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Who benefits from productivity growth? – The labour income share in New Zealand

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Abstract

There is international interest in changes in the labour income share. In part, this reflects concerns that in a number of countries, real wage growth has not kept pace with labour productivity growth in an environment of rapidly changing technology. This paper investigates changes in the labour income share in the "measured sector" of the New Zealand economy and provides insights into the causes of these changes. Changes in the labour income share are decomposed into contributions from productivity growth and changes in quantities and prices in labour, capital and product markets. Industry contributions to changes in the labour income share are also examined, and comparisons with Australia are drawn. It turns out that the LIS has fallen in the measured sector of the New Zealand over the past 35 years in no small part because of sharp falls over three short periods. Aside from these falls, results also show that growth in real wages has been closely aligned with productivity growth and that there is no systematic relationship between strong productivity growth and falls in the labour income share. Indeed, the important message from the paper is that strong productivity growth sustains strong growth in real wages.

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Foreword

The labour income share (LIS) measures the split of national income between the owners of labour and capital. In most OECD countries over the last three decades, the share of national income paid to workers for their labour services has been declining while the owners of capital have been receiving an increasing share. While this general decline in the LIS across countries is due to a number of factors, predominant reasons include rapid technological change, globalisation and decreases in labour's bargaining power.

Technology is moving ahead in leaps and bounds internationally, bringing great potential for improvements in global living standards and wellbeing. As with previous waves of innovation, new technologies are fundamentally changing the work people do. Research by Carl Frey and Michael Osborne from Oxford University estimates that 47% of United States employment is at high risk of automation, suggesting that labour market dislocation will not end any time soon.

In large part, the current wave of new technology is labour-saving in that it reduces the labour input needed in the production process across a wide range of output. While beneficial for labour productivity, this is a key reason why the LIS has been falling in a number of countries. However, the long-term impact of the current spate of new technologies on the labour market is still unclear. Previous general-purpose innovations have ultimately improved labour productivity *and* created new occupations and employment, suggesting that the current wave may end up creating as many or more jobs than it destroys.

Ongoing globalisation is another factor playing a significant role in the general decline in the LIS across a number of countries. The internationalisation of production has effectively increased the supply of low- and middle-skill workers, reducing job opportunities and wages for these types of workers in high-income countries. Increased competition from imports has also raised competitive pressures on domestic businesses, encouraging them to constrain labour costs.

Regulatory change should also not be discounted. Some changes in policies and institutions over the past thirty years have altered the balance of bargaining power across the owners of labour and capital. For example, the privatisation of some firms in network industries has contributed to simultaneous productivity growth and employment falls, which have been linked to declines in the LIS in some countries.

This paper is about the split of national income between capital and labour incomes in the "measured sector" of the New Zealand economy. This distribution of income *between* the owners of labour and capital is distinct from the distribution of income *within* the owners of labour and capital. Changes in the LIS will influence the overall distribution of income if capital income is distributed more unevenly in favour of high-income households than labour income. However, this income split does not account for a number of other important factors – such as government's influence through taxes and transfers – and this paper is not an assessment of changes in income inequality in New Zealand.

This paper also avoids judgements about the optimal level of the LIS or whether given changes in the LIS are socially beneficial or not. Balancing these considerations depends on the situation and is partly a matter of preference. For example, would New Zealanders prefer to participate in an economy where real wages are increasing strongly but the LIS is falling because productivity growth is even faster, or an economy with weak growth in real wages and productivity so that the LIS is more constant? Any assessment of these issues is beyond the scope of the current paper.

While innovation and new technology is critical in making New Zealand more productive, economic adjustment to these profound shocks will be lengthy and disruptive and pose a considerable policy challenge. In addressing this disruption, slowing down technological change and globalisation is not a sensible option given that both of these help increase the total amount of income there is to share.

Instead, benefiting from new technology requires investment in the necessary complementary skills. In particular, the education system must be of high quality and sufficiently responsive to provide new and dislocated workers with the skills they need to enter productive and lucrative occupations where they can make the most of new technology. Policy should also work to minimise entry barriers and other frictions, such as excessive occupational licensing, that prevent workers from moving to where they can work most productively. There is also a geographic aspect to this in that cities are one of humankind's most productive inventions. So restrictions on housing supply that mean low-skilled workers cannot afford to live in economically dynamic places can limit productivity growth and economic resilience to change.

Even if policy is set just right to ensure that the benefits of technology-based growth and globalisation are widely spread, a social safety net may still have to catch people who fall through the cracks. Accordingly, policy must ensure that social services function effectively to deal with the side effects of rapid technological change.

The focus in this paper is on measuring the LIS to improve our understanding of how the New Zealand economy operates and the links between productivity growth and the returns to labour and capital given rapid changes in technology. The policy implications of this work are not addressed directly in the current paper but are instead touched on in the accompanying "Cut to the chase" and will be outlined in detail in a forthcoming Productivity Commission Research Paper, "How to lift productivity growth in New Zealand".

Key points

- The labour income share (LIS) is the proportion of income generated from production that is spent on labour in the form of wages and associated on-costs.
- In many countries, there was a "hump-shaped" pattern in the LIS over the second half of the 20th century – it increased in the 1960s and 1970s and then returned to longer run levels in the 1980s and 1990s. There have been further falls in a number of countries in the 2000s.
- If productivity gains are distributed proportionately across workers and the owners of capital, growth in the real product wage (RPW) matches labour productivity (LP) growth and the LIS remains unchanged. This also occurs if wage growth relative to the return on capital offsets increases in capital intensity.
- In the New Zealand "measured sector" – which covers all industries in the primary and goods-producing sectors plus some (but not all) service industries – the LIS has fallen by 8.5 percentage points from 1978 to 2010. This indicates a tendency for capital income to grow more quickly than labour income. Much of this fall in the LIS occurred in three short periods:
  - 1982-1984: The price and wage freeze led to real wage falls and a sharp increase in the return on capital, causing the LIS to fall. This fall proved to be partly temporary.
  - 1992-1995: Strong productivity growth, coupled with real wage restraint, led to strong returns on capital and the LIS fell markedly.
  - 1999-2002: Increased product price inflation was not anticipated in nominal wage setting and the return on capital increased. This fall also proved to be largely temporary and the LIS increased over the remainder of the 2000s.
- At the industry level, the manufacturing; electricity, gas, water & waste; information, media & telecoms and agriculture industries have all played important roles in the decline in the LIS, although no single industry dominated as was the case in Australia in the 2000s.
- Productivity growth has not been associated with falls in the LIS. Instead, growth in the real wages that firms in the measured sector pay their workers has been closely aligned with productivity growth both through time and across industries. At least from past experience, strong productivity growth goes hand-in-hand with strong growth in real wages.
- From the perspective of wages as income, the general decrease in the share of income accruing to labour in the measured sector has been exacerbated by relatively high inflation in some low-productivity service industries outside of the measured sector. This has eroded growth in the purchasing power of wages.
- New Zealand and Australia have had some different experiences, but also share some similarities. New Zealand shows perhaps greater effects of reform, especially more-rapid effects on labour market adjustments in the 1990s. Australia showed more prominent signs of the greater boom in its terms of trade.
- The analysis provides no basis to determine what might be an "appropriate" labour income share. Nevertheless, in-depth analysis of the contributors to changes in the LIS suggests that, after some periods of major adjustments, the New Zealand economy now operates with better coordination between product and factor markets and provides for better allocation of resources.

1 Introduction

This paper examines trends in the labour income share (LIS) in New Zealand. The LIS is the share of gross income from the production of goods and services that producers pay for labour services. The primary motivation for unravelling changes in the LIS is that it can tell us quite a bit about the inner workings of the economy, such as the importance of price signals and quantity responses and the coordination of product and factor markets. From this perspective, an improved understanding of change in the LIS can also inform us about how the economy responds to policy actions and economic shocks.

Movements in the LIS also influence the distribution of income across individuals and households. For example, in the United States, an increase in the income share accruing to capital, which is more highly skewed toward high-income earners compared with labour income, is one reason for a widening in the overall income distribution (Congressional Budget Office, 2011). However, the LIS only describes the broad split of national income between labour and capital. It does not assess the *within* distributions of labour income and capital income.[1] As such, a comprehensive analysis of the determinants of the distribution of income requires a broader approach than the one used in this paper.

Section 2 of the paper introduces the LIS concept and sketches out some historical and international context on its evolution and interpretation. As well as describing the way in which it is measured, this section outlines the two principal approaches used in the paper to decompose the LIS. The first expresses changes in the LIS as the difference between growth in labour productivity and growth in real product wages (which are nominal wages deflated by product prices). The second approach decomposes changes in the LIS into divergences between growth in factor proportions (the capital-labour ratio) and growth in the reward ratio (wage rates relative to the rate of return on capital).

While the paper is primarily focused on how the income "pie" is sliced between labour and capital, it is also important to bear in mind how rapidly the pie has been growing. This context is given in Section 3 in a brief assessment of how the terms of trade, productivity growth and the accumulation of factor inputs have all contributed to income growth in New Zealand.

Movements in the LIS in the so-called "measured sector" of the New Zealand economy are discussed in Section 4. The LIS has generally declined in this part of the economy since the late 1970s, indicating a tendency for capital income to grow more quickly than labour income. Much of this decline occurred in three sharp contractions in 1982-1984, 1992-1995 and 1999-2002. Section 4 also uses the "productivity and costs" and "quantities and prices" decompositions to identify the proximate reasons for these movements in the LIS. In brief, this analysis shows that improvements in labour productivity and growth in the real wages that firms in the measured sector pay their workers tend to go hand-in-hand.

This analysis of the LIS is conducted from the perspective of real wages as a cost of production for firms and deflates nominal wages by the price of the output workers produce. However, from a personal income point of view, it is the real purchasing power of wages that matters. At the aggregate economy level, product and consumption prices have broadly moved together. However, with relatively high inflation outside of the measured sector, the cost of the consumption basket for workers in the measured sector has increased more rapidly than the price of the output they produce. This means that the divergence between labour productivity growth and real wages as income for measured sector workers has been greater than that indicated by the fall in the LIS.

Section 5 of the paper delves into changes in the LIS at the industry level. This shows that changes in the LIS have been distributed across a changing mix of industries and that no single industry dominates, as is the case with mining in Australia over the 2000s. There is also evidence indicating that

[1] For analysis of income inequality in New Zealand, see for example Perry (2014) and Creedy and Eedrah (2014), and for analysis of the distribution of wealth (for which capital income is the flow), see Le, Gibson, and Stillman (2010) and Scobie and Henderson (2009).

growth in labour productivity and real product wages is well aligned at the industry level, notwithstanding a few important periods of realignment that also show up at the aggregate level. This is further evidence that strong real wages growth tends to go hand-in-hand with strong productivity growth.

Drawing on Parham (2013), section 6 of the paper briefly compares the evolution of the LIS in New Zealand and in Australia. This shows broadly similar trends in productivity growth and input accumulation in both economies, although the latter has tended to be much stronger in Australia. Both countries also show a broadly similar pattern of a declining LIS, although there have been some notable differences over shorter time horizons. Finally, concluding comments and observations are offered in Section 7.

2 The LIS – background, methodology and measurement

2.1 Background[2]

The share of income attributed to labour and capital was of keen interest to the classical economists of the 18th and 19th centuries and later to others such as the neoclassical, Marxian and post-Keynesian schools. However, interest waned in light of evidence that labour and capital income shares were broadly constant over time, which Kaldor (1957) famously declared to be a stylised fact.[3] Nevertheless, there was still scope for short-term variability in factor income shares in response to the business cycle or temporary shocks, with the LIS considered to be counter-cyclical. For example, it rises in the contraction phase of the cycle as firms hoard labour and profits fall, while nominal wages remain "sticky".

Interest in the LIS was rekindled by evidence of medium- to long-term movements in the post-WWII era. As a general pattern across developed nations, the LIS rose in the late 1960s and 1970s, and then declined gradually over the 1980s and 1990s (European Commission, 2007; Karabarbounis & Neiman, 2014; Rodriguez & Jayadev, 2010). This was clearly evident in most European countries where the LIS rose to a peak in the late 1970s and early 1980s and then steadily declined (European Commission, 2007). The pattern was also very evident in Japan.

These increases in the LIS in the post-WWII era are generally viewed as resulting from a combination of wage increases due to institutional arrangements that increased the bargaining power of labour, economic shocks (particularly the oil shocks) and a slowdown in productivity growth (Bertoli & Farina, 2007).

The subsequent decline in the LIS has been attributed to a number of factors (Bertoli & Farina, 2007; European Commission, 2007; OECD, 2012; Sweeney, 2013). Perhaps most importantly, technological advances that have increased the return on capital have led to capital deepening as businesses have substituted capital for more-expensive labour (Bassanini & Manfredi, 2012). Other contributing factors include shifts in industry composition towards more capital-intensive industries, increased globalisation that increased the global supply of cheap labour, and institutional developments that have reduced labour's bargaining power.

Interest in the labour income share has intensified in recent years as part of broader concerns about income inequality in advanced economies. The United States is a prominent case in point. There, the

[2] The very brief review of the LIS in this section is drawn from Parham (2013). European Commission (2007) and Bertoli and Farina (2007) provide more extensive reviews of contemporary issues and literature. Piketty (2014) provides a very long-term review of the labour income share and factors that have affected it.

[3] The constancy of the factor income shares is also known as Bowley's Law, after a British statistician who drew attention to it in the 1920s (see for example, Schneider, 2011).

LIS had been very stable in comparison with other countries (European Commission, 2007), but has fallen sharply over the 2000s. This sharp fall has received a lot of attention (for example, Council of Economic Advisers, 2013; Jacobson & Occhino, 2012). It has also stirred considerable international interest from the point of view that it may indicate what may be in store for other countries (Sweeney, 2013).

2.2 Methodology

Decomposing the LIS into its various elements goes part of the way towards identifying the relative importance of the different influences contributing to change. This sub-section outlines the two principal decompositions used in the rest of the paper.

Labour productivity and real product wages

Growth in the LIS can be decomposed into growth in a real labour cost component and in a real labour product component, thus providing an assessment of whether real wage growth is keeping up with productivity growth.

The real cost of an hour of labour is the average hourly rate of labour compensation (including on-costs) relative to the price of output – that is, the nominal rate of labour compensation deflated by an index of the prices of the output produced by that labour. This variable is referred to as the real product wage (RPW). The RPW increases if the nominal rate of compensation rises faster than inflation in product prices. The real product or output of an hour of labour is simply labour productivity (LP).

Growth in the LIS can be expressed as growth in the RPW less growth in LP. The derivation of this relationship is as follows. The labour income share is the nominal cost of labour (LC^n) divided by nominal income (Y^n):

$$LIS = \frac{LC^n}{Y^n}$$

Multiplying the top and bottom by an index of output prices (P^Y) gives:

$$LIS = \frac{LC^n}{Y^n} \cdot \frac{P^Y}{P^Y} = \frac{LC^r}{Y^r} \quad (1)$$

where LC^r is the real cost of labour and Y^r is real output.

To define the LIS in terms of the real product wage (RPW) and labour productivity (LP), multiply and divide Equation (1) by the number of hours worked (L):

$$LIS = \frac{LC^r}{L} \cdot \frac{L}{Y^r}$$

$$= \frac{RPW}{LP} \quad (2)$$

Equation (2) can alternatively be viewed as the real unit labour cost since it is the ratio of real labour costs per hour to labour productivity. Taking logs, equation (2) can be expressed in growth rate terms, where a hat '^' over a variable signifies a growth rate in that variable:

$$\widehat{LIS} = \widehat{RPW} - \widehat{LP} \quad (3)$$

In words, the LIS falls if growth in the RPW does not keep pace with labour productivity growth, with the extent of the fall related to the size of the gap between RPW and LP growth. Conversely, the LIS rises if growth in the RPW is greater than growth in labour productivity.

This decomposition gives some insight into why the LIS might remain constant over the long term, *all other things being equal*. If the real cost of labour was growing more rapidly than labour productivity,

firms would be more likely to cut back on employment and this, in turn, would tend to rein in growth in real wages. The opposite would happen if LP was growing more rapidly than the RPW. However, as discussed above, significant changes in the LIS in a number of countries over recent decades suggest that other things have not been equal, in which case the LIS decomposition depicted in Equation (3) identifies periods in which there have been mismatches between wage growth and productivity growth.

