Output Co-movement between Australia and China

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Abstract

Historical stylised facts show a high degree of output co-movement between Australia and the US. This has served to inform the policy response in Australia to developments in the US. However, in the 2000s, a perception has arisen in some policy circles, and even more so in the mass media, that output fluctuations in Australia increasingly reflect developments in China. This paper seeks to shed light on this view by examining the degree of output co-movement between Australia and China. The results indicate that while output co-movement has increased in recent years, it continues to lag behind that between Australia and the US. Several explanations are provided as to why output co-movement between Australia and China is modest, and likely to remain so into the foreseeable future.

JEL codes: E32, F15, F43

Key words – Australia, China, Output Co-movement

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# The authors would like to thank Kam Ki Tang, Rodney Strachan and participants at the 21st annual conference of the Association for Chinese Economic Studies (Australia) held at RMIT University, Melbourne, Australia, 15-17, July, 2009, for valuable comments on an earlier draft. Any errors are our own.

I. Introduction

As a relatively open, medium-sized economy, it has long been regarded that output fluctuations in Australia are to a significant extent determined by developments abroad. Not surprisingly, it has been output fluctuations in the US, the world’s largest economy and a major trade and investment partner of Australia, that have traditionally been the focus of attention. The historical stylised facts are compelling and point to a high degree of output co-movement between Australia and the US. For example, Andrews and Kohler (2005) showed that over the period 1983Q1-2004Q4, the correlation coefficients between real GDP growth and real GDP output gap series in Australia and the US were 0.59 and 0.82, respectively. Crosby and Bodman (2005) noted that between 1960 and 2000 every period of recession in Australia corresponded to a period of recession in the US. This output co-movement gave rise to the phrase that when the US sneezed, Australia caught a cold. It also served to inform the response of policy-makers in Australia, such as those in the Commonwealth Treasury and the RBA, to developments in the US, and as Andrews and Kohler (2005) pointed out, has been incorporated into most macroeconomic models of the Australian economy. ¹

However, in the 2000s, a remarkable change in focus has occurred. Specifically, a perception has arisen in some policy circles, and even more so in the mass media, that output fluctuations in Australia increasingly reflect developments in China rather than the US. In the 1980s, some economists, such as Garnaut (1989), observed that the economic reforms that began in China in the late 1970s had the potential to have a profound impact on Australia’s economy. However, it was not until 2001 that the potential influence of China began attracting significantly more attention. In that year, for the first time in a long time the Australian economy shrugged off the spillover effects of a (albeit mild) recession in the US. During the 2000s, China’s stature in Australia’s macroeconomic policy dialogue has grown enormously for two main reasons. The first is that China has emerged as a leading source of export demand. Figure 1 shows that China now absorbs 16 per cent of Australia’s total merchandise exports, up from around 5 per cent at the

¹ Whether the high degree of output co-movement between Australia and the US reflects causality is a matter of some debate. While this is usually assumed to be the case, Crosby and Bodman (2005) argue that it might simply reflect coincident shocks.
start of the 2000s. In the 12 months to May 2009, Australia’s merchandise exports to China totaled $A39 billion. China is now the second largest destination for Australia’s merchandise exports following Japan, and it is absorbing nearly three times the value of exports to the US. The second is that China has emerged as a major player in world resources markets and this in turn has had a dramatic impact on Australia’s terms of trade. It can be seen in Figure 2 that during the 2000s Australia’s terms of trade have increased sharply and that this has almost entirely been as a result of rising export prices. RBA (2009) shows that China has played an important role in this outcome by influencing the world price Australia’s two most important merchandise export categories, coal and iron ore, which respectively account for around 25 per cent and 15 per cent of the total value of merchandise exports.

Insert Figure 1 here

Insert Figure 2 here

The economic commentary during the global financial crisis period amply illustrates the perception that significant output co-movement exists between Australia and China. The US entered 2008 in recession. By mid-year it had been joined by Japan and the EU. A decade earlier, such a state of affairs would have led to a recession in Australia being considered inevitable. Yet in their mid-year Economic Outlook, the OECD contended that, “…the weakening economic situation in the OECD should be cushioned in Australia's case by the persisting strength of the Chinese economy”.

