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New Zealand's Productivity Performance

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New Zealand's Productivity Performance

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Summary

Productivity is about how efficiently a firm or any other organisation can turn its inputs, such as labour and capital, into outputs in the form of goods and services. Over the long term, productivity is the key determinant of a country's material standard of living. New Zealand's level of labour productivity remains relatively low in comparison to other developed countries.

The ability to gauge productivity varies across the economy. Although there are still significant issues, productivity measurement in New Zealand has improved with official productivity data for the measured sector. Gaps remain in the measurement of the service and public sectors and in terms of industry detail. These gaps highlight the need for ongoing investment in measuring outputs, inputs and productivity. The analysis in this paper focuses on the measured sector, but also looks at economy-wide measures given their role in international comparisons and forecasting, as well as being more up-to-date.

The paper finds that productivity growth in New Zealand's measured sector has been on a par with that of Australia over the last two decades. However, productivity growth in New Zealand's measured sector since 2000, the end of the last growth cycle as assessed by Statistics New Zealand, has been below average. Analysis of recent trends is not definitive as the latest productivity cycle is not yet finished. At the economy-wide level, labour productivity growth has also had periods of weakness since 2000, but this experience has been shared by some other developed nations and a rebound has been witnessed in the recent economic upturn.

This paper also looks at possible explanations of the more recent period of below-average productivity performance. The explanations considered relate to employment growth, changes in labour quality, and industry and sector developments. The fact that recent growth in output has been sourced more from labour utilisation than labour productivity reflects a labour market performance that has seen rising participation and falling unemployment. Given the available information, it is difficult to isolate and weight the relative importance of the explanations because of uncertainty around variables and data limitations. Limitations on our ability to fully explain past productivity performance need not detract from the importance of efforts to raise future productivity performance.

New Zealand's Productivity Performance

1. Introduction

This paper examines the productivity performance of the New Zealand economy.

Productivity is the key determinant of a country's standard of living over the long term. For workers, productivity is important because of its link to wages and the consumption these wages can finance. Similarly, for firms, productivity is important given its link to profits.

The drivers of productivity will be examined in future papers.

This paper is part of a series of papers that discuss New Zealand's long-term productivity performance and the factors that may be inhibiting New Zealand from reaching its potential. The series begins with this paper and two others. 'Does Quality Matter in Labour Input? The Changing Pattern of Labour Composition in New Zealand' examines how changes in the composition of the workforce have affected productivity growth in New Zealand. 'Putting Productivity First' outlines the factors that are important in determining productivity, with consideration to New Zealand's specific circumstances, and introduces the five driver framework for considering productivity (enterprise, innovation, skills, investment and natural resources). The final set of four papers address the first four of these drivers in turn, building on the analysis in the preceding papers by reviewing and interpreting available evidence to draw some conclusions for the underlying factors affecting productivity.

This paper examines the evidence surrounding New Zealand's productivity performance at an aggregate level. In addition to setting the scene for the five driver framework, understanding past productivity performance is important for the Treasury's short-term forecasts and long-term projections.

Section 2 of this paper describes what we mean by productivity and how it is measured. In Section 3, we examine New Zealand's recent productivity performance over time and relative to other developed nations, particularly Australia. Following this, Section 4 looks at some possible explanations of New Zealand's productivity performance in recent years, including the impact of employment growth and labour quality, and industry and sector developments. Section 5 offers our conclusions from the paper.

2. Productivity definitions and measurement

Definitions of productivity

Productivity is about how efficiently a firm or any other organisation can turn its inputs, such as labour and capital, into outputs in the form of goods and services. Producing more goods and services with the same inputs or producing the same quantity of goods and services with less input is an improvement in productivity.

Productivity is the ratio of output to one or more inputs such as labour.

Productivity is typically defined as a ratio of a volume measure of output to a volume measure of input. Beyond this basic concept a range of definition and measurement issues arise. Productivity can be defined in relation to a single input (eg, labour) or to a combination of inputs (eg, labour and capital). The different productivity definitions can be used for different purposes, and each has its own advantages and disadvantages.

Labour productivity

Labour productivity is a central definition of productivity.

Labour productivity is a central definition because:

- it is a measure of the amount produced for a certain amount of labour effort;
- it is closely related to individual incomes (ie, wages and salaries) and so living standards; and
- it can be measured with reasonable reliability.

The simplest measure of labour productivity is output per worker. Increased output per worker could occur if workers produce more in the hours they work or if they work longer hours (eg, by reducing holidays or moving from part-time to full-time employment). The fact that working longer hours also lifts output per worker is a disadvantage of this definition.

Output per hour worked is the main measure of labour productivity we use.

The second measure of labour productivity is output per work hour. Its main advantage is it takes account of variations in the number of hours worked per worker. A disadvantage is that hours worked data tend to be less reliable than employment data. Nevertheless, given average hours worked can and do change, particularly recently, we focus on output per hour worked as the definition of labour productivity.

Labour productivity can change as a result of a change in technology or additional capital. As a result, a limitation of partial productivity measures such as labour productivity is they attribute to one factor of production, in this case labour, changes in efficiency attributable to other factors of production.[1]

Multifactor productivity

It is also important to examine multifactor productivity

Multifactor productivity (MFP) takes into account both labour and capital inputs. It is the part of output growth that cannot be attributed to the growth of labour or capital inputs. MFP reflects such things as business process innovations like supply-chain management techniques or more effective retail store layouts, advancements in technology or almost any other type of improvement in the efficiency of a firm's operations. When MFP rises, the economy can produce more output with the same quantity of labour and physical capital.

MFP can be equated with technological change if certain conditions are met. For example: firms must behave efficiently and seek to maximise profits; markets must be competitive; and the coverage of inputs must be complete. In practice, these conditions are rarely met so measured MFP will therefore, in addition to technological change, include the combined effects of any model mis-specification and mis-measurement of the variables, including quality change in the inputs. We examine changes in labour quality in Section 4.

Measurement of productivity

Measurement of productivity is difficult in some service and government-dominated industries.

On the measurement side, the ability to gauge productivity varies across the economy. Measurement difficulties are generally greater in the service industries,[2] especially government.[3] For example, in the case of government non-market activities (eg, education, health, administration and defence), services are provided free or at nominal charges. In the national accounting statistics, the output (value added) of these activities is largely measured by inputs, such as the number of employees. Using changes in inputs to measure changes in outputs implicitly assumes zero productivity growth.

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1 The theory and evidence on investment and productivity will be covered in more detail in one of the five driver papers.

2 In this paper, "industry" refers to an area of activity such as "mining", "manufacturing" or "government administration and defence". A "sector" refers to a particular group of industries (eg, "measured" and "non-measured") or refers to the sector of ownership (ie, "private" and "public"). Claus and Li (2003) compare New Zealand's production structure (albeit in the mid-1990s) to that in other developed countries.

3 In the context of Gross Domestic Product (GDP) and productivity measures, "government" refers to goods and services but not transfer payments. The government's direct role in GDP is therefore less than indicated by the amount of government spending (which includes transfer payments) recorded in the financial statements of the government prepared by the Treasury.

The productivity work of Statistics New Zealand (SNZ) is focused on the so-called "measured sector" (see *Box 1*). The measured sector excludes industries in which outputs are not adequately measured independently of inputs. The latest SNZ estimates are for a measured sector that makes up around 73% of the economy. This version of the measured sector approximates the "business" or "market" sector and hence the firms that are seeking the best mix of resources to exploit market opportunities and earn profits. Australia has a long history of publishing official market sector productivity statistics. Although extending the coverage of the SNZ measured sector to include government non-market activities is useful, there is arguably still a case for retaining measures that focus solely on the business or market sectors.

The measurement of productivity in New Zealand still has some gaps despite recent improvements. Some gaps will be addressed in the near term (eg, wider industry coverage in the measured sector) but others are longer term (eg, productivity by industry, including in education and health, and productivity levels).

