 6.0% growth recorded by Victoria.[15] So, at least in this period, it seems it was the favourable environment for manufacturing, not tariff protection, which was the prime driver of growth in the manufacturing sector. That is, far from being a source of "de-industrialisation", the growth of the commodity sectors in this period had actually been a force for industrialisation.

5. The 1890-1965 period – slow growth

The period 1890-1965 saw a marked deceleration in Australia's rate of growth, with GDP growth averaging just 2.9%, compared with over 6.5% in the earlier period and population growth averaging just 1.7% (vs. 5.9%). From significantly outpacing Europe/US, real GDP growth was in-line and in per capita terms lagged. (Table 1) From ranking ahead of Europe and the US in 1890, by 1965 Australia was lagging behind the US.[16]

In terms of sectoral growth, there was a sharp deceleration in the growth of the commodity sectors. Mining output grew at just a slower pace (Table 2) and shrank from 4.4% of GDP in 1890 to 1.6% in 1965. The wool industry decelerated to an average growth rate of 1.8% and, while the beef industry benefitted from innovations such as refrigeration, the pastoral industry overall declined from 11.2% to 6.3% of GDP. Non-pastoral agriculture benefitted from innovations which made it more competitive in foreign markets declined more sharply from 10.8% to 4.2% of GDP. It should be noted that prices of commodities generally were steady, measured relative to manufactures, in this period (Figure 8). Prices of wool and wheat exhibited volatility but also a steady trend, while base metals fell early but were then steady. It would appear that just as price rises did not explain the rise of these sectors, they do not explain the deceleration. The more likely explanation is that the more profitable segments had been exploited and the industry was now exploring more marginal prospects. An exception here is gold. With the price fixed by central banks, its price declined significantly over this period, apart from a significant rise in the 1934, until the Bretton Woods system collapsed and the gold price was free to rise.[17] In response to the declining price, Australia's production of gold had declined to negligible amounts by the early 1970s.

In the period 1890-1970 three significant cycles in the terms of trade can be observed. (Figure 1)The first was associated with the great depression of the 1890s. While the boom in the property market and construction activity in the property in the 1880s and its subsequent collapse was a significant part of the story, the commodity sector also contributed significantly. There had been high levels of investment in the pastoral sector in the late 1880s, which reflected what proved to be excessive optimism about future demand, contributed to the boom conditions. The negative shock to wool prices in the 1890s brought a sharp decline in investment which was then exacerbated by drought conditions in the period 1896-1902 which caused a sharp fall in the stock of sheep.[18] (Figure 5) The decline in the terms of trade of 20% would have subtracted 3 percentage points off real GDI and contributed to the decline in spending and economic activity.

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[15] Vamplew (1987) page 288. The growth rates quoted are based on the Linge estimates in Vamplew. The Butlin estimates of manufacturing employment have NSW showing faster growth (6.5%) then Victoria (6.2%) in this period.
[16] Irwin (2007) and McLean (2004) discuss the evidence for this decline, which is the subject of some debate.
[17] Reserve Bank of Australia (2007)
[18] Rutherford (1948)

The turnaround in the terms of trade coincided with the second gold rush which like the first was the product of discovery not a favourable price shock and was labour intensive. It caused some disruption however coming in the wake of the recessionary conditions, it could be said to have soaked up surplus resources. The share of mining rose but it primarily compensated for the decline in the pastoral sector and there was no significant change in the share of manufacturing.

The other two terms of trade shocks were associated with post-war economic adjustment. In each case, there was a significant decline in the terms of trade and, from the troughs in 1921 and 1944, the subsequent turnaround in the terms of trade to the peaks in 1925 and 1951 was very sharp. This volatility matters for its impact on cyclical activity. In the case of the 1950s, Figure 9 shows that in the early 1950s real GDI moved much more sharply than GDP and that spending in the economy moved more in line with real GDI.

In terms of cyclical measures of terms of trade shock (Table 3), the 1950s episode is the largest of the three, with the 1951 peak 187% above the cyclical low in 1944 and average for the boom period (1948-55) 66% above the level in the preceding bust (1939-46). On this latter measure, the 1920s shock is only marginally less pronounced, averaging 59% above the bust of 1919-22. Comparing these episodes with the 2000s episode, in trough to peak terms the 2000s rise of 100% does not match the 1950s episode but its sustained rise means its actual cyclical impact is larger (see discussion below).