OECD (2008a, p.125)

To be sure, real GDP growth in China did slow down in the first half of 2008 compared with the end of 2007, but by the third quarter it remained a relatively robust 9.0 per cent in year-on-year terms. In their subsequent end-of-year Economic Outlook, the OECD was still forecasting Australia’s real GDP to grow by 2.5 per cent in 2008 and 1.7 per cent in 2009 (OECD, 2008b). Such forecasts were clearly far more in keeping with the output growth slowdown being experienced in China than the sharp recession being experienced in most other OECD countries. The first negative output growth forecast for Australia
came at the end of January 2009 with the IMF predicting -0.2 per cent growth for the year. This came on the back of the release of China’s fourth quarter GDP growth figure, which fell to 6.8 percent. While still sounding relatively robust, as *The Economist* (2009) noted, this year-on-year figure implied that output growth between the third and fourth quarters had been virtually zero. In responding to this development, Commonwealth Government Treasurer, Wayne Swan, commented:

“What Australia now faces is the prospect of a shrinking US economy and China not growing anything like it was expected to just six months ago…China is absolutely critical to our economic fortunes and the outlook now certainly is of concern.”

Uren (2009)

Another twist occurred in June 2009 when it had become clear that the Chinese Government’s fiscal stimulus package in response to the global financial crisis was boosting output growth there. Michael Stutchbury, Economics Editor of *The Australian*, the national daily, commented that:

“The OECD, the International Monetary Fund and the Australian Bureau of Agricultural and Resource Economics this week all bolstered the cautious but growing optimism in official circles that Australia’s recession will remain modest. The main reason is the good news contained in Australia’s Chinese fortune cookie. Soon to become Australia’s biggest export market, China is now the only major economy posting solid growth”.

Stutchbury (2009)

In some sections of the mass media, the notion that significant output co-movement exists between Australia and China has reached axiomatic levels with one commentator going so far as to declare that Australia had become a “Sino-economy” (Hughes, 2008).

While there is now a widespread perception that significant output co-movement exists between Australia and China, to the best of our knowledge this has yet to be empirically confirmed. Previous studies, such as Andrews and Kohler (2005) and Crosby and Bodman (2005), only considered the extent of output co-movement between Australia and other OECD economies. Investigating the extent of output co-movement between Australia and China has important implications for policy. If significant output co-movement does indeed exist, and if co-movement vis-à-vis China is now greater than co-
movement vis-à-vis the US, policy responses in Australia will need to become more attuned to developments in China. Moreover, there might also be a case for revisiting the various models of the Australian economy to ensure they adequately capture the China dimension.

2. Extent of Output Co-movement

In this section we examine the extent of output co-movement between Australia and China by calculating the correlation coefficients between two data series - real GDP growth and the real GDP output gap, i.e., the percentage deviation in real GDP from trend GDP. The trend component of real GDP needed to calculate output gaps is extracted using a Hodrick-Prescott (H-P) filter. Of course, many factors – domestic and international – combine to determine Australia’s real GDP growth and real GDP output gap. However, this was also true in earlier periods and yet previous studies still found that a high degree of output co-movement existed between Australia and the US. Thus, it is interesting to consider whether a similar phenomenon now exists vis-à-vis China.

One problem with using correlation analysis to determine the extent of output co-movement between Australia and China is that it does not control for possible third party effects. For example, changes in real GDP growth in Australia and China might appear highly synchronised, but this could simply be because changes in real GDP growth in both countries are to a significant extent determined by developments in a third country. Given that China is now the world’s second largest economy, the only obvious contending third party is the US. Despite its rapid growth, it is important to keep the relative size of China’s economy in perspective: according to IMF data it remains less than one-third the size of the US (in $US terms). There are measures that can be taken to gauge whether the third party effect of the US is likely to make interpreting correlation coefficients between Australia and China a problem or not. Aside from calculating correlation coefficients between Australia and China, correlation coefficients between

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2 Although commonly used, the H-P filter is not without its critics, e.g., Cogley and Nason (1995).
3 Japan might also be considered a possible third party but this argument is much less compelling. Firstly, China is nearly the same size as Japan. Secondly, the value of China’s exports to Japan is less than a half the value to the US. Both the US and Japan have limited financial exposure to China given its tightly controlled capital account.
Australia and the US, and between China and the US, can also be calculated. If the three way correlations between Australia, China and the US are all high, then in light of the relative sizes of the three economies, the correlation between Australia and China would indeed need to be interpreted cautiously.

