Reserve Bank of New Zealand
Analytical Notes

Structural adjustment in New Zealand since the commodity boom

AN 2014/2

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April 2014

Reserve Bank of New Zealand Analytical Note series
ISSN 2230-5505

Reserve Bank of New Zealand
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NEW ZEALAND

www.rbnz.govt.nz

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TE PŪTEA MATUA

Non-technical summary[1]

After being fairly stable for 15 years or so, New Zealand's terms of trade (the prices of the goods and services we export relative to the prices of goods and services that we import) have risen by about 30 percent since the commodity boom started around 2003/04. Changes of this magnitude in the terms of trade are a substantial change for the economy: boosting incomes, but also changing relative returns across different sectors of the economy. This note looks at what the implications of the increase in the terms of trade have been.

Higher terms of trade boost national income. They also allow more consumption than previously, and allow the economy to devote fewer real resources than otherwise to producing tradables, especially from those parts of the sector where real global prices have not risen. A higher exchange rate distributes some of the improvement in purchasing power quite quickly to consumers as imported goods and services become cheaper, and encourages resources to move out of some segments of the tradable sector. That can be a helpful part of the adjustment if the terms of trade improvement is long-lasting.

Over the recent decade, the appreciation of the exchange rate has meant that average real New Zealand dollar export commodity prices have been only modestly higher than they were in previous years. The international price of dairy products has risen more than the offsetting impact of the stronger exchange rate. But exporters of other commodities have not been so fortunate, and non-commodity exporters have generally seen their real New Zealand dollar export prices fall.

Overall, the bulk of the income gains have gone to dairy producers, consumers, and to non-tradable firms using imports as intermediate inputs (and to firms supplying them). Increased national income has boosted demand across the economy, with the net effect on activity tending to be strongest in the services sector since large parts of that sector do not face direct foreign competition.

The manufacturing sector's share of output and employment has continued to fall, and over the last decade neither agriculture nor manufacturing have recorded any growth in real GDP (although real incomes of dairy farmers have grown). Non-commodity exports have shown much more modest growth than in earlier periods. There is little evidence that agricultural commodity-related sectors themselves have been putting upward pressure on economy-wide wages, or that there has been a sustained boom in commodity-related investment. However, there appears to have been considerable reallocation of resources within the agricultural sector, through the conversion of forestry land and sheep farms to dairy production. Although overall productivity growth has slowed since 2004 (here and abroad), the observed structural shifts of resources within the economy associated with the higher terms of trade do not themselves appear to have had a clear adverse effect on aggregate productivity growth.

[1] I would like to thank Dean Ford, Michael Reddell and Richard Sullivan for comments and suggestions.

1 Introduction

This note describes the nature of the structural changes and relative price shifts that have occurred in the New Zealand economy since the considerable lift in the terms of trade from around 2003/04. The lift in the terms of trade has been the largest and longest New Zealand has experienced for many decades, and can be expected to have had considerable implications for how the economy has performed. The extent of New Zealand's terms of trade improvement mainly reflects the rise in the global prices of New Zealand's traditional agricultural export commodities. There is a large international literature on commodity booms, although New Zealand's situation is different from what is considered in much of the recent literature on advanced country experience, much of which is focused on oil and mineral experiences in countries such as Australia, Chile, and Norway. In New Zealand, few new resources have been discovered or developed. Rather the world has been willing to to pay more for the (renewable) products of New Zealand's highly productive agricultural sector.[2]

This note looks at some of the specifics of New Zealand's experience so far. The lift in the terms of trade has continued even over the last year or so, and many key data emerge only slowly, and are subject to revision. A full and final assessment of the implications of the commodity boom may not be possible for many years, but the changes in relative prices and incomes are large enough that it is important to attempt an assessment with the data we have to hand, provisional as some of it inevitably must be.

2 The theoretical impact of a commodity boom

When thinking about the macroeconomic effects of a commodity boom, it is useful to differentiate between the impact on three different stylised markets, two in the 'tradable' sector (one booming commodity sector and one lagging non-commodity sector) and one the 'non-tradable' sector (as in Corden and Neary (1982)). In an open economy, tradables producers typically face prices set in world markets. Producers of non-tradables, on the other hand, tend to face little direct international competition (additional demand for non-tradables generally cannot be met from abroad) and hence real prices in this sector respond primarily to domestic real resource pressures.

The price of non-tradables relative to the price of tradables is one way of thinking about the real exchange rate. Selling prices for tradables are set in world markets, so an increase in the price of non-tradables relative to the price of tradables undermines the relative attractiveness of production in the tradables sector, all else equal. For a commodity exporting country, higher commodity prices (and therefore higher terms of trade), tend to be associated with a higher real exchange rate: prices of non-tradables rise relative to those

[2] Unlike 'hard' commodities, New Zealand's agricultural commodity exports are not exhaustible resources. As such, output could expand to meet sustained growth in foreign demand, subject to constraints of land availability and potential productivity improvements.

of tradables. Under a fixed exchange rate, the price of non-tradable goods relative to tradables tends to gradually re-align via higher domestic inflation brought on by increased income and spending made possible by the higher terms of trade. With a floating exchange rate on the other hand, the nominal exchange rate tends to do most of the adjustment, often quite quickly, making tradable goods relatively cheaper.[3] A flexible currency may therefore provide more immediate signals of relative price changes, which could promote faster shifts of resources across sectors. This process is largely symmetric, as the exchange rate tends to depreciate quite quickly (and act as a useful buffer for commodity sub-sectors) when commodity prices fall. These signals are likely to be helpful if the terms of trade change is long-lasting. But a flexible exchange rate may introduce additional variability in the profit signals faced by producers in various sectors if terms of trade changes prove surprisingly short-lived.

Assessing the economic impact of an improvement in the terms of trade is less straightforward than it might seem, once the exchange rate reaction is taken into account.

Stronger export commodity prices boost aggregate income and purchasing power. But the extent of the nominal exchange rate appreciation will affect how the immediate income gains are distributed between commodity producers and consumers.

A stronger exchange rate improves the purchasing power of households and firms by reducing the cost of imports. Commodity exporting sectors tend to benefit from higher commodity prices, although the domestic currency returns they receive depend on the extent of any resultant exchange rate appreciation. But the international competitiveness of non-commodity exporting sectors and import-competing industries, which have not experienced increases in global prices, suffers.

How long firms and households in general expect the improvement in commodity prices to last will also have an important bearing on their reactions. The more permanent the higher terms of trade are expected to be, the more agents would tend to change their spending behaviour. Expectations that the improvement is temporary would tend to see a higher private saving rate as households smooth consumption, perhaps offset by some opportunistic purchases of imported tradables.

Higher real domestic currency commodity prices (i.e. higher returns to firms operating in these sectors) can stimulate output and employment in commodity-related sectors, intensifying competition with other domestic sectors for land, capital and labour (commonly known as *resource movement effects*). The resultant cost increases would tend to reduce profitability in all tradable sectors (since competition keeps tradable prices aligned globally in common currency terms), causing employment and output in non-commodity tradable sectors to fall.[4] Prices of non-tradables would also be expected to rise.

[3] The nominal exchange rate may appreciate, for example, via increased demand for domestic currency because of developments in the commodity sector or market participants may anticipate income effects and consequent demand pressures and expect monetary policy tightening. Exchange rate changes take longer to pass through to consumer prices (see Parker (2014) for a recent discussion).

[4] This is subject to whether prices are set in domestic currency or in the currency of foreign buyers, but will typically be true for commodities and also true more generally over the longer term.

The boost to incomes, profits and related wealth effects originating in the booming sector will also raise aggregate demand (often referred to as *spending effects*). Some of the additional aggregate demand will be met through higher imports, and some portion of the higher incomes from commodity exporting activities will be spent on non-tradable goods. The latter improves profitability in the non-traded sector, making production in that sector relatively more attractive. That causes the sector's output and employment to expand, drawing in labour and capital from other sectors, particularly the non-commodity tradable sector. Higher relative non-traded prices and (to the extent that they are observed) higher economy-wide wages will also reinforce the appreciation of the real exchange rate described earlier.

Together, increased competition for factors of production and higher spending on non-tradables would be expected to cause non-commodity manufacturing production, employment and exports to contract compared to the pre-commodity boom baseline. The impact on the non-traded sector and the extent of the rise of real wages, however, depend on whether the resource movement or the spending effect dominates. The resource movement effect causes both non-tradable and non-booming manufacturing to shed labour and experience reduced profitability, while the spending effect tends to support the non-tradable sector.

In general, the resource movement effect will be stronger, and real wages will rise by more outside the commodity sector if labour and capital are very mobile (and substitutable) between sectors, if the boom sector is a major employer, if the sector competes with other sectors for capital, or if the economy is close to full capacity.

The strength of the spending effect will depend on the mix of consumption. The higher the share of non-tradables in consumption (or the greater the substitution from domestically produced goods to imported goods that have become cheaper in comparison), the more pronounced the spending effect will be. The spending effect will also be weaker if the booming sector has substantial foreign direct investment, and the sector's profits are repatriated to overseas owners.

Regardless of how the exchange rate reacts, stronger real world export commodity prices (i.e. people abroad paying more for a country's exports) provide an income boost to the aggregate economy. Whether the non-commodity tradable sector expands or contracts following a commodity boom depends on the structure of the specific economy and the nature of impacts of the commodity boom. For example, increased commodity production might support some non-commodity tradable sectors or high productivity service sectors (such as bio-technology or engineering industries) that provide intermediate inputs. Likewise, there could be offsetting effects from reduced borrowing costs from an increase in the country's wealth and therefore more available collateral.

The sections that follow consider how New Zealand's structural characteristics and the nature of New Zealand's commodity boom have affected the economy's adjustment to higher commodity prices over the last decade for so.

3 Recent adjustments during the commodity boom

3.1 Real exchange rate appreciation

The current terms of trade are around 30 percent higher than at the end of 2003, averaging almost 20 percent above the levels between 1990 and 2003 (Figure 1). On the one hand, this has reflected declining real New Zealand import prices over the last two decades (Figure 2). This has been a common trend in a range of advanced economies as a consequence of the expansion of low cost manufacturing in East Asia.[5] But New Zealand's terms of trade have risen while those of most advanced economies have not. What makes New Zealand (and Canada, Norway and Australia) different has been a strong increase in commodity export prices since around 2003/04.[6] Global dairy prices, for example, have doubled in real terms since 2000 (Figure 3).[7]

While real commodity prices have risen significantly in world terms, this has been accompanied by a significant appreciation of the exchange rate. The real exchange rate has appreciated by around 20 percent since the start of the commodity boom. Its average level since 2004 is also almost 20 percent higher than on its average level between 1990 and 2003.[8]

As a result, export prices have risen much less in real New Zealand dollar terms (Figure 4). While real New Zealand dairy prices have been higher since 2004 than the average for 1990 to 2003, real prices of New Zealand's commodity export products as a whole have been close to flat over the period since 1990. Nevertheless, the roughly 30 percent improvement in New Zealand's terms of trade since the end of 2003 has provided a considerable boost to national income and purchasing power, equivalent to around 9 percent (given New Zealand's export share of GDP of around 30 percent).

