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How integrated are the Australian and New Zealand economies?

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Information on the Productivity Commission can be found on www.productivity.govt.nz or by contacting +64 4 903 5150.

Abstract

This paper examines various de facto measures of the extent of economic integration between New Zealand and Australia. The range of measures considered indicates that significant progress has been made towards achieving a single market across the Tasman. In particular, business cycles have become more synchronised and price changes for the same goods are strongly correlated across the two countries over the medium to long term.

Underpinning these interdependencies, Australia is New Zealand's largest trading partner, trans-Tasman investment and migration flows are considerable and financial markets appear highly integrated. However, the available evidence suggests that Australia and New Zealand are not as economically integrated as the Australian states. The linkages between economic cycles and relative prices are tighter inter-state than they are across the Tasman, reflecting larger flows of trade and people. This indicates that the international border is considerably "thicker" than state borders within Australia.

On balance, the scope for further integration, with the aim of achieving a genuine trans-Tasman single economic market, especially in services, appears to be considerable.

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Summary

Economic integration can be assessed in a number of ways. In broad terms, at the macro level, increasing integration should lead to greater interdependence between both the trend and cyclical characteristics of the two economies. Integration should also see a closer alignment of relative price pressures in individual markets. In short, increased integration should lead the two countries to display characteristics more consistent with a single economic entity.

Integration can also be assessed by looking at the extent of trade and cross-border factor flows that underpin interdependencies in economic performance. Similarly, the returns to factors across countries can also reveal information on the extent to which markets are integrated across national boundaries.

Overall, the range of measures we consider in this paper indicate that significant progress has been made towards achieving a single market across the Tasman. In particular, business cycles have become more synchronised and price changes for the same goods are strongly correlated across the two countries over the medium to long term. Underpinning these interdependencies, Australia is New Zealand's largest trading partner, trans-Tasman investment and migration flows are considerable and financial markets appear highly integrated.

However, notwithstanding data limitations, Australia and New Zealand do not appear to be as economically integrated as the Australian states. The linkages between economic cycles and relative prices are tighter inter-state than they are across the Tasman, reflecting larger flows of trade and people. This indicates that the international border is considerably "thicker" than state borders within Australia. On balance, the scope for further integration, with the aim of achieving a genuine trans-Tasman single economic market, especially in services, is significant. Although beyond the scope of this paper, the costs of remaining market fragmentation are likely to be substantial, reflecting a failure to reap the full gains from specialisation, a lack of competition and consumer choice.

Do the Australian and New Zealand economies behave as one?

Long-run convergence

In principle, increasing integration should encourage convergence towards the best performing economy as capital flows from richer to poorer countries in search of higher marginal products. Convergence has been widely observed across countries with economic institutions above a certain quality threshold. However, long-run cross-country growth dynamics can differ for many reasons and the empirical evidence on regional convergence is mixed, with some studies finding convergence, some finding convergence "clubs", and others finding divergence.

The New Zealand-Australian growth experience over recent decades does not conform to the convergence hypothesis; GDP per capita in New Zealand has persistently diverged from Australia since the mid-1970s, when both countries had similar levels of average income. This predominantly reflects a comparatively poor labour productivity performance in New Zealand. This lack of convergence may reflect:

- An insufficient level of integration between the two countries, although the evidence presented in this paper suggests that this is unlikely;
- Regulatory shortcomings and natural impediments in the New Zealand economy that reduce technological diffusion into the country and the capacity to absorb new technologies (broadly defined);
- A prolonged period of positive shocks in Australia relative to New Zealand, consistent with an observed lack of convergence across Australian states;
- Increasing returns associated with agglomeration, although this is inconsistent with strong growth in knowledge-intensive sectors in Auckland.

Business cycle synchronisation

Given broadly similar economic structures in Australia and New Zealand, integration should increase the extent of cross-country business cycle correlation, given demand-side spillovers. Indeed, GDP cycles in New Zealand and Australia have become highly correlated in recent years. However, employment cycles co-move to a greater extent across Australian states than across the Tasman, indicating that the degree of trans-Tasman integration is less than at the national level within Australia.

Co-movements in relative price changes

The extent to which relative price changes co-move across borders is a measure of the various barriers to the free movement of goods and services and, hence, gives an indication of economic integration. These barriers might be natural, such as geographic distance; policy induced, such as tariffs or other barriers; or as a result of domestic policy or other barriers that restrict competition.

Across Australia and New Zealand, overall price movements (measured by the CPI) are highly correlated. Not surprisingly, and consistent with other studies, this correlation is lowest for non-tradables (typically services), suggesting that these markets are less integrated than tradables. On average, price co-movements across the Tasman are lower than among Australian cities, indicative of greater market integration within Australia than between Australia and New Zealand. Correlations among disaggregated relative prices support these aggregate results. There is also some evidence that trans-Tasman market integration, as measured by relative price correlations, may have increased in the 2000s relative to the 1990s.

Mechanisms driving market integration

Trade and factor flows are key mechanisms driving interdependencies at the macro level. It is important to note that even in the absence of a single market, a high degree of trade integration is likely across Australia and New Zealand given their geographic proximity and small size (particularly New Zealand).

Trade flows

The importance of Australia as a trading partner for New Zealand has grown considerably since at least the 1960s and Australia is now New Zealand's largest trading partner. In contrast, New Zealand has become relatively less important as a destination for Australian exports and is only Australia's seventh largest trading partner. Across both countries, merchandise trade is becoming increasingly focused on Asia. This is particularly the case for Australia, which partly explains the diminishing importance of New Zealand as a trading partner.

Without the use of a gravity model, it is difficult to assess whether New Zealand and Australia over- or under-trade with each other. However, data on the extent to which Queensland trades with the rest of Australia suggests that goods trade integration within Australia is significantly greater than between Australia and New Zealand.

Trade integration in services remains far lower than for goods. Measured in terms of services trade as a share of sector value-add, the degree of integration for the services sector is even lower relative to goods given that the services sector is much larger than the good-producing sector in both economies. Despite services becoming a large and growing share of OECD economic activity and global trade, the available data suggests that the trans-Tasman trade in services has been relatively flat over recent years.

Capital

Investment from Australia makes up a large and increasing share of New Zealand's stock of foreign investment while New Zealand's investment in Australia is a small share of Australia's stock of foreign investment with no obvious trend over time. The majority of Australian investment in New Zealand is FDI, whereas the majority of New Zealand investment in Australia is portfolio investment.

Various price measures in capital markets generally support the notion of increasing integration between Australia and New Zealand. There is evidence that equity market returns have become more

correlated across the Tasman and that arbitrage opportunities are not available, indicating a high level of integration. The extent of co-movements between Australian and New Zealand real interest rates has also increased through time. With all of these measures, however, it is difficult to know if trans-Tasman capital markets have become integrated over and above what would be expected given increases in capital market integration across the broader global economy.

Labour flows

Australia is a key destination for New Zealand's diaspora, with the majority of New Zealand's permanent and long-term emigrants destined for Australia. As a share of population, New Zealand is also home to a significant number of Australian citizens. However, the numbers of New Zealand-born people living in Australia and Australian-born people living in New Zealand do not appear unusual compared to other countries with close geographic and economic ties. Also, Australian inter-state migration flows as a share of population are larger than trans-Tasman flows.

1 Introduction

Since the inception of NAFTA in 1965, or even earlier, considerable effort has gone into facilitating trade and creating a Single Economic Market (SEM) across the Tasman.[1] In addition, since the mid-1980s and early 1990s respectively, governments in New Zealand and Australia have implemented reform programmes aimed at encouraging competition in domestic markets and increasing international openness, which should also increase integration. In this paper, we take a preliminary look at various indicators of the extent of trans-Tasman economic integration to shed some light on the impacts of these prolonged policy efforts. The analysis is focused on de facto measures of integration that assess economic interdependence as opposed to de jure measures of policy barriers to integration.

A difficulty with this exercise is choosing an appropriate benchmark for assessing the extent of integration. Ideally, this would involve quantifying the impacts of Closer Economic Relations (CER) and SEM on integration across the two economies. However, it is difficult to isolate such an effect for at least two reasons. First, many of the data series do not extend back far enough to allow meaningful "before" and "after" comparisons. Second, without a more sophisticated empirical approach, the descriptive statistics we consider do not control for changes in other determinants of integration, such as improvements in transportation or communications technology.

Instead, we use a variety of techniques and data sources to measure economic integration and, where possible, the extent to which it has changed over time. Also, where possible, integration between Australia and New Zealand is compared with integration among Australian states to illustrate the "thickness" of the international border relative to state boundaries within Australia. In the case of trade and investment flows, the extent of trans-Tasman integration is also assessed relative to other economically close nations to provide an international comparison. However, a more rigorous assessment of this aspect of integration would require a more sophisticated modelling approach.[2]

Against this background, the remainder of this paper is structured as follows. We look at trans-Tasman convergence in economic performance in Section 2; the degree of business cycle synchronisation in Section 3; and the co-movements in relative price changes in Section 4. Integration can also be assessed by looking at the extent of trade and cross-border factor flows that underpin interdependencies in economic performance. Similarly, the returns to factors across countries can also reveal information on the extent to which markets are integrated across national boundaries. Therefore, we examine trans-Tasman trade in goods and services, migration and capital market integration using quantity and price measures in Section 5.

2 Long-run economic performance

In principle, increasing integration should encourage convergence towards the best performing economy. The textbook theory behind this result is straightforward. Integration increases the ease with which capital flows from richer to poorer countries in search of a higher marginal product. This is productivity enhancing, given that the poorer country has a lower capital-labour ratio (assuming the same production technology in a broad sense). Capital inflows may also bring productivity gains from generalised knowledge transfer or greater domestic financial sector efficiency, better governance and improved macroeconomic discipline (Kose et al., 2006). All these impacts speed up per capita income convergence as incomes in the poorer country increase faster to their steady-state levels.

[1] For the history behind and description of the various trans-Tasman agreements, see Australian Productivity Commission & New Zealand Productivity Commission (2012), chapter 3.

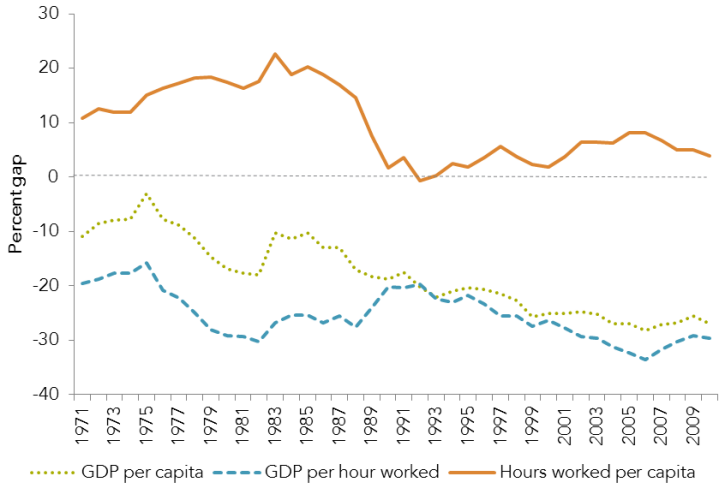
[2] For example, gravity modelling techniques could be used to give a more rigorous assessment of trans-Tasman trade and investment flows in international comparison and in the context of a globalising world economy.

Of course, long-run growth dynamics differ across countries and regions for many deep historic and geographic reasons. Indeed, while there has been a global tendency towards convergence across countries with economic institutions above a certain quality threshold, the international evidence on regional convergence is mixed. For example, Straubhaar et al. (2002) finds evidence of income divergence in the US and the EU, Neven and Gouyette (1995) finds evidence of "twin peak" convergence in the EU where the northern core countries converge with each other but not the southern core, while Maurseth (2001) finds signs of convergence in the EU.

At the aggregate level, the Australia-New Zealand experience over recent decades does not conform to the convergence hypothesis. Despite having broadly similar levels of institutional development and policy settings, GDP per capita in New Zealand has persistently diverged from Australia since the mid-1970s, when both countries had similar levels of average income (Figure 1). Comparatively low GDP per capita in New Zealand overwhelmingly reflects a poor performance in labour productivity, which has typically suffered a long slow decline vis-à-vis Australia and the OECD average for a number of decades (Figure 2).

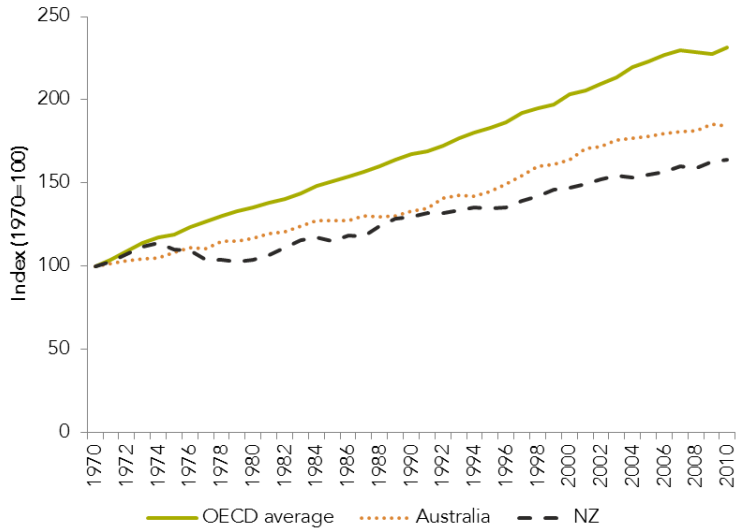
Figure 1 Components of the real GDP per capita gap, 1971-2010

Gap expressed as a percent of Australian level



Source: OECD Productivity database

Figure 2 Labour productivity index, 1970-2010



Source: OECD Productivity database

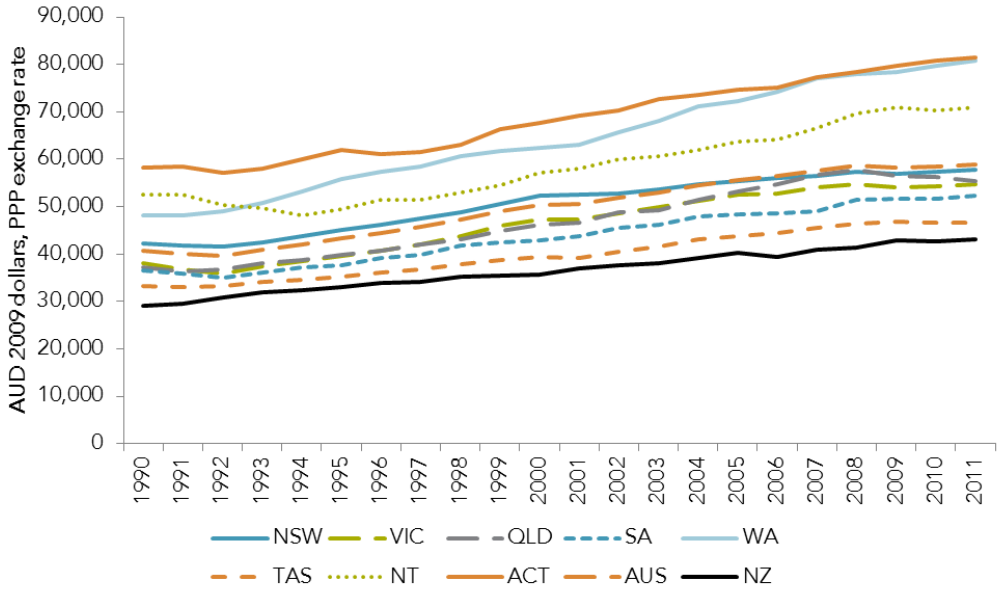
Notes:

1. The OECD average is the simple average of labour productivity for countries that were OECD members prior to 1974 and had continuous labour productivity series from 1970 to 2010 (20 countries in total).