To dig deeper into changes in the LIS and mismatches in wage and productivity growth, growth in the RPW and in LP can be decomposed further:

$$\widehat{RPW} = \widehat{NW} - \widehat{P^Y} \tag{4}$$

where *NW* is the nominal wage, and:

$$\widehat{LP} = \widehat{Y^r} - \hat{L}$$

Nominal income Y^n is exhausted in that it either goes to labour or capital with nothing left over. Moreover, nominal wages NW is total labour compensation, and not just wages and salaries.

It is important to note that P^Y in equation (4) is the price of the output that workers have produced and that the equation does not hold if nominal wages are deflated by some other price. Instead, relating labour productivity and the RPW to real consumption wages (RCW) gives:

$$\frac{LC^n}{Y^n} = \frac{LC^n}{P^c \cdot L} \cdot \frac{P^Y \cdot L}{Y^n} \cdot \frac{P^c}{P^Y}$$

$$= \frac{RCW}{LP} \cdot \frac{1}{ToT^L} \tag{5}$$

where P^c is the price of consumption goods, measured by the CPI or other consumption deflator.

In words, the labour share equals the RCW divided by labour productivity, multiplied by the reciprocal of labour's terms of trade, which is the ratio of product prices to consumption prices ($ToT^L = \frac{P^Y}{P^c}$). Intuitively, labour's terms of trade is how much the product of labour can be exchanged for each unit of consumption.

Factor proportions and reward ratios

An alternative decomposition of the LIS can be used to identify the impact of changes in the capital-labour ratio (factor proportions) and changes in the gross rate of return on capital relative to wage rates (the reward ratio).

Starting with the ratio of labour income to capital income and multiplying and dividing by nominal income (Y^n) gives:

$$\frac{L \cdot w}{K \cdot r} \frac{Y^n}{Y^n} = \frac{LIS}{KIS} \tag{6}$$

In this equation, *K* is capital services, *L* is hours worked, *w* is the nominal average hourly wage rate, *r* is the rate of return on capital. LIS and KIS are the labour and capital shares of income respectively.

This relationship can be expressed in growth rate terms as:

$$\left[\widehat{\frac{w}{r}}\right] - \left[\widehat{\frac{K}{L}}\right] = \widehat{LIS} - \widehat{KIS} \tag{7}$$

where w/r is the rewards ratio and K/L represents factor proportions. A rearrangement of Equation (7) shows that the relationship between growth in the LIS and growth in the KIS can be assessed in terms of the difference between growth in labour income and growth in capital income.

$$\widehat{w \cdot L} - \widehat{r \cdot K} = \widehat{LIS} - \widehat{KIS} \tag{8}$$

Equations (7) and (8) provide some insights into Kaldor's stylised facts. Kaldor (1961) observed that a constant LIS over the long term was one of the key regularities characterising economic growth. Because KIS=1-LIS, this implies that the KIS was also constant in the long run. Kaldor noted that while the capital-labour ratio increases over time, the rate of return on capital tends to remain constant. In combination, this means that wages increase, leading to a higher rewards ratio that offsets the impact of greater capital intensity on the LIS.

In the scenario depicted by Kaldor, the elasticity of substitution between labour and capital is assumed to equal one so that greater capital intensity increases the marginal productivity of workers, leading to higher wages and a broadly constant LIS. Increasing capital intensity and higher wages go hand-in-hand.

As discussed above, more recent contributions have found evidence of significant long-term movements in the LIS. A breakdown in the relationships underpinning Kaldor's stylised facts is often cited as an explanation for the recent declines in the LIS in a number of countries (see for example Arpaia, Pérez, & Pichelmann, 2009; Bentolila & Saint-Paul, 2003; Driver & Muñoz-Bugarin, 2010; Hutchinson & Persyn, 2012; Raurich, Sala, & Sorolla, 2012).

In particular, if the elasticity of substitution between labour and capital is greater than one, then an increase in capital intensity need not be fully compensated for by an increase in wages. While labour-augmenting technical change will result in a constant LIS in the face of capital deepening, capital-augmenting technical change will reinforce the effect of increasing capital intensity and depress the labour share.

Kaldor's stylised facts are also disputed by Piketty (2014), who points out that Kaldor's insights are based on a relatively short time series from a particularly unusual period in history (roughly the mid-20th century). Piketty finds evidence that the KIS increases over the long run, contributing to increasing inequality given that capital tends to be owned by only a small fraction of people. In this scenario, if the elasticity of substitution between capital and labour is sufficiently large, then economic growth can be driven by capital accumulation alone. From the very long term viewpoint of Piketty, the rise in the LIS over the 20th century has been a brief aberration.

2.3 Measurement

Although the LIS is reasonably straightforward from a methodological perspective, there are a number of challenging issues around its measurement. These are briefly outlined in this sub-section with a fuller description given in Appendix A.

Coverage

The paper focuses on the LIS in the measured sector of the New Zealand economy. In principle, it would be preferable to examine the LIS for the whole economy not least of all because wages are partly determined in the aggregate economy (Sharpe, Arsenault, & Harrison, 2008). In practice, however, data availability restricts analysis to the 11-industry measured sector (MS-11), which covers around 60% of New Zealand's GDP. This includes all the primary and good-producing industries and some (but not all) of the services sector.

The labour income share is measured as labour income divided by total income. The income allocated to labour includes wages, salaries and on-costs such as employer superannuation payments and workers' compensation premiums. The allocation of labour income is measured in gross terms, with no allowance for the tax liabilities incurred. Using value added as the measure of income means that all non-labour income is attributed to capital. As such, capital income is a measure of gross returns to

capital, before deductions of tax, depreciation and interest. The income of working proprietors is split between labour income and capital income, with labour income based on hours worked and the average employee wage in the same industry (Statistics New Zealand, 2014).

This split of gross income between labour and capital means that potentially significant allocations of income are not included in the analysis. This includes government transfers through taxes and in-work benefits (such as Working for Families), depreciation and income flows to foreigners. For example, if depreciation rates and taxes are constant, using gross and net returns will provide the same LIS trends. However, increases in ICT capital in recent years may mean that depreciation rates have increased, resulting in more muted decreases in the *net* LIS compared with the *gross* LIS. Empirically, Bridgman (2014) shows that the decrease in net LIS has been markedly less than the decrease in gross LIS in the United States and in some countries there has actually been an increase in the net LIS.

By not accounting for these, movements in the LIS only describe the broad split of national income between labour and capital. A detailed and comprehensive account of changes *within* the labour or capital share of national income would need to account for these other important determinants and is beyond the scope of this paper.

Variables of interest

Ideally, LIS analysis would be conducted using a measure of nominal wages that is both exhaustive and comprehensive (Sharpe et al., 2008). However, such a measure is not available in New Zealand (Box 1). So nominal wage growth is derived from data on labour income (compensation of employees plus labour income of proprietors) and hours paid. A similar technique is used to derive growth in the returns on capital as the difference between capital income growth and capital input growth. This technique is used for the industry-level and aggregate MS-11 analysis.

Indexes of labour productivity growth for each MS-11 industry are calculated using real value added as the measure of output, and hours paid as the measure of labour input. Implicit product price deflators in aggregate and in each MS-11 industry are calculated as current-price output divided by chain-volume output.

Rosenberg (2010) analyses the relationship between wages and productivity in New Zealand and uses a similar labour productivity growth measure as this paper – that is, Statistics New Zealand labour productivity growth index for MS-12. On the labour cost side of the equation, Rosenberg uses compensation of employees (CoE) per hour paid for MS-12 and explicitly assumes that working proprietors are paid the same rate as employees. Several other wage measures – growth in the average wage from the Quarterly Employment Survey (QES) and the unadjusted Labour Cost Index (LCI) are also included in Rosenberg's analysis for comparison purposes.

Box 1 **Wages data – exhaustive and comprehensive?**

A wage series is:

- **Exhaustive:** if it includes all monetary and in-kind compensation paid to labour (wages, salaries, bonuses, commission, overtime, employer superannuation contributions etc.);
- **Comprehensive:** if it covers all workers in the economy, that is, it covers all industries and classes of workers (including the self-employed).

In addition to the labour compensation figures derived from the productivity series mentioned in the main text, there are several sources of labour compensation available for New Zealand: compensation of employees (CoE), Quarterly Employment Survey (QES), linked employer-employee dataset (LEED) (annual and quarterly), and the Labour Cost Index (LCI).

Of these measures, only the LEED annual series is both comprehensive and exhaustive. It is, however, only available from 2000 onwards. The other series are not comprehensive for various reasons. Specifically, the measure of labour compensation derived from the productivity statistics is only available for industries in the measured sector. The CoE series does not include the self-

employed. QES covers employees only and excludes the agriculture industry. The LEED quarterly series does not cover the self-employed.

An additional, overriding issue with these other measures is that "they do not provide a direct understanding of the growth in labour cost relative to the growth in output or changes in inflation" (Statistics New Zealand, 2014, p. 38). For example, "measures of average earnings and CoE are designed to measure the average level of wages or labour cost per employee" and "[t]he LCI is intended to represent employers' expenditure on the benefits granted to their employees as compensation for an hour of labour" (Statistics New Zealand, 2014, p. 38).

3 Income growth in New Zealand

This paper is primarily concerned with the distribution of the income "pie" across labour and capital. However, when focussing on the proportionality of the slices, it is important to also keep in mind how rapidly the pie has been growing. For example, if total income is growing fast enough, labour income can rise even when its national-income share is falling.

Broadly speaking, there are two proximate sources of real income growth: real output growth and shifts in the terms of trade. In turn, output growth can be broken down into contributions from input accumulation (growth in the use of inputs) and productivity growth. This section first outlines the impact of real output growth and shifts in the terms of trade on average income growth. It then decomposes real output growth into contributions from input accumulation and productivity growth.

3.1 Growth in output and income

Real (or volume) GDP is usually taken as a measure of both the volume of output and of the real income generated from the production of goods and services. At an average of 3.7% a year, New Zealand's economy-wide real GDP growth was generally strong between 1993 and 2008. This came after a period of much slower growth of 2.3% a year from 1978 to 1988 and virtual stagnation between 1988 and 1993 (Figure 3.1).[4] After 2008, the economy felt the effects of the global financial crisis, with real GDP falling by -1.0% a year between 2008 and 2010. Reflecting these trends, the period from 1993 to 2008 is referred to as the "high output growth period" in the rest of this paper.

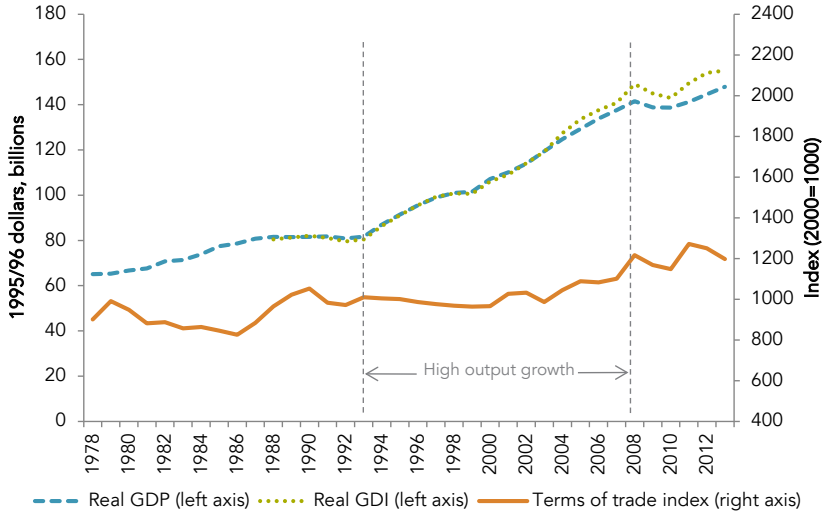
Movements in the terms of trade – the ratio of export prices to import prices – affect real income growth, quite apart from growth in GDP. A rise in the terms of trade, for example, means that a given volume of exports generates income with more purchasing power in terms of its command over imported goods and services.

Gross Domestic Income (GDI) is a measure of real income that adjusts GDP for movements in the terms of trade. With a relatively stable terms of trade in the 1990s, growth in New Zealand's real GDP and GDI were very closely aligned (Figure 3.1). However, a significant increase in the terms of trade over the 2000s added to real income growth. Specifically, a 26% rise in the terms of trade between 2000 and 2008 meant that annual real GDI grew 0.8 percentage points faster than annual real GDP growth over this period.[5]

[4] Unless otherwise stated, all figures in this paper are calculated by the authors using Statistics New Zealand data.

[5] The terms of trade peaked in 2011. The 32% rise from 2000 to 2011 added 0.6 of a percentage point to annual real income growth.

Figure 3.1 Real gross domestic income (GDI), real gross domestic product (GDP) and the terms of trade, economy-wide



Notes:

1. Real GDI is calculated as real GDP plus the terms of trade effect. The terms of trade effect is calculated as current price exports deflated by the implicit import price index less chain-volume exports.
2. GDI and GDP are March years. The terms of trade index is for June years.

3.2 Sources of real output growth

As mentioned above, real output growth can be broken down into contributions from input accumulation and multi-factor productivity (MFP) growth according to a standard growth accounting relationship:

$$Output\ growth = Input\ growth + MFP\ growth$$

That is, broadly speaking, output growth consists of input growth and changes in the efficiency with which inputs are used to produce output. Because output volumes are involved, there is no allowance in this accounting relationship for movements in the terms of trade.

Decomposing real output growth in this way is best done at the 11-industry measured sector (MS-11) level. As well as allowing for a longer time series, more-precise estimates of productivity (and labour income shares) are available for the industries within MS-11. This greater precision is highly desirable given that an objective of the paper is to assess shifts in the LIS and attendant variations in real wages and productivity growth. The turning points in MS-11 output growth are the same as those for total economy real GDP (Figure 3.1 versus Figure 3.3), suggesting that developments in MS-11 are broadly indicative of trends in the aggregate economy.

Figure 3.3 shows an index of real output along with indexes of input accumulation and MFP growth for New Zealand's 11-industry measured sector (MS-11). These data indicate that the New Zealand economy has shifted its reliance on MFP growth and input accumulation as sources of output growth over time. In short, two periods in which different sources of output growth came to the fore in the measured sector can be identified:

- A "**high productivity growth period**" from 1986 to 2000: Productivity growth, as measured by MFP growth, was strong and accounted for 83% of output growth over the period.[6] However, input accumulation was slow and there was even a shedding of inputs between 1987 and 1993.

[6] MFP growth accelerated during the period. It rose from 1.3% a year between 1986 and 1993 to 2.3% a year between 1993 and 2000.

- An "**input accumulation period**" from 2000 to 2008: Input accumulation was the dominant source of output growth in the 2000s and accounted for virtually all of the output growth from 2000 to 2009. In contrast, MFP growth almost disappeared over this period.

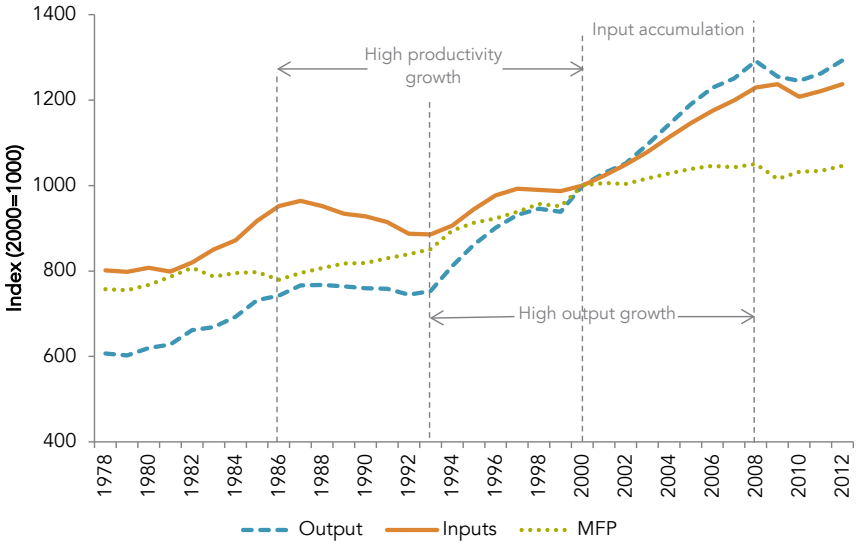
Splitting total inputs into labour input and capital input reveals that capital input growth was relatively strong and stable over the whole period (Figure 3.4). Capital use grew at 2.5% a year in the "high productivity growth period" (1986 to 2000) before stepping up to 3.7% a year in the "input accumulation period" (2000 to 2008).