Strengths of economy-wide measures of productivity include consistency with real Gross Domestic Product (GDP), real GDP per capita, and forecasts of real GDP.[4] Economy-wide measures are generally better suited to international comparisons since the definition of the measured sector is not uniform across countries and the measured sector series are only available for a small number of countries. Economy-wide measures are also typically more up-to-date (being quarterly and sourced from current series) and provide information on productivity levels (not just growth rates as with the measured sector data).

We focus on the measured sector productivity data but also consider economy-wide measures.

On balance, we think analysis should generally focus on the measured sector, although it is important to consider economy-wide measures. A focus on measured sector productivity is not to deny the importance of public sector productivity (including linkages between the sectors, say from public sector capital). However, there are substantive measurement issues with public sector productivity and it can therefore be appropriate to focus on a broader set of measures to assess public sector performance.[5]

[4] Throughout this note GDP and GDP per capita will refer to real GDP and real GDP per capita respectively, unless otherwise stated.

[5] See Douglas (2006).

Box 1: Statistics New Zealand work on productivity measurement

The quality of productivity data has improved in recent years and further improvements are planned. Statistics New Zealand (SNZ) received funding from the Growth and Innovation Framework in 2003 to develop official productivity statistics for New Zealand, building on initial work by Diewert and Lawrence (1999) and Black, Guy and McLellan (2003).

The releases from SNZ cover productivity growth in the measured sector of the economy. The latest version of the measured sector, which made up 73% of the economy in the March 2004 year, excludes industries in which outputs are not adequately measured independently from inputs, namely: property services (6% of nominal GDP in 2004); ownership of owner-occupied dwellings (7%); government administration and defence (4%); education services (4%); and health and community services (5%).

The SNZ productivity statistics comprise index series for labour productivity, capital productivity and MFP. These series identify productivity growth rates but not absolute levels of productivity. The SNZ productivity statistics are consistent with Organisation for Economic Co-operation and Development (OECD) guidelines. SNZ productivity data are annual and cover March years, with a publication lag of almost one year.

Real GDP (production) is used as the output measure. Labour input is based on hours paid for all employed persons (paid employees and the self-employed) in the measured sector. It is derived as a composite of firm surveys and household surveys. Capital input is based on the flow of capital services generated by capital stocks, which are themselves developed using the Perpetual Inventory Method (PIM) for 24 asset types within seven asset classes (eg, intangible assets; buildings; plant, machinery and equipment; transport equipment). These are supplemented by estimates for three other assets: livestock, exotic timber grown for felling, and land used for agriculture and forestry.

The first release of official productivity data by SNZ in March 2006 covered the 1988-2005 period. The second release in March 2007 covered the 1988-2006 period and was updated for an erratum in May 2007. As part of the third release, in October 2007, SNZ provided a longer time series back to 1978 and examined productivity growth between cyclical peaks. The peaks are determined by comparing annual MFP growth with a trend estimate. The peak deviations between the two series are used as the main indicator of growth-cycle peaks.

In March 2008, SNZ released productivity data for 1978-2007 and the measured sector was expanded to include business services and personal and other community services (both from 1996 onward). A series covering the previous definition of measured sector (ie, excluding business services and personal and other community services) was published to provide a link to previously-released data and enable a direct comparison with Australia. The Australian Bureau of Statistics (ABS) use the term “market sector”, which makes up about two thirds of the Australian economy.

An experimental quality-adjusted labour productivity series will be released by SNZ later in 2008, and the measured sector will be expanded to about 80% of nominal GDP in the near future by including property services. No date has been set for industry-level productivity data.

3. Productivity performance

Economy-wide data are used to provide a big picture view of productivity, with measured sector data providing more detail.

This section examines the productivity performance of the New Zealand economy. Firstly, we look at productivity growth and levels across the whole economy. This economy-wide analysis provides a long-term perspective, a comparison with all members of the OECD, and a direct link to per capita incomes. Secondly, we turn to productivity growth in New Zealand's measured sector, where productivity data are more reliable, more detailed, and can be compared directly with Australia.

Economy-wide productivity performance

The simplest way to examine labour productivity is to divide real GDP (production) in a given period by the number of actual hours worked from the Household Labour Force Survey in the same period. Hours worked are generally preferred over hours paid as workers are better able to assess actual hours worked than are employers.[6]

To reduce data volatility and seasonal variation, quarterly data are averaged over a year from the March 1988 year (when this GDP series began) to the December 2007 year (the latest data point). These productivity growth rates are not published by SNZ, although output and input data are official SNZ series.

Economy-wide labour productivity growth averaged 1.4% per annum since 1988.

Economic growth in New Zealand over the past two decades was driven by both labour input growth (ie, hours worked) and labour productivity growth (ie, output per hour). Of annual economic growth of 2.6% between the years to March 1988 and December 2007, 1.2% was from labour input growth and 1.4% was from labour productivity growth (*Figure 1*).

Labour productivity growth can be volatile from year to year.

Around this average, labour productivity growth is volatile over time. Since 1988, it has varied from a high of 5.5% in the June 1989 year to a fall of 0.5% in the March 1993 year. More recently, it has risen from 0.1% in the September 2005 year to 2.6% in the December 2007 year, the highest since 2000, on the back of the recent upturn in the economy.

Peaks in labour productivity growth tend to match business cycle peaks and falls in labour productivity often match troughs in the business cycle (ie, productivity is pro-cyclical). Exceptions to this rule of thumb are when labour input exhibits significant change (eg, economic growth was high in 2004, despite low labour productivity growth, and low in 1989, despite high labour productivity growth).

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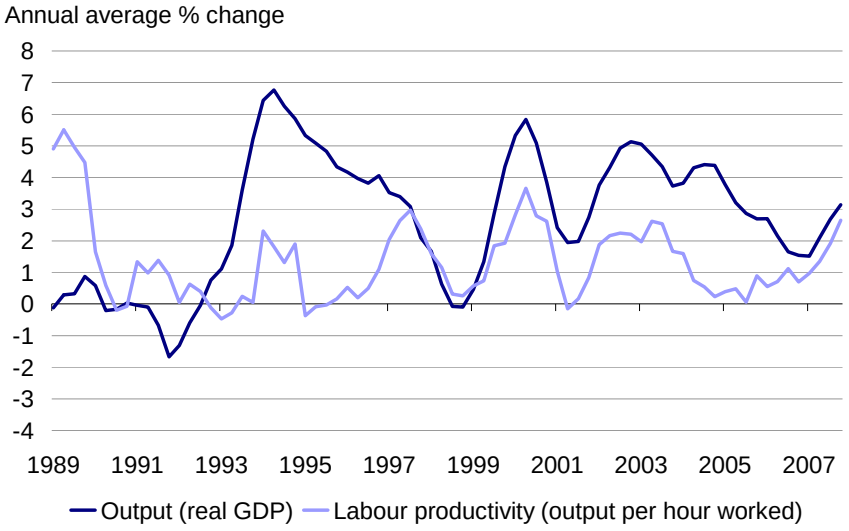
[6] Hours paid from the Quarterly Employment Survey (QES), together with other sources, have been used in SNZ productivity data to provide robust industry data for disaggregating the economy (see *Box 1*). We use hours worked because we examine the whole economy (the QES excludes some industries), do not want to include holidays and other paid leave, and the Treasury's forecasts are on an hours-worked basis.

Figure 1: Economy-wide output and labour productivity growth (March 1989 quarter to December 2007 quarter)



Source: The Treasury, Statistics New Zealand

A variety of methods can be used to remove short-term fluctuations and estimate trend productivity growth. These methods include moving averages, point-to-point analysis (including the peak-to-peak method), statistical filters and econometric procedures. The appropriateness of any particular method depends on the purpose for which it is being used.