Correlation analysis also has several other well known limitations but these do not limit its usefulness for exploring output co-movement. For example, it does not directly comment on the issue of causality. However, here our interest lies in co-movement, not causality, and in any case, the relative sizes of the Australian and Chinese economies make the issue of causality largely redundant. That developments in Australia could have a significant impact on output fluctuations in China, which according to IMF data has an economy less than one quarter the size of China’s, is highly unlikely. Correlation analysis also makes no comment on the channels through which developments in China might result in output fluctuations in Australia, nor their relative importance. Yet before exploring such channels, it would seem prudent to first explore whether significant output co-movement even exists. Moreover, there really are only two channels through which output fluctuations in China could impact on Australia - directly through changes in export demand and indirectly through changes in the terms of trade. We return to discussing these channels in the following section.

The data set used in the analysis covers the period 1980Q1 to 2009Q1 at a quarterly frequency. The full period is divided into three sub-periods. The degree of correlation in the first sub-period, 1979Q1-1994Q5, serves as a benchmark for assessing the strength of correlation in the second and third sub-periods. As can be seen in Figure 1, prior to 1995 China’s share of Australia’s total merchandise exports was less than 5 per cent. Moreover, there was almost a complete absence of any investment linkages. Thus, any correlation evident during this period must be either coincidental or as a result of third party effects. The period since 1995 is divided into two sub-periods, 1995Q1-2001Q4 and 2002Q1-2009Q1, in a bid to shed light on whether there has been a strengthening of output co-movement in more recent years. Given the rise of China as a destination for Australia’s exports and as a major player in world resources markets, one might expect to see evidence of stronger synchronisation in output fluctuations in the third sub-period. Aside
from the degree of correlation evident in the first sub-period, two other benchmarks are used to assess the strength of correlation evident in the second and third sub-periods. These include whether the correlation coefficients are statistically significant and how the size of correlation coefficients between Australia and China compare with those between Australia and the US.

The required real GDP data for Australia and the US were drawn from the database, *SourceOECD*. Growth rates are expressed in year-on-year format. Unlike OECD economies, China does not have a long history of publishing GDP data at a quarterly frequency. Since 1999 the required data can be obtained from China’s National Bureau of Statistics. Data for the period 1995-1998 is taken from Abeysinghe and Rajaguru (2004), who in turn source it from *The People’s Bank of China Quarterly Statistical Bulletin*. Data for the period 1980Q1-1994Q4 is also taken from Abeysinghe and Rajaguru (2004). However, in the absence of official data, these authors estimated this data using a modified version of the Chow-Lin procedure. The reliability of these estimates becomes a necessary caveat when comparing the correlation coefficients found in the second and third sub-periods with the first sub-period. Data for China was originally in seasonally unadjusted form and so it was adjusted using the US Census Bureau’s X12 technique.

Table 1 shows the correlation coefficients between Australia and China’s real GDP growth and output gap series. Correlation coefficients were calculated on both a contemporaneous and lagged basis given that developments in China’s economy might not have an impact on Australia immediately. However, the contemporaneous correlation coefficients proved to be higher and hence only these are reported (see Appendix Table 1 for lagged correlation coefficients). Correlation coefficients that are statistically significant at the 1 per cent and 5 per cent levels are denoted by ** and *, respectively.

**Insert Table 1 here**

Table 1 contains several interesting results. Over the duration of the second and third sub-periods, 1995Q1-2009Q1, there is little evidence to support the view that a high degree of
output co-movement between Australia and China exists. While the correlation coefficient between the two countries’ output gap series is statistically significant at the 5 per cent level, the correlation coefficient between real GDP growth series is insignificant. The correlation coefficients for both real GDP growth and output gap series over the period 1995Q1-2009Q1 are also actually less than in the first sub-period, 1980Q1-1994Q4, which is one of our benchmarks. Here it should be reiterated that the data for the first sub-period are estimated and therefore the significant correlation found during this sub-period should be interpreted with caution. Notwithstanding this, there is support for an emergent, stronger synchronisation in the third sub-period. During the period 2002Q1-2009Q1 the correlation coefficient evident between real GDP growth series is statistically significant at the 5 per cent level and that between output gap series is statistically significant at the 1 per cent level. Also, in the case of both series, the correlation coefficients are higher in the third sub-period than in the first sub-period.

To shed more light on the results in Table 1, Table 2 considers the extent of output co-movement between these same variables in Australia and the US. Again, correlation coefficients were higher on a contemporaneous basis and hence only these are reported (see Appendix Table 2 for lagged correlation coefficients).