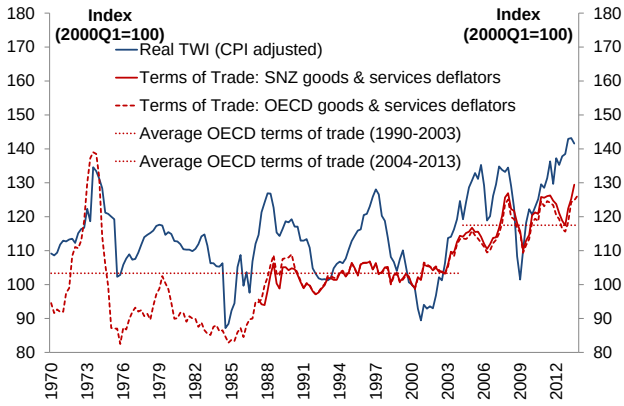
[5] Figures 2 and 4 are deflated using the New Zealand private consumption deflator, while the IMF advanced economy consumer prices is used in Figure 3.

[6] Although the terms of trade and commodity prices and the terms of trade rose strongly in late 2003, the commodity boom is taken to start in 2004 in this note as annual data is used for some of the analysis.

[7] The ANZ Commodity Price Index in Figures 3 and 4 is used as it is representative of New Zealand's bundle of exports.

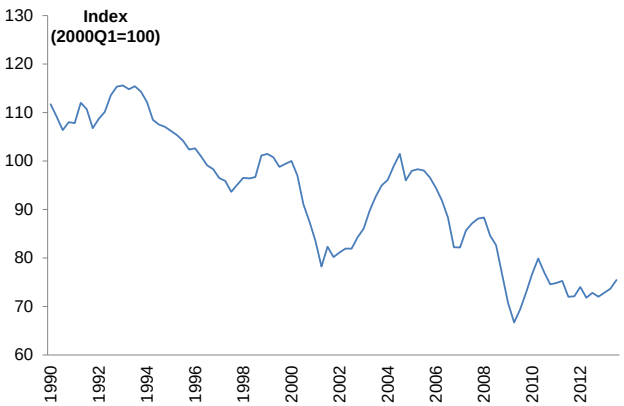
[8] Many different measures of the real exchange rate could be used, but these would all show a significant appreciation over this period.

Figure 1: Terms of trade and real exchange rate



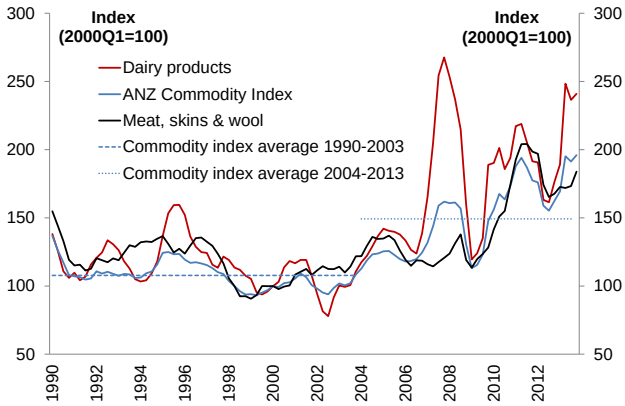
Source: OECD, RBNZ, Statistics New Zealand

Figure 2: Real import prices (goods and services, NZD)



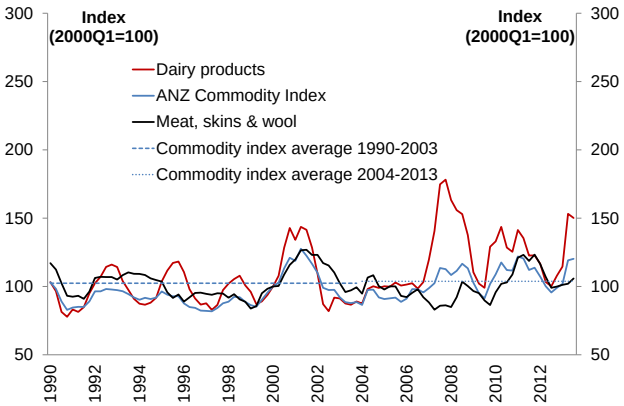
Source: OECD, Statistics New Zealand, author's calculations

Figure 3: Real commodity prices (world prices)



Source: ANZ Banking Group, IMF, Statistics New Zealand, author's calculations

Figure 4: Real commodity prices (NZD prices)



Source: ANZ Banking Group, Statistics New Zealand, author's calculations

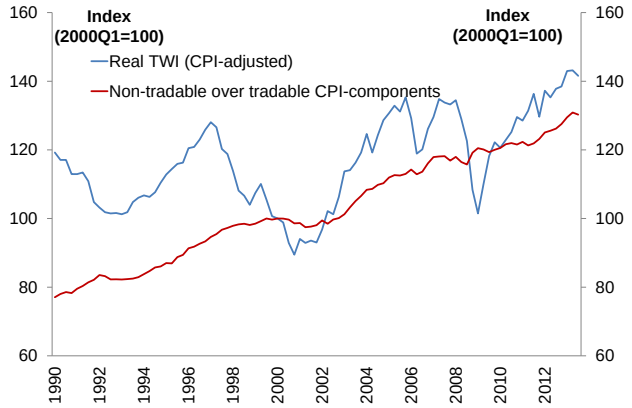
A variety of factors is likely to have contributed to the higher exchange rate, but in many models a large part of the appreciation can be explained by increases in export commodity prices (see McDonald (2012) for example). Likewise, several studies have demonstrated that the New Zealand dollar is a 'commodity currency', with expectations of higher commodity prices (for which we have few accurate measures) tending to get capitalised into the exchange rate (see Rogoff and Chen (2002) or Cashin et al. (2004)).[9] Despite the strong relationship between commodity prices and the exchange rate, several other factors tend to be important in explaining movements in the exchange rate, including indicators of the relative strength of the New Zealand business cycle (see McDonald (2012)). The drivers of the exchange rate can differ over time (see Cassino and Wallis (2010)). For example, between 1990 and 2003 the terms of trade were roughly flat, while the exchange rate went through big cycles, the correlation between the 'trade-weighted' exchange

[9] These papers show that commodity prices can help explain the volatility of the real exchange rates of countries with significant exposure to commodities, including New Zealand.

rate index (TWI) and world commodity prices was weak (see McCaw (2007)).[10]

Real exchange rate movements imply changes to relative prices. Non-tradable prices have continued to grow faster than tradable prices since the the terms of trade improvement since 2003/4 (see Figure 5). This reflected reduced tradable inflation from exchange rate appreciation, as well as higher non-tradable inflation driven by the boost to national income from higher commodity prices.

Figure 5: Ratio of non-tradable to tradable prices and the real exchange rate



Source: RBNZ, Statistics New Zealand

3.2 Continuing decline in the output share of non-commodity tradables

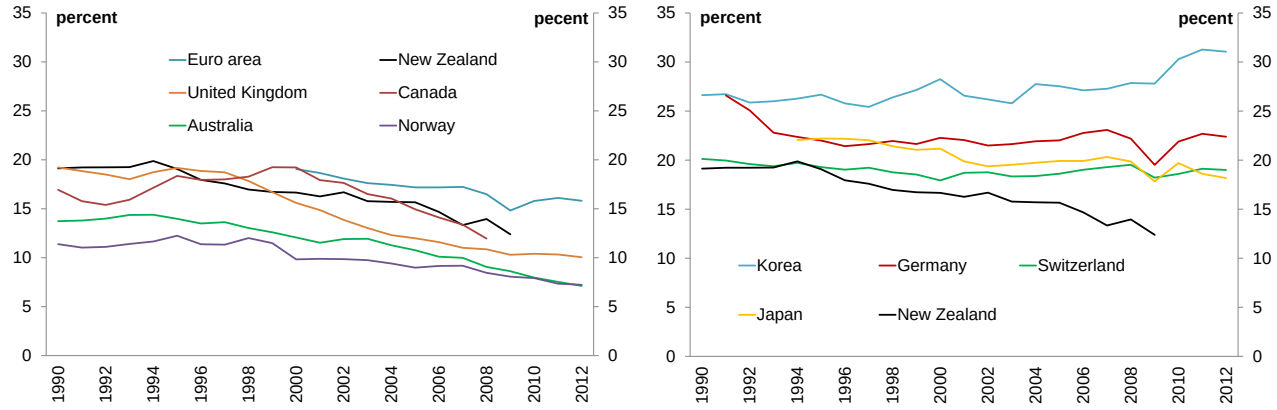
The primary sector represents only around 10 percent of total output and that share has remained relatively constant over the last two decades.[11] There are, however, some important linkages to other sectors, particularly to food-related manufacturing (see Appendix A for more detail), implying that higher commodity prices would provide some direct stimulus to other sectors of the economy, unless offset by exchange rate appreciation (as suggested in the previous section).

The single largest component of the tradables sector is manufacturing. Over the past decade or so, the size of the manufacturing sector as a share of GDP has declined. But this represents a continuation of an earlier trend, one which has been common across many developed economies (Figure 6).

[10] During the earlier part of that period, the US dollar was strong on expectations of high returns associated with the technology boom, and there were perceptions that New Zealand and Australia were 'old economies', rather than one of the 'new economies' where information technology-related sectors were expected to deliver accelerated productivity growth. Brash (2000) discusses several additional explanations.

[11] In this note, the primary sector refers to the agriculture, fishing, forestry and mining industries. Different data sources use different industry breakdowns, preventing clear distinctions to be made between commodity, non-commodity tradables and non-tradables sectors.

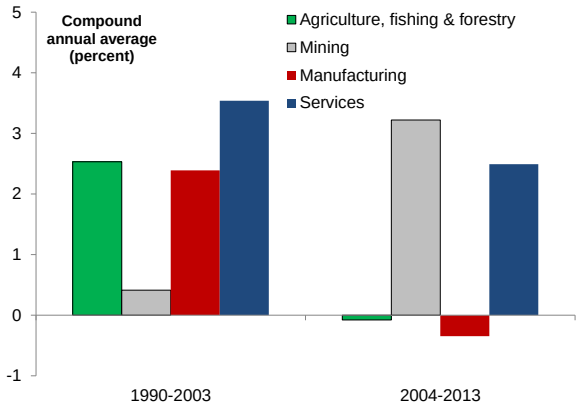
Figure 6: Manufacturing sector share in total economy gross value added (current prices, national currency)



Source: OECD Source: OECD

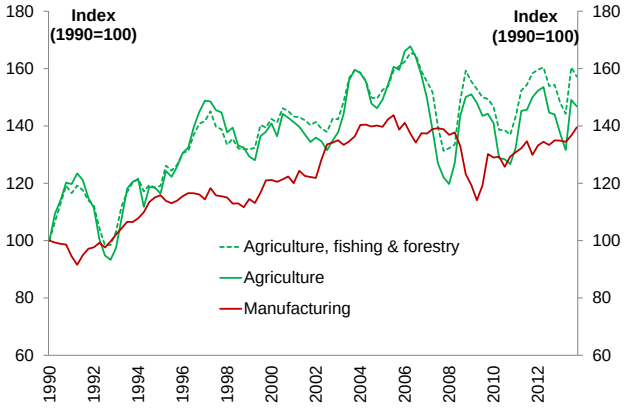
Real output in manufacturing has been largely flat since 2004 (see Figures 7 and 8). But this is true also in agriculture. The strong increase in real dairy prices has boosted national income and shifted agricultural resources from other uses to dairy, but appears not to have boosted overall agricultural sector production value-added. Mining (including oil) and service industries, on the other hand, experienced strong real GDP growth since 2004. In the dairy sector in particular, production processes appear to have become much more input-intensive (greater use of supplementary feed and irrigation) so that higher gross output (gross dairy output rose 35-40 per cent in the decade from the 2002/03 season) does not translate to similar growth in real value-added in that sector.