While these episodes in the 1920s and 1950s had a cyclical impact, they appear to have had negligible, if any, structural effect on the economy. If we look at a measure of ToT average in those booms relative to the long-term trend, then we observe that the 1920s and 1950s episodes were 24% and 23% above trend, while for comparison the 2000s episode is substantially more significant at 49% above its trend (Table 1). These two episodes were also relatively short-lived. If investors take their cue from trend prices, then it is no real surprise that these episodes produced no structural shift towards commodities. Observing the long term growth in wool (Figure 5), output declined in response to the post-war disruption and the recovery saw output return to its trend path. With no structural shift in the share of economic activity towards wool, aside from any short-term cyclical effects, it would have not have been putting any sustained competitive pressure for resources on other sectors of the economy in either of these two periods. The share of manufacturing in both these periods appears to be on an upward trend, particularly in the 1950s when government policy inducing high levels of immigration and the lagged effect of the Scullin tariffs favoured labour intensive manufacturing. Battacharyya and Williamson[19] reached a similar conclusion on the 1950s episode observing that the forces for industrialisation were more powerful in this period but argued that the terms of trade had had some structural impact in the 1920s.

While the 1959-63 bust in the terms of trade may have been minor, it preceded a gradual but significant trend decline in the terms of trade in the period between the 1960s and the 1980s. This decline was in line with the broad decline in the Grilli commodity price series in this period. (Figure 8) The key for Australia, given it accounted for around 30% of exports in the 1960s, was the decline in wool as synthetic materials displaced it – the price of wool declined by about 75%. (Figure 8) In 2011/12, wool exports represented just 1% of exports.[20] In the 1960s it might have been hard to imagine how the economy would cope with

[19] Battacharyya and Williamson (2011)
[20] ABS 5368.0 International Trade in Goods and Services, Australia. Vamplew (1987) for 1960 export share.

such a diminution in the wool industry. But a significant section of the wool industry sector shifted into different products, albeit potentially offering lower marginal returns than historically provided by wool production, and the industry adapted. From a broader economy perspective, the decline of the wool industry coincided with a new phase dominated by the mining sector.

6. The post-1960s minerals expansion

The rise of the minerals sector has been associated with the rise in the Asian economies. The expansion of the sector in the 1960s and 1970s is closely linked with Japan's period of rapid catch-up to the developed economies. This saw significant expansion of iron ore and coal output to meet demand from that market. In the case of iron ore, akin to wool prices in the period 1820-50, its rise was not associated with a rise in prices for these commodities. Indeed, prices for iron ore declined significantly in real terms from the 1950s through to the 1990s.[21] The existence of high quality iron ore deposits in the Pilbara region of Western Australian was known but the inland location required development of rail links as well as port facilities. The magnitude and long term nature of the investment presented a risk element to investors. This was overcome by the major Japanese steel mills entering into long-term contracts to buy specified quantities at prices which made the investments profitable. The first part of the Pilbara Iron rail network constructed was a line known as the Hamersley railway which went ahead in December 1964, when Japanese steel mills agreed to purchase iron ore from Hamersley Iron Pty Ltd over 16 years beginning in August 1966.[22] Risk sharing also came via the Asian steel companies becoming joint investors in the development of a number of the iron ore mines.

In the case of the energy commodities, price shocks have been a major part of the story since the 1960s. In the period 1900-1960s, the long-term trend was for steady prices in real terms.[23] The oil price shocks of the 1970s changed that and the oil price experienced significant cyclical highs in the late 1970s and the 2000s, with the cyclical lows in the 1990s still well above long-term trend levels. Coal prices have experienced similar cyclical highs, although its cyclical low in the early 2000s was below long-term trends. Before the oil price shocks, Australia was an exporter of energy commodities but also a significant importer, so the rise in energy prices led to no rise in the terms of trade. Given Australia's untapped coal and natural gas resources, the rise in energy prices produced a significant rise in investment in these commodity resources. It also led to significant investment in aluminium manufacturing which is a high consumer of energy.

In the period from 1800 to the early 1970s the price of gold was fixed by the US gold standard. The price was lifted to $US35 in 1934 and there it stayed until the Bretton Woods system collapsed in the early 1970s and the gold price was set free. With inflation since 1934 having eroded its real value, this had caused a sharp decline in gold production (Figure 6) and it was a similar story in other gold producing countries. When the link was broken, the lack of supply saw the price rise substantially and the gold industry re-emerged as a significant commodity producer.