**Insert Table 2 here**

Table 2 shows that the high degree of output co-movement that previous studies found to exist between Australia and the US has continued in more recent times. The correlation coefficients for both real GDP growth and output gap series are statistically significant at the 1 per cent level over the duration of the second and third sub-periods and also when these sub-periods are considered separately. Comparing the results of Table 1 and Table 2, it can also be seen that even in the third sub-period when the degree of output co-movement between Australia and China increased, the estimated correlation coefficients remained below those between Australia and the US, albeit only marginally in the case of the output gap series.
As noted earlier, in view of the relative sizes of the three economies, it is important to consider the extent of output co-movement between China and the US when interpreting output co-movement between Australia and China. Correlation coefficients between China and the US are shown in Table 3.

**Insert Table 3 here**

It can be seen that in the third sub-period, the extent of output co-movement between China and the US increased considerably. This implies that at least some part of the increase in output co-movement between Australia and China during this sub-period may simply reflect the increase in output co-movement between China and the US.

In a bid to separate out the third party influence of the US, we undertook the following exercise. US real GDP growth was regressed on Australia’s real GDP growth and the residuals were saved. These residuals are a measure of the component of Australia’s real GDP growth that cannot be explained by developments in the US. Similarly, US real GDP growth is regressed on China’s real GDP growth and the residuals are a measure of the component of China’s real GDP growth that cannot be explained by developments in the US. The correlation coefficient between Australia and China’s residual series was then calculated. The same exercise was also performed for output gaps. The results are presented in Table 4.

**Insert Table 4 here**

The results in Table 4 support the earlier conclusion that the extent of output co-movement between Australia and China did increase between the second and third sub-periods. However, with respect to real GDP growth, once the explanatory power of the US has been removed from Australia and China’s real GDP series individually, the correlation coefficient evident in the third sub-period is considerably smaller than that reported in the third sub-period in Table 1 (0.41 versus 0.18) and is no longer statistically significant. With respect to output gaps, the correlation coefficient is also smaller than in Table 1, although the fall is much less pronounced (0.57 versus 0.48) and it remains statistically significant at the 1 per cent level.
3. Output Co-movement: Perceptions Versus Evidence

The results of the previous section are consistent with output fluctuations in Australia continuing to be more closely synchronised with developments in the US than in China, albeit with a strengthening in synchronisation vis-à-vis China in the most recent years. In this section we provide several reasons why the extent of output co-movement between Australia might be modest, and is likely to remain so into the foreseeable future.

Firstly, unlike Australia’s relationship with the US, there is almost a complete lack of investment linkages between Australia and China. This is despite the public attention that has recently been drawn to instances of some prospective yet politically sensitive Chinese investment in Australia. According to Australian Bureau of Statistics (ABS) data, as of year-end 2008, the US was by far the largest foreign investor in Australia, accounting for 24.3 per cent of total accumulated foreign investment. In contrast, China accounted for just 0.46 per cent. Moreover, whereas Australian investors have a significant exposure to financial markets in the US, they have almost nil exposure to those in China where the capital account remains tightly controlled. As of year-end 2008, the US hosted 39.0 per cent of Australia’s total investment abroad. In contrast, China hosted just 0.69 per cent. Thus, whereas international capital flows provide a direct channel through which developments in the US economy can have immediate spillover effects on Australia, this channel is simply not present between Australia and China.

Secondly, the importance of the direct channel that does link Australia with China – the channel of export demand – should not be overstated. While Figure 1 showed that China now absorbs 16 per cent of Australia’s merchandise exports, it also showed that this only equates to around 3 per cent of Australia’s GDP. Meanwhile, the share of domestic consumption in GDP is around 70 per cent. Thus, by sheer weight of numbers, it would be quite extraordinary if changes in export demand from a single country, even from one as relatively important as China, were able to drive changes in Australia’s GDP. It is also relevant to note that in the literature that analyses the determinants of output co-movement between countries, it has been found that once other relevant factors are controlled for, the effect of inter-industry trade (i.e., the type of trade that takes place
between Australia and China) appears to be positive, but modest in magnitude (Imbs, 2004).