Figure 7: Real GDP growth by industry (calender years)



Source: Statistics New Zealand, author's calculations

Figure 8: Real GDP for selected industries



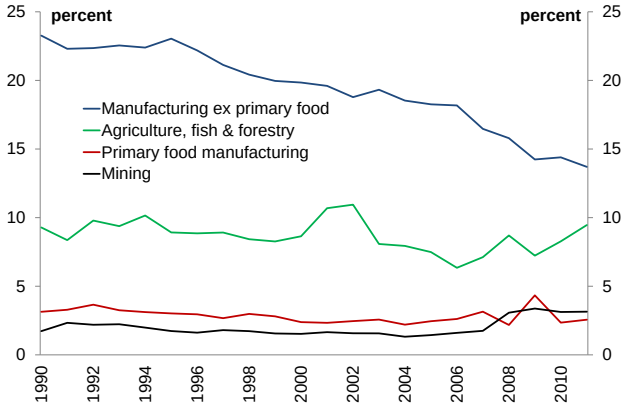
Source: Statistics New Zealand, author's calculations

The aggregate data can mask divergent trends in the output of primary food- and non-primary food manufacturing. While the overall share of manufacturing excluding primary food in market GDP has been on a downward trend since the mid-1990s, primary food manufacturing's share has held fairly steady since the early 2000s in both nominal and real terms (Figures 9 and 10).[12] In nominal terms, mining's contribution

[12]The jump in the value added series (Figure 10) in the early 2000s reflects the formation of Fonterra (a dairy co-operative formed from

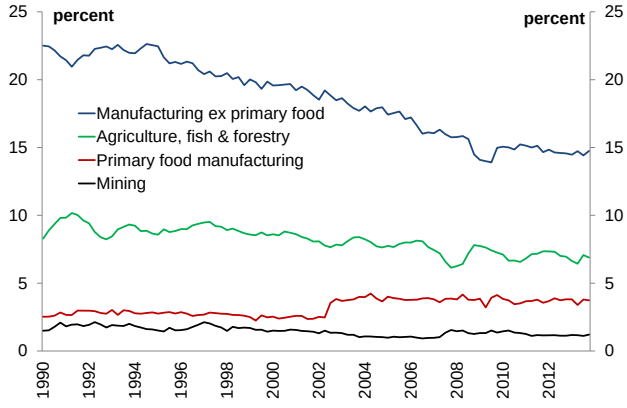
increased strongly in the second half of the 2000s, though from a low share. The share of agriculture in GDP has been relatively flat in nominal terms, although it has experienced some recent growth. But while the New Zealand agricultural sector has broadly maintained its share of total output, agriculture's share has been in decline in most advanced economies (Figure 11, data only available with a lag).[13]

Figure 9: Shares of nominal market economy GDP



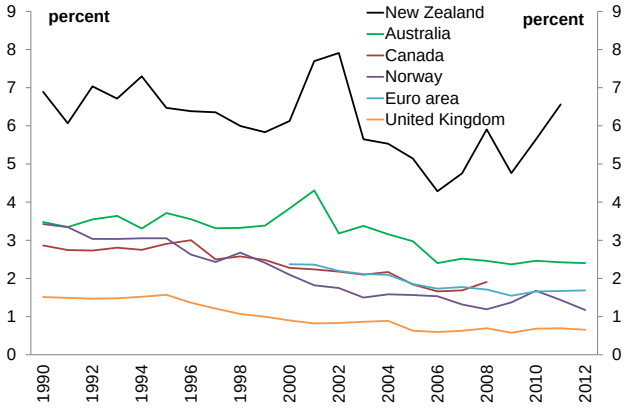
Source: RBNZ, Statistics New Zealand

Figure 10: Shares of real market economy GDP

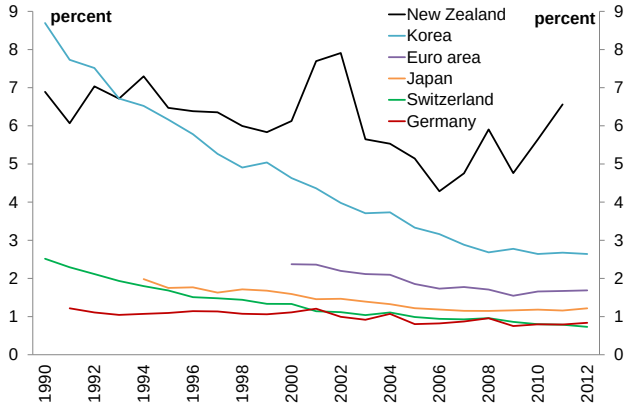


Source: RBNZ, Statistics New Zealand

Figure 11: Agricultural sector share in total economy gross value added (current prices, national currency)



Source: OECD, Statistics New Zealand



Source: OECD, Statistics New Zealand

Within the manufacturing sector, processing of primary products comprises the largest share of output. Food and beverage production represents around 35 percent of total manufacturing, about 60 percent of which is accounted for by meat and dairy products alone. Wood, petroleum, chemical, mineral and metal-related products make up another 50 percent or so of the manufacturing sector.

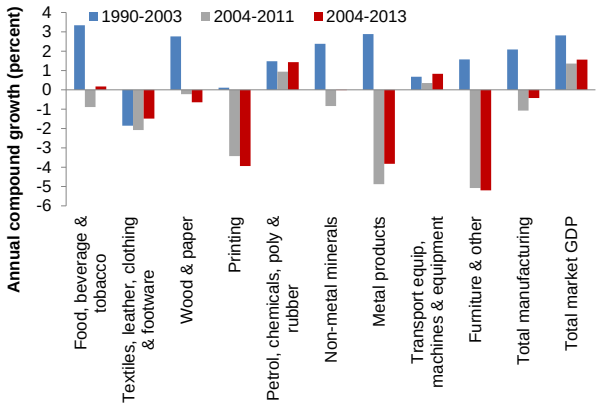
Figures 12 and 13 compare the annual growth rates of output in different sub-sectors of manufacturing between the 1990 and 2003 and the period since 2004 in volume and value terms (the nominal comparison

two major dairy production and processing co-operatives and the New Zealand Dairy Board, which had exported dairy products) which resulted in the reclassification of some wholesale sector output to the manufacturing sector.

[13] The New Zealand series is based on agriculture and forestry and logging, and fishing and aquaculture, while the other OECD figures are based on agriculture, forestry and fishing.

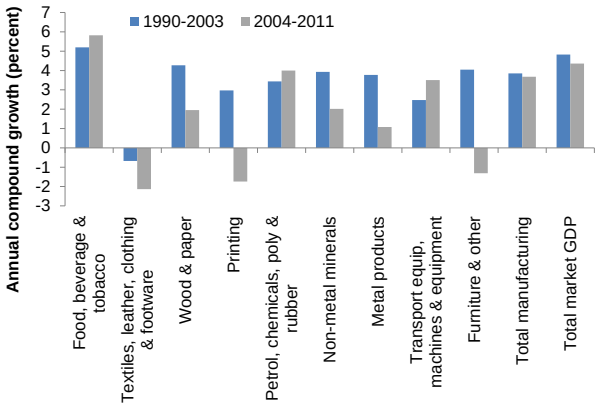
is only up to 2011 on account of data availability). The manufacturing sector grew slightly more slowly than the aggregate market economy in nominal terms over both periods. Since 2004, the manufacturing sector's output has fallen in real terms.

Figure 12: Real GDP growth by manufacturing sub-sector (March annuals)



Source: Statistics New Zealand, author's calculations

Figure 13: Nominal GDP growth by manufacturing sub-sector (March annuals)



Source: Statistics New Zealand, author's calculations

Food-related manufacturing performed strongly compared to the rest of the manufacturing sector and the economy in value terms, but even its output has been largely flat in volume terms since 2004 despite the increase in global food prices. Textiles, leather, clothing and footwear is the only sub-sector where output declined in both volume and value terms across both periods, no doubt in the earlier period partly related to the removal of formerly high protective barriers. Output also fell in both volume and value terms in other non-food manufacturing sectors such as printing and furniture and other manufacturing. Commodity-related manufacturing sectors such as petroleum, chemical, polymer and rubber product manufacturing and metal product manufacturing experienced stronger nominal growth on the back of higher commodity prices.

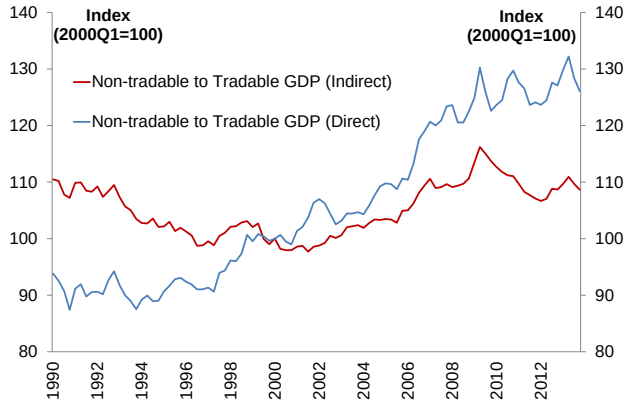
Differentiating between tradable and non-tradable sectors can be a useful way of thinking about how exchange rates and global developments might impact the domestic economy. But giving empirical form to such a breakdown has its complications. One of the problems using a simple categorisation of GDP into tradable and non-tradables is that both tradable and non-tradable products and services will include intermediate inputs from the other sector. Figure 14 plots two sets of measures: a narrow set based on the *direct* exposure of industries to international competition, and a broader set incorporating *indirect* exposure, that is, where industry outputs are used as intermediate inputs in products that are exported by other industries.[14] The divergence between the two classifications between 2005 and the GFC reflected the poor performance of the manufacturing sector, which represents around 70 percent of the tradable sector under the direct classification.[15] Since then, growth in the tradable and non-tradable sectors has been more even,

[14] Under the direct classification, tradables accounted for around 20 percent of GDP in 2010, compared to around 40 percent under the indirect classification (see Attewell and Crossan (2013)).

