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Industry productivity and the Australia-New Zealand income gap

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Executive summary

Differences in productivity explain much of the growing income gap between Australia and New Zealand. Good policy responses rely on understanding the sources of these differences.

Seventy percent of the aggregate gap in productivity between the two countries is due to underperformance of New Zealand's industries rather than a difference in the industrial structure of the two countries.

Decomposing the New Zealand-Australia income gap

Percent contribution to next tier up, 2001-2006, rounded to nearest decile, at 2006 prices
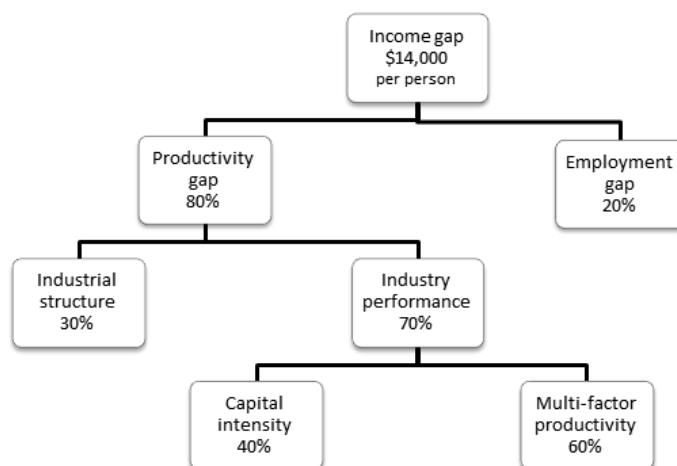
Source: NZIER, OECD STAN Database

Despite often voiced concerns to the contrary, capital intensity is not the main thing we should be concerned with when worrying about the growing income gap with Australia, as that primarily reflects differences in economic structure. New Zealand's principal problem is multifactor productivity – the quality of management, organisational innovation, the production process, and the quality of labour and capital. Simply investing in more capital is of secondary importance.

There are sectors in New Zealand, sadly too few, which outperform Australia's – in agriculture and energy and water supply. New Zealand has even been performing better in the one sector which many are quick to label the secret of Australia's success – mining. Most of the income gap can be attributed to low labour productivity in the services sector. The sheer size of this sector means this is a problem that needs a serious second look.

Our findings support the idea of studying and tackling the root causes of productivity differences at the sectoral level. The significant differences in multifactor productivity also indicate the need for more focus on the *quality* of labour, capital, and management, and regulatory environment

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1. Introduction

Since the early 1970s, incomes in New Zealand have fallen substantially behind those in Australia. Why has New Zealand fallen behind? Can New Zealand catch up? How can New Zealand catch up?

A crucial piece of the puzzle is understanding the sources of the current income gap.[1] Usually, these are defined at the aggregate level, where income is a function of employment and the all-important "productivity" or output per worker.

Figure 1 New Zealand GDP and productivity relative to Australia
NZ as a percentage of Australia
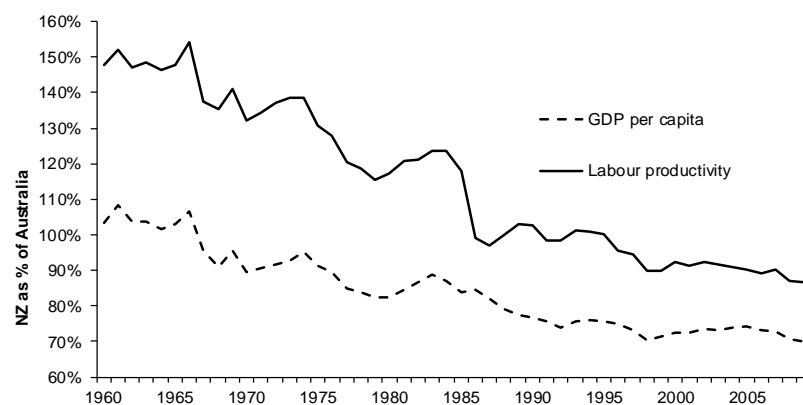
However, these measures tend to overlook the fact that while New Zealand as a whole has lagged behind Australia, this may not be true for all sectors of the economy.