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[21] Reserve Bank of Australia (2010), Graph 5.
[22] Joyce and Tilley (1980)
[23] Reserve Bank of Australia (2010), Graphs 4, 7.

The impact of these partly related factors in the 1960s and 1970s was significant investment which saw the sector's share of the capital stock rise from the mid-1960s to the early 1970s (Figure 4) and this was accompanied by a sharp rise in the production of bulk commodities (Figure 7). Thereafter the share of the net capital stock slowly but steadily before the 2000s investment boom which has produced another significant structural lift.

Between the major commodity shocks of the 1960s and 1970s and that of the 2000s there was a comparative lull and the view took hold in the 1990s that the future was bleak for commodity exporting countries. Reflecting that the $A was at low levels from the mid-1980s which cushioned the impact of the lowering of tariffs in the 1980s and 1990s and the rise of the Asian economies as a competitive source of manufactured imports. The extent of the decline in manufacturing that would otherwise have occurred was delayed. The low $A assisted some resource-based sectors of manufacturing to actually grow, with the wine industry an example of that. It also provided stimulus for the expansion of some service exports, with tourism and education services. With the mining boom of the 2000s seeing a rise in the $A, these new growth industries have suffered reversals[24] but they do illustrate the potential for new area of activity to emerge if or when the mining boom loses momentum.

7. The 2000s Terms of Trade Boom

The 2000s commodity price boom is closely linked to the rise of China which is following the example of Japan in the earlier period.[25] The difference is that China is a much larger economy than Japan so that its potential demand for resources is correspondingly larger. In the 1980s and 1990s, China experienced similar strong economic growth to the 2000s. However, it primarily met its demand for commodities from its own domestic supplies and was it only in the 2000s that its demand outstripped those supplies and it became a more significant influence in world commodity markets. A measure of its significance is that, despite the negative demand shock posed by the sustained recessionary conditions experienced in the US and Europe in the period 2007-12, this was largely offset by demand from China.

In contrast with the earlier price shocks, this boom is distinguished by the magnitude of the price movements and the associated rise in the terms of trade. In contrast to the 1920s and 1950s, it was not preceded by a period of weakness in commodity prices. For the period 1980-2003, the terms of trade had been comparatively steady. Prices for most commodities contributed to the price shock but the sharpest rises occurred in the bulk mining commodities, iron ore, coal and natural gas. Relative to its 1980-2003 mean, the terms of trade peaked in 2011 at 96% above that level and over the period 2004-12 has been on average 54% above that level.

Prices started rising in 2003 but, reflecting caution by investors about whether these higher prices were temporary or a had a more permanent element, its impact on investment was not immediate. However, as confidence built that the higher price levels might be more sustained, there was significant rise in investment. Bearing in mind that the wool and gold booms of the 19th century were not capital intensive, the investment boom that emerged in the period 2005-12 appears to be the most significant in Australia's history.

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[24] Battelino (2010)

[25] Garnaut (2012) gives a good discussion of the impact of China's growth.

From a structural perspective, reflecting the magnitude of this investment, the share of capital stock accounted for by the mining sector rose significantly. Conversely, reflecting the low labour intensity of mining, its share of labour doubled from 1% to 2% but was still a small share except that industries supplying inputs to the mining sector are more labour intensive and their use of labour also would have risen proportionately. The share of mining output in the economy also grew from 4.5% in 2003 to 8.5% in 2012 (Figure 1). This largely reflected price gains as over this period as mining sector output had only managed to grow in line with aggregate growth in the economy. On this basis, some have argued that this suggests less structural change in the economy. However, given the long lead times in mining projects, and the reasonable expectation that this new capital stock will boost potential output, volume growth is likely to run ahead of aggregate growth in the economy. Moreover, to the extent that the rise in nominal prices has a permanent component to it, the share of nominal GDP is a valid measure of structural change.

If the mining sector is expanding its share, and the construction sector is at least temporarily lift its share, the question is how is that being accommodated? They key price signal for change is the exchange rate. In previous boom, the exchange rate has been fixed and pressures were reflected in price and wage inflation. On this occasion, the rise in the real exchange rate has almost wholly reflected the lift in the nominal exchange. With the real exchange up about 40% on its long-term average (Figure 9), it is a strong signal for change and is putting sustained pressure on the non-commodity traded sector which is where theory predicts the most of the room needs to be made. Consistent with what theory suggests, a decline in the share of manufacturing can be observed (Figure 3) but that has been on-going trend since the 1960s. It is argued by Battacharyya and Williamson[26] that this decline is no more than structural decline occurring in developed countries generally and that, like the 1950s commodity shock, the 2000s shock has had no impact itself in causing change. The difference between the 1950s and the 2000s is that in the 1950s the prices were seen (correctly) as temporary and hence did not lead to investment to expand the commodity sector. By contrast, investors have interpreted the more substantial and sustained rise in prices in the 2000s as having a permanent element and have accordingly invested to lift output. Within manufacturing, the sunk costs of existing investments mean that there can be a lag before the full impact is felt but the decline looks fairly real.