[15] It is important to remember that, as shown earlier in Figures 12 and 13, real measures will tend to suggest a weaker relative performance of tradable sectors than nominal measures during a period of rising terms of trade. The growing importance of services sector

reflecting the improved performance of agriculture, forestry, and fishing and mining (which are classified as tradables under both classifications).[16] The chart also suggests that the income effects from a stronger currency, and therefore lower import prices and higher wages in foreign currency terms (boosting demand for both tradable and non-tradable goods and services), dominated the substitution effects from the stronger New Zealand dollar (which encourages switching from non-tradables and domestically produced tradables to imported goods and services).

Figure 14: Ratio of non-tradable to tradable GDP (seasonally adjusted chain-volume)



Source: Statistics New Zealand, author's calculations

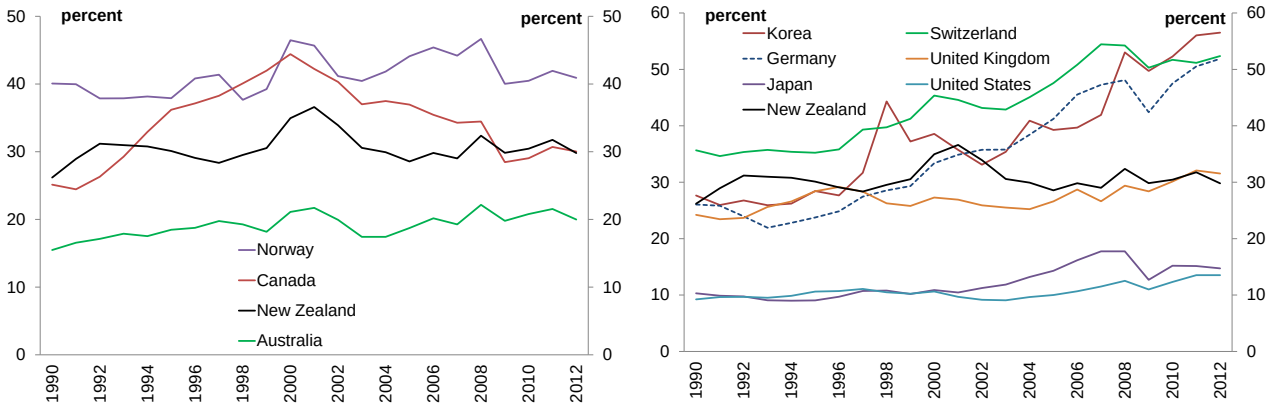
3.3 Increasing export concentration on primary-based exports

Global prices of agricultural exports, particularly dairy, have risen substantially since the early 2000s. But as demonstrated earlier in Figure 4, the appreciation of New Zealand's exchange rate offset most of these gains. In fact, overall export receipts as a share of nominal GDP have fallen slightly over the past decade or so. Figure 15 shows that the ratio of exports to GDP has been roughly flat in Australia since 2000 and fell in Norway and Canada, three other countries which experienced large terms of trade increases. On the other hand, the value of exports as a share of GDP rose strongly in Korea, Switzerland and Germany.

production has also been a common trend across other countries.

[16] Agriculture is classified as tradable despite most of its output being sold to domestic firms (e.g. farmers sell milk to Fonterra) because the ultimate destination of most agricultural production is abroad.

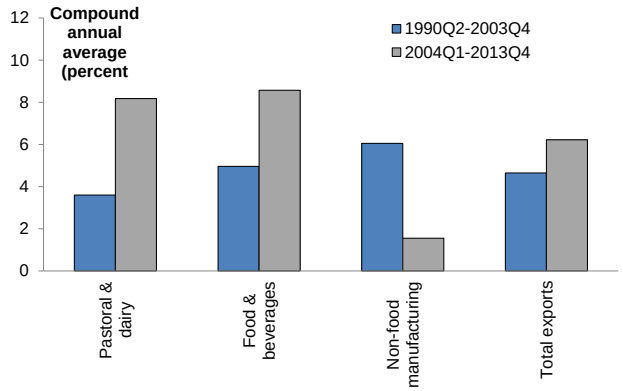
Figure 15: Ratio of nominal exports to GDP



Source: OECD Source: OECD

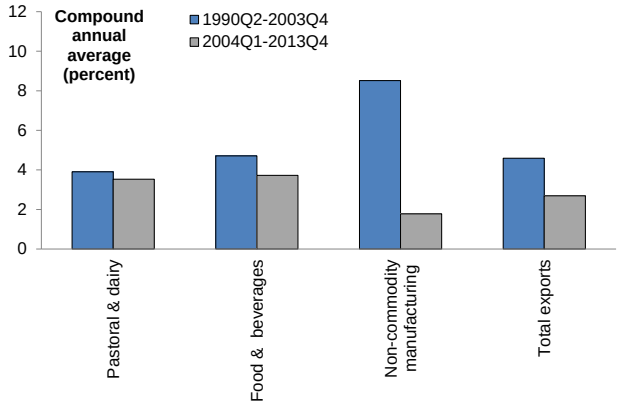
Dairy and processed food exports have outperformed other categories of goods exports since 2004 (Figure 16, data only available from 1990Q2). Non-commodity manufactured export volumes have grown since 2004, but growth has been materially slower than between 1990 and 2003 (Figure 17). Total export volume growth has also been slower than over the previous period.[17] In value terms, growth of non-food manufacturing exports (a non-commodity category is not available for value series) has been relatively low compared to other sub-sectors, reflecting the weak New Zealand dollar prices for manufactured exports globally. This has seen increased export concentration in food- and commodity-related exports.[18]

Figure 16: Growth in nominal goods export values by industry



Source: Overseas Trade Index

Figure 17: Growth in goods export volumes by industry



Source: Overseas Trade Index

National Accounts data show that primary and processed primary products (a classification that includes non-agricultural commodities such as oil and minerals) have been key drivers of export growth over recent

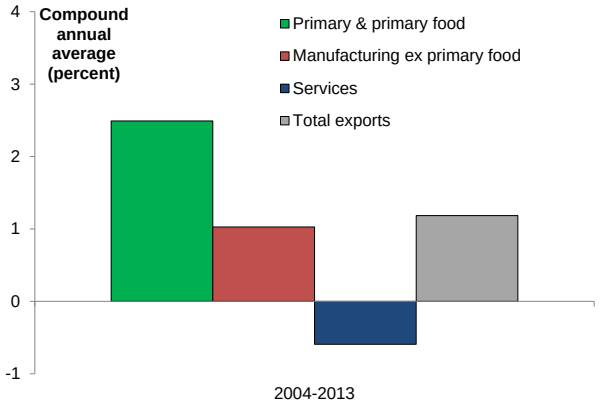
[17] Non-food manufacturing has experienced more moderate volume growth since 2004 than both dairy and processed food exports and non-commodity exports.

[18] Since the big increase in dairy and agricultural prices from 2004, the share of food and live animals of total export values rose from about 47 to 51 percent, while the share of non-food manufactured goods, machinery and transport equipment fell from about 29 percent to about 19 percent.

years (Figure 18, with current sector classifications only available since the early 2000s). Services exports (which are dominated by travel and transportation and are particularly sensitive to exchange rate changes) have performed poorly in comparison.

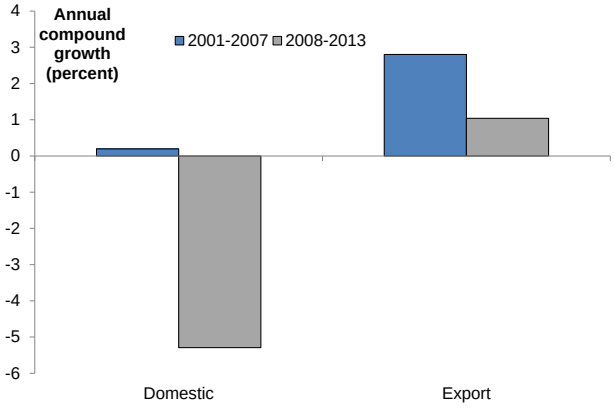
It is difficult to gauge the extent of displacement of local manufacturing, but Figure 19 suggests that import-competing sales volumes have performed poorly compared to exports, declining strongly post-GFC. Data availability prevents a comparison to the 1990s, although Figure 17 shows that goods export volume growth has been slower since 2004 than during the previous period.

Figure 18: Real export growth (calender years)



Source: National Accounts

Figure 19: Domestic and export-oriented real manufacturing sales (March annuals)



Source: Statistics New Zealand, author's calculations

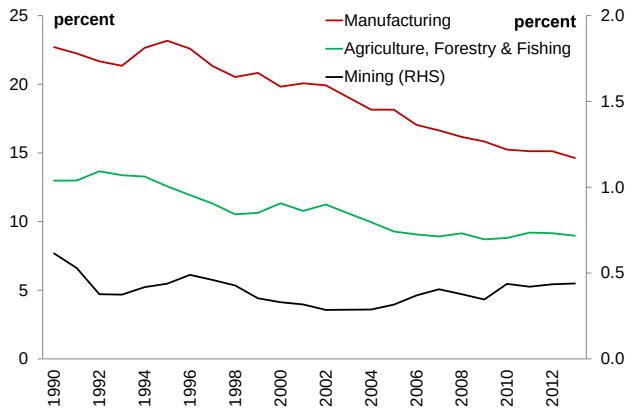
3.4 Little employment growth in commodity-related sectors or clear sectoral wage trends

Given the links between the primary sector, food-related manufacturing and the broader economy, one might expect higher commodity prices to have encouraged resources to shift from non-commodity tradable industries and for there to be spillovers to wages and employment in non-commodity sectors (provided that labour is mobile and substitutable between sectors). The resource movement effect would tend to be stronger (and real wages be expected to rise by more) if there are no unemployed resources in the economy at the start of the commodity boom. In New Zealand, the labour market was particularly tight by historical standards between 2004Q1 and 2008Q4, with the unemployment rate below 4 percent on average. But since 2009Q2, the unemployment rate has been above 6 percent. As it turns out, employment growth has not been concentrated in commodity-related sectors and there is little evidence that these sectors have been putting upward pressure on economy-wide wages (see Appendix B for more detail on the latter).

Manufacturing's share of total employment has declined over the past several years, but this has been a continuation of an earlier trend. The sector's share of total market sector employment has fallen from over

20 percent in 1990 to about 15 percent recently. The agricultural sector's share of employment has not grown - but it is notable that the sector's employment share has leveled off in recent years at around 10 percent (Figure 20).[19] Unfortunately, aggregate series do not reveal the extent to which the reduction in manufacturing employment reflected high- or low value-added manufacturing jobs or a shift to primary food manufacturing.[20]

Figure 20: Share of market sector employment (March annuals)



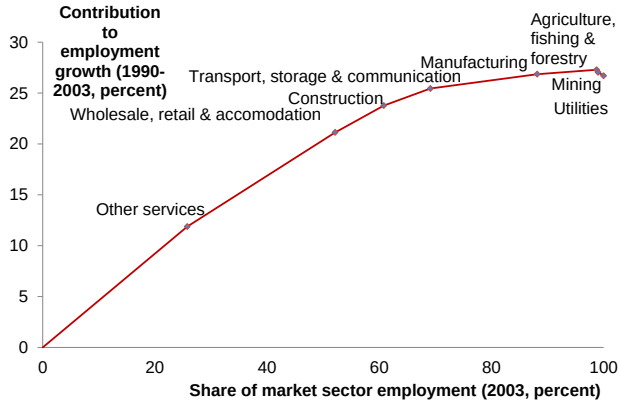
Source: Household Labour Force Survey, author's calculations.