Australia may also have innate advantages in industries that New Zealand has no hope of replicating –mining is often mentioned in this regard. If this is the case then aspirations to close the gap with Australia may be little more than jealously.

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[1] Throughout this paper we refer to differences in GDP per capita as an income gap. GDP per capita is an incomplete measure of income but we have adopted this as a short hand for the non-technical reader.

This paper takes a look at the sources of economic growth and decomposes them by industry to see where New Zealand has been lagging behind Australia. Our approach and the structure of this paper are described in Figure 2.

By way of context, we begin by decomposing the income gap between New Zealand and Australia in terms of its highest level influences, employment and labour productivity. We also examine the direct influence of capital intensity and other forms of productivity (multifactor productivity) on aggregate productivity.

The remainder of the paper then seeks to fill some of the gaps in more conventional analysis – the third tier in Figure 2. First we examine the extent to which the income gap with Australia is due to differences in industrial structure or whether it is because New Zealand's sectors aren't performing as well as Australia's in terms of labour productivity.

Figure 2 Decomposing the New Zealand-Australia income gap
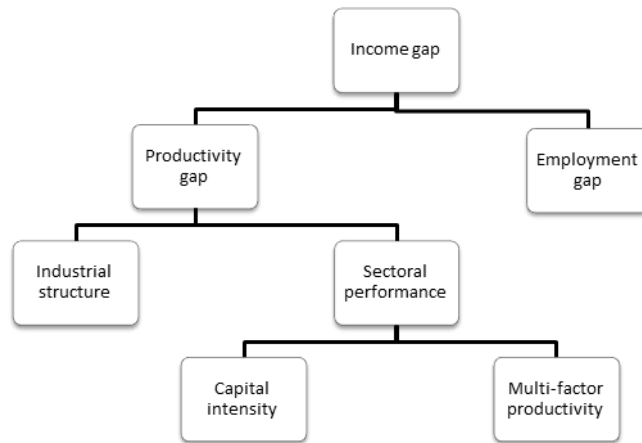
Source: NZIER

We find that majority of the income gap (70%) is explained by gaps in performance rather than differences in industrial structure. Australia's advantages in mining do not appear to explain the income gap. The New Zealand services sector appears to have been the biggest underperformer relative to Australia.

We then decompose labour productivity by sector to see what the relative contributions of capital intensity and multifactor productivity are to sector performance. This sheds light on an often cited hypothesis that labour productivity in New Zealand is low because of lower investment and lower capital intensity. We find that capital intensity is a smaller contributor to the income gap across most sectors.[2]

An important feature of this paper is that we consider a range of sectors across the economy, including those for which it is hard to measure output and therefore productivity – such as the services sector. Most studies comparing New Zealand and Australian economic performance have focussed only on the so called "measured sectors"[3].

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[2] This accords with what is seen internationally where increases in factor inputs, such as capital explain no more than a third of differences in countries growth rates (Romer and Jones, 2010).

[3] Statistics New Zealand's productivity series are based on the "measured sectors". Using these series two recent Treasury working papers have found that labour productivity growth performance in New Zealand measured sectors are similar to that in Australia. This runs contrary to the observation that aggregate labour productivity for New Zealand has been declining relative to Australia. There are good reasons why Statistics New Zealand only measure productivity in some sectors. This paper should be interpreted as having all of the problems associated with productivity measurement.

2. Employment and productivity trends

Overall trends in output or GDP per capita can be explained by decomposing high-level drivers of economic growth into employment and labour productivity.[4] Table 1 does this for New Zealand and Australia for the period from 1990 to 2006.

We have also decomposed productivity growth into its two constituent parts: (i) the effect that capital intensity has on labour productivity (i.e., more machinery and equipment make people more productive) and (ii) the remaining unexplained labour productivity, often referred to as multifactor productivity (MFP).

MFP arises from a range of sources including efficiency of the production process, technological change, and organisational innovation.[5] It is also captures the quality of labour and to some extent the quality of capital. As shown in Table 1 it is an important source of growth.

Decomposing growth in this way starts to shed some light on the proximate causes of the income gap and how they have changed over time. For example, in the period between 1990 and 1994 there was not much difference between New Zealand and Australia in terms of output (GDP) growth. Australia's growth was slightly ahead of New Zealand's thanks to faster employment growth. Labour productivity growth was the same in both countries, with the only a small difference in contributions due to productivity growth – in Australia capital intensity played a fractional larger role.