There are a number of potential explanations for why average income and productivity levels in New Zealand have failed to converge towards those in Australia. It may, of course, reflect an insufficient level of integration between the two economies. However, convergence has occurred among economies that are much less closely integrated than Australia and New Zealand. Conversely, a growing productivity gap between Canada and the USA suggests close integration is not a sufficient condition for convergence.

An alternative explanation may be that Australia has experienced a prolonged series of positive shocks relative to New Zealand. For example, increasing mineral prices have resulted in Australia's export commodity price index increasing faster than New Zealand's for a number of years. Reflecting this, mineral-rich states have grown more quickly than other states despite relatively high incomes (Figure 3). Another possibility is that increasing returns driven by agglomeration may be working to "hollow out" the New Zealand economy. However, on the face of it, this is inconsistent with strong growth in knowledge-intensive sectors in Auckland (Figure 4).

Figure 3 Real GDP per capita for New Zealand and the Australian states

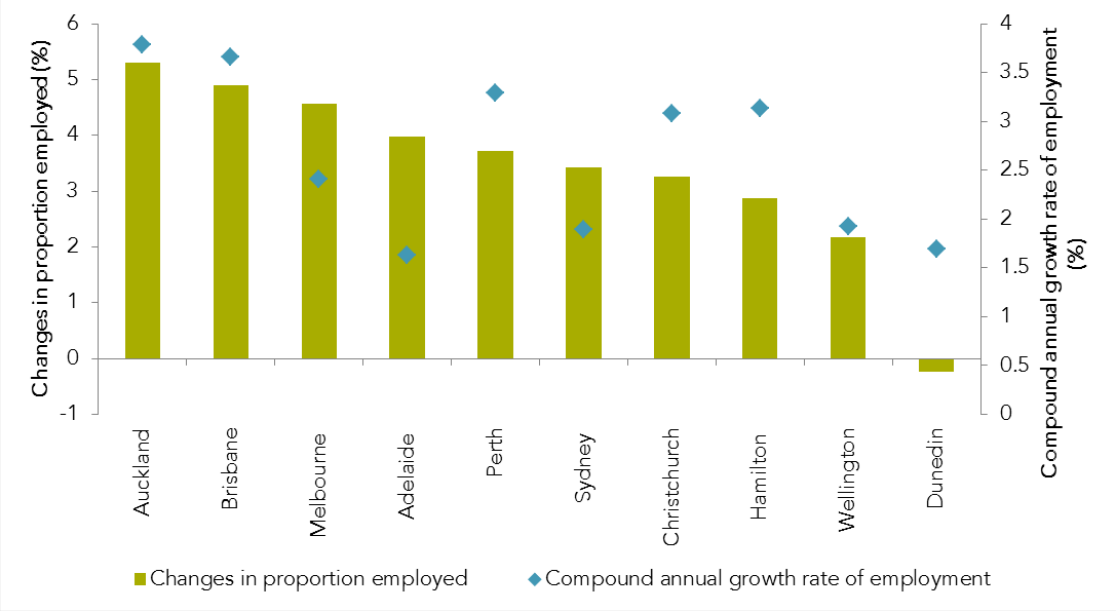


Source: Australian Bureau of Statistics; Statistics New Zealand; authors' calculations.

Notes:

1. These figures should be interpreted with caution. The Australian figures are calculated using the System of National Accounts 2008, and the New Zealand figures are calculated using the System of National Accounts 1993. There are also other differences in the Australian and New Zealand methods for calculating GDP, which tend to mean that New Zealand GDP is more conservatively estimated than Australia's (see Bollard & Barrow (2012)). For example, earlier figures (from before Australia moved to SNA2008) presented in MED et al. (2007) show New Zealand's GDP per capita overtaking Tasmania's in the 2000s, whereas, New Zealand's figure is lower throughout the 1990s and 2000s here.
2. All figures are for June years.

Figure 4 Change in workforce in medium/high-tech manufacturing and knowledge intensive sectors for ten Australasian cities, 1991-2006



Source: Ministry of Economic Development et al. (2011)

3 Business cycle synchronisation

It is not entirely clear whether, in theory, economic integration should increase the extent of cross-country business cycle correlation. On one hand, increased cross-border trade should generate demand-side spillovers that lead to greater business cycle correlation. For example, an investment or consumption boom in Australia may generate increased demand for imports, increasing demand in New Zealand.

Increasing financial linkages could also increase business cycle correlation via demand-side effects. For example, if cross-country equity market investment is high, then a stock market decline could induce simultaneous declines in demand across both economies. Relatedly, the increasing use of international financial markets to diversify risk should also result in stronger co-movement of consumption across countries.

On the other hand, increased trade flows may increase specialisation in both countries, which may decrease business cycle co-movement if industry-specific shocks are important in driving business cycles.

Empirically, a number of studies have found that increased economic integration is, on balance, associated with greater business cycle synchronisation. Dées & Zorell (2011) find that trade integration fosters business cycle synchronisation, particularly when production structures are similar across countries. Otto et al. (2001) also find that trade and financial linkages are important in accounting for business cycle co-movements among OECD countries. Given that Australia and New Zealand share broadly similar production structures (Box 1), increased integration can be expected to increase the extent of business cycle co-movement.

Box 1 **Industrial structure and its contribution to regional differences in business cycles**[3]

The industrial structure index (ISI_i) is a measure of the similarity of the industrial structure in each region relative to Australasia. ISI_i is calculated as:

$$ISI_i = 100 * \left(\frac{\sum_j |S_{i,j} - S_{ANZ,j}|}{n} \right)$$

where $S_{i,j}$ is the share of industry *j* in region *i*, $S_{ANZ,j}$ is the share of industry *j* in Australasia, and *n* is the total number of industries. A figure of 0 indicates perfect alignment of sectoral shares, a figure of 1 indicates an absolute average deviation of sectoral shares of 1 percentage point.

Table 1 Australia-New Zealand industrial structure index, 1990Q2 - 2011Q4 average[4]

	ISI 1990-1999	ISI 2000-2011	ISI 1990-2011
New Zealand	1.6	1.68	1.62
Queensland	1.01	0.95	1
New South Wales	1.19	1.25	1.18
Victoria	1.29	1.42	1.32
ACT	3.8	4.27	4.08
Northern Territory	2.15	1.95	2.06
Western Australia	0.79	0.85	0.82
South Australia	0.87	0.99	0.92
Tasmania	0.84	1.07	0.97

Source: Australian Bureau of Statistics; Statistics New Zealand; authors' calculations.

Notes:

1. The average ISI for each time period is presented. For example, the ISI for 1990-2011 is the average of the quarterly ISI figures over this period.

The results indicate that ACT and Northern Territory have quite different industrial structures to the overall Australasian structure (Table 1), but both have small populations and therefore are more likely to have idiosyncratic structures. Looking at the industry shares in more detail reveals that ACT has a large share of employment in government-related services. Northern Territory and Western Australia have a larger-than-average share in mining and New Zealand has a relatively large agricultural share.

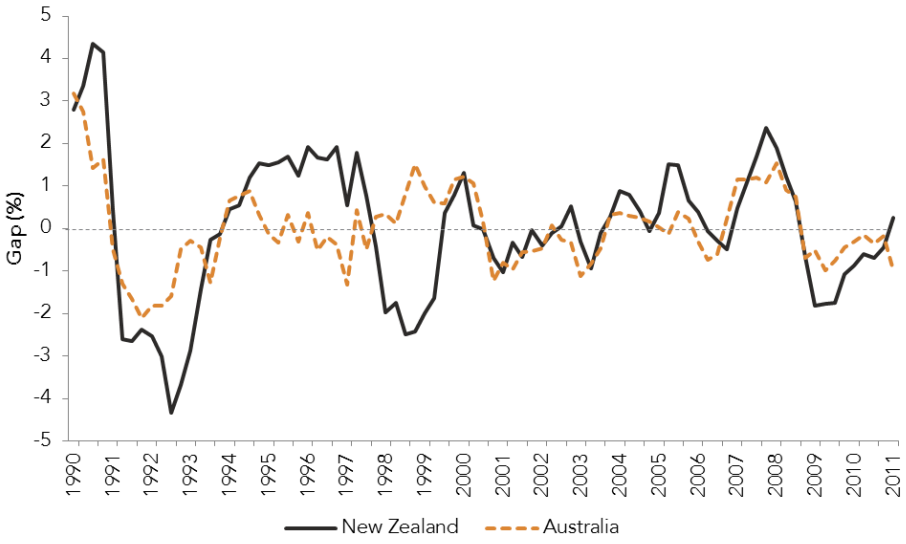
In general, industry structures across regions appear to have become more differentiated over time, perhaps suggesting an increasing degree of specialisation (Table 1). The ISI is higher in the 2000s than the 1990s in all but two regions. However, there has not been a large divergence in industry structure over the last two decades. Moreover, the discrepancies in regional business cycles can be decomposed into an industry structure effect and an industry cycle effect – for example, it may be the case that disparities in the New Zealand cycle from the overall Australasian cycle arise because New Zealand's economy has a higher share of agriculture or because the New Zealand agricultural cycle is different from the Australasian one. Decomposing these discrepancies reveals that they are mainly due to differences in industry cycles (see Appendix A). Therefore, for Australasia, increased business cycle synchronisation is an indicator of greater economic integration.

[3] This analysis is based on Grimes (2005).

[4] Hall & McDermott (2012) find that major micro and macroeconomic reforms between the mid-1980's and early-1990's lead to a break point in the Australian business cycle in 1994Q4 or 1995Q1. These reforms may have induced changes in industrial structures to some degree across all regions. However, we unable to test that here given that the employment data only start only from 1990.

Indeed, GDP cycles in New Zealand and Australia have become increasingly correlated in recent years (Figure 5). The three-year rolling window correlation shows the cycles becoming more synchronised over the 2000s (Figure 6) suggesting increased economic integration. With more formal modeling using data from 1985 to 2007, Hall & McDermott (2012) also find that New Zealand's region-specific cycle was reduced from the late-1990s. However, it is unclear whether increased co-movement in trans-Tasman cycles reflects greater integration or simply increased synchronisation of world business cycles from around 2000 onwards (European Commission, 2008, ch 8). Relatedly, cyclical differences in the 1990s may reflect temporary disturbances arising from economic reforms in New Zealand and Australia.

Figure 5 Australia and New Zealand GDP gaps, 1990Q2 - 2011Q1

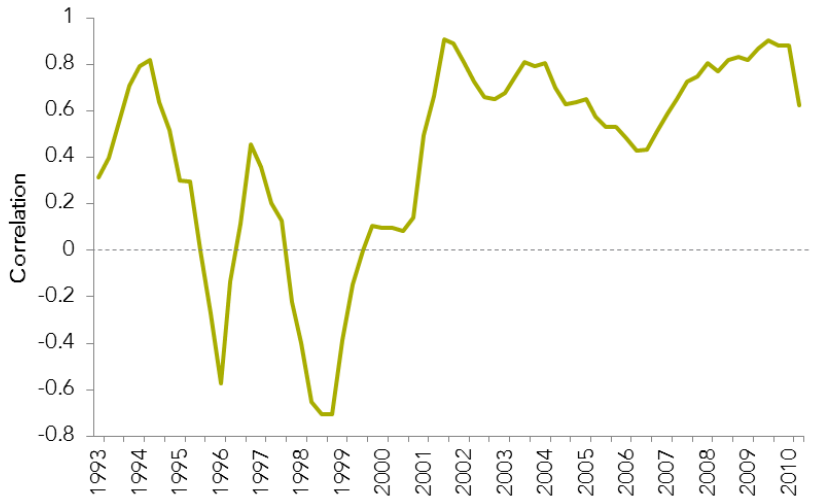


Source: Australian Bureau of Statistics; Statistics New Zealand; Reserve Bank of New Zealand; authors' calculations.

Notes:

1. The GDP gap is real GDP divided by its long-run trend. The long-run trend is calculated using Hodrick-Prescott filter with lambda=1600.

Figure 6 Rolling GDP gaps correlations, 3-year window



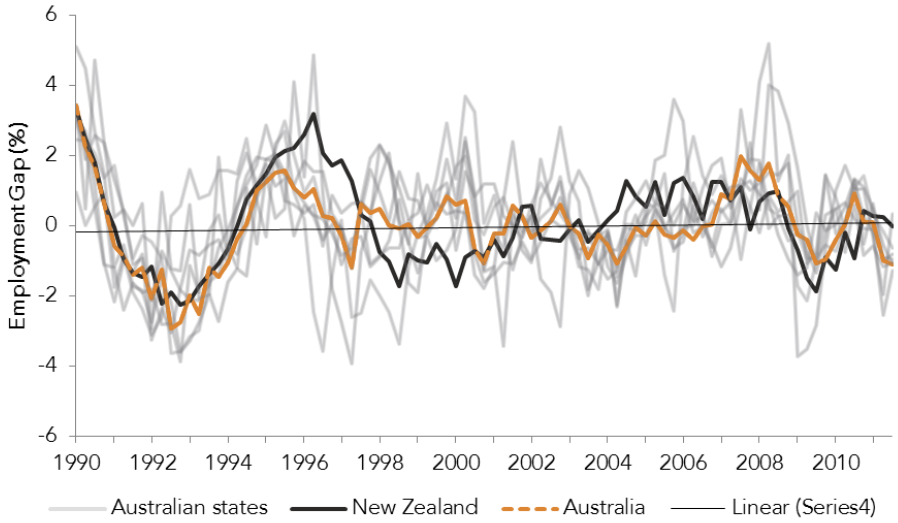
Source: Australian Bureau of Statistics; Statistics New Zealand; Reserve Bank of New Zealand; authors' calculations.

Notes:

1. The 3-year rolling window correlation at quarter t is estimated using the most recent 3-years of quarterly data (ie, from quarter t-12 to quarter t).

The degree of synchronisation in employment cycles across the Australian states provides a useful benchmark for the trans-Tasman relationship.[5] Based on quarterly employment numbers, cyclical co-movement in employment across Australia and New Zealand is typically less than across Australian states, suggesting that the extent of trans-Tasman integration is less than at the national level within Australia (Figure 7 and Figure 8).

Figure 7 Australian states and New Zealand employment gaps, 1990Q2 - 2011Q4

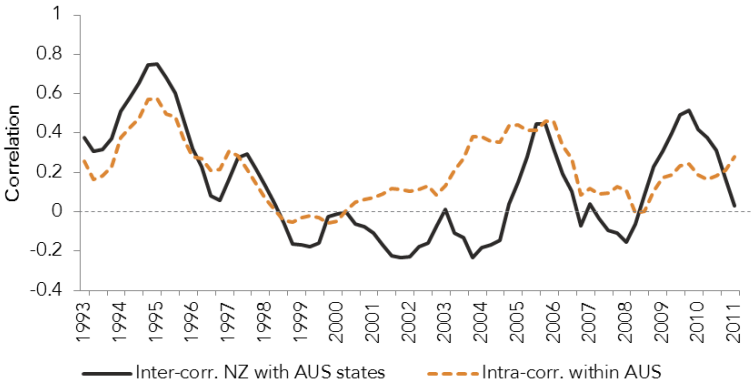


Source: Australian Bureau of Statistics; Statistics New Zealand; authors' calculations.