That said, the commodity boom has lifted the overall size and potential growth of the economy. The 2000s has, for example seen much higher levels of immigration than experienced in the 1990s and this has parallels to the response to the commodity booms in the 19th century. This higher potential growth can be expected to moderate the pressure and beyond the short-term be positive for other sectors of the economy, including segments of manufacturing.

The 1920s and 1950s terms of trade shocks had sizeable cyclical impacts on the economy via the impact in boosting real GDI and spending. Similarly, the 2000s episode has provided a significant boost to real GDI and this can explain the higher growth in spending observed in this period (Figure 11). There are two differences between this and the two earlier periods. Firstly, whereas the 1950s was probably seen as short-term and hence not lifting permanent incomes, the sustained nature of the terms of trade boost to incomes in the 2000s suggests that consumers might have interpreted the lift as more permanent and have adjusted up their spending accordingly. That is fine if the boost proves to be permanent but could present problems if it proves less permanent. The second difference is the very substantial investment boom

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[26] Battacharyya and Williamson (2011)

12

generated by the commodity price shock. One of the key observations of Butlin on this period was that variation in investment associated with resource booms was the main contributor to volatility in the economy rather than exports.[27] In short, the 2000s episode provided a more substantial cyclical boost and that poses risks for policymakers.

8. Conclusion

The 2000s episode appears to be unique in the combination of both a sustained terms of trade shock and a commodity boom. The combination has generated significant cyclical and structural impacts on the economy. The focus of this paper has been primarily on the latter structural impact and addressing the issue of the supposed threat posed in de-industrialisation of the economy. The terms of trade booms in the 1920s and 1950s were short-term and turned out to be largely cyclical events. The key lessons appear to come from further back in history in the period 1800-90 when Australia absorbed commodity shocks which in relative terms were on a much larger scale than the 2000s boom. In the short-term, these booms caused some disruption to other industries but the key lesson of the period is that the commodity booms lifted the whole economy. If the wool and gold industries had somehow been constrained, manufacturing would not have benefitted as it did. In the period 1860-90, manufacturing was one of the growth sectors of the economy but that was conditional on the groundwork laid by wool and gold.

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[27] Butlin (1964)

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Table 1: Australian Relative Growth Rates

	Real GDP Growth (% per annum)		
	Europe/US	Australia	Difference
1820-1890	2.2	6.5 (8.3)	+4.3 (6.1)
1890-1965	2.7	2.9	0.2
1965-2012	2.8	3.6	0.8
	Population Growth (% per annum)		
1820-1890	1.0	5.9	+ 4.9
1890-1965	0.9	1.7	+ 0.8
1965-2012	0.65	1.4	+ 0.75
	Real GDP per capita growth (% per annum)		
1820-1890	1.2	1.5	+0.3
1890-1965	1.8	1.1	-0.7
1965-2012	2.1	2.2	+0.1

Table 2: Indicators of Australian Commodity Sector Growth

	Indicators of Volume, Per Annum Compound Growth Rates (% per annum)				
	Sheep No.'s	Wool output	Gold	Base Metals	Bulk Mining
1800-1890	10.8	11.9	-		
1820-1890	8.0	9.2	3.5	14.3	9.4
1890-1965	0.9	1.8	-0.5	3.0	3.0
1965-2012	-1.8	-1.4	4.8	3.5	6.9