For the period 1995-2000, a sizeable labour productivity growth gap opened up between New Zealand and Australia which was entirely due to lower growth in MFP. This productivity gap amounted to nearly 1% more growth in output in Australia than in New Zealand.

GDP growth in New Zealand and Australia was similar between 2001 and 2006; however, labour productivity growth in New Zealand was 1% lower than that in Australia. The difference was made up by faster employment growth in New Zealand. This is consistent with a finding from Hyslop and Mare (2008) that the economic upturn from 1999 to 2007

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[4] See Appendix A.2 for the growth accounting formulae.
[5] Multifactor productivity, as a residual measure, also includes measurement errors as well as under-measured output and inputs, such as research and development and other intangible investments, including organizational improvements (Hulten, 2001).

brought many low-skilled people into the workforce and has consequently lowered average productivity.

In and of itself, that is a good thing. However, productivity growth is needed to drive wage increases. The labour productivity growth gap between 2001 and 2006 is due to both lower growth in capital (intensity) and lower MFP growth, in equal measure.

The question that we now try to answer is whether these gaps in productivity growth were due to poor performance or differences in industrial structure.

Table 1 Sources of aggregate growth

Average annual growth rate

	Output =	Employment	Productivity	Contribution to productivity	
New Zealand				Capital	MFP
1990-1994	2.3	0.5	1.8	0.6	1.2
1995-2000	3.0	1.7	1.3	0.5	0.8
2001-2006	3.0	3.1	-0.1	0.2	-0.2
Australia				Capital	MFP
1990-1994	2.4	0.6	1.8	0.7	1.0
1995-2000	4.0	1.8	2.1	0.5	1.6
2001-2006	3.3	2.2	1.1	0.7	0.3

Source: NZIER

3. Industrial structure and sector performance

The labour productivity story discussed above disguises the large degree of variation in productivity across industries. As shown in Table 2, labour productivity in New Zealand has been much stronger in some industries relative to Australia than in others. The agricultural sector has consistently outperformed Australia's agricultural industry, for example, even though the gap has declined somewhat.

The utilities (energy and water supply) sector has also outperformed its Australian counterpart and also made big gains between 2001 and 2006 when labour productivity was on average 60% higher in New Zealand than in Australia. Mining is another sector where New Zealand has made big gains in labour productivity relative to Australia. In the early nineties labour productivity in the mining sector was around 15% lower in New Zealand than in Australia and between 2001 and 2006 it was around 15% higher.

Table 2 Relative labour productivity by sector

NZ labour productivity as a percentage of Australian labour productivity

	1989-1994	1995-2000	2001-2006
Agriculture	174	167	161
Mining	86	73	117
Manufacturing	84	86	85
Utilities	106	102	161
Construction	95	87	72
Wholesale and retail	99	87	75
Transport	76	81	76
Finance	98	93	77
Community services	83	80	78
Total	91	86	83

Source: NZIER

Meanwhile, in the services sector, the gap in labour productivity between New Zealand and Australia, which has been there for some time, has been increasing. In the early 1990s, labour productivity in the services sector in New Zealand was around 10% lower than that in Australia; between 2001 and 2006, it was around 25% lower.

This widening of the productivity gap in the services sector was most pronounced in the Wholesale and Retail sector (including restaurants and hotels) and the Finance sector.

Similarly, in the construction sector, the gap in labour productivity between New Zealand and Australia has been increasing. In the early 1990s, construction sector labour productivity in New Zealand was only around 5% below that in Australia; during the period between 2001 and 2006 it was nearly 30% below that in Australia.

To understand how these patterns in industry productivity are affecting overall productivity gains and gaps we have to contend with how relative industry size is changing over time as well as changes in industry performance.

Both New Zealand and Australia experienced some degree of structural change between 1990 and 2006. In Australia, there was a shift of both employment and production from manufacturing industries towards services. In New Zealand, employment migrated from manufacturing to services while the production, in terms of value added, tended to shift from manufacturing to agriculture (see Table 3). In both countries, the services sector now accounts for more than 70% of total employment, and more than 65% of production.