Notes:

1. The GDP gap is real GDP divided by its long-run trend. The long-run trend is calculated using Hodrick-Prescott filter with lambda=1600.
2. Northern Territory and ACT are excluded from this graph because their industry structures and employment gap trends are markedly different from those of the other Australian states. That is, divergences between the territories and Australasian employment cycles are likely to be driven by differences in industrial structure rather than due to a lack of economic integration.

Figure 8 Rolling employment gaps correlations, 3-year window



Source: Australian Bureau of Statistics; Statistics New Zealand; authors' calculations.

Notes:

1. Inter-correlation is the average of the correlations between NZ and each of the Australian states (except NT and ACT), ie, the average of 6 correlations.
2. Intra-correlation is the average of the correlations between each of the Australian states (except NT and ACT), ie, the average of 15 correlations.
3. The 3-year rolling window correlation at quarter t is estimated using the most recent 3-years of quarterly data (ie, from quarter t-12 to quarter t).

[5] Quarterly GDP data by industry at the state level is not available, so this analysis uses employment gaps instead. The use of industry-level data allows us to decompose cycle discrepancies into differences in industry structure and industry cycles (see Appendix A).

4 Co-movements in relative price changes

Economic theory suggests that in the absence of transaction costs, identical goods should sell for the same price, but that prices will fail to equalise when there are barriers to the free movement of goods. Hence, the extent to which prices move together across two markets provides a measure of economic integration in that country-specific changes in relative prices are a measure of barriers to the free movement of goods and services. These barriers might be natural barriers, such as geographic distance; tariffs or other policy barriers; or informal trade barriers such as national marketing arrangements or tradition.

Evidence for the USA and Canada shows that while distance is a significant deterrent to price convergence, national borders impose a much more significant barrier (Engel & Rogers, 1998). There are several possible reasons for the importance of national borders. For instance, if nominal prices are sticky, prices can diverge greatly in the short-run given nominal exchange rate fluctuations. However, for the USA and Canada, Engel & Rogers (1998) find that the combination of price stickiness within countries and volatile exchange rates explains some, but not all, of the lack of price convergence. They postulate that some portion of the border effect is also due to differences in national markets and distribution networks. For instance, tariffs and other regulatory or geographic impediments to market integration across borders can provide opportunities for pricing-to-market that reduce co-movement in relative price changes.

Across Australia and New Zealand, overall price changes (measured by the CPI) are highly correlated.[6] Not surprisingly, and consistent with other studies, this correlation is highest for tradable goods, suggesting that these markets are more integrated than markets for non-tradable goods. On average, trans-Tasman inflation correlations in tradable and non-tradable markets are lower than among selected Australian cities, suggesting greater market integration within Australia than between Australia and New Zealand (Figure 9). For example, the pairwise correlation of annual tradables inflation between eight Australian cities ranges from 0.74 for Sydney and Hobart and 0.94 for Adelaide and Melbourne, while the correlation between New Zealand and each of the eight Australian cities is between 0.65 and 0.75.[7,8]

Although overall inflation movements are informative, they do have their limitations.[9] However, more disaggregated analysis that compares relative price changes in about 50 different CPI categories, such as fruit, wine and dental services, confirms the aggregate result: Australian and New Zealand price movements are highly correlated (correlation coefficient of 0.89 for tradables and 0.77 for non-tradables), but less correlated than price movements among Australian cities.

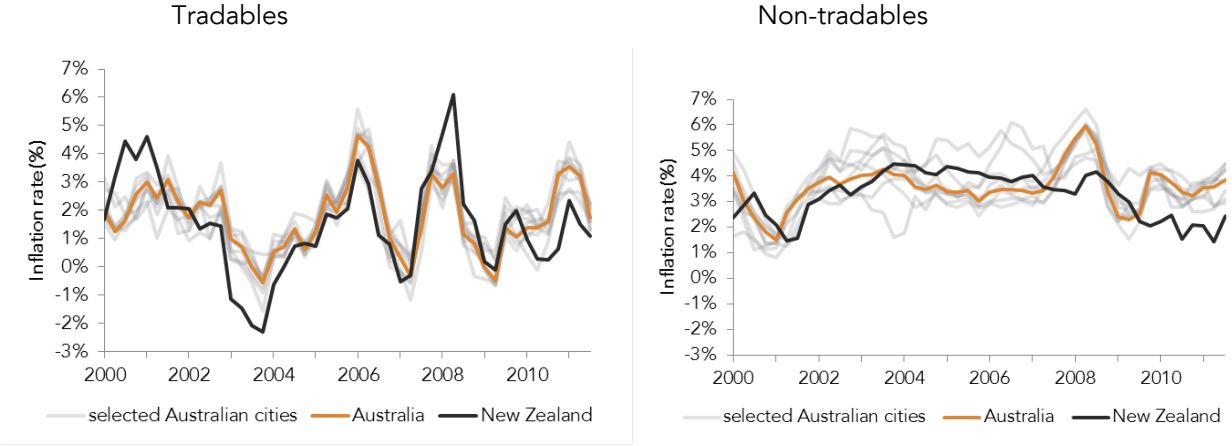
[6] Note that the CPI baskets in New Zealand and Australia are very similar.

[7] The correlation between Australia and New Zealand is likely to be an under-estimate of the true correlation of price changes because there are some differences between how the Australian and New Zealand series are calculated, so some of the differences between the measured relative price changes in each country will reflect the different measurement practices.

[8] Detailed pairwise correlations of annual tradable and non-tradable inflation between eight Australian cities and New Zealand are shown in Table B.2 and Table B.3 in Appendix B.

[9] For example, if the CPI baskets in Australia and New Zealand consisted of two goods only, A and B, if the price of good A increased and the price of good B decreased in Australia while the price of good A decreased and the price of good B increased in New Zealand, this may result in similar overall trends in the two countries' CPIs, even though the prices of good A and B are actually diverging.

Figure 9 Annual price changes in New Zealand, Australia and selected Australian cities



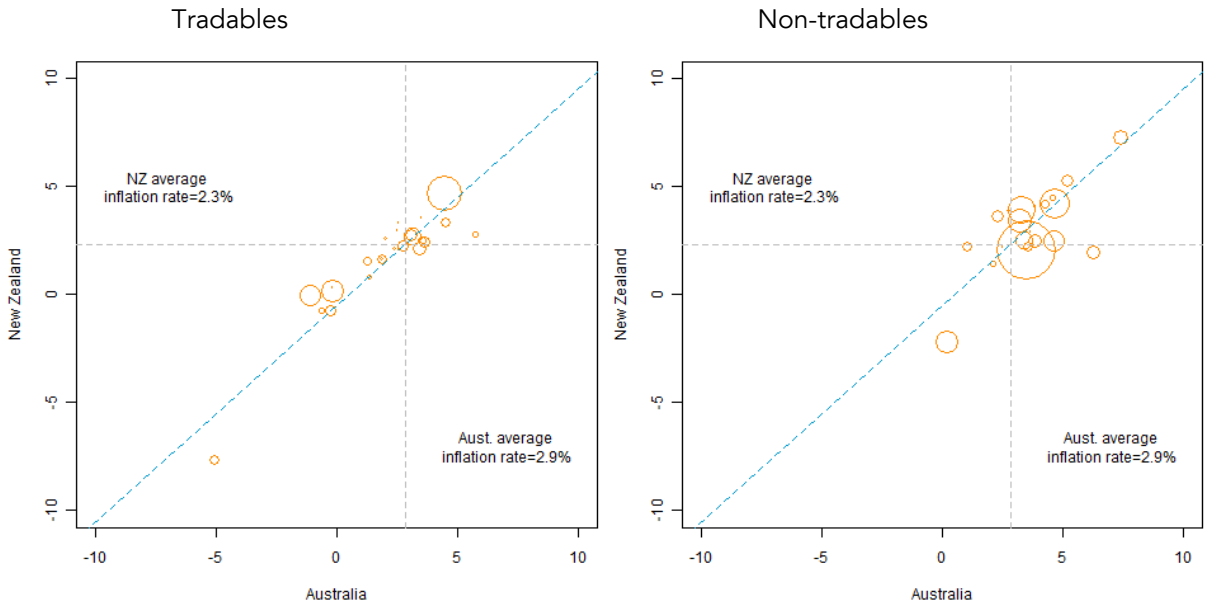
Source: Australian Bureau of Statistics; Statistics New Zealand; authors' calculations.

Notes:

1. The effects on inflation of the rise in GST in New Zealand in October 2010 and the introduction of GST in Australia in July 2000 were removed from the indices.

This high degree of correlation can be seen in a scatter-plot of New Zealand price changes against the Australian price changes for each of the CPI components, along a 45-degree line passing through the average inflation rate in each country (Figure 10). Each point represents the average annual price increase for a single CPI component, with the area of each point proportional to the New Zealand CPI weight. The points above the 45-degree line indicate New Zealand price changes relative to average New Zealand inflation were higher than Australian price changes relative to average Australian inflation. This figure suggests that the relative price increase for tradable components of the CPI has been high in New Zealand compared with Australia, while relative price increases for non-tradable components have been relatively high in Australia (see Appendix B for details of the data used in this analysis).

Figure 10 Relative price changes in Australia and New Zealand, 1993Q4 - 2011Q4



Source: Australian Bureau of Statistics; Statistics New Zealand; authors' calculations.

Notes:

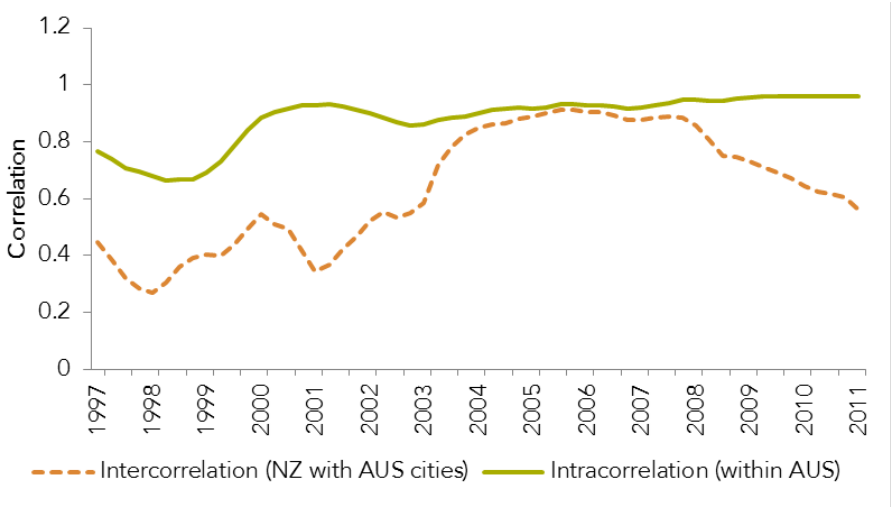
1. Each dot represents a component of the CPI. The size of dots is proportional to NZ CPI 2011 weights.
2. Dashed grey lines represent average inflation rates and the dashed black line is a 45-degree line passing through the intersection of average New Zealand and Australian inflation rates.

Analysis which formally incorporates geographic distance as a possible explanation for the greater intra-Australian correlation in price movements would allow us to measure how "thick" national borders are (in a similar fashion to Engel & Rogers, 1998). Although this analysis was not undertaken, distance is unlikely to account entirely for the lower inter-country correlations given that Auckland is substantially closer to Sydney than either Darwin or Perth. This suggests that the border effect is important in Australasia.

Analysis of this disaggregated data also reveals that relative price movements in Australia and New Zealand are highly correlated in the medium term, but not in the short term (consistent with Coleman, 2007), suggesting nominal price stickiness and volatile exchange rates may account for some of the difference in relative price movements between Australia and New Zealand.

The degree of trans-Tasman price movement correlation appears to have increased over time relative to the correlation of price movements within Australia (Figure 11). This may suggest that the New Zealand and Australian economies are becoming more integrated in the sense that relative prices increasingly move by the same amount at the same time.

Figure 11 Rolling price movement correlations, 3-year window



Source: Australian Bureau of Statistics; Statistics New Zealand; authors' calculations.

Notes:

1. The correlations are based on analysis of like-with-like CPI components. Scatterplots reveal some outlier components. In some cases, this may at least partly reflect differences in the way ABS and SNZ measure certain CPI components. Therefore the Australia/New Zealand inter-correlation figures may be an under-estimate of the true correlation.
2. Inter-correlation is the average of the correlations between NZ and each of the Australian cities.
3. Intra-correlation is the average of the correlations between each of the Australian cities.
4. The 3-year rolling window correlation at quarter t is estimated using the most recent 3-years of quarterly data (ie, from quarter t-12 to quarter t).

5 Mechanisms driving market integration – the four freedoms

Overall, the trans-Tasman flow of goods, services, capital and people (collectively the "four freedoms") indicates that Australia and New Zealand are economically close: Australia is New Zealand's largest trading partner, there is considerable trans-Tasman investment and a significant flow of trans-Tasman migrants (Table 2). However, Australia and New Zealand are not as economically integrated as the Australian states. This is consistent with international evidence that, for example, shows that there is less trade between geographically close regions in the USA and Canada than between more distant provinces within Canada (McCallum, 1995).

Australia is economically much more important to New Zealand than New Zealand is to Australia. Australia accounts for a large share of New Zealand's trade and inwards and outwards investment, and the majority of New Zealand emigrants are destined for Australia. However, this is not surprising or even particularly unusual, since Australia is a larger economy and other countries with close economic relationships, such as the USA and Canada and the USA and Mexico, experience similar asymmetries in their relationships.

Table 2 Summary of the four freedoms, circa 2011

	% of Australian total to/from NZ	% of NZ total to/from Australia
Trade in goods		
• Exports	3%	22%
• Imports	3%	17%
Trade in services		
• Exports	6%	32%
• Imports	5%	35%
Investment		
• Total inward	2%	35%
• Total outward	6%	36%
• Inward FDI	1%	59%
• Outward FDI	10%	55%
Migration		
• Arrivals	2%[1]	11%
• Departures	4%[1]	53%

Source: Australian Bureau of Statistics; Statistics New Zealand; authors' calculations.

Notes:

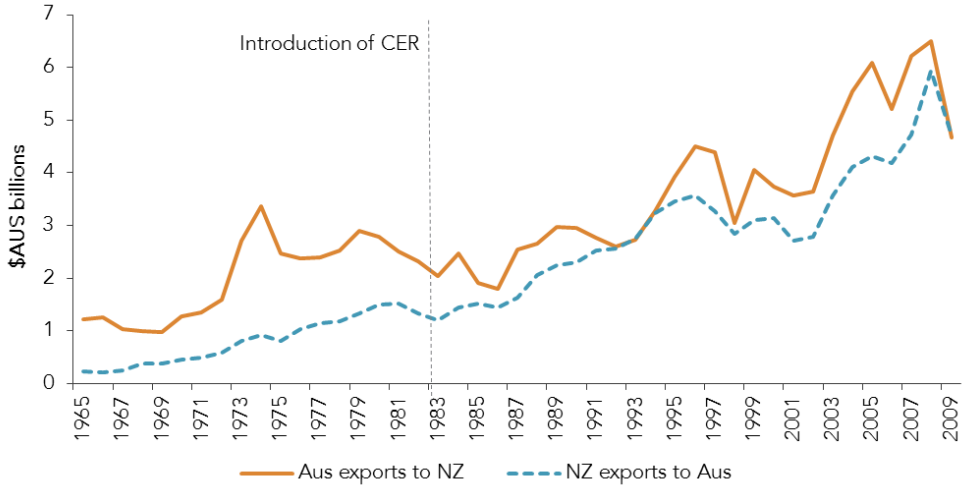
1. Australia long-term and permanent migration (PLT) data by country are not publicly available. Australian migration figures are calculated using the Statistics New Zealand PLT dataset (for example, New Zealand departure to Australia should be equivalent to New Zealand arrivals in Australia) in the numerator, and total PLT figures from the Australian Bureau of Statistics in the denominator. As noted below for services trade and investment, while the Statistics New Zealand and Australian Bureau of Statistics figures should reconcile, this is not necessarily the case.

