Taking on the West Island
How does our productivity stack up?

Brendan Mai (Statistics New Zealand)
brendan.mai@stats.govt.nz

John Janssen, Geoff Lewis, Simon McLoughlin (New Zealand Treasury)
john.janssen@treasury.govt.nz

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Abstract

New Zealand's productivity performance has gained considerable attention in recent times, particularly compared with Australia's. Using a three-pronged approach, this paper sheds new light on that comparison. Firstly, levels as opposed to productivity growth rates are compared, giving insight into income per capita disparities. Secondly, the paper examines the puzzle of why OECD economy-wide productivity growth rates differ from official 'measured' or 'market' sector estimates compiled by Statistics New Zealand and the Australian Bureau of Statistics. Thirdly, growth rates are compared for the 12 common industries for which New Zealand and Australia compile official productivity estimates. The paper also highlights the usefulness of the new industry-level dataset for New Zealand, and suggests areas for further development.

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Disclaimer

The views, opinions, findings, and conclusions expressed in this paper are strictly those of the authors and largely reflect the state of knowledge as at the above-mentioned workshop. The paper does not necessarily reflect the views of Statistics New Zealand or the New Zealand Treasury. Statistics New Zealand and the Treasury take no responsibility for any errors or omissions in, or for the correctness of, the information contained in this paper. The paper is presented not as policy, but to inform and stimulate wider debate.

1. Introduction

Productivity is the key determinant of a country's material standard of living over the long term. A series of Treasury Productivity Papers released over the course of 2008 and 2009 discussed New Zealand's productivity and policy implications.[1] The second paper in this series focused on productivity measurement and performance, including comparisons with Australia, for the so-called measured sector and selected OECD economies, on an economy-wide basis (New Zealand Treasury, 2008). That paper also included some preliminary industry level analysis aimed at investigating cyclical effects in the construction industry.

Productivity measurement issues have been canvassed in detail in the various publications supporting the official productivity statistics published by Statistics New Zealand (Statistics NZ), including the analytical report prepared by Statistics NZ for the 2025 Taskforce (Statistics NZ, 2009). In this paper we draw extensively on these Statistics NZ publications. The 2025 Taskforce examined the evidence on New Zealand's productivity performance (2025 Taskforce, 2009)[2] and Statistics NZ has just released (on 25 June) the first set of official productivity statistics for New Zealand at the industry level, covering the years 1978 to 2008.

Section 2 of this paper briefly restates the definitions of productivity, measurement issues, and industry coverage. Otherwise the paper is concerned with interpreting productivity measurement and performance in New Zealand and Australia. 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.

In Section 3 we set out the available evidence on productivity levels, noting the measurement challenges present in levels analysis. These measurement challenges increase as we move from economy-wide measures to groupings of industries (eg, the group making up the measured sector) and then to the individual industries themselves. Despite the challenges, we start with levels analysis given its relevance to the income gap (as measured by GDP per capita) and the interpretation of growth rates. For example, even if we know that measured-sector productivity growth rates in New Zealand and Australia have been broadly similar since 1978, this by itself does not tell us about any gap in the level of measured sector productivity.

Section 4 includes a preliminary examination of the puzzle of why economy-wide productivity measures, including those published by the OECD, appear to present a different picture to the one that emerges from the official statistics published by Statistics NZ and the Australian Bureau of Statistics (ABS). We attempt to establish the extent to which these differences reflect measurement or economic reality. Doing this requires an examination of labour inputs, as well as the measurement methodologies of output in specific industries. It is worth noting that these types of puzzles are not unique to the New Zealand-Australia situation.[3] For example, a

[1] See http://www.treasury.govt.nz/publications/research-policy/tprp.

[2] See Part I: Understanding the problem – multifactor productivity.

[3] Drew (2007) discusses some of the New Zealand productivity measurement puzzles, including the apparent low productivity growth of the non-measured sector (see in particular Table 6).

number of puzzles exist in comparing the productivity performance of Canada and the United States (Sharpe, 2004):

> A comparison of aggregate labour productivity growth between Canada and the United States reveals a significantly different story depending on which measure of aggregate labour productivity is used. Business sector output per hour advanced at a 2.2 per cent average annual rate over the 1981-2003 period in the United States versus 1.5 per cent in Canada … The United States enjoyed a 0.7 percentage point advantage over Canada. Total economy output per hour grew 1.7 per cent per year in the United States compared to 1.4 per cent in Canada, a difference of 0.3 points, one half that registered for the business sector. The better relative productivity performance for Canada with the total economy measure is explained by the measured productivity growth in the non-business sector: 1.1 per cent per year versus 0.1 per cent in the United States. The key issue is which of these two productivity growth rates better captures the true productivity performance of the non-business sector. Non-business sector output is generally proxied by labour inputs. But Statistics Canada attempts to capture productivity gains in certain non-business industries by using output measures that are independent of inputs. The United States appears more reticent in the use of this practice.