For simplicity, we use moving averages for economy-wide labour productivity growth. A moving average growth rate has two advantages.[7] First, it does not require the identification of cyclical peaks, troughs, or on-trend points. Second, it is computationally easier when comparing the growth performance of different countries. This is why it is common for international agencies to report GDP and productivity as average growth rates over particular time periods. There is no ideal period over which to calculate a trend growth rate based on moving averages. If the period is too short, growth rates are likely to fluctuate considerably owing to business cycle effects. If it is too long, significant changes in performance may not be captured for some time.

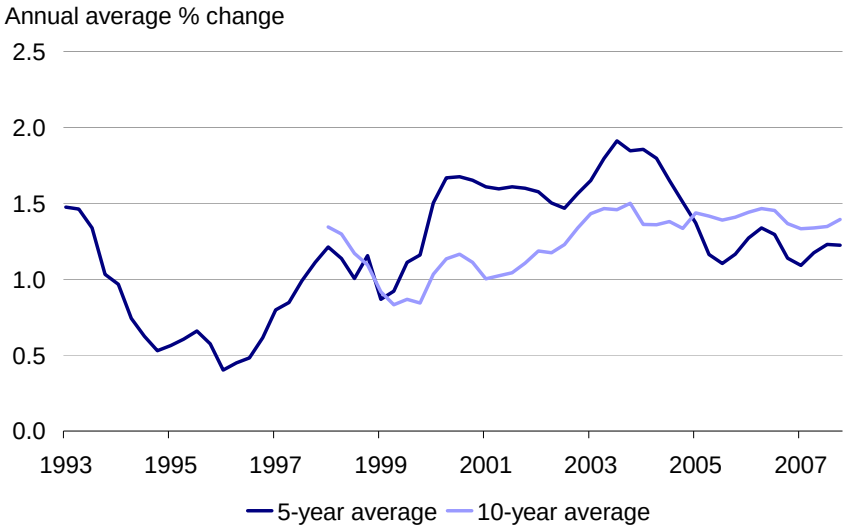
There may have been some slowing of economy-wide labour productivity growth in recent years.

The moving averages in *Figure 2* indicate that trend labour productivity growth, on an economy-wide basis, has been in the 1% to 2% per annum range since the early 2000s. The 10-year moving average rose from 0.8% in 1999 to 1.5% in 2003 and fell back slightly to 1.4% in 2007, while the 5-year moving average rose from 0.4% in 1996 to 1.9% in 2004, fell to 1.1% in 2006 and rose slightly to 1.2% in 2007. However, the 5-year moving average series may still be picking up business cycle effects. The 10-year

[7] A moving average is an average calculated over a fixed time span (say 5 or 10 years), but where that fixed time span moves through time. When comparing across countries, any fixed time span that does not move through time suffers the significant drawback that it does not allow for possible differences in the timing of business cycle phases across countries.

moving average series has been relatively steady between 1.3% and 1.5% in recent years.

Figure 2: Economy-wide labour productivity growth (hours-worked basis, moving average calculated at each quarter)



Source: The Treasury, Statistics New Zealand

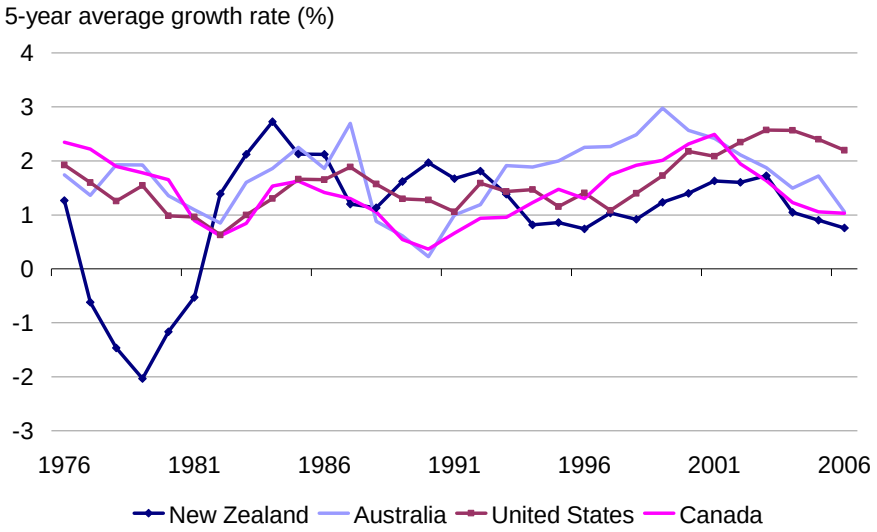
International comparisons

To place New Zealand's labour productivity performance in context, *Figure 3* shows economy-wide labour productivity growth in New Zealand relative to Australia, Canada, and the United States. Once again, these are on an hours-worked basis and presented as moving averages (in this case, five years) to reduce fluctuations.

Productivity growth in New Zealand is below that of other nations over the long term, but a recent slowing is also evident in some other nations.

New Zealand's annual labour productivity growth rate over the whole 36-year period averaged 1.1% per annum, below Australia (1.6%), Canada (1.5%), and the United States (1.7%). Using 5-year moving averages, New Zealand's productivity growth was especially low in the late 1970s and very early 1980s. Following this, there were periods when productivity growth was above some of the comparators, including Australia. Nevertheless, from the early 1990s to the mid-2000s, New Zealand's labour productivity growth was below that of Australia and generally below that of the other comparators.

Figure 3: Labour productivity growth (economy wide, 5-year average)



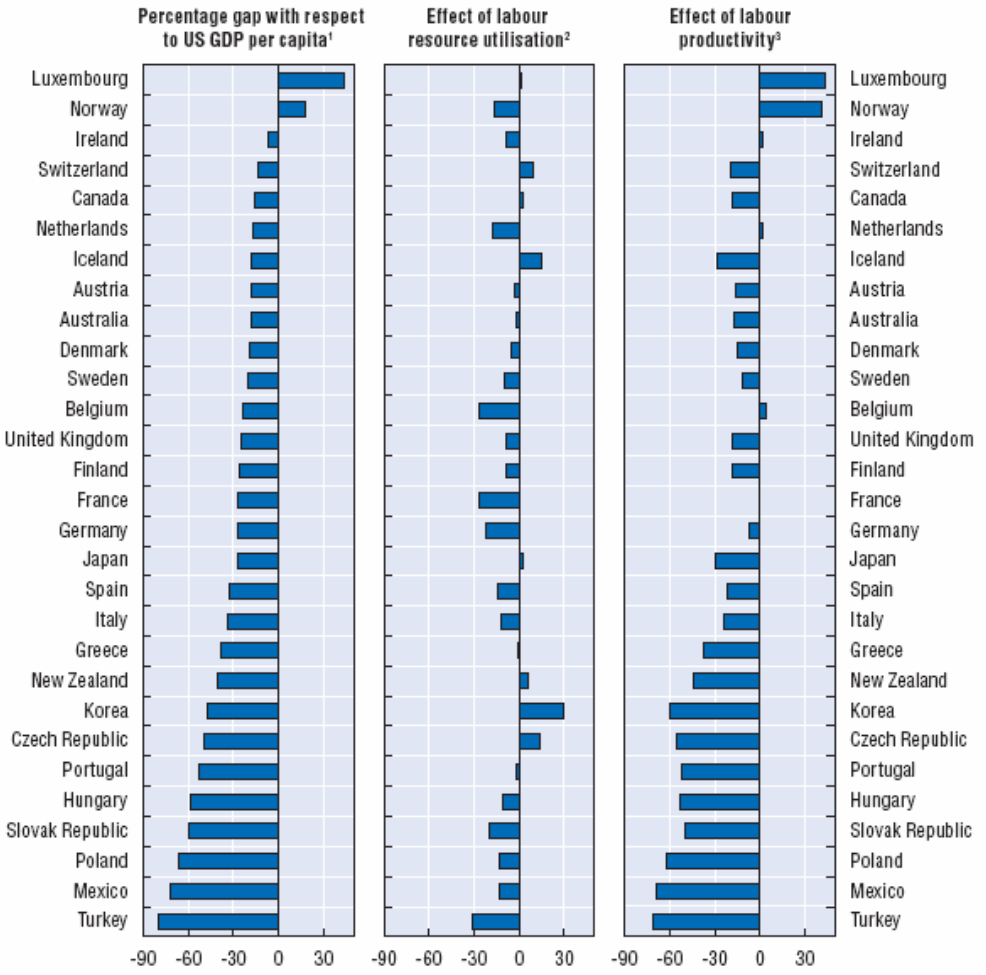
Source: OECD, The Treasury

New Zealand's annual labour productivity growth (5-year moving average) slowed from almost 2% in 2003 to around 1% in 2006, the lowest among this group of comparators. However, Australia and Canada also experienced a slowing of labour productivity growth of a similar magnitude in recent years. This pattern is also evident in some OECD nations not shown in the graph (eg, Germany and Italy).