5.1 Merchandise trade

The share of New Zealand merchandise exports destined for Australia has grown substantially since the 1960s to about 21% in 2009, and Australia is now New Zealand's largest trading partner (Figure 13). This trend pre-dated the commencement of CER (Figure 13).

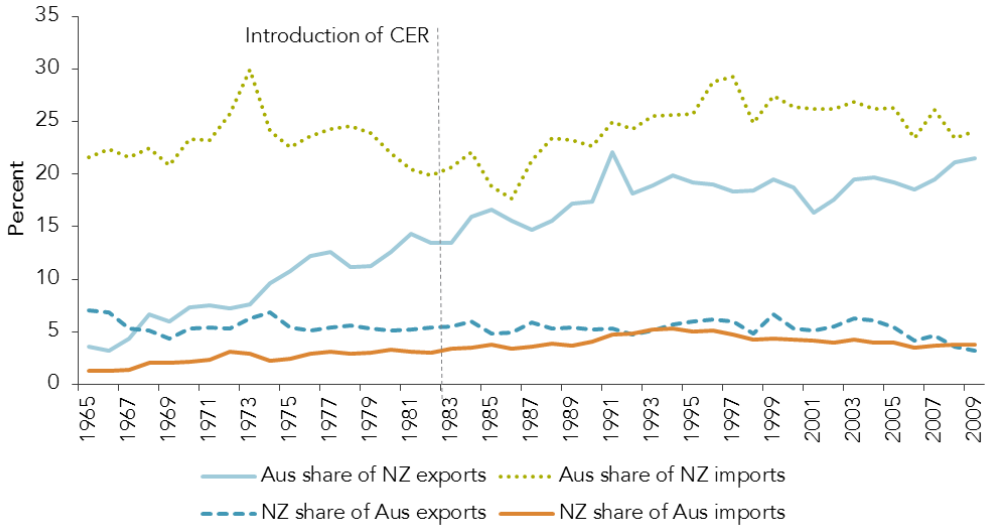
The New Zealand share of Australia's merchandise exports remained at about 5% to 6% throughout most of the past 30 years. This has declined to about 3% over the last few years, despite the value of Australia's exports to New Zealand being at historically high levels (Figure 12). This is largely due to the rising share of mineral exports to Asia. Reflecting these smaller shares, New Zealand is only Australia's seventh largest trading partner.

Figure 12 Trans-Tasman merchandise trade, 2010 prices



Source: UN ComTrade database

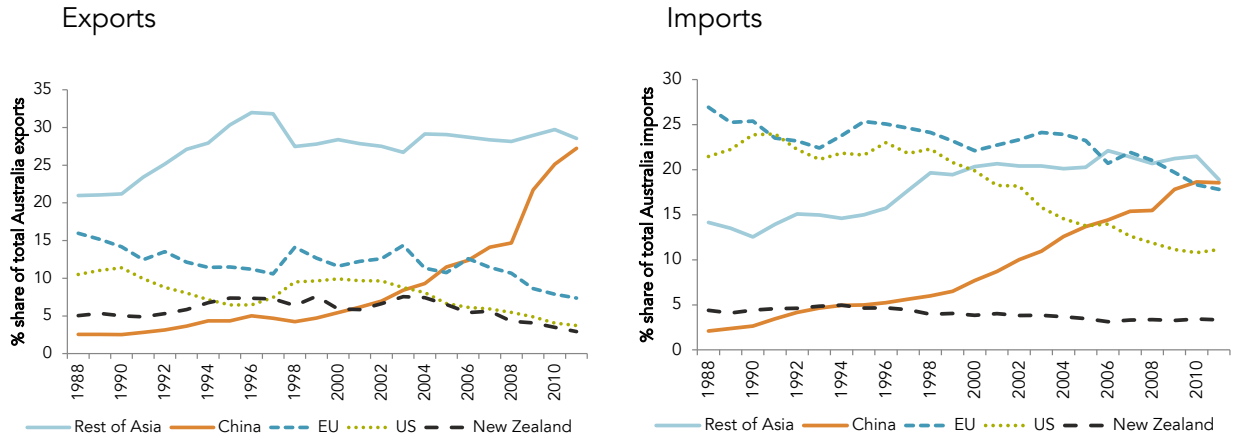
Figure 13 Trans-Tasman merchandise trade as a share of total trade



Source: UN ComTrade database

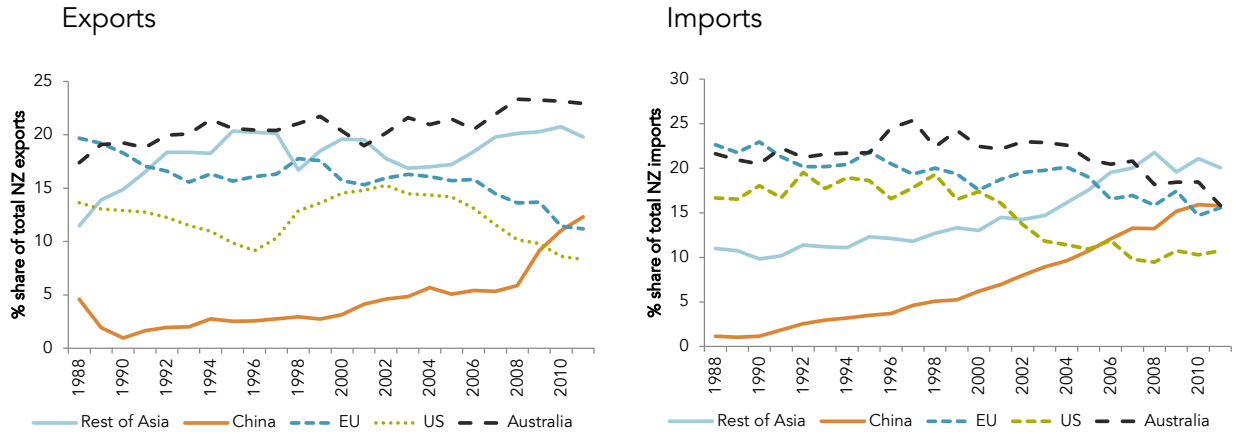
To put these results in context, it is useful to look at the general trends in trade in the two countries. In particular, China and developing Asia have accounted for an increasing share of exports and imports from both Australia and New Zealand (Figure 14 and Figure 15). This increase in trade integration with Asia has been particularly pronounced for Australia. It has been suggested that New Zealand exporters see Australia as a stepping stone to the other markets, particularly in Asia, as the small home market does not allow them to grow to a sufficient scale to make entry into Asia directly from New Zealand feasible (ACIL Tasman Pty Ltd & LECG Asia Pacific, 2004).

Figure 14 Australian exports and imports by selected countries and regions



Source: Australian Bureau of Statistics

Figure 15 New Zealand exports and imports by selected countries and regions

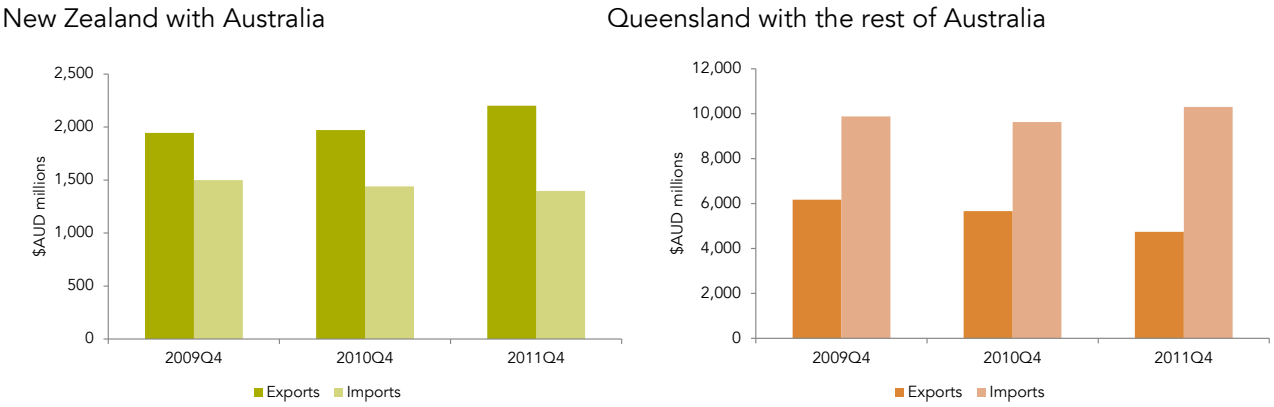


Source: Statistics New Zealand

Although the above results are indicative, it is difficult to know whether Australia and New Zealand under- or over-trade with each other given their respective economic size and distance from international markets. Such an assessment would require the use of a gravity model, which is beyond the scope of this paper. However, by way of a benchmark, Queensland's total GDP is about 80% greater than New Zealand's but the value of its trade with the rest of Australia is over three times greater than the value of trans-Tasman trade (Figure 16).[10] Queensland's greater proximity to the rest of Australia may partly explain the higher level of trade between Queensland and the rest of Australia compared with trans-Tasman trade. On the other hand, Queensland's trading partner (the rest of Australia) is smaller than New Zealand's (all of Australia) suggesting Queensland's trade should be lower. In other words, although we would ideally control for distance to, and size of, markets, it does appear that national borders are "thicker" than domestic state borders.

[10] Unfortunately, data on trade among other Australian states are not available.

Figure 16 Merchandise trade between Australia and New Zealand and between Queensland and the rest of Australia



Source: Australian Bureau of Statistics; Statistics New Zealand

Another useful comparison is other partner countries' share of total merchandise trade (Table 3). While Australia accounted for 18% of New Zealand's total exports and 24% of New Zealand's total imports, the USA's share of Canadian exports and imports was much higher (50% and 75% respectively), as was the USA's share of Mexican exports and imports (48% and 80% respectively). New Zealand's share of Australia's total exports and imports (4% and 3% respectively) was also much lower than the Canadian share of USA exports and imports (20% and 14% respectively) and the Mexican share of USA exports and imports (14% and 12% respectively). The UK share of Ireland's total trade and the Irish share of the UK's total trade were more similar to the Australia-New Zealand shares. However, multi-lateral regional relationships are likely to be more important than bi-lateral ones for these EU-member countries.

On the face of it, these comparisons seem to suggest that that Australia and New Zealand under-trade relative to other partner countries (particularly Canada, the USA and Mexico). However, the lower shares for trans-Tasman trade may be due to the small size of the Australia and New Zealand economies. It is difficult to assess this possibility without a fully specified gravity model.

Table 3 Partner countries' share of merchandise trade, 2010

	Exports	Imports
Australian share of NZ	24.0%	18.2%
NZ share of Australian	3.5%	3.4%
US share of Canada	50.4%	75.0%
Canadian share of US	20.2%	14.2%
US share of Mexico	48.2%	80.0%
Mexican share of US	13.6%	11.8%
UK share of Ireland	15.5%	32.2%
Irish share of UK	6.2%	3.5%
German share of France	16.0%	17.3%
French share of Germany	9.5%	7.7%

Source: UN ComTrade database

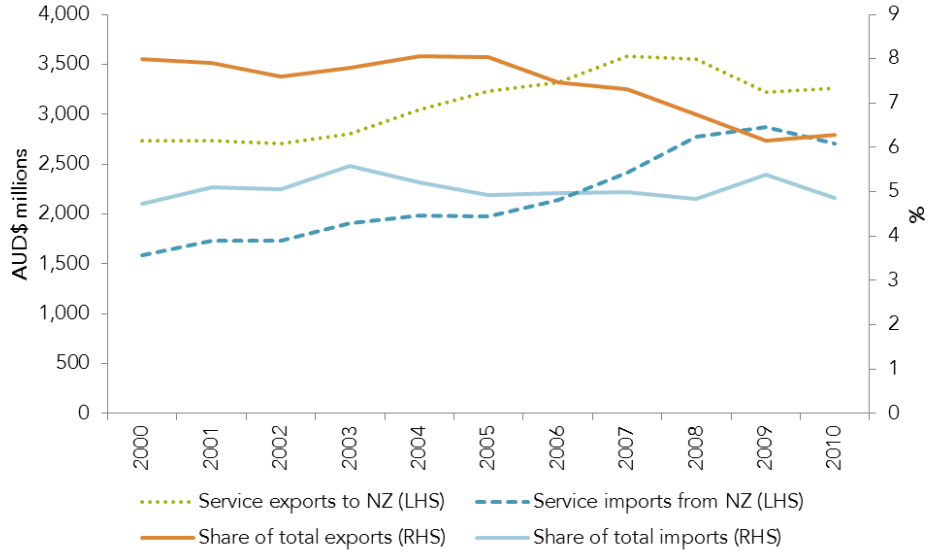
5.2 Services

Cross-border trade in some services sectors is inherently more difficult than merchandise trade, and this is reflected in much lower levels of international services trade compared with global merchandise

trade. For some types of services, physical proximity between the supplier and customer is important. Reputational effects may also be particularly important for some services, and this may lead to a greater degree of "home bias" as consumers are more likely to know and trust local suppliers.

However, services trade has been growing globally as improvements in ICT are reducing some of the obstacles to trade. In addition, the introduction of trans-Tasman mutual recognition should have facilitated services trade between Australia and New Zealand as it mitigates the impact of regulatory differences in professional services.[11] However, despite linguistic and cultural similarities that should facilitate services trade, the share of trans-Tasman services trade in total services trade has been flat to declining, reflecting only modest growth in the value of services trade (Figure 17 and Figure 18).[12] However, the New Zealand services series is restricted to commercial services only, so is likely to underestimate the level of services trade. For example, it excludes tourism, which is a large component of New Zealand's overall services trade.

Figure 17 Australian total services imports from and exports to New Zealand, current dollars



Source: Australian Bureau of Statistics

[11] Unfortunately, the available data on services trade does not extend back to before the introduction of mutual recognition in 1997.

[12] Total trade in services is available for Australia, but the New Zealand series includes only commercial services, that is, services excluding travel, transportation, insurance, and government services. Note also the short time span of services trade data.

Figure 18 New Zealand commercial services imports from and exports to Australia, current dollars

Source: Statistics New Zealand

Notes:

1. Australian data includes all trade in services; New Zealand includes only commercial services data (ie, it excludes travel, transport, government and insurance services).
2. There is a break in the New Zealand series – prior to 2005, less detailed country breakdowns were available. After 2005, the country classification improved, resulting in an upward jump in the series.