Labour input has been much more volatile. In general over the high productivity growth period (1986 to 2000), New Zealand firms in MS-11 shed labour, with hours paid falling at an annual average rate of 0.9%. However, as outlined in detail in Conway and Meehan (2013), this reduction in labour input was concentrated in the first part of this period and growth in labour hours was positive from 1993 as firms reabsorbed labour. Labour input in MS-11 continued to grow during the input accumulation period (2000 to 2008), at an annual average rate of 1.8%.

It is important to note that employment growth in MS-11 has been much weaker than at the aggregate level, as services industries outside MS-11 increased their share of total employment (see Meehan, 2014 for details). For instance, between 1996 and 2011, hours paid in MS-11 increased at 0.2% a year, versus 0.6% a year across 16 industries.[7] The number of workers increased 0.4% a year in MS-11, versus 0.7% for the wider set of industries.

To summarise the key drivers of real output growth, Table 3.1 presents real output growth decomposed into the rate of total input growth plus the rate of MFP growth. Total input growth is broken down into the rates of labour and capital input growth. Income-share weighted sums of these growth rates (not shown) equal the rate of total input growth. The four periods used in the table are identified on the basis of the various turning points in output, productivity and labour use discussed above. The post-GFC period is not separated out and examined in detail since this paper is primarily concerned with trends over time and the small number of post-GFC data points means that cyclical factors are likely to dominate.[8]

Figure 3.2 Output, inputs and MFP in New Zealand's MS-11



[7] Hours paid and worker count data is available for a wider set of industries from 1996. These industries include the MS-16 industries plus education and healthcare.

[8] It is important to note that the calculated growth rates should be considered in the context of how the periods have been identified. For instance, these periods do not necessarily represent underlying rates of growth that might be calculated between the same points in business cycles.

Figure 3.3 Capital and labour input growth in New Zealand's MS-11

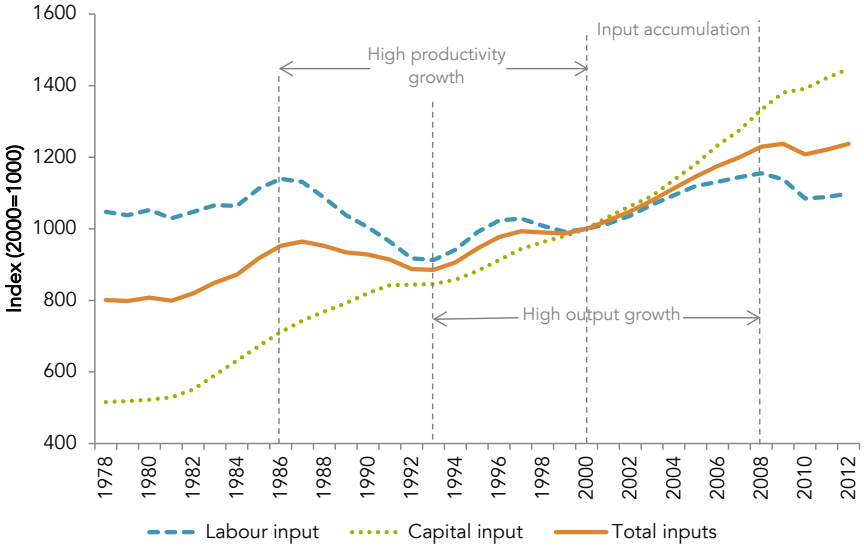


Table 3.1 Decomposition of output growth in New Zealand's MS-11

	1978 to 1986	1986 to 1993	1993 to 2000	2000 to 2008
Output growth	2.5	0.2	4.1	3.2
Total input growth	2.2	-1.0	1.8	2.6
Labour growth	1.1	-3.1	1.3	1.8
Capital growth	4.1	2.5	2.4	3.7
MFP growth	0.4	1.3	2.3	0.6

4 The income split between labour and capital

This section details the split of income between the owners of capital and labour. It begins by outlining the evolution of the labour income share (LIS) in New Zealand's measured sector (MS-11). The two decompositions described in section 2 above are then used to identify the proximate drivers of changes in the LIS over time. That is, sub-section 4.2 describes the impact of movements in labour productivity and the real product wage (RPW) while sub-section 4.3 outlines the impacts of changes in capital intensity and the rewards ratio.

4.1 The LIS in the measured sector

The LIS has declined in the measured sector of the New Zealand economy since the late 1970s (Figure 4.1). Over the late 1970s to 2010, the LIS had a high of 65.9% in 1981 and a low of 53.9% in 2002. By 2010, the LIS was at 56.1%. Unfortunately, insufficient observations are available to tell whether the general fall in the LIS over the 1980s and 1990s followed increases in the 1960s and 1970s, as was the broad pattern in a number of other countries (discussed in section 2 above).

Closer inspection reveals three sharp falls in the LIS over relatively short periods of time within this pattern of general decline. The first was a 7.4 percentage point drop from 1982-1984 – prior to New Zealand's period of economic reform. This fall was partly temporary in that there was a partial recovery of 3.8 percentage points over the next two years to 1986. The second fall of 3.7 percentage points was

mostly permanent and occurred between 1992 and 1995. The third fall of 5.6 percentage points came between 1999 and 2002. It was, however, temporary to some extent and partially reversed from 2002 to 2008 with a recovery of 2.7 percentage points.

Table 4.1 reports changes in the LIS over the periods of interest identified in section 3 and the three short periods of major declines in the LIS. The table also reports the growth rates of nominal output, labour income and capital income. Consistent with a declining LIS, capital income grew more rapidly than labour income in each period. However, labour income did not fall in any period. The table illustrates the importance of viewing changes in the LIS in the context of growth in the income "pie". For example, while the LIS fell during the high growth period of 1993 to 2000, the labour income "slice" grew at a strong positive rate. In the 2000s, the LIS also declined slightly overall. However, with continued strong growth in income, labour income growth accelerated.

Figure 4.1 Output and labour income share in MS-11

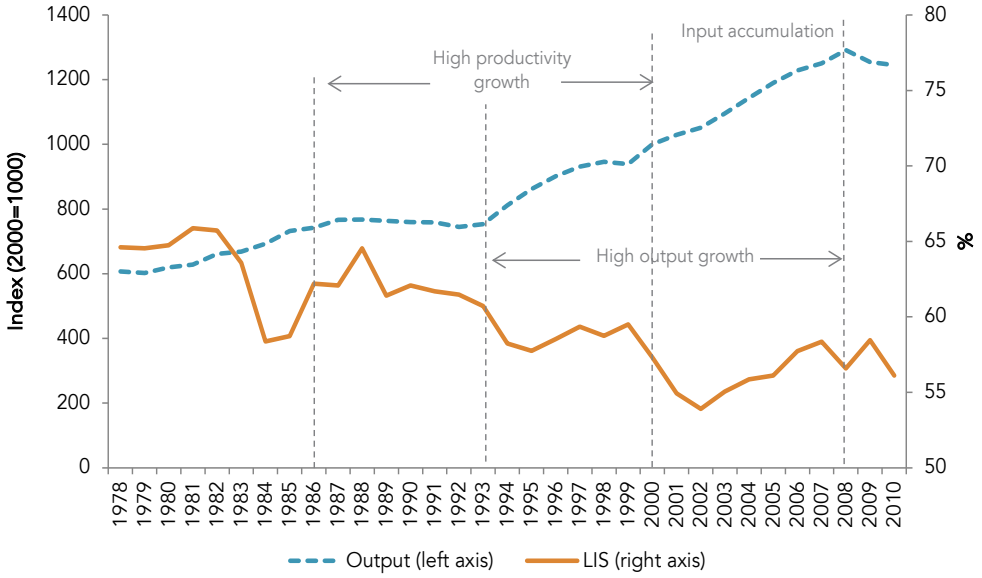


Table 4.1 Growth in LIS, nominal output, labour income and capital income

		1978 to 1986	1986 to 1993	1993 to 2000	2000 to 2008	1982 to 1984	1992 to 1995	1999 to 2002
Change in LIS	pp	-2.4	-1.5	-3.4	-0.7	-7.4	-3.7	-5.6
Growth in LIS	%pa	-0.5	-0.3	-0.8	-0.2	-5.8	-2.1	-3.2
Growth in nominal income	%pa	14.6	4.7	4.7	5.9	12.4	6.5	7.4
Growth in nominal labour income	%pa	14.1	4.3	3.8	5.7	6.0	4.4	3.9
Growth in nominal capital income	%pa	15.5	5.3	5.9	6.1	23.9	9.9	12.1

4.2 Labour productivity and real labour costs

This sub-section uses the "productivity and costs" decomposition, as set out in section 3, to investigate changes in the LIS. Figures 4.2a, b and c set out the results of this decomposition.

An important issue from this perspective is whether workers proportionately share in the income gains generated from productivity improvements. As well as having distributional consequences, if workers do not share in productivity gains, community acceptance of policies aimed at enhancing general

living standards and wellbeing via additional productivity growth could be undermined. The LIS provides a ready window to look into this issue.

Numerous factors – including new technology, globalisation, and regulatory changes – are likely to have influenced LP and the RPW in New Zealand since the late-1970s. Isolating the impact of these factors would be challenging and is out of scope of the paper. However, looking at the time profiles of LP and the RPW does reveal some interesting insights into New Zealand's economic history.

First, government intervention appears to have had a hand in the first sharp fall in the LIS. From 1982 to 1984, New Zealand adopted a price and wage freeze in an ultimately futile attempt to control inflation. This engendered a greater slowdown in nominal wages growth than in output price growth, with the RPW falling sharply as a result (Table 4.2b).

From the mid-1980s to the early 1990s, labour productivity growth improved as firms shed labour in response to more effective price signals following the onset of market-orientated economic reform. At the same time, real wages increased as nominal wages recovered from the impact of the price and wage freeze. The LIS stayed more or less constant over this period as strong labour productivity growth contributed proportionately to increasing both labour and capital incomes.

Although it is difficult to be conclusive, labour market reform may have had some influence on the step fall in the LIS from 1992 to 1995. Inflation was under control by this time and nominal wage growth was restrained and closely aligned with growth in output prices (Figure 4.2b). The passing of the Employment Contracts Act in 1991 may have acted to restrain nominal wage growth over these years. However, the economy was also emerging from a period of deep recession and pronounced labour shedding.[9] On balance, the RPW was broadly flat between 1992 and 1995 (Figure 4.2b and Table 4.1). In contrast, LP growth was robust as output growth recovered ahead of hours worked, following the period of labour shedding and recession (Figure 4.2c). As such, this was a short period of very strong output (and total income) growth, while restrained growth in nominal wages and employment combined to reduce the LIS.

From 1995 to 1999, the LIS was relatively stable as strong LP growth once again lifted both capital and labour incomes at more or less the same rate.

The sharp decline in the LIS from 1999-2002 predominantly reflects a temporary fall in the RPW associated with a brief acceleration in output prices that was unanticipated in nominal wage setting (Figure 4.2b). As such, this fall in the LIS appears to be the result of a temporary acceleration in output prices driving RPW growth into negative territory. However, from 2002 to 2007, nominal wage growth accelerated. The RPW grew more strongly than LP and the LIS regained most of the ground it lost in the early 2000s.

In general over the observation period, and reflecting the general fall in the LIS, LP growth has been stronger than growth in the RPW (2.2% pa vs 1.7% pa) (Figure 4.2a and Table 4.1). Notwithstanding this general decline, however, growth in the RPW does appear to be linked to LP growth, indicating that workers have shared substantially in the productivity gains they have helped to create (Figure 4.3).

Specifically, RPW growth was fastest during the high productivity growth period of 1986-2000 (Figure 4.3). In the first half of this period, the RPW grew at 3% a year – the strongest growth the in RPW in New Zealand at least since the late 1970s – alongside LP growth of 3.4% a year. The second-highest growth in the RPW – 1.8% a year – came in the second half of the high productivity growth period. This was about one percentage point less than the rate of LP growth given that the period contains at least parts of the sharp falls in the LIS. Growth in the RPW and LP were both much weaker outside of the high productivity growth period – that is, in the late 1970s-mid-1980s and in the 2000s. On the face of it, this indicates that LP growth is a necessary condition for sustainable improvements in the RPW.

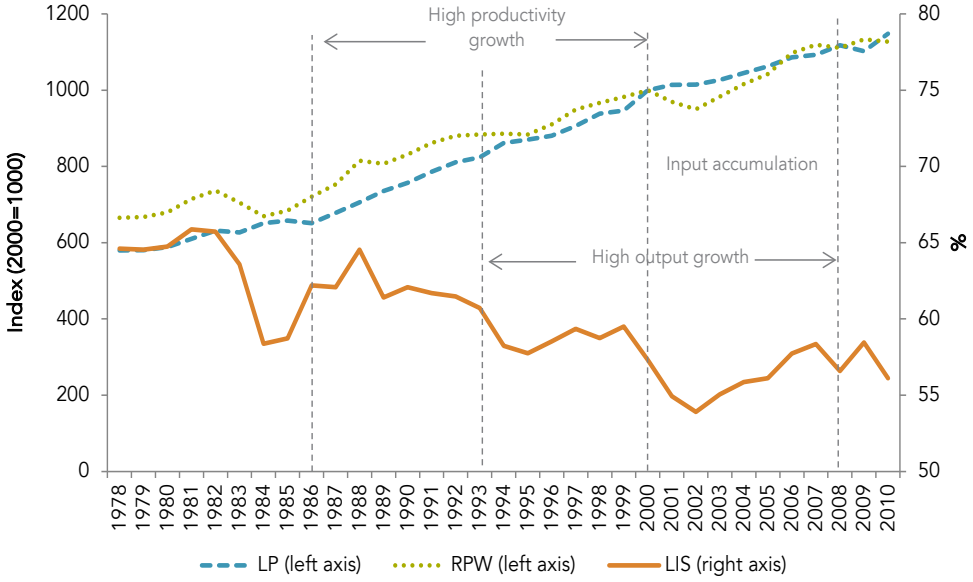
[9] At the aggregate level, unemployment peaked at 11.2% in 1991Q3 before falling sharply to a low of 6.2% in 1995Q3.

With robust and sustainable growth in the RPW more likely when LP growth is strong, there is no evidence of a clear relationship between productivity growth and changes in the LIS. During the high productivity growth period, there were the sharp falls in the LIS in 1992-1995 and from 1999 (Figure 4.1 above). Mostly, however, the LIS was relatively stable over this period. From 1986 to 1993, when LP growth was at its strongest at 3.4% a year, the LIS fell only moderately (0.3% a year) (Table 4.2). The LIS fell more rapidly (0.8% a year) in the second part of the high productivity growth period, but that result is coloured by the two short periods of sharp decline.

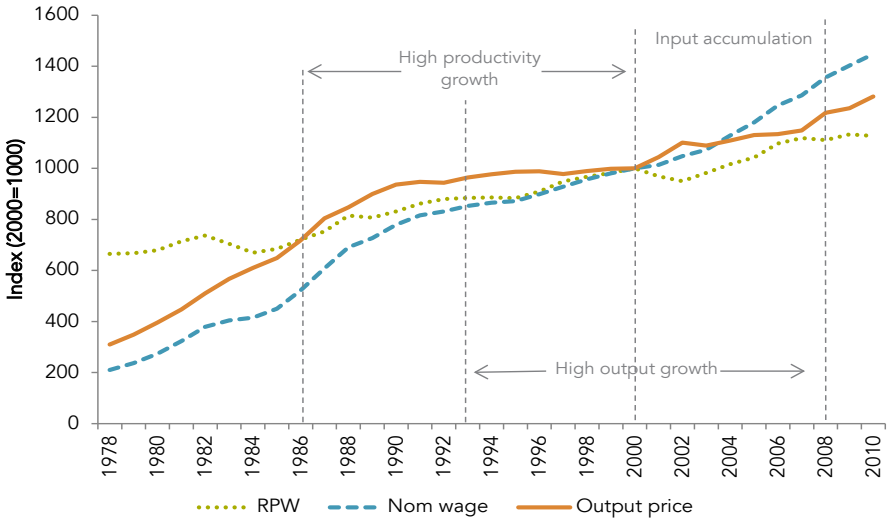
Figure 4.4 provides even further evidence. It presents the three-year moving average of the absolute value of deviations of RPW growth from LP growth. Deviations were generally lower in the 1990s during New Zealand's high productivity growth period.

