

# Productivity by the numbers: The New Zealand experience

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# Abstract

This paper describes New Zealand's productivity performance at the level of the whole economy, sectors and individual industries. It describes trends in New Zealand's productivity performance through time and in comparison to other OECD countries, particularly Australia.

For a number of decades, labour productivity in New Zealand has suffered a long, slow decline compared with productivity levels in other OECD countries. This persistent productivity underperformance is the key reason why GDP per capita in New Zealand is lower than in most other OECD countries. Looking forward, any narrowing of the income gap between New Zealand and the OECD average will require a much improved productivity growth performance.

As in a number of other countries, some of the service industries that use information and communications technologies (ICT) intensively have been important drivers of New Zealand's aggregate productivity growth, with the primary sector also making a substantial contribution. In contrast, the construction industry and a number of labour-intensive low-skilled service industries have generally dragged down New Zealand's aggregate productivity growth performance.

Since the 2000s, multi-factor productivity (MFP) growth in New Zealand has fallen considerably relative to the 1990s. Although reasonably broad based, this slowdown in MFP growth in no small part reflects slower productivity growth in the finance & insurance; transport, postal & warehousing and agriculture, forestry & fishing industries.

The paper offers some speculation on whether New Zealand's productivity trends are consistent with 'catch up' towards the higher productivity levels in leading economies. At the aggregate and industry levels, there is little evidence of productivity catch up, which raises questions about the extent to which new technologies and work practices developed off-shore diffuse into the New Zealand economy. However, if tentative evidence of very wide productivity distributions across New Zealand firms is substantiated, then the extent to which new technologies and work practises diffuse from high- to low-productivity firms in the domestic economy may also be an important consideration in explaining New Zealand's poor productivity record.

# 1 Introduction

*Productivity isn't everything, but in the long run it is almost everything. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker."*

Krugman (1994, p11)

*"...nothing contributes more to the reduction of poverty, to increases in leisure, and to the country's ability to finance education, public health, environment and the arts."*

Blinder & Baumol (1993, p778)

Productivity refers to the efficiency with which people or firms convert productive resources – such as labour and capital – into outputs of goods and services. Improvements in productivity allow a given quantity of output to be produced using fewer resources or more and better output to be produced from the same resource base. Strong productivity growth allows countries to enjoy higher material living standards, including improved health and education services. By delivering 'more for less', productivity growth also enhances some of the non-material factors that influence wellbeing, including the quality of the environment and the time available for leisure. In short, as apparent from the quotes above, productivity is the key determinant of a country's standard of living over the long term.

This paper describes New Zealand's productivity performance through time and in comparison to other OECD countries, particularly Australia. It uses official data to describe New Zealand's productivity performance at the aggregate economy level, the sector level (primary, goods-producing and services), and the individual industry level.<sup>1</sup> The focus is on illustrating productivity trends and the paper does not directly assess the economic causes underlying New Zealand's productivity performance, which is the subject of on-going work at the Productivity Commission.

Section 2 of the paper discusses the link between productivity growth and income growth. While New Zealand's productivity performance has been a key determinant of income growth, increased employment and terms of trade gains have also been very important since the early-1990s. Going forward, as labour market participation and terms of trade gains reach their natural limits, an improved productivity performance will be even more critical to improving incomes. Section 2 also describes important measurement and conceptual issues around estimating labour productivity and MFP.

Section 3 sketches out the broad trends in New Zealand's productivity performance at the aggregate economy level since the late 1970s. In summary, after the immediate onset of economic reform in the mid-1980s, New Zealand businesses cut back on employment, which increased the amount of capital available per worker and the volume of output produced per hour of work. From the mid-1990s, employment bounced back, marking the beginning of a sustained period of strong employment growth. Growth in the amount of capital available per worker – capital deepening – was relatively modest over the late 1990s. MFP growth, however, improved considerably over this period, leading to reasonable labour productivity growth up until the onset of the Asian financial crisis, a drought in 1999 and the dotcom slump in the early 2000s. Over the 2000s, as in a number of other OECD countries, labour productivity growth fell in New Zealand, primarily as a result of poor MFP growth.

Section 4 of the paper delves into New Zealand's sector and industry productivity data. Since the late 1970s, the primary sector has experienced strong and volatile labour productivity growth, mainly as a result of large swings in MFP growth. In the goods-producing sector, labour productivity growth has generally been slower than at the aggregate level. MFP growth in this sector was strong during the mid-1990s but has otherwise been low and volatile on average. In the services sector, growth in labour

<sup>1</sup> Throughout this paper, 'industry' refers to a group of businesses that have the same main activity as classified within ANZSIC06 (for example, manufacturing). A 'sector' is based on SNZ's classification that allocates productive activities in the economy into one of three sectors: primary, goods-producing and services.

and capital inputs has generally been strong, reflecting the structural transformation of the economy towards services. From the late 1990s until the onset of the Global Financial Crisis (GFC), labour productivity and MFP growth in the services sector outperformed the primary and goods-producing sectors. In all three sectors, labour productivity and MFP growth fell in the 2000s relative to the 1990s.

Analysis at the industry level reveals a wide diversity of experience. Some industries have accounted for shares of aggregate labour productivity and MFP growth that are far larger than their shares of GDP while others have detracted considerably from New Zealand's aggregate productivity performance. In short, information, media & telecommunication and finance & insurance have outperformed while the construction industry and some low-productivity growth service industries – including the relatively large professional, scientific & technical services industry – have generally detracted from aggregate productivity growth.

At the industry level, the slowdown in MFP growth in the 2000s was reasonably broad based, although the transport, postal & warehousing and agriculture, forestry & fishing industries made the largest contributions to the aggregate decline in MFP growth.

Section 5 of the paper puts New Zealand's productivity performance at the aggregate and industry levels into international perspective. From the late 1970s to the late 1980s, New Zealand suffered a pronounced fall in GDP per capita relative to other OECD countries. Over the 1990s and 2000s, the gap in New Zealand's GDP per capita compared with the OECD stabilised at roughly 15 to 20% below average.<sup>2</sup> However, this improvement in New Zealand's GDP per capita performance relative to other OECD countries reflects strong employment growth. In contrast, labour productivity in New Zealand has continued a long, slow decline compared to other OECD countries. This relative decline in labour productivity is particularly pronounced compared with Australia, reflecting an above average productivity performance in that country.

The limited available cross-country data suggests that compared with Australia and the United Kingdom, New Zealand's low level of labour productivity is broad based at the industry level. Echoing the aggregate results, growth decompositions at the industry level generally show that labour input growth has been strong in New Zealand while labour productivity growth has been weak at the industry level compared with OECD countries. With capital deepening not too out of line internationally, the industry productivity data suggests that relatively poor MFP growth is the primary cause of New Zealand's poor labour productivity performance vis-à-vis other OECD countries.

The prolonged and on-going divergence in New Zealand's labour productivity relative to other OECD countries is unusual internationally and highlights serious concerns about the diffusion of improved technologies into the New Zealand economy (section 6). However, preliminary evidence that the distribution of labour productivity across firms is comparatively wide in New Zealand suggests that some firms may already operate at the global productivity frontier. If this is the case, then an important issue for productivity research in New Zealand is to better understand the barriers to superior technologies and production techniques spreading from high- to low-productivity firms within the domestic economy.

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<sup>2</sup> This is the average of OECD countries for which data are available from 1970 to 2010, namely: Australia, Belgium, Canada, Denmark, Finland, France, Germany, Iceland, Ireland, Italy, Japan, Netherlands, NZ, Norway, Spain, Sweden, Switzerland, Turkey, UK and USA.

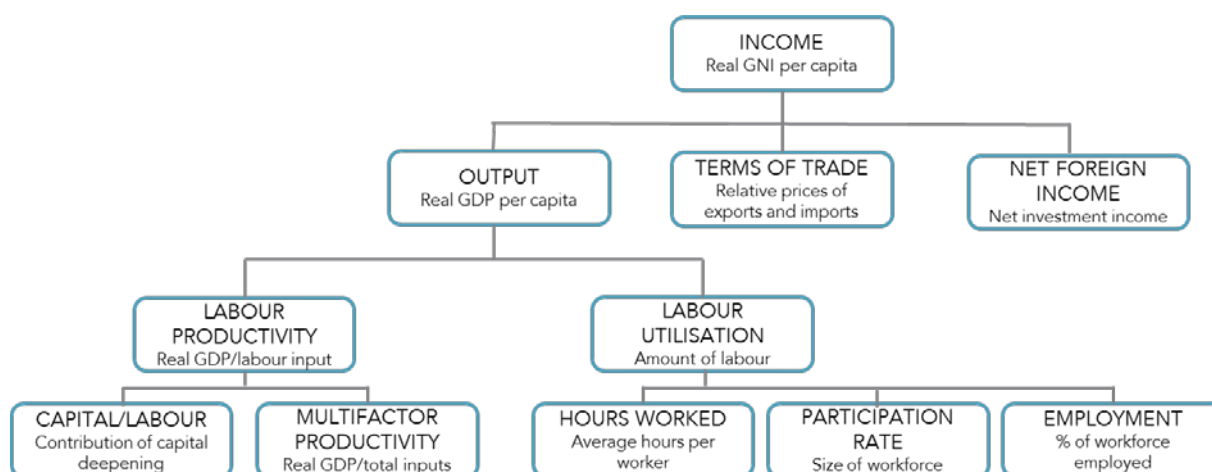
## 2 Productivity and income

### 2.1 Measuring productivity

This paper assesses New Zealand's productivity performance using measures of both labour productivity and MFP.<sup>3</sup> Labour productivity estimates reflect the amount of output produced from each unit of labour employed. As such, labour productivity is relatively easy to estimate with reasonable reliability and to compare across countries, once adjusted for differences in purchasing power parity (PPP). It is a very broad measure of productivity that does not account for the role and cost of capital accumulation and other productive inputs in increasing output. Given this, labour productivity estimates can vary considerably over time and across industries and countries as a result of variation in capital and other productive inputs.

Labour productivity can be broken down into two components (Figure 1). The first is capital intensity – the amount of capital available per unit of labour. Increasing capital intensity – or capital deepening – typically improves labour productivity as workers have more capital to use in the production process. MFP is the second component of labour productivity. MFP is usually measured as the output produced from a 'unit bundle' of both capital and labour and thereby accounts for changes in the capital stock. As such, estimating MFP involves aggregating capital services and combining them with hours worked, which is a much more difficult measurement challenge than estimating labour productivity.

**Figure 1** Components of real GNI per capita



Source: New Zealand Treasury (2008) (modified).

MFP reflects the efficiency with which a combination of productive inputs is used to produce output. As such, it is often considered a proxy for broad technological advances that increase the amount of output produced from a given amount of labour and capital. This potentially includes a range of factors such as improvements in management and production processes, increased scale, skill accumulation and improvements in the effectiveness with which labour is combined with capital and put to work in firms and industries throughout the economy.

Certain conditions need to be met before MFP can be equated with technological change in this way. For example: firms must behave efficiently and seek to maximise profits; markets must be competitive; capacity utilisation must not change; and the coverage of inputs must be complete. In practice, these conditions are rarely met, so measures of MFP reflect some combination of technological progress and any model misspecification or mismeasurement of productive inputs.

<sup>3</sup> This section draws on New Zealand Treasury (2008) and several Statistics New Zealand publications, including Statistics New Zealand (2013c).



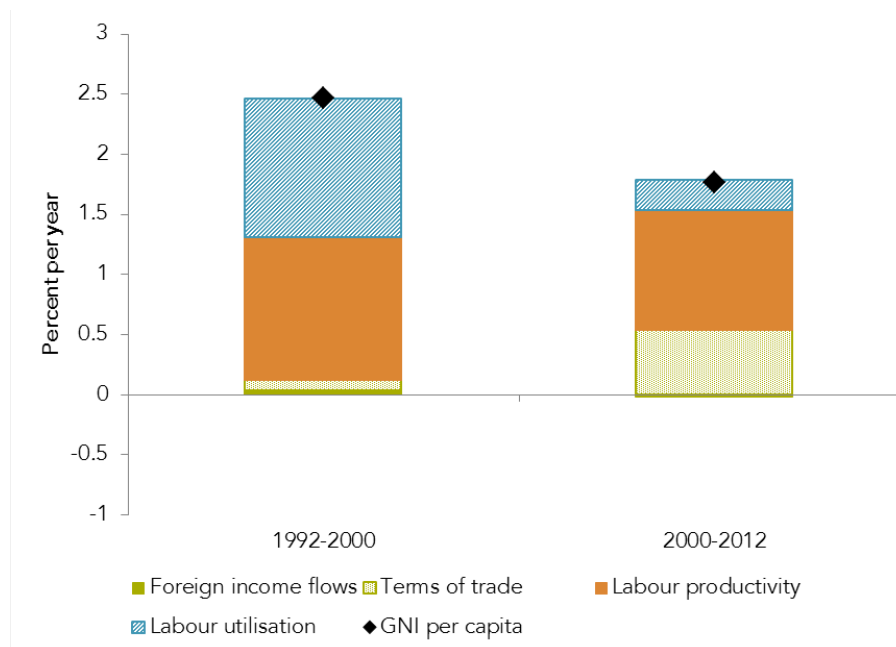
Finally, although it is convenient to consider capital intensity and MFP as distinct, they often come bundled together. For instance, a new IT system not only provides workers with increased capital, but also typically embodies more advanced technology and enables improved work processes.

## 2.2 Productivity is key to income growth

Improving productivity is a means to the end of higher incomes for New Zealanders. In broad terms, higher per capita incomes can be achieved by producing more output per person or by getting higher world prices for what is produced via improvements in the terms of trade. In turn, higher output per person requires more total hours spent in work – higher labour utilisation – and/or more output produced from each hour of work – higher labour productivity (Figure 1).<sup>4</sup>

Average income growth in New Zealand declined considerably in the 2000s (Figure 2). In large part, this reflected slower growth in labour utilisation relative to the 1990s. As discussed in detail in subsequent sections of this paper, labour productivity growth also declined in the 2000s. In contrast, improvements in New Zealand's terms of trade have worked to increase average income growth in the 2000s compared with the 1990s and partially offset the negative impacts of slower growth in labour utilisation and labour productivity.

**Figure 2 Sources of income growth in New Zealand**



Source: Statistics New Zealand; authors' calculations.

Notes:

1. See Statistics New Zealand (2013a) for details of data sources and calculation.

Since the early 1990s, labour productivity growth has accounted for over half of New Zealand's average income growth. Going forward, it is likely that income growth will become even more dependent on improvements in labour productivity. First, labour market participation has a natural limit and is already high in New Zealand by international and historical standards. Given an aging population, this suggests that raising average incomes via increased labour input is becoming progressively more difficult. Second, improvements in the terms of trade, which have contributed about 30% of average income growth over the 2000s, are unlikely to continue increasing indefinitely.

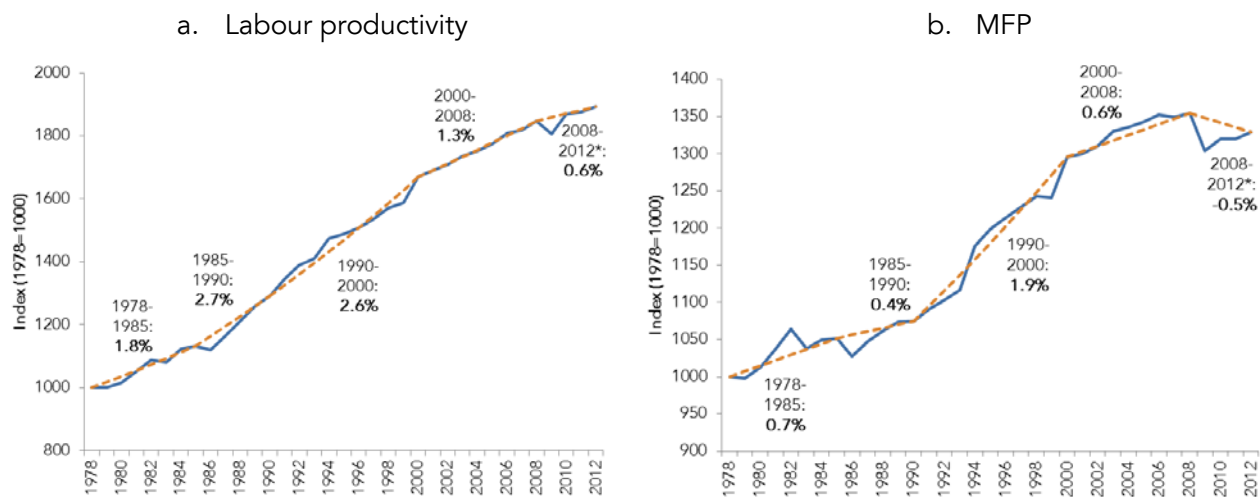
<sup>4</sup> Labour utilisation (or employment participation) reflects the proportion of the total population of working age, the proportion of the working age population in the labour market, the unemployment rate, and the number of hours worked per person employed. In short, adding more labour – in the form of people or hours – into the production process increases output per capita and hence average incomes.

As such, the Paul Krugman quote at the beginning of this paper – that a country’s ability to improve its standard of living over the long run depends almost entirely on improvements in labour productivity – is likely to become increasingly apt for New Zealand.

### 3 New Zealand’s aggregate productivity performance

In 2012, measured sector labour productivity was 89% higher than it was in 1978, an average annual growth rate of 1.9%.<sup>5</sup> Over the same time period, the analogous figures for MFP are 33% higher in 2012, an annual average growth rate of 0.8%. New Zealand’s productivity performance was uneven over this time – labour productivity growth was more rapid from the mid-1980s to the end of the 1990s, but has since slowed (Figure 3a). MFP growth was very strong over the 1990s but slowed markedly in the 2000s and turned negative from 2008 (Figure 3b). This slowdown in labour productivity and MFP growth over the 2000s was not solely due to the GFC, with productivity growth also relatively slow in the first eight years of the 2000s.<sup>6</sup>

**Figure 3** Labour productivity and MFP indexes and trends for selected productivity cycles



Source: Statistics New Zealand; authors’ calculations.

**Notes:**

1. The selected periods up to 2008 cover one or two complete productivity growth cycles. 1978 to 1985 covers two full cycles: 1978-1982 and 1982-1985. 1985 to 1990 is a full cycle. 1990 to 2000 covers two full cycles: 1990-1997 and 1997-2000. The latest full cycle is 2000 to 2008. The most recent period of 2008 to 2012 is an incomplete productivity cycle. Breaking the series into growth cycles allows for average growth rate comparisons that account for variation in capacity utilisation over cycles. Statistics New Zealand calculates these productivity cycles on a ‘peak-to-peak’ basis using a Hodrick-Prescott filter. See Statistics New Zealand (2007) for more details.
2. The measured sector is: ANZSIC06 divisions A to K, and R from 1978 to 1995 covering 61% of the economy in 2009; and ANZSIC06 divisions A to K, M, N, R, and S, and industry LL1 covering 81% of the economy in 2009. For more information about coverage, see Statistics New Zealand (2012a) and Statistics New Zealand (2012b). If the former measured sector is used over the entire period, the average annual labour productivity growth rates are: 1990-2000, 2.9%; 2000-2008, 1.3%; 2008-2012, 1.1%. That is, the slowdown in the 2000s is still evident.

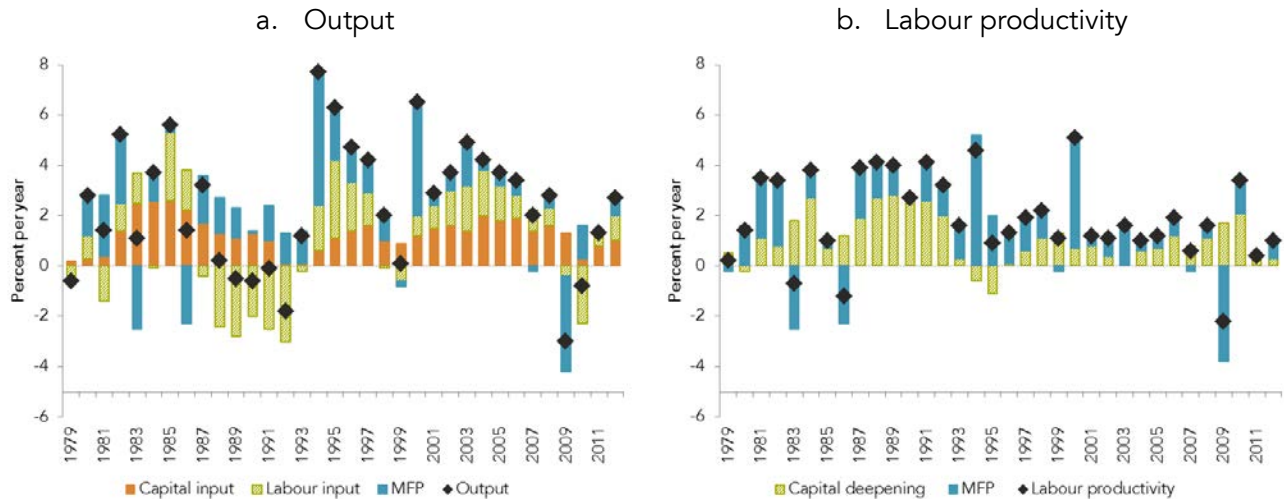
To better understand what lies behind New Zealand’s productivity growth pattern, Figure 4 decomposes growth in output and labour productivity into their proximate drivers. In the left-hand panel, output growth is broken down into growth in labour input, capital input and MFP. The right-hand panel takes labour productivity growth and breaks it down into growth in capital intensity – that is, capital deepening – and MFP growth.

<sup>5</sup> This section assesses New Zealand’s productivity performance on the basis of Statistics New Zealand’s data on productivity in the measured sector.

<sup>6</sup> This eight year period (2000-2008) is a full productivity cycle.

During the late 1980s and early 1990s, at the beginning of New Zealand's period of intensive economic reform, real output growth was low or negative in most years (Figure 4a). In large part, this reflected labour shedding with considerable falls in labour input. Investment growth at this time was also subdued but did not collapse to the same extent as labour input. So the amount of capital available per hour worked – capital intensity – increased strongly during this early reform period and was the predominate source of strong labour productivity growth (Figure 4b). In contrast, MFP growth was more modest over these years.

**Figure 4** Decomposition of measured sector output and labour productivity growth



Source: Statistics New Zealand; authors' calculations.

**Notes:**

1. The measured sector is ANZSIC06 divisions A to K, and R from 1978 to 1995; and ANZSIC06 divisions A to K, M, N, R, and S, and industry LL1 from 1996 onwards.
2. The contribution of capital (labour) input is equal to the growth rate of capital (labour) input weighted by capital's (labour's) share of total income. See Statistics New Zealand (2013d) for details.

Following this early reform period and a deep recession in the early-1990s, firms started rehiring and labour input began to recover. This is consistent with recovery from recession and a reallocation of labour resources following the earlier period of labour shedding. The increase in labour input, combined with a more modest increase in capital input, resulted in very low to negative capital deepening over the mid-1990s – ie, low to negative growth in capital per worker hour. However, perhaps reflecting increased efficiency given the reorganisation of productive factors and production processes following reform, MFP growth was solid over this period. As a result, labour productivity growth remained reasonable and output grew strongly during the mid-1990s.

In the late 1990s, in the wake of the Asian financial crisis and a drought in 1999, growth in labour productivity and output weakened. The slowdown in output growth proved to be short-lived. Driven by solid increases in capital and labour inputs, output growth bounced back strongly during the early 2000s. In contrast, with the exception of the year 2000, labour productivity growth remained subdued over the 2000s. Following the GFC, growth in output and labour productivity has been low or negative.

This slowdown in labour productivity growth over the 2000s reflects poor MFP growth – annual MFP growth over the 1990s was 1.9% compared with 0.2% for 2000 to 2012. In contrast, the capital-to-labour ratio actually grew slightly more strongly in the 2000s than in the 1990s – 2.0% compared with 1.8%. As such, the labour productivity growth slowdown over the 2000s is associated with less rapid improvements in the drivers of MFP. As outlined above, these include the pace at which new and more efficient technologies and business practices are adopted and improvements in the efficiency with which capital and labour are employed.

To summarise, strong labour productivity growth in the late 1980s and early 1990s reflected reduced labour input given recessionary conditions in New Zealand (and globally) and economic restructuring most likely related to the commencement of economic reform. From the mid-1990s, the labour market began to recover and the pace of capital deepening slowed. However, this was offset to some extent by reasonably robust MFP growth. Over the 2000s, MFP growth has slowed, dragging down New Zealand's rate of labour productivity growth.

## 4 Productivity performance by sector and industry

This section looks at productivity trends at the sector and industry levels. It then outlines the contributions of industries to New Zealand's aggregate productivity performance.

Assessing productivity performance at this level provides further insights into the proximate drivers of aggregate productivity performance described above. Growth patterns at the disaggregated level can also give some indication of the extent to which New Zealand has benefited from broader economic change, such as the emergence and dispersion of ICT.<sup>7</sup> However, growth accounting can only ever identify areas of relative over- and under-performance at the industry level and industry-specific studies are required to gain a deeper understanding of the ultimate causes of industry performance.<sup>8</sup>

A summary of the industry result presented here and in the following section can be found in Appendix A.