As with merchandise trade, Australia is more important to New Zealand than New Zealand is to Australia. While merchandise trade with Asia is becoming increasingly important, for New Zealand, commercial services trade remains focussed on countries that have traditionally been New Zealand's top investment partners, including Australia, reflecting the close link between foreign direct investment and services trade. Australia's share of New Zealand's commercial services exports has increased from 23% in 1992 to 36% in 2011, and commercial services imports from Australia have increased from 25% to 40% (Statistics New Zealand, 2012a).

It is difficult to know whether Australia and New Zealand are under- or over-trading services. Although more sophisticated analysis would be required to investigate this further, it is useful to look at other partner countries' share of services trade. The relationship between the USA and Canada is similar to that of Australia and New Zealand in the sense that the USA is more important to Canada than Canada is to the USA. However, the US share of Canadian services imports and exports is greater than the Australia share of New Zealand trade (Table 4).

Table 4 Partner countries' share of the trade in services, 2010

	Exports	Imports
Australian share of NZ	27.0%	34.7%
NZ share of Australia	8.0%	2.4%
US share of Canada	54.0%	57.4%
Canadian share of US	9.3%	6.5%
US share of Mexico	n/a	n/a
Mexican share of US	4.4%	3.5%
UK share of Ireland	19.5%	12.9%
Irish share of UK	4.9%	3.6%
German share of France	10.9%	10.3%
French share of Germany	6.1%	6.8%
EU15 share of France	50.1%	38.0%
EU15 share of Germany	31.2%	38.3%

Source: OECD; Statistics New Zealand; Australian Bureau of Statistics.

Notes:

1. The USA share of Mexico's trade in services was not available.

5.3 Capital

Quantity measures

Australian investment makes up a large and increasing share of New Zealand's inward investment stock. The majority of Australian investment in New Zealand is FDI, reflecting the large number of Australian-owned firms in New Zealand. In contrast, New Zealand's investment in Australia is a small share of Australia's total inward investment, with no obvious trend over time. The majority of New Zealand's investment in Australia is portfolio investment, indicating that New Zealand-based entities play a much smaller and less active role in the Australian economy compared with the role of Australian-based entities in the New Zealand economy (Figure 19).

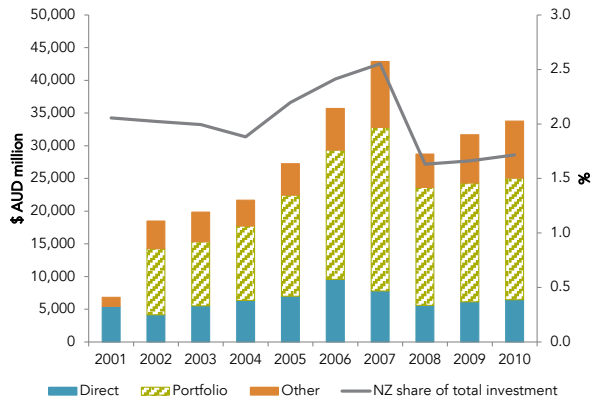
Australia is also a more important destination for New Zealand's outward investment than New Zealand is for Australia. About a third of New Zealand's investment abroad is into Australia, and this share is increasing over time. In contrast, New Zealand accounts for a much smaller share of total Australian outward investment and there is no clear pattern over time (Figure 19).

The importance of Australia to New Zealand businesses is also confirmed by the Business Operations Survey. Of New Zealand businesses that produced goods or services overseas, 43% did so in Australia in 2011 (roughly the same as in 2007). This was second only to China (52%). Of New Zealand businesses that generated overseas income in the last financial year, 76% sourced this income from Australia, which is a much higher percentage than the next highest source country, the USA at 43% (Statistics New Zealand, 2012b).[13]

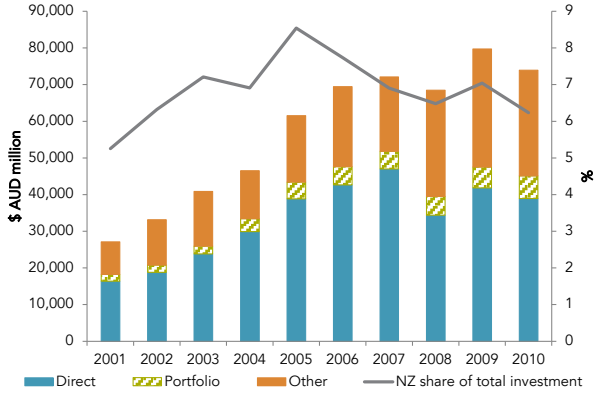
[13] Percentages can add up to more than 100% due to businesses that produce goods or services overseas or generate overseas income in multiple countries.

Figure 19 Trans-Tasman investment stocks

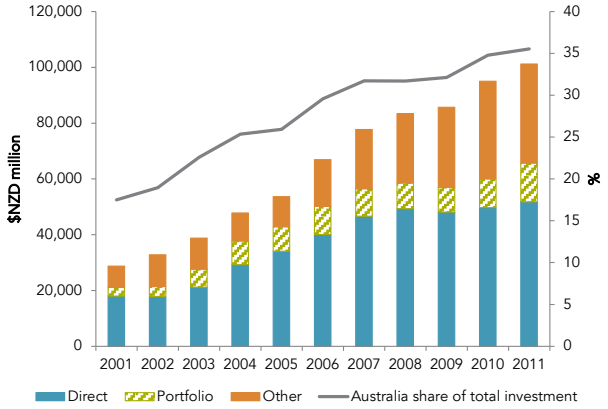
Australia – inward investment from NZ



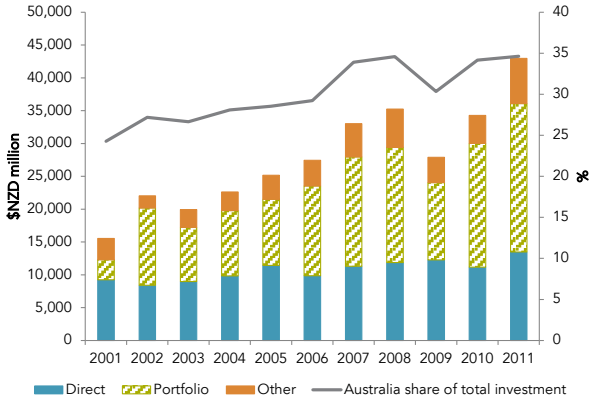
Australia - outward investment to NZ



NZ – inward investment from Australia



NZ – outward investment to Australia



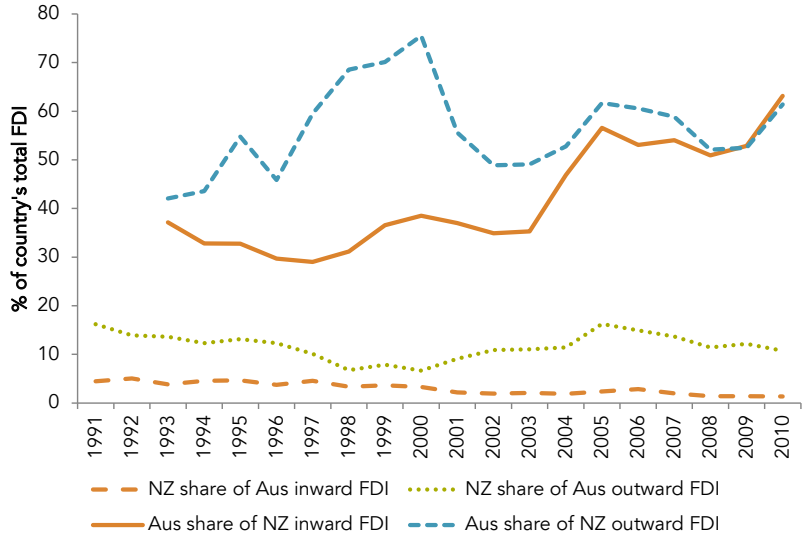
Source: Australian Bureau of Statistics; Statistics New Zealand.

Notes:

1. Statistics New Zealand and Australian Bureau of Statistics data do not always reconcile. For example, Australian investment in New Zealand (bottom right graph) should equal New Zealand inward investment from Australia (top left graph).

The flow of investment between Australia and New Zealand is highly variable. For instance, there was a large increase in Australian investment in New Zealand over the period of global credit expansion in the mid-2000s, followed by a decrease during the financial crisis (Figure 20). This suggests that some of the increases in financial flows during the 2000s stemmed from the global credit cycle rather than from long-term increases in financial integration. Unfortunately, Australian Bureau of Statistics and Statistics New Zealand data do not go back far enough to assess this. OECD data on just the FDI component of investment is available back to 1991 and shows a marked increase in Australian FDI into New Zealand in the 2000s compared with the 1990s. It also shows that Australia has been an important destination for New Zealand FDI for many years, and the Australian share of NZ outward FDI may be on a gradual upwards trend.

Figure 20 Australian and New Zealand FDI stocks as a share of total FDI stocks



Source: OECD

The OECD data also enables us to examine the FDI linkages of other economically close country pairs, which is a useful reference point to gauge the extent of trans-Tasman investment. The USA and Canada and the USA and Mexico are similar to Australia and New Zealand in the sense that the USA, with its larger economy, accounts for a high proportion of total Canadian inward and outward FDI (Table 5). However, the US share of Canadian inward and outward FDI has been decreasing over the period 1991-2010, while the Australian share of NZ inward FDI has been increasing over time and its share of NZ outward FDI has had no discernible pattern.

While the UK share of Irish inward and outward FDI is higher than the Irish share of UK inward and outward FDI, these shares are much lower than the trans-Tasman and US-Canada and US-Mexico shares. Likewise, the French share of Germany's inward and outward FDI and the German share of France's FDI are low. However, the multi-lateral European arrangements appear to be more important, with the EU15 accounting for a large share of Germany's and France's inward and outward FDI. The EU15 share of inward FDI for Germany and France is increasing over time, while there is no clear trend in the EU15 share of outward FDI.[14] Overall, the level of Australia's share of inwards and outwards FDI is similar with intra-EU FDI shares, but, New Zealand is much less important to Australia. However, as with trade, it is difficult to assess from these descriptive data whether Australia and New Zealand over- or under-invest in each other's countries relative to what would be expected given the relative size of each of the economies.

[14] Figures showing the trends over time in country pairs' FDI stock are not shown, but are available on request.

Table 5 Partner countries' share of the stock of FDI, 2010

	Inward FDI	Outward FDI
Australian share of NZ	63.2%	61.4%
NZ share of Australian	1.4%	10.8%
US share of Canada	54.5%	50.5%
Canadian share of US	8.8%	7.6%
US share of Mexico	47.6%	28.1%
Mexican share of US	0.5%	2.3%
UK share of Ireland	12.9%	15.3%
Irish share of UK	1.3%	4.0%
German share of France	9.5%	7.0%
French share of Germany[1] (2009)	10.2%	5.0%
EU15 share of Germany[2]	70.2%	50.2%
EU15 share of France	73.9%	59.5%

Source: OECD

Notes:

1. Based on 2009 data (2010 unavailable)
2. Based on 2006 data (2007-2010 unavailable)

Price measures

The difficulty of identifying whether patterns of foreign asset and liability flows are cyclical or are due to genuine changes in the degree of financial integration demonstrates a more general point that actual capital flows will reflect a number of factors unrelated to financial market integration, such as trade openness and fiscal policies. Due to these limitations, it is also useful to look at measures of integration that focus directly on capital markets activity.

Equity market returns

The simplest of these is equity market return correlations, specifically, the correlation coefficient of the Australia and New Zealand returns. The idea underlying correlation calculations is that because the price of a security is the same in all markets under perfect integration, price changes (ie, returns) will be perfectly correlated across markets. For example, Fraser et al. (2008) uses monthly stock market data from 1970 to 2003 and finds that the correlation between Australian and New Zealand equity returns has increased over time. In addition, Australia and New Zealand's relationships with other markets have generally increased with time, which is consistent with the notion that Australasia has become increasingly integrated into the world economy. The paper also finds that since the mid-1980s, short-run movements in the New Zealand stock market have been increasingly associated with movements in the Australian market rather than with movements in other Pacific-Basin countries or the USA.

Some researchers have also investigated cointegration between the two equity markets on the basis that this implies an absence of long-run arbitrage opportunities. Narayan & Smyth (2005) use monthly data from 1967 to 2005 and find that the New Zealand equity market is not cointegrated with Australia or any of the G7 countries. However, several other papers dispute this finding. Chen *et al.* (2008) use data from 1990 to 2005 and find that the Australian and New Zealand markets are cointegrated. Lok & Kalev (2006) consider the intraday price behaviour of Australia-New Zealand cross-listed stocks between 2000 and 2002 and find that the cross-listed stocks are cointegrated and that arbitrage from

trading dual-listed stocks across the two markets is generally not available, indicating a high level of integration.

Claus & Lucey (2012) looks at the convergence in discount factors.[15] This method is based on the idea that stock markets are integrated if all assets in a market share the same expected discount rate. In other words, while the expected discount rates in different markets may vary over time, they are equal for all assets in integrated markets at any one point in time.[16] Discount factors are estimated for 10 Asia-Pacific countries in 2006. Surprisingly, while the study finds a relatively high degree of integration for Japan, Hong Kong and New Zealand, there is a lack of bilateral integration of Australia and New Zealand.

On balance, there is evidence that equity market returns have become more correlated across the Tasman and that arbitrage opportunities are not available, indicating a high level of integration. However, it is difficult to know if trans-Tasman capital markets have become integrated over and above what would be expected given increases in capital market integration across the broader global economy.

Real interest rates

The real interest rate is a measure of the cost of capital, so the degree of real interest rate parity can be used to measure market integration.[17] On the face of it, real interest rates in Australia and New Zealand appear to move together increasingly over time (Figure 21). To investigate real interest rate co-movements more formally, we use a real interest parity model on data from 1974 to 2011 to assess whether Australian and New Zealand real interest rates are cointegrated and how the degree of cointegration has changed over time.[18] As explained in Appendix C, the closer the estimated intercept and slope coefficients in this model are to zero and one respectively, the greater the degree of market integration.

In the case of Australia and New Zealand, and consistent with the raw data, these estimates indicate that the degree of integration has increased over time – that is, the intercept term (left-hand panel of Figure 22) has trended towards zero and the slope term has increased towards one (right-hand panel of Figure 22). Although this suggests an increase in trans-Tasman economic integration, it is unclear whether this is due to CER and related policy initiatives or a global trend of increasingly correlated interest rates.

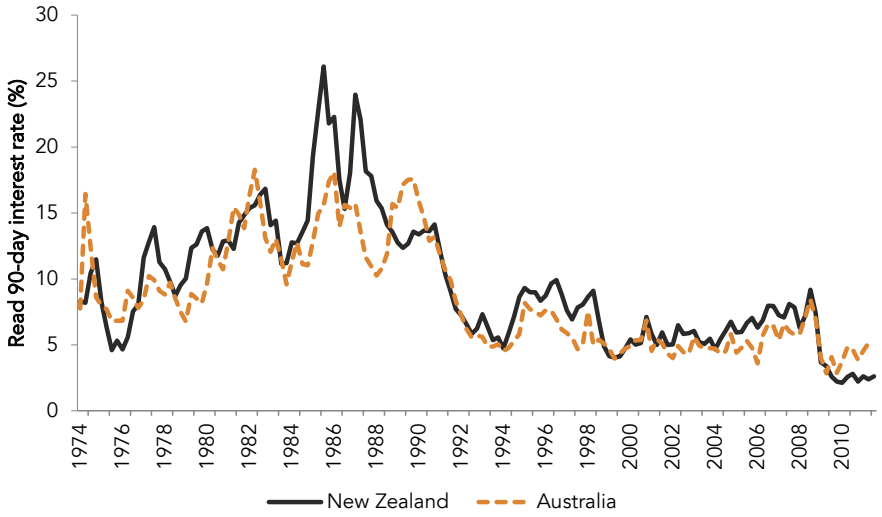
[15] This rate discounts future asset earnings into a current asset value in today's dollars.