Restructuring of the economy may work to offset some of the patterns of industry productivity gains if a sector's share of the economy is declining even while its productivity is increasing. Indeed, rationalisation in some sectors, which lowers their overall size in the economy, maybe boosting productivity because under-utilised resources are shifted out of the sector.

To disentangle all these changes we have decomposed labour productivity differences. We start with the fact that aggregate labour productivity is a weighted average of individual sectors' labour productivity, with the weight for each sector's share in total employment:

$$P = \left(\frac{Y}{L}\right) = \sum_i \left(\frac{Y_i}{L_i}\right)\left(\frac{L_i}{L}\right) = \sum_i P_i S_i$$

Table 3 Changes in industry structure

Percent of total

	Employment					
	New Zealand			Australia		
	1989-1994	1995-2000	2001-2006	1989-1994	1995-2000	2001-2006
Agriculture	6.3	6.2	5.4	5.3	5.0	3.9
Mining	0.3	0.3	0.2	1.2	1.0	1.1
Manufacturing	18.8	16.8	14.8	14.4	12.9	11.2
Utilities	1.1	0.7	0.4	1.3	0.8	0.8
Construction	5.0	5.4	5.8	7.2	7.3	8.3
Wholesale and retail	24.4	25.2	25.6	25.2	25.3	24.5
Transport	6.1	5.8	5.9	6.6	6.6	6.4
Finance	12.3	13.2	14.6	12.5	14.4	15.4
Community services	25.7	26.4	27.3	26.2	26.8	28.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
	Value added					
	New Zealand			Australia		
	1989-1994	1995-2000	2001-2006	1989-1994	1995-2000	2001-2006
Agriculture	8.5	9.0	9.3	3.8	3.8	3.4
Mining	1.3	1.4	1.4	5.3	5.4	5.0
Manufacturing	17.6	17.1	16.9	14.7	13.2	11.9
Utilities	3.0	2.7	2.5	3.0	2.7	2.3
Construction	4.3	4.4	4.2	6.0	6.0	6.8
Wholesale and retail	14.2	14.0	13.9	13.5	14.0	14.2
Transport	5.3	6.6	7.6	6.9	7.9	8.5
Finance	28.5	27.6	27.1	27.1	28.1	29.7
Community services	17.3	17.1	17.2	19.6	18.8	18.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: NZIER

We then use the following formula to decompose aggregate labour productivity by sector and its contribution to overall productivity:

$$P_{AU} - P_{NZ} = \sum S_{i,AU} P_{i,AU} - \sum S_{i,NZ} P_{i,NZ}$$

$$= \sum S_{i,NZ} (P_{i,AU} - P_{i,NZ})$$

$$+ \sum (S_{i,AU} - S_{i,NZ}) P_{i,NZ}$$

$$+ \sum (S_{i,AU} - S_{i,NZ})(P_{i,AU} - P_{i,NZ})$$

where P_{AU} and P_{NZ} are aggregate labour productivity in Australia and New Zealand in a particular year, $S_{i,NZ}$ and $S_{i,AU}$ are employment share of sector i in New Zealand and Australia respectively; $P_{i,NZ}$ and $P_{i,AU}$ are labour productivity of sector i respectively. This formula decomposes differences in aggregate productivity into three components:

- Differences due to structural differences
    - the part of the productivity gap which would have been eliminated if each sector's share of employment in New Zealand was made equal to that in Australia, holding each sector's labour productivity in New Zealand fixed.
- Differences due to industry-specific productivity differences
    - the part of productivity gap which would have been eliminated if labour productivity within each sector in New Zealand was raised to the level in the same sector in Australia, holding each sector's employment share in New Zealand fixed.
- The cross effect of both structural differences and productivity differences.

The decomposition results in Table 4 show that productivity differences at the sector level account for around two thirds of the labour productivity gap at the aggregate level and its contribution has been increasing from 66% during 1989 and 1994 to around 80% during 2001 and 2006.