### 4.1 Productivity at the sector level

#### Productivity levels

In 2010, the level of labour productivity was broadly equal across the primary, goods-producing and services sectors. Specifically, average GDP per hour paid was \$51 in the primary sector, and \$48 in the goods-producing and services sectors. However, as discussed below, these small differences in sector labour productivity levels mask considerable variation at the industry level.

#### Productivity growth

From 1978 to 2011, labour productivity growth was highest in the primary sector – 3.3% per year compared with 1.4% in both the goods-producing and services sectors (Table 1). At this broad level of aggregation, all sectors experienced slower productivity growth in the 2000s than in the 1990s. Most notably, labour productivity growth in the primary sector slowed from 4.6% in the 1990s to 1.3% over the 2000s, which was still higher than labour productivity growth in the other two sectors. The services sector also experienced a productivity slowdown in the 2000s and has borne the brunt of New Zealand's labour productivity growth slowdown in the wake of the GFC. Labour productivity growth in industries that use ICT intensively was reasonable over the 1990s before subsiding somewhat in the 2000s.<sup>9</sup>

<sup>7</sup> A caveat around the results in this section is that data on hours worked is only available at the aggregate level in New Zealand. So labour productivity at the industry level is measured on the basis of hours paid, which may not accurately reflect actual hours worked due to paid leave and unpaid overtime (Statistics New Zealand, 2012d).

<sup>8</sup> In the Australian context, see, for example, Topp & Kulys (2012) on the electricity, gas & water industry and Topp et al. (2008) on mining.

<sup>9</sup> Statistics New Zealand classifies ICT-intensive industries as those where ICT assets make up a relatively large proportion of productive capital stocks. These are: information media & telecommunication services, financial & insurance and professional, scientific & technical services. In the move from ANZSIC96 to ANZSIC06 industry classifications, significant changes were made to the ICT-intensive industries. For example, communication services under ANZSIC96 became information media & telecommunication under ANZSIC06. Information media & telecommunication now includes sub-industries that were previously included in manufacturing (eg, print and recorded media publishing) and cultural and recreational services (eg, information services and TV services). Although information media & telecommunication is still a strong performer, labour productivity growth in this sector is much lower than ANZSIC96 communication services. Not surprisingly, this change has significantly altered the productivity profile of the ICT-intensive group of industries. For example, the slowdown in ICT-intensive industries' labour productivity growth was more marked under ANZSIC96 classification, with annual average growth in the 1990s of 5.9% versus 2.5% from 2000 to 2010. See Appendix B and Statistics New Zealand (2012a) for more details.

**Table 1** Labour productivity growth by sector for selected time periods

Annual average growth rate (%)

	Measured sector	Primary sector	Goods-producing sector	Services sector	ICT-intensive industries
1978-1985	1.8	2.3	2.2	0.6	2.5
1985-1990	2.7	6.8	1.8	1.5	0.5
1990-2000	2.6	4.6	1.5	2.1	3.3
2000-2008	1.3	1.3	0.6	1.7	2.0
2008-2011*	0.5	1.3	0.8	0.1	1.0
1978-2011	1.9	3.3	1.4	1.4	2.2

Source: Statistics New Zealand; authors' calculations.

*Notes:*

1. The selected periods up to 2008 cover one or two complete productivity growth cycles. 1978 to 1985 covers two full cycles: 1978-1982 and 1982-1985. 1985 to 1990 is a full cycle. 1990 to 2000 covers two full cycles: 1990-1997 and 1997-2000. The latest full cycle is 2000 to 2008. The most recent period of 2008 to 2012 is an incomplete productivity cycle. Breaking the series into growth cycles allows for average growth rate comparisons that account for variation in capacity utilisation over cycles. Statistics New Zealand calculates these productivity cycles on a 'peak-to-peak' basis using a Hodrick-Prescott filter. See Statistics New Zealand (2007) for more details.
2. The primary sector includes the following industries: agriculture, forestry, & fishing, and mining. The goods-producing sector includes the following industries: manufacturing; electricity, gas, water & waste services; and construction. The services sector includes the following industries from 1978: wholesale trade; retail trade; accommodation & food services; transport, postal & warehousing; information media & telecommunication services; and financial and insurance services. Rental, hiring & real estate services; professional, scientific & technical services; administrative & support services; arts & recreation services and other services are included from 1996. ICT-intensive industries are a sub-group of the services sector. It includes the following industries from 1978: information media & telecommunication services, and financial and insurance services. Professional, scientific & technical services are included from 1996.

As well as being strong – particularly up until 2000 – labour productivity growth in the primary sector has also been highly volatile (Figure 5a). Although still an open question, this volatility may arise as a result of the resource-dependent nature of primary industries. In large part, both high labour productivity growth and its volatility in the primary sector reflect very large swings in MFP growth (Figure 5a). This volatility fell in the 2000s, but remained high relative to other parts of the New Zealand economy. In comparison to MFP growth, capital deepening has played a smaller role in driving labour productivity growth in the primary sector. In broad terms, capital deepening over the 1990s and early 2000s reflected reductions in labour input, whereas capital investment has increased over the latter part of the 2000s (Figure 5a and Table 2).

In the goods-producing sector, labour productivity growth since the late 1970s was, on average, lower than in the measured sector overall (Table 1). Labour input into this sector has displayed distinct cycles that broadly coincide with the aggregate pattern discussed in section 3 above. That is, the sector generally experienced labour shedding in the early 1990s, then briefly in the late 1990s and more recently in the wake of the GFC (Figure 5b). Capital input in the goods-producing sector displays a broadly similar pattern. On balance, the impact of capital deepening on labour productivity growth has oscillated between positive and negative since the early 1990s. MFP growth in the goods-producing sector was strong in the mid-1990s, but has otherwise been volatile with large increases in some years and negative growth in a number of other years (Figure 5b).

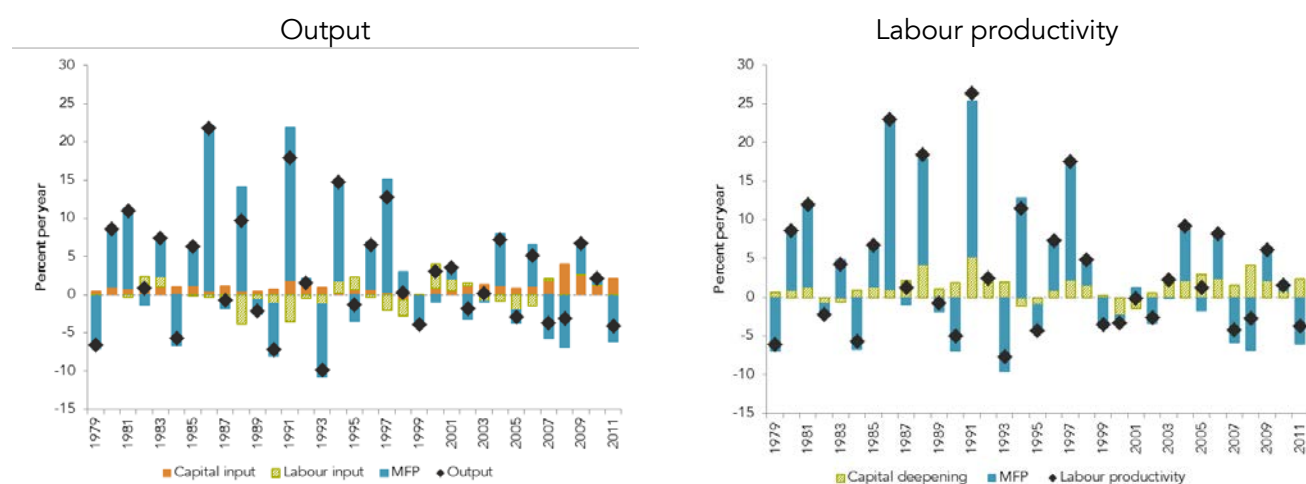
In the services sector, with the exception of the early 1990s recession, both capital and labour inputs have increased markedly since the mid-1980s, reflecting the structural transformation of the New Zealand economy towards services. Capital deepening in this sector has generally had a positive impact on labour productivity growth since the mid-1990s (Figure 5c). Since that time, MFP growth also made a positive contribution each year, with the exception of 2004 and 2009. However, weaker labour productivity growth in the services sector since the GFC reflects slower MFP growth. These



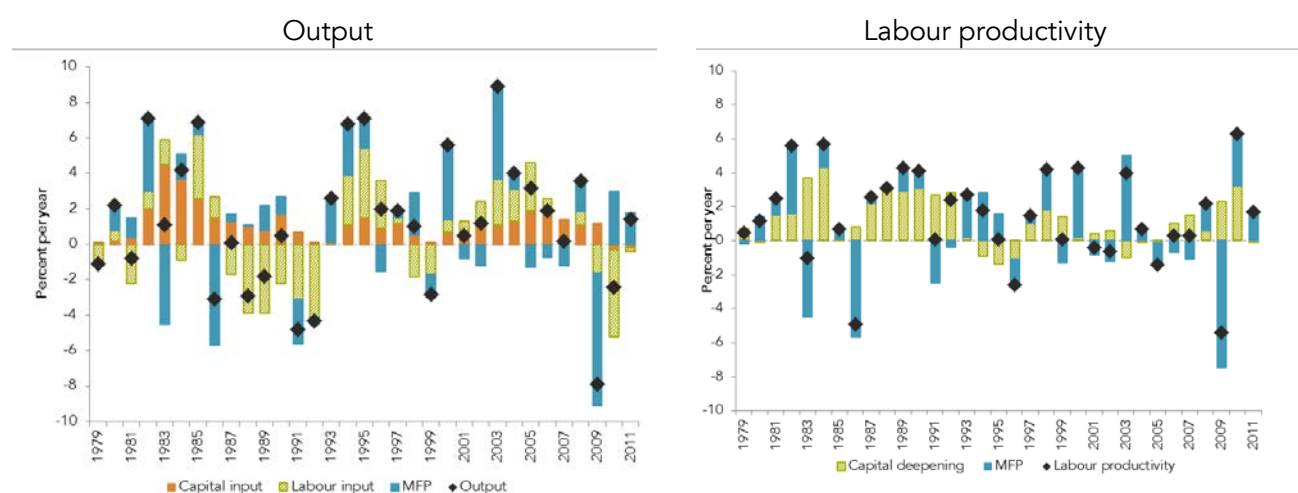
general patterns in the services sector were relatively more pronounced in ICT-intensive industries, leading to superior productivity outcomes (Figure 5d).

**Figure 5** Decomposition of measured sector output and labour productivity growth by sector

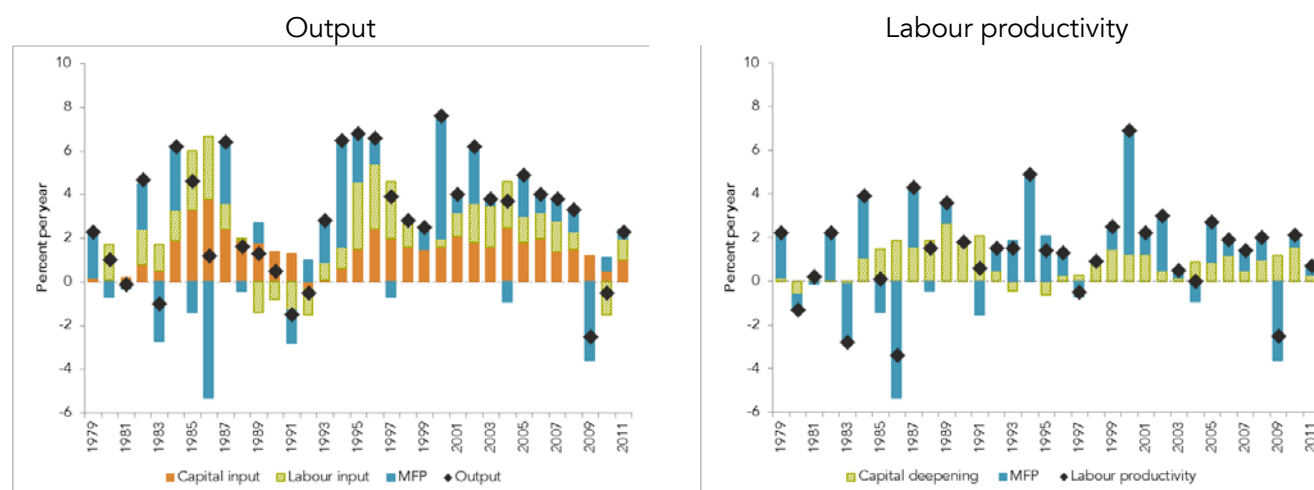
a. Primary sector



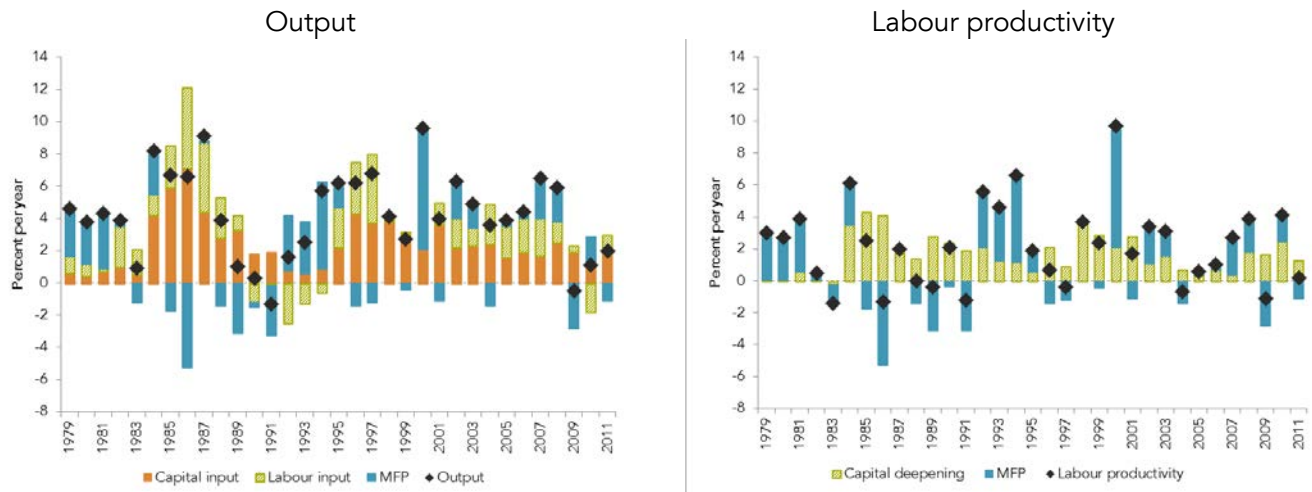
b. Goods-producing sector



c. Services sector



## d. ICT-intensive industries



Source: Statistics New Zealand.

Notes: See Note 2 to Table 1.

## 4.2 Productivity at the industry level

### Productivity levels

The similar labour productivity levels across the primary, goods-producing and services sectors mask considerable diversity at the industry level, with GDP per hour paid in 2010 ranging from a low of \$21 in the accommodation & food industry to \$333 in the mining industry (Figure 6). Even within sectors, the range of labour productivity levels is large at the industry level. For example, in the goods-producing sector, labour productivity in the electricity, gas, water & waste industry was about six times higher than the construction industry. In the primary sector, GDP per hour paid in mining in 2010 was about 8.5 times higher than in agriculture, forestry & fishing. Given the diversity of the sector, the range of labour productivity levels in service industries is also very wide with generally higher labour productivity in industries assessed as being ICT intensive.<sup>10</sup> In general, as discussed in section 2 above, cross-industry differences in labour productivity levels in part broadly reflect differences in capital intensity (Figure A.1).

### Productivity growth

As with labour productivity levels, there is considerably diversity in labour productivity growth rates at the industry level. In the primary sector, labour productivity growth was strong in both the agriculture, forestry & fishing and mining industries up until the late 1990s but slowed considerably thereafter (Table 2). This slowdown was particularly pronounced in mining, in large part driven by negative MFP growth from the late 1990s.

In goods-producing industries, growth in labour productivity, MFP and capital intensity in manufacturing have all been around or a little below the measured-sector average with the exception of a surge in MFP growth at the end of the 1990s. In electricity, gas, water & waste, extremely strong labour productivity growth over the 1990s reflected capital deepening, despite MFP declining over most growth cycles. In construction – a perennial underperformer in the New Zealand economy – growth in labour productivity, MFP and capital deepening has been persistently low or negative (Table 2).

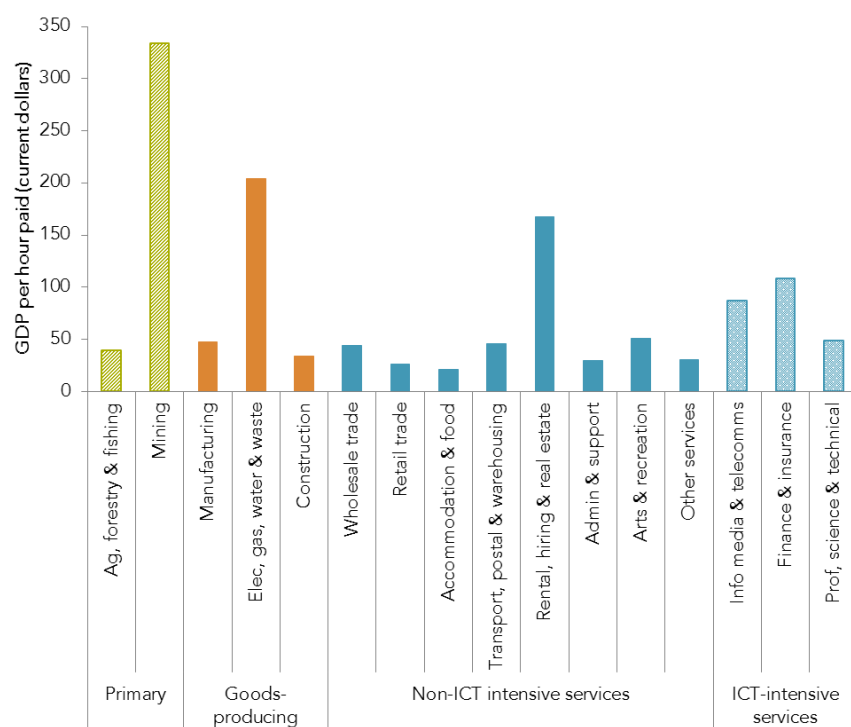
In service industries, labour productivity growth has varied markedly by industry since 1990 from an average annual rate of -0.5% in accommodation & food to 6.1% in information, media & telecommunication (Table 2). The latter reflects a combination of solid MFP growth and capital

<sup>10</sup> Note that methodological issues cast doubt on the cross-industry comparability of the estimated level of labour productivity in the rental, hiring & real estate industry. Specifically, GDP in this industry includes private rentals, but there is no corresponding labour input for this sub-industry, resulting in an increased level of labour productivity for this industry. See Statistics New Zealand (2013c) for details.

deepening, particularly over the 1990s. The transport, postal & warehousing industry also experienced fast labour productivity growth in the 1990s, stemming from very strong MFP growth that more than offset low to negative capital deepening. Labour productivity growth slowed considerably in this industry from the late 1990s as MFP growth fell and offset a modest increase in capital deepening. In the finance & insurance industry, labour productivity growth has persistently being well above the measured sector average and was particularly strong over the 1990s. In professional, scientific & technical services MFP growth has been persistently negative at least since the late 1990s.

In the wake of the GFC, MFP growth fell in most industries in the New Zealand economy except agriculture, forestry & fishing. In mining, MFP declined by a staggering 6.9% per year from 2008 to 2011. Over the same time period, the capital-to-labour ratio in this industry increased by almost 4% per annum, after being slightly negative in the earlier part of the 2000s. The finance & insurance industry shows a similar pattern of slower MFP growth in the wake of the GFC that is offset to some extent by a significant increase in capital deepening. Similarly, increased capital intensity in the information, media & telecommunication industry from 2008 has offset slower MFP growth, leading to improved labour productivity growth (Table 2).

**Figure 6** Industry labour productivity levels, 2010



Source: Statistics New Zealand; authors' calculations.



**Table 2** Industry growth in labour productivity and contributions from capital deepening and MFP growth

	Labour Productivity: Growth rates (% per year)					MFP: Growth rates (% per year)					Average rate of capital deepening				
	1990-1997	1997-2000	2000-2008	2008-2011*	1990-2011	1990-1997	1997-2000	2000-2008	2008-2011*	1990-2011	1990-1997	1997-2000	2000-2008	2008-2011*	1990-2011
<i>Primary</i>	7.6	-0.7	1.4	1.3	3.2	5.9	-0.6	-0.5	-0.5	1.6	1.5	-0.1	1.9	1.8	1.5
- Ag, forestry, fishing	7.4	-0.3	1.2	2.3	3.2	6.1	-0.3	-0.3	2.1	2.2	1.3	0.0	1.4	0.2	1.0
- Mining	10.1	0.4	-2.7	-3.5	1.9	5.3	-2.0	-2.3	-6.9	-0.4	4.1	2.4	-0.5	3.7	2.1
<i>Goods-producing</i>	0.9	2.9	0.6	0.9	1.1	0.4	1.7	0.3	-0.9	0.4	0.5	1.1	0.4	1.8	0.7
- Manufacturing	1.0	3.6	1.1	0.5	1.3	0.8	2.5	0.5	-0.6	0.7	0.2	1.1	0.6	1.1	0.6
- EGWW	5.0	13.1	-2.9	-2.3	2.1	1.0	-0.1	-1.9	-3.2	-0.9	3.9	13.2	-1.1	0.9	2.9
- Construction	-0.4	0.1	0.9	-0.2	0.2	-1.5	0.3	0.8	-0.4	-0.2	1.2	-0.2	0.2	0.2	0.5
<i>Services</i>	1.5	3.4	1.7	0.1	1.7	1.2	2.2	0.9	-0.9	0.9	0.3	1.2	0.8	1.0	0.7
- Wholesale trade	-0.9	5.3	1.8	-0.2	1.1	-0.5	4.8	1.6	-0.4	1.1	-0.4	0.4	0.2	0.2	0.0
- Retail trade	2.2	2.7	2.1	-0.3	1.9	1.6	1.8	1.3	-0.3	1.2	0.7	0.8	0.8	-0.1	0.6
- Accom & food	-1.1	-1.1	0.2	-0.1	-0.5	-0.9	-1.1	-0.7	-0.2	-0.7	-0.2	0.0	0.9	0.0	0.3
- Transport	6.1	2.9	1.5	0.2	3.1	7.0	2.5	0.4	-1.4	2.6	-0.8	0.5	1.1	1.6	0.4
- Info media & telecoms	7.4	10.5	4.0	4.4	6.1	2.8	3.8	2.0	0.8	2.4	4.6	6.6	1.9	3.5	3.7
- Finance & insurance	3.6	8.0	3.0	2.7	3.9	2.9	5.8	1.5	-1.4	2.2	0.6	2.0	1.5	4.2	1.7
- Rental, hire, real est	n/a	1.0	4.2	1.4	n/a	n/a	0.9	2.1	-0.5	n/a	n/a	0.1	2.0	1.9	n/a
- Prof, scientific & technical	n/a	0.8	0.5	-0.6	n/a	n/a	-0.9	-0.5	-0.8	n/a	n/a	1.6	1.0	0.2	n/a
- Admin & support	n/a	-4.4	0.4	-5.0	n/a	n/a	-3.4	0.0	-5.8	n/a	n/a	-1.0	0.4	0.8	n/a
- Arts & rec	n/a	2.1	-0.9	-0.2	n/a	n/a	2.4	-1.6	-1.8	n/a	n/a	-0.4	0.7	1.7	n/a
- Other services	n/a	7.5	1.8	1.3	n/a	n/a	6.9	1.3	1.1	n/a	n/a	0.6	0.5	0.1	n/a
<i>ICT-intensive industries</i>	2.5	5.3	2.0	1.1	2.5	1.1	2.4	0.8	-0.8	0.9	1.4	2.9	1.2	1.8	1.6
<i>Measured sector</i>	2.7	2.8	1.3	0.5	2.0	2.0	1.8	0.6	-0.8	1.1	0.6	1.0	0.7	1.4	0.9

Source: Statistics New Zealand; authors' calculations.

**Notes:**

1. 2008-2011 is an incomplete productivity cycle.
2. ICT-intensive industries include ANZSIC06 divisions J & K for 1990-1997 and 1990-2011, and divisions J, K & MN1 for other periods
3. The measured sector includes ANZSIC06 divisions A-K & R for 1990-1997 and 1990-2011, and divisions A-K, M, N, R, S & industry LL1 for other periods.