[16] For more information about the theory behind this method, see Flood & Rose (2005).

[17] The real interest rate parity condition requires efficiency in the goods market (via ex-ante purchasing power parity) and efficiency in the capital (or money) market (via uncovered interest parity). Thus, this measure is technically a measure of integration in goods and capital markets.

[18] This analysis is similar to Moosa & Bhatti (1995).

Figure 21 Real interest rates in Australia and New Zealand, 1974-2011

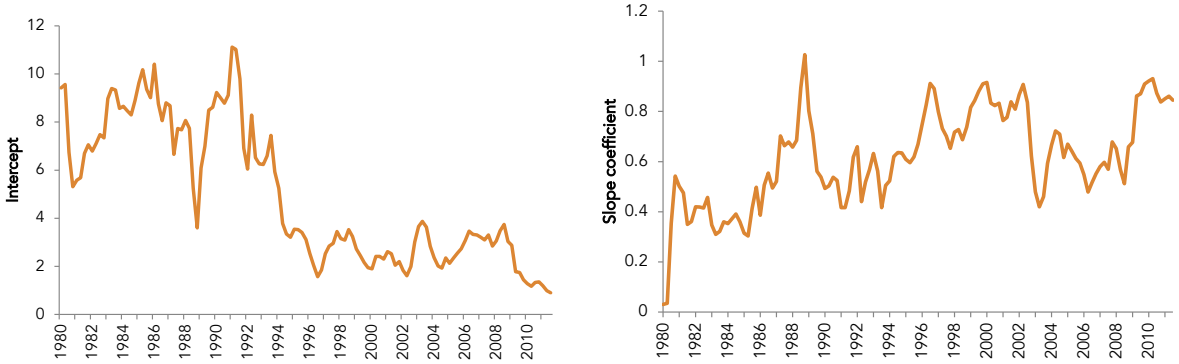


Source: OECD; Australian Bureau of Statistics; Statistics New Zealand

Notes:

1. Real interest rates are calculated using 90-day rates sourced from the OECD and producer price indices from Australian Bureau of Statistics and Statistics New Zealand

Figure 22 Real interest rates cointegration: time-varying intercept and slope estimates, 6-year rolling window



Source: OECD; Australian Bureau of Statistics; Statistics New Zealand; authors' calculations

Notes:

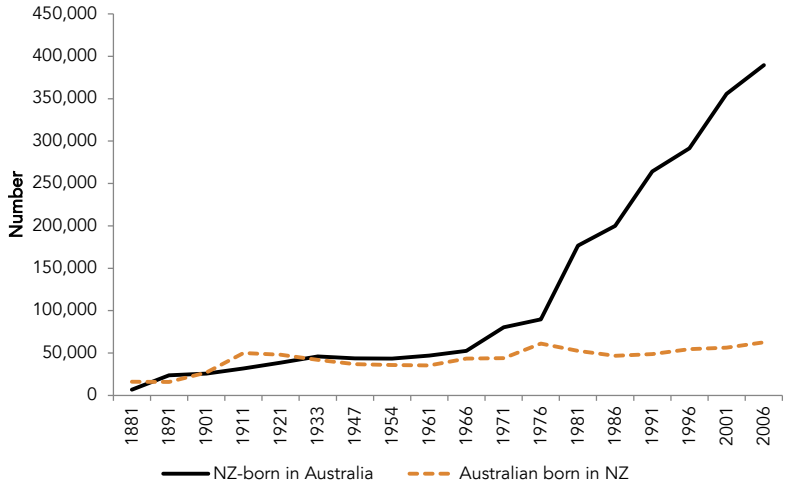
1. Estimates are calculated using Prais-Winsten method, which corrects the coefficient estimates for AR(1) effects.
2. The 6-year rolling window correlation at quarter t is estimated using the most recent 6-years of quarterly data (ie, from quarter t-24 to quarter t).

Overall, there appears to be a high degree of financial integration between the Australian and New Zealand markets. There are considerable trans-Tasman investment flows, Australian and New Zealand equity market returns have become increasingly correlated over time, and Australian and New Zealand interest rates increasingly move together to a large extent.

5.4 Migration

Since the 1960s, and prior to the 1973 Trans-Tasman Travel Arrangements, there has been a strong increase in the number of New Zealanders living in Australia, not matched by equal growth in the number of Australians living in New Zealand (Figure 23). In 2006, almost 400,000 New Zealand-born people lived in Australia, approximately three-quarters of New Zealand's total diaspora (Department of Labour, 2010). New Zealand-born migrants living in Australia have, on average, the same level of education as New Zealand-born individuals living in New Zealand and Australian-born individuals living in Australia (Stillman & Velamuri, 2010).

Figure 23 The trans-Tasman born population, 1881-2006

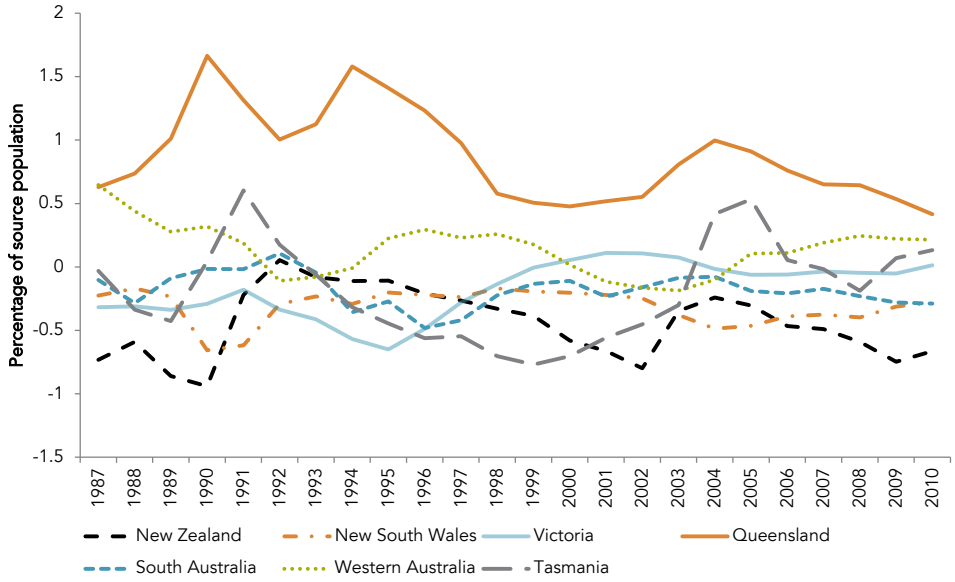


Source: Poot (2009)

Economic theory suggests that open labour markets will give rise to flows of labour to the country with higher returns to labour. The direction of migration flows is consistent with the trans-Tasman wage differential, with an average New Zealand-born person in Australia earning 19% more than an identical worker in New Zealand, and the more educated having, on average, an even greater pay differential. Indeed, economic factors may be more important than lifestyle or other factors in explaining the migration flows of New Zealanders to Australia (Green, Power, & Jang, 2008) and the start of the net outflow of New Zealanders to Australia coincided with the beginning of Australia's comparatively strong economic growth relative to New Zealand (Poot, 2009). Consistent with this, regions of Australasia with faster GDP per capita growth have also had relatively fast-growing populations (Grimes, 2004).

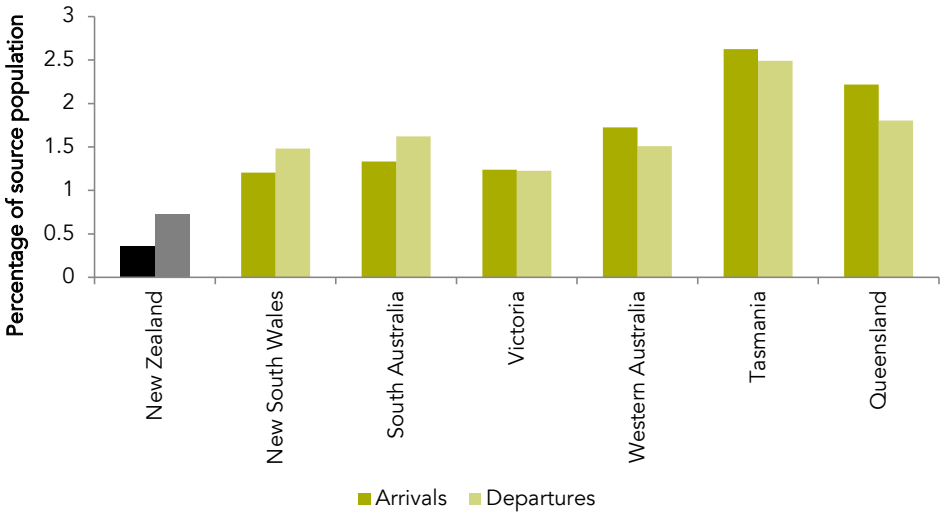
How do migratory flows between Australia and New Zealand compare with flows among Australian states? As a percentage of its population, New Zealand has had large net outflows of people to Australia, but these flows are smaller than the share of populations of New South Wales and South Australia flowing to other Australian states (Figure 24). Looking at gross flows, New Zealand migration to and from Australia as a share of New Zealand's population were substantially smaller than Australian states' migration flows as a share of their populations and significantly weighted in favour of departures (Figure 25). Although a gravity model that takes into account distance was not undertaken here, the descriptive results appear to be consistent with a study using a gravity model and data from the 1980s. This study showed that there are Australasian "border effects" with the elasticities of trans-Tasman migration flows being significantly different from Australian inter-state flows (Poot, 1995).

Figure 24 Annual net migration between Australian states and between New Zealand and Australia, 1987-2010



Source: Ministry of Economic Development *et. al* (2011)

Figure 25 Gross migration flows between Australian states and between New Zealand and Australia, 2009



Source: Ministry of Economic Development *et. al* (2011)

The number of New Zealand-born people living in Australia and Australian-born people in New Zealand does not appear to be unusual compared with other countries with close geographic and economic ties (Table 6). New Zealand-born people in Australia made up about 2% of the Australian population in the early 2000s, and the numbers were equivalent to about 11% of New Zealand's population. On the other hand, Australians accounted for 1.5% of the New Zealand population, and 0.3% of Australia's total population. There is a similar pattern for Mexico and the USA, and Ireland and the UK, with people moving to the country with the (historically) superior economic performance.[19] However, the numbers for these country-pairs are higher than for other close country-pairs such as Canada and the USA and Poland and Germany.

[19] Although the GDP and NNI per capita of the UK and of Ireland have converged, these figures are the stock of foreign-born residents, and Ireland historically had lower GDP per capita than the UK.

Table 6 Percentage of foreign-born people for selected country pairs, circa 2000

	% of destination country population	% of destination country foreign-born population	% of birth country's population
New Zealand-born in Australia	2.2%	8.2%	11.4%
Australia-born in New Zealand	1.5%	6.7%	0.3%
Mexico-born in USA	3.8%	26.3%	13.2%
USA-born in Mexico	0.2%	44.7%	0.05%
Canada-born in USA	0.4%	2.8%	3.6%
USA-born in Canada	0.2%	44.7%	0.01%
Ireland-born in UK	1.1%	11.7%	17.3%
UK-born in Ireland	6.8%	62.3%	4.3%
Poland-born in Germany	1.7%	15.4%	3.3%
Germany-born in Poland	0.3%	12.2%	0.1%
French-born in Germany	0.1%	0.8%	0.1%
German-born in France	0.4%	0.4%	0.3%

Source: OECD DIOC-E 2000 database

Notes:

1. Based on data from approximately 2000.
2. Population aged 15 years and over.

6 Conclusion

This paper examined trans-Tasman economic integration using various de facto measures. These measures included macro level indicators of convergence, business cycle synchronisation and relative price movements. Trans-Tasman trade and factor flows and factor returns were also considered.

Overall, the range of measures considered indicates that significant progress has been made towards achieving a single market across the Tasman. In particular, business cycles have become more synchronised and price changes for the same goods are strongly correlated across the two countries over the medium to long term. Underpinning these interdependencies, Australia is New Zealand's largest trading partner, trans-Tasman investment and migration flows are considerable and financial markets appear highly integrated.

However, notwithstanding data limitations, Australia and New Zealand do not appear to be as economically integrated as the Australian states. The linkages between economic cycles and relative prices are tighter inter-state than they are across the Tasman, reflecting larger flows of trade and people. This indicates that the international border is considerably "thicker" than state borders within Australia. On balance, the scope for further integration, with the aim of achieving a genuine trans-Tasman single economic market, especially in services, is significant. Although beyond the scope of this paper, the costs of remaining market fragmentation may be substantial, reflecting a failure to reap the full gains from specialisation, a lack of competition and consumer choice.

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Appendix A Industrial structure and regional business cycles

This appendix estimates and compares industrial structures and business cycles across Australasian regions, using a similar methodology to Grimes (2005) .[20]

Industrial structure index

The industrial structure index (ISI) is a measure of the similarity of the industrial structure in each region relative to Australasia.[21] The ISI is calculated as:

$$ISI_i = 100 * \left(\frac{\sum_j |S_{i,j} - S_{ANZ,j}|}{n}\right) \quad (1)$$

where $S_{i,j}$ is the share of industry *j* in region *i*, $S_{ANZ,j}$ is the share of industry *j* in Australasia, and *n* is the total number of industries. A value of 0 indicates perfect alignment of sectoral shares whereas a value of 1 indicates an absolute average deviation of sectoral shares of 1 percentage point.

To construct the ISI, we use quarterly employment data from the June quarter of 1990 to the December quarter of 2010.[22] The employment data provide estimated employee counts[23] for 14 industries[24] across eight Australian states/territories and New Zealand. Total employment for Australasia is simply the sum of employment numbers for each Australasian region across all industries.

We filter employment numbers for each region and industry combination using the Hodrick-Prescott (HP) filter (lambda=1600) and use the long-run employment trends to calculate industrial employment shares in each region (ie, $S_{i,j}$). The employment gap, the ratio of employment over its trend, will be used later to examine the degree of synchronisation in employment cycles across Australian regions and New Zealand.

Australian Capital Territory (ACT) and Northern Territory (NT) have quite different industrial structures to the overall Australasian structure (Figure A.1 & Table A.1), but both have small populations and therefore are more likely to have idiosyncratic structures. Looking at the industry shares in more detail (Table A.2) reveals that, as expected, ACT has a large share of employment in government-related services, like public administration and safety. NT and WA have a larger-than-average share in mining and NZ has a relatively large agricultural share.

Industry structures across regions appear to have become more differentiated over time, perhaps suggesting an increasing degree of specialisation (Figure A.1 & Table A.1). The ISI is higher in the 2000s than the 1990s in all but two regions. As mentioned above, increased trade flows may increase specialisation in both countries. However, there has not been a large divergence in industry structure over the last two decades.

[20] Australasian regions include: six Australian states, two Australian territories and New Zealand.