We focus on labour productivity puzzles because the puzzles related to capital measurement (especially with regard to OECD data) are substantive and require further analysis. Section 5 utilises the new industry-level productivity dataset to provide a richer comparison between Australian and New Zealand labour productivity growth performance. Section 6 offers conclusions.

2. Definitions and measurement

2.1 Definitions

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 fixed inputs, producing the same quantity of goods and services with less input, or producing goods and services at a faster rate than the increase in inputs are increases in productivity.

Productivity is typically defined as the ratio of a volume measure of output to a volume measure of input. Beyond this basic definition a range of issues arise. Productivity can be defined in relation to a single input (eg, labour) or to a combination of inputs (eg, labour and capital). 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 that they attribute to one factor of production, in this case labour, changes in efficiency attributable to other factors of production.

Multifactor productivity (MFP) 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, advances 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 (eg, firms seek to maximise profits, markets are competitive, and the coverage of inputs is complete). Because these conditions are typically not met, measured MFP will, in addition to technological change, include the effects of model misspecification and errors in the measurement of the variables.

2.2 Measurement

In addition to which definition of productivity we are interested in, choices exist about coverage – whether we are assessing the performance of the total economy (ie, economy-wide), groupings of industries into particular sectors (ie, market), or individual industries. Strengths of economy-wide measures of productivity include consistency with real GDP (and therefore well established National Accounting procedures), real GDP per capita, and forecasts of these variables. Economy-wide measures are generally better suited to international comparisons, because the definition of the measured sector is not uniform across countries and official 'measured' sector series are only available for a limited number of countries (eg, Australia, New Zealand, Canada, Netherlands, Switzerland, and the United States).[4] Economy-wide measures are also typically more up-to-date, being quarterly and sourced from current series, and provide information on productivity levels and not just growth rates.

However, the ability to gauge productivity varies across the economy. Measurement difficulties are generally greater in the service industries, especially government activities in education, health, administration, and defence. Productivity statistics that cover the 'business' or 'market' sector are less prone to measurement issues and are more closely related to the entities (ie, firms) that are seeking the best mix of resources to exploit market opportunities and earn profits. In addition, the existence of market prices provides a set of natural weights to add a range of individual outputs into a single aggregate output.

For any given productivity series there are also issues of interpretation across time, including the role of the business cycle, and possibly changes in the terms of trade. Because the New Zealand and Australian business cycles do not match, we focus here on long-spans of data. The effects of changes in the terms of trade on measured productivity have been well canvassed in the Australian context (see, for example, Ewing, Fenner, Kennedy and Rahman, 2007; Dolman, 2009; Australian Productivity Commission, 2009).

2.3 The measured sector

The Statistics NZ and ABS official productivity statistics are consistent with OECD guidelines and comprise index series for labour productivity, capital productivity, and MFP. These series identify productivity growth rates but not absolute levels. Statistics NZ productivity data are annual and cover March years, with a publication lag of around one year.

The Statistics NZ productivity statistics cover the so-called measured sector, which excludes industries in which the growth of outputs is difficult to measure and is sometimes proxied simply by the growth of inputs. In 2007, the latest year for which current price industry value-added data are available, the present measured sector covered 74% of the economy. This measured sector is available on a consistent basis from 1996.

Statistics NZ also publishes a series covering a subset of the measured sector. This subset is in fact the former Statistics NZ measured sector before it was expanded to include business services, and personal and other community services. The continued publication of this series provides a link to previously-released Statistics NZ statistics

[4] See OECD (2008).

and enables comparisons with Australia (where the ABS use the term “market sector” rather than “measured sector”). The former Statistics NZ measured sector is available from 1978.

The use of the same industrial classification system (Australian and New Zealand Standard Industrial Classification or ANZSIC 1993/96) facilitates cross-Tasman comparisons. Under ANZSIC 1993/96, the ABS market sector has identical industry coverage to the former Statistics NZ measured sector. However, the ABS ANZSIC 1993/96 market sector was discontinued in 2008, so comparisons can only be made up to this year.