### Industry contributions to aggregate productivity growth

An industry's contribution to New Zealand's aggregate measured sector productivity performance depends not only on its own 'within industry' performance, as described above, but also on its size and the impact of resource shifts into and out of the industry (Box 1). Accounting for all these effects reveals a wide diversity in the contribution of different industries to New Zealand's aggregate productivity performance. Indeed, the share of aggregate labour productivity growth attributable to some industries is far larger than their size as a share of GDP. Other industries – including some that account for a considerable GDP share – have generally detracted from New Zealand's aggregate labour productivity and MFP growth over a number of years.

To illustrate, from 1996 to 2011, industries that accounted for around 40% of measured sector GDP contributed about 80% of aggregate labour productivity growth – 1.1 percentage points of 1.4% (Figure 8a).<sup>11</sup> This 'bang for the buck' was particularly strong in the high-productivity growth industries of information, media & telecommunication and finance & insurance, which collectively account for just over 10% of GDP but contributed half a percentage point to aggregate labour productivity growth of 1.4%.

At the other end of the distribution, the construction industry and a number of low-productivity growth service industries have detracted from New Zealand's aggregate labour productivity growth performance. This includes the professional, scientific & technical services industry which is reasonably large – at about 10% of GDP – and has detracted almost a tenth of a percentage point per year from aggregate labour productivity growth between 1996 and 2011.

Service industries are represented at both ends of the distribution of industry contributions to aggregate labour productivity growth, illustrating the diversity of productivity experiences in this sector.

The distribution of industry contributions to MFP growth is even more asymmetric. Indeed, industries that account for around 40% of measured sector GDP collectively contributed around 110% to aggregate MFP growth – 0.53 percentage points of 0.48% (Figure 8b). The positive contributions to MFP growth from a number of predominantly service industries is offset to a considerable extent by poor performances in a range of other industries, including professional, scientific & technical services; electricity, gas, water & waste and mining.

In terms of absolute contributions to aggregate productivity growth, partly reflecting its large size – about 20% of GDP – the manufacturing industry made the largest contribution to aggregate labour productivity growth between 1996 and 2011 (Figure 9). Although much smaller, rapid productivity growth in information, media & telecommunication and finance & insurance have resulted in these industries also making comparatively large contributions to New Zealand's aggregate labour productivity growth performance. Both industries have accounted for a considerable share of aggregate capital deepening since the mid-1990s, although MFP growth, particularly in the information media & telecommunication industry, has also been significant. On the other hand, administrative & support services and professional, scientific & technical services have been the largest detractors from aggregate productivity growth.

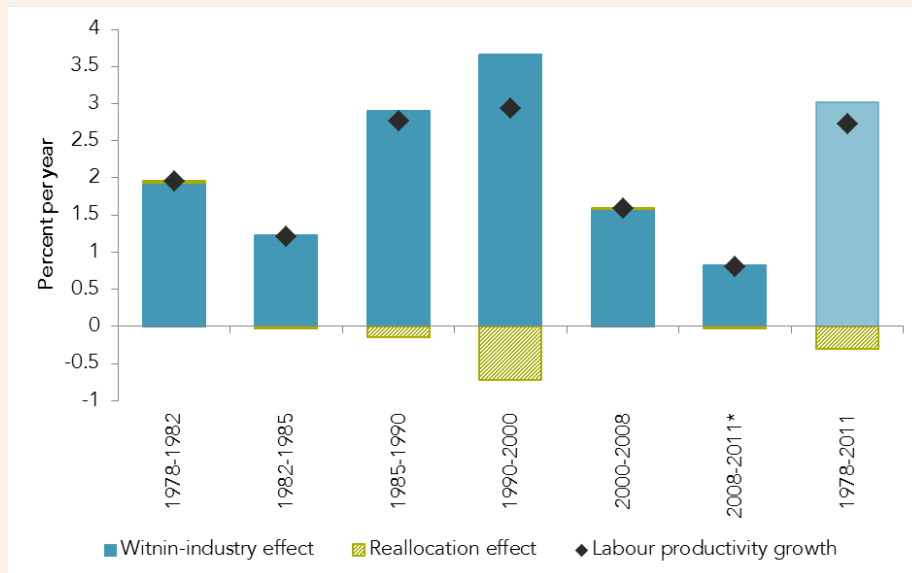
<sup>11</sup> The technique used to estimate these industry contributions uses separate industry weights for labour input, capital input and output, rather than a simple current price GDP weighting. However, for simplicity, the results are summarised in terms of their GDP share.

### Box 1 Decomposing productivity – within vs. between effects

New Zealand's aggregate productivity growth performance reflects the impact of productivity growth within industries (weighted by size) and the reallocation of resources between industries with differing productivity levels. The 'within-industry' component reflects industries producing more (or less) output for a given quantity of inputs. The 'reallocation' component reflects the impact on aggregate productivity growth from changes in the allocation of productive inputs across industries.

Decomposing New Zealand's aggregate labour productivity performance into these two components reveals that the within-industry effect has been the dominant driver of labour productivity growth at the aggregate level (Figure 7). Particularly over the 1990s, the reallocation effect was negative in New Zealand, indicating that the inter-industry movement of labour exerted a negative impact on aggregate labour productivity growth. This reallocation reflected a decrease in the share of labour in some high-productivity industries and an increase in the share of labour allocated to some low-productivity industries.<sup>12</sup>

**Figure 7** Decomposition of former measured sector labour productivity growth over productivity cycles

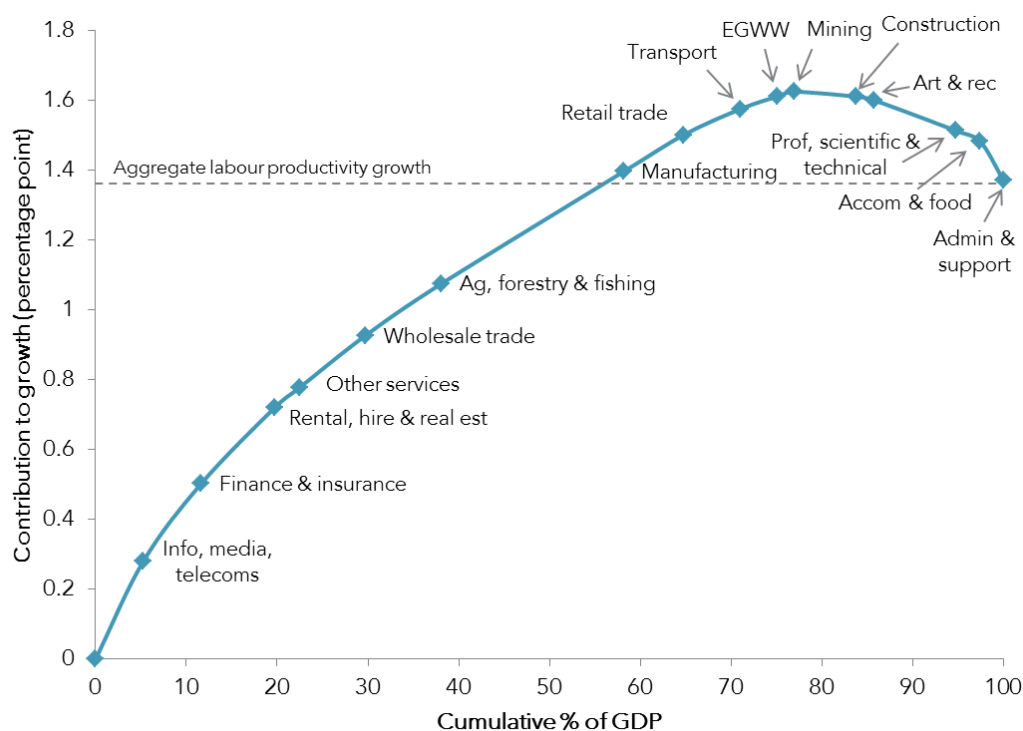
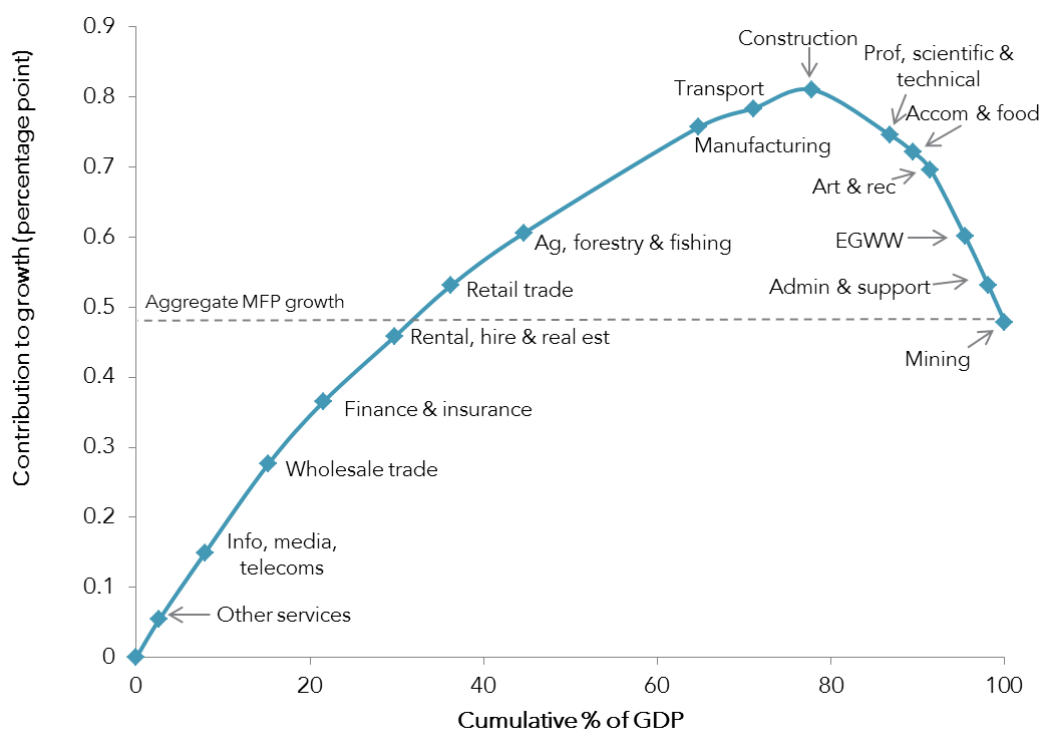


Source: Statistics Zealand; authors' calculations.

*Notes:*

1. 2008 to 2011 is an incomplete productivity cycle.
3. The former measured sector is ANZSIC06 divisions A to K, and RS2. For measured sector analysis from 1996 onwards, see Meehan (2013a).

<sup>12</sup> The impact of within-industry and reallocation effects is discussed in detail in Meehan (2013a).

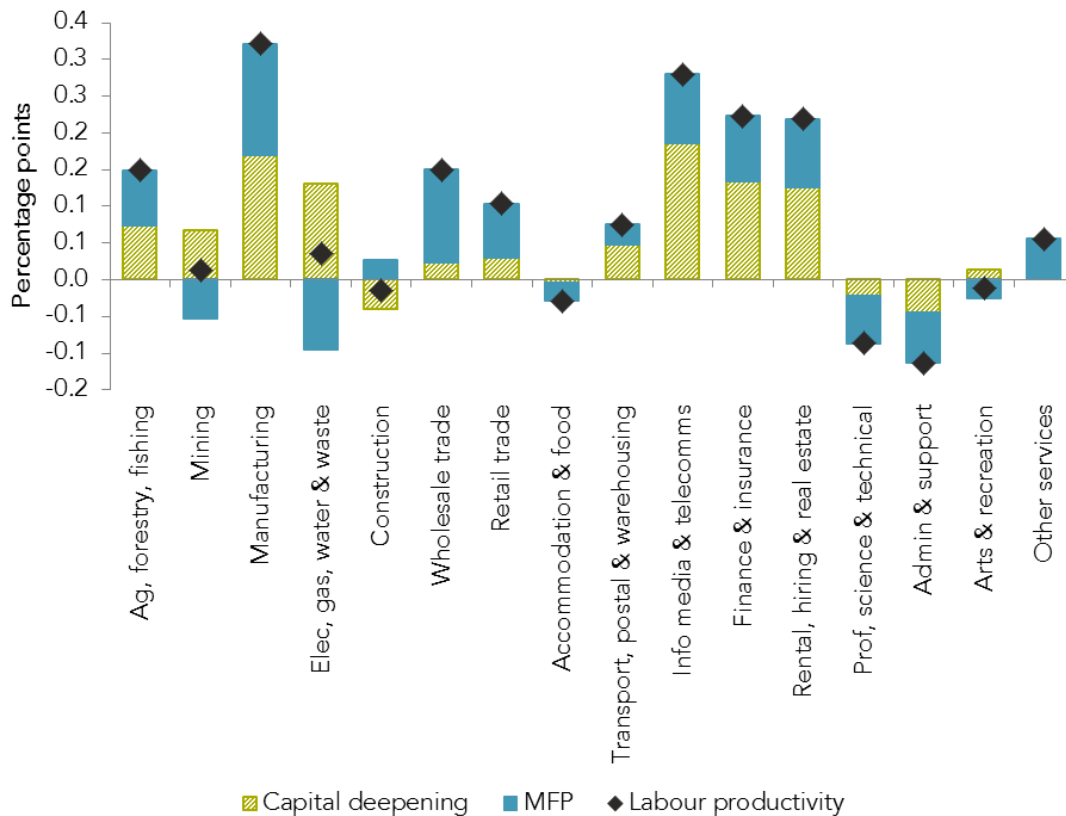
**Figure 8 Industry contributions to aggregate productivity growth relative to size (% GDP)****a. Labour productivity growth, 1996-2011****b. MFP growth, 1996-2011**

Source: Statistics New Zealand.

**Notes:**

- Industries are ordered by industry contribution divided by GDP. However, the industry contribution is estimated using the methodology developed in Parham (2012) (see Meehan, 2013b). This involves calculating labour productivity growth (MFP) using separate indexes for output and labour input (output and total inputs) rather than a simple weighting of industry labour productivity (MFP) growth weighted by GDP share.

**Figure 9** Industry contributions to aggregate growth in labour productivity, capital intensity and MFP, 1996-2011



Source: Statistics New Zealand; authors' calculations.

**Notes:**

1. Estimated using the methodology developed in Parham (2012). This technique follows the Statistics New Zealand approach of estimating industry contributions of labour input, capital input and output separately in order to estimate the contribution to labour productivity, MFP and capital deepening. See Meehan (2013b).

### The industry contributions to the productivity slowdown

As New Zealand's productivity growth slowed in the 2000s, MFP growth became more concentrated in a smaller number of industries – the GDP share of industries recording positive MFP growth fell from 90% in the 1990s to 78% from 2000 to 2008. At the same time, the GDP share of industries with positive labour productivity growth actually increased slightly.<sup>13</sup> This is consistent with the aggregate results outlined above showing that the labour productivity growth slowdown over the 2000s reflects slower MFP growth rather than a slowdown in capital deepening. This also indicates that some capital deepening over the 2000s has taken place in industries with low or negative MFP growth.

The productivity slowdown over the 2000s has been reasonably broad based with the contribution to aggregate labour productivity and MFP growth declining in all but three industries at the one-digit level (Figure 10a). Reflecting a pronounced slowdown from extremely rapid productivity growth over the 1990s, the contribution of the transport, postal & warehousing industry to aggregate productivity growth fell considerably in the 2000-08 productivity cycle. This may reflect the positive impact of reform on the performance of the transport sector, which saw very rapid productivity growth over the 1990s that has since dissipated. It may also reflect relatively low capital input growth in this industry in the 1990s, followed by a period of 'catch-up' investment in the 2000s (Table 2 above).

<sup>13</sup> This refers to former measured sector industries' shares of GDP and MFP growth because some measured sector industries do not have pre-1996 data available. The former measured sector is ANZSIC06 divisions A to K, and RS2.

The agriculture, forestry & fishing industry also experienced a sizeable slowdown in labour productivity and MFP growth in the 2000s productivity cycle relative to the 1990s. Given that this industry accounts for a reasonable proportion of GDP, the contribution to the aggregate slowdown in MFP growth has been considerable. Over the 1990s, the agricultural sector was heavily influenced by reform, such as the removal of support payments. This has been a catalyst for change in the sector, including widespread changes in land use with the numbers of beef cattle and sheep decreasing and the number of dairy cattle increasing substantially (Ministry for the Environment, 2007). In any case, the contribution of this industry to New Zealand's aggregate productivity growth performance has declined considerably over recent years.

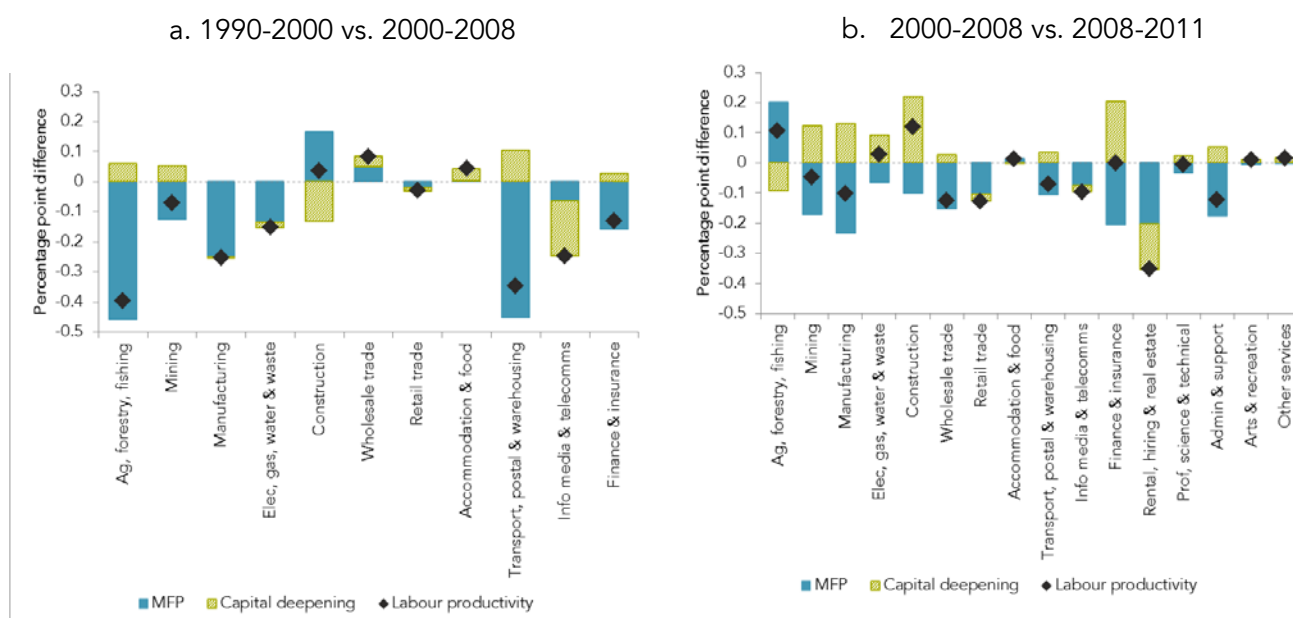
The manufacturing and finance & insurance industries have both made sizeable contributions to the aggregate MFP growth slowdown, while the impact on aggregate labour productivity growth has been mitigated to an extent by increased capital deepening in these industries. In contrast, the information, media & telecommunication industry has recorded a slower rate of capital deepening in the 2000s productivity cycle relative to the 1990s.

At the other end of the spectrum, the construction industry has improved its typically very poor rate of productivity growth and had a positive influence on aggregate MFP growth in the 2000s productivity cycle relative to the 1990s (Figure 10a).

In the incomplete 2008-11 productivity cycle, slower labour productivity growth in the services sector resulted in slower aggregate labour productivity growth compared with the 2000-08 cycle. While capital deepening increased in all three sectors, MFP growth was slower in the goods-producing and services sector. In the goods-producing sector, the MFP growth slowdown was more than offset by greater capital deepening, leading to an increase in labour productivity. In the services sector, the increase in capital deepening was not enough to offset the MFP growth decline.

At the industry level, all industries except agriculture, forestry & fishing and accommodation & food services contributed to slower aggregate MFP growth over the last few years. In 11 of the remaining 14 industries, greater capital deepening offset this lower MFP growth to some extent (Figure 10b).

**Figure 10 The slowdown in productivity growth by industry**



Source: Statistics New Zealand; authors' calculations.

**Notes:**

1. The figures show the total industry contribution to the slowdown in aggregate labour productivity growth between the two productivity growth cycles. Industry contributions are calculated using the method developed in Parham (2012) (see Meehan, 2013b).
2. The '1990-2000 vs. 2000-2008' figure is for the 11-industry former measured sector due to data availability, while the 2000-2008 vs. 2008-2011 uses the 16-industry measured sector.

## 5 New Zealand's productivity record compared

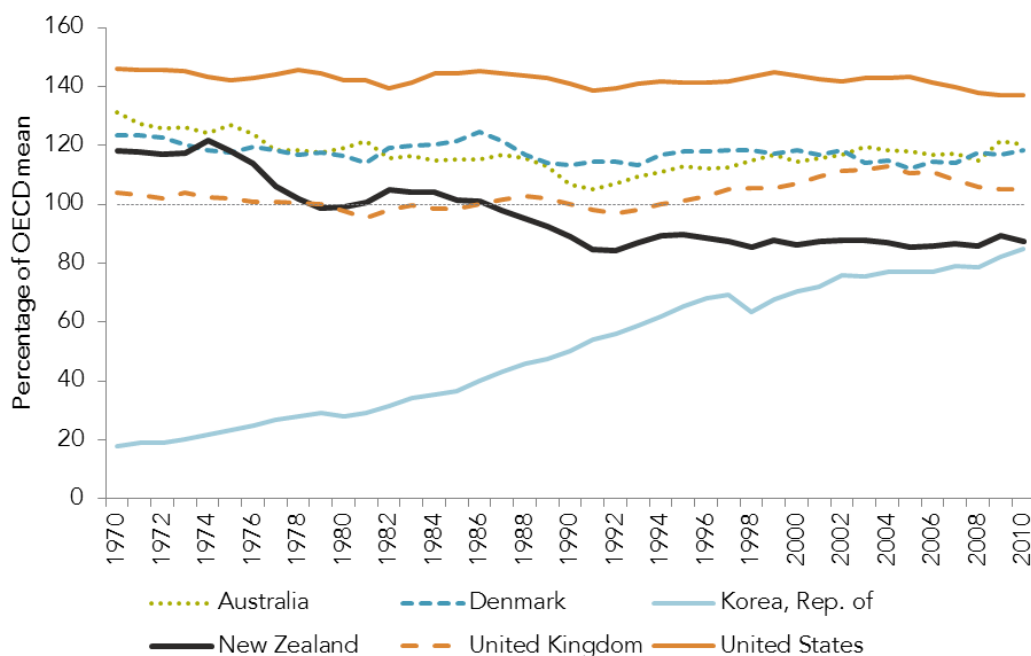
This section puts New Zealand's productivity performance described above into international context. It begins at the aggregate level by comparing New Zealand's productivity experience firstly with that of other OECD countries and secondly with that of Australia. It then contrasts New Zealand's productivity performance at the industry level with a selection of other countries to the extent that the data allow.

### 5.1 Economy wide

#### The OECD

GDP per capita in New Zealand has been below the OECD average for over 25 years (Figure 11). This has not always been the case – in 1970, New Zealand's GDP per capita was almost 110% of the OECD average, but had fallen to 79% of the average by 2010.<sup>14</sup>

Figure 11 GDP per capita as a percentage of the OECD mean (US\$ PPPs)



Source: OECD; authors' calculations.

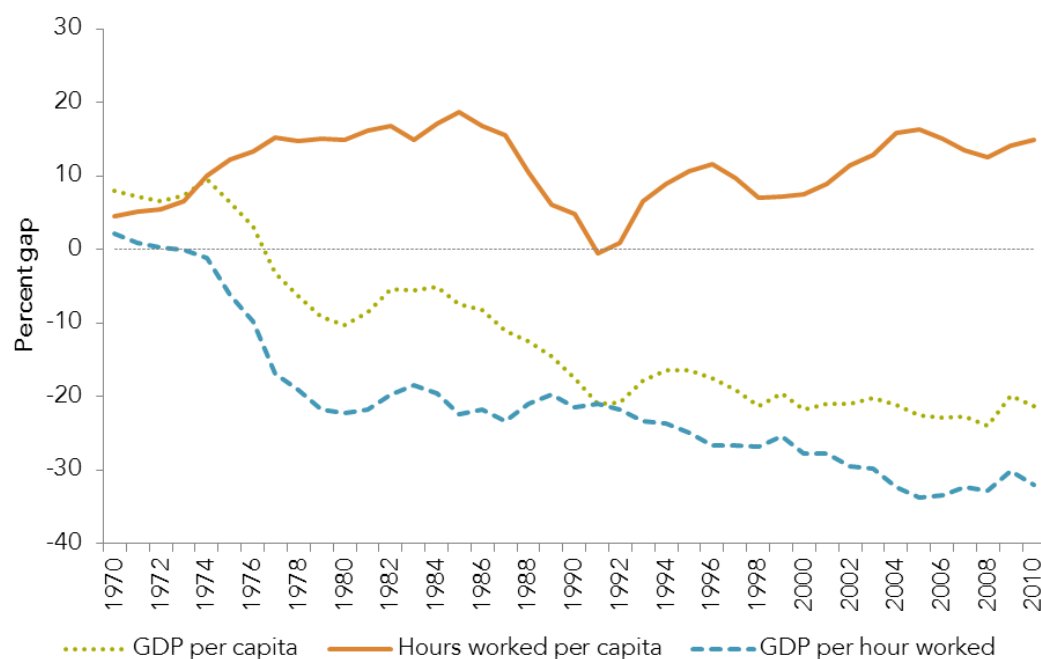
Almost the entire decline in New Zealand's GDP per capita relative to the OECD occurred over two distinct periods. The first 'step down' in New Zealand's relative per capita GDP took place in the second half of the 1970s, with a roughly 20 percentage point fall compared to the OECD average. In large part, this reflected a steep decline in New Zealand's labour productivity compared with other OECD countries (Figure 12). In the second episode of relative decline, in the late 1980s and early 1990s, per capita GDP fell by another ten percentage points compared with the OECD average. This decline mainly reflected a precipitous drop in hours worked per capita in New Zealand relative to the OECD average.