Figure 4.2 The productivity and costs decomposition in New Zealand's MS-11

a. Labour productivity and the real product wage



b. Nominal average hourly wage and output prices



c. Output and hours paid in New Zealand's MS-11

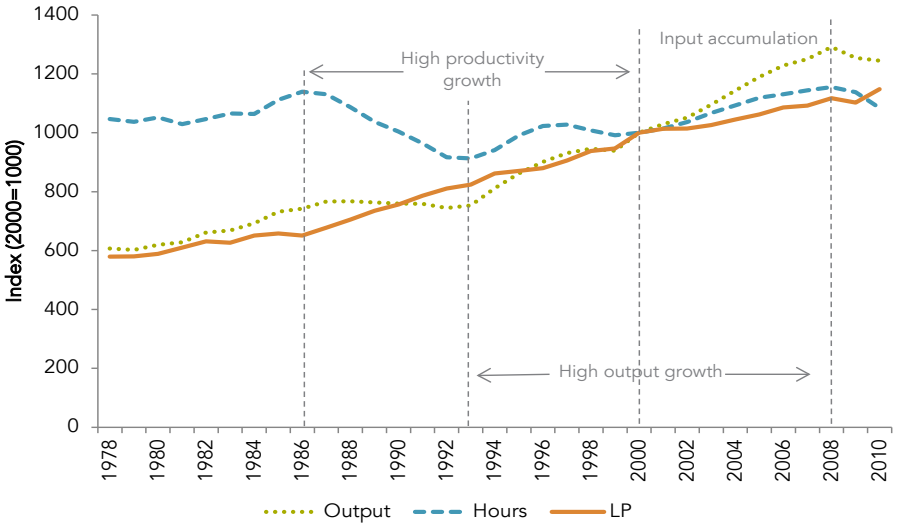


Table 4.2 Decomposition of LIS growth, annual percent

	1978 to 1986	1986 to 1993	1993 to 2000	2000 to 2008	1982 to 1984	1992 to 1995	1999 to 2002	1978 to 2010
LIS growth	-0.5	-0.3	-0.8	-0.2	-5.8	-2.1	-3.2	-0.4
(=) RPW growth	1.0	3.0	1.8	1.3	-4.7	0.1	-1.1	1.7
(-) LP growth	1.5	3.4	2.8	1.4	1.5	2.4	2.3	2.2
RPW growth								
(=) nom wage growth	12.1	7.3	2.3	3.9	4.7	1.6	2.3	6.2
(-) price growth	11.1	4.3	0.5	2.5	9.4	1.5	3.3	4.5
LP growth								
(=) output growth	2.5	0.2	4.1	3.2	2.4	5.0	3.9	2.3
(-) hours growth	1.1	-3.1	1.3	1.8	0.8	2.6	1.5	0.1

Notes:

1. These are approximations only, and there is some error so that, for example, LP growth does not exactly equal output growth less hours growth. In the case of LP growth, Statistics New Zealand MS-11 indexes were used for labour productivity, output growth and hours growth. The errors, therefore, are likely to be due to a combination of factors, such as the use of rounded numbers and log approximations for growth rates.

Figure 4.3 Growth in real product wages and labour productivity

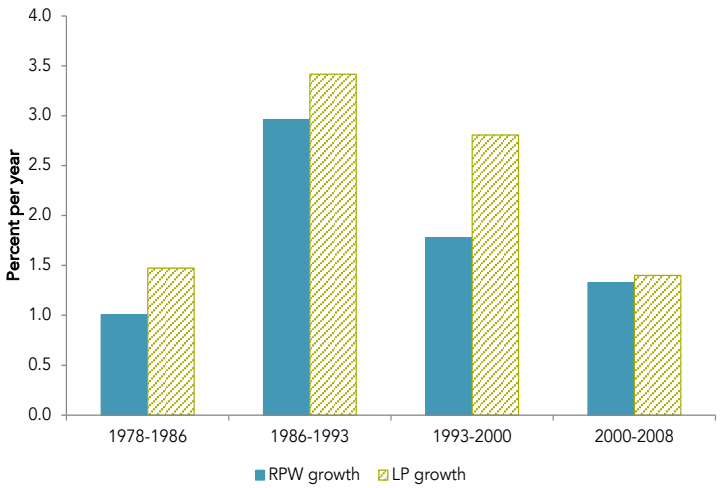
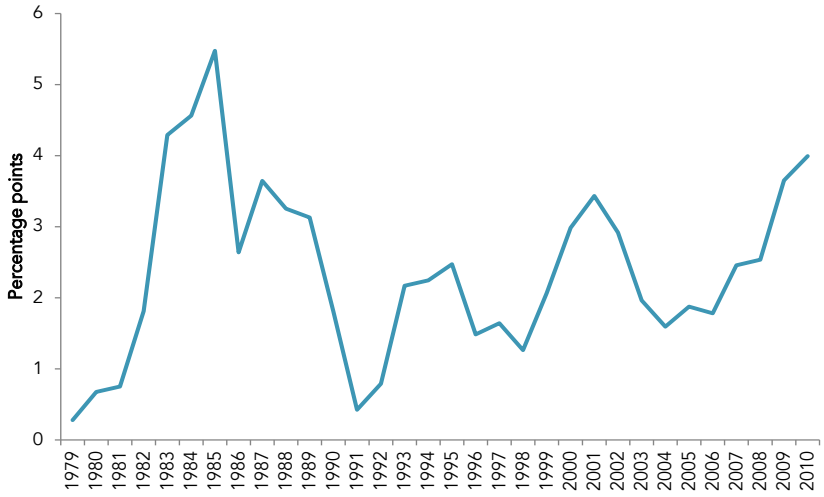


Figure 4.4 Absolute value of deviations of RPW growth from LP growth, 3-year-moving average



Real consumption wages

The above analysis of labour productivity and real labour costs in the New Zealand measured sector uses a measure of real wages that adjusts nominal wages for inflation in the same way as the nominal output measure is deflated to calculate productivity. That is, both are adjusted using an index of product price inflation. This is appropriate given that from the firm's perspective, the RPW represents the real average cost of an hour of labour to producers. As such, this is the most appropriate measure of real compensation to compare with labour productivity growth (Feldstein, 2008, p. 593).

However, from the "wages as income" viewpoint of those employed, it is movements in the prices of consumption goods and services that matter, given that consumption prices determine the purchasing power a given nominal wage delivers. As outlined in section 2, the relationship between LP and real consumption wages (RCW) – which are calculated as nominal wages deflated by the CPI or another consumption price deflator – depends on relative shifts in the prices of workers' consumption basket and the output they produce. This is called labour's terms of trade.

In New Zealand at the aggregate level, labour's terms of trade – measured as the economy-wide GDP deflator relative to the CPI – has been more or less flat since the late 1970s.[10] This indicates that the cost of goods and services consumed by workers has increased broadly in line with the price of output produced by workers (Figure 4.5).

This, however, need not always the case. The steep rise in Australia's terms of trade in the 2000s, for example, drove a wedge between product and consumption prices that led to significant differences in the growth rates of the RPW and the RCW. As described in Parham (2013), while growth in the RPW fell behind LP growth in Australia over the 2000s, growth in the RCW did not.

As outlined in Section 3, New Zealand also experienced a gain in the terms of trade over the 2000s. However, this was considerably smaller than in Australia and did not lead to as major a divergence between product and consumption prices.

Labour's terms of trade for workers in a given sector of the economy may vary over time depending on how changes in the price of the output they produce compares with changes in the CPI. This is relevant to the analysis above – movements in labour's terms of trade are much more pronounced when measured using the MS-11 product price deflator relative to the CPI (Figure 4.5). Over most of

[10] Normally, product and consumer prices tend to grow at the same or similar rates. They can, however, differ if workers do not consume the same goods and services as they produce. At the aggregate level, this can reflect international trade – some of the output of New Zealand workers is exported, and some of the goods and services consumed by New Zealand workers are imported. The implicit price of services provided by owner-occupied houses can be another key source of differences in product and consumption wages. At the industry level, workers in the mining industry, for example, consume a much wider variety of more goods and services than those produced by their industry.

the observation period, CPI inflation has been higher than inflation in the price of output produced in MS-11 and the terms of trade for workers in MS-11 has fallen through time.

This reflects the fact that inflation tends to be relatively high in the so-called non-measured sector of the New Zealand economy.[11] Because this contributes to CPI inflation but is outside MS-11, the terms of trade for workers in MS-11 have deteriorated over time and growth in their RCW has been persistently weaker than growth in their RPW (Table 4.3). Specifically, from 1978 to 2010, the RPW increased by 1.7% a year whereas the RCW increased by a much more modest 0.8%.

Given the alignment of consumer and producer prices at the economy-wide level, the terms of trade for workers outside of MS-11 must have increased. That is, there has been higher inflation in the price of output produced by these workers than in the CPI. So growth in the RCW for these workers must have been higher than growth in their RPW.

Figure 4.5 Labour's terms of trade

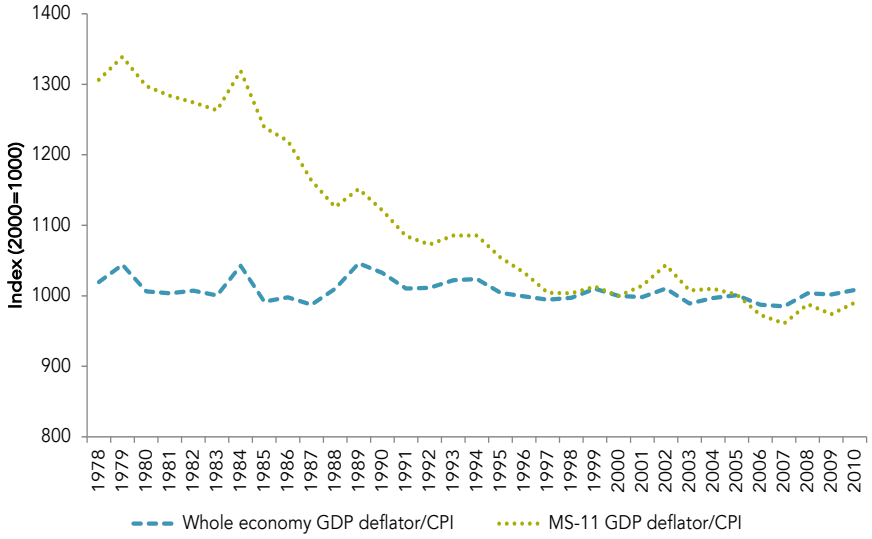


Table 4.3 CPI and GDP deflator and the gap between RPW and RCW, annual percent

	1978 to 1986	1986 to 1993	1993 to 2000	2000 to 2008	1982-1984	1992-1995	1999-2002	1978-2010
CPI	12.7	6.2	1.7	2.7	8.0	2.1	2.4	5.7
GDP deflator	12.4	6.6	1.4	2.8	9.8	1.8	2.4	5.6
MS-11 deflator	11.7	4.5	0.5	2.6	9.8	1.5	3.4	4.8
RCW	0.2	1.3	0.6	1.2	-2.9	-0.4	-0.1	0.8
RPW	1.1	3.0	1.8	1.4	-4.6	0.1	-1.1	1.7
LP	1.5	3.4	2.8	1.4	1.5	2.4	2.3	2.2

4.3 Quantities and prices

As outlined above in section 2, the LIS can alternatively be viewed using a "factor proportions and rewards ratios" approach. This decomposition traces changes in the LIS to differences between growth

[11] These industries outside of MS-11 are: Rental, hiring & real estate services; professional, scientific & technical services; administrative & support services; public administration & safety; education & training; healthcare & social assistance; arts & recreation services; other services.

in factor proportions (the capital-labour ratio) and growth in the rewards ratio (wage rates relative to the rate of return on capital).

Indexes of the quantity and rewards ratios for MS-11 are shown in Figure 4.6a, along with the time series of the LIS. Figure 4.6b displays the quantity ratio and its constituent parts – capital (K) and labour (L) – while Figure 4.6c shows the rewards ratio with its constituent parts – the wage rate (w) and the rate of return on capital (r). The time periods used previously are also identified in the figures, with growth rates presented in Table 4.4.

The capital-labour ratio has increased by 3% per year on average from 1978 to 2010 in the New Zealand measured sector. Consistent with a decline in the LIS, the rewards ratio also increased over the period but at the more modest rate of 1.9% per year. This increase in the rewards ratio occurred in two major step-ups – from the mid-1980s to the early-1990s and from the early-2000s. In both cases, wages accelerated while rates of return on capital remained flat.

Short-term volatility in the LIS predominantly reflects volatility in the reward ratio.[12] In turn, short-term variability in the reward ratio largely stems from the greater variability in the rate of return on capital, as opposed to the wage rate (Figure 4.6c). From this perspective, the three short sharp falls in the LIS were primarily associated with weak growth in the rewards ratio, which in turn was associated with a combination of wage restraint and acceleration in capital returns. This would very likely have contributed to a more skewed distribution of personal and household income.

For instance, the largely temporary dip in the LIS in 1982-84 reflected a very large fall in the rewards ratio (at -9.5% a year) as slower nominal wage growth during the price and wage freeze coincided with strong growth in the rate of return on capital. This is consistent with the results reported above – during the price and wage freeze, firms were more effective at restricting wages growth rather than growth in the price of their output and the return on capital increased accordingly. The growth in K/L also blipped up over this period, adding to the fall in the LIS.

From 1986 to 1993, the first part of the high-productivity growth period, labour input fell in absolute terms and the capital-labour ratio grew at a very fast rate. Strong wage increases after the price and wage freeze pushed growth in the rewards ratio to a similarly high rate over this period and the LIS fell only marginally. This suggests that at least some of the reduction in labour input in this period may have been due to labour being priced out of the market in an environment of high wage growth and low growth in returns on capital. However, the onset of economic reform from 1984, which exposed firms to greater competitive forces, also stimulated a period of intensive labour reallocation at this time (Meehan, 2014).

The sharp fall in the LIS from 1992 to 1995 also came about as a result of a short-term dip in the rewards ratio, this time driven by very strong growth in the rate of return on capital and very weak wages growth.

For the rest of the high-productivity growth period, growth in the rewards and quantity ratios were broadly matched and the LIS was more or less constant. K/L grew modestly as labour input picked up strongly following the early-1990s recession and the immediate impact of reform. This strong employment growth may have reflected wage restraint in conjunction with strong growth in the rate of return over the mid-1990s period.

In the final period of 2000 to 2008, labour and capital input both grew relatively strongly in the early years of the 2000s and K/L was more or less flat. During the step fall in the LIS from 1999 to 2002, wages growth was reasonable while the return on capital accelerated strongly. As is apparent from Figure 4.6, different trends emerged later in the 2000s. From around 2004, capital accumulation intensified at the same time as employment growth moderated and growth in K/L picked up accordingly. Wages growth picked up while the return on capital generally stagnated, causing the

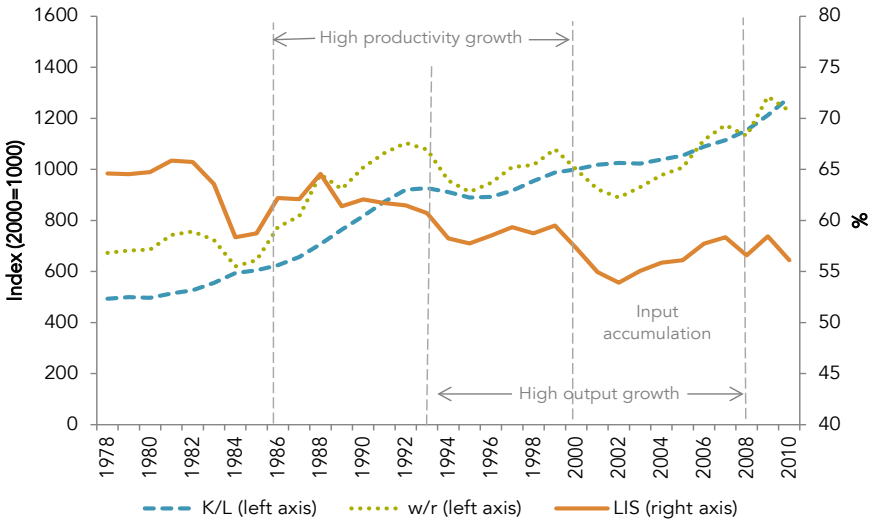
[12] Note that higher volatility in the rewards ratio means that the calculation of growth rates over intervals of some years can be sensitive to starting and finishing points of the intervals chosen.

rewards ratio to increase markedly and outpace the increase in capital intensity. As such, the LIS recovered the ground it lost in the early 2000s.