Table 4 Decomposition of productivity differences

	1989-1994	1995-2000	2001-2006
Average productivity gap (Aus-NZ, US$ at 2000 Prices)	$2,868	$5,286	$8,680
Due to (US$):			
Structural Difference	$805	$1,167	$1,886
Productivity Difference	$1,890	$3,606	$6,911
Cross effect	$172	$513	-$117
Due to (%):			
Structural Difference	28%	22%	22%
Productivity Difference	66%	68%	79%
Cross effect	6%	10%	-1%

Source: NZIER, OECD STAN

Structural differences in New Zealand's economy relative to Australia account for less than 30% of the labour productivity gap and this contribution has been decreasing. In this regard, concern about the growing income gap between New Zealand and Australia is not simply jealousy.

4. Decomposing sector productivity

In this section we return to the accounting framework used in section 2 and apply it at the sector level to try and diagnose the main drivers of poor and positive performance across New Zealand industries. However, here we focus on productivity levels as opposed to growth. That is, we consider the extent to which gaps in labour productivity levels by sector can be explained by lower capital intensity or lower MFP.

The results of our analysis, in Table 5, show that with one exception (transport) New Zealand's sectors with lagging labour productivity have consistently lower MFP.

In most sectors capital intensity only plays a minor role in explaining poor productivity performance (with the exception of transport). It is only in two sectors where labour productivity is better than in Australia, agriculture and (lately) mining, that we find capital intensity playing a role in reducing labour productivity. In agriculture this may be due to lower relative returns from investment in capital intensive farming, such as intensive irrigation. It is unclear why mining in New Zealand should be less capital intensive.

The two sectors which improved labour productivity performance between 1989 and 2006 relative to Australia (mining and utilities) have also shown consistent gains in MFP.

That said, capital intensity does have an important role in constraining labour productivity. Around 40% of New Zealand's sectoral productivity gap is due to lower capital intensity[6]. This is in part due to the large role that capital intensity has in reducing productivity in the transport sector.

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[6] This result is similar to Hall and Scobie (2005), in which they found that it was only in 2002 the capital intensity gap accounted for more than 50% of total labour productivity gap between 1987 and 2002.

Table 5 Sources of labour productivity gaps by sector

Labour productivity gaps and contributions of capital intensity and MFP[3], percent

Sector	1989-1994			1995-2000			2001-2006		
	Product ivity	Capital	MFP	Product ivity	Capital	MFP	Product ivity	Capital	MFP
Agriculture	-55	14	-69	-50	11	-61	-46	12	-58
Mining	15	-12	27	32	21	12	-14	6	-20
Manufacturing	17	-10	28	15	-6	22	16	-2	18
Utilities	-6	20	-25	-1	16	-17	-47	-25	-22
Construction	6	-5	11	14	-13	27	34	-17	51
Wholesale + retail	1	9	-8	15	10	5	30	11	19
Transport	28	38	-10	21	41	-20	28	48	-20
Finance	2	-3	5	8	-3	11	26	2	25
Community services	19	-6	25	22	-5	28	25	-4	29
Total	10	4	6	15	6	9	18	8	10

Notes: (1) Data may not sum due to rounding.
         (2) A negative figure implies New Zealand is performing better than Australia.
         (3) Multifactor productivity

Source: NZIER

The services sector as a whole, making up more than 70% of the economy, appears to be the major source of productivity gaps between New Zealand and Australia (see section 3). But in this sector we find that capital intensity makes only a very minor contribution to labour productivity (Figure 3).

In contrast to the focus of much of the policy debate, around 90% of the difference in capital intensity in New Zealand can be explained by differences in industrial structure between New Zealand and Australia. This contrasts with the influence that differences in capital intensity has, as an explanation for New Zealand's overall productivity gap.

Figure 3 Capital intensity and productivity in the services sector

Share of capital intensity and MFP in explaining productivity gaps with Australia

Contributions to overall labour productivity gap

Contributions to labour productivity gap in services

The services sector as a whole, making up more than 70% of the economy, appears to be the major source of the productivity gap between New Zealand and Australia (see section 3). But in this sector we find that capital intensity makes only a very minor contribution to labour productivity (Figure 3).

In contrast to the focus of much of the policy debate, around 90% of the difference in capital intensity in New Zealand can be explained by differences in industrial structure between New Zealand and Australia. This contrasts with the influence that differences in capital intensity has, as an explanation for New Zealand's overall productivity gap.