Figures 21 and 22 show that employment has risen most in service sector industries, which account for a relatively large share of total employment. Employment grew in the manufacturing sector between 1990 and 2003, although at a slower rate than aggregate employment. Since 2004 however, the manufacturing sector has experienced a decline in employment. Job numbers have also fallen in agriculture, fishing and forestry over the full period since 2004.

[19] Historical series of industry employment are created by backdating ANZSIC06 industry figures using the growth rates of most closely matching industries in previous industry classifications.

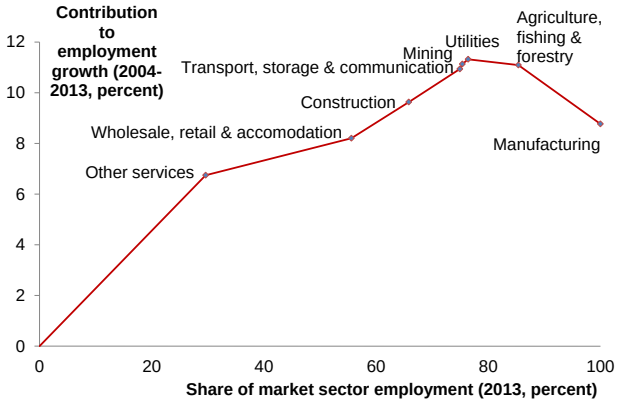
[20] For the economy as a whole, there does not appear to have been a reallocation to higher wage sectors, with employment since the early 2000s growing most in industries with mid-range wage rates, particularly in professional, scientific, technical, administration and support services.

Figure 21: Employment growth by market industry (March annuals, 1990-2003)



Source: Household Labour Force Survey, author's calculations.

Figure 22: Employment growth by market industry (March annuals, 2004-2013)

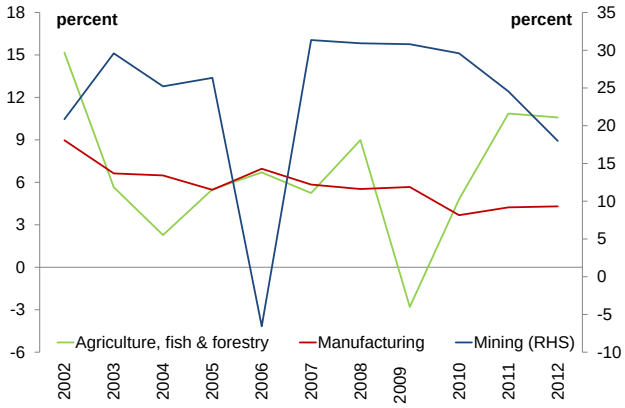


Source: Household Labour Force Survey, author's calculations.

3.5 Declining relative profitability of manufacturing

It is unsurprising that there has not been a significant shift of real resources into the commodity tradables sector as a whole, given the impact that the exchange rate has had on relative real returns. For non-commodity tradables producers, whose global output prices have typically not gone up, returns would have tended to fall. Figure 23 shows that profitability trended down in the manufacturing sector as a whole, while profitability has been flatter in other sectors.[21]

Figure 23: Surplus before tax over total income by industry



Source: Annual Enterprise Survey

[21] Surplus before tax is calculated as total income less total expenditure plus or minus change in stocks. As in the case of surplus over income, returns to equity declined in the manufacturing sector. In agriculture, returns to equity have remained relatively low over this period.

3.6 No sustained boom in commodity-related investment

Higher commodity prices tend to encourage increased investment into the commodity sector. If the commodity boom is accompanied by a stronger exchange rate, this also encourages firms to upgrade their production processes through importation of machinery, equipment and new technologies. If higher commodity prices induce an investment boom in commodity-related sectors, this may tend to crowd out investment elsewhere.

While investment figures suggest that there have been periods of rapid growth in primary sector investment, there does not appear to be evidence of a sustained boom in business investment overall, or that sectors directly related to agriculture or the mining sector were drawing investment away from other sectors. Indeed, New Zealand's business investment rate has not increased in the way it has in Australia (Figure 24), averaging about 10 percent since 2004, compared to 11 percent between 1990 and 2003.[22] This highlights the different characters of the two terms of trade booms. In New Zealand, higher prices mostly simply increased returns to agricultural production without making any more land viable for agricultural production. Thus, the agricultural sector took few additional real resources away from the rest of the economy. By contrast, in Australia, the terms of trade boom rendered economic whole new coal, iron ore and gas deposits, but required massive investments, and significant pressure on other domestic resources, to increase future output of these products.

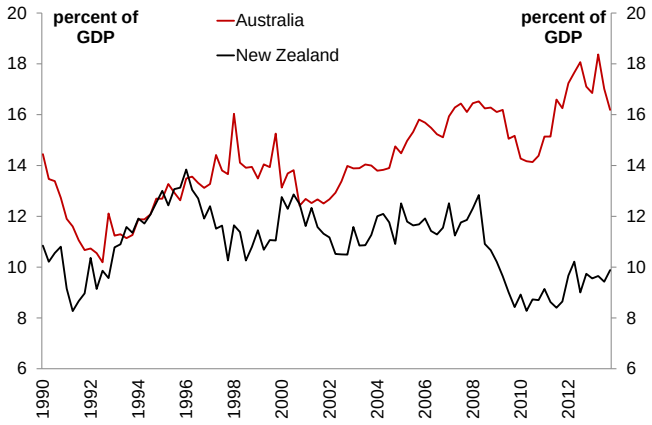
Much of the investment growth that occurred in New Zealand reflected reallocations within the agricultural sector, such as conversions of sheep farms to dairy farms (Figure 25 is indicative of this trend), or investment in non-tradable sectors as income gains were spent in that sector. Conversion to dairy has allowed labour productivity improvements as revenue per hectare and per farmworker has been higher in the dairy industry. But dairy farms are generally much more capital intensive and tend to have higher working expenses, so that total factor productivity may not necessarily rise following conversion to dairy.

In real terms, total investment grew at over 6 percent per annum between between 2000 and 2008, although investment growth fell from 2009 onwards, possibly reflecting increased household and firms' caution or perceived lack of opportunities following the GFC. Figure 26 suggests that there had been robust growth in plant and machinery, intangible fixed asset investment (which includes mining exploration) and other construction between 2004 and 2008. The relative investment share of the mining sector has more than doubled since 2006 (from a low base) (Figure 27, data only available to 2010), while property-related activities continued to take a large proportion of new investment (around 27 percent of total investment between 2000 and 2008).[23]

[22] New Zealand business investment is calculated as total private investment less residential investment.

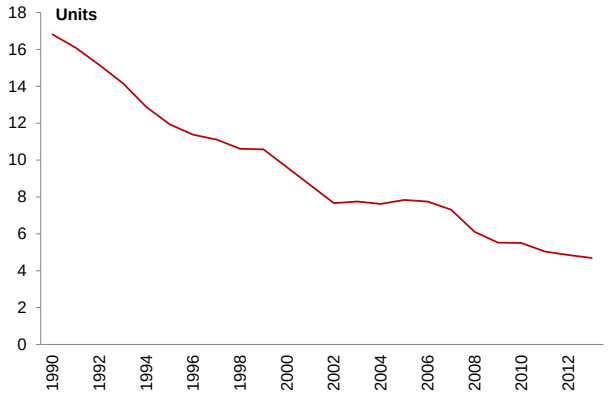
[23] New Zealanders spent about 26 percent of household disposable income on housing in 2013, the second highest figure among developed OECD economies.

Figure 24: Nominal business investment to GDP



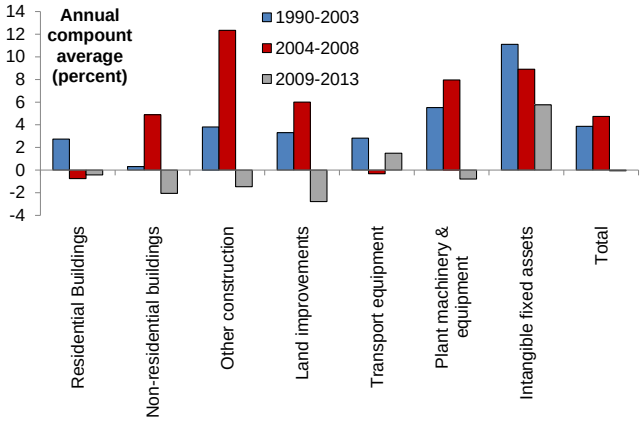
Source: Haver Analytics, Statistics New Zealand, author's calculations

Figure 25: Ratio of sheep numbers to dairy cattle numbers (June annuals)



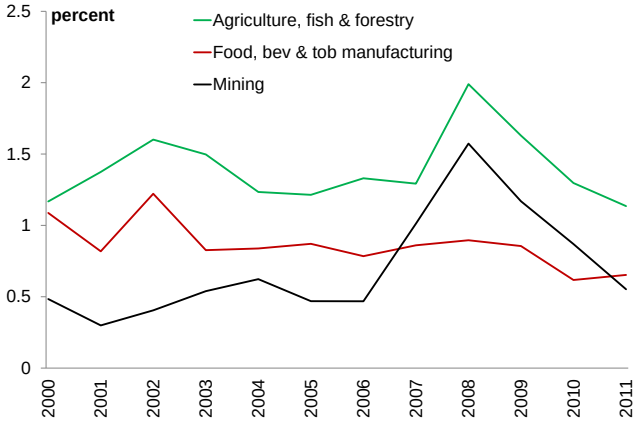
Source: Statistics NZ. Missing values linearly interpolated.

Figure 26: Growth in real investment by type (March annuals)



Source: Statistics New Zealand

Figure 27: Nominal investment as a share of GDP (March annuals)



Source: Statistics New Zealand

New Zealand's agricultural sector production has required much less of an increase in investment than would typically be required for extraction of new deposits of hard resources. Some proportion of new business investment is often funded through foreign direct investment inflows. To the extent that happened in commodity sectors it would ease immediate resource pressures, although if more of the commodity sector's future profits accrue to overseas owners (as happens in Australia), this would tend to imply weaker spending effects from future terms of trade gains. In New Zealand's case, inward foreign direct investment flows have not risen significantly since the commodity boom started. The agricultural sector has not historically had substantial foreign ownership, although there has been some recent significant foreign investment in dairy product processing, for example.