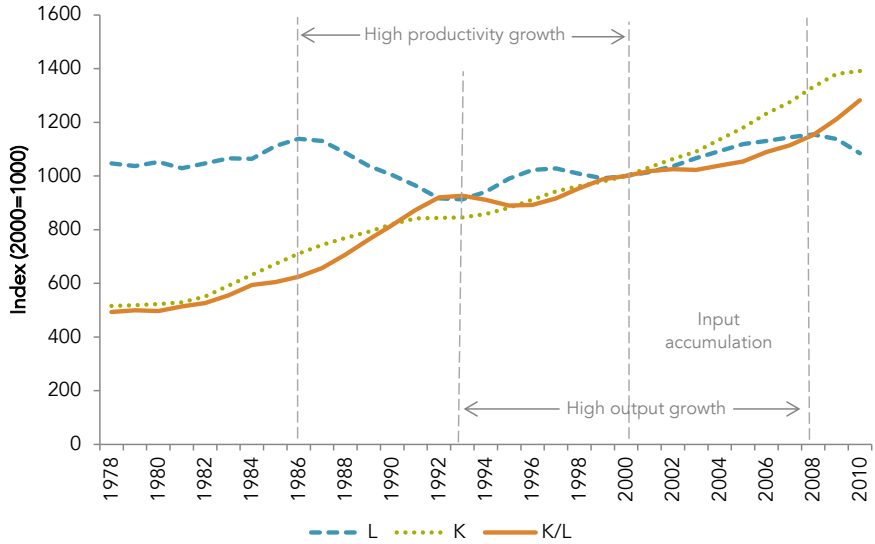
While it can be argued that rates of return were boosted at the expense of wages in these periods of sharp fall, none of the movements was outside the realms of "standard" cyclical movements that were counterbalanced later by cyclical movements in the other direction.

Figure 4.6 The quantities and prices decomposition

a. The capital-labour ratio, the wage-return ratio and the LIS



b. The quantities ratio



c. The prices ratio

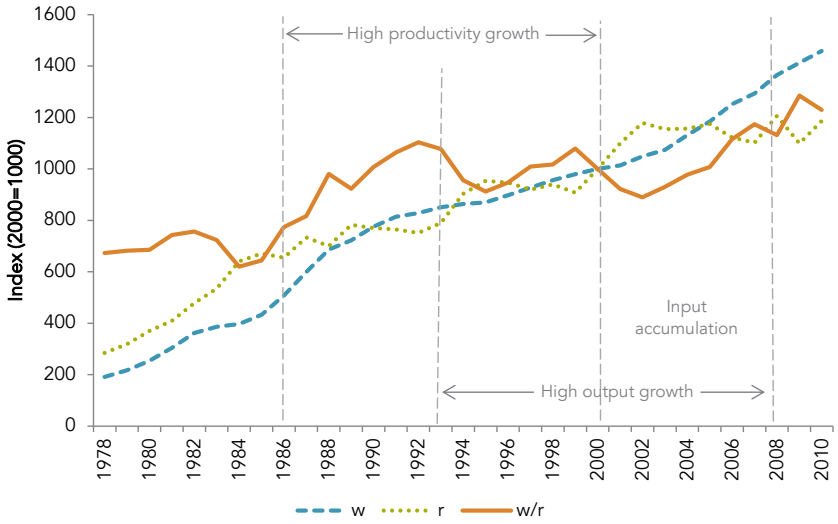


Table 4.4 Rates of growth in the capital-labour ratio, the wage-return ratio and the labour income share, various periods percent per year

	1978 to 1986	1986 to 1993	1993 to 2000	2000 to 2008	1982 to 1984	1992 to 1995	1999 to 2002	1978 to 2010
Growth in LIS	-0.5	-0.3	-0.8	-0.2	-5.8	-2.1	-3.2	-0.4
Growth in K/L	3.0	5.8	1.1	1.8	6.2	-1.1	1.3	3.0
Growth in w/r	1.8	4.8	-1.1	1.6	-9.5	-6.1	-6.2	1.9
Growth in K	4.1	2.5	2.4	3.7	7.1	1.5	2.8	3.1
Growth in L	1.1	-3.1	1.3	1.8	0.8	2.6	1.5	0.1
Growth in w	13.0	7.7	2.3	4.0	4.8	1.6	2.3	6.6
Growth in r	11.0	2.7	3.4	2.4	15.8	8.3	9.1	4.6

5 An industry perspective

This section investigates the industry-level contributions to the aggregate changes in the LIS in MS-11 outlined above. It also uses the LIS decompositions outlined in Section 2. The focus is on the labour productivity-real product wage decomposition, to better understand the link between productivity and wages. Results from the quantities and rewards ratios decomposition can be found in Appendix B.

5.1 LIS by industry – labour productivity and real product wages

Growth rates in the LIS by industry, together with their decomposition into RPW growth and LP growth over the four periods of interest are shown in Figure 5.1. There is some variation in the LIS movements across industries. The largest within-industry fall in the LIS occurred in the electricity, gas, water & waste industry in the 1993 to 2000 period, following smaller falls since the late 1970s. As such, up until 2000, this industry stands out as having had LP growth that has been considerably faster than RPW growth, particularly over the 1990s.

This is consistent with large falls in employment in the electricity, gas, water & waste industry – which would have acted to constrain wage increases – in conjunction with strong labour productivity growth (for a discussion see Laws & Meehan, forthcoming; Meehan, 2014). This may be indicative of

over-employment prior to reform, as was the case in the utilities industries in a number of other countries. However, new technologies that improved labour productivity while at the same time reducing demand for labour may have also played a role.

The mining industry recorded negative growth in the LIS across all four periods of interest, including particularly large declines in 1978-1986 and 2000-2008. On average over the full observation period, LP growth has been over two percentage points faster than growth in the RPW in the mining industry. As in Australia, this may reflect increasing capital intensity in mining coupled with high commodity prices in the 2000s that effectively lowered the real cost of labour for firms and increased the return on capital (Parham 2013).

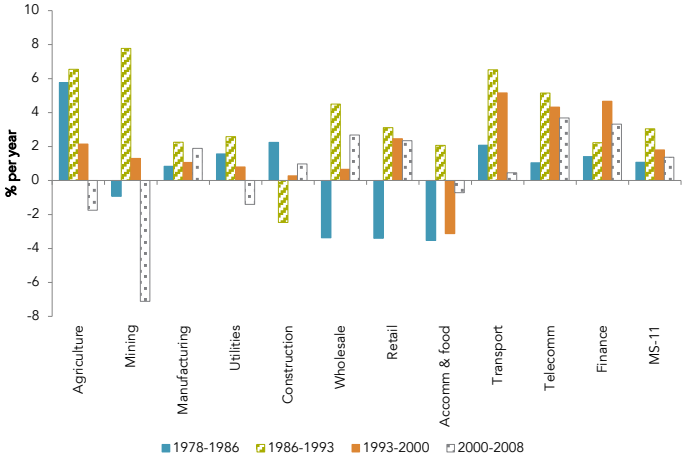
In the information, media & telecoms industry, growth in the LIS has been persistently negative in all four periods of interest, with LP growth considerably stronger than growth in the RPW.

In contrast and with some exceptions, more labour-intensive industries – such as the wholesale; retail and accommodation & food industries – have registered some gains in the LIS, particularly from 1986 to 1993 when growth in nominal and real product wages was particularly strong. Indeed, the largest positive growth rate in the LIS was recorded in the accommodation & food industry over this period.

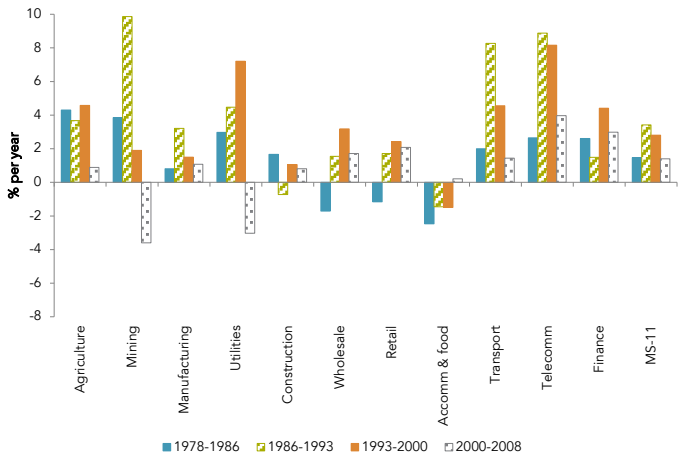
Figure 5.1 Growth in the LIS, RPW and LP by industry, various periods

a. LIS growth

b. RPW growth



c. Labour productivity growth



Notes:

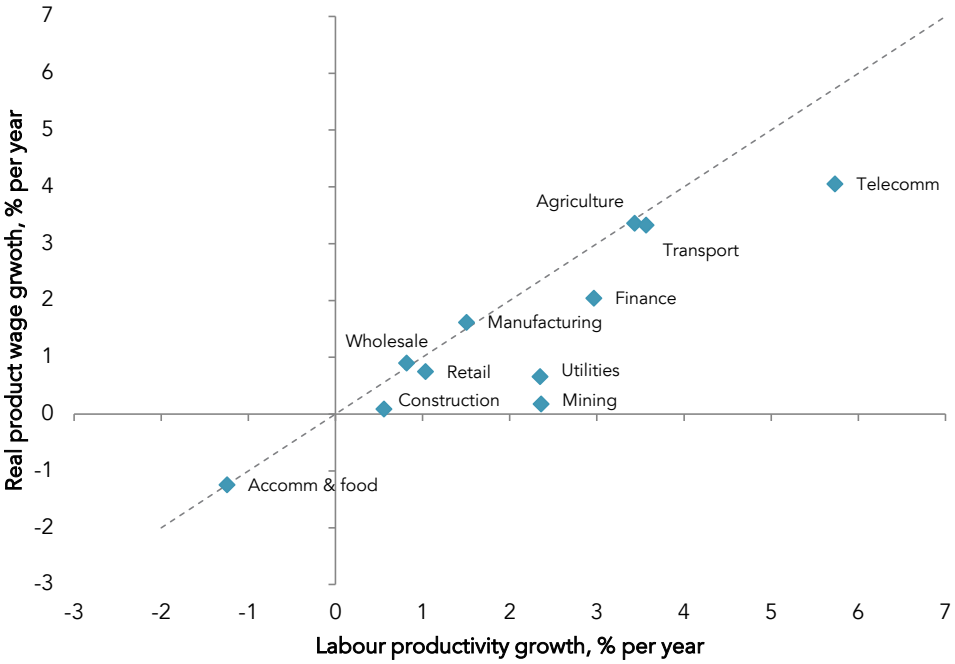
1. Some of the industry names have been abbreviated as follows: 'Agriculture' is 'Agriculture, forestry & fishing'; 'Utilities' is 'Electricity, gas, water & waste services'; 'Wholesale' is 'Wholesale trade'; 'Retail' is 'Retail trade'; 'Accomm & food' is 'Accommodation & food services'; 'Transport' is 'Transport, postal & warehousing', 'Telecomm' is 'Information media & telecommunications' and 'Finance' is 'Financial & insurance services'.

Another feature of these decomposition results is that growth in labour productivity and in real product wages is correlated across industries. To illustrate, from 1978 to 2010, the cross-industry correlation between growth in LP and in the RPW is 0.9 (Figure 5.2). Although well aligned, growth in the RPW was more modest than growth in LP in the 8 out of 11 industries that are below the 45 degree line in Figure 5.2. Accordingly, and consistent with the aggregate measured sector results outlined above, these eight industries experienced general declines in the LIS.

This indicates some alignment between growth in LP and in the RPW at the industry level in the New Zealand economy. In other words, industries with high productivity growth tend to experience larger increases in real wages compared to industries in which labour productivity growth is lower. As with the evidence of a correlation between growth in labour productivity and in the RPW at the MS-11 level over time, these results provide further evidence that high productivity growth tends to be associated with strong growth in real product wages.

This cross-industry alignment between growth in labour productivity and the RPW is reasonably strong in general but does change through time. Specifically, the correlation tends to become looser around the three periods over which falls in the LIS were concentrated: 1982-1984, 1992-1995 and 1999-2002 (Figure 5.3). This suggests some realignment between labour productivity and real product wages across industries at these times of short sharp falls in the LIS.

Figure 5.2 Growth in LP and the RPW by industry, 1978-2010



Source: Statistics New Zealand; authors' calculations

Notes: Some of the industry names have been abbreviated as follows: 'Agriculture' is 'Agriculture, forestry & fishing'; 'Utilities' is 'Electricity, gas, water & waste services'; 'Wholesale' is 'Wholesale trade'; 'Retail' is 'Retail trade'; 'Accomm & food' is 'Accommodation & food services'; 'Transport' is 'Transport, postal & warehousing'; 'Telecomm' is 'Information media & telecommunications' and 'Finance' is 'Financial & insurance services'.

Figure 5.3 Correlation between annual growth in RPW and LP at the industry level, 3 year moving average

5.2 Industry contributions to changes in the LIS

The industry contributions to changes in the LIS at the MS-11 level for each period of interest are shown in Figure 5.4.[13] These account for change in the LIS within each industry, the relative importance of the industry in MS-11 and changes in the relative size of the industry. For each period,

[13] Note that there are several complications in calculating these industry contributions, especially over intervals of several years. The methodology used in this paper is set out in Appendix B.

the contributions sum across industries to the change in the LIS at the MS-11 level. Note that because of variability around the trend changes in industry contributions, results can be sensitive to selection of period beginning/end points.

The industry contributions to changes in the LIS at the MS-11 level are quite variable across time with no one industry predominating. The mining; electricity, gas, water & waste and information media & telecommunications industries made negative contributions to the change in LIS in all four periods. The other industries had a mix of positive and negative contributions over time. Over the 1993 to 2000 period, during which productivity growth was relatively high, agriculture; electricity, gas, water & waste and information, media & telecoms were the most prominent in bringing down the LIS. During the period 1986-1993, the manufacturing industry made the largest negative contribution to the fall in the LIS. No industry made a consistently positive contribution to the change in the LIS in MS-11.

Figure 5.5 shows the industry contributions to the three periods of sharp decline in the LIS. The manufacturing industry made by far the largest contribution to the fall in the LIS in the 1982-84 and 1992-95 periods, accounting for just over 40% of the aggregate fall in the LIS at the MS-11 level. In both cases, that came about through a combination of a strong negative contribution to RPW growth and a strong positive contribution to LP growth. It was the contributions to RPW growth that were unusual, as they were opposite in sign to manufacturing's usual contribution (Appendix B).[14]

Agriculture made the largest contribution – over 45% of the aggregate decline – to the fall in the (largely temporary) fall in the MS-11 LIS from 1999-2002. This was predominantly as a result of a strong negative contribution to growth in the RPW.

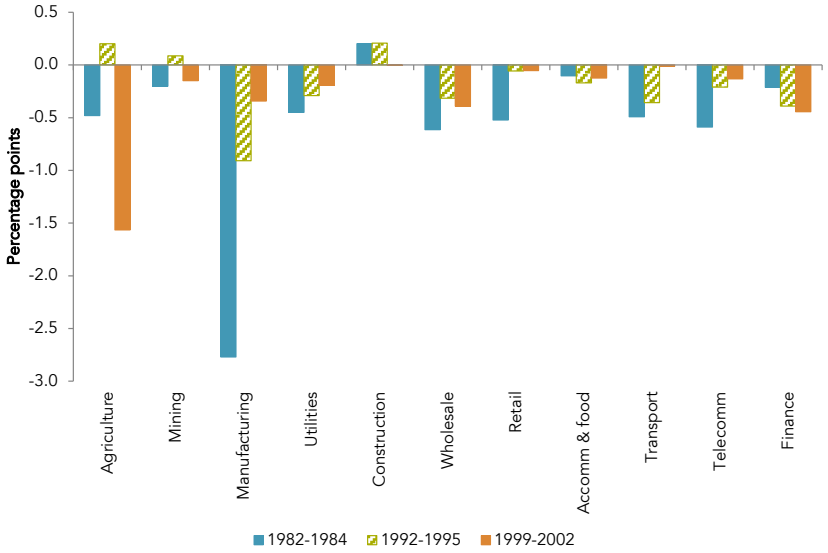
Figure 5.4 Industry contributions to change in MS-11 LIS, various periods[1]

Source: Statistics New Zealand; authors' calculations

1. Bars sum horizontally MS-11 aggregate growth.

[14] Analysis of the nine sub-industries that make up the manufacturing industry (available on request) shows that in the 1992-95 period petroleum, chemical, polymer & rubber product manufacturing made by far the largest negative contribution to the decrease in manufacturing's LIS as a result of a strong contribution to labour productivity growth combined with a negative RPW contribution. This reflected strong MFP growth, after an earlier period of capital intensification, and a large positive contribution to output price growth coupled with a large negative contribution to nominal wage growth.