Table 1 lists the 12 industries in the Statistics NZ former measured sector and the ABS market sector (ie, industries A to K and P) and their contributions to GDP.

Table 1 *– Industry contributions to GDP in New Zealand and Australia*

Industry	**Average contribution to nominal GDP (%) 1990 to 2007***	
	New Zealand	**Australia**
A – Agriculture, forestry, and fishing	7.2	3.6
B – Mining	1.3	5.3
C – Manufacturing	17.2	13.5
D – Electricity, gas, and water supply	2.9	2.9
E – Construction	4.6	6.3
F – Wholesale trade	7.8	5.4
G – Retail trade	6.1	6.6
H – Accommodation, cafes, and restaurants	1.8	2.3
I – Transport and storage	4.7	5.2
J – Communication services	3.4	3.1
K – Finance and insurance	6.2	6.6
*L – Property and business services***	*13.8*	*11.7*
*Ownership of occupied-dwellings****	*8.7*	*8.9*
M – Government administration and defence	*5.1*	*4.3*
N – Education	*4.2*	*4.7*
O – Health and community services	*5.3*	*6.1*
P – Cultural and recreational services	2.0	1.4
*Q – Personal and other community services***	*1.4*	*2.0*
*FISIM*****	*-3.7*	
Measured sector total	65.2	62.2
Economy total	100.0	100.0

* 1990 to 2007 is the period for which current price GDP by industry are commonly available.
** ‘Business services’ and ‘Personal and other community services’ are in the current Statistics NZ measured sector, both from 1996 onward.
*** Statistics NZ separates dwellings into owner-occupied dwellings (OOD) and rental dwellings whereas the ABS combines these into a single category – ownership of dwellings (also designated as OOD).
**** Financial Intermediation Services Indirectly Measured (FISIM).

The ABS is now publishing productivity statistics under ANZSIC 2006, with Statistics NZ not making this change until 2012. Therefore, when undertaking trans-Tasman comparisons, the ANZSIC 1993/96 series must be used at this stage.

The two measured sectors are largely identical except that Australia allocates FISIM (see Section 4). The reference year for the productivity statistics matches that for National Accounts – March years in New Zealand and June years in Australia. Two rows in Table 1 have valued added recorded in the National Accounts but do not have corresponding labour inputs (eg, Ownership of occupied-dwellings, and FISIM). The effects of the five non-measured sector industries (ie, L, M, N, O, and Q), and the other GDP components, on productivity comparisons is the focus of Section 4.

The key data sources and methods used in compiling the Statistics NZ official productivity statistics can be summarised as follows:

- Real GDP for the measured sector (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 at an industry level from various firm surveys and household surveys (eg, Quarterly Employment Survey, Census of Population and Dwellings, Household Labour Force Survey, Linked Employer-Employee Data). Although hours of work is the preferred conceptual measure of labour input, Statistics NZ has opted for hours paid because of greater confidence in aligning labour inputs with corresponding industry outputs and the availability of longer historical time series.

- 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 of the available 26 produced asset types by industry. These are supplemented by estimates for other assets: livestock, exotic timber grown for felling, inventories, and six types of land (agriculture, forestry, commercial, industrial, mining, and other land). Central Government Roading and Local Government Roading are excluded as these two assets are 'owned' by ANZSIC division M (Government administration and defence) which is outside the measured sector.[5]

An implication of these data sources and methods is that there can be a trade-off between what is optimal for official national productivity statistics and what is required for consistent cross-country comparisons. There is generally less of a trade-off in the case of output, but much more of one with labour and capital inputs. As discussed in Section 4, trade-offs also exist across time given the varying quality of data sources and/or specific judgments made about methodologies, further complicating the reconciliation of productivity puzzles.

3. Levels and growth rates

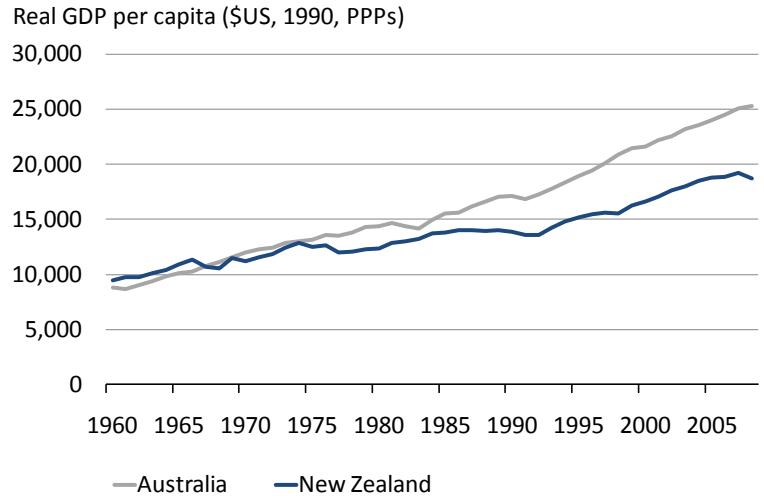
Cross-country comparisons of productivity levels play an important part in decomposing the sources of cross-country income gaps. However, levels comparisons are subject to more measurement issues than comparisons of growth rates.