<sup>14</sup> The results presented in Section 3 are derived from Statistics New Zealand data on productivity in the measured sector while the current sub-section is based on OECD and Conference Board data for the aggregate economy. As such, results are not directly comparable. However, in the case of New Zealand, the trends in both data sets are broadly similar. For a discussion of OECD versus Statistics New Zealand productivity measures, see Statistics New Zealand & New Zealand Treasury (2010) and Statistics New Zealand (2013c).

From the early 1990s, New Zealand's economic performance has improved in international comparison and GDP per capita has broadly stabilised at around 20% below the OECD average. In large part, this reflects greater labour utilisation – since the early 1990s, significant increases in labour force participation and generally lower unemployment have led to strong growth in hours worked per capita (Figure 12). In contrast, labour productivity has continued its long slow decline vis-à-vis other OECD countries.

**Figure 12 The source of economy-wide GDP per capita differences**

Gap expressed as % of the average of selected OECD countries



Source: OECD; authors' calculations.

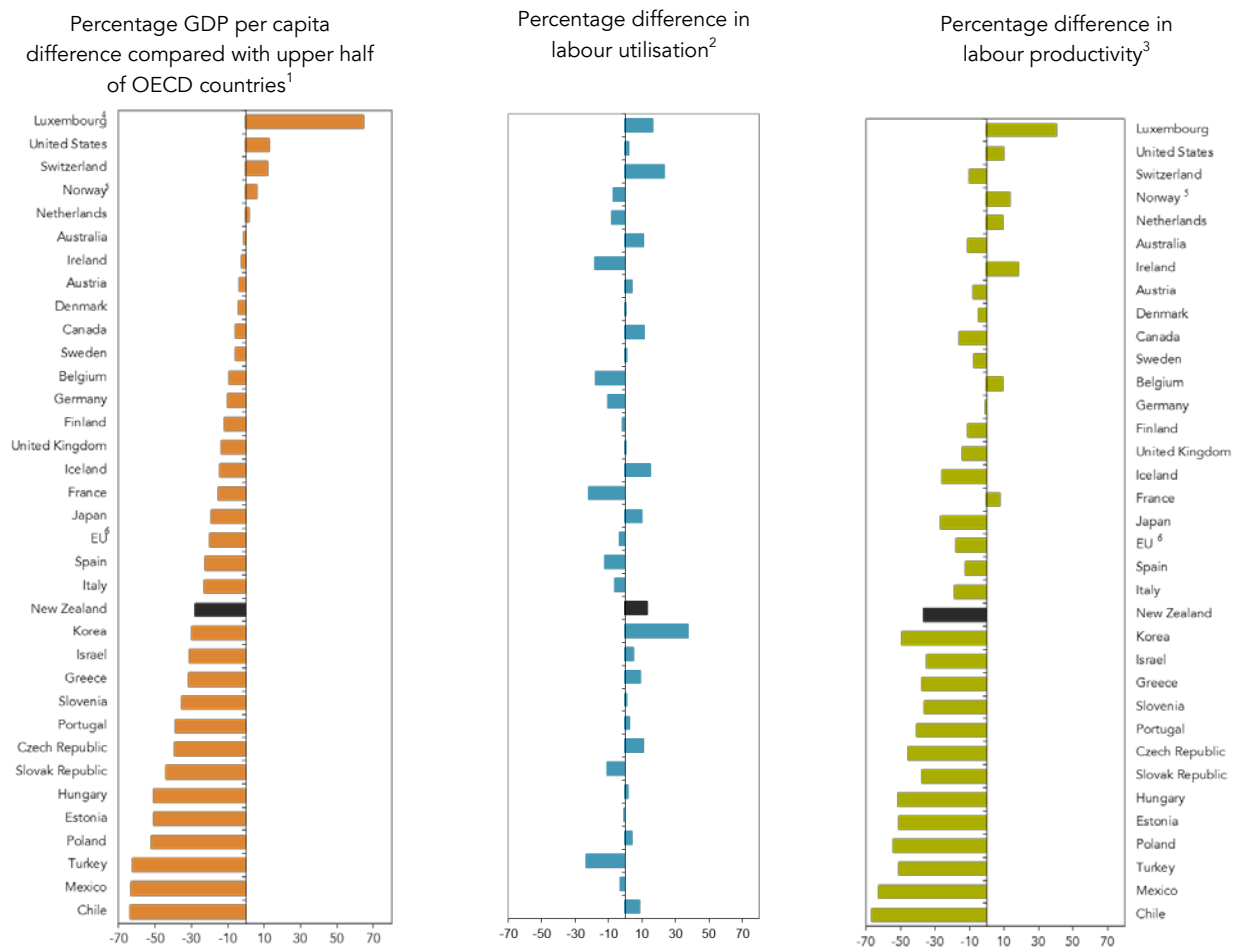
*Notes:*

1. Based on OECD countries with the necessary data from 1970 to 2010, namely: Australia, Belgium, Canada, Denmark, Finland, France, Germany, Iceland, Ireland, Italy, Japan, Netherlands, NZ, Norway, Spain, Sweden, Switzerland, Turkey, UK and USA.
2. To facilitate international comparison, labour productivity is measured on an economy-wide basis.

Reflecting these trends, in 2011 average GDP per capita in New Zealand was around USD30 000 in PPP terms. This is comparable with GDP per capita in Korea and Israel and puts New Zealand in 21<sup>st</sup> place in the OECD GDP per capita rankings.<sup>15</sup> However, reflecting strong growth since the early 1990s, labour input in New Zealand is among the highest in the OECD. In contrast, New Zealand's hourly labour productivity ranks in the lower third of OECD countries in 2011 and is broadly comparable to that in Slovenia, Greece, Israel and the Slovak Republic. As such, the gap in New Zealand's GDP per capita relative to the better-performing OECD countries overwhelmingly reflects a poor labour productivity performance (Figure 13).

<sup>15</sup> Note, however, that reflecting substantial net foreign debt, New Zealand's net national income per capita – at about USD24 000 in PPP terms – is considerably lower than GDP per capita and about the same as net national income per capita in Greece and Israel but below that in Korea.



**Figure 13 The source of real income differences, 2010**

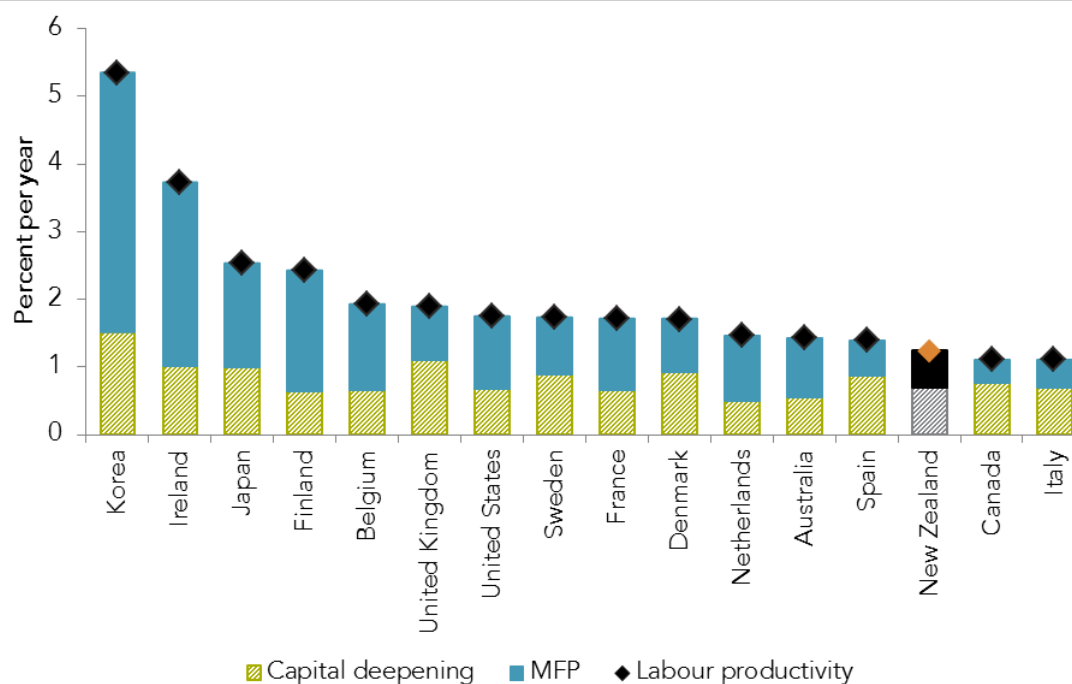
Source: OECD (2012).

**Notes:**

1. Compared with the average of the 17 OECD countries with the highest GDP per capita in 2010, based on 2010 PPPs. The sum of the percentage difference in labour utilisation and labour productivity do not add up exactly to the GDP per capita difference since the decomposition is multiplicative.
2. Labour utilisation is measured as the total number of hours worked per capita.
3. Labour productivity is measured as GDP per hour worked.
4. In the case of Luxembourg, the population is augmented by the number of cross-border workers in order to take into account their contribution to GDP.
5. Data refer to GDP for mainland Norway which excludes petroleum production and shipping. While total GDP overestimates the sustainable income potential, mainland GDP slightly underestimates it since returns on the financial assets held by the petroleum fund abroad are not included.
6. The EU category brings together countries that are members of both the European Union and the OECD. These are the EU15 countries plus Czech Republic, Estonia, Hungary, Poland, the Slovak Republic and Slovenia.

Given data limitations, it is difficult to conclusively determine the respective contributions of capital intensity and MFP in driving New Zealand's poor labour productivity performance compared with the OECD (Statistics New Zealand, 2013b). In levels terms, the evidence indicates that both capital intensity and MFP are considerably lower in New Zealand than in comparator countries (New Zealand Treasury & Ministry of Economic Development, 2005; Schreyer, 2007). For example, Schreyer (2007) estimates that the capital-to-labour ratio in New Zealand is about half of that in the United States and that MFP in New Zealand is about 70% of the United States level. For labour productivity growth, OECD data indicate that New Zealand's underperformance since the mid-1980s is more a reflection of poor MFP growth than capital deepening (Figure 14).<sup>16</sup>

<sup>16</sup> It is important to note that MFP and capital intensity are to some extent endogenous, suggesting that low capital intensity can be thought of, at least partly, as a by-product of low MFP. This arises because, assuming no impediments to the free movement of capital, a country with relatively low MFP is likely to have a lower rate of return on capital investment. If there are barriers to the movement of capital, these are likely to drive up the cost of capital and depress capital intensity further (New Zealand Treasury, 2008a).

**Figure 14** Decomposition of economy-wide labour productivity growth, 1985-2010 <sup>1</sup>

Source: OECD.

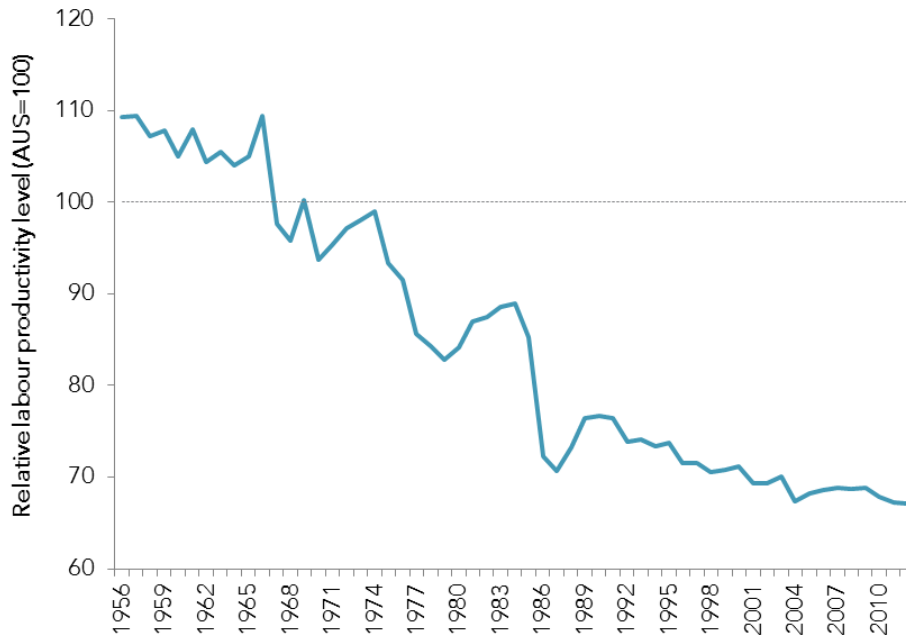
Notes:

1. Or latest available year.

## Australia

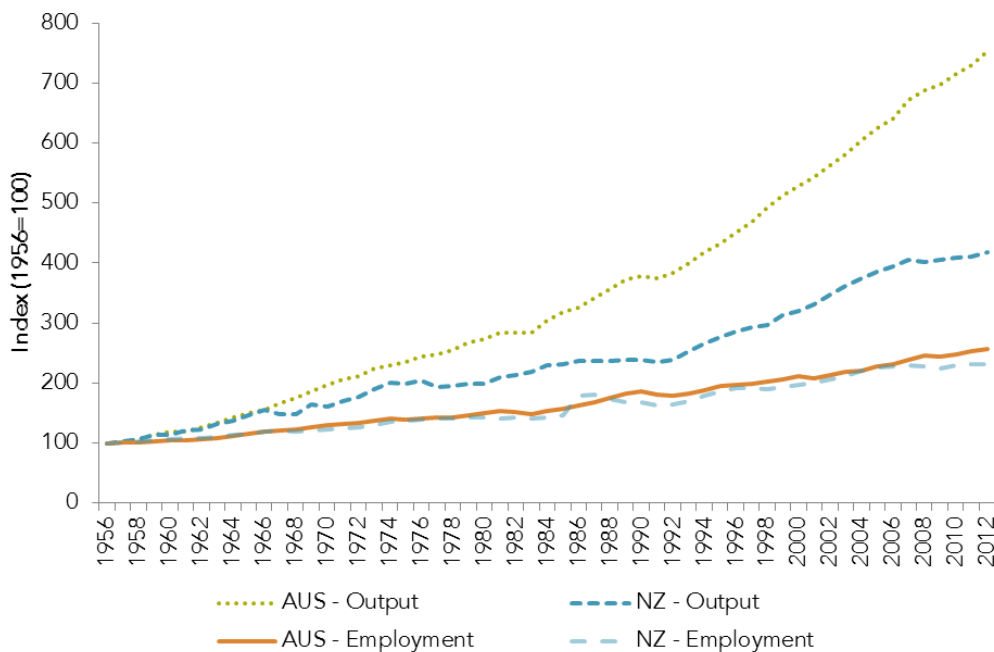
New Zealand's persistent labour productivity decline is more marked relative to Australia than the OECD in general, given an above average performance in that economy.

Labour productivity in Australia has grown considerably faster than in New Zealand over a long period of time. In 1967, the level of labour productivity in New Zealand dropped to parity with Australia from an average 8% lead in the late 1950s and early 1960s (Figure 15). Over the mid-1970s to late 1980s, New Zealand's labour productivity declined markedly relative to Australia's, including two periods of precipitous underperformance. From the beginning of the 1990s, the rate of decline in New Zealand's labour productivity vis-à-vis Australia has been more gradual.

**Figure 15 GDP per hour worked in New Zealand relative to Australia**

Source: The Conference Board.

This growing gap in labour productivity has been the main driver of an increasing disparity in GDP per capita between the two trans-Tasman economies. Growth in labour input over the past four decades has been remarkably similar in both economies and persistently faster than the OECD average since the early 1990s (Figure 16). However, although growth in total hours worked has been very similar, Australia has had considerably faster GDP growth since the late 1960s. Specifically, in 2011 real GDP in Australia was 4.4 times higher than in 1967 but only 2.8 times higher in New Zealand.

**Figure 16 Growth in GDP and hours worked, Australia vs. New Zealand**

Source: The Conference Board.

Mason (2013) estimates that in 2009 the trans-Tasman labour productivity gap was 38% in Australia's favour and that New Zealand's underperformance reflects deficiencies in both capital intensity and MFP. Specifically, he attributes 39% of New Zealand's labour productivity shortfall to lower capital intensity, 58% to lower MFP and the remaining 3% to lower skills. Over time, the respective

contributions of MFP and capital intensity to the gap in labour productivity are estimated to have been relatively stable. Compared with Australia, this indicates that while New Zealand is a relatively capital shallow economy, a poor MFP performance accounts for the majority of the underperformance in labour productivity.

## 5.2 New Zealand's industry productivity performance compared

In comparing productivity performance across countries, it is important to consider whether differences in industrial structure account for some of the difference at the aggregate level. For example, countries that are sufficiently open to international trade are likely to specialise in areas where they have an advantage and building scale in these areas provides a further advantage. Based on natural resource endowment, Australia's mining industry is likely to be larger than New Zealand's and therefore have a bigger impact on aggregate productivity. In turn, these differences in industrial structure will explain some of the differences in aggregate productivity across the two economies.

Cross-country productivity comparisons at the industry level mitigate differences in aggregate productivity performance arising from broad differences in economic structure. They do not, however, control for structural differences within industries such as, for example, coal-fired versus hydro electricity generation. They are also challenging to undertake, given cross-country differences in data coverage and methodology, and difficulties in estimating PPP deflators at the industry level.<sup>17</sup>

Unfortunately, New Zealand is typically not included in cross-country databases of productivity at the industry level, making a detailed cross-country assessment of New Zealand's productivity performance difficult.<sup>18</sup> However, Mason & Osborne (2007) and Mason (2013) provide a like-with-like comparison of New Zealand's productivity performance at the industry level with the United Kingdom and Australia respectively. In addition, Statistics New Zealand has calculated industry-level productivity statistics for New Zealand based on the OECD's methodology, allowing a limited cross-country comparison of productivity growth by industry.<sup>19</sup>

### Productivity levels

In 2009, the level of labour productivity in New Zealand is estimated to be lower than in Australia in 10 of the 16 one-digit industries included in in Mason (2013) (Figure 17). New Zealand's labour productivity level is estimated to be less than half of Australia's in the mining, construction and finance & insurance industries. Some of New Zealand's manufacturing sub-industries are also estimated to have labour productivity levels that are less than half that in Australia. New Zealand's labour productivity level in transport, postal & warehousing; wholesale trade and retail trade also scores poorly compared with Australia (Mason, 2013).

New Zealand performs relatively well in food & drink manufacturing; electricity, gas, water & waste and a smattering of services including professional, scientific & technical services.<sup>20</sup> The data also indicates that New Zealand has a massive productivity advantage in rental, hiring & real estate services, but this may reflect deficiencies in the underlying data.<sup>21</sup> In all but a few industries, capital intensity is estimated to be lower in New Zealand than in Australia. However, with the exceptions of manufacturing; accommodation & food services; agriculture, forestry & fishing, trans-Tasman differences in the level of MFP are found to be the primary reason for different levels of labour productivity across the two trans-Tasman economies (Figure 17).

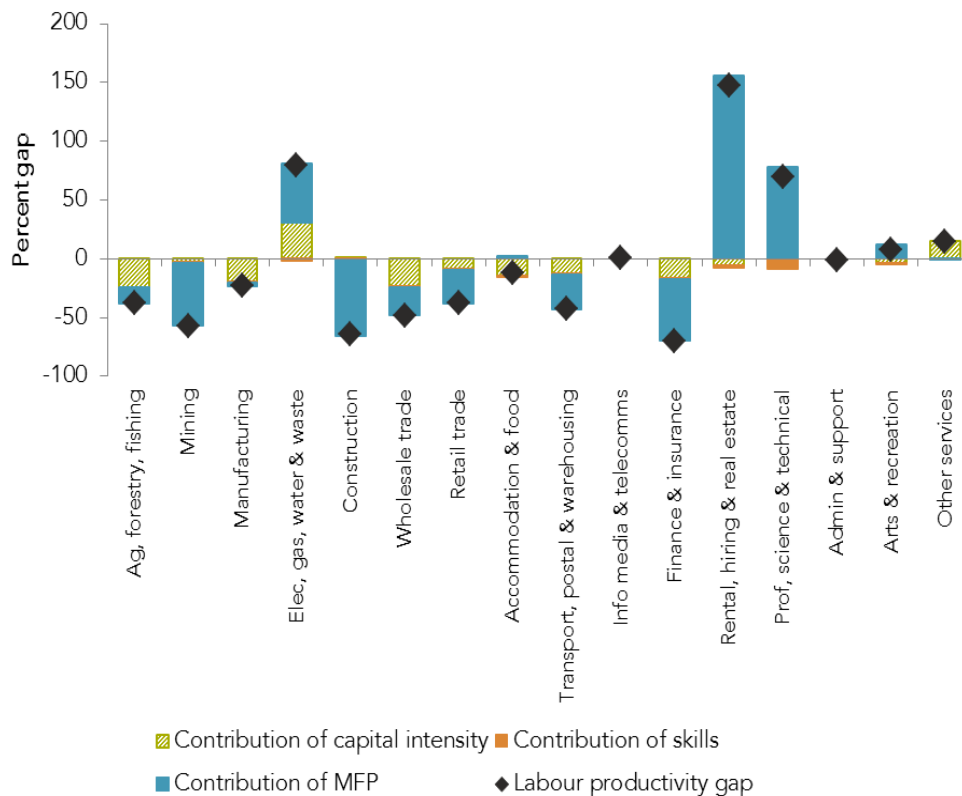
<sup>17</sup> Some studies have attempted industry productivity comparisons between Australia and New Zealand – for example Boven, Bidois, & Harland (2010) and NZIER (2011) – but have not used industry PPPs.

<sup>18</sup> In particular, New Zealand is not part of the EUKLEMS database (see <http://www.euklems.net/> for details).

<sup>19</sup> New Zealand is not included in the OECD's industry productivity database. The New Zealand data was obtained by following the OECD's method for estimating industry productivity as closely as possible (see Arnaud, Dupont, Koh, & Schreyer (n.d.)).

<sup>20</sup> However, New Zealand's productivity advantage in professional, scientific & technical services is not robust to the choice of industry PPPs. See Mason (2013) for details.

<sup>21</sup> Specifically, the rental, hiring & real estate services industry includes private rentals in New Zealand but not in Australia (Statistics New Zealand, 2013b). However, while the output of private rentals is included for New Zealand, there is no corresponding labour input. Therefore, Mason (2013) attempts to correct for this difference by excluding the private rentals component of GDP from the New Zealand data. However, comparability issues for this industry may remain.

**Figure 17** Decomposition of New Zealand's labour productivity levels relative to Australia, 2009

Source: Mason (2013).

In Mason & Osborne (2007), the level of labour productivity in New Zealand in 2002 is estimated to be lower than in the United Kingdom in nine out of the 13 industries examined. As is the case with Australia, New Zealand underperforms considerably in the wholesale, retail trade and construction industries. In contrast, New Zealand's communications and cultural & recreational services industries are estimated to have labour productivity levels that are considerably higher than in the United Kingdom.