Figure 5.5 Industry contributions to change in MS-11 LIS, various periods[1]



6 Comparisons with Australia

This section compares the results for New Zealand presented above with results for Australia. Decade averages are used as the basis for these trans-Tasman comparisons, given that the periods of interest identified for New Zealand may not accurately fit Australia's economic history story. The coverage of the Australian data is the measured sector – MS-12.[15]

6.1 Income growth

Growth in output and income has been lower in New Zealand than in Australia. New Zealand's GDP growth gap has, however, narrowed progressively over the decades – from 1.4 percentage points in the 1980s to 0.4 percentage points in the 2000s (Table 6.1).[16] Over the 2000s, real income growth in New Zealand did not receive the same gain from terms of trade increases as did Australia's. The much larger increase in Australia's terms of trade added a full percentage point to the rate of gross domestic income (GDI) growth above GDP growth, whereas New Zealand received a more modest 0.4 percentage point boost. Growth patterns in the measured sector were similar to growth patterns in the whole economy in both countries.

As in New Zealand, MFP growth in the measured sector was strong in Australia in the 1990s but fell precipitously in the 2000s as input accumulation became the predominant driver of output growth (upper panel of Table 6.2). Indeed, MFP growth was stronger in the New Zealand measured sector over the 1980s and 1990s, while Australia has had much stronger growth in input accumulation over all decades. As such, Australia's growth advantage over New Zealand in the measured sector stems from much more rapid growth in inputs into the production process.

Breaking down input accumulation further reveals an important difference between the two countries. Whereas New Zealand experienced labour shedding in the 1980s and no overall change in labour input in the 1990s (after an initial fall was offset by a subsequent recovery), Australia had strong growth in labour use in the 1980s and positive growth in the 1990s (lower panel of Table 6.2). At the economy-wide level, employment growth has been remarkably similar across the two countries

[15] Appendix A discusses the reason for this slight difference in industry coverage.

[16] Moreover, the 3.6% a year growth in New Zealand between 1993 and 2008 compares very favourably with average Australian rates over this period. It should be highlighted that this is a narrowing of the growth gap, and convergence of New Zealand to Australia's per capita output and income levels would require that New Zealand had higher growth rates.

(Mason, 2013). It follows, therefore, that a much higher proportion of employment growth in New Zealand has taken place outside of the measured sector, as captured by MS-11.

Growth in the use of capital follows the same general pattern in both countries but was much stronger in Australia in the 1990s and 2000s. Australia's strong growth in capital input in the 2000s undoubtedly reflects rapid capital accumulation through the mining boom (Parham 2012). With New Zealand shedding labour from the measured sector in the 1980s, capital deepening was stronger than in Australia over that decade (lower panel of Table 6.2). However, with stronger capital accumulation, Australia had more rapid capital deepening over the 1990s and 2000s even though growth in labour input was also stronger than in New Zealand.

Labour productivity growth was similar in Australia and New Zealand in the 1990s, as stronger capital deepening in Australia made up for weaker MFP growth. In the 2000s, labour productivity growth did not fall as far in Australia as in New Zealand, mostly because of a sharper rise in capital deepening.

Table 6.1 Annual average rates of growth in GDP, the terms of trade and GDI in New Zealand and Australia

	1980s	1990s	2000s
New Zealand			
GDP	2.0	2.8	2.6
Terms of trade	1.0	-0.8	1.7
GDI		2.6	3.0
Australia			
GDP	3.4	3.3	3.0
Terms of trade	0.4	-0.8	4.8
GDI	3.5	3.2	4.0

Source: For New Zealand, Statistics New Zealand and authors' calculations; for Australia, Parham (2013)

Table 6.2 Sources of growth and growth in inputs in the measured sectors of New Zealand and Australia

	1980s	1990s	2000s
New Zealand			
Output	2.1	2.8	2.2
Inputs	1.4	0.8	1.9
MFP	0.7	2.0	0.3
Australia			
Output	3.2	3.5	3.2
Inputs	2.8	1.8	2.9
MFP	0.3	1.7	0.4
New Zealand			
Labour	-0.5	0.0	0.8
Capital	4.6	2.0	3.4
Capital deepening	1.9	0.8	1.1
Labour productivity	2.5	2.8	1.4
Australia			
Labour	1.7	0.5	1.0
Capital	4.7	3.5	5.0
Capital deepening	1.1	1.2	1.8
Lab productivity	1.5	2.9	2.1

Source: For New Zealand, Statistics New Zealand and authors' calculations; for Australia, Parham (2013)

Notes:

1. New Zealand market-sector is MS-11; Australian market-sector is MS-12. See Appendix A for explanation.

6.2 The labour income share

The labour income share in the measured sector

Over the long term, New Zealand and Australia show a broadly similar pattern of a declining LIS in the measured sector (Figure 6.1). Australia's LIS declined through the 1980s as a correction for a rise that took place in the 1970s (Parham et al, 2000).

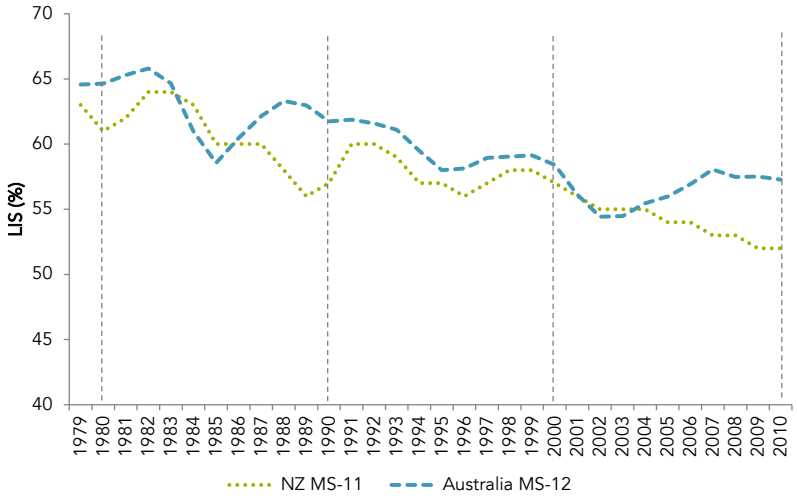
Despite broad similarities from the 1980s, there are some differences in the evolution of the LIS in New Zealand and Australia over shorter time horizons. Over the 1980s, the LIS was more volatile in New Zealand than in Australia as a result of the sharp decline from 1982 to 1984 and subsequent recovery.

In 1990, the LIS was considerably higher in New Zealand than in Australia. However, over the 1990s, the LIS in Australia is generally considered to have been relatively flat (Parham et al, 2000, ACTU, 2012), even though it spiked in the early-1990s – a development that can be discounted as an association with the early-1990s recession. In New Zealand, the LIS generally declined over the 1990s, in no small part because of the considerable fall in 1992-95.

By 2000, the LIS was around the same level in both countries. Over the 2000s, the LIS moved in very different directions in the two countries – the relatively sharp fall in Australia's LIS contrasts with the overall stability in New Zealand's LIS (including a rise from 2002).

The significance of the trans-Tasman comparison lies in the fact that the two countries had similar broad productivity patterns and yet their LIS outcomes were different over short-run time horizons. In the high productivity growth periods, the LIS fell in New Zealand but was relatively steady in Australia. In the high accumulation period, New Zealand's LIS mostly rose whereas Australia's fell. This reinforces the conclusion that there is no necessary relationship between productivity growth and falls in the LIS. It also reinforces the need to dig deeper to find underlying factors that brought similar productivity outcomes but different distribution outcomes across labour and capital. This might, for example, be related to the fact that New Zealand went a lot earlier with labour market reforms.

Figure 6.1 The labour income share in New Zealand and Australia



Source: Authors calculations and Parham (2013).

Notes: The series are two-period moving averages.

Labour productivity and the real product wage

With trans-Tasman labour productivity growth broadly similar in the 1990s, the relative fall in the LIS in New Zealand reflected weaker RPW growth, which was 0.8 percentage points slower than in Australia (Table 6.3). In large part, this was due to faster nominal wage growth in Australia over this decade (Table 6.4).

In the 2000s, RPW growth almost halved in Australia to be significantly below LP growth and the LIS fell accordingly. New Zealand also experienced a decline in RPW growth in the 2000s to a broadly similar rate as in Australia. However, with weaker LP growth, the LIS in the New Zealand measured sector was more or less flat over this decade.

Digging deeper into the sources of these changes in the RPW and LP reveals that New Zealand experienced a milder case of what happened in Australia in the 2000s. Growth in nominal wages was quite strong in both countries in this decade, but the effect on real labour costs was mitigated by strong growth in output prices (Table 6.4). Slower growth in RPW in both countries in the 2000s relative to the 1990s was conducive to employment growth (Table 6.5). In both countries, growth in hours worked in the measured sector accelerated while output growth remained more or less steady. Labour productivity growth decreased accordingly.

At the industry level, there is no clear difference in the sources of trans-Tasman variation in the LIS in the measured sector in the 1990s. With a couple of exceptions – mining and finance – the industry contributions to growth in the aggregate LIS were weaker across the board in New Zealand (Figure C.1 in Appendix C). Over the 2000s, the minerals price boom played a major role in Australia and the fall

in the LIS over this period is overwhelmingly due to the mining industry (Parham, 2013) (Figure C.1 in Appendix C). This industry acted to keep growth in the RPW down in Australia, partly offsetting stronger RPW growth in the finance and arts & recreation industries.

Table 6.3 Contributions of the real product wage and labour productivity to changes in the labour income share, New Zealand and Australia percentage points of annual growth

	1980s	1990s	2000s
New Zealand (MS-11)			
1. Real product wage	2.0	1.9	1.2
2. Labour productivity	2.5	2.8	1.4
3. Labour income share	-0.4	-0.8	-0.2
Australia (MS-12)			
1. Real product wage		2.7	1.4
2. Labour productivity		2.9	2.1
3. Labour income share		-0.2	-0.7

Source: For New Zealand, Statistics New Zealand and authors' calculations; for Australia, Parham (2013)

Notes:

1. Row 1 – row 2 ≈ row 3

Table 6.4 Contributions of nominal wages and product prices to changes in the real product wage, New Zealand and Australia percentage points of annual growth

	1980s	1990s	2000s
New Zealand (MS-11)			
1. Nominal wages	11.0	2.5	3.8
2. Product prices	9.0	0.7	2.5
3. Real product wage	2.0	1.9	1.2
Australia (MS-12)			
1. Nominal wages		3.8	4.8
2. Product prices		1.1	3.4
3. Real product wage		2.7	1.4

Source: For New Zealand, Statistics New Zealand and authors' calculations; for Australia, Parham (2013)

Notes:

1. Row 1 – row 2 ≈ row 3

Table 6.5 Contributions of output and hours worked to labour productivity growth, New Zealand and Australia percentage points of annual growth

	1980s	1990s	2000s
New Zealand (MS-11)			
1. Output	2.1	2.8	2.2
2. Hours worked	-0.5	0.0	0.8
3. Labour productivity	2.5	2.8	1.4
Australia (MS-12)			
1. Output		3.4	3.2
2. Hours worked		0.5	1.1
3. Labour productivity		2.9	2.1

Source: For New Zealand, Statistics New Zealand and authors' calculations; for Australia, Parham (2013)

Notes:

1. Row 1 – row 2 ≈ row 3

Capital intensity and the rewards ratio

From the perspective of the quantity ratio and the rewards ratio decomposition, growth in the rewards ratio was negative in New Zealand in the 1990s and considerably less than the rate of capital deepening, consistent with the fall in the LIS (Table 6.6). Growth in the rewards ratio in New Zealand was also considerable below that in Australia over this decade – for the 1990s as a whole, the w/r ratio declined by 0.1% a year in New Zealand, compared with growth of 2.3% a year in Australia (Table 6.6). The much slower growth in the w/r ratio in New Zealand was due to a combination of weaker growth in wage rates and stronger growth in rates of return (Table 6.7). Because growth in the w/r ratio was more closely aligned with growth in the K/L ratio in Australia, there was a much smaller fall in LIS over the 1990s.

In the 2000s, growth in the reward ratios was very similar in both countries (Table 6.6). Wages growth increased in both countries compared with the previous decade (Table 6.7). However, growth in rates of return slowed in New Zealand, while it accelerated in Australia. Rewards to labour and capital both grew more rapidly in Australia than in New Zealand in the 2000s.

While there was stronger growth in labour input in both countries in the 2000s in comparison to the 1990s, Australia had a much stronger rate of capital deepening due to very strong growth in capital (Table 6.8). This was primarily associated with the mining boom, but also assisted by stronger investment in the utilities and manufacturing industries (Parham 2012, 2013).

Table 6.6 Growth in the price ratio, the quantity ratio and the difference between them, New Zealand and Australia annual average rate of growth (percent per year)

	1980s	1990s	2000s
New Zealand (MS-11)			
1. Rewards ratio (w/r)	3.9	-0.1	2.1
2. Quantity ratio (K/L)	5.1	2.0	2.5
3. LIS[1]	-0.4	-0.8	-0.2
Australia (MS-12)			
1. Rewards ratio (w/r)		2.3	2.2
2. Quantity ratio (K/L)		2.9	3.9
3. LIS[1]		-0.2	-0.7

Source: For New Zealand, Statistics New Zealand and authors' calculations; for Australia, Parham (2013)

Notes:

1. Row 3 does not equal row 1 minus row 2. It is equal to the difference between growth in the LIS and growth in the capital income share.

Table 6.7 Growth in nominal wages, gross rate of return and the price ratio, New Zealand and Australia annual average rate of growth (percent per year)

	1980s	1990s	2000s
New Zealand (MS-11)			
1. Wage rate (w)	11.0	2.5	3.8
2. Rate of return (r)	7.6	2.6	1.7
3. Rewards ratio (w/r)	3.9	-0.1	2.1
Australia (MS-12)			
1. Wage rate (w)		3.8	4.7
2. Rate of return (r)		1.5	2.5
3. Rewards ratio (w/r)		2.3	2.2

Source: For New Zealand, Statistics New Zealand and authors' calculations; for Australia, Parham (2013)

Notes:

1. Row 1 – row 2 ≈ row 3

Table 6.8 Growth in capital services, use of labour and the quantity ratio, New Zealand and Australia annual average rate of growth (percent per year)

	1980s	1990s	2000s
New Zealand (MS-11)			
1. Capital (K)	4.5	2.0	3.3
2. Labour (L)	-0.5	0.0	0.8
3. Quantity ratio (K/L)	5.0	2.0	2.5
Australia (MS-12)			
1. Capital (K)		3.5	5.0
2. Labour (L)		0.5	1.1
3. Quantity ratio (K/L)		2.9	3.9

Source: For New Zealand, Statistics New Zealand and authors' calculations; for Australia, Parham (2013)

Notes:

1. Row 1 – row 2 ≈ row 3

7 Concluding remarks

This paper has outlined trends in the split of national income across capital and labour to better understand how the New Zealand economy works and the impact of productivity growth on the returns to labour and capital. Through the lens of the LIS, the paper has provided a perspective on New Zealand's recent economic history and some of the economy's structural underpinnings.

Over the full observation period of 1978 to 2010, the LIS in the measured sector of the New Zealand economy fell by 8.5 percentage points, indicating a tendency for capital income to grow more quickly than labour income. There are insufficient data to determine whether this decline in the LIS is part of a correction for a rise in the LIS in the 1960s and 1970s, as had occurred in a number of other countries.

In the proximate terms used in the paper, the decline in the LIS is associated with labour productivity growth in excess of growth in the real product wage (2.2% a year vs 1.7% a year). Alternatively, the decline in the LIS can be viewed as a divergence between growth in the capital-labour ratio and growth in the ratio of the wage rate to the rate of return on capital (3.0% a year vs. 1.9% a year).

Within this pattern of general decline, the LIS in New Zealand fell sharply over three short periods. In turn, these have been traced to a mix of government policy interventions and the distortionary impact of elevated and volatile product price inflation. Although difficult to be conclusive, underlying causal factors – such as new technologies and ongoing globalisation – may be having an influence, as discussed in the Foreword to the paper.

Prior to economic reform in the mid-1980s, output and income growth in New Zealand was moderate and largely based on input accumulation. Much of this input accumulation proved to be inefficient, as signalled by slow MFP growth at the time. The LIS suffered a considerable but largely temporary fall in this period when the price and wage freeze was put in place. In practice, this proved to be more a wage freeze than a price freeze – the real product wage and the LIS fell accordingly.