5. Implications

This paper has shown that focussing on aggregate productivity measures or GDP per capita may mean we overlook some important issues.

First, the most important finding of our analysis is that most of the income gap can be attributed to low productivity in the services sector. The sheer size of this sector in the New Zealand economy and its crucial importance to post-industrial societies means this is a problem and an issue that needs a serious second look.

Second, despite some concerns to the contrary, capital intensity is not the main thing we should be concerned with when worrying about the growing income gap with Australia. New Zealand's principal problem is MFP. This may of course be related to the kind of capital being employed and also how it is employed but simply investing in more capital is of secondary importance.

Third, New Zealand's income gap with Australia is not a function of across the board malaise. There are sectors in New Zealand, sadly too few, which can and do outperform their Australian equivalent. New Zealand has even been performing better in the one sector which many are quick to label the secret of Australia's success – mining.

To be sure, the magnitude of Australia's mining wealth is nothing to be sniffed at, but the cause of our gap in incomes is not so much that Australia does different things but that, in the things we do too, it generally does them better. In this regard, concern about the growing income gap is not simply jealously.

Our findings point to the importance of studying the root causes of productivity differences at the sectoral level – the approach that seems to being taken by the recently established New Zealand Productivity Commission.

One question which also warrants further investigation is the impact that employment shifts have had on aggregate productivity. It may be that much of New Zealand's productivity growth gap is due to the fact that lower skilled labour in Australia has, at the margins, found a home in mining while in New Zealand it tends to end up in the services sector. At the end of the day, growth depends less on what happens on average in the economy and more on what happens at the margins.

The significance of differences in multifactor productivity also indicates that research will need to focus much more on the quality of management, labour and capital. This contrasts with the character of debate in New Zealand which is usually about quantities: of jobs and of locally raised capital and saving rates.

The quality of productive inputs matters. 1000 shovels might represent the same capital value as a bulldozer but access to a bulldozer has much more profound implications for productivity and ultimately prosperity.

Similarly, higher skills, management capability, and organisational quality will have a potentially profound effect on New Zealand's growth potential because they improve the overall economic environment and increase New Zealand's capacity to innovate (Treasury, 2008).

Finally, if low multifactor productivity is the main constraint to New Zealand's growth, then we also need to look closely at our regulatory architecture and address recent trends which led the OECD (2011) to conclude that "New Zealand's long standing front runner status in product market regulation has been eroded away over the past decade".

6. References

Bosworth, B. and S. M. Collins (2008), "Accounting for Growth: Comparing China and India", *The Journal of Economic Perspectives*, Vol.22, No. 1, pp. 45-66.

Hall, J. and G. Scobie (2005),*Capital Shallowness: A Problem for New Zealand*, New Zealand Treasury Working Paper 05/05, New Zealand Treasury, Wellington.

Hulten, C. R. (2001), *Total Factor Productivity. A Short Biography*, NBER Working Paper 7471.

Jones, C. and P. Romer (2010), "The New Kaldor Facts: Ideas, Institutions, Population, and Human Capital." *American Economic Journal: Macroeconomics*, 2(1): 224–45.

Jorgenson, D. W. and Z. Griliches (1967), "The Explanation of Productivity Change", *The Review of Economic Studies*, Vol. 34, No. 3, pp. 249-283.

Jorgenson, D. W., F. M. Gollop, and B. M. Fraumeni (1987), *Productivity and US Economic Growth*, Cambridge, MA: Harvard University.

Jorgenson, D. W., and M. P. Tommer (2011), "Structural Change in Advanced Nations: A New Set of Stylised Facts", *The Scandinavian Journal of Economics*, Vol. 113 No. 1,pp.1-29.

OECD (2011), *Economic Survey of New Zealand 2011*, Organisation for Economic Cooperation and Development, Paris.

Statistics New Zealand and New Zealand Treasury (2010), *Taking on the West Island: How does New Zealand's labour productivity stack up?*, Statistics New Zealand and New Zealand Treasury, Wellington.

Timmer, M. P., R. Inklaar, M. O'Mahony and B. van Ark (2010), *Economic Growth in Europe. A Comparative Industry Perspective*, Cambridge University Press.