Table 3: Australian Terms of Trade Booms and Busts

	Major Terms of Trade (ToT) booms [1] and minor episodes [2]				
	1903-10(2)	1923-29	1948-55	1973-75(2)	2004-12
Trend ToT	101(1870-1959)				88 (1980-2003)
Cyclical measures					
ToT peak	121.4 (1905)	158.5 (1925)	176.1 (1951)	115.7 (1974)	172.4 (2012) [3]
Peak vs. trough (% chge)	56.7% (vs.1893)	128.2% (vs. 1921)	186.7% (vs. 1944)	28.6% (vs. 1972)	103.7% (vs. 1998)
Structural measures					
ToT average during 'boom'	116.3	124.8	123.6	108.8	135.5
Boom average vs. trend (% chge)	15.3%	23.7%	22.5%	7.8%	54.3%
	Terms of trade busts [4] and one minor episode [5]				
	1891-97	1919-22	1930-33	1939-46	1959-63
Cyclical measures					
Trough	77.5	69.5 (1921)	72.9 (193X)	61.4 (1944)	91.6 (1959)
Trough vs. peak (% chge)	-23.9% (vs. 1886)	-35.1% (vs. 1913)	-43.4% (vs. 1928)	-49.2% (vs. 1937)	-48.0% (vs. 1951)
Structural measures					
ToT average during 'bust'	82.5	78.6	79.7	74.6	95.7
Average vs. trend (% chge)	-18.2%	-20.1%	-21.0%	-26.1%	-5.1%

(1) Major ToT boom periods defined as period when terms of trade rises above trend for at least three years and by at least (on average) 20% relative to its trend. First year chosen shows movement of about 5%. End defined as year when ToT returns below 10% above trend.

(2) The booms of 1903-05 and 1973-75 included for comparative purposes. The boom of 2003-11 has been compared with the 1973-75 period in a number of studies (Battelino, 2010)

(3) Technically there was a peak in 2009 but this taken as temporary check to rise to peak in 2012.

(4) ToT bust periods defined as period when terms of trade falls below trend for at least three years and by at least 10% relative to its trend.

(5) 1959-63 included for comparative purposes. Highlights point that there was a soft landing after the ToT boom of 1948-55.
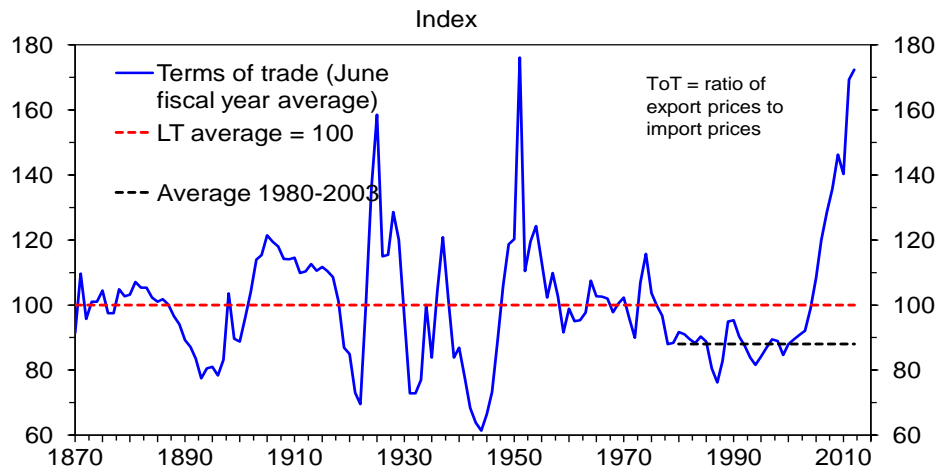
Figure 1: Australian Terms of trade index 1870-2012