New Zealand's lower per capita GDP reflects a lower level of productivity.

Figure 4 looks at the gap between the level of GDP per capita for OECD economies and the United States (in 2006) and decomposes the gap into labour utilisation (ie, hours worked per capita) and GDP per hour worked. The percentage point gap between New Zealand's GDP per capita and that of the United States is around 41. This gap is essentially due to a gap in labour productivity. New Zealand ranks 22nd among the 30 OECD nations in terms of labour productivity and this matches the ranking on GDP per capita, despite having the fifth highest utilisation of labour in the OECD.

Figure 4: Decomposition of gap in GDP per capita related to the United States, 2006



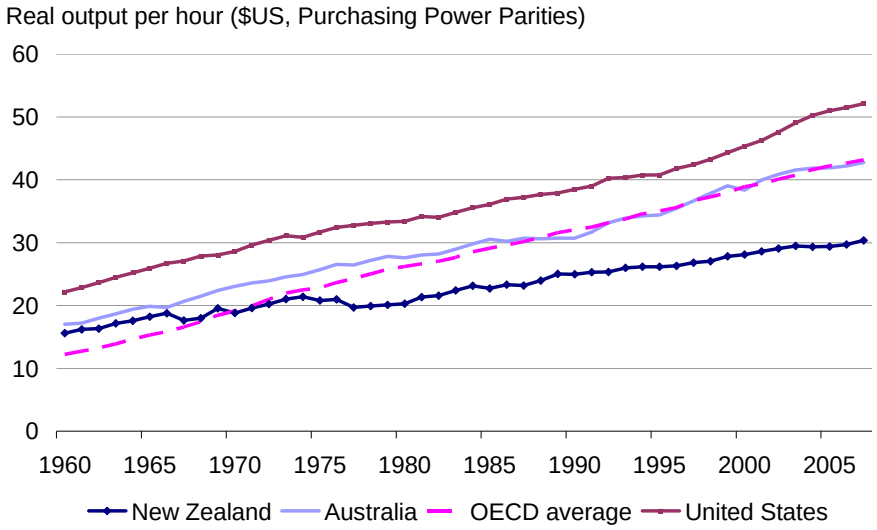
Notes: 1) Based on 2006 purchasing power parities (PPPs). For Luxembourg, the population is augmented by the number of cross-border workers to take account of their contribution to GDP. For Greece, data take into account a 10% upward revision to GDP as agreed to by Eurostat in October 2007.
2) Labour resource utilisation is measured as total number of hours worked per capita.
3) Labour productivity is measured as GDP per hour worked.

Source: OECD

The lower level of labour productivity in New Zealand is a long-term issue.

The relatively low level of labour productivity in New Zealand has been an issue for some time. Using estimates from the Conference Board (2008), the level of labour productivity was fairly steady from the mid-1960s through until the early 1980s (*Figure 5*). Labour productivity growth has picked up since then but has not been enough to close the gap with these comparator nations or the OECD average. Using the Conference Board (2008) data, New Zealand's ranking of 22nd in the OECD in terms of level of labour productivity has been constant since the 1980s.

Figure 5: Long-term labour productivity levels



Note: OECD unweighted average is an estimate of 24 nations in the OECD with data available from 1960

Source: The Conference Board and Groningen Growth and Development Centre (2008)

Measured sector productivity performance

Official productivity data cover the measured sector of the New Zealand economy.

In New Zealand, as in many nations, productivity measurement issues are important. As discussed in Section 2 above, one element of measurement is that some industries do not have independent measures of both inputs and outputs. New Zealand now has official productivity statistics for the measured sector (see *Box 1*), which is the focus of this section.

Labour productivity growth in the measured sector averaged 2.0% per annum from 1978 to 2007.

Output growth in the measured sector averaged 2.6% per annum from 1978 to 2007. The main driver of this output growth was labour productivity growth of 2.0% per annum. Growth in labour input in the measured sector averaged 0.6% per annum. This is quite a slow growth rate and reflects large falls in the late 1980s and early 1990s and the exclusion of growth in labour input outside of the measured sector.

Productivity growth can be volatile from year to year so should be examined over the course of a cycle.

As with the economy-wide measure, productivity growth in the measured sector varies considerably from year to year. Changes in input utilisation arising from business cycle fluctuations are reflected in observed productivity. For example, although firms may reduce staff numbers during downturns, workers who are retained are often under-utilised. Under-utilisation of the capital stock also tends to be greater because the capital stock cannot be adjusted as easily as labour. In addition, there may be reallocation of activity with different productivity growth rates between or within industries during a business cycle. For these reasons, changes in productivity are analysed across growth cycles as estimated by SNZ (see *Box 1*).

Table 1: Output, input, and productivity growth across growth cycles[8]

Cycles (March years)	Output (A)	Labour input (B)	Labour productivity (A) – (B)	Capital input (C)	Capital productivity (A) – (C)	Multifactor productivity *
1978-2007	2.6%	0.6%	**2.0%**	3.4%	-0.7%	0.9%
1978-1982	2.1%	0.4%	**1.7%**	1.7%	0.4%	1.2%
1982-1985	3.4%	2.0%	**1.4%**	6.8%	-3.2%	-0.5%
1985-1990	0.7%	-2.1%	**2.9%**	4.9%	-4.0%	0.2%
1990-1997	3.3%	0.8%	**2.5%**	2.0%	1.2%	2.0%
1997-2000	2.9%	0.1%	**2.8%**	2.4%	0.5%	1.9%
2000-latest	3.3%	2.2%	**1.1%**	3.8%	-0.5%	0.4%

* Growth in MFP is a weighed average of growth in labour and capital productivity

Percentage changes are geometric annual growth rates calculated on unrounded index numbers; numbers may not add to total due to rounding; 2000-latest is an incomplete cycle

Source: Productivity Statistics 1978-2007, Statistics New Zealand

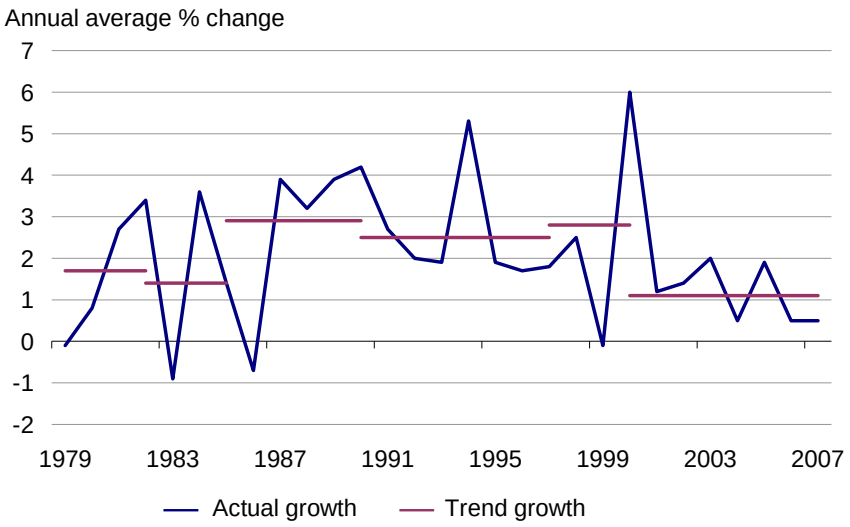
Table 1 sets out growth in output, labour input, labour productivity, capital input, capital productivity and MFP across the SNZ growth cycles. As noted in *Box 1*, the definition of the measured sector changes from 1996 onwards. This means the full period averages are not on a consistent basis and the pre- and post-1996 cycles are not directly comparable.