Following the onset of economic reforms in the mid-1980s, labour productivity growth picked up strongly. This was initially driven by capital deepening as firms shed labour given weak output growth and strong wages growth. However, from the early-1990s, MFP growth improved substantially, contributing to ongoing strength in labour productivity, as labour and capital inputs started to grow again and were allocated more productivity throughout the economy.

The LIS fell over the 1990s, to a large extent due to a localised fall in the 1992 to 1995 period. Wage restraint following the earlier period of high wage growth and labour shedding and the introduction of the Employment Contracts Act (1991) were possible likely key factors. This general fall in the LIS contrasted with Australia, where there was also good productivity growth but the LIS remained more or less steady. It appears that it is not labour productivity growth as such that contributes to the fall in LIS, but the nature of the underlying changes that contribute to both productivity and real wage outcomes. Given the role of low RPW growth in reducing the LIS, New Zealand's earlier and deeper foray into labour market reform may be an important contributing factor to trans-Tasman differences in the LIS over this period.

In the 2000s, growth in labour productivity and in MFP both collapsed and input accumulation became the dominant source of output and income growth in New Zealand. This was similar to the Australian experience, although the pickup in input accumulation in the "measured" part of the economy was much milder in New Zealand. The temporary fall in the LIS in the early 2000s reflected weak RPW growth as nominal wages failed to keep up with a surge in product price inflation. However, this corrected over the remainder of the 2000s as real product wage growth picked up and grew more quickly than labour productivity. The LIS increased accordingly.

From the perspective of workers' purchasing power, inflation in product prices and the CPI have been reasonably well aligned at the level of aggregate economy. However, relatively strong inflationary pressures in the non-measured sector have meant CPI inflation has been greater than output price inflation in the measured sector. As a result, growth in the real consumption wage of workers in the measured sector has been less than growth in real product wages. The converse is presumably true for workers in the non-measured sector of the New Zealand economy.

As well as a view of New Zealand's economic history, this paper has also highlighted a few structural features of the New Zealand economy. There is evidence indicating that growth in the RPW and in LP is reasonably closely aligned over time and across industries. This indicates reasonable coordination of price signals in output and factor markets and is consistent with the view that labour productivity growth is an important prerequisite for growth in real wages.

Another major finding of the study is that high productivity growth is neither necessary nor sufficient to bring about a fall in the LIS. While the LIS did fall during New Zealand's high-productivity growth period, this can be attributed to wage restraint and perhaps a change in labour market institutions. Other sharp falls in the LIS were due to temporary spikes in output prices, rather than anything to do with productivity growth. The comparison with Australia provides further evidence that there is no necessary relationship. While both countries had strong productivity growth in the 1990s, the LIS declined in New Zealand, but was steady in Australia.

Finally, an important feature of New Zealand's economic performance since the late 1970s is the relatively small rate of employment growth in the measured sector. Much of New Zealand's employment growth has been in the non-measured sector of the economy. While there are pitfalls in considering single variables in isolation, it is striking that the growth in MS-11 labour input over the entire period has been a meagre 0.1% a year. All other things equal, lower growth in labour input means higher growth in labour productivity and in the capital-labour ratio.

While New Zealand has performed well on MFP growth in the measured sector relative to Australia, the big difference between the two economies is in the rate of capital accumulation. Generally speaking, Australia has leveraged stronger output growth on more accumulation of capital.

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Appendix A Measurement

This paper focuses on the LIS in the measured sector of the New Zealand economy – the 11-industry measured sector (MS-11), which covers around 60% of GDP. In the Australian comparisons in Section 6, data for the 12-industry measured sector (MS-12) – which includes arts & recreation – are used.[17] In practical terms, the exclusion of the arts & recreation industry makes little difference and MS-11 and MS-12 series yield very similar results.[18]

Statistics New Zealand does publish data for the 16-industry measured sector, which includes the MS-12 industries plus four additional industries and covers 80% of GDP. However, data for these additional industries are only available from 1996 onwards.[19] Statistics New Zealand also produces economy-wide measures of real unit labour costs, although only from 2000. In an algebraic sense, these are equal to the LIS, although Statistics New Zealand's RULC and LIS series are not exactly the same due to measurement issues. Hence, data for the smaller set of 11 industries are used in the paper given the longer time coverage that facilitates understanding of the medium- to long-run trends in the LIS. Data are mainly taken from Statistics New Zealand's 2013 National Accounts and Productivity releases. Annual data from 1978 to 2010 are used.[20]

The labour income share is measured as labour income divided by total income. One complication in allocating total income to capital and labour is how to split the income of firm proprietors into a capital component (the return on proprietors' capital) and a labour component (the return to proprietors' labour input). A number of methods impute the labour component of proprietors' incomes based on hours worked and the average employee wage in the same industry. Statistics New Zealand use this approach by calculating the labour income of working proprietors as the compensation of employees in the industry multiplied by the proportion of the industry's hours paid that are attributed to working proprietors (Statistics New Zealand, 2014).[21]

LIS analysis requires that all income in the economy goes to either labour or capital, so the analysis would ideally be conducted with a nominal wage measure that is both exhaustive and comprehensive (Sharpe et al., 2008). However, as mentioned in the main text, as well as the usual difficulties in measuring labour productivity in non-market industries, economy-wide analysis of the LIS in New Zealand is also hampered by the lack of a comprehensive and exhaustive wage measure over a reasonably long time period. Instead, given that the Statistics New Zealand Productivity series for MS-11 do not include nominal wage series, growth in nominal wages is derived from data on labour income (compensation of employees plus labour income of proprietors) and hours paid. A similar technique is used to derive growth in the returns on capital as the difference between capital income growth and capital input growth.

Finally, the paper uses implicit output price deflators in aggregate and in each MS-11 industry. These are calculated as current-price output divided by chain-volume output. Industry price deflators are used for the industry-level analysis and MS-11 price deflators are used for the aggregate MS-11 analysis.

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[17] These MS-12 industries are: 1.) agriculture, forestry & fishing; 2.) mining; 3.) manufacturing; 4.) electricity, gas, water & waste services; 5.) construction; 6.) wholesale trade; 7.) retail trade; 8.) accommodation & food services; 9.) transport, postal & warehousing; 10.) information media & telecommunication; 11.) financial & insurance services; 12.) arts & recreation services. Statistics New Zealand refers to these 12 industries as the "former measured sector". MS-11 excludes arts & recreation.

[18] While Statistics New Zealand publishes aggregate productivity series for MS-12 rather than MS-11, due to robustness issues, it does not publish arts & recreation industry productivity, labour income and capital income series prior to 1996. Aggregate series for MS-11 were provided to the authors by Statistics New Zealand.

[19] Statistics New Zealand refer to MS-16 as the "measured sector". Note that there are also some measurement issues in the four additional industries in MS-16 that present particular problems for trans-Tasman comparisons (see Statistics New Zealand, 2010 & 2014).

[20] The data are available up to 2010 because this was the latest balanced year for current price GDP in the 2013 data release.

[21] While it would be preferable to use hours worked to take account of factors such as unpaid overtime and paid leave, Statistics New Zealand productivity statistics uses hours paid since the hours paid is more robust than the hours worked measure at the industry level (Statistics New Zealand, 2014). Also note that this adjustment is not always made. It is less likely to be made where long time series are involved (due to data deficiencies) or international comparisons are involved (lack of data for some countries).

Appendix B Industry contributions

This paper makes extensive use of industry contributions, which take account of not only growth in variables at the industry level but also the relative importance of each industry as a share of the measured sector total and the impact of employment flows across industries.

Methodology

The industry contributions are calculated according to the methodology set out in Parham (2012) and Parham (2013). This approach is favoured over shift-share analysis. Shift-share analysis decomposes the aggregate change in the LIS into "within-industry" and "reallocation" components. The within-industry component is the sum over industries of the change in industry LIS weighted by the industry's output share. The reallocation component is the sum over industries of industry LIS multiplied by the change in the industry's output share.

In contrast, the method used here does not distinguish between the within-industry and reallocation effects. Rather, it identifies what the different industries contributed to the observed aggregate difference between labour and capital income growth.[22] This approach takes account of the separate importance of an industry to measured sector labour and to measured sector capital income, which the shift-share approach does not. The shift-share approach takes account of the importance of an industry only in terms of its share of total income in the measured sector. As discussed in Parham (2013), shift-share analysis implicitly assumes that increases in the size of industries can be separated from the way in which industries expand (in capital- or labour-intensive ways). For example, for Australia, shift-share analysis attributes an important but less-than-complete role to structural change and the mining boom in explaining Australia's LIS fall in the 2000s, whereas the separate-contribution approach attributes the vast majority of the fall to mining due to its capital-intensity (Parham, 2013).

There are three main features of the methodology used:

- a multiplicative aggregation function is used to combine real inputs and real output from different industries into measured sector (MS) indexes, which means;
  - the aggregation of inputs and outputs are additive in growth rate form; and
  - aggregation of outputs and inputs can be undertaken independently;
- industry contributions to complex variables are computed as industry contributions to the elemental variables;
  - for example, an industry contribution to MS labour productivity growth is the industry's contribution to MS output growth, less its contribution to labour input growth; and
- annual weights (industry shares) are incorporated in the aggregation process (known as "chaining");
  - this provides more accurate calculations of industry contributions over a period of time than using base-period or end-period weights.

The method only provides an approximation and there are some small differences between estimates based on these calculations and Statistics New Zealand's aggregate market-sector figures. The greatest errors appear to be in the aggregation of outputs of industries, due to the use of Tornqvist aggregation whereas Statistics New Zealand applies a Laspeyres aggregation.[23] While it is not exact, the methodology generates reasonably small approximation errors (sum of industry contributions,

[22] Or equivalently, the industry contributions to the difference between the factor and rewards ratio.

[23] Tornqvist aggregration was applied because the industry weights enter the growth rate form multiplicatively (ie, the growth of an industry's output is multiplied by its share of output).

compared with published aggregate growth rates) and is a major improvement on methods traditionally used.[24]

The general form of industry aggregation for a variable, V, is given by the Tornqvist formula:

$$\frac{V_{MS}^t}{V_{MS}^{t-1}} = \prod \left[\frac{V_i^t}{V_i^{t-1}}\right]^{v_i^t} \quad \text{and} \quad \frac{V_{MS}^t}{V_{MS}^{t-1}} = \prod \left[\frac{V_i^t}{V_i^{t-1}}\right]^{v_i^t}$$

$$\frac{V_{MS}^t}{V_{MS}^{t-1}} = \prod \left[\frac{V_i^t}{V_i^{t-1}}\right]^{x_i^t} \quad \text{and} \quad x_i^t = \frac{1}{2}\left(s_i^t + s_i^{t-1}\right)$$

where the superscript t refers to year, the subscript i refers to industry and MS to the measured sector aggregate and s_i^t is the share of industry *i* in the relevant measured sector variable at time t

Growth over one year can be written:

$$\hat{V}_{MS}^{t,1} = \sum_i x_i^t . \hat{V}_i^{t,1}$$

where a hat '^' over a variable signifies the growth in the variable and the '1' in the superscript refers to growth over 1 year.

The growth in measured sector V over n years accumulates or "chains" the growth in each of the intervening years:

$$\hat{V}_{MS}^{t,n} = \sum_{j=1}^n \sum_i x_i^{t+j} . \hat{V}_i^{t+j,1}$$

Now, for labour productivity, LP:

$$\widehat{LP}_{MS}^{t,n} = \hat{Y}_{MS}^{t,n} - \hat{L}_{MS}^{t,n}$$

where *Y* refers to value added and L refers to labour input.

The contribution of industry m to measured sector labour productivity growth over n years is given by:

$$\sum_{j=1}^n y_m^{t+j} . \hat{Y}_m^{t+j,1} - \sum_{j=1}^n l_m^{t+j} . \hat{L}_m^{t+j,1}$$

where y_m is industry *m*'s share of MS nominal value added and l_m is industry *m*'s share of MS hours paid.

Similarly, for the real product wage (RPW):

$$\widehat{RPW}_{MS}^{t,n} = \hat{W}_{MS}^{t,n} - H_{MS}^{t,n} - P_{MS}^{t,n}$$

where *W* is the nominal wage, *H* is hours paid and *P* is the implicit price deflator for value added.

The contribution of industry m to growth in the RPW is given by:

$$\sum_{j=1}^n w_m^{t+j} \hat{W}_m^{t+j,1} - \sum_{j+1}^n l_m^{t+j} . \hat{H}_m^{t+j,1} - \sum_{j+1}^n y_m^{t+j} . \hat{P}_m^{t+j,1}$$

where w_m is industry m's share of MS nominal labour income, and l_m and y_m are as previously defined.

[24] Diewert (2013) has suggested a method that further reduces approximation errors.

The methodology for calculating the industry contributions to changes in the quantity and price ratios is similar to the methodology for calculating the industry contributions to changes in the real product wage and labour productivity. For example, an industry's contribution to the change in the capital-labour ratio is equal to the difference between the industry's contribution to the Tornqvist aggregation of capital input growth and the industry's contribution to the Tornqvist aggregation of labour input growth (where the Tornqvist weights are two-period average shares of measured sector capital income and labour income respectively).

Industry contributions - details

An industry's contribution to growth in the MS-11 LIS in a given time period is equal to that industry's contribution to growth in aggregate RPW less its contribution to growth in aggregate LP. That is, the entries in the top panel of Figure B.1 are equal to the difference between the entries in the bottom two panels.

Manufacturing had the most consistently positive influence on RPW growth over the four main periods of interest. Transport; information, media & telecoms and finance also made consistently positive contributions to the MS-11 RPW over the four periods examined.

- Agriculture, manufacturing, transport (postal and warehousing) and information, media & telecoms have had strong influences on labour productivity growth at various times.
    - Even though manufacturing had moderate productivity growth, its contribution was elevated by its large size.
    - Manufacturing played a large part in lifting labour productivity growth in the 1986 to 1993 period, adding 1.1 pp to the aggregate rate of growth.
- Most industries made positive contributions to labour productivity over most periods.
    - The two exceptions were accommodation and construction. Accommodation made a negative contribution to LP growth in all four periods, and construction made a negative contribution in the 1993-2000 and 2000-2008 periods.
- Agriculture and IMT had strong LP contributions, whereas EGW had its usual pattern of negative RPW contribution and moderate LP contribution.

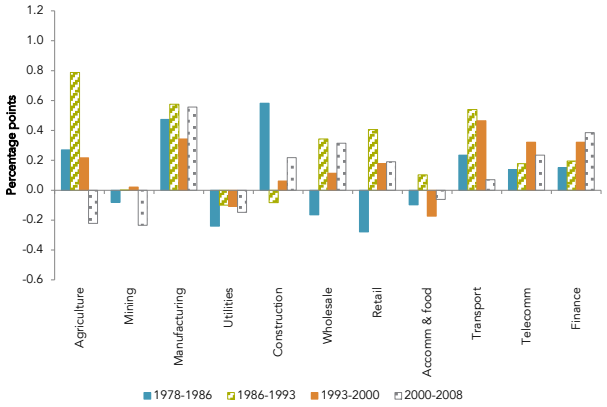
The fall in the LIS in the 1993-2000 period reflected a decrease in the wage-return ratio coupled with slow growth in the capital-labour ratio which was broad-based across industries. Agriculture and wholesale made the largest negative contributions due to large positive contributions to rate of return growth, but only small contributions to wage growth.

Table B.1 shows the industry contribution to MS-11 growth in the LIS, RPW and LP during the three short periods of relatively sharp declines in the MS-11 LIS. With the exceptions of the construction industry in all three of these short periods and agriculture and mining in the 1992 to 95 period, LP growth outpaced RPW growth in all other industries, with resultant falls in the LIS.