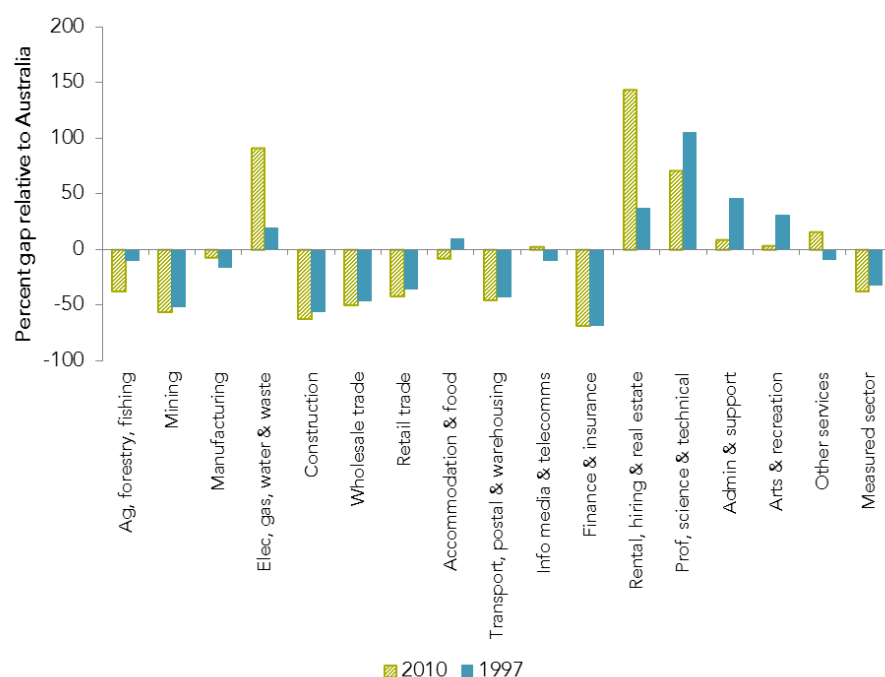
### Productivity growth

At the industry level, data assembled by Mason (2013) indicates that between 1997 and 2010 labour productivity growth in New Zealand's has been slower than in Australia in 10 out of 16 industries (Figure 18). New Zealand experienced faster labour productivity growth than Australia in: rental, hiring & real estate services; electricity, gas, water & waste services; information media & telecommunication; manufacturing and other services. Finance & insurance had similar growth rates in the two countries.

Across a broader range of countries over the relatively short period of 2000-2007, labour productivity growth in New Zealand has been around or below the average in most industries for which data are available (Figure 19). New Zealand's agricultural sector is the notable exception to this generally below-average productivity growth performance at the industry level.<sup>22</sup>

Consistent with the economy-wide results discussed in section 4.1 above, below-average labour productivity at the industry level predominantly reflects weak MFP growth, while capital deepening in New Zealand has been closer to the average among the OECD countries analysed. Wholesale & retail trade & repairs follow this pattern, while in hotels and restaurants, New Zealand's MFP growth was relatively weak, but capital deepening was particularly strong. In finance, insurance & business services, New Zealand's MFP growth was about average, but its capital deepening was the weakest.

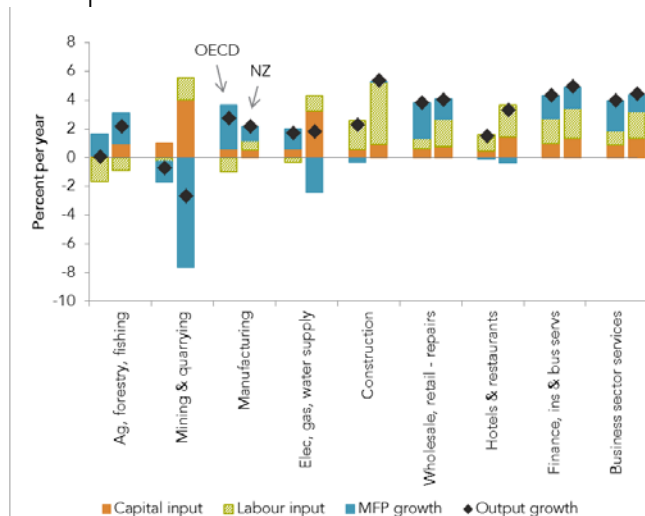
<sup>22</sup> Detailed breakdowns of output and labour productivity growth by industry and country are given in Appendix C.

**Figure 18** Labour productivity gap relative to Australia by industry, 1997 vs. 2010

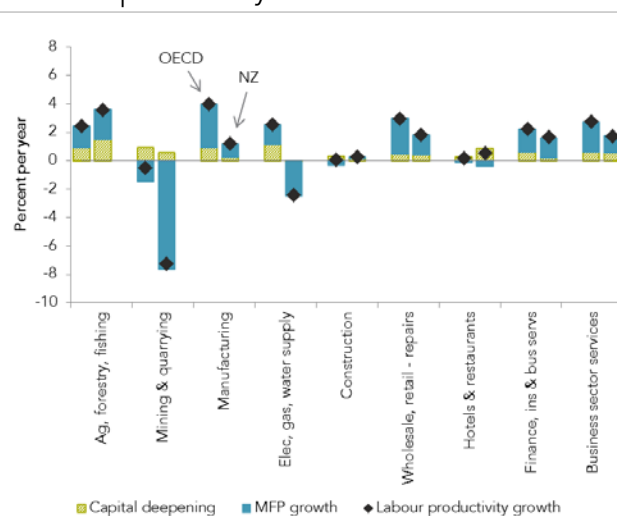
Source: Mason (2013); authors' calculations.

**Figure 19** Cross-country growth accounting for output and productivity growth by industry, 2000-2007

## a. Output



## b. Labour productivity



Source: OECD; Statistics New Zealand<sup>23</sup>; authors' calculations.

## Notes:

1. The OECD average is the simple average of selected countries for which data are available from 2000 to 2007 and New Zealand. These generally are: Austria, Belgium, Czech Republic, Denmark, Finland, Germany, Greece, Iceland, Italy, Sweden, the United Kingdom and the United States. See Appendix C for detailed breakdowns by country.
2. 'Agriculture' is ISIC Rev. 3 category C01T05: Agriculture, hunting, forestry & fishing. 'Mining' is C10T14: Mining & quarrying. 'Manufacturing' is C15T37: Manufacturing. 'EGWS' is C40T41: Electricity, gas & water supply. 'Construction' is C45: Construction. 'Wholesale & retail' is C50T52: Wholesale & retail trade – repairs. 'Hotels & restaurants' is C55: 'Hotels & restaurants'. 'Finance & insurance' is C65T74X: Finance, insurance & business services. 'Business sector services' is C50T74X: Business sector services (excluding real estate activities).

<sup>23</sup> New Zealand data provided to the Productivity Commission by Statistics New Zealand.

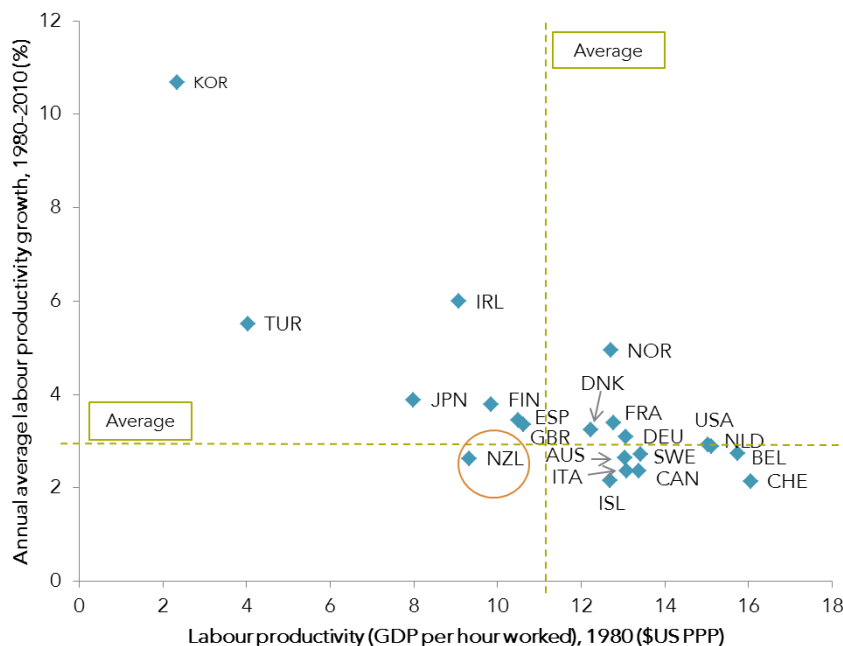
## 6 Is New Zealand 'catching up'?

In principle, the productivity performance of a low-productivity country such as New Zealand should, over time, converge towards better performing economies as capital and ideas flow from richer to poorer countries in search of higher marginal products. Because learning from others is typically easier than pushing out the global productivity frontier, low-productivity countries some distance behind the frontier tend to experience faster productivity growth than high-productivity countries operating at the frontier. In a broad sense, this 'catch up' reflects the extent to which new technologies and knowledge diffuse across international borders via mechanisms such as foreign direct investment and cross-border mobility of high-skilled workers and managers.

Of course, catching up is by no means automatic and 'productivity gaps' persist between countries for a range of policy and non-policy reasons. Catch up has, however, been observed across a wide range of countries with economic institutions above a certain quality threshold. For example, catch up has occurred across a number of OECD countries and in the manufacturing industries of a wide range of countries (Acemoglu, 2008; Rodrik, 2013). The United States is generally considered to be one of the world's most productive economies in aggregate, but different countries are likely to be at the productivity frontier in different industries.

At the aggregate level, New Zealand's productivity performance shows no evidence of catching up, with labour productivity declining relative to other OECD countries for a number of decades (Figure 12 above). So despite having one of the lowest *levels* of labour productivity in the OECD in the 1980s, labour productivity *growth* in New Zealand has still been among the lowest of comparator countries since that time (Figure 20).

**Figure 20** New Zealand's aggregate labour productivity level and growth rate compared



Source: OECD; authors' calculations.

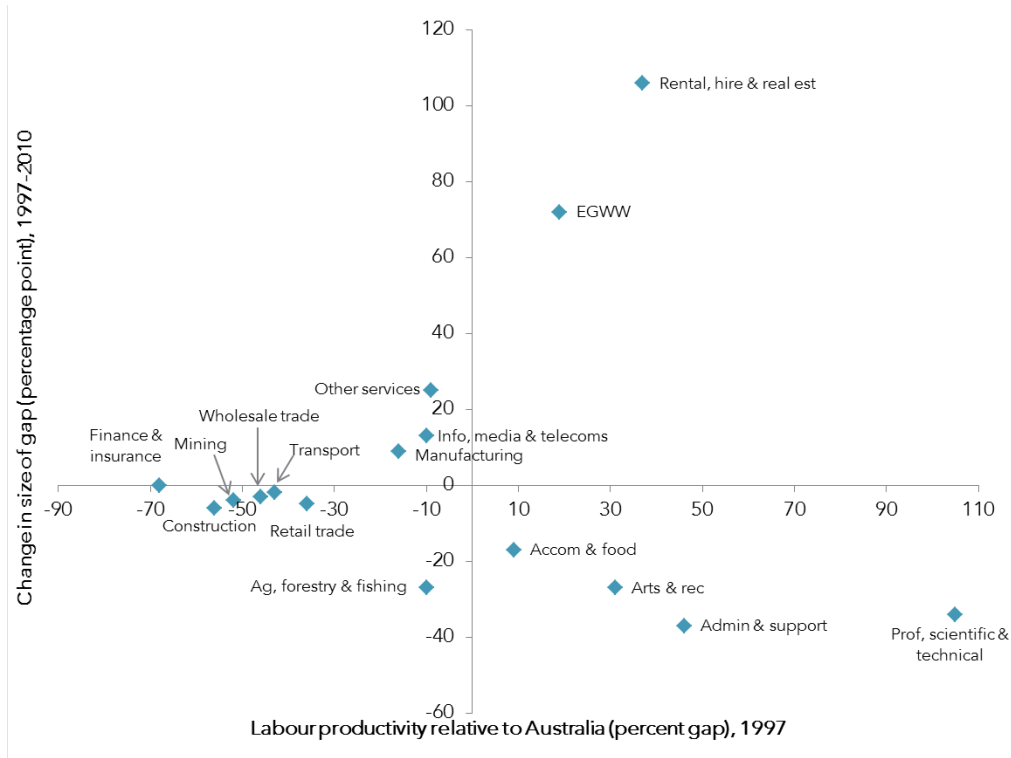
Notes:

1. Economy-wide labour productivity.

Notwithstanding data limitations, New Zealand's productivity performance at the industry level is also inconsistent with productivity catch up. Specifically, since the late 1990s, the limited available data shows no indication of labour productivity catch up between Australia and New Zealand, with the

correlation between productivity levels and growth rates statistically insignificant (Figure 21).<sup>24</sup> Of the ten industries where New Zealand's labour productivity levels were lower than Australia's in 1997, only three had caught-up or narrowed the gap by 2010 – other services, information media & telecommunication and manufacturing. Furthermore, although only indicative, labour productivity growth in New Zealand has been below the average of available OECD countries in all but three industries over recent years despite a large and growing levels gap in labour productivity at the aggregate level (Figure 19 & Figure 12).

**Figure 21 Labour productivity gap vs. growth relative to Australia by industry**



Source: Mason (2013)

This on-going divergence in New Zealand's labour productivity, with no sign of productivity 'catch up' towards more productive countries is unusual within the OECD group of countries and raises serious concerns about the extent to which new technologies and work practices developed off-shore diffuse into the New Zealand economy.

It is worth bearing in mind, however, tentative evidence that the distributions of productivity across firms within the same industries may be relatively wide in New Zealand in international comparison. If confirmed, wide productivity distributions at the firm level may be consistent with some of New Zealand's most productive firms operating at the international productivity frontier. If this is the case, then New Zealand's poor productivity performance at the industry and aggregate levels would also relate to the extent to which new technologies and work practises diffuse from high to low-productivity New Zealand firms. Exploring this issue and the impact of policy on technological diffusion within New Zealand is an important area of further research.

<sup>24</sup> Note that this result is consistent with the work of Matheson & Oxley (2007), who also generally reject convergence in labour productivity at the aggregate and disaggregated level across New Zealand and Australia.



## 7 Conclusion

This paper draws together data on New Zealand's productivity performance over time and in comparison to other countries. It highlights that New Zealand's deteriorating GDP per capita gap with other OECD countries has been driven by a growing gap in labour productivity, while employment growth in New Zealand has been relatively strong.

At the aggregate level, New Zealand's labour productivity has grown at an average rate of just under 2% a year over the last three decades, but growth has varied considerably over time. In particular, labour productivity growth was relatively strong in the 1990s, but slowed in the 2000s, driven by slower MFP growth.

At the industry level, the level and growth rates of labour productivity are diverse. Information media & telecommunication and finance & insurance, two ICT-intensive industries, have been strong performers. At the other end of the spectrum, the construction industry and some service industries have detracted from aggregate productivity growth. The 2000s slowdown in productivity growth was broad based, with almost all industries experiencing slower growth, particularly in MFP.

A comparison of industry productivity growth across OECD countries shows that New Zealand has underperformed in most industries, and this has been predominantly driven by poor MFP growth rather than a lack of capital deepening. New Zealand also has lower levels of productivity than Australia and the UK across the majority of industries.

A low-productivity country, such as New Zealand, should tend to converge towards the higher productivity levels in better performing countries. However, New Zealand has both low productivity levels and growth rates in aggregate and at the industry level and, as such, shows no sign of 'catching up' towards higher productivity countries.

This paper adds to the growing literature highlighting New Zealand's poor productivity performance. Productivity is crucial to improving incomes and standards of living. This paper sets the backdrop for on-going work at the Productivity Commission which aims to address the causes underlying New Zealand's productivity performance.

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## Appendix A Industry productivity profiles

This appendix presents summaries of the productivity performance of different sectors and industries in New Zealand along with supporting graphs. It also decomposes the trends for the primary, goods-producing, services and ICT-intensive sectors presented in section 4 into their industry components. The data in this appendix was sourced from Statistics New Zealand.

1. **The primary sector:** Labour productivity growth has been high and volatile as a result of high and volatile MFP growth. Labour productivity growth slowed markedly in the 2000s.
  - a. **Agriculture, forestry & fishing:** This is a relatively large industry, accounting for around 10% of measured sector total hours paid in 2010 (Table A.1). Since the late 1970s, labour productivity growth has been strong in this industry, particularly in the late 1980s and the 1990s, reflecting strong MFP growth (Figure A.2). However, the level of labour productivity is relatively low compared with other industries (Figure A.1). This industry has contributed relatively strongly to aggregate productivity growth (Figure 9). However, labour productivity growth deteriorated markedly in the 2000-08 productivity cycle and this industry has made a very large contribution to the productivity slowdown over the 2000s (Figure 10).
  - b. **Mining:** This is a small industry, accounting for just 0.4% of total hours paid and 3% of GDP in 2010 (Table A.1). Labour productivity growth was very strong in the mining industry in the late 1980s and 1990s but turned negative over the 2000s (Figure A.3c & Table 2). Mining is a capital intensive industry with a high level of labour productivity (Figure A.1). Given its small size, the productivity performance of the mining industry has had only a small impact on New Zealand's aggregate productivity performance (Figure 9).
2. **Goods-producing:** Labour productivity growth has generally been below the measured sector average. MFP growth was strong in the mid-1990s but has generally been volatile with large increases in some years and negative growth in others.
  - a. **Manufacturing:** Manufacturing is a large industry – 16% of measured sector hours paid and GDP in 2010 (Table A.1) – and can be further decomposed into nine sub-industries with varying labour productivity growth rates (Figure A.5). Labour productivity growth in manufacturing was relatively strong in the late 1990s but, more generally, has been slightly below aggregate labour productivity growth (Figure A.4 & Table 2). Given its size, manufacturing made the largest positive contribution to aggregate productivity performance between 1996 and 2011 (Figure 9). With slower MFP growth in the 2000s, it has made a considerable contribution to the productivity slowdown over the 2000s (Figure 10).
  - b. **Electricity, gas, water & waste:** Reflecting very strong growth driven by capital deepening in the 1990s and negative growth in the 2000s, labour productivity in this industry has grown at a similar rate to the overall measured sector since the late 1970s (Figure A.4 & Table 2). Strong positive productivity growth in the 1980s and 1990s was largely driven by capital deepening. Productivity growth turned negative in the 2000s. Partly as a result of its capital intensity, GDP per hour paid is very high in this industry (Figure A.1). However, it is a comparatively small sector, accounting for around 1% of total hours paid and 4% of GDP in the measured sector in 2010 (Table A.1). For a small industry, it has made a reasonable contribution to the productivity slowdown over the 2000s (Figure 10).
  - c. **Construction:** Construction is a reasonably large and growing industry. It accounted for 11% of labour hours paid and 8% of GDP in the measured sector in 2010 (Table A.1), up from 7% of hours paid in 1997. Unfortunately, given its size, the construction

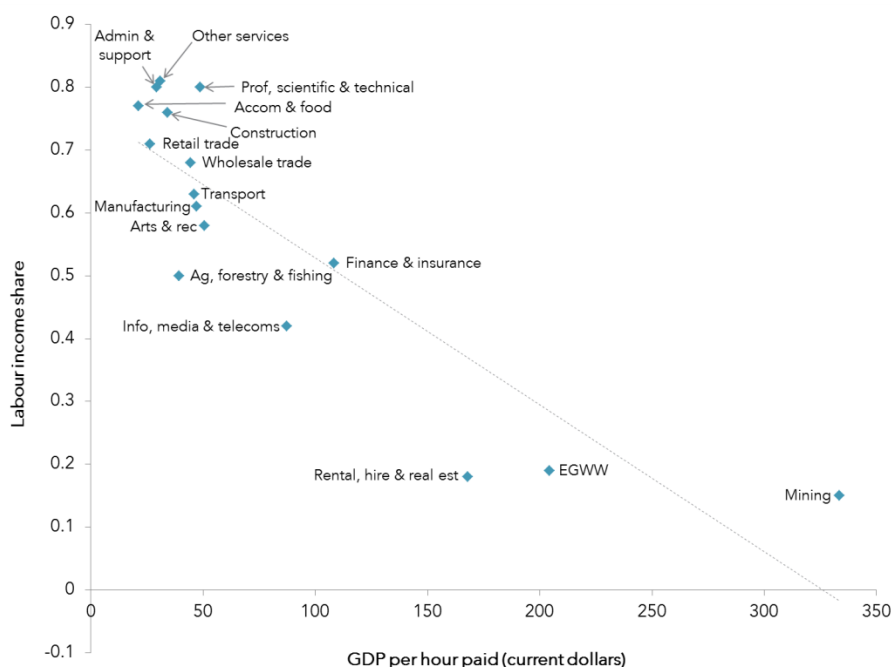
industry is a perennial productivity underperformer – despite a relatively low level of labour productivity, productivity growth has been poor (Figure A.1 & Figure A.4). Over the 1990s, labour productivity actually went backwards (Table 2). Construction is one of the few industries that had a positive influence on aggregate productivity in the 2000s relative to the 1990s, as it moved from negative productivity growth in the 1990s, to positive (albeit low) growth in the 2000-08 cycle (Figure 10).

3. **Services:** Services is a very diverse sector. It has exhibited strong growth in labour and capital input since the mid-1980s and persistently positive capital deepening since the mid-1990s. The slowdown in labour productivity post the GFC predominantly reflects weaker MFP growth.
  - a. **Wholesale:** This industry accounted for 7% of measured sector hours paid in 2010 (Table A.1). Its productivity growth has been below measured sector growth over all cycles except 2000-08 (Table 2). It is one of the few industries that experienced improved productivity over the 2000s compared with the 1990s, albeit from a reasonably low base (Figure 10).
  - b. **Retail trade:** This is a reasonably large industry, accounting for 12% of hours paid and 6% of GDP in the measured sector in 2010 (Table A.1). It has a low level of labour productivity and has generally experienced below-average productivity growth (Figure A.1 & Table 2). Internationally, wholesale and retail trade are two industries that have experienced strong productivity growth on the back of gains from ICT. This does not appear to be the experience in New Zealand to date (New Zealand Productivity Commission, 2013).
  - c. **Accommodation & food:** This industry accounted for 6% labour hours and 3% GDP in 2010 (Table A.1). It is the only former measured sector industry whose productivity was lower in 1978 than 2011 (Figure A.7). It has the lowest level of labour productivity of all measured sector industries in 2010 (Figure A.1). Like construction, it is one of the few industries that had a positive influence on aggregate productivity in the 2000s relative to the 1990s, as it moved from negative productivity growth in the 1990s, to positive (albeit low) growth in the 2000-08 cycle (Figure 10).
  - d. **Transport, postal & warehousing:** This industry accounted for 6% of labour hours and GDP in 2010 (Table A.1). This industry has been a strong performer, with labour productivity growth generally outperforming the measured sector. This growth was particularly high in the late 1980s and 1990s, driven by very strong MFP growth (Table 2). Due to this strong growth in the 1990s followed by about average performance over the 2000s, it was one of the largest contributors to the slowdown in the 2000s (Figure 10).
  - e. **Information media & telecommunication:** This is a relatively small industry, accounting for 2% of labour hours and 4% GDP in 2010 (Table A.1). This industry has been a strong performer, with labour productivity growth consistently outperforming the measured sector (Table 2). It also has high labour productivity levels (Figure A.1). It experienced impressive labour productivity growth in the 1990s, and lower, but still strong growth in the 2000s (Table 2). The majority of its labour productivity growth has occurred due to capital deepening, although contributions from MFP have also been positive (Table 2 & Figure A.8e). Despite its relatively small size, it has made a sizable contribution to measured sector labour productivity growth.
  - f. **Finance & insurance services:** This industry accounted for 4% of labour hours and 8% GDP in 2010 (Table A.1). As well as having high labour productivity levels, this industry has experienced higher-than-average labour productivity growth (Table 2). Although it is not a large industry, it has made a sizable contribution to measured sector labour productivity (Figure 9). Like most industries, its productivity growth was slower in the

2000s than the 1990s, resulting in a reasonable contribution to the slowdown in productivity growth (Figure 10).

- g. **Rental, hiring & real estate services:** This industry accounts for 2% of labour hours and 9% of GDP (Table A.1). Productivity data for this industry are available over a shorter time period (1996 to 2011). It has a high level of labour productivity and has experienced strong productivity growth (Figure A.1 & Figure A.7). However, there are measurement issues with this industry, since output includes private rentals, but there is no corresponding labour input (Statistics New Zealand, 2013b).
- h. **Professional, scientific & technical services:** This industry accounted for 10% of labour hours paid and GDP in 2010 (Table A.1). Productivity data for this industry are available over a shorter time period (1996 to 2011). Labour productivity growth has been poor at only 0.2% a year from 1996 to 2011. This has been due to negative MFP growth being more than offset by capital deepening (Table 2).
- i. **Administrative and support services:** This industry accounts for 5% of labour hours and 3% of GDP (Table A.1). Productivity data for this industry are available over a shorter time period (1996 to 2011). Over this period, labour productivity growth has gone backwards (Table 2). It also has a relatively low level of labour productivity (Figure A.1). This has been mainly due to negative MFP growth coupled with generally positive, albeit weak, capital deepening (Figure A.7).
- j. **Arts & recreation services:** This industry accounted for 4% of labour hours and 3% of GDP in the measured sector in 2010 (Table A.1). Productivity data for this industry are available over a shorter time period (1996 to 2011). This industry has relatively low levels of labour productivity (Figure A.1). However, it has had reasonably strong labour productivity growth, mainly due to MFP growth (Table 2 & Figure A.8j).

Figure A.1 Industry labour productivity levels and capital intensity, 2010



Source: Statistics New Zealand.