[5] SNZ note that because roading assets are essentially public goods in the sense they are non-excludable and non-rival in consumption, they do not have an allocable user cost. Rather they enhance other transport assets and are reflected in the calculated MFP residual

Comparisons of productivity *growth* across different countries rely on national estimates of real output based on nominal output and price deflators. Comparisons of productivity levels require common international price units such as those provided by Purchasing Power Parity (PPP) exchange rates. Economy-wide PPP exchange rates (derived from expenditure prices) are used in GDP per capita and economy-wide labour productivity levels comparisons. However, industry (and indeed sector) comparisons should ideally use industry-specific conversions based on production/commodity prices to allow for differences in relative prices and how they change over time.[6]

The Conference Board Total Economy Database provides long-term time series for real GDP per capita for New Zealand and Australia (Figure 1). Of 126 countries in 2008, GDP per capita in 1990 $US (converted at Geary Khamis PPPs) was $25,300 in Australia (10th highest of all countries and 7th highest in the OECD) and $18,700 in New Zealand (26th highest of all countries and 21st in the OECD). The real GDP gap between New Zealand and Australia opened up from the mid-1970s. In percentage terms, real GDP per capita in 2008 was around 35% higher in Australia than in New Zealand. Alternatively, real GDP per capita was around 26% lower in New Zealand than in Australia.

Figure 1 *– Economy-wide real GDP per capita 1960-2008*

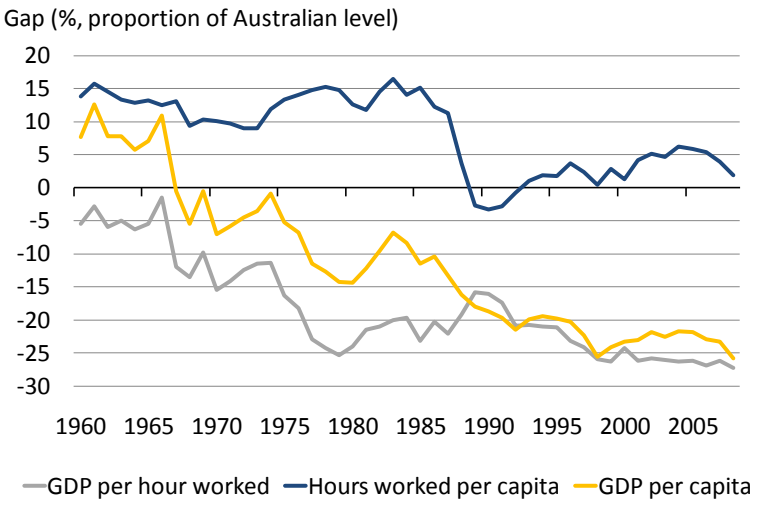


Source: The Conference Board Total Economy Database

Figure 2 indicates that until the early 1990s the per capita GDP gap comprised both an economy-wide labour productivity gap (GDP per hour worked) and a labour utilisation gap (hours per capita). Labour productivity now accounts for the vast majority of the per capita GDP gap, with the productivity gap starting to open up in the late 1960s and widening from the mid-1970s.

[6] These points are a summary of the discussion in Dolman, Parham and Zheng (2007) who undertake some preliminary industry levels comparisons between Australia and the United States. Australia has subsequently been included in the EU-KLEMS industry database.