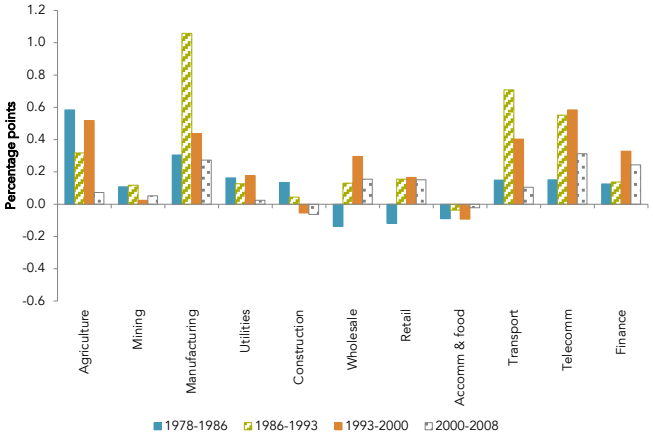
Figure B.1 Industry contributions to RPW, LP and LIS growth, various periods

a. Contribution to LIS change in MS-11[1]

b. Contributions to RPW growth



c. Contributions to labour productivity growth



Source: Statistics New Zealand; authors' calculations

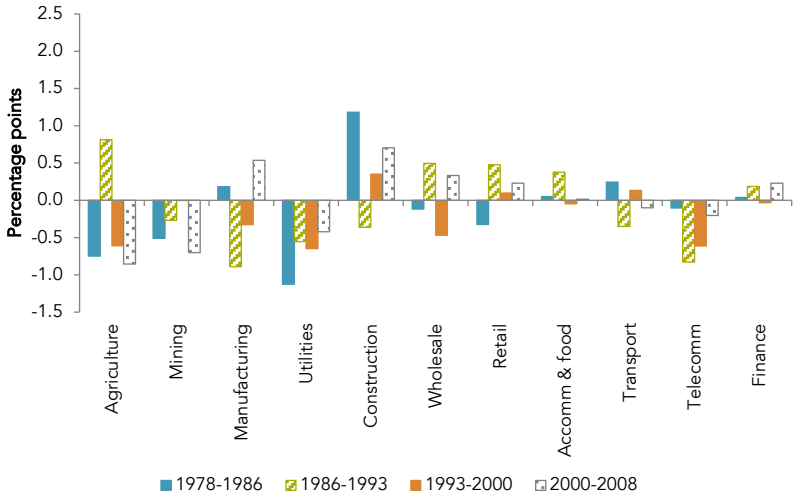
1. Bars sum horizontally to MS-11 aggregate growth.

Table B.1 Industry contribution to growth in the LIS, RPW and LP

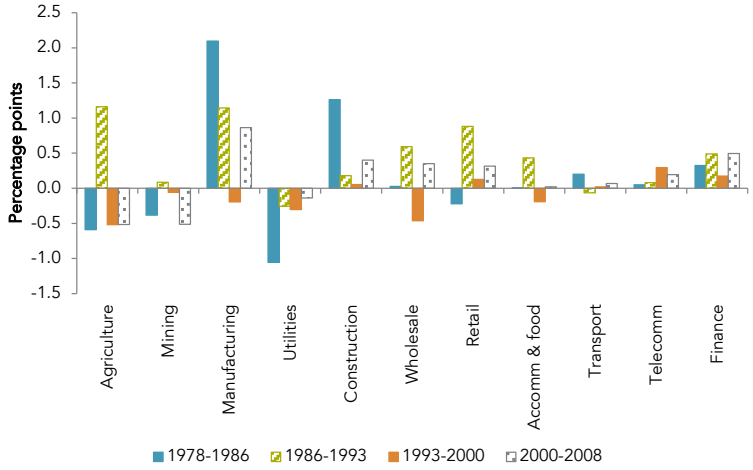
	1982-84			1992-95			1999-02		
	LIS	**RPW**	**LP**	**LIS**	**RPW**	**LP**	**LIS**	**RPW**	**LP**
Agriculture	-0.48	-0.73	-0.25	0.20	0.19	-0.01	-1.56	-1.74	-0.17
Mining	-0.20	0.02	0.21	0.09	0.05	-0.04	-0.15	-0.18	-0.04
Manufacturing	-2.77	-1.91	0.86	-0.91	-0.45	0.46	-0.34	0.15	0.49
Utilities	-0.45	-0.26	0.19	-0.29	-0.07	0.22	-0.19	-0.24	-0.05
Construction	0.20	0.28	0.08	0.21	0.22	0.01	0.00	-0.01	-0.01
Wholesale	-0.61	-0.69	-0.08	-0.32	-0.45	-0.14	-0.39	0.37	0.76
Retail	-0.52	-0.68	-0.16	-0.06	0.13	0.19	-0.05	0.16	0.21
Accommodation & food	-0.10	-0.24	-0.13	-0.17	-0.23	-0.06	-0.12	-0.21	-0.09
Transport	-0.49	-0.18	0.31	-0.36	0.38	0.73	-0.01	0.09	0.10
Telecoms	-0.59	-0.30	0.29	-0.21	0.31	0.52	-0.13	0.53	0.66
Finance	-0.21	-0.07	0.14	-0.39	0.03	0.42	-0.44	-0.06	0.39

Figure B.2 Contributions to growth in the capital-labour and wage-returns ratios, various periods

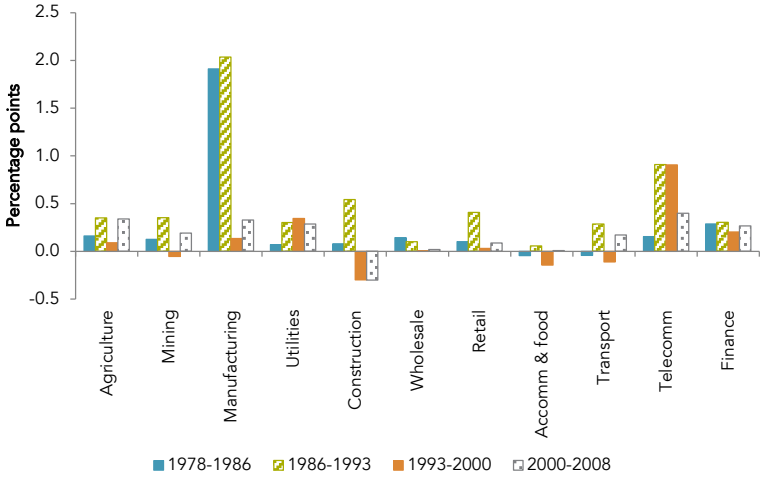
a. Contribution to wage-return ratio less contribution to capital-labour ratio



b. Contribution to wage-return ratio



c. Contribution to capital-labour ratio



Appendix C Industry-level comparisons with Australia

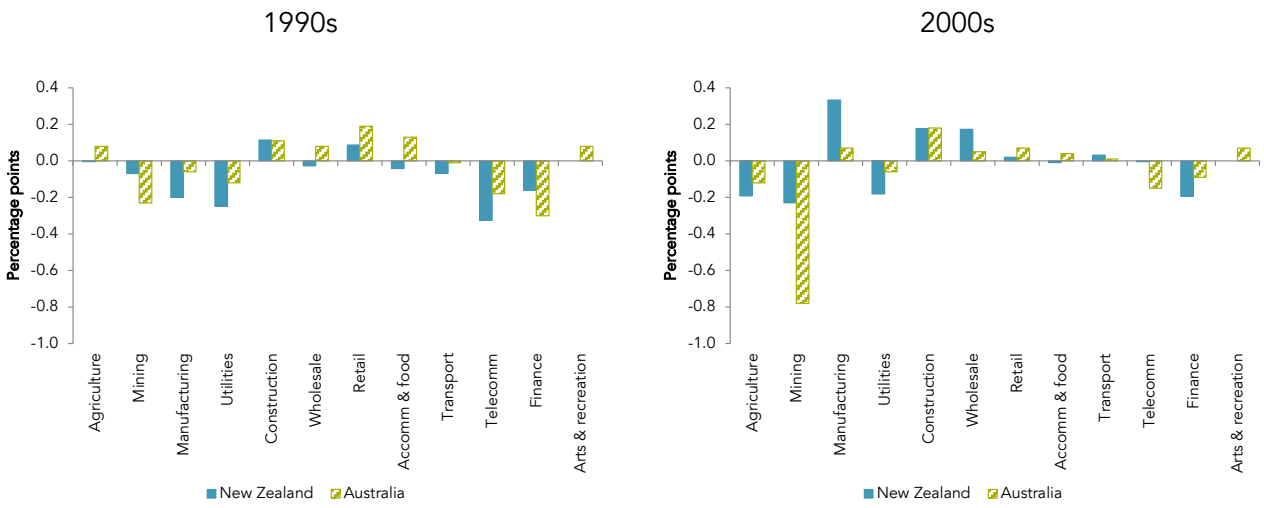
Differences in LIS contribution

New Zealand's LIS fell in the 1990s, whereas Australia's was relatively steady. The top left panel of Figure C.1 shows that there was no clear industry source of the difference between the two countries. Country differences in industry contributions were relatively small. Most industry contributions to the change in the LIS were weaker in New Zealand, including accommodation & food services, manufacturing and IMT. Mining and finance made higher industry contributions in New Zealand than Australia.

Australia's LIS fell in the 2000s, whereas New Zealand's stabilised over the whole decade. The Australian fall was overwhelmingly due to the mining industry (top right panel in Figure C.1). The negative mining contribution to RPW growth was the major reason (middle right panel). The biggest positive contribution to New Zealand's LIS came from manufacturing, which had a turnaround from the 1990s of over half a percentage point.

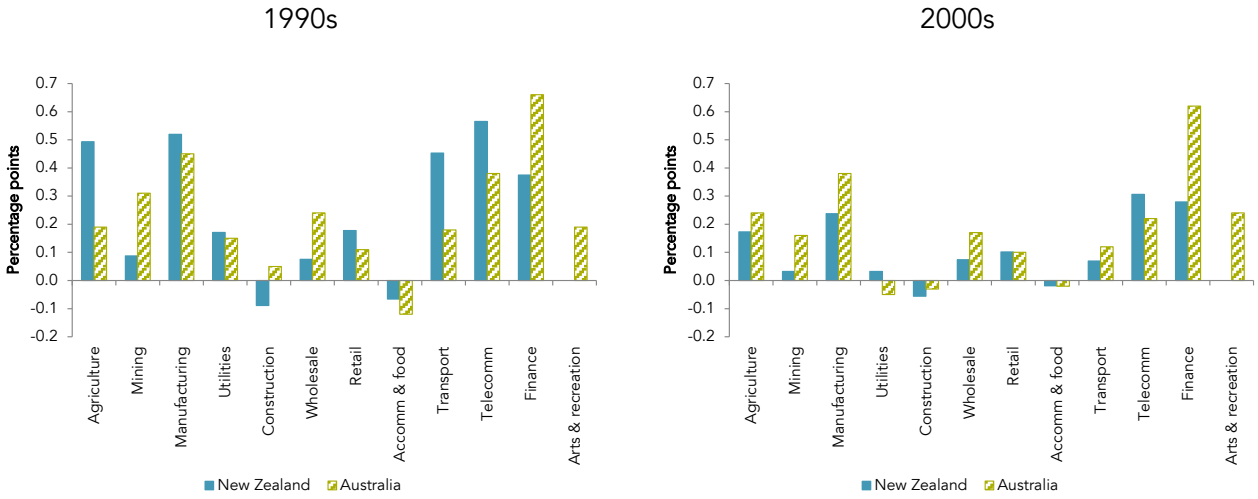
Figure C.1 Industry contributions to change in MS LIS in New Zealand and Australia

a. Labour income share growth



b. Real product wage growth

c. Labour productivity growth

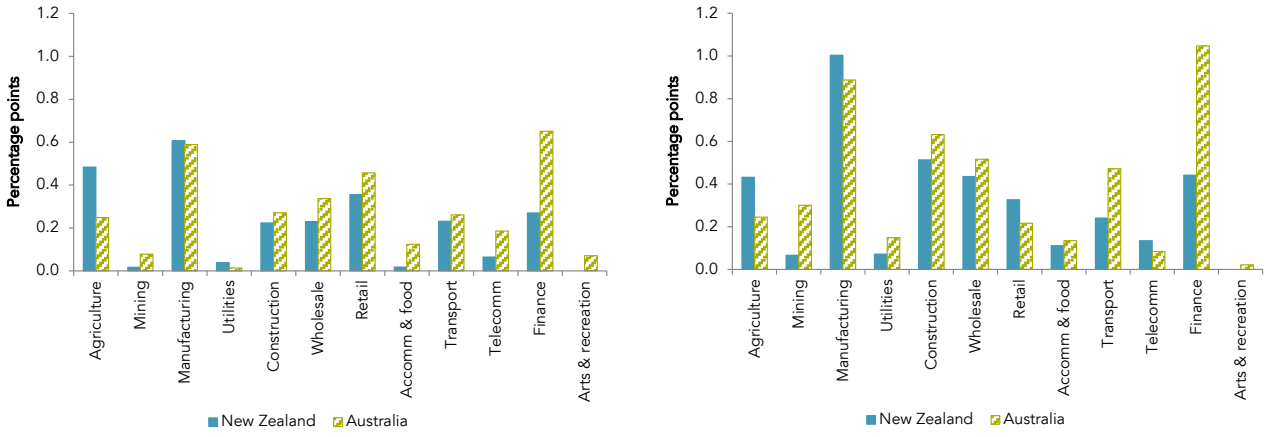


The 1990s fall in New Zealand's LIS was associated with weaker growth in real and nominal wages. New Zealand's growth in the real product wage was 0.8 percentage points slower than in Australia and growth in nominal wages was 1.3 percentage points slower. There is no stand-out industry contributor to weaker RPW growth in New Zealand in the 1990s (left hand side of the middle panel of Figure C.1). Differences were generally small and spread over quite a number of industries. The largest was a 0.27 percentage point difference in wholesale trade. The absence of the arts and recreation industry in the New Zealand measured sector definition is also a factor, with that industry contributing 0.27 of a percentage point to Australia's MS RPW growth.

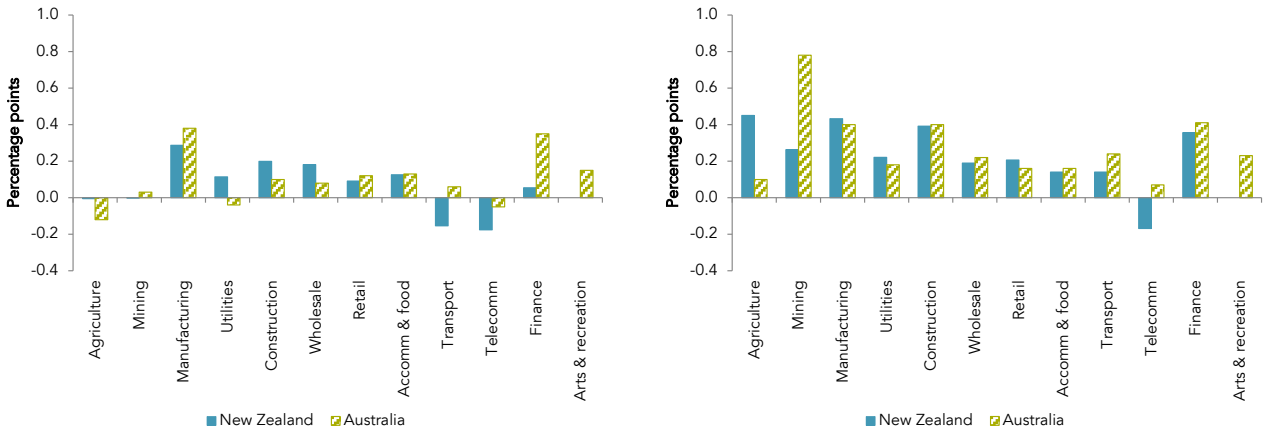
There is, however, a standout difference in industry contributions to growth in nominal wages. Australia's contribution from the finance industry is nearly 0.4 of a percentage point higher than New Zealand's (left hand top panel of Figure C.2). Most other industries show a contribution in Australia that is higher by up to around 0.1 of a percentage point. The main exception is agriculture, in which New Zealand had a 0.2 percentage point stronger contribution.

Figure C.2 Industry contributions to growth in MS nominal wages and output prices in New Zealand and Australia

a. Nominal wage growth



b. Output price growth



While the aggregate difference between RPW growth in the two countries was small in the 2000s, there were some important differences in the distributions of industry contributions. Australia had a much weaker (more negative) contribution from mining, but much stronger contribution from finance and arts & recreation (middle right panel in Figure C.1). New Zealand had stronger contributions from IMT and manufacturing.

Australia's weaker mining RPW contribution came from a stronger contribution to price growth, which overpowered the industry's stronger nominal wage contribution. In finance, on the other hand, there was little difference in price contribution and so Australia's much larger RPW contribution was due to its greater nominal wage contribution. New Zealand's stronger manufacturing RPW contribution came from a stronger nominal wage contribution, while its stronger IMT came from a negative price contribution.

The price growth panels also give an indication of where terms of trade effects were primarily felt in the domestic economies. Compared with the 1990s, the contribution to New Zealand's price growth increased substantially in agriculture, finance, mining and transport. Agriculture and mining outputs are exported. In Australia, there was a very large increase in mining's price contribution, reflecting the boom in minerals prices on export markets. There was also an increase in construction's price contribution, reflecting the demand placed on the industry by the boom in mining investment.