Productivity growth appears to have slowed in recent years.

SNZ estimates of trend annual labour productivity growth vary from 1.4% from 1982 to 1985 to 2.9% from 1985 to 1990 (*Figure 6*). Although the period since 2000 is not a full cycle, labour productivity growth averaged 1.1% per annum and MFP growth averaged 0.4% per annum from 2000 to 2007. These rates of growth are below those recorded in the last full cycle (1997-2000).

[8] Capital productivity is output per unit of capital, and like labour productivity it is a partial measure. However, in general we are more interested in investing in capital to raise the productivity of each person working rather than adding more people to raise the productivity of each machine or other piece of capital. Put another way, a high figure for capital productivity can reflect efficient use of capital or low investment. This ambiguity makes capital productivity a less useful partial measure than labour productivity.

Figure 6: Labour productivity growth, actual and trend, measured sector (March years 1978-2007)



Note: The period from 2000 is an incomplete productivity growth cycle

Source: Productivity Statistics 1978-2007, Statistics New Zealand

Figure 7 sets out the so-called "growth accounting" approach, which shows the relationships between inputs, productivity and output.

Figure 7: Growth accounting approach

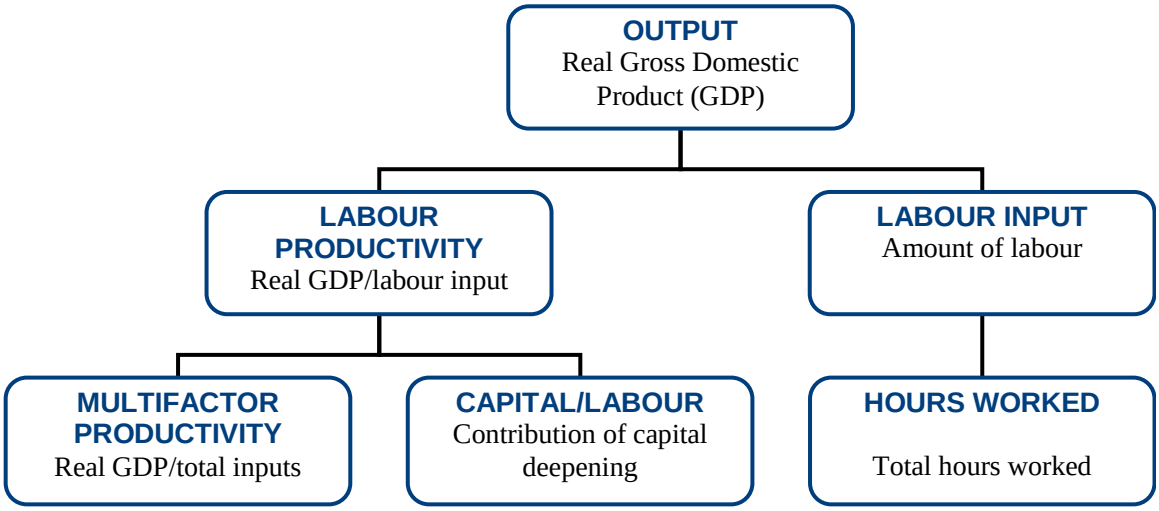


Table 2 sets out the contributions to output growth and labour productivity growth. Output growth of 2.6% from 1978 to 2007 can be "accounted for" by contributions from capital (1.4%), MFP (0.9%) and labour (0.3%). Alternatively, labour productivity growth of 2.0% per annum from 1978 to 2007 can be "accounted for" by 0.9 percentage points from growth in MFP and 1.1 percentage points from a rise in the capital-to-labour ratio (ie, capital deepening). Comparing the incomplete cycle since 2000 with the whole period, growth in both labour and capital inputs was above average and led to output growth of 3.3%. However, labour productivity growth was lower due to subdued MFP growth and less capital deepening.

Table 2: Contributions to output growth and labour productivity growth across growth cycles*

Cycles (March years)	Labour Contribution (A)	Capital contribution (B)	Multifactor productivity contribution (C)	Output (A)+(B)+(C)	Capital deepening contribution (D)	Labour productivity (C)+(D)
1978-2007	0.3%	1.4%	0.9%	2.6%	1.1%	2.0%
1978-1982	0.3%	0.7%	1.2%	2.1%	0.5%	1.7%
1982-1985	1.2%	2.7%	-0.5%	3.4%	1.8%	1.4%
1985-1990	-1.4%	1.9%	0.2%	0.7%	2.7%	2.9%
1990-1997	0.5%	0.8%	2.0%	3.3%	0.4%	2.5%
1997-2000	0.1%	0.9%	1.9%	2.9%	0.8%	2.8%
2000-latest	1.2%	1.6%	0.4%	3.3%	0.7%	1.1%

* The contributions of labour and capital to output growth are essentially the growth in the input weighted by the share of the input in total factor income. MFP growth contributes directly to output growth and is not weighted.

Percentage changes are geometric annual growth rates calculated on unrounded index numbers; numbers may not add to total due to rounding; 2000-latest is an incomplete cycle

Source: Productivity Statistics 1978-2007, Statistics New Zealand

New Zealand and Australia comparison

We focus on the New Zealand and Australia comparison because such comparisons are common in economic debates and also because the two countries have comparable measured sector productivity statistics. The series for New Zealand we use in this trans-Tasman comparison differs from the series used above in that it is for the "narrow" definition of the measured sector. This is because the Australian market sector has a narrower coverage of industries (it excludes business services and personal and other community services).

Productivity growth in the measured sector has been similar in New Zealand and Australia since 1978, although it has been higher in Australia since 2000.

Table 3 shows the trans-Tasman comparison across New Zealand's growth cycles. Labour productivity growth of 2.1% per annum in New Zealand's measured sector matched that of Australia's market sector from 1978 to 2007, while MFP growth was also similar. Notwithstanding the point that the growth cycles of the two economies may not coincide, Australian annual labour productivity growth of 2.0% since 2000 was higher than New Zealand's 1.2%. MFP growth was similar in the two countries since 2000 (0.5% per annum in New Zealand and 0.7% per annum in Australia), which means the higher labour productivity growth in Australia since 2000 can largely be explained by a greater degree of capital deepening in Australia.