Despite the relatively subdued business investment since 2008, there is evidence of some capital deepening (growth in capital available per hour paid) occurring over the period of the commodity boom. New Zealand's

total capital stock grew by 20 percent in real terms during the period 2004 and 2011, for which industry data are available. This was driven by property- and construction-related sectors, financial and insurance services and mining, which saw a near doubling of its capital stock in real terms. National Accounts figures suggest that the net capital stock of the dairy cattle farming industry grew by over 60 percent, while these also figures suggest, rather surprisingly, that net capital stock of dairy product manufacturing was largely flat over this period. Capital intensity rose almost 20 percent between 2004 and 2011 in agriculture, forestry and fishing, about 2 percent in mining and over 20 percent in the manufacturing sector overall.[24] Appendix C shows that capital deepening has contributed strongly to aggregate labour productivity growth since 2004. Even though overall labour productivity growth has slowed and business investment has been quite subdued, hours worked have grown only modestly, meaning that capital per hour worked has grown significantly.

3.7 Little evidence of reallocation to low productivity growth sectors in New Zealand

At times, concerns are expressed that a commodity boom, particularly if short-lived, could pose a threat to long-term economic prospects. The implicit view behind this concern appears to be partly that prospects for productivity growth may be much greater in manufacturing and other non-commodity tradables industries, for example, than in agriculture. New Zealand's overall productivity growth has been relatively disappointing. However, in New Zealand the agricultural sector that has been among the sectors recording the fastest multi-factor productivity (MFP) growth over recent decades (see Figure 28).[25] Services sectors (i.e. those sectors to which labour has been shifting) have experienced slightly higher MFP growth over the last two decades than in manufacturing.[26] It is unsurprising that multi-factor productivity growth has been weak in mining over the last decade (Figure 29) since higher output prices in this sector tend to make extraction of lower grade resources profitable (the same phenomenon is seen in Australia, for example).

Multi-factor productivity growth is widely regarded as the most important foundation for sustained lifts in living standards. New Zealand's MFP growth has slowed materially in the last decade or so. Most other advanced economies have seen something similar, although the slowing appears to have been particularly marked in advanced commodity exporters (Australia, Norway and Canada).[27] Quite what has caused productivity growth to slow is not clear. However, resource reallocations between sectors associated with higher terms of trade over the past decade do not appear to have been responsible for the economy's weak productivity performance. Appendix C uses detailed sectoral data to illustrate that point as regards the slow rate of labour productivity growth. Productivity growth generally appears to have weakened (Figure 29), rather than being the outcome of a process whereby resources have transferred from high productivity (or fast-growing)

[24] Over this period, hours paid fell by 11 and 13 percent respectively in agriculture and manufacturing, while it rose by over 55 percent in mining.

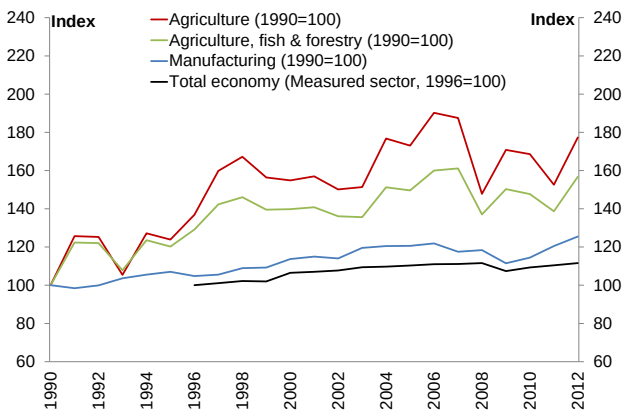
[25] Note that drought in 2008 dragged down output growth in agriculture in that year.

[26] Note that the service industries category here is not consistent with the national accounts, which includes non-measured sector industries.

[27] See, for example, the Conference Board's Total Economy Database.

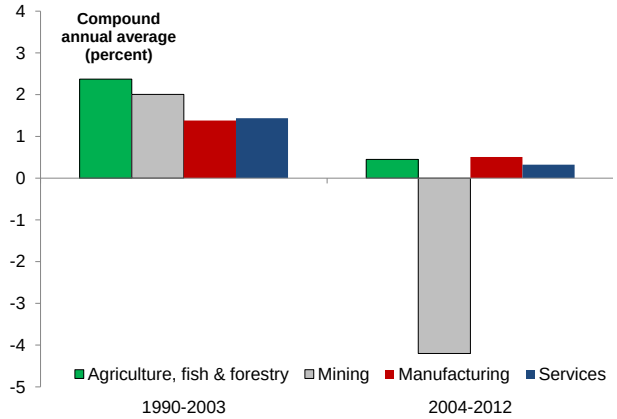
sectors to low productivity sectors.[28]

Figure 28: Multi-factor productivity by industry



Source: Statistics New Zealand

Figure 29: Multi-factor productivity growth by industry



Source: Statistics New Zealand

4 Conclusion

Since the start of the commodity boom, higher commodity prices have materially boosted national income. The higher terms of trade have also been reflected in a stronger real exchange rate. The appreciation of the exchange rate has substantially offset the boost to real New Zealand dollar returns to agricultural exports, and lowered the cost of New Zealanders' consumption. The international competitiveness of segments of New Zealand's non-agricultural exporting sector that have not seen higher global prices for their output has deteriorated. The gains from the higher terms of trade appear to have accrued mostly to consumers, dairy producers, and to firms using imported inputs.

Production has continued to shift towards services sectors. Employment in the manufacturing sector has continued its long-term decline, though not obviously faster than previously. Real agricultural GDP itself has been subdued, although there have been reallocations within agriculture-related industries, such as conversions of sheep farms to dairy farms. Most employment gains have been in service sectors on the back of the higher national income. Manufacturing and service exports have under-performed relative to other sectors over recent years, although weak global growth post-GFC has probably contributed to that. In common with most of the advanced world, overall multi-factor productivity growth has slowed since 2004. Whatever the reasons for this slowing, it appears to have been quite a pervasive phenomenon (across all main economic sectors), rather than resulting from shifts of resources between sectors in response to the higher terms of trade.

[28] Swings in New Zealand's terms of trade could be linked to New Zealand's poor productivity performance. One possibility is that New Zealand's relatively long and large terms of trade cycles (and associated exchange rate cycles) make it difficult for non-commodity exporters to break into export markets and gain economies of scale (see Chetwin, Ng, and Steenkamp (2013) for more on this argument).

References

Attewell, J. and S. Crossan (2013). The tradable sector and its relevance to New Zealand's GDP. Paper presented at the New Zealand Association of Economists conference 3 July 2013.

Brash, D. (2000). The fall of the New Zealand dollar: why has it happened, and what does it mean? Reserve Bank of New Zealand *Bulletin*.

Cashin, P., L. F. Cespedes, and R. Sahay (2004). Commodity currencies and the real exchange rate. *Journal of Development Economics 75*(1), 239–268.

Cassino, E. and Z. Wallis (2010). The New Zealand dollar through the global financial crisis. Reserve Bank of New Zealand *Bulletin*.

Chetwin, W., T. Ng, and D. Steenkamp (2013). New Zealand's short- and medium-term real exchange rate volatility: drivers and policy implications. Reserve Bank of New Zealand Analytical Note AN2013/03.

Conway, P. and L. Meehan (2013). Productivity by the numbers: The New Zealand experience. New Zealand Productivity Commission Research Paper.

Corden, W. M. and J. P. Neary (1982). Booming sector and de-industrialisation in a small open economy. *Economic Journal 92*(368), 825–48.

McCaw, S. (2007). Stylised facts about New Zealand business cycles. Reserve Bank of New Zealand Discussion Paper DP2007/04.

McDonald, C. (2012). Kiwi drivers: the New Zealand dollar experience. Reserve Bank of New Zealand Analytical Note AN2012/02.

Meehan, L. (forthcoming). Structural change and new zealand's productivity performance. New Zealand Productivity Commission Staff Working Paper.

Parker, M. (2014, March). Some perspectives on the pass-through of exchange rate movements to consumer prices. Reserve Bank of New Zealand *Bulletin*.

Price, G. (2012). Building a picture of New Zealand manufacturing. Reserve Bank of New Zealand Analytical Note AN2012/11.

Rogoff, K. and Y. Chen (2002). Commodity currencies and empirical exchange rate puzzles. IMF Working Paper 02/27.

Appendix A Linkages to and from the primary sector

The effects of a commodity price boom partly depend on the structure of the economy. Resource movements associated with any rapid growth in primary-related sectors will be made stronger by any linkages between the primary sector and other sectors, such as forward linkages to bio-technology or engineering industries or backward linkages to manufacturing.[29] The stronger these linkages, the larger the stimulus to related sectors will be. These stimulatory effects would tend to offset any adverse effects from any exchange rate appreciation and shifts in relative prices. This section describes the linkages between the primary section and other sectors of the economy.

The primary sector in New Zealand accounts for about 10 percent of real market sector output. Primary food manufacturing (comprising meat and dairy products) accounts for almost 60 percent of the food, beverage and tobacco category of manufacturing and just under 4 percent of market output. Commodity-related manufacturing sectors excluding primary food accounts for another 8 percent of total output.[30] The broader food, beverage and tobacco category of manufacturing accounts for around 6 percent of market output. The share of the manufacturing sector excluding primary food and commodity manufacturing is small, accounting for only 7 percent of total market output (35 percent of manufacturing output).

This section shows that the primary sector has some important linkages to other sectors, particularly to food- and commodity-related manufacturing. This implies that higher commodity prices will tend to generate some income spillovers to other sectors of the economy.

Several industries are highly dependent on the output of the primary sector, with over 75 percent of that industry's output supplied as intermediate inputs to other sectors (Figure 30). Agricultural outputs are particularly important inputs in food-related manufacturing production. Based on the 2007 Input-Output tables, Figure 31 shows, for example, that dairy and meat-related manufacturing requires a 0.68 percent increase in domestic primary sector output for its output to expand by 1 percent.

In the case of non-food manufacturing, on the other hand, over 55 percent of the sector's output is sold to other domestic industries as intermediate inputs, another 25 percent or so is exported directly and the balance is consumed domestically or included in gross capital formation. Meat and dairy-related manufacturing exports the highest proportion of its output directly of any manufacturing sub-sectors, at about 70 percent of total, while less than 10 percent of minerals output is exported.[31]

The domestic sector that is most dependent on manufacturing is the construction sector. About 13 percent of non-food manufacturing output is a used as direct input into domestic construction.[32] Price (2012) argued

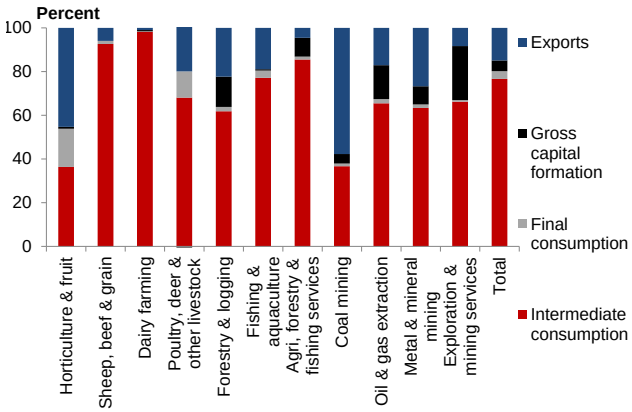
[29] In this note, the primary sector refers to the agriculture, fishing, forestry and mining industries.