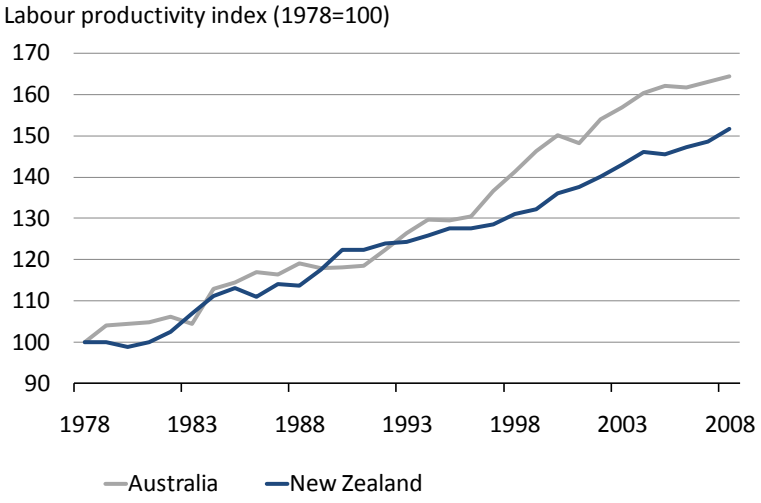
Figure 2 *– Economy-wide real GDP per capita gap (% of Australian level) by labour input and labour productivity 1960-2008*



Source: The Conference Board Total Economy Database

Obviously, levels and growth rates of a time series variable are linked – so if there is a significant gap in levels today but there was none in the late 1960s/early 1970s, the question arises as to when the gap opened up? This takes us back to a need for a comparison of growth rates over a long time period. However, the measured sector productivity statistics that are relevant to some of the puzzles we are interested in are only available from the mid-1970s. Figure 3 plots economy-wide labour productivity indexes to compare *growth* rates from 1978.

Figure 3 *– Economy-wide labour productivity indexes 1978-2008*

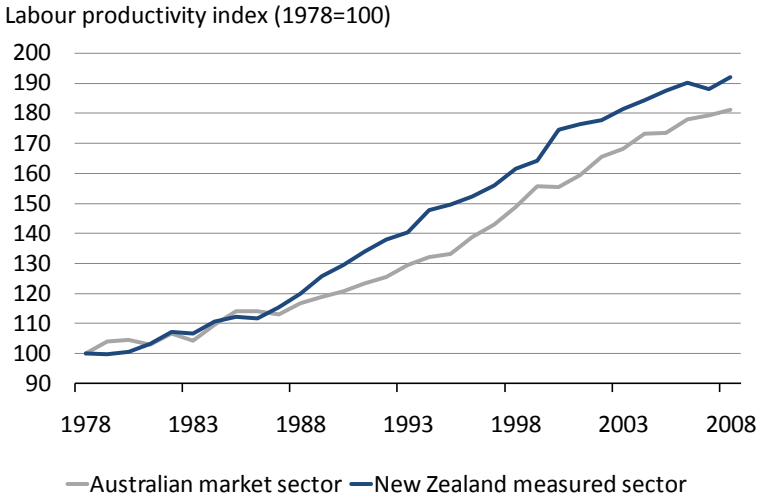


Source: OECD

Finally, Figure 4 shows cross-Tasman measured-sector productivity *growth* using the measured sector definitions outlined in Table 1 above. New Zealand's average annual

growth rate (2.2%) actually exceeds Australia's (2.0%) on this measure over the 1978 to 2008 period. New Zealand also exceeds Australia in measured-sector MFP growth over 1978 to 2008 with MFP growth of 1.1% versus 1.0%.

***Figure 4** – Measured sector labour productivity indexes 1978-2008*



Although we do not have official levels comparisons, analysis by the Department of Labour using aggregate PPP exchange rates suggests that in 2008, New Zealand GDP per hour in the measured sector was around 25% lower than in Australia, with the gap being constant since the start of the analysis (ie, 1996).[7]

4. Puzzles and reconciliations

The similar labour productivity growth performance for the New Zealand and Australian measured sectors (Figure 4) contrasts with the difference in economy-wide labour productivity performance (Figure 3). Table 2 summarises output, labour and labour productivity growth for the economy as a whole, the former measured sector and other parts of the economy.

For the total economy and industries outside the measured sector, Table 2 uses hours worked from the Household Labour Force Survey (HLFS) for New Zealand and hours worked from the Labour Force Survey (LFS) for Australia. The use of this labour data restricts the start point relative to Figure 3 and Figure 4. For the reasons discussed in Section 2, the comparison ends in 2008.

For the measured sector, Table 2 uses the official statistics, and the associated labour input series, prepared by Statistics NZ and the ABS (see Section 4.1 below).