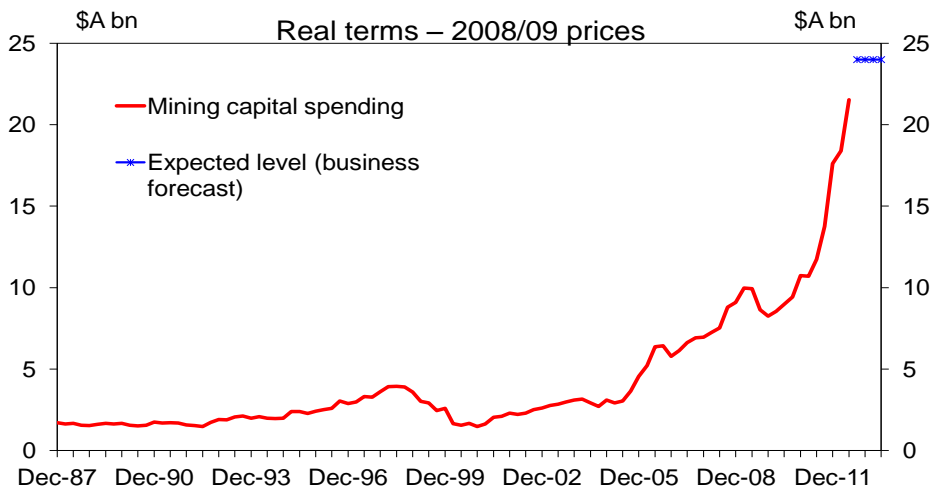Index

Figure 2: Mining sector capital spending
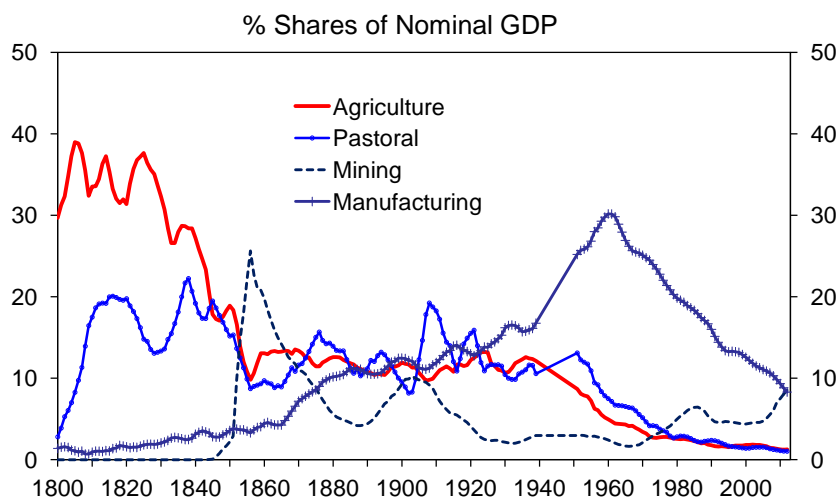
Figure 3: Shares of Output 1800-2012

% Shares of Nominal GDP

Figure 4: Industry Shares of Net Capital Stock 1960-2012

% Share of Net Capital Stock
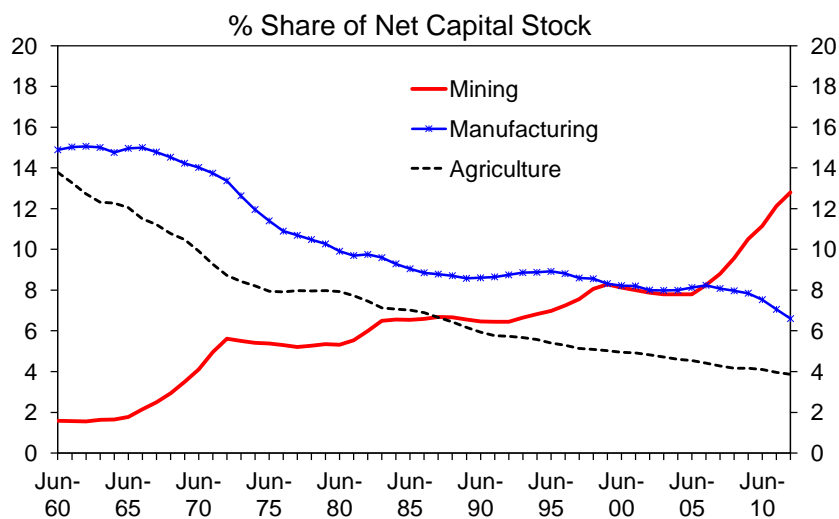
Figure 5: The Wool Industry 1801-2011

No. million   Log scale   Million kilos

Legend:
- Sheep (No.million) - left scale
- Wool output (Million kilos) - right scale
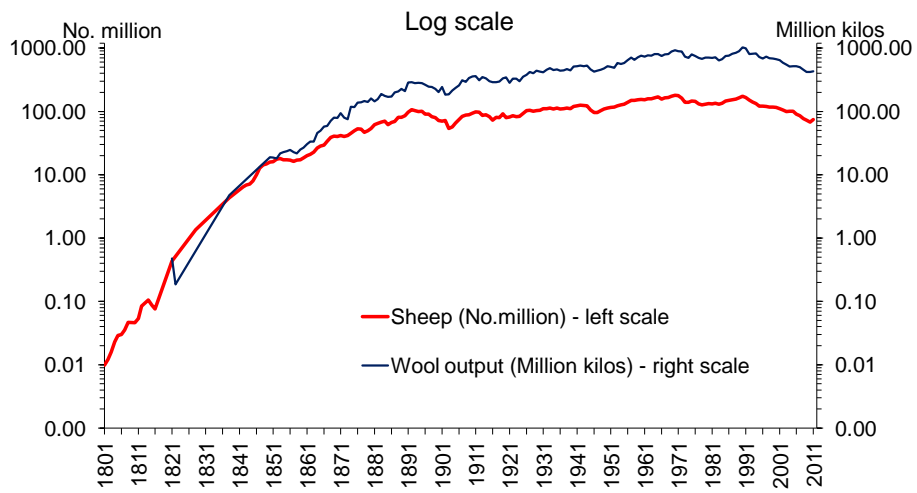
Figure 6: Base metals 1845-2011