Table 3: New Zealand and Australia comparison across growth cycles (comparable "narrow" measured sectors)

Cycles (March years for NZ, June years for Aus)	Output		Labour		Labour productivity		Multifactor productivity	
	NZ	Aus	NZ	Aus	NZ	Aus	NZ	Aus
1978-2007	2.5%	3.1%	0.4%	1.0%	2.1%	2.1%	1.0%	1.1%
1978-1982	2.1%	3.1%	0.4%	1.2%	1.7%	1.9%	1.2%	1.0%
1982-1985	3.4%	1.8%	2.0%	-0.6%	1.4%	2.4%	-0.5%	1.2%
1985-1990	0.7%	4.0%	-2.1%	3.1%	2.9%	0.9%	0.2%	0.6%
1990-1997	3.2%	2.6%	0.6%	0.0%	2.6%	2.5%	2.1%	1.5%
1997-2000	2.6%	4.6%	-0.8%	1.6%	3.4%	2.9%	2.3%	2.0%
2000-latest	3.1%	2.9%	1.9%	0.9%	1.2%	2.0%	0.5%	0.7%

Percentage changes are geometric annual growth rates calculated on unrounded index numbers; numbers may not add to total due to rounding; cycles relate to New Zealand; 2000-latest is an incomplete cycle

Source: Statistics New Zealand, Australian Bureau of Statistics

Although labour productivity growth in New Zealand's measured sector matched that of Australia's market sector from 1978 to 2007 (*Figure 8*), differences in economy-wide labour productivity levels, noted above, suggest a difference in the levels of measured sector labour productivity.

Reconciling this "on par" productivity growth performance for the measured sector with the economy-wide performance of *Figure 3* is challenging. First, *Figure 3* indicates that there were periods when New Zealand's economy-wide labour productivity growth performance was above that of Australia, and other periods when it was below. Second, a complete reconciliation would need to assess any differences in the way the non-measured sectors are compiled and the relative growth of outputs and labour inputs in the non-measured sectors.

Figure 8: Labour productivity growth in Australia and New Zealand (1978-2007, comparable "narrow" measured sectors)

Source: Statistics New Zealand, Australian Bureau of Statistics, Treasury calculations

4. Productivity performance in recent years

A number of factors may explain recent productivity performance.

Several factors might be contributing to the apparent slowing of observed growth in both economy-wide and measured sector productivity. The main factors considered in this section relate to changes in employment, labour quality, and industry and sector developments. Given the available information, it is difficult to isolate and weight the relative importance of the factors because of uncertainty around unobservable variables (eg, the business cycle) and data limitations.

Other studies have previously examined slowing productivity growth in New Zealand, Australia and Canada.

Studies examining productivity developments in New Zealand (Drew, 2007), Australia (Ewing, Fenner, Kennedy and Rahman, 2007) and Canada (Rao, Sharpe and Smith, 2005) have tended to find suggestive, as opposed to clear-cut, explanations. The latter two studies have considered the potential contribution of significant and sustained commodity price booms to the slowing of productivity growth in Australia and Canada noted in Section 3 above. A decline in observed productivity from higher commodity prices is not necessarily detrimental to national income.[9] However, because the terms of trade are volatile, increases in productivity tend to matter more over the longer term.

Changes in employment and labour quality

Recent output growth in New Zealand was strong because of high employment growth.

Ongoing labour input growth and lower-than-expected observed labour productivity growth have been features of New Zealand's economic performance in recent years. For a number of years, the Treasury's economic forecasts have incorporated the view that this pattern would change, with labour input growth slowing and labour productivity growth rising. This has not been borne out so far because of a story about labour force participation and employment, which have risen to rates beyond what was being forecast a decade ago. This has meant that, although GDP growth has been in the 3% per annum range, its composition (in a labour input and labour productivity sense) has been different from forecast.

High employment growth can dampen observed productivity growth.

During times of high employment growth, new workers tend to dampen observed productivity growth. For example, a rise in the employment rate might see a temporary reduction in observed productivity growth as new workers, even if they have high levels of formal qualifications, are generally

[9] Observed productivity may decline as firms allocate extra inputs to marginal activities, where those activities are nonetheless still profitable given international prices. The time taken to put in place additional capital may also contribute to lower labour productivity growth. Real Gross National Disposable Income (RGNDI) adjusts real GDP for income flows with the rest of the world and changes in a country's terms of trade (eg, a terms of trade improvement makes it possible to purchase more goods and services from overseas from the incomes generated by a given level of domestic production).

less productive than existing workers, at least until they gain job-relevant skills. This is a short-term effect as once these workers gain job-relevant skills productivity growth should return to its original rate.

The IMF (2005) has assessed the impact of rapid employment growth on New Zealand labour productivity growth. They use results from a cross-country study on the determinants of labour productivity growth (Belorgey, Lecat and Maury, 2004), which found that the short-run elasticity of labour productivity growth in relation to increases in the employment rate is around -0.5. Given the employment rate rose by about 1% per annum from 1992 to 2004, the IMF note that labour productivity growth could have been dampened by as much as ½% per annum over this period. They suggest that annual growth in labour productivity should increase in the future in the absence of further increases in the employment rate.

Drew, Dupuy, Downing and Karagedikli (2005) decompose the 18% rise in employment from 1998 to 2005 into five different components to estimate the potential impact of changes in labour quality. They assume people entering work from short-term unemployment and net immigration are experienced workers, while those from outside the labour force, long-term unemployment and natural population increase are inexperienced. With inexperienced workers accounting for about two thirds of net employment growth from 1998 to 2005, the authors suggest the -0.5 estimate of the dampening effect on labour productivity from Belorgey, Lecat and Maury (2004) is plausible.

Hyslop and Maré (2008) examine compositional changes among workers from 1999 to 2007 using Linked Employer-Employee Data (LEED). They note that average annual earnings for a full-time equivalent worker rose by about 9% in this period, but this rise would have been about 15% without compositional changes in employment. The economic upturn from 1999 to 2007 brought many lower-skilled people into the workforce and dampened average wage growth (and, by proxy, average worker productivity).

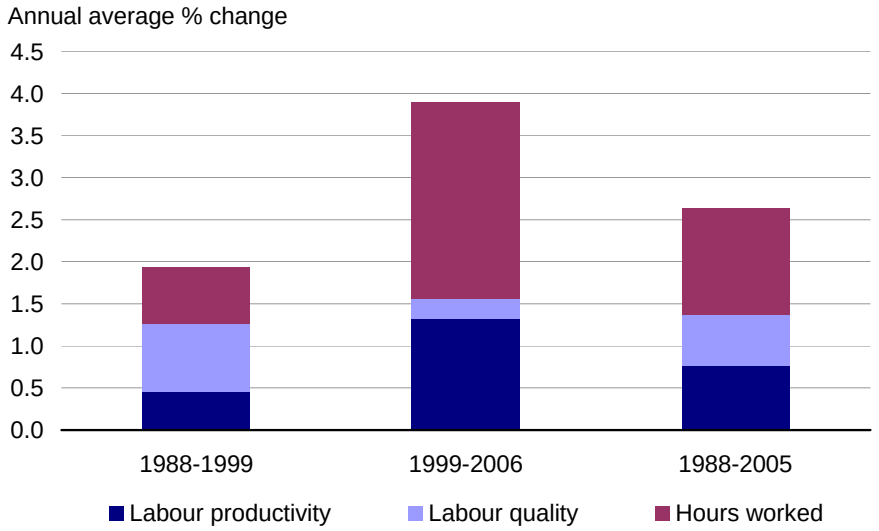
Changes in labour quality currently get picked up as changes in labour productivity.

Szeto and McLoughlin (2008) examine labour quality using a similar methodology to work done overseas (including Australia) and outlined in McNaughton (2006). This methodology will also be used by SNZ in the near future. In this methodology, hours worked by high-skilled workers are given more weight than workers of low skill when calculating aggregate labour input. Weights of different skill groups are determined using wage rates, which assumes that wages are a good proxy for productivity and that individual characteristics reflect differences in productivity. Skill level is estimated by the level of formal education (proxied by highest qualification) and work experience and on-the-job training (proxied by age).

New estimates suggest labour quality has risen strongly since 1988, but modestly since 1999.

Estimates from Szeto and McLoughlin (2008) show an average rise in labour quality of 0.6% per annum from 1988 to 2005 as a result of increasing qualification levels, particularly at university degree level. With age as a proxy for work experience, an ageing of the workforce also contributed to rising labour quality. Although labour quality rose in every year of the sample period, the rise was not constant over time. The increase from 1988 to 1999 was 0.8% per annum on average and the increase from 1999 to 2005 was 0.2% per annum on average (*Figure 9*).