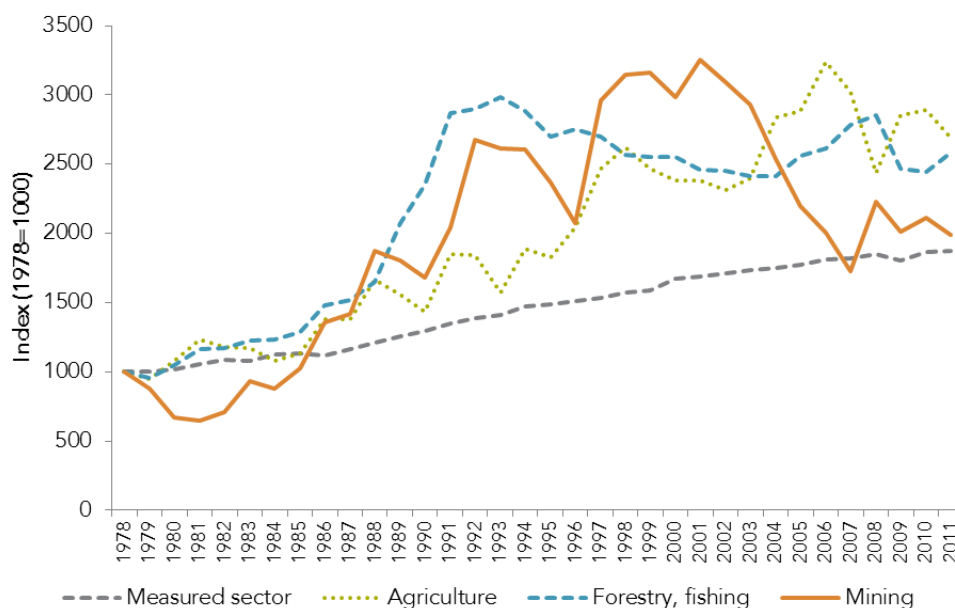
**Table A.1 Industry share of measured sector labour hours paid and GDP, 2010**

	Share of labour hours paid (%)	Share of GDP (%)
Agriculture, forestry, fishing	10.5	8.5
Mining	0.4	3.1
Manufacturing	16.4	16.0
Electricity, gas, water, waste	1.1	4.5
Construction	10.8	7.7
Wholesale trade	7.0	6.5
Retail trade	11.8	6.5
Accommodation & food	6.2	2.8
Transport, postal & warehousing	6.1	5.8
Info media & telecommunication	2.3	4.2
Finance & insurance	3.7	8.2
Rental, hiring & real estate	2.5	8.6
Professional, scientific & technical	10.0	10.0
Administrative & support	4.8	2.9
Arts & recreation	2.0	2.1
Other services	4.4	2.8

Source: Statistics New Zealand.

Notes:

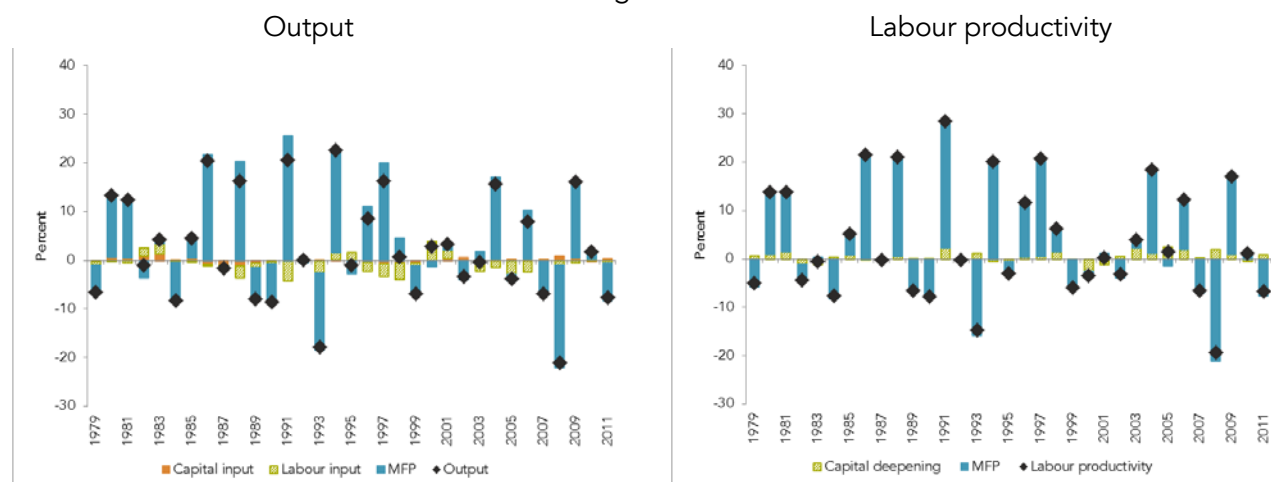
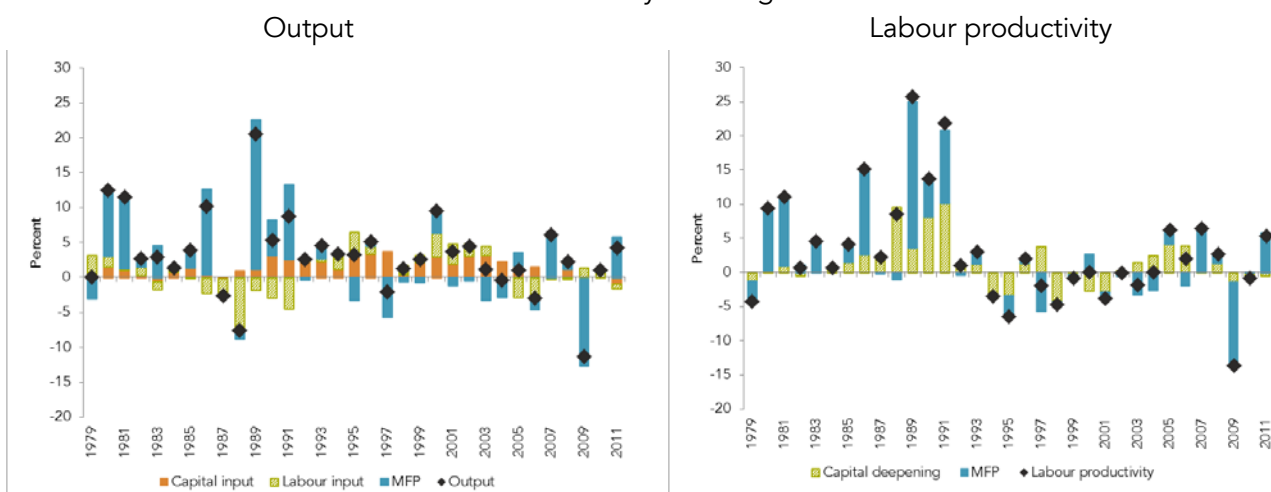
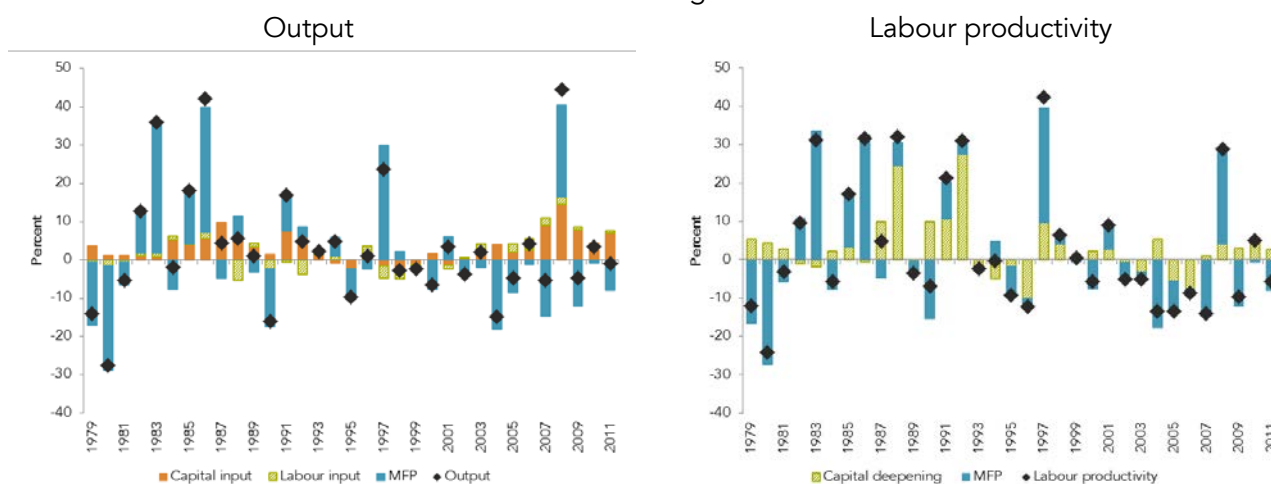
1. The GDP shares may not equal the ones used in Figure 8. The shares presented here are for 2010, while Figure 8 uses the average GDP shares from 1996 to 2011.

**Figure A.2 Labour productivity growth by primary industry, 1978-2011**

Source: Statistics New Zealand.

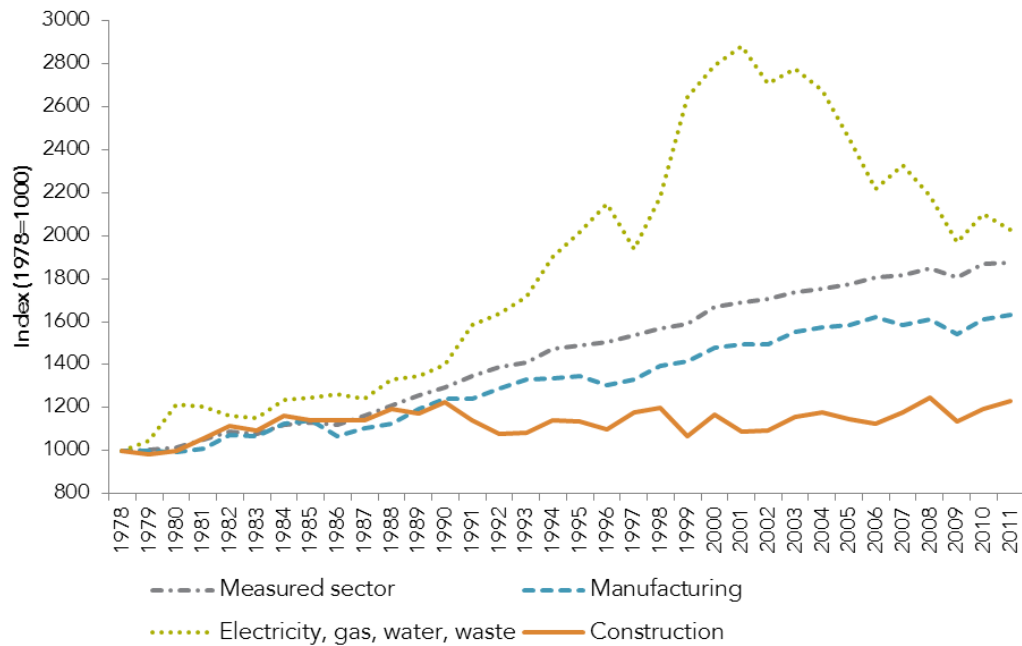
Notes:

1. The measured sector is ANZSIC06 divisions A to K, and R from 1978 to 1995; and ANZSIC06 divisions A to K, M, N, R, and S, and industry LL1 from 1996 onwards.

**Figure A.3 Decomposition of output and labour productivity growth by primary industry, 1978-2011****a. Agriculture****b. Forestry & fishing****c. Mining**

Source: Statistics New Zealand.

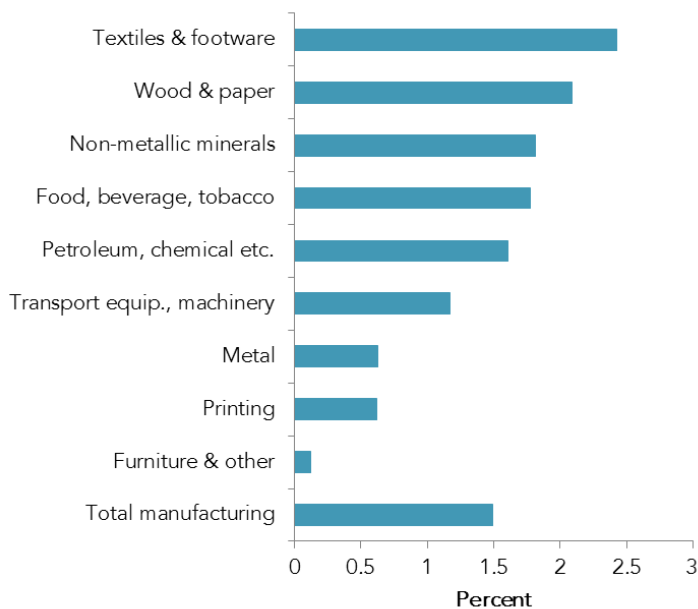


**Figure A.4 Labour productivity growth by goods-producing industry, 1978-2011**

Source: Statistics New Zealand.

Notes:

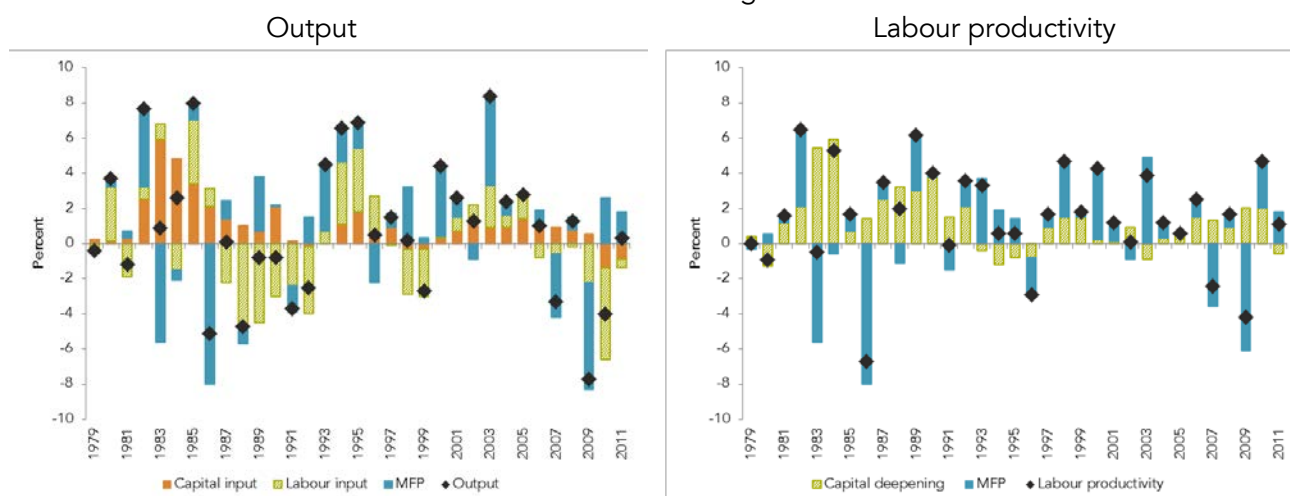
1. The measured sector is ANZSIC06 divisions A to K, and R from 1978 to 1995; and ANZSIC06 divisions A to K, M, N, R, and S, and industry LL1 from 1996 onwards.

**Figure A.5 Annual average growth in labour productivity for disaggregated manufacturing industries, 1978-2011**

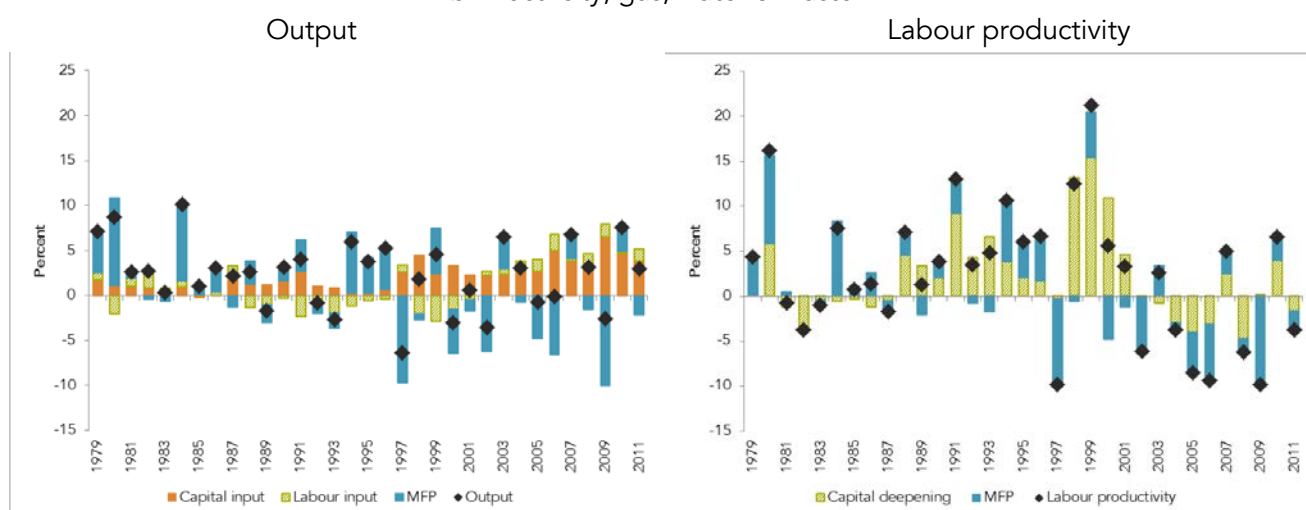
Source: Statistics New Zealand.

**Figure A.6 Decomposition of annual output and labour productivity growth by goods-producing industry, 1978-2011**

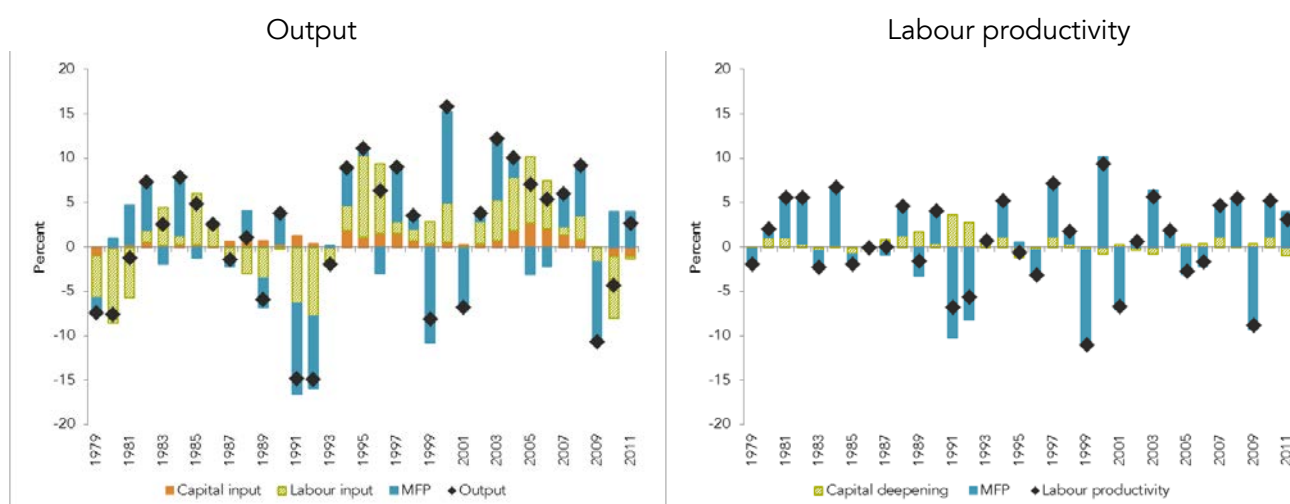
a. Manufacturing



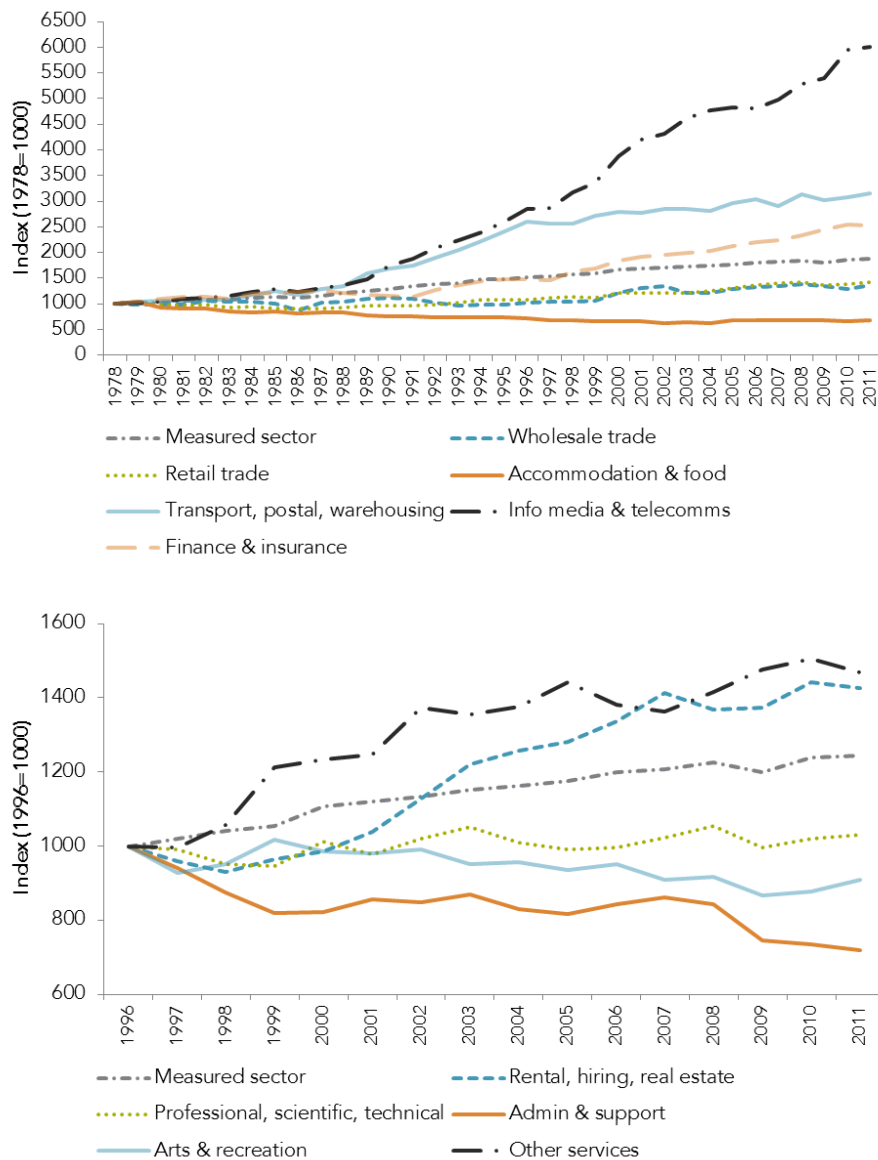
b. Electricity, gas, water & waste



c. Construction



Source: Statistics New Zealand.

**Figure A.7 Labour productivity growth by service industry, 1978-2011**

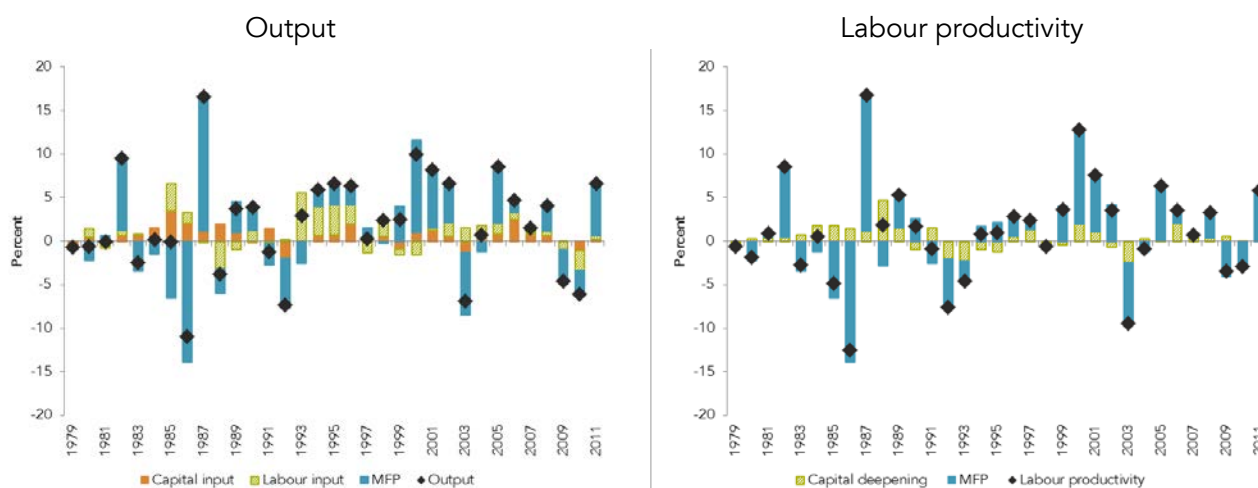
Source: Statistics New Zealand.