As discussed in Section 2, the economy outside the measured sector consists not only of industries in which output is difficult to measure but also includes components not allocated to industries (ie, FISIM in the New Zealand case) and/or with no labour input (ie, residential dwellings). It is therefore more appropriate to focus on those five

[7] The New Zealand Institute has carried out some levels comparisons at an industry level, but without the benefit of industry-specific PPPs (The New Zealand Institute, 2009). Mason and Osborne (2007) undertake a levels analysis at the industry level for New Zealand relative to the United Kingdom (UK). They find New Zealand labour productivity exceeds the corresponding UK industry in 2002 in only six of these industries. This pattern largely persists throughout 1995 to 2004.

industries not included in the former measured sector. The last two columns of Table 2 set out the data for other industries, in isolation as well as in combination with the unallocated components.

Table 2 *– Labour productivity growth (average annual growth rates) 1988-2008**

	Economy-wide		**Former Measured sector****		**Other industries*****		**Other industries and other components**	
	Australia	NZ	Australia	NZ	Australia	NZ	Australia	NZ
ABS SNZ								
Output	3.3	2.6	3.3	2.7	3.6	2.9	3.5	2.4
Labour	1.7	1.3	1.1	0.3	3.0	3.0	3.0	3.0
Productivity	1.6	1.3	2.2	2.4	0.5	-0.1	0.5	-0.5
OECD								
Output	3.3	2.7						
Labour	1.7	1.2						
Productivity	1.6	1.5						

* OECD New Zealand data is calendar years for hours worked and March years for GDP. ABS is June years. Statistics NZ is March years.
** Industries A to K plus P (refer to Table 1 above)
*** Industries L,M,N,O, and Q (refer to Table 1 above).

From Table 2 we observe that over the 1988 to 2008 period:

- Australia's economy-wide labour productivity growth was higher than New Zealand's, and the gap also exists when using OECD data. This particular gap is sensitive to the time period used. For example, if the period is 1987-2007 then OECD derived Australian labour productivity growth is 1.7% and for New Zealand it is 1.3% (ie, a larger gap).

- New Zealand's former measured sector labour productivity growth is slightly ahead of the comparable Australian measured sector.

- Labour productivity growth in the non-measured sector has been slower in New Zealand although average annual labour input growth has been identical in both countries at 3.0%. The productivity gap remains if we focus solely on the five industries in the non-measured sector.

In trying to reconcile the different pictures of productivity growth in Australia and New Zealand presented by economy-wide OECD measures and official measured-sector statistics from the ABS and Statistics NZ, there is a clear need to understand what is going on in the parts of the economy not included in the measured sector. Is underlying productivity performance in these areas in Australia sufficiently superior to that in New Zealand to explain its higher economy-wide productivity growth?

The following sub-sections examine measurement issues in labour input as well as the areas outside the measured sector. In the latter case we look at two areas where treatment appears obviously different in New Zealand and Australia – FISIM and

residential dwellings – and then at the industries which are not in the measured/market sectors that are used for trans-Tasman comparisons.

4.1 Labour input

Labour input could be expected to be relatively easy to measure compared with other parts of the productivity equation, particularly capital input or non-measured sector output. However, there are a number of issues with measuring labour input in both New Zealand and Australia.

The OECD (2001) recommends using actual hours worked as the measure of labour input:

> Notwithstanding some of the measurement issues, it is recommended that hours actually worked be the statistical variable used to measure labour input, as opposed to simple head counts of employed persons. Hours paid and full-time equivalent persons can provide reasonable alternatives. Significant differences in country practices for calculating hours worked and full-time equivalent persons persist, and raise issues of international comparability.

As noted above, official productivity data from Statistics NZ are for hours paid and based on data from a number of sources, particularly business datasets. This composite measure of labour input (or labour volumes series) is used because industry data are needed to build up the measured sector. Industry level data are also needed for the industry productivity series released recently. Hours paid data by industry are considered more robust as they are sourced from business datasets and have a longer time series than the HLFS.[8] Only at the measured and economy-wide level is the annual change in hours worked considered as statistically robust as hours paid. Had the focus of the official statistics been solely on the measured sector as distinct from the (recent) disaggregation to the industry level, HLFS hours worked could have been used.

At the economy-wide level, no industry splits are needed, so the OECD uses hours worked from the HLFS to estimate growth in economy-wide labour input. As expected, the OECD and HLFS economy-wide measures match closely. The OECD data match best with the HLFS measure on a calendar-year basis.[9] In New Zealand, economy-wide labour input between the 1988 to 2008 calendar years grew by an average of 1.4% per annum on both the OECD and on HLFS measure. Table 3 shows 1.2% for the OECD measure (1987 to 2007 calendar years) and 1.3% (1988 to 2008 March years) for the labour force survey to match with Table 2.