Volume Index   Log scale   Volume Index

Legend:
- Base metals (copper, tin, lead, zinc, nickel, silver)
- Base metals + Gold

19
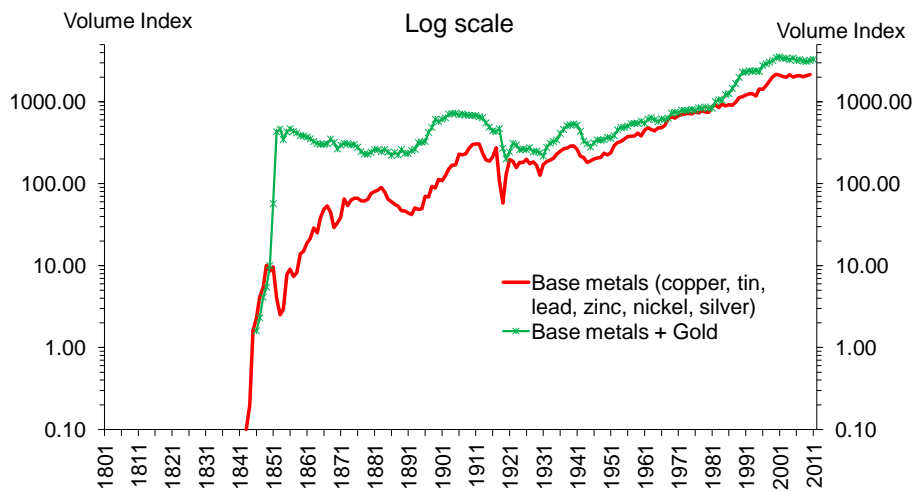
Figure 7: Bulk commodities 1860-2011

Log scale

Volume Index

Volume Index

- Bulk minerals (coal + iron ore)
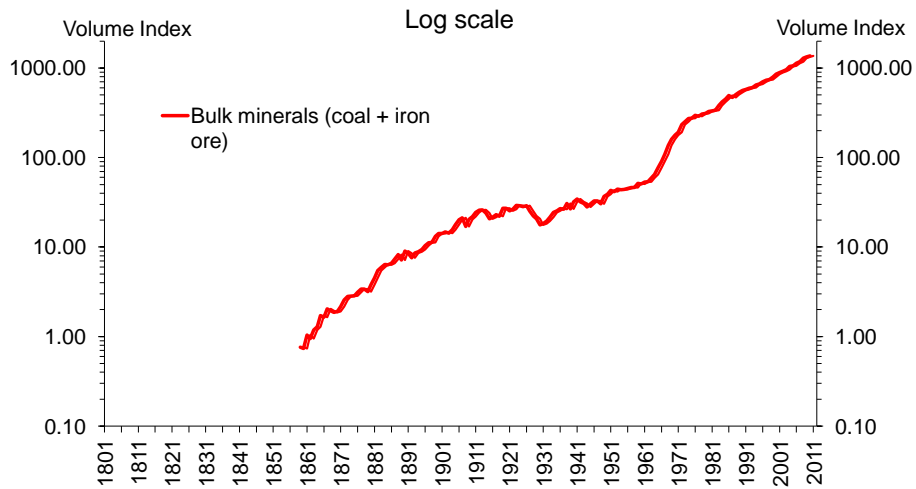
Figure 8: Grilli commodity price indexes 1900-2011