Notes:

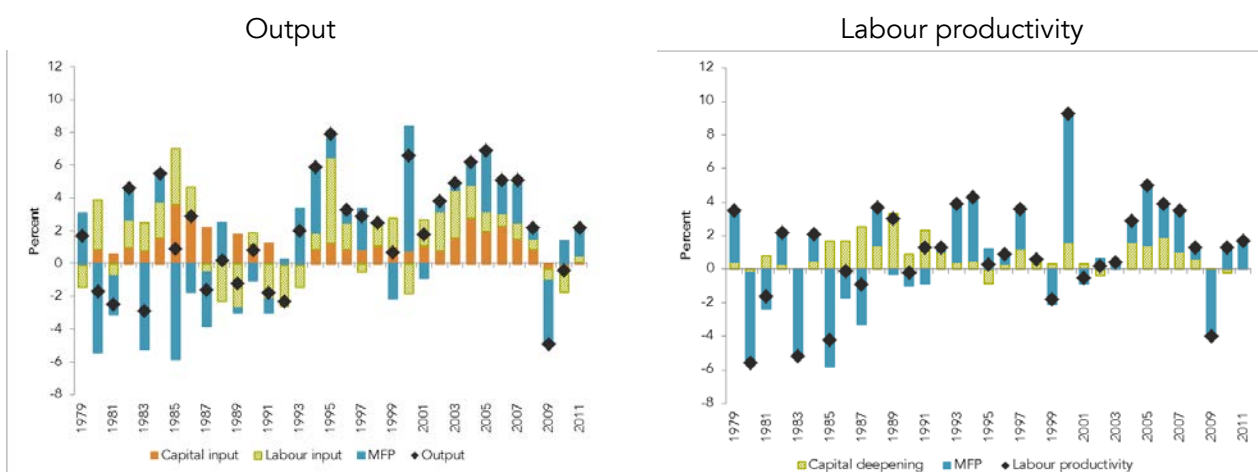
1. The measured sector is ANZSIC06 divisions A to K, and R from 1978 to 1995; and ANZSIC06 divisions A to K, M, N, R, and S, and industry LL1 from 1996 onwards.

**Figure A.8** Decomposition of annual output and labour productivity growth by service industry, 1978-2011

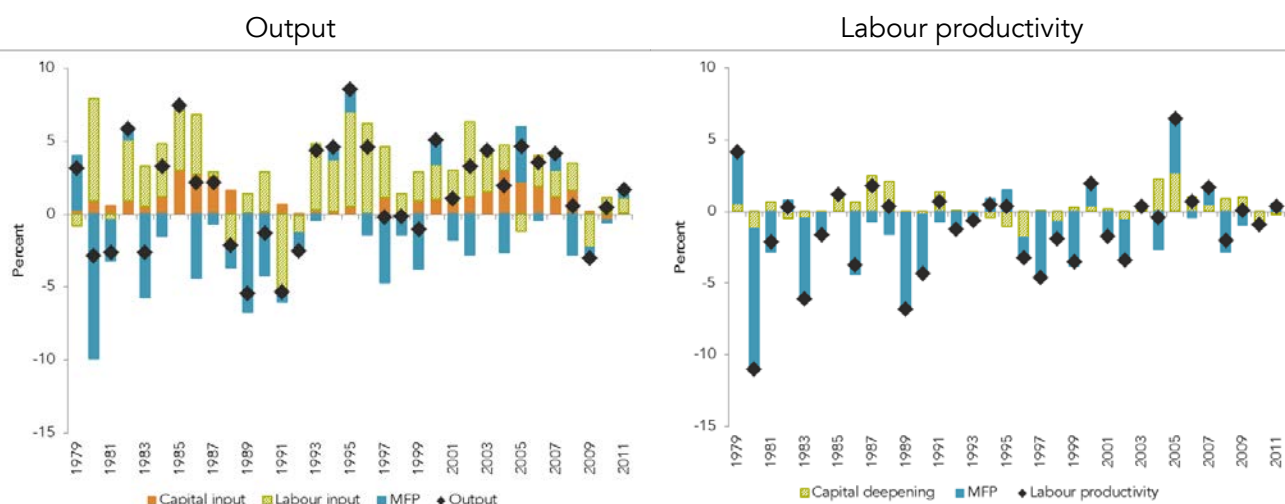
a. Wholesale trade



b. Retail trade

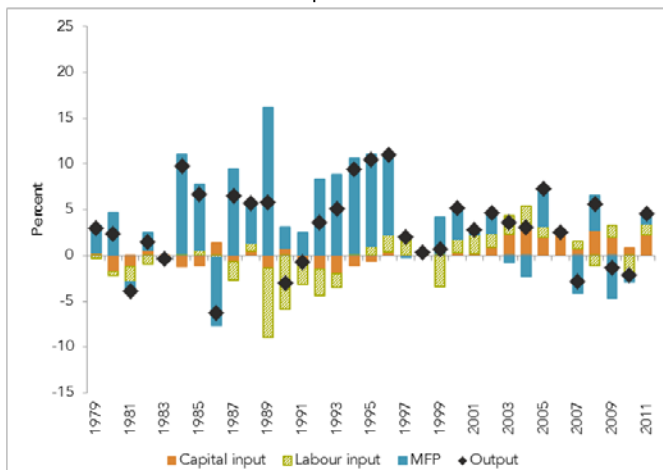


c. Accommodation & food services

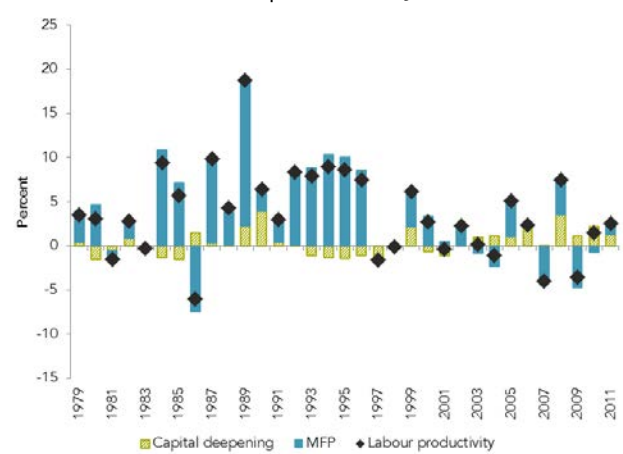


## d. Transport, postal &amp; warehousing

Output

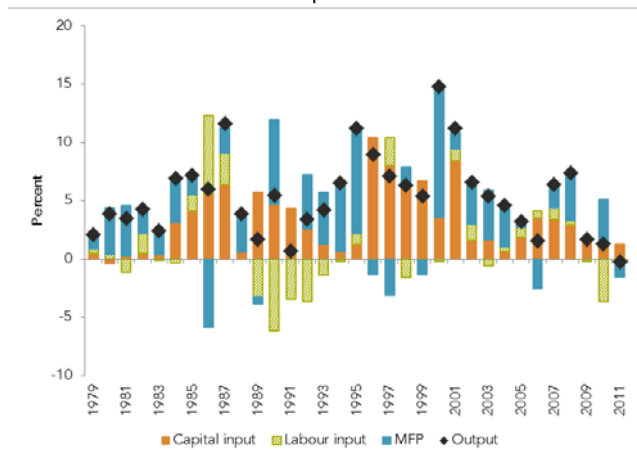


Labour productivity

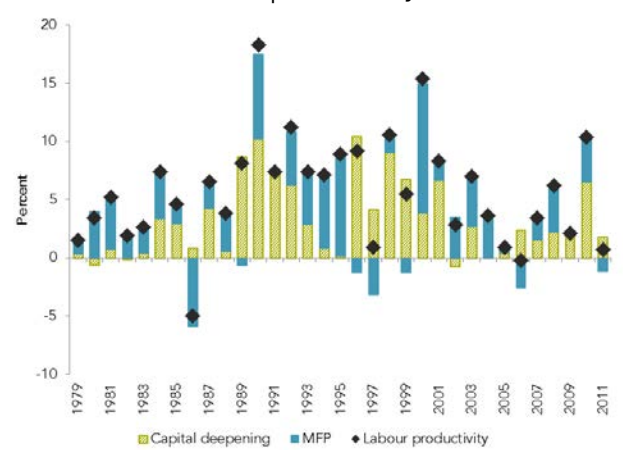


## e. Information, media &amp; telecommunication services

Output

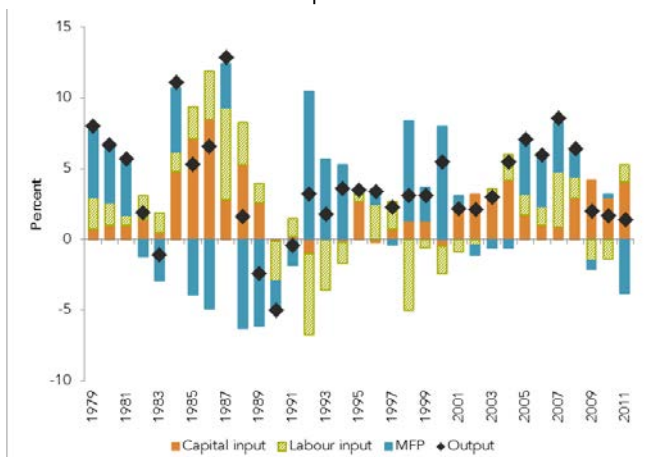


Labour productivity

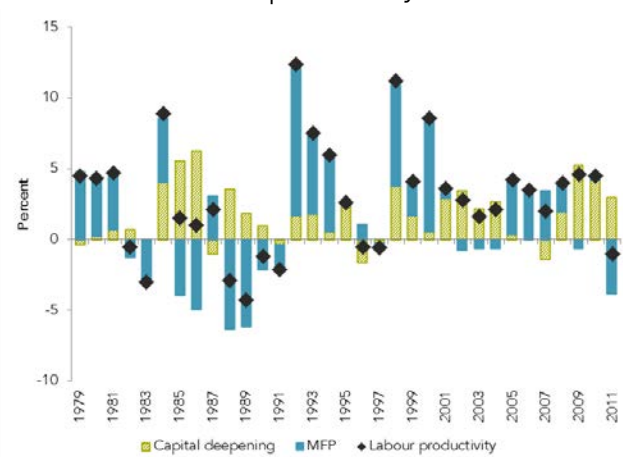


## f. Financial &amp; insurance services

Output

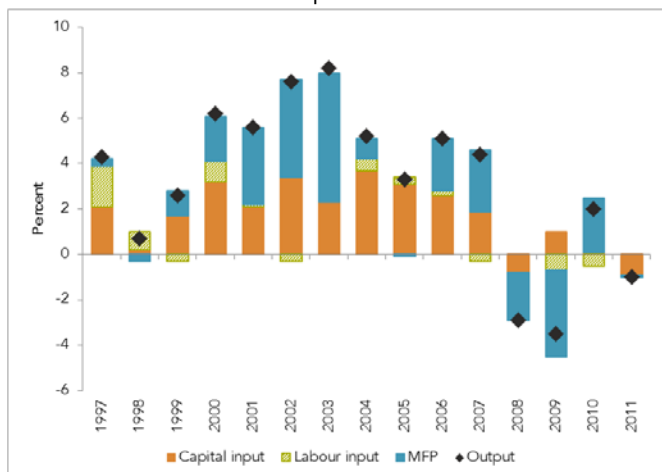


Labour productivity

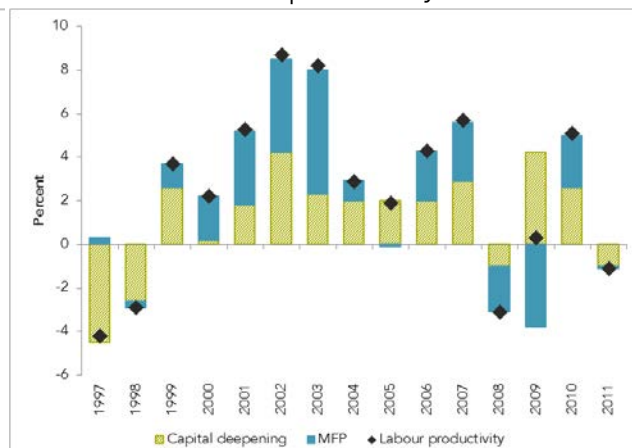


## g. Rental, hiring &amp; real estate services

Output

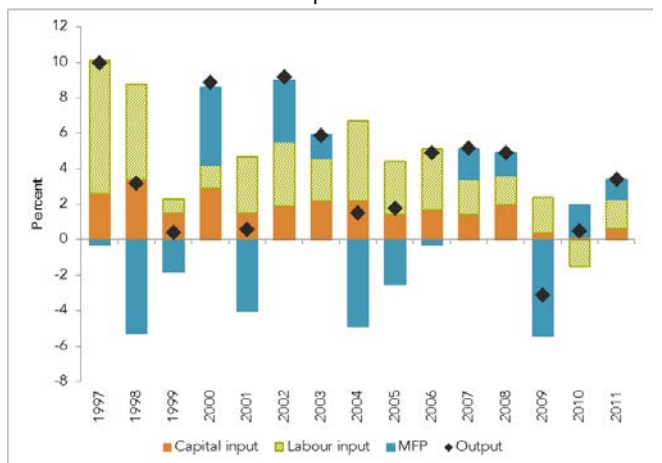


Labour productivity

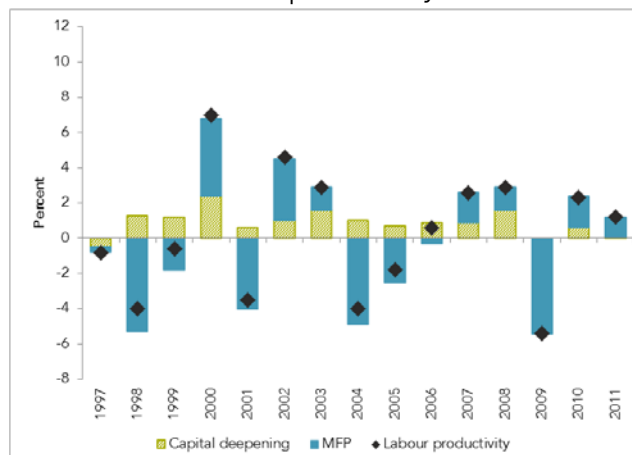


## h. Professional, scientific &amp; technical services

Output

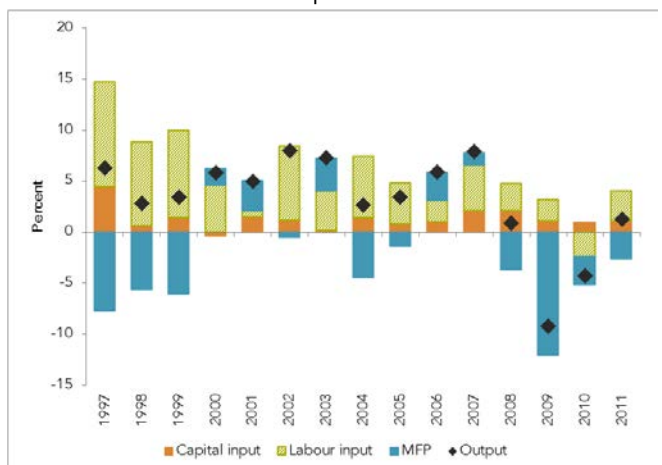


Labour productivity



## i. Administrative &amp; support services

Output

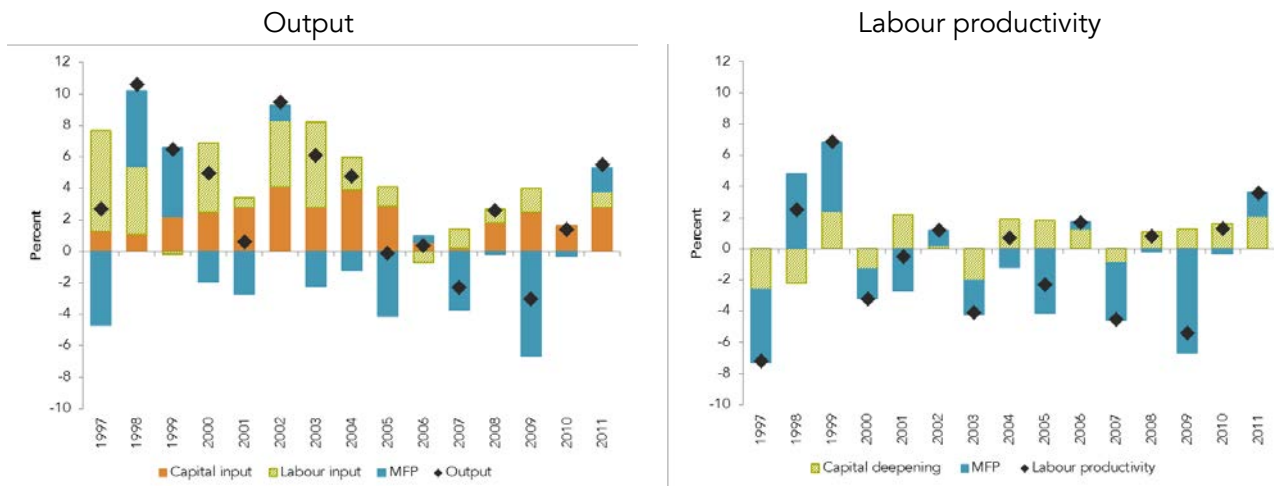


Labour productivity

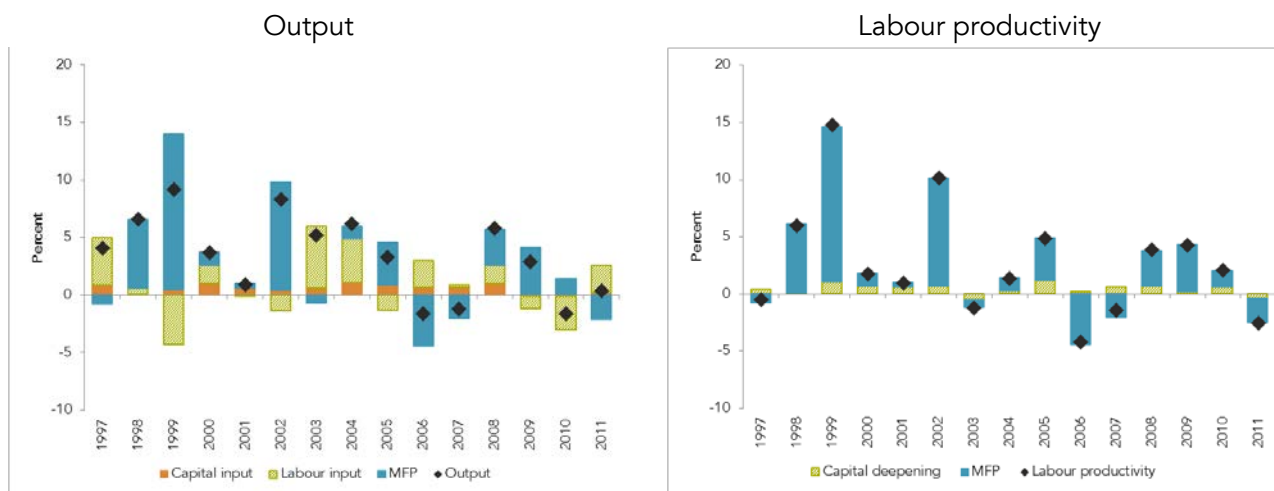




## j. Arts &amp; recreation services



## k. Other services



Source: Statistics New Zealand.

## Appendix B Comparisons of industry labour productivity under ANZSIC96 and ANZSIC06

From September 2012, Statistics New Zealand's productivity statistics follow the Australia and New Zealand Standard Industrial Classification 2006 system. Previous releases used ANZSIC96 classifications.

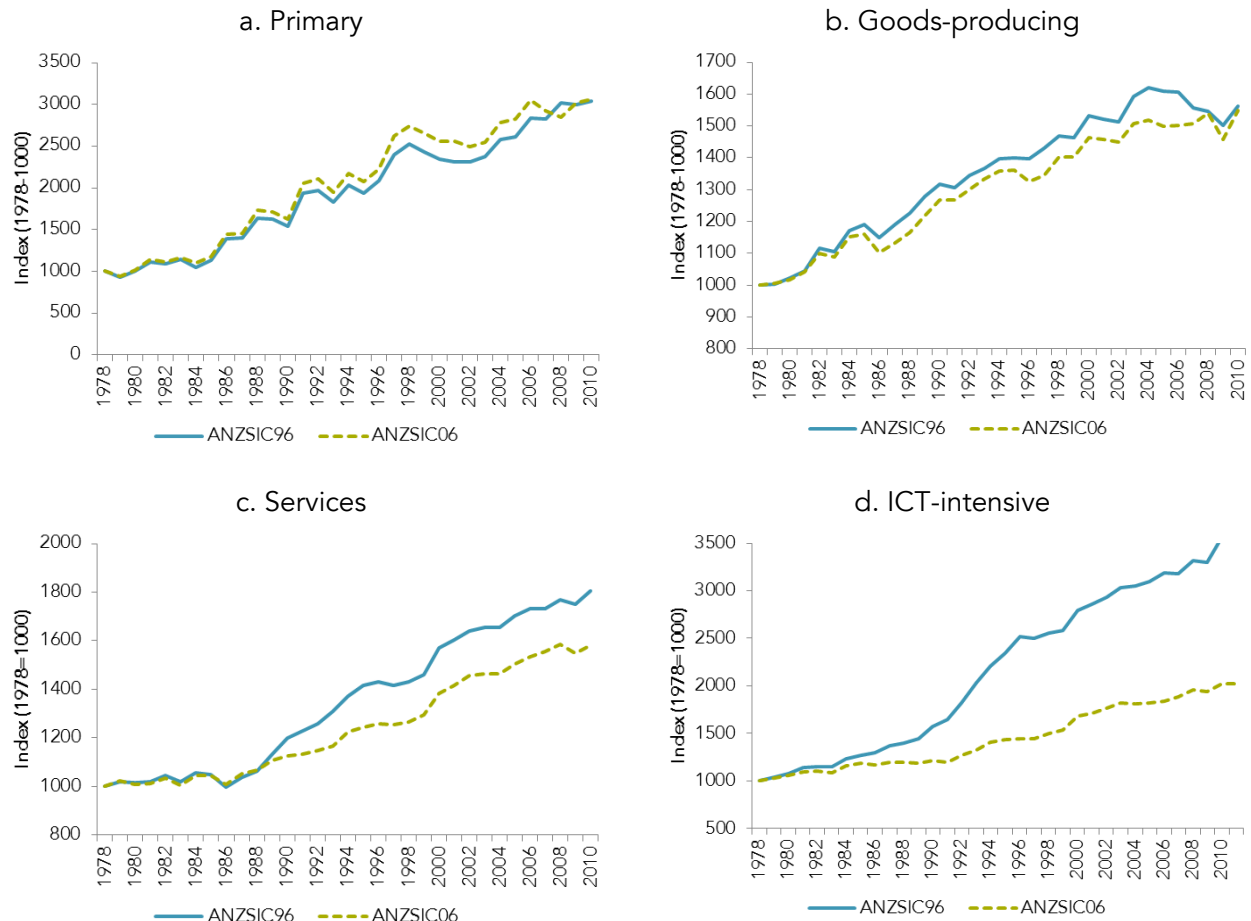
The main differences between ANZSIC06 and ANZSIC96 productivity statistics are (see Statistics New Zealand (2012) for further details:

- The coverage of the measured sector is slightly wider under ANZSIC06. The measured sector under ANZSIC96 covered 80% of economy-wide GDP in 2007 compared with 81% under ANZSIC06.
- Industry classifications have changed. The biggest changes are to information media & telecommunication, and other services.

There were no major changes in the composition of the primary sector from ANZSIC96, and consequently the ANZSIC96 and ANZSIC06 labour productivity growth series are similar. Likewise, while there were some revisions to the goods-producing sector (most notably, the inclusion of sewerage and waste services in electricity, gas, water & waste), overall, labour productivity growth did not change markedly. The differences are more pronounced in the services sector, and in particular, in the ICT-intensive subsector (Figure B.1).

Labour productivity in the ICT-intensive industries changed markedly between ANZSIC96 and ANZSIC06 due to significant classification changes. For example, communication services under ANZSIC96 became information media & telecommunication under ANZSIC06. Information media & telecommunication now includes sub-industries that were previously included in manufacturing (eg, print and recorded media publishing) and cultural and recreational services (eg, information services and TV services). Although information media & telecommunication is still a strong performer, labour productivity growth in this sector is much lower than ANZSIC96 communication services (Figure B.2). The labour productivity growth in finance & insurance was somewhat higher under ANZSIC96 than ANZSIC06. Business services under ANZSIC96 were split into two categories under ANZSIC06: professional, scientific & technical services and administrative & support services. While business services was an ICT-intensive industry under ANZSIC96, only the professional, scientific & technical services component is included under ANZSIC06. However, there was little difference in the labour productivity growth rates of business services under ANZSIC96 and professional, scientific & technical services under ANZSIC06 over the 1978 to 2010 period (Figure B.2).