Thirdly, and related to the point above, while the direct channel of export demand might be important for certain regions within Australia, this does not mean it is important for the country as a whole. To illustrate this point, Table 5 shows the correlation coefficients between the growth in “final demand” – essentially, real GDP calculated according to the expenditure approach - in Australia’s five states and two territories and real GDP growth in China. Data for Australia’s states were obtained from the ABS. The figures in brackets in the second row of Table 5 show the percentage share of each state in national final demand as of 2009Q1.

**Insert Table 5 here**

The Australian state that exhibits the highest degree of positive correlation with China over the duration of the second and third sub-periods, but particularly in the third sub-period, is Western Australia. Figure 3 shows that 70 per cent of Australia’s merchandise exports to China now emanate from Western Australia. Figure 4 shows that Western Australia’s merchandise exports to China now equate to around 17 per cent of its final demand. In contrast, in all other states apart from Western Australia (and with the exception of the Northern Territory), exports to China account for less than 2 per cent of final demand. The share of Western Australia in national final demand is only 12.32 per cent. The correlation coefficients between the two largest states, New South Wales and Victoria, and China, are insignificant in all periods. For this reason, the finding presented in Table 1 that Australia’s real GDP growth was not correlated with China’s in a statistically significant manner over the duration of the second and third sub-periods is more readily understood.

**Insert Figure 3 here**

**Insert Figure 4 here**

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4 The ABS presents this data in the form of year-ended growth rates, and thus the format differs slightly from the year-on-year format of China’s data.
Similarly, while the channel of export demand might have important effects on particular regions within Australia but not the country as a whole, it might also have important effects on particular industry sectors but not the economy as a whole. Australia’s merchandise exports to China are dominated by resources, most notably iron ore. In 2008, the product category of iron ore alone made up 55 per cent of the total. However, according to ABS data, in the year to March 2009, the mining sector (including services to the mining sector), only accounted for 7.8 per cent of Australia’s GDP.

Fourthly, the channel of export demand does not appear to be particularly sensitive to output fluctuations in China. One might think that when China’s real GDP growth slows, the growth rate of China’s demand for iron ore from Australia would fall along with it. However, this does not appear to be the case. For example, when China’s real GDP growth fell by nearly one third from 13 per cent in 2007 to 9 per cent in 2008, according to Australian Bureau of Agricultural and Resource Economics (ABARE) data, the volume of iron ore exported from Australia to China actually increased by nearly one third during the same period. This seemingly counterintuitive outcome can be attributed to several factors. One is that resources such as iron ore are used intensively in infrastructure projects and the worth of these projects tends to be evaluated over a time horizon longer than the vagaries of the business cycle. Another is that the Chinese government has demonstrated a willingness to offset downturns in private sector spending with a boost in its own spending and resource-hungry infrastructure projects tend to be a focus of this spending. The Chinese Government’s fiscal stimulus package in response to the global financial crisis is a case in point and there was a similar policy response to the Asian financial crisis in 1997. Yet another is that when China’s economy slowed in 2008 and into the first quarter of 2009, this contributed to a substantial decline in the spot price of iron ore in China. While China is one the world’s largest producers of iron ore, relative to Australian and Brazilian producers, its domestic producers are relatively low quality / high cost. As a result, when spot prices fall, this actually has the effect of making Australia’s exports more competitive.

Fifthly, the demand boost that Australia has received via the terms of trade displays all the hallmarks of being a structural rather than cyclical event. That is, China’s emergence
in world resources markets means that Australia’s terms of trade have risen and are likely
to remain permanently higher than the historical average. This point has already been
made by RBA Governor, Glenn Stevens, but seemingly missed by many other
commentators. To illustrate this point, Figure 5 shows fluctuations in China’s real GDP
output gap alongside percentage changes in Australia’s terms of trade. There is no
obvious association between the two: when China’s economy booms / slumps, there is no
obvious response with Australia’s terms of trade rising / falling. The correlation
coefficient between the two series in Figure 5 is -0.07. This is not to say that China has
not had an influence on Australia’s terms of trade, rather that its influence has primarily
taken a non-cyclical form.