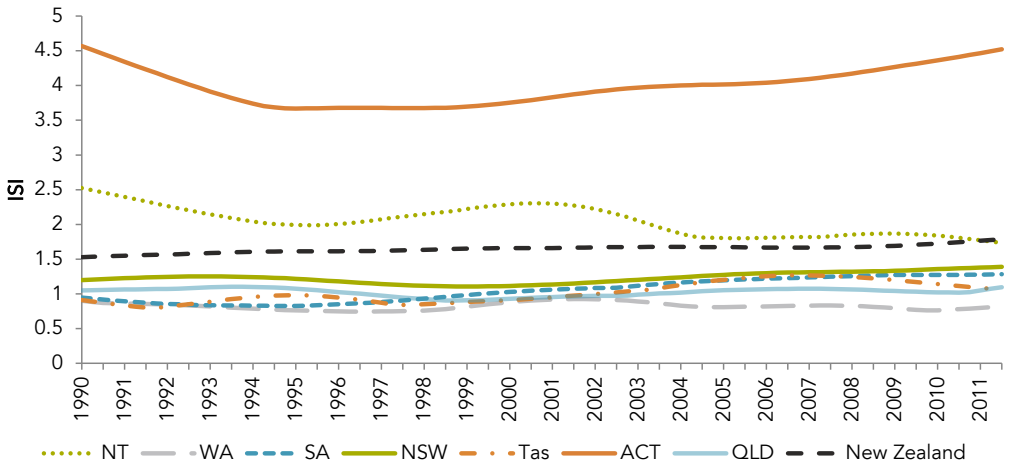
[21] Australasia is defined as the sum of Australia and New Zealand.

[22] Employment data are sourced from (household) labour force surveys from Australian Bureau of Statistics and Statistics New Zealand.

[23] Total employee counts include full-time and part-time workers and are seasonally adjusted by X12-ARIMA (http://www.census.gov/srd/www/x12a/)

[24] These industries are based on Australia and New Zealand Standard Industry Classifications (ANZSIC). They are (1) AFF: Agriculture, forestry and fishing, (2) MIN: Mining, (3) MAN: Manufacturing, (4) EGW: Electricity, gas and water, (5) CON: Construction, (6) WLS: Wholesale, (7) RTA: Retail trade and accommodation, (8) TRAN: Transport, postal and warehousing, (9) IMT: Information media and telecommunications, (10) FIS: Financial and insurance services, (11) PST_ASS: Professional, scientific and technical services, administrative and support services, (12) PAS: Public administration and safety, (13) ETH_AS: Education, training, health care, social assistance and (14) AR_OTH: Arts, recreation and other services.

Figure A.1 Industrial structure index, 1990Q2 - 2011Q4



Source: Australian Bureau of Statistics; Statistics New Zealand; authors' calculations.

Table A.1 Industrial structure index, 1990Q2 - 2011Q4 average

	ISI 1990-1999	ISI 2000-2011	ISI 1990-2011
New Zealand	1.6	1.68	1.62
Queensland	1.01	0.95	1
New South Wales	1.19	1.25	1.18
Victoria	1.29	1.42	1.32
ACT	3.8	4.27	4.08
Northern Territory	2.15	1.95	2.06
Western Australia	0.79	0.85	0.82
South Australia	0.87	0.99	0.92
Tasmania	0.84	1.07	0.97

Source: Australian Bureau of Statistics; Statistics New Zealand; authors' calculations.

Table A.2 Regional industrial employment share, 1990Q2 – 2011Q4 average

	NZ	QLD	NSW	VIC	ACT	NT	WA	SA	TAS	Australia	Australasia
AFF	8.2%	5.7%	3.9%	4.1%	0.5%	3.9%	5.7%	6.2%	8.5%	5.0%	5.3%
MIN	0.3%	1.6%	0.9%	0.3%	0.1%	3.9%	4.5%	0.9%	1.3%	1.3%	1.1%
MAN	14.7%	10.5%	12.2%	15.5%	2.8%	4.4%	10.4%	13.4%	12.4%	13.3%	12.9%
EGW	0.8%	1.2%	1.4%	1.3%	0.9%	1.2%	1.4%	1.3%	1.8%	1.4%	1.1%
CON	7.1%	8.9%	7.7%	7.3%	6.6%	9.5%	9.2%	6.7%	7.2%	8.4%	8.3%
WLS	4.6%	4.4%	5.0%	4.8%	2.2%	3.4%	4.7%	4.3%	4.1%	5.0%	4.8%
RTA	15.6%	19.0%	17.6%	16.9%	15.5%	20.1%	18.6%	18.2%	19.6%	18.9%	18.8%
TRAN	4.5%	5.8%	5.6%	5.0%	3.1%	6.1%	5.3%	4.6%	4.9%	5.7%	5.4%
IMT	2.2%	1.8%	2.6%	2.4%	2.6%	2.4%	1.9%	1.9%	2.0%	2.4%	2.4%
FIS	3.1%	3.0%	5.0%	4.2%	2.6%	2.5%	3.4%	3.2%	3.0%	4.3%	4.0%
PST_ASS	10.0%	8.0%	9.6%	9.4%	11.1%	1.7%	2.0%	8.1%	1.2%	1.7%	3.3%
PAS	5.8%	5.5%	5.2%	5.1%	26.9%	9.3%	6.7%	5.3%	6.3%	6.5%	6.4%
ETH_AS	16.2%	16.4%	16.3%	16.4%	17.4%	20.5%	17.6%	18.3%	20.0%	17.9%	18.1%
AR_OTH	7.0%	8.3%	7.0%	7.2%	7.7%	11.2%	8.7%	7.7%	7.5%	8.2%	8.1%

Source: Australian Bureau of Statistics; Statistics New Zealand; authors' calculations.

Notes:

1. The industry abbreviations are: (1) AFF: Agriculture, forestry and fishing, (2) MIN: Mining, (3) MAN: Manufacturing, (4) EGW: Electricity, gas and water, (5) CON: Construction, (6) WLS: Wholesale, (7) RTA: Retail trade and accommodation, (8) TRAN: Transport, postal and warehousing, (9) IMT: Information media and telecommunications, (10) FIS: Financial and insurance services, (11) PST_ASS: Professional, scientific and technical services, administrative and support services, (12) PAS: Public administration and safety, (13) ETH_AS: Education, training, health care, social assistance and (14) AR_OTH: Arts, recreation and other services.

Regional business cycles

As discussed above, it not clear from theory whether economic integration will lead to a greater degree of business cycle synchronisation since integration can lead to greater differences in industry structure through increased specialisation. Decomposing regional cycles into an 'industry structure' and 'industry cycle' components enables us to investigate whether differences in regional cycles are driven by differences in industry structure or differences in industry cycles among regions.

For each region, total regional employment ($E_{i,total}$) is the sum of 14 industrial employment series (E_{ij}), described above:

$$E_{i,total} = \sum_{j=1}^{14} E_{ij} \quad (2)$$

Similarly, the total regional employment trend ($T_{i,total}$) is calculated as the sum of regional industrial trends ($T_{i,j}$) estimated using a Hodrick-Prescott filter (lambda=1600).

$$T_{i,total} = \sum_{j=1}^{14} T_{ij} \quad (3)$$

Then, the total regional business cycle (or employment gap), $G_{i,total}$, is calculated by:

$$G_{i,total} = {E_{i,total}}/{T_{i,total}}$$

$$= {\left(\sum_{j=1}^{14} E_{ij}\right)}/{T_{i,total}}$$

$$= \sum_{j=1}^{14}\left(\frac{E_{ij}}{T_{ij}} \times \frac{T_{ij}}{T_{i,total}}\right)$$

$$= \sum_{j=1}^{14}\left(G_{ij} \times S_{ij}\right) \quad (4)$$

Equation (4) shows that the total regional employment cycle is the sum of industrial employment cycles weighted by each industry's trend share in its region.

Idiosyncratic cycles, cyclical discrepancies between the region and Australasia, can be obtained by $G_{i,total} - G_{ANZ,total}$:

$$G_{i,total} - G_{i,ANZ} = \left\{\sum_{j=1}^{14}\left(S_{ij} - S_{ANZ,j}\right)\left[\frac{G_{ij}+G_{ANZ,j}}{2}\right] + \sum_{j=1}^{14}\left(G_{ij} - G_{ANZ,j}\right)\left[\frac{S_{ij}+S_{ANZ,j}}{2}\right]\right\} \quad (5)$$

In equation (5), the idiosyncratic cycle can be decomposed into an "industry structure effect" (first term) and an "industry cycle effect" (second term). The industry structure effect is the sum of differences between regional industrial share weighted by the average industry cycles in the region and Australasia. The industry cycle effect is the sum of the differences between the regional cycles (or employment gaps) and the Australasian cycle weighted by the average industrial shares in a region and Australasia.

The first column of Table A.3 shows the standard deviation of each region's idiosyncratic cycle ($G_{i,total} - G_{ANZ,total}$), which indicates which regions may have the largest industry structure and/or industry cycle effects. New South Wales, Queensland, Victoria, South Australia and New Zealand each have a regional employment gap that is within 1% of the overall Australasian cycle. Western Australia is moderately close to the Australasian cycle, with Tasmania and ACT a little more different. NT is a clear outlier. Using a similar technique and data from 1985Q2 to 20002Q4, Grimes (2005) found that the five big regions (NSW, Victoria, Queensland, South Australia, Western Australia) differed by less than 1% from the Australasian cycle and New Zealand differed by about 1.4%. Our results suggest a greater similarity between New Zealand and Australasia, perhaps due to the different time periods investigated – data from 1985 to 2002 may have been more heavily influenced by differences in timing in Australia and New Zealand's economic reforms.

The industry cycle and idiocyncratic cycle are highly correlated and similarly deviated in most regions, except for ACT and NT, which have larger differences in industrial structure. In other words, the cyclical discrepancies are mainly due to differences in industry cycle effect and very little is due to difference in industry structure effects (Table A.3 & Figure A.2). This suggests that the highly correlated regional business cycles in Australasia indicates a high degree of economic integration.[25]

[25] Hall & McDermott (2012) find a larger region cycle deviation for Western Australia using GDP data without identifying idiosyncratic and industry effects separately. Our more modest idiosyncratic cycle deviation for Western Australia may be due to the use of employment data rather than GDP data.

Table A.3 Differences between regional and Australasian employment cycles, 1990Q2 - 2011Q4

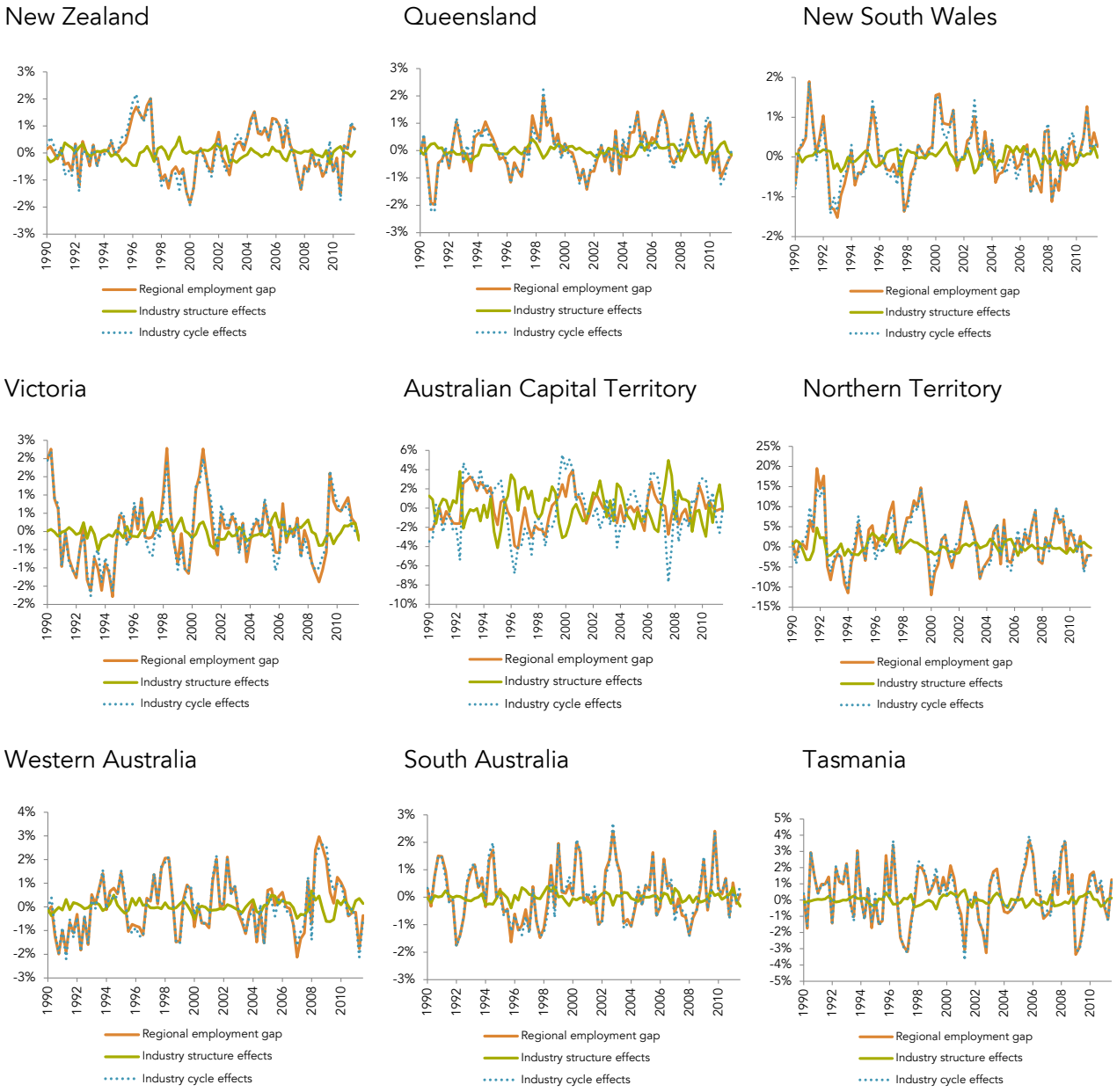
	(1) Idiosyncratic cycle std dev (%)	(2) Industry structure effect std dev (%)	(3) Industry cycle effect std dev (%)	(4) Correlation coefficient between idiosyncratic cycle and industry structure effect	(5) Correlation coefficient between idiosyncratic cycle and industry cycle effect
NZ	0.81	0.2	0.87	-0.21	0.97
Queensland	0.75	0.18	0.77	0.00	0.97
New South Wales	0.69	0.18	0.67	0.19	0.97
Victoria	0.89	0.21	0.86	0.25	0.97
ACT	1.7	1.73	2.78	-0.31	0.81
Northern Territories	6.08	1.51	5.56	0.45	0.97
Western Australia	1.14	0.25	1.14	0.08	0.98
South Australia	0.96	0.17	0.98	-0.06	0.99
Tasmania	1.65	0.26	1.68	-0.05	0.99

Source: Australian Bureau of Statistics; Statistics New Zealand; authors' calculations

Notes:

1. Columns (1), (2), and (3) show standard deviations from cyclical averages.
2. Columns (4) and (5) are Pearson linear correlations.

Figure A.2 Business cycle decomposition: idiosyncratic cycle, industry structure effect and industry cycle effect, % deviation from Australasian employment cycles



Source: Australian Bureau of Statistics; Statistics New Zealand; authors' calculations

Notes:

1. Vertical axes represent the percentage deviation from Australasian business cycle.
2. Black, blue and red lines represent idiosyncratic cycle, industry cycle effect and industry structure effect respectively.