1900 = 100

- All
- Metals
- Wool

All series are deflated by Manufactured Prices. Grilli (1988), updated as per Pfaffenzeller et al (2007)
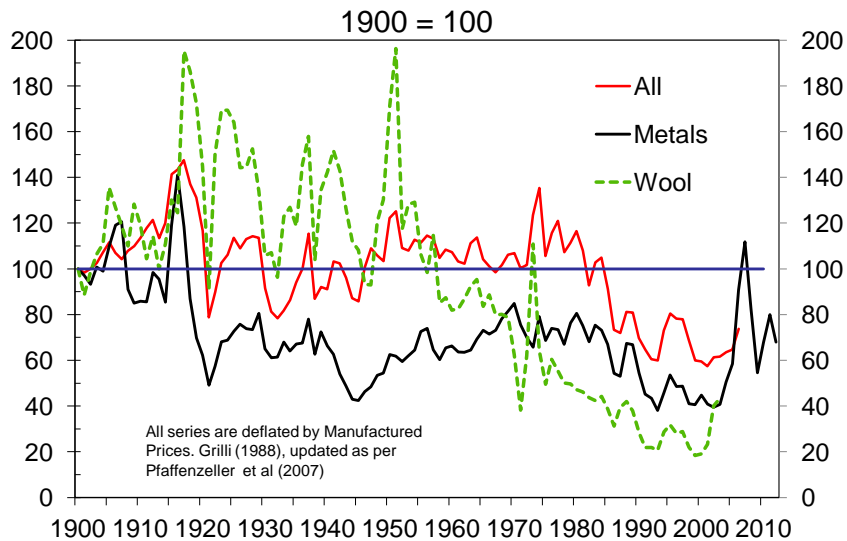
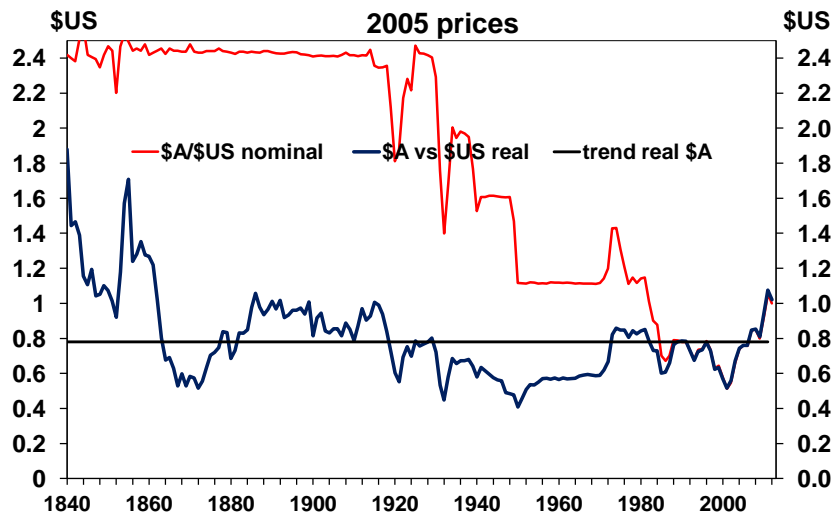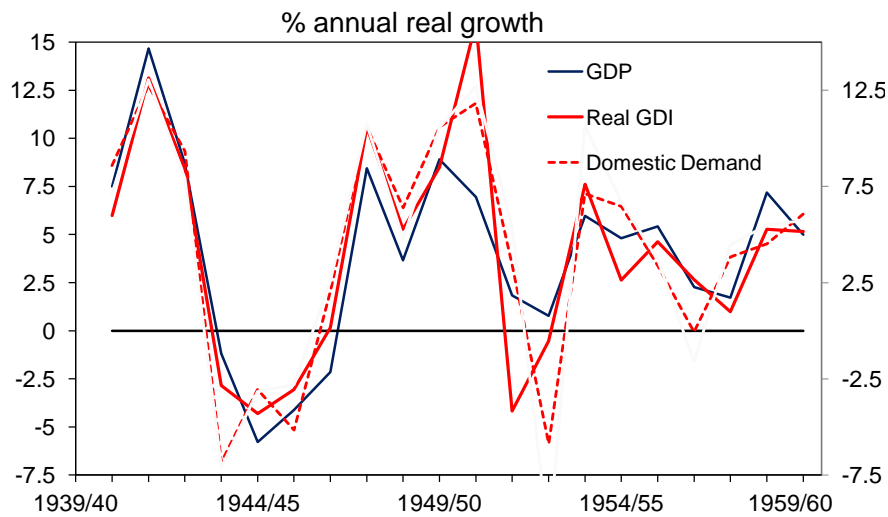## Figure 9: Real exchange $A vs. $US1840-2012

Figure 10: Real GDI, GDP and Spending Growth 1940s-1950s

Figure 11: Real GDI, GDP and Spending – 2000s

% annual change   Real terms – 2008/09 prices   % annual change

Legend: GDP, Real GDI, Final Demand