[30] Commodity-related manufacturing industries are taken to include wood and paper production, petrol and chemical manufacturing, non-metal and mineral production as well as metal production. Meat and dairy-related manufacturing's share in real manufacturing output is about 20 percent, while the non-food commodity sub-sectors' share is around 65 percent of total manufacturing.

[31] The minerals industry in New Zealand is largely focussed on production of inputs for the construction sector.

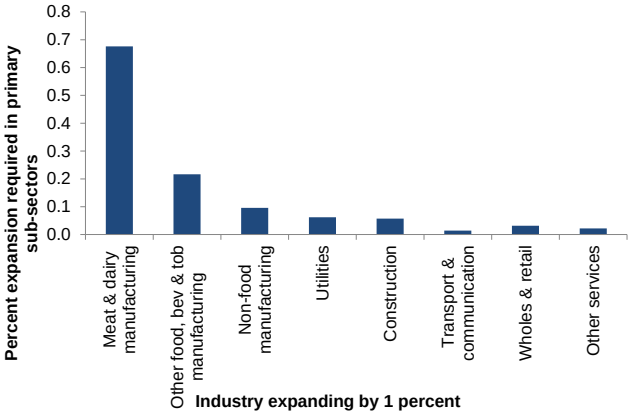
[32] Measured as a proportion of total intermediate outputs produced by the non-food manufacturing sector, the figure is about 22 percent.

Figure 30: Inter-industry uses of primary industry output (nominal, year ended March 2007)



Source: 2007 Input-Output Table

Figure 31: Percent expansion required in primary sub-sectors to provide a 1 percent expansion in other industries (nominal, year ended March 2007)



Source: 2007 Input-Output Table, author's calculations

that the manufacturing sector's exposure to the domestic construction sector explained a large proportion of the fall in manufacturing output around the 2008/9 recession.[33]

Although any exchange rate appreciation erodes the New Zealand dollar returns received by exporters, there will be some mitigating effects on tradable producers from lower intermediate input costs. Besides cheaper imported inputs, cost savings will be compounded as the costs of other domestic inputs fall on the back of cheaper inputs. About 13 percent of primary sector inputs are imported directly (Figure 32), compared to about 20 percent of manufacturing inputs.[34] The low import share in the primary sector suggests a larger hit to exporters' bottom-line from exchange rate appreciation.

A much higher proportion of output is ultimately exported in primary sectors than non-food manufacturing sub-sectors. About 65 percent of output is ultimately exported in the case of the primary sector as a whole, and over 80 percent in the case of dairy cattle farming output (Figure 33). In comparison, approximately 45 percent of non-food manufacturing output is eventually exported.[35]

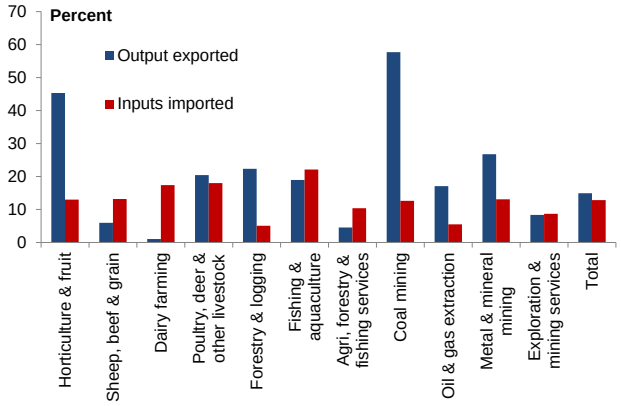
Many sub-sectors provide inputs into the primary industry (such as distribution or engineering services). Figure 34 is based on the Input-Output tables and show that the primary sector uses a large proportion of service inputs, compared to the non-food manufacturing sector. Unsurprisingly, well over half of food-related manufacturing sector's inputs are agricultural and food products. Intermediate inputs comprise the largest share of inputs for non-food manufacturing.

[33] To achieve a 1 percent expansion in construction output, for example, requires a 0.37 percent increase in non-food manufactured output, with the largest contributions coming from wood and paper, minerals and metals and petroleum and chemicals.

[34] This figure excludes inputs imported for intermediate use in other sectors before being supplied to the the sector in question.

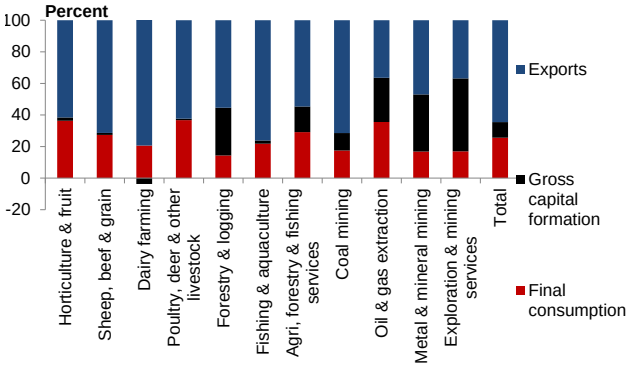
[35] Within New Zealand manufacturing, meat and dairy-related manufacturing exports the highest proportion of its output at about 80 percent eventually, while around 15 percent of minerals output is eventually exported.

Figure 32: Trade in primary inputs and outputs (nominal, year ended March 2007)



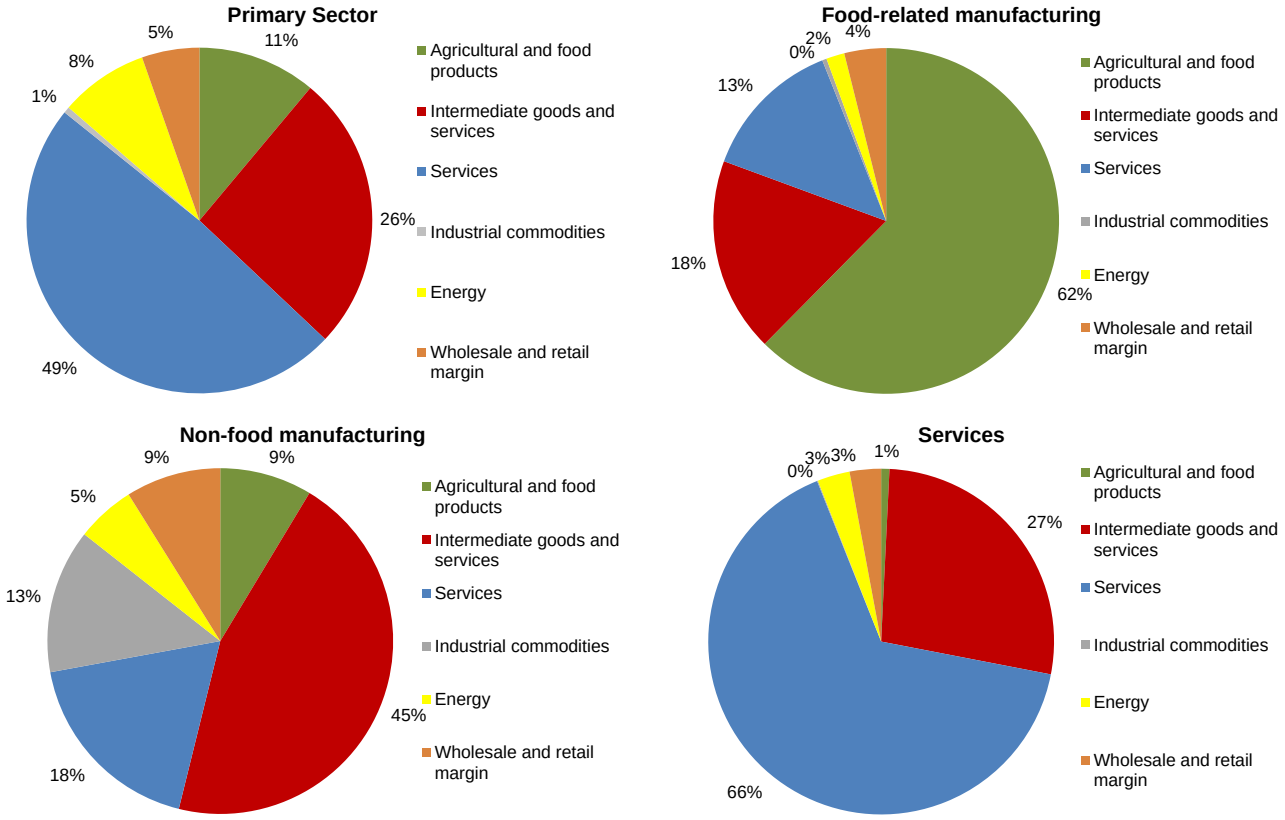
Source: 2007 Input-Output Table

Figure 33: Ultimate use of primary industry output (nominal, year ended March 2007)



Source: 2007 Input-Output Table

Figure 34: Breakdown of intermediate inputs (nominal, year ended March 2007)