**Insert Figure 5 here**

When discussing the terms of trade, another important issue is that the impact an increase
in the terms of trade has on domestic economic activity depends crucially on the response
of the real exchange rate. This point is emphasized in RBA (2005). Rising terms of trade
constitute an income transfer to Australia from the rest of the world. Given that exports
account for around one fifth of Australia’s GDP, each 10 percent increase in the terms of
trade translates into around a two percent increase in national income. This can provide a
substantial boost to domestic activity by bolstering company profits and government tax
revenues, as well as encouraging additional investment in the resources sector. However,
movements in the exchange rate can act to mollify such effects. RBA (2005) provides the
following instructive example. Consider an increase in the terms of trade that results from
rising world commodity prices. World non-commodity prices remain unchanged. Thus,
the terms of trade increase by less than the rise in world commodities prices. This is in
line with the nature of the increase in Australia’s terms of trade in the 2000s. If the
exchange rate does not respond to rising world commodity prices and the terms of trade,
then the domestic currency price of commodities would increase by the full amount of the
rise in world prices and the income gains from the increase in the terms of trade would
accrue solely to commodities exporters. Income accruing to non-commodities exporters
would be unchanged. However, if the exchange rate appreciates by the same amount as
the increase in the terms of trade, then the domestic currency price of total exports would
be unchanged: income gains accruing to commodities exporters would be offset by income losses to non-commodities exporters. Since the floating of the Australian dollar in the early 1980s the real exchange rate has tended to appreciate / depreciate when the terms of trade have increased / decreased. This can be seen in Figure 6, which shows the situation since 1995. The correlation coefficient between these two series is 0.45, which is statistically significant at the one per cent level. Having said that, the relationship is not strictly one for one. Between March 2002 and the peak in September 2008, the terms of trade increased by 72 per cent. However, the income effects of this rise would have only been partially offset by the 44 per cent appreciation in the real exchange rate over the same period.

Insert Figure 6

While the extent of output co-movement between Australia and China appears to continue to lag behind that between Australia and the US, what are the prospects that stronger synchronisation of output fluctuations might emerge in the future? If one accepts that the impact of China on Australia’s terms of trade is a structural rather than cyclical event - and the resilience of world resources prices in the face of the global financial crisis provides strong support to this viewpoint - then the prospects must be considered slim. The importance of China as a source of export demand will no doubt continue to grow. However, compared with other components of aggregate expenditure, notably consumption, exports to China will remain marginal. Perhaps most importantly, there is little prospect that China will significantly open its capital account. Australia receiving increased levels of Chinese investment via large, state-owned companies as a result of the Chinese government’s “Go abroad” policy is one thing; relaxing controls on China’s private sector investing abroad, and controls on foreigners investing in China’s financial markets, are quite another.

Nonetheless, there are reasons to suppose that developments in China might have a greater impact on output fluctuations in Australia than those in the leading destination for Australia’s merchandise exports, Japan. Firstly, the sheer size potential of China’s economy means that in the future exports to China are likely to account for a larger share
of Australia’s total exports than the 23 per cent share currently held by Japan. Secondly, China’s “metals intensity” – the quantity of metals used per unit of GDP – is extraordinarily high: 7.5 times as high as in high-income countries and 4 times as high as in other developing countries (World Bank, 2009). As long as this remains the case, it implies that a one dollar increase in output in China will translate into a much greater rise in demand for Australia’s resources exports than a one dollar increase in output in most of Australia’s other trading partners.

4. Conclusion

This paper set out to investigate the extent of output co-movement between Australia and China. The main finding was that while there is some evidence of stronger output co-movement in recent years, Australia remains far from being accurately described as a “Sino-economy”. Even in the most recent years, the extent of output co-movement between Australia and China lags behind that between Australia and the US. This finding is not in fact surprising: there are many reasons why developments in China might not have large effects on output fluctuations in Australia. One is that the investment linkages between Australia and China remain in their infancy. Another is that the value of exports to China is marginal relative to other components of aggregate expenditure. Thus, it is likely to be some time before policy makers in Australia will be operating in an environment where, “When China sneezes, Australia catches a cold”.
References


Date finalized – 28th August, 2009

Word count – 5203 (text, including title page, excluding Table and Figures)
Figure 1. Australia’s Merchandise Exports to China

Source – Australian Bureau of Statistics

Notes – Percentages are calculated using year-ended values at a quarterly frequency.
Figure 2. Australia’s Terms of Trade (March 1995 = 100)

Source – Australian Bureau of Statistics.
Figure 3. Australia’s Merchandise Exports to China, by state (% total)

Source – Australian Bureau of Statistics
Figure 4. Merchandise Exports to China, by state (% state final demand)