Treasury (2008), *Working Smarter: Driving Productivity Growth Through Skills*, New Zealand Treasury Productivity Paper 08/06, New Zealand Treasury, Wellington.

Appendix A Data and methods

A.1 Data

The data we used for this analysis is from the OECD structural analysis database (STAN). This database provides harmonised and comparable measures of range of output and input information at a relatively detailed level of activity across 32 OECD countries, e.g., output, labour inputs, investment and capital stock, and international trade.

For our sector analyses we use data on the following nine sectors:

- Agriculture
- Mining
- Manufacturing
- Utilities i.e., electricity, gas and water supply
- Construction
- Wholesale and retail services
- Transport services
- Finance, insurance and real estate
- Community services e.g., education, health and recreational services.

Indicators used from the OECD STAN Database:

- Value Added, volumes (at the price of 2000)
- Value Added, current prices
- Total Employment
- Net Capital Stock, volumes (at the price of 2000)
- Labour Costs (compensation for employees).

Based on the indicators above, we have derived the following variables:

- Labour productivity: Value Added (volumes)/Total Employment
- Capital intensity: Net Capital Stock (volumes)/Total Employment
- Labour income share: Labour Costs/Value Added (current prices).

Employment data covers the period from 1989 to 2006. We have divided this period into three sub-periods, 1989-1994, 1995-2000, 2001-2006 in order to analyse changes over time.

A.2 Growth accounting framework

To assess the contribution of capital intensity to labour productivity growth, we apply the neoclassical growth accounting framework pioneered by Solow (1957) and further developed by Jorgenson and associates (Jorgenson and Griliches, 1967; Jorgenson, Gollop, and Fraumeni, 1987). Using this framework, growth in output per worker can be decomposed into the contributions of capital intensity and productivity:

This approach allows us to assess the relative importance of labour and capital, and to derive measures of multifactor productivity. The contribution of capital intensity growth to labour productivity growth is measured by the growth rate of the capital intensity weighted by one minus labour income share, assuming constant returns to scale. Labour income shares reflect the output elasticity of labour input.

The portion of labour productivity growth not attributable to capital intensity is the multifactor productivity residual.

To decompose the contribution of capital intensity and multifactor productivity to labour productivity gaps in New Zealand and Australia, we will use the following formula, which was used in Hall and Scobie (2005):

$$\ln(\frac{P_{AUS}}{P_{NZ}}) = \ln(\frac{MFP_{AUS}}{MFP_{NZ}}) + (1 - \overline{\alpha})\ln(\frac{(K/L)_{AUS}}{(K/L)_{NZ}})$$

Where $\overline{\alpha}$ is the average labour income share of both New Zealand and Australia, K/L is capital intensity, and MFP is the residual.

A.3   Market exchange rate vs PPP exchange rate

We need an appropriate exchange rate to convert economic indicators measured at local currencies to a single currency when comparing productivity levels across countries. We can choose from three types of exchange rates:

- market exchange rate
- economy-wide purchasing power parity (PPP) exchange rate
- industry-specific PPP exchange rate.

We use the market exchange rate because it is easy to observe, its value is certain, and it does not change the relative productivity difference between industries *within* a country. Where internationally tradable goods play an important role, the market exchange rate is the best choice. However, the market exchange change rate does not take into account price differences in the non-tradable sectors between countries and also tends to understate productivity in the non-tradable sectors.

The economy-wide PPP exchange rate is used when comparing international labour productivity differences at an aggregate level, but it is not appropriate for comparing labour productivity differences at the industry level. It tends to understate the productivity in non-tradable sectors, and overstate labour productivity in tradable sectors. Given methodological choices, there is uncertainty around which PPP exchange rates to use.

Industry-specific PPP exchange rates are thus more desirable, but tend to distort the relative productivity across industries within a country. Furthermore, deriving industry-specific PPP exchange rates is a complicated process, involving the calculation of PPPs for outputs, labour inputs, capital inputs, etc. See Timmer et al. (2010) for details.

As a sensitivity test, we experimented with using economy-wide PPP exchange rates. We found that using economy-wide PPP exchange rates changed the level of relative labour productivity between New Zealand and Australia. However, this approach showed the productivity gap widening at the same rate, and the choice of exchange rate does not change the conclusions we can draw from this study.