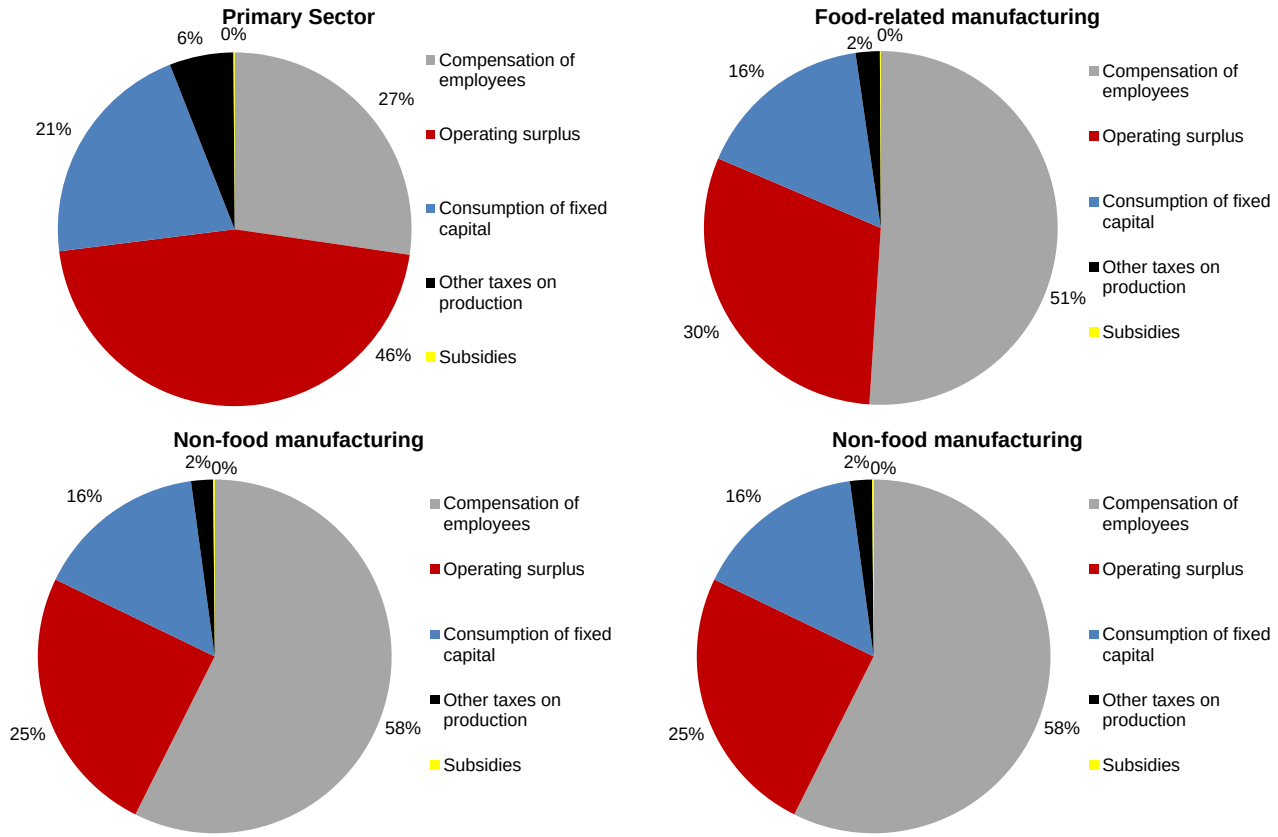


Source: 2007 Input-Output Table, author's calculations

Factor intensities in the non-commodity tradable sector and non-tradable sector matter for overall relative price changes associated with the commodity boom. If the non-tradable sector tends to be more labour intensive than the non-commodity tradable sector, then higher wages may increase wage-related costs by

more in the non-tradable sector than in the tradable sector.[36] Figure 35 shows that production in the primary sector production involves lower labour input and higher consumption of fixed capital than either services or manufacturing (although for family farms the boundary between labour costs and operating surplus may be quite blurred). The service sector as a whole is also less labour intensive than non-food manufacturing in New Zealand.

Figure 35: Share in gross value added (nominal, year ended March 2007)



Source: 2007 Input-Output Table, author's calculations

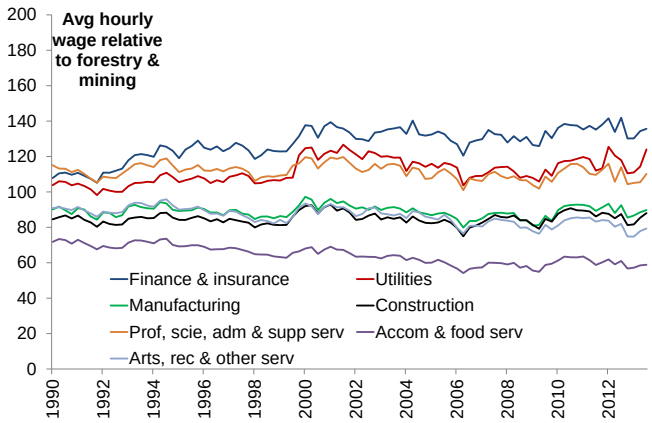
[36] The long run impact of developments in commodity-related sectors on wage costs will depend on whether capital intensity increases in response to any changes in real wages.

Appendix B Wage developments

To assess the evolution of labour costs and wages in different sectors, two different data sources and different sector classifications are available. Nominal wage growth rates for similar industries are lower when measured using Labour Cost Index (LCI) than when based on the Quarterly Employment Survey (QES).[37] The LCI measures wage inflation adjusted for quality and productivity. The QES measures average hourly wages across all jobs in economically significant enterprises in an industry, and therefore picks up shifts in employment between and within industries. Sector breakdowns differ slightly across the two data sources.

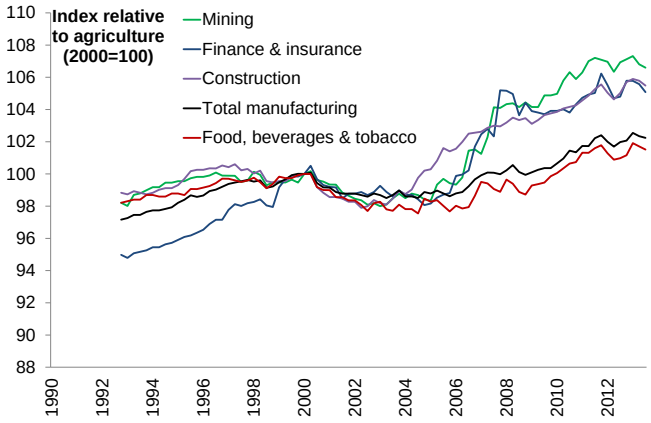
As a wage series is not available for the agricultural sector from the QES, nominal wages are compared to forestry and mining in Figure 37. Wage developments in manufacturing and service sector industries appear to have tracked commodity sector (forestry and mining) wages, with the ratio of each sector's actual hourly wage over forestry and mining wages quite stable over time. However, productivity-adjusted wages grew (as measured by the LCI) more slowly in agricultural and food-related industries than in other industries, particularly mining (Figure 36).

Figure 36: Figure: Nominal wages relative to forestry and mining



Source: QES

Figure 37: Figure: Nominal wages relative to agricultural sector



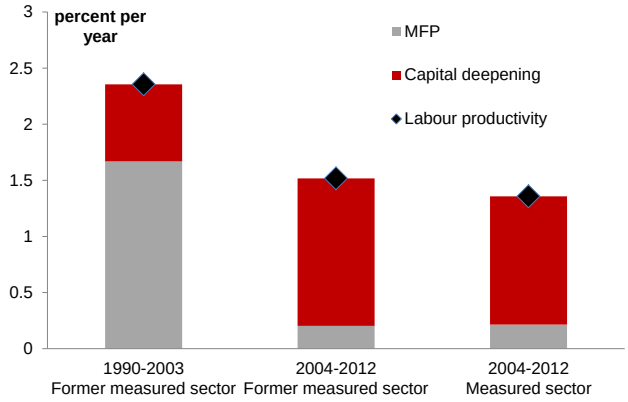
Source: LCI All Salary and Wage rates (Private Sector)

[37] LCI series are based on splicing of the ANZSIC 2006 industry breakdown and previous breakdowns. Here, groupings are created by taking averages of relevant industries where necessary. Basing the charts on other LCI series, i.e. the LCI Salary and Ordinary Time Wage Rates All Sectors series, produces broadly similar results. Data availability limits the time period considered.

Appendix C Labour productivity developments

Labour productivity reflects two components - the amount of capital used per labour unit and multi-factor productivity (MFP), the efficiency with which capital and labour are combined to produce output. MFP contributed the largest share of labour productivity growth between 1990 and 2003. New Zealand's labour productivity growth has been weaker since 2004, reflecting weaker MFP growth rather than slower capital deepening (see Figure 38 and Conway and Meehan (2013) for more discussion).[38]

Figure 38: Decomposition of labour productivity growth

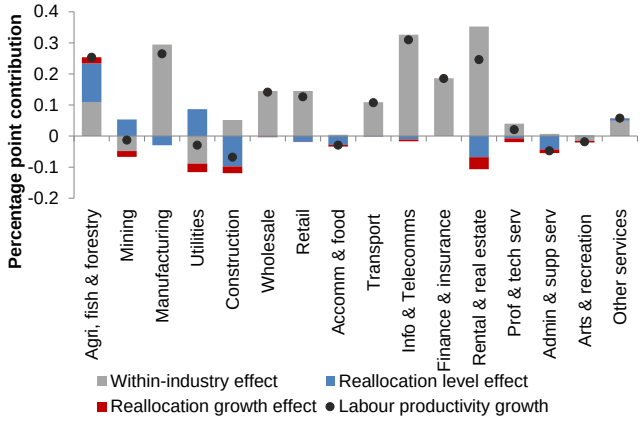


Source: Statistics New Zealand

Low aggregate labour productivity growth could reflect low average productivity growth across individual industries or alternatively labour movement to lower productivity level or lower productivity growth sectors. It does not appear that New Zealand's low aggregate labour productivity growth has reflected a reallocation of labour to low productivity sectors over the periods of the productivity cycles identified by Statistics New Zealand. Instead, Figures 39 and 40 show that 'within-industry effects', that is, low productivity growth within individual industries (weighted by industry labour share) and across indusustries on average) has been the largest contributor to subdued industry productivity growth. Overall, 'reallocation effects' are small across sectors relative to each industry's contribution to aggregate productivity growth (see Meehan (forthcoming) for more detail). Thus, to the extent that the marked increase in the terms of trade has shifted resources between sectors, those shifts themselves have not dampened New Zealand's overall rate of productivity growth.

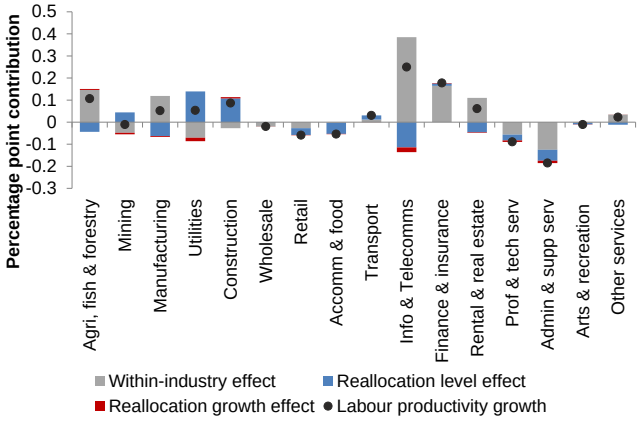
[38] Since 2004, MFP growth was negative in mining and particularly low in non-tradable sectors such professional, scientific, technical, administrative and support services and construction.

Figure 39: Industry contribution to labour productivity growth (2000-2008)



Source: Meehan (forthcoming)

Figure 40: Industry contribution to labour productivity growth (2008-2011)



Source: Meehan (forthcoming)

Reallocation effects are composed of *level* effects, measuring whether labour has moved to industries with above- or below-average labour productivity levels, and *growth* effects, measuring whether labour has moved to industries with above- or below-average labour productivity growth. Positive reallocation effects in agriculture, forestry and fishing between 2000 and 2008, for example, reflected a fall in that industry's labour share and its low level of labour productivity and slow labour productivity growth relative to the aggregate economy. In manufacturing's case, the negative reallocation level effect reflected the decline in the industry's labour share combined with its high initial relative level of labour productivity. Reallocation effects were also negative in retail, accommodation and food, professional, scientific and technical services and in administrative and support services as these industries had gained labour share but had both low relative levels of productivity and low relative productivity growth rates. Since 2008, the labour share of agriculture, forestry and fishing increased, but the reallocation level effect was negative since the industry had lower than average labour productivity. Reallocation effects were negative in manufacturing and several service sectors, but were still dominated by within-industry effects.