Source – Australian Bureau of Statistics
Figure 5. China’s Real GDP Output Gap and Changes in Australia’s Terms of Trade
Table 1. Correlation Coefficients between Australia and China

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Table 2. Correlation Coefficients between Australia and the US

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Table 3. Correlation Coefficients between China and the US

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Table 4. Residual Correlation - Australia and China

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Table 5. Correlation Coefficients between Real GDP Growth in Australia’s Regions and China

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</thead>
<tbody>
<tr>
<td>(share in national final demand)</td>
<td>(30.75)</td>
<td>(23.35)</td>
<td>(19.97)</td>
<td>(12.32)</td>
<td>(6.83)</td>
<td>(3.34)</td>
<td>(2.02)</td>
<td>(1.42)</td>
</tr>
<tr>
<td>1995Q1-2009Q1</td>
<td>0.01</td>
<td>-0.10</td>
<td>0.43**</td>
<td>0.44**</td>
<td>-0.17</td>
<td>0.07</td>
<td>0.07</td>
<td>-0.11</td>
</tr>
<tr>
<td>1995Q1-2001Q4</td>
<td>-0.02</td>
<td>0.03</td>
<td>0.20</td>
<td>0.03</td>
<td>0.03</td>
<td>-0.23</td>
<td>0.08</td>
<td>0.01</td>
</tr>
<tr>
<td>2002Q1-2009Q4</td>
<td>0.05</td>
<td>-0.12</td>
<td>0.34*</td>
<td>0.67**</td>
<td>-0.59**</td>
<td>0.32*</td>
<td>-0.16</td>
<td>-0.28</td>
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</table>
### Appendix Table 1. Lagged Correlation Coefficients between Australia and China

<table>
<thead>
<tr>
<th>Lag</th>
<th>Real GDP growth</th>
<th>Output gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995Q1-2009Q1</td>
<td>-0.01</td>
<td>0.19</td>
</tr>
<tr>
<td></td>
<td>1995Q1-2001Q4</td>
<td>-0.01</td>
</tr>
<tr>
<td></td>
<td>2002Q1-2009Q1</td>
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</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>1995Q1-2009Q1</td>
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<td>0.05</td>
</tr>
<tr>
<td></td>
<td>1995Q1-2001Q4</td>
<td>-0.06</td>
</tr>
<tr>
<td></td>
<td>2002Q1-2009Q1</td>
<td>-0.02</td>
</tr>
<tr>
<td>Lag = 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995Q1-2009Q1</td>
<td>-0.17</td>
<td>-0.04</td>
</tr>
<tr>
<td></td>
<td>1995Q1-2001Q4</td>
<td>-0.09</td>
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<tr>
<td></td>
<td>2002Q1-2009Q1</td>
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<tr>
<td>Lag = 4</td>
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<tr>
<td>1995Q1-2009Q1</td>
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<td>-0.08</td>
</tr>
<tr>
<td></td>
<td>1995Q1-2001Q4</td>
<td>-0.02</td>
</tr>
<tr>
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<td>-0.35</td>
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### Appendix Table 2. Lagged Correlation Coefficients between China and the US

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<th>Lag</th>
<th>Real GDP growth</th>
<th>Output gap</th>
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<td>1995Q1-2009Q1</td>
<td>-0.03</td>
<td>0.23</td>
</tr>
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<td>1995Q1-2001Q4</td>
<td>-0.05</td>
</tr>
<tr>
<td></td>
<td>2002Q1-2009Q1</td>
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<tr>
<td>Lag = 2</td>
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</tr>
<tr>
<td>1995Q1-2009Q1</td>
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<td>0.19</td>
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<tr>
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<td>1995Q1-2001Q4</td>
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<tr>
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<td>2002Q1-2009Q1</td>
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</tr>
<tr>
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<td>1995Q1-2009Q1</td>
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<td>0.20</td>
</tr>
<tr>
<td></td>
<td>1995Q1-2001Q4</td>
<td>-0.19</td>
</tr>
<tr>
<td></td>
<td>2002Q1-2009Q1</td>
<td>0.28</td>
</tr>
<tr>
<td>Lag = 4</td>
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</tr>
<tr>
<td>1995Q1-2009Q1</td>
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<td>0.22</td>
</tr>
<tr>
<td></td>
<td>1995Q1-2001Q4</td>
<td>-0.32</td>
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<tr>
<td></td>
<td>2002Q1-2009Q1</td>
<td>0.38</td>
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</table>