Official and labour force survey estimates of labour input for the measured sector differ moderately. In New Zealand, labour input between 1988 to 2008 grew by an average of 0.3% per annum in the official measured sector (ie, former) and by an average of 0.6% per annum in the HLFS data for the same group of industries.

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[8] There are some draw backs to using hours paid rather than hours worked. For example, increased minimum annual leave provisions in New Zealand from 2007 had the effect of reducing average hours worked per worker but had no direct effect on hours paid.

[9] The use of calendar years aligns with the usual practise of the OECD. However, the OECD do not use calendar years for New Zealand GDP data. The OECD take New Zealand's GDP data on a March year basis as this is the way Statistics New Zealand publish it (so 2007 in the OECD GDP figures actually refers to the year to March 2008).

In contrast, official productivity statistics from the ABS for the market sector of the economy use a measure of labour input based on hours worked data from their labour force survey. This is the same concept of labour input used at the economy-wide level by the OECD to estimate economy-wide labour productivity growth. The OECD economy-wide measure therefore matches the labour force measure. In Australia, labour input between 1988 to 2008 grew by an average of 1.7% per annum on both the OECD and their labour force measure. Australia has had issues with hours worked in the past (eg, hours worked were surveyed at four points of the year but not adjusted for holidays). These issues seem to be resolved with, for example, adjustments now made for holidays.

The official market sector measure of labour input in Australia uses the same concept (hours worked) as the labour force survey measure. In Australia, labour input between 1988 to 2008 grew by an average of 1.1% per annum between 1988 to 2008 on the official market sector measure and on their labour force measure.

In conclusion, it appears that the choice of labour input does make a potentially important contribution to the productivity puzzle. The measured sector labour input series in New Zealand understates labour input growth (and thus over overstates labour productivity growth) relative to the HLFS measure for the same group of industries by about 0.3% points. In Australia, the same approach is used in both the market sector and economy-wide measures and so the issue does not arise. The New Zealand data are not wrong. The measured sector estimates are "fit for purpose" as industry estimates are needed and this cannot be done with hours worked data, especially prior to 1996 when industry coding is less consistent. The issue arises when comparisons are made with other countries that have better hours worked data and so chose this as the basis of their official productivity measure, as in Australia. With the OECD using hours worked, New Zealand (but not Australia) runs into problems when comparing economy wide and measured sector labour input data.

***Table 3** – Labour input growth from 1988 to 2008 in New Zealand and Australia*

Annual average % changes	**New Zealand**	**Australia**
	1988-2008	**1988-2008**
Economy-wide		
OECD	1.2% (Dec)	1.7% (Dec)
Labour force survey	1.3% (Mar)	1.7% (Jun)
Measured/market sector		
Official	0.3% (Mar)	1.1% (Jun)
Labour force survey	0.6% (Mar)	1.1% (Jun)

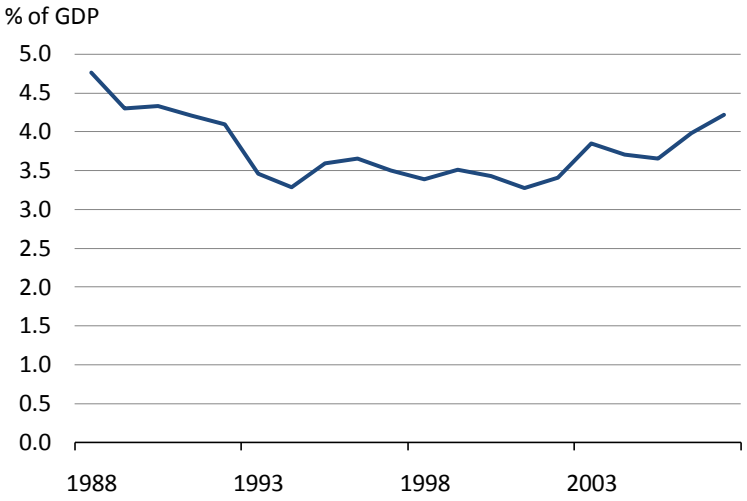
Notes: Measured/market sector here is as defined in Table 1. See date in brackets above for years used. Technically, the OECD figures are December years 1987-2007 but we have shown labour force survey for March/June years to be consistent with Table 2 (OECD use March years for New Zealand output and June years for Australian output but December years for both labour inputs).
Measured sector labour input growth is calculated from the index number published by Statistics New Zealand. The index number is derived using a chained Törnqvist index in which weights are based on industry wage shares of the measured sector nominal labour income. The actual hours paid series, which consistent with the Australian series is not weighted by labour income, grew by 0.4% from 1988 to 2008.