Figure 9: Decomposition of economy-wide output growth into growth in hours worked, labour quality and quality-adjusted labour productivity



Source: The Treasury

Underlying growth in labour productivity (ie, excluding labour quality) was higher from 1999-2005 than from 1988-1999.

The implication of rising average labour quality is that some of the rise in observed economy-wide labour productivity can be attributed to changes in the quality of labour input. In a growth accounting sense this means labour quality is identified separately. With labour quality rising by an average of 0.6% per annum, almost half of observed economy-wide labour productivity growth of 1.4% per annum between 1988 and 2005 can be attributed to the rise in labour quality. Put another way, labour productivity measured as output per quality-adjusted working hour rose by 0.8% per annum on average from 1988 to 2005, with annual growth of 0.5% in the 1988-1999 period and 1.3% from 1999. By comparison, unadjusted (ie, observed) economy-wide labour productivity growth averaged 1.3% to 1.6% over the whole sample period and in both of these sub-periods.

The stage and length of the business cycle is likely to have an impact on labour quality. The only times the labour quality index grows by at least 1% per annum are in economic downturns (ie, 1989, 1991, 1992, and 1998) as low-skilled workers are generally the first to be laid off in a downturn. The relatively long economic upturn since 1999 has led to a large rise in the number of workers and, as discussed above, this rise had a relatively high proportion of the lower-skilled. The rise in labour quality was much smaller in the latter part of the sample period, possibly due to a large increase in the employment of lower-skilled workers in the recent upturn.

Changes at the industry and sector level

The industrial composition of the workforce has changed considerably since 2000.

Average productivity levels can vary considerably by industry so changes in the composition of employment by industry or sector may have affected overall growth in labour productivity. Furthermore, overall productivity growth may have been affected by changes in productivity growth within industries or sectors. Recent years have seen strong growth in domestic demand lead to an expansion of construction and the service industries (many of which are in the non-measured sector) relative to industries such as manufacturing (where recorded productivity tends to be higher).

Industry developments

Official productivity data by industry are not yet available so the analysis in this section is suggestive. Industry output can be measured as value-added output (total value of products produced in an industry excluding the value of intermediate inputs) or gross output (total value of all products produced in an industry including intermediate inputs).[10] The analysis below uses value-added output to be consistent with the discussion above, but future work on industry productivity by SNZ may also use gross output.

As mentioned above, SNZ recommend the use of the QES measure of hours paid for the purposes of calculating labour productivity by industry and sector. This is because the hours paid data are of better quality at the industry level. However, we are unable to use the QES to fully identify how the switching of resources between industries is affecting overall productivity as industries such as agriculture and fishing are excluded from this survey.

Changes in labour productivity can be decomposed into industry-related factors:[11]

- The degree to which the shift of labour between industries with relatively low productivity levels and industries with relatively high productivity levels contributed to changes in labour productivity.
- The degree to which changes in within-industry labour productivity contributed to changes in labour productivity.

Table 4 sets out output growth by industry, growth in hours by industry, and labour productivity growth by industry over the seven years to March 2007. It also shows the contribution to total growth in labour productivity decomposed by industry. This contribution includes the combined impact of changing shares of labour by industry and labour productivity growth within each industry. The information is based on the Linked Employer-

[10] The value-added approach attributes productivity gains from the more efficient use of intermediate inputs to capital and labour. The gross output approach attributes the gains across all inputs, including intermediate inputs themselves.

[11] A third factor, not reported, captures contributions that cannot be decomposed into these two effects.

Employee Data (LEED) so as to give wider industry coverage. Although it uses the less preferable per worker (filled jobs) measure of labour productivity, the data are consistent and we are primarily interested in compositional changes.[12]

Table 4: Output, jobs, labour productivity and contribution to labour productivity growth by industry (seven years to March 2007)

Annual average growth (%)	Output	Jobs	Labour productivity (output per job)	
			Total	Contribution (percentage points)
Total measured sector	**3.4**	**3.1**	**0.3**	**0.3**
Primary	1.5	2.7	-1.2	-0.1
Manufacturing	1.9	0.9	1.0	0.2
Electricity, gas & water	1.4	-0.9	2.2	0.0
Construction	4.1	7.4	-3.1	-0.2
Wholesale trade	2.4	2.6	-0.2	0.0
Retail trade	4.6	3.1	1.5	0.1
Hospitality	3.0	3.5	-0.6	0.0
Transport & storage	3.0	2.9	0.1	0.0
Communications	6.8	0.3	6.5	0.3
Finance & insurance	4.9	2.8	2.1	0.2
Business services	5.0	4.3	0.6	0.0
Culture & recreation	5.2	3.8	1.3	0.0
Personal & other	3.2	3.5	-0.3	0.0

Source: Gross Domestic Product, Linked Employer-Employee Data (December 2006 year was used for job growth as data for the March 2007 quarter were not available), Statistics New Zealand; Treasury calculations

In particular, employment growth has been very high in the construction industry, where recorded labour productivity is below average.

In terms of the decomposition set out above, the construction industry, with high employment growth but labour productivity below the average (and falling over the period), makes the largest negative impact on overall measured sector labour productivity growth at 0.2 percentage points per annum. Construction employment has expanded since 2000 as a result of factors such as high net migration inflows, previously low interest rates, declining household sizes, and infrastructure investment. The growth in construction, a labour-intensive industry, has likely had a negative influence on overall productivity growth. However, without a long span of data we are unable to test if this pattern is present in past cycles.

[12] However, this means labour productivity growth differs from that discussed above. Measured sector labour productivity growth in *Table 4* over the period was 0.3% per annum. This is lower than the estimate in Section 3 of about 1% per annum as output growth of about 3½% per annum was associated with job growth of about 3% per annum rather than hours growth of about 2% per annum. Using the Household Labour Force Survey, average hours per worker fell over this period by over 3% at the economy-wide level.

Other developments of note include contributions to labour productivity growth from communications services (a small industry with high productivity growth) and retail trade and finance and insurance (larger industries with robust labour productivity growth). The small negative contribution to labour productivity growth from primary industries may reflect changes within this diverse group of industries (ie, agriculture, forestry, fishing, and mining) or changes in average hours per worker.

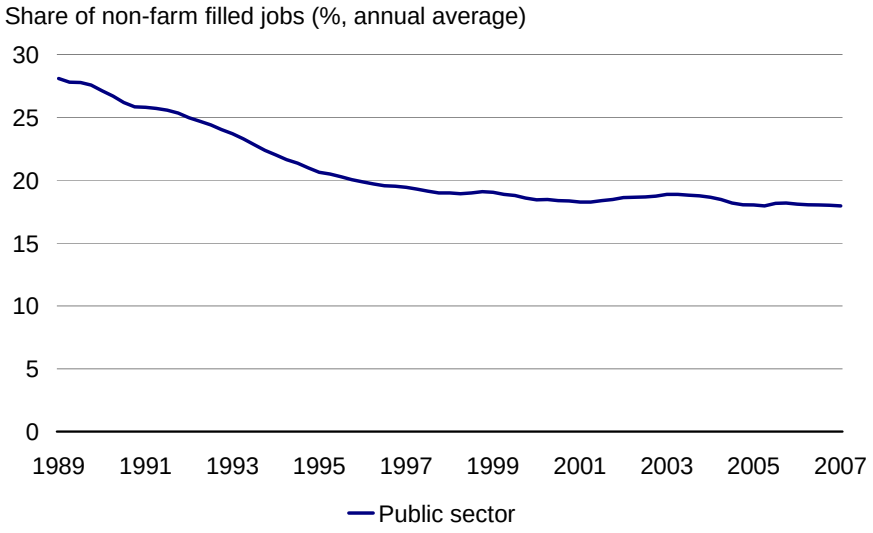
Sector developments

The industry analysis suggests there could have been a downward influence on overall productivity growth from shifts in industry composition. We can also analyse some of these influences on a sector basis. The non-measured sector has been stable as a share of labour input over the whole 1978-2007 period. However, the time series is affected by the inclusion of business services and personal and other services from 1996, which means the new measured sector series is not strictly comparable with data prior to 1996.