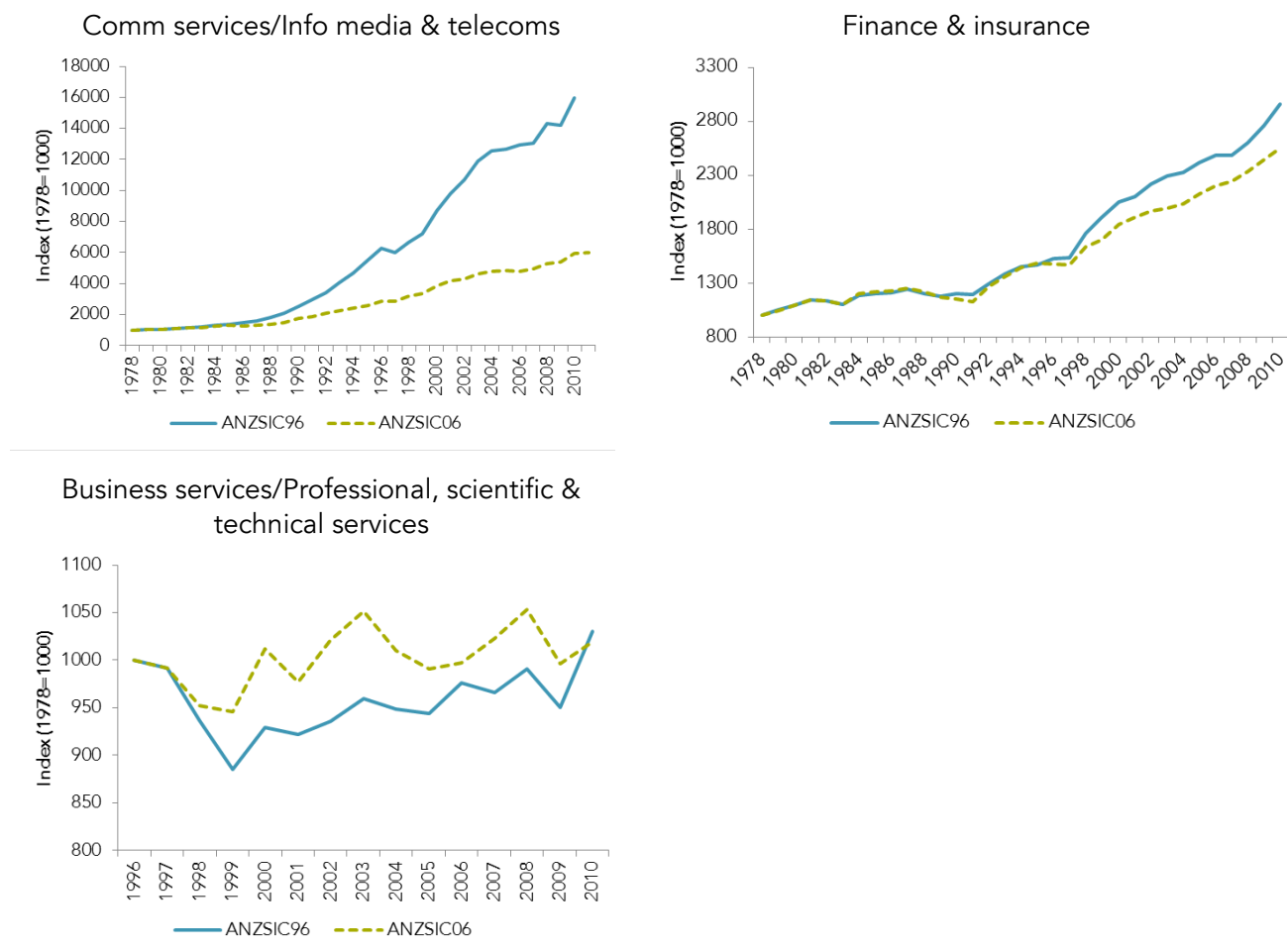


**Figure B.1 Labour productivity growth by sector - ANZSIC96 vs. ANZSIC06**

Source: Statistics New Zealand

Notes:

1. ICT-intensive industries under ANZSIC96 are: communication services and finance & insurance (from 1978) and business services (from 1996). Under ANZSIC06: information media & telecommunication and finance & insurance (from 1978) and professional, scientific & technical services (from 1996).

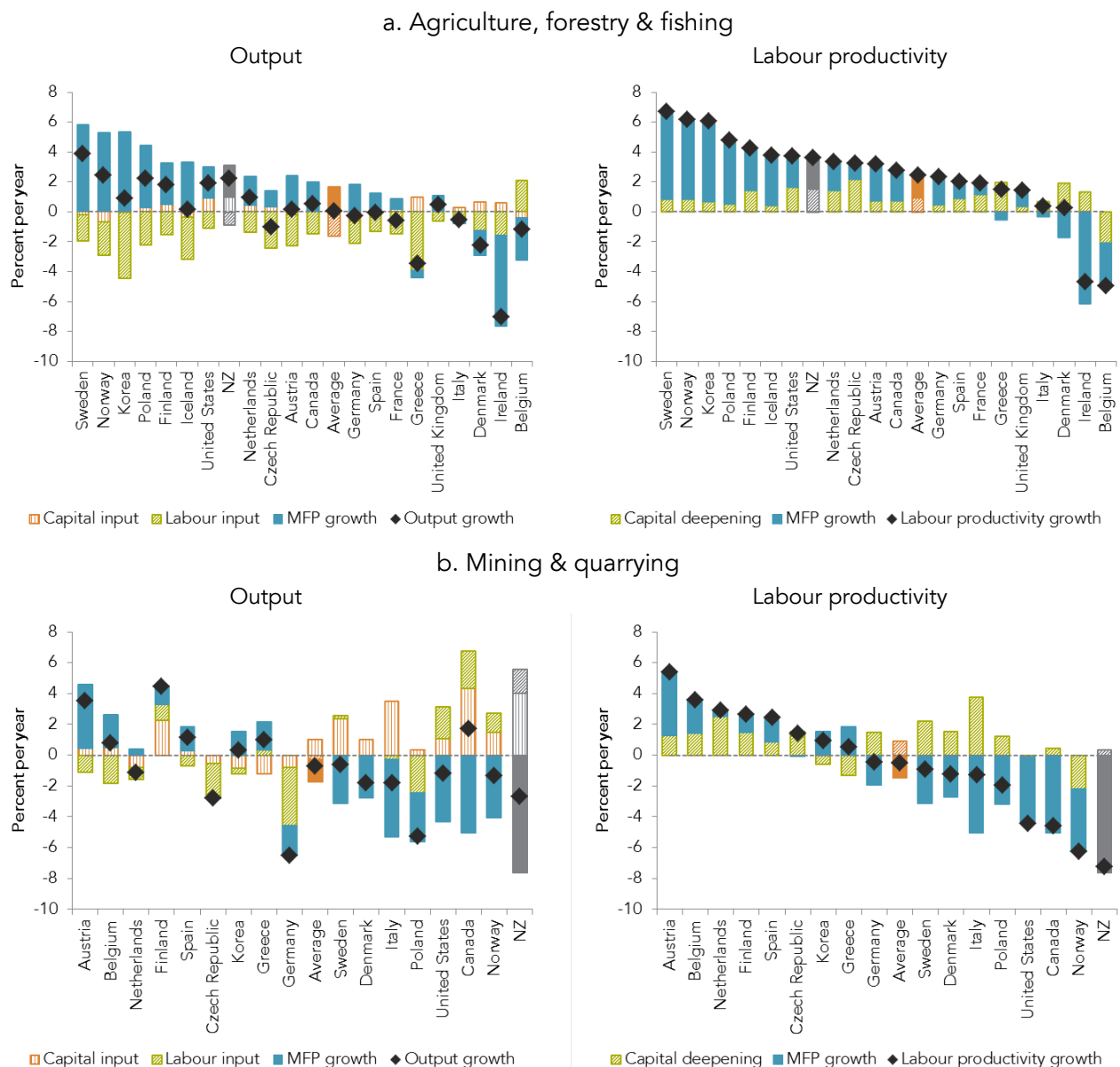
**Figure B.2 Labour productivity growth: ANZSIC96 vs. ANZSIC06 ICT intensive industries**

Source: Statistics New Zealand

## Appendix C Detailed international productivity and output growth comparisons

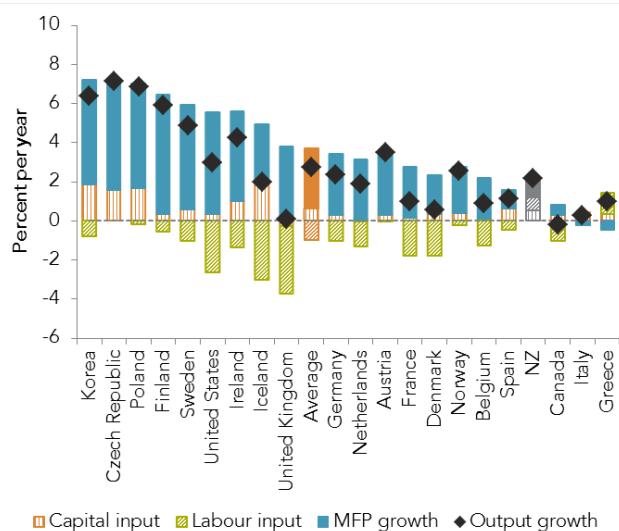
This appendix presents OECD comparisons of industry output and labour productivity growth, as described in section 6. The international data in this appendix comes from the OECD industry productivity database. The data for New Zealand was compiled by Statistics New Zealand and follows the OECD methodology as closely as possible (see Arnaud, Dupont, Koh, & Schreyer (n.d.)).

**Figure C.1** OECD comparisons of output and labour productivity growth decompositions by industry, 2000-2007

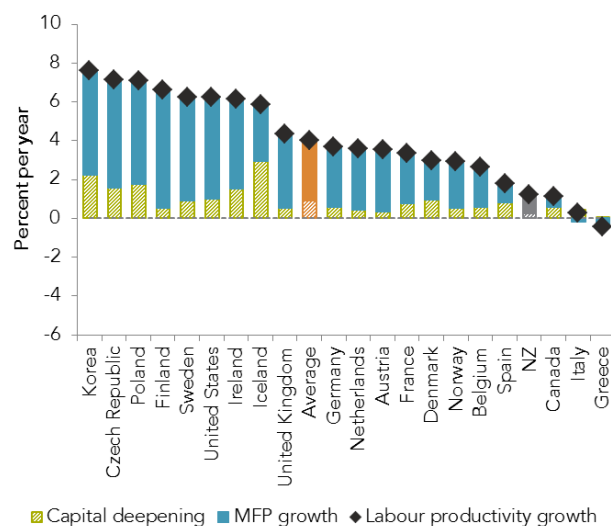


## c. Manufacturing

Output

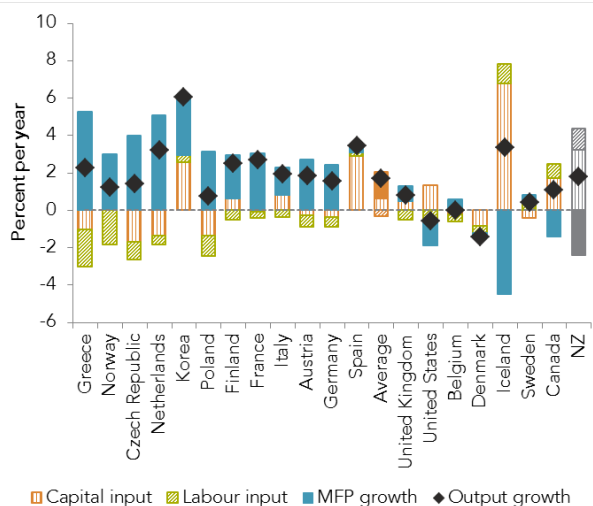


Labour productivity

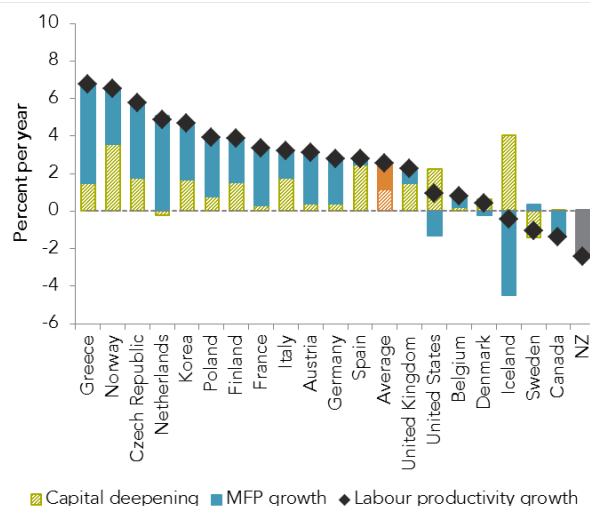


## d. Electricity, gas &amp; water supply

Output

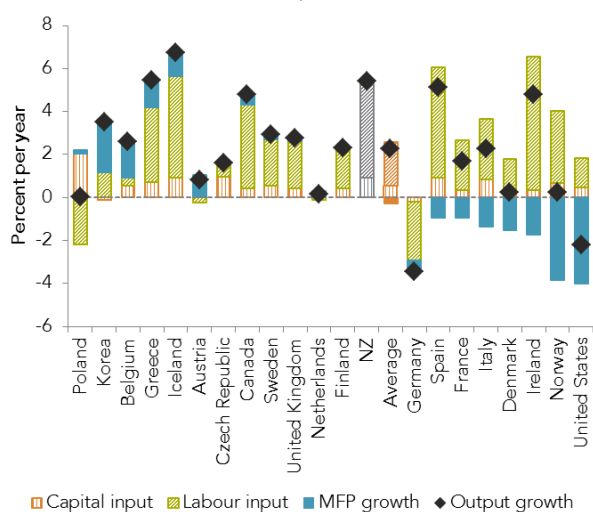


Labour productivity

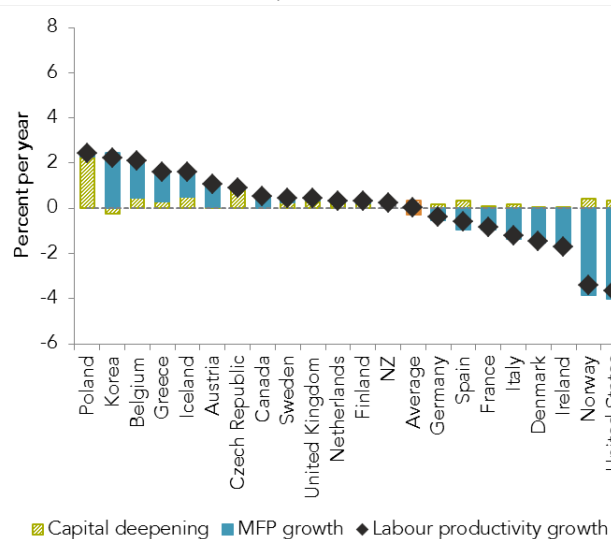


## e. Construction

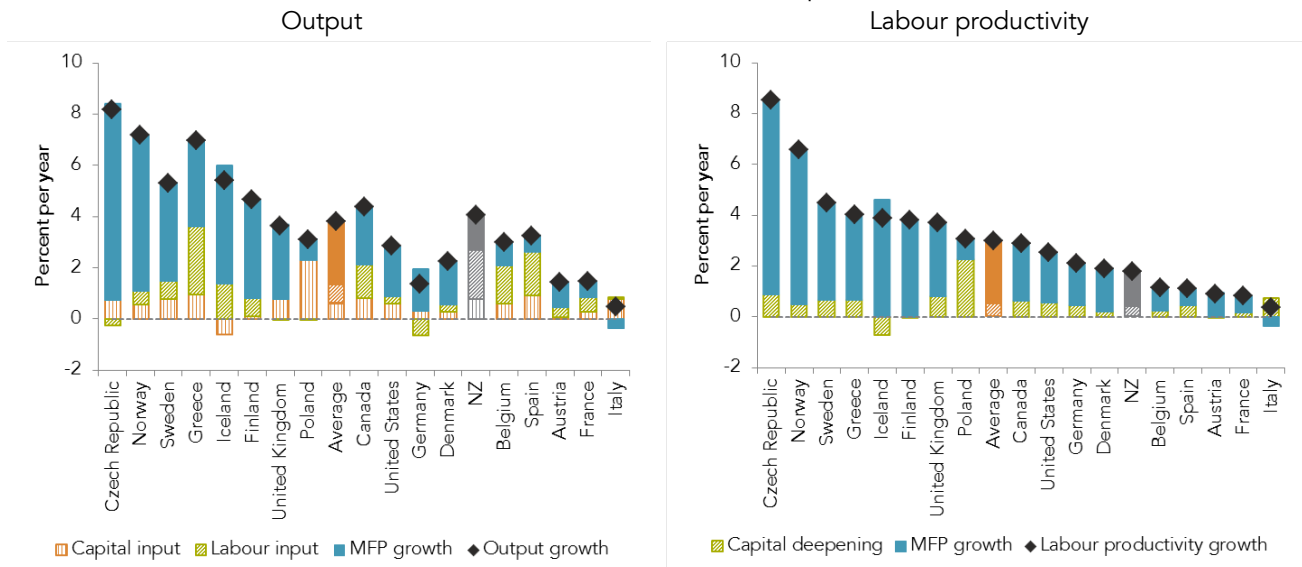
Output



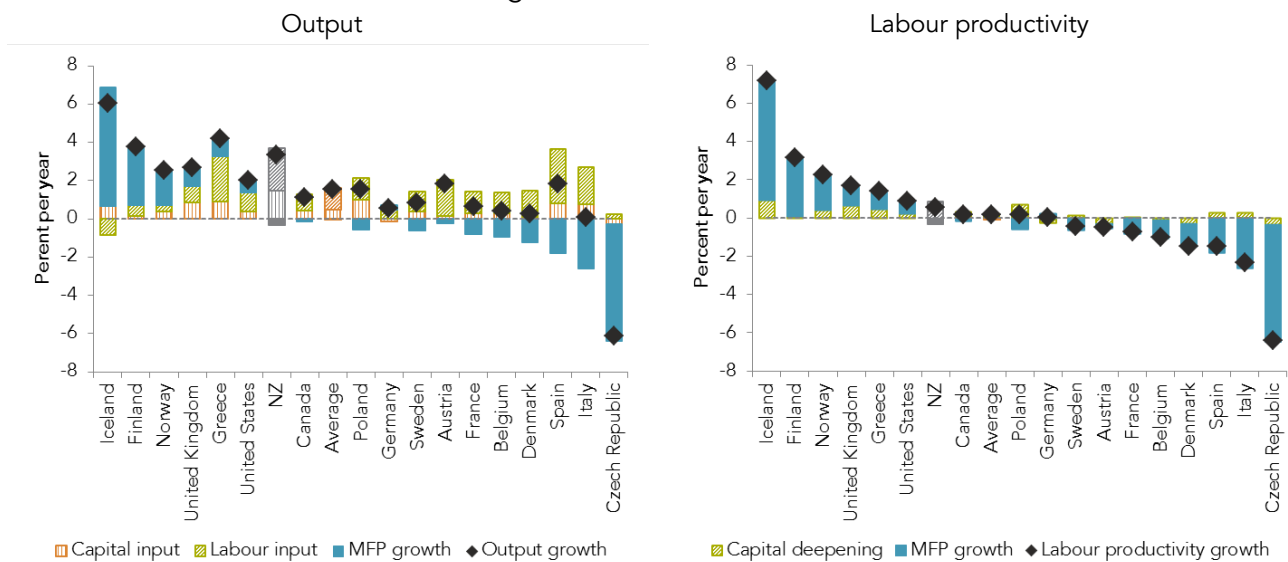
Labour productivity



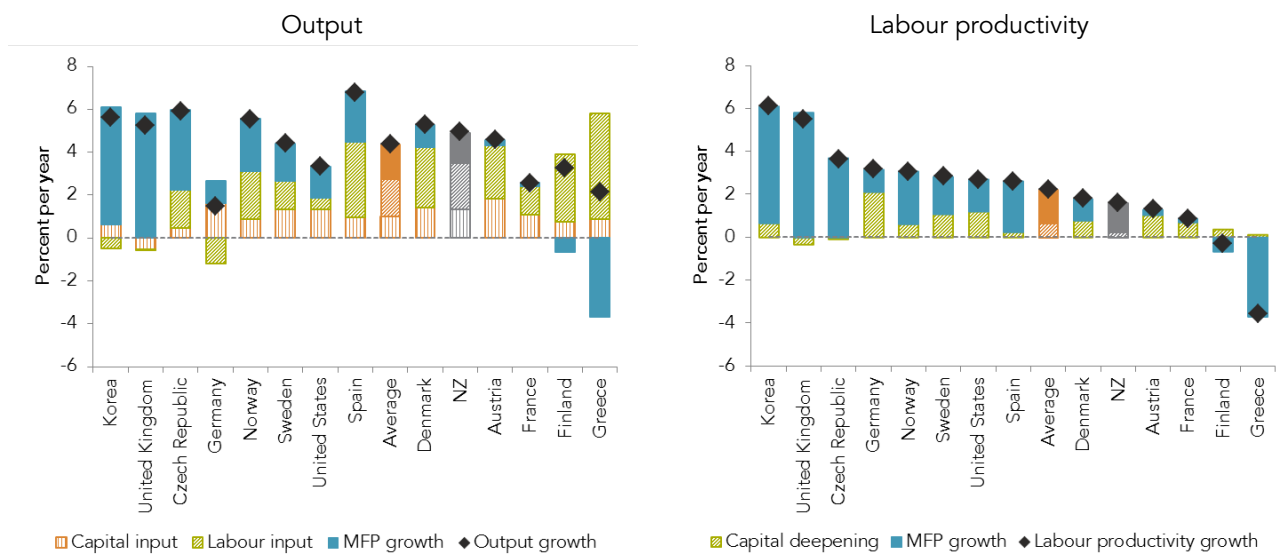
## f. Wholesale &amp; retail trade - repairs



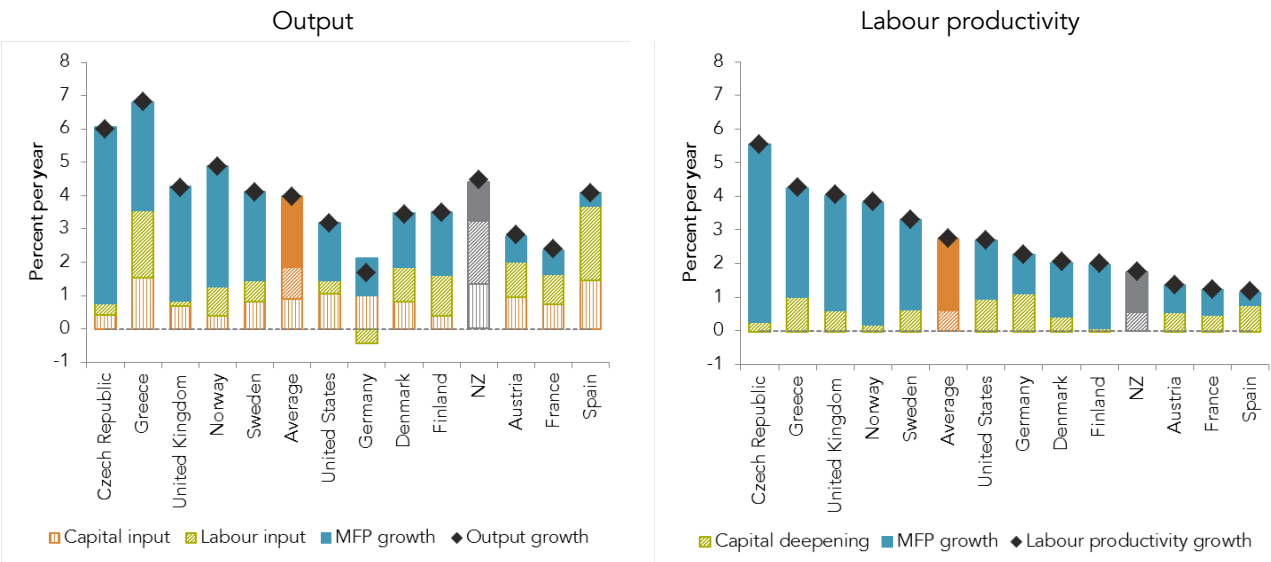
## g. Hotels &amp; restaurants



## h. Finance, insurance &amp; business services



i. Business sector services



Source: Productivity Commission calculations using Statistics New Zealand & OECD data.

Notes:

- 1. 'Business sector services' is an aggregation of several OECD classification industries, including: wholesale & retail trade; information & communication; finance & insurance; professional, scientific & technical activities and administrative & support services.