Appendix B Description of data for co-movement of price convergence

This appendix provides details of the data sources and issues for the analysis of co-movement of price convergence.

CPI time series data for different categories of goods and services are available from the Australian Bureau of Statistics and Statistics New Zealand. However, there are a few issues with matching Australian and New Zealand data sources

Changes in data availability: Most of the detailed CPI goods and services series for New Zealand are available for a relatively short time period compared with Australia – most New Zealand series start in 1999, whereas Australia's go back to the mid-1980s. In order to extend the analysis to a longer time period, we backcast New Zealand's CPI data by matching similar discontinued Statistics New Zealand CPI series and extrapolating back to 1993Q4. For example, the 'bread and cereals' CPI series is backcasted using price movements from the 'cereals and cereal products' series.

1. **Matching data between Australia and New Zealand:** Although both official statistics agents use similar sample designs and methodologies, this does not guarantee that a one-to-one match is always achievable. Some goods and services are excluded from the analysis because there is no obvious match – 12% of items for Australia and 15% for New Zealand. In addition, some categories are aggregated in order to achieve a match; for example, 'beef and veal', 'lamb and mutton', 'pork' and 'poultry' in New Zealand are aggregated in order to match these to the 'meat and poultry' category in Australia. In addition, a potential caveat is that the same category may not mean the same in both countries; for example, each country may measure prices of 'fruit' differently in terms of quantity, quality and fruit species.

2. **GST:** GST was introduced in Australia in 2000 and the rate of GST was increased from 12.5% to 15% in New Zealand in 2010. GST affects difference CPI categories differently, but they contribute about 4% for Australia and 2.2% for New Zealand. All categories are deflated by these numbers to adjust for the GST price increase effect.

3. **CPI expenditure weights:** CPI expenditure weights are regularly updated from household expenditure surveys and CPI basket reviews. Therefore, weights are expected to change only gradually. In the analysis, weights are held constant at the latest available weights to simplify the calculations.

Table B.1 CPI expenditure weights of goods and services in Australia and New Zealand, 2011

Category	CPI expenditure weights % in New Zealand	CPI expenditure weights % in Australia	Tradable or non-tradable
Bread and cereal products	2.1	1.7	Tradable
Meat and poultry	2.57	1.88	Tradable
Fish and other seafood	0.46	0.41	Tradable
Milk cheese and eggs	1.91	0.87	Tradable
Fruit	1.01	1.6	Tradable
Vegetables	1.46	1.34	Tradable
Food additives and condiments	0.54	0.3	Tradable

Oils and fats	0.35	0.17	Tradable
Snacks and confectionery	1.68	0.97	Tradable
Other grocery food	0.62	0.47	Tradable
Coffee, tea and cocoa	0.38	0.27	Tradable
Waters, soft drinks and juices	1.74	0.87	Tradable
Restaurant meals	1.45	2.81	Non-tradable
Ready-to-eat food	2.51	2.62	Non-tradable
Spirits	1.32	0.91	Tradable
Wine	1.48	1.64	Tradable
Beer	1.98	2.2	Non-tradable
Tobacco	2.13	2.32	Non-tradable
Clothing	3.27	2.52	Tradable
Footwear	0.84	0.61	Tradable
Rents	8.78	6.71	Non-tradable
Purchase of new housing	4.01	8.67	Non-tradable
Property maintenance and rates	3.57	3.31	Non-tradable
Utilities	4.45	3.61	Non-tradable
Furniture and furnishings	1.37	1.91	Tradable
Household textiles	0.42	0.61	Tradable
Household appliances, utensils and tools	1.74	1.43	Tradable
Non-durable household products	0.66	2.86	Tradable
Domestic and household services	0.18	2.29	Non-tradable
Medical products, appliances and equipment	1	1.32	Non-tradable
Medical and hospital services	3.17	3.42	Non-tradable
Dental services	0.95	0.56	Non-tradable
Motor vehicles	3.18	3.25	Tradable
Vehicle parts and accessories	0.58	0.99	Tradable
Automotive fuel	5.27	3.55	Tradable
Maintenance and repair of motor vehicles	1.79	1.67	Non-tradable
Other services in respect of motor vehicles	1.32	1.35	Non-tradable
Urban transport fares	0.51	0.74	Non-tradable
Postal services	0.17	0.12	Non-tradable
Telecommunication equipment and services	3.36	2.93	Non-tradable
Audio, visual and computing equipment and services	1.51	2.53	Tradable
Books	0.39	0.4	Tradable
Newspapers, magazines and stationery	0.56	0.68	Non-tradable
Other recreations	1.51	1.77	Non-tradable
Veterinary	0.19	0.4	Non-tradable

Education	1.84	3.18	Non-tradable
Insurance	1.97	1.4	Non-tradable
Total	**84.25**	**88.14**	

Source: Australian Bureau of Statistics; Statistics New Zealand

Table B.2 Pairwise correlations of annual tradable inflation between eight Australian cities and New Zealand, 1999Q2 - 2011Q4

Pearson linear correlation	Sydney	Melbourne	Brisbane	Adelaide	Perth	Hobart	Darwin	Canberra	Australia	New Zealand
Sydney		0.922	0.881	0.901	0.78	0.838	0.78	0.882	0.966	0.554
Melbourne			0.919	0.926	0.829	0.831	0.789	0.887	0.977	0.588
Brisbane				0.903	0.831	0.814	0.762	0.861	0.946	0.544
Adelaide					0.84	0.868	0.766	0.842	0.951	0.58
Perth						0.804	0.731	0.836	0.874	0.561
Hobart							0.763	0.83	0.875	0.599
Darwin								0.806	0.818	0.579
Canberra									0.921	0.635
Australia										0.604

Table B.3 Pairwise correlations of annual non-tradable inflation between eight Australian cities and New Zealand, 1999Q2 – 2011Q4

Pearson linear correlation	Sydney	Melbourne	Brisbane	Adelaide	Perth	Hobart	Darwin	Canberra	Australia	New Zealand
Sydney		0.692	0.719	0.750	0.613	0.651	0.326	0.703	0.921	0.187
Melbourne			0.601	0.736	0.470	0.515	0.042	0.563	0.867	0.079
Brisbane				0.705	0.644	0.696	0.382	0.725	0.822	0.472
Adelaide					0.557	0.747	0.199	0.746	0.856	0.196
Perth						0.516	0.382	0.575	0.711	0.344
Hobart							0.251	0.674	0.712	0.315
Darwin								0.334	0.297	0.381
Canberra									0.772	0.354
Australia										0.266

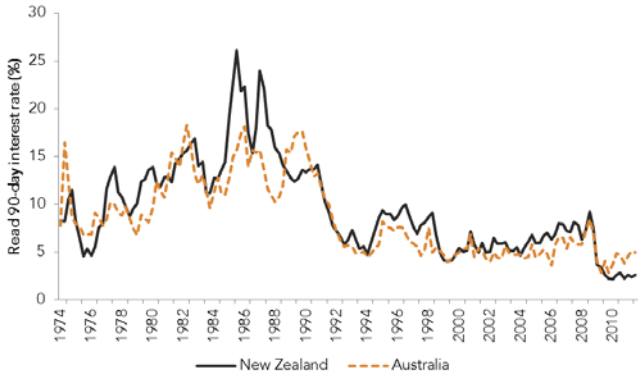
Source: Australian Bureau of Statistics; Statistics New Zealand

Appendix C Real interest rate parity model

This appendix outlines the real interest rate parity model, similar to Moosa & Bhatti (1995), used to measure the degree of market integration between New Zealand and Australia before and after the implementation of CER.

The quarterly real interest rates (Figure C.1) in New Zealand and Australia cover June quarter 1974Q2 to 2011Q4. The period 1974-1982 is the pre-CER period, while the period 1983-2011 is the post-CER period. In the model, we regress New Zealand's real interest rates on Australia's under the co-integration framework. In addition, we relax the assumption of constant coefficients by using a rolling six-year moving window. This analysis indicates whether the degree of bilateral market integration has been increasing over time.

Figure C.1 Real interest rates in Australia and New Zealand , 1974Q2 – 2011Q4



Source: OECD; Australian Bureau of Statistics; Statistics New Zealand

Notes:

1. Real interest rates are calculated using the 90-day rate (sourced from the OECD) and producer price index (sourced from Australian Bureau of Statistics and Statistics New Zealand).

The co-integration regression is done in three steps. First, unit root and co-integration tests are undertaken. This is followed by regression modelling and the detection of structural breaks. Both Australian and New Zealand real interest rates contain one unit root (first column in Table C.1) and co-integration tests are statistically significant (first column in Table C.2).

Table C.1 Test statistics for Dickey-Fuller & Phillips-Perron unit root tests

Dickey-Fuller test	1974Q2 - 2011Q4	1974Q2 - 1982Q3	1982Q4 - 1988Q3	1988Q4 - 2011Q4
Australia	-1.653	-0.476	-0.521	-1.757*
New Zealand	-1.181	-1.099	-0.521	-1.755*
Phillips-Perron test	**1974Q2 - 2011Q4**	**1974Q2 - 1982Q3**	**1982Q4 - 1988Q3**	**1988Q4 - 2011Q4**
Australia	-3.27*	-1.80	-1.93	-2.04
New Zealand	-2.76	-2.46	-1.94	-2.73

Notes:

1. The null hypothesis of the Dickey-Fuller & Phillips-Perron unit root test is the series is non-stationary.
2. Stars denote significance levels of: p<=1% ***, p<=5% **, p<=10% *.

Table C.2 Test statistics for Dickey-Fuller & Phillips-Perron co-integration tests

	1974Q2 - 2011Q4	1974Q2 - 1982Q3	1982Q4 - 1988Q3	1988Q4 - 2011Q4
Dickey-Fuller test	-5.6***	-3.22***	-1.98*	-2.61**
Phillips-Perron test	-48.55***	-14.03	-12.03	-21.37**

Notes:

1. The null hypothesis is no co-integration between Australian and New Zealand real interest rate series.
2. Stars denote significance levels of: p<=1% ***, p<=5% **, p<=10% *.

In step 2), the co-integration regression is specified by the Prais-Winsten estimation (Prais & Winsten, 1954):

$$(\sqrt{1-\rho^2})y_t = b_0\sqrt{1-\rho^2} + b_1(\sqrt{1-\rho^2}x_t) + \sqrt{1-\rho^2}\varepsilon_t \quad (1)$$

Where x and y are real interest rates in New Zealand and Australia respectively; ρ is the first order serial correlation and ε_t is a residual. b_0 and b_1 are the intercept and the slope respectively.

Table C.3 Prais-Winsten estimates

Coefficient estimates	1974Q2 - 2011Q4	1974Q2 - 1982Q3	1982Q4 - 1988Q3	1988Q4 - 2011Q4
b_0	4.39***	8.964***	5.244***	2.969***
b_1	0.588***	0.173***	0.894***	0.634***
ρ	0.729***	0.675***	0.579***	0.726***

Notes:

1. Stars denote significance levels of: p<=1% ***, p<=5% **, p<=10% *

Prais-Winsten estimation is a procedure that accounts for first-order serial correlation in a linear model. This estimation will return unbiased and efficient estimates if serial correlation is present. We estimate that ρ is statistically significant at 0.729 (first column in Table C.3), and Prais-Winten stabilises coefficient estimates by eliminating distortions from serial correlations.

The intercept and the slope, b_0 and b_1, provide indications of the strength of market integration. The closer the intercept is to zero and the slope is to one, the greater the degree of market integration. Through the entire sample period, the strength of market integration between Australia and New Zealand is moderate, with estimated intercept and slope of 4.39 and 0.588 respectively (Table C.3). However, market integration is evolving over time. The detection of structural breaks using the Bai & Perron (2003) algorithm[26] suggests there are two major break points, 1982Q3 and 1988Q3 respectively, with 95% confident intervals on 1975Q1 – 1986Q4 and 1988Q1-1992Q4. The first break point, 1975Q1-1986Q4, is likely associated with the Closer Economic Relations Trade Agreement (CER) between Australia and New Zealand in March 1983. The second break point, 1988Q1-1992Q4, may be associated by a combined effect from the implementation of floating exchange rate in New Zealand dollar in March 1985 and New Zealand's monetary policy framework laid out in the Reserve Bank Act 1989. They have significant impact on the co-integration relationship, so co-integration regression should be analysed separately in three discontinuous time segments, 1974Q2-1982Q3, 1982Q4-1988Q3 and 1988Q4-2011Q4.

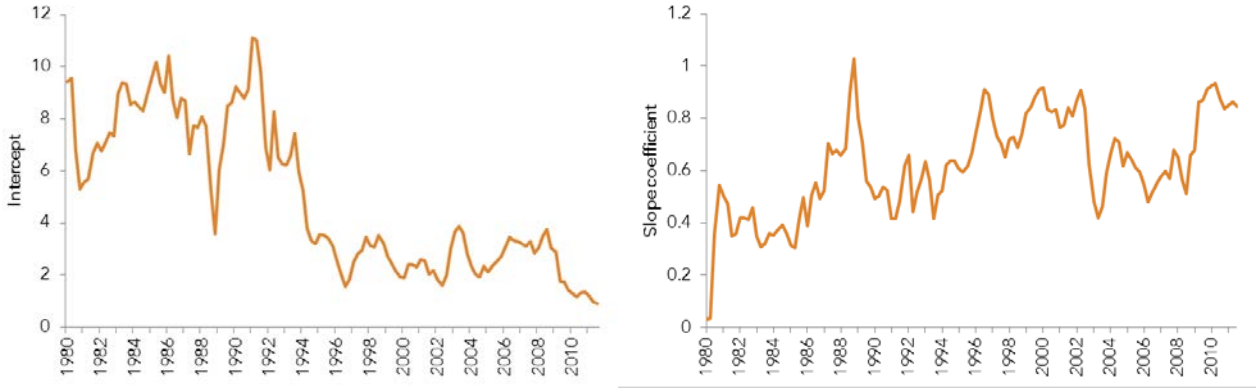
[26] Under the Bai & Perron's algothrim, method of recursive cumulative sums of standardised residuals and the minimal segment size of series=24 quarters are employed.

During 1975Q2-1982Q3 and 1982Q4-1988Q3, co-integration relationship is inconclusive. Co-integration tests (Table C.2) have no consistent results to support the presence of co-integration that indicates weak or spurious co-integration relationship.[27] Regression results show market integration improves after CER as the slope coefficient increases (0.173 to 0.894) and the intercept decreases (8.964 to 5.244).

For the period of 1988Q4-2011Q4, co-integration is stable and strong (Table C.2). Market integration improves further, with the intercept dropping from 5.244 to 2.969.

It appears that CER and the combination of the implementation of floating exchange rate in New Zealand dollars and monetary policy have strengthened Australasian market integration over time, with the intercept moving towards zero and the slope coefficient towards one (Figure C.2). Therefore, increasing co-movements of real interest rates between Australia and New Zealand suggest greater integration over time.

Figure C.2 Real interest rate co-integration: time-varying intercept and slope estimates , 6-year moving window



Notes:

1. The grey dashed lines represent the average over the entire time period.
2. The 6-year rolling window correlation at quarter t is estimated using the most recent 6-years of quarterly data (ie, from quarter t-24 to quarter t).

[27] If co-integration is either weak or spurious, coefficient estimates are likely to be unstable or biased.