Employment growth in the public sector has been similar to that in the private sector since 2000.

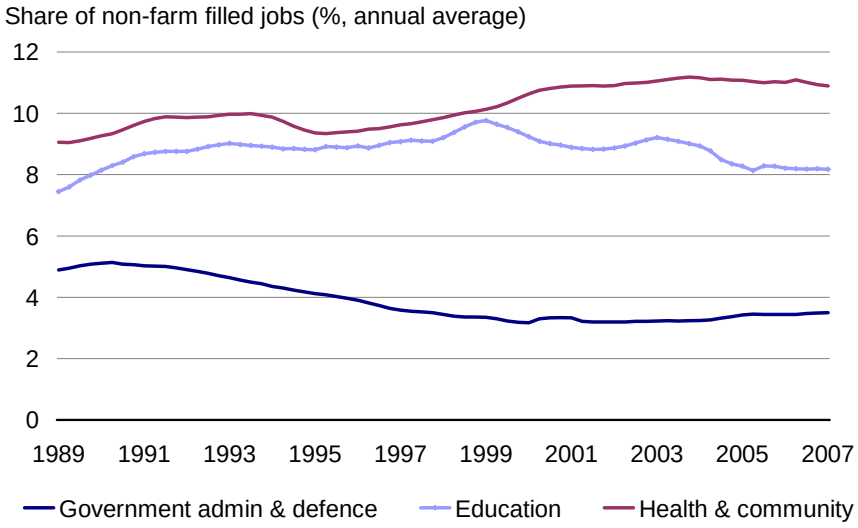
QES figures show that the public sector share of employment has trended down from around 28% of total non-farm employment in 1989 to around 18% in 2000 (*Figure 10*). The public sector in this context refers to sector of ownership (the sector of the economy that owns an organisation or business). This means the public sector will include some market activities (eg, electricity State Owned Enterprises) and will be affected by activities whose ownership has changed. Although the proportion of the workforce in the public sector has remained stable since 2000, this still means an absolute rise in public sector employment of around 50,000 jobs. *Figure 11* sets out employment trends in three industries which are concentrated in the public sector.

Figure 10: Public sector employment



Source: The Treasury, Statistics New Zealand

Figure 11: Employment by industry (government administration and defence, education, health and community services)



Source: The Treasury, Statistics New Zealand

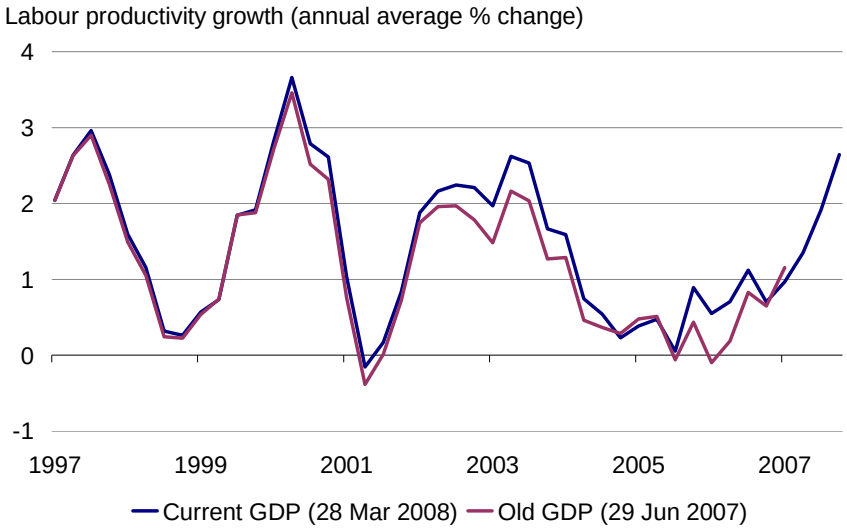
Productivity of the public sector is not measured directly in New Zealand (as outputs are largely measured by inputs) even though it is included in economy-wide measures. This means growth in labour input outside the measured sector, including that in the public sector in recent years, will tend to dampen observed economy-wide labour productivity growth. In making this point, public sector employment is regarded purely in terms of its impact on observed productivity growth. This of course ignores the rationale for increased public sector employment and financing implications.

Data revisions and methodology

Revisions to data and methodological changes can have an impact on productivity figures.

Revisions to historical data, particularly related to GDP, can have a large impact on the productivity data we analyse. When looking at the figures in mid-2007, economy-wide labour productivity growth had averaged 0.2% per annum over the two years to March 2006. Following upward revisions to GDP, this average growth rate has since risen to 0.5% per annum. The fall in productivity previously recorded for the year to March 2006 became a 0.5% rise after the revision (*Figure 12*).

Figure 12: Labour productivity growth revisions (hours-worked basis)



Source: The Treasury, Statistics New Zealand

At the measured sector level, SNZ note that data covering the final four years is provisional so could change. The estimate of labour productivity growth in the former measured sector over the March 2006 year has changed in all four productivity releases (up from 0.4% to 0.7%, down to 0.3% and now 0.2%). Methodological changes have also had an impact (eg, expanded coverage of the measured sector and greater use of LEED).

There are also difficulties in assessing trend productivity growth, with considerable uncertainty around estimates of trend and the associated length of growth cycles. The large rise in labour productivity of 6.0% over the year to March 2000 raises the average growth rate in the previous cycle and likely dampens the average growth rate in the recent period. Furthermore, the period since 2000 is not a complete cycle, and different methods of estimating trend growth can yield different results.

Economy-wide labour productivity growth rebounded in 2007.

Finally, there has been an increase in economy-wide labour productivity growth more recently to 2.6% in the year to December 2007, the highest since 2000, but this will not show up in the measured sector statistics until at least March 2009 when 2008 data are released.

5. Conclusions

This paper has been written to explain New Zealand's productivity performance. However, it has noted continued difficulties with productivity measurement. Although there have been some recent improvements in the official measured sector productivity data, there are still difficulties in gauging productivity across parts of the economy and there are still gaps, some of which will be addressed in the near term (eg, wider industry coverage), while others are longer term (eg, productivity at the industry level and productivity in the public sector).

Productivity growth in New Zealand's measured sector has been on a par with Australia's at around 2% per annum, although New Zealand's level of productivity remains lower than that of Australia. New Zealand's trend labour productivity performance over the last two decades, on an economy-wide basis, has generally been in the 1% to 2% per annum range. The official statistics for productivity growth in the measured sector appear to have slowed in recent years. However, analysis of recent trends is not definitive as Statistics New Zealand estimates that the most recent cycle is not yet complete. This means the trend for the current decade may still change by the time the cycle is complete.

In the context of recent trends and the incomplete business cycle, this paper looked at explanations of the apparent slowing of observed productivity growth. Given the available information, it is difficult to isolate and weight the relative importance of the factors because of uncertainty around unobservable variables (eg, the business cycle) and data limitations. There is evidence that employment growth and changes in labour quality have tended to dampen observed labour productivity growth in the recent past. An expansion of construction and the service industries (many of which are in the non-measured sector), relative to industries where recorded productivity tends to be higher, may also be playing a part.

Policy changes, as reflected in the five driver framework, may have had an effect. However, it is hard to determine causality, even when association exists. The recent resurgence of economy-wide labour productivity growth largely reflects an upturn in the business cycle so does not detract from the importance of efforts to raise future productivity performance.

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