4.2 Financial Intermediation Services Indirectly Measured (FISIM)

FISIM are financial services that depositors and borrowers pay bank-type organisations for indirectly through the lender-borrower interest rate margin. These services are in the nature of security and convenience for depositors and liquidity and convenience for borrowers.

In New Zealand, total FISIM is treated as intermediate use rather than some of it being allocated according to use in final consumption, or exports. Instead, FISIM is measured as intermediate consumption in a nominal industry outside the measured sector. Figure 5 plots FISIM as a share of New Zealand nominal GDP. In current price terms, FISIM grew by 4.5% per annum, while total GDP grew by 5.2% per annum, from 1988 to 2007. In contrast, the ABS attributes FISIM to individual industries, exports, and final consumption. The use of FISIM for dwellings (household mortgages) is deemed to be intermediate usage and not final consumption (ie, it is an intermediate input into the output of owner-occupied dwellings). The Australian 'supply and use' tables for 2005 suggest that one-third of FISIM is in final consumption and two-thirds is for intermediate use (including that used by owner-occupied dwellings).

Figure 5 *– FISIM as a share of New Zealand GDP (current prices) 1988-2007*



The current treatment of FISIM has three effects for New Zealand's GDP and productivity estimates:

- It reduces the level of GDP and economy-wide productivity, as all FISIM is counted as an intermediate input, as opposed to final consumption.
- It inflates the level of output and productivity in the measured sector, as not all intermediate use is accounted for in calculating value added.
- It reduces the level of output and productivity in the non-measured sector, where all intermediate use is recorded and scored as a negative (except where the non-measured sector is defined to exclude it as in Table 2).

If New Zealand allocated one third of FISIM to final consumption in 2005, the level of current price GDP would have increased by 1.2%. Overall, the effect of FISIM on GDP and productivity growth will depend on the actual allocations. There are plans to

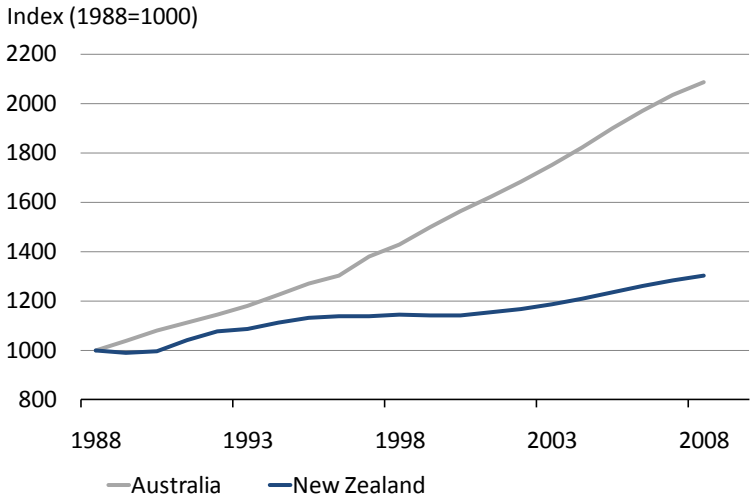
allocate FISIM in the near future in accordance with the System of National Accounts 1993 (SNA93).

4.3 Residential dwellings

Residential dwellings yield services that are part of GDP. Under SNA93, imputed rents of owner-occupied dwellings (OOD) are included in the National Accounts so that GDP is not affected by relative shifts in the size of the owner-occupied and rental housing sectors. The size of the output is relatively large, with housing services consumed by owner-occupiers in New Zealand comprising 8.7% of GDP and those in Australia 8.9% of GDP from 1990 to 2007 as in Table 1.

Figure 6 below uses each countries' chosen methodology for residential dwellings. Over the 1988 to 2008 period the reported expansions are around 100% and 25% for Australia and New Zealand respectively. Given that both countries experienced long housing booms during the 1998 to 2008 period and that rates of owner-occupation have not changed dramatically, the large difference in these growth rates suggests that differing measurement methodologies may be part of the explanation.

Figure 6 *– Output growth in residential dwellings 1988-2008*



The approaches are similar in many respects, although there are fundamental differences which appear to cause significantly different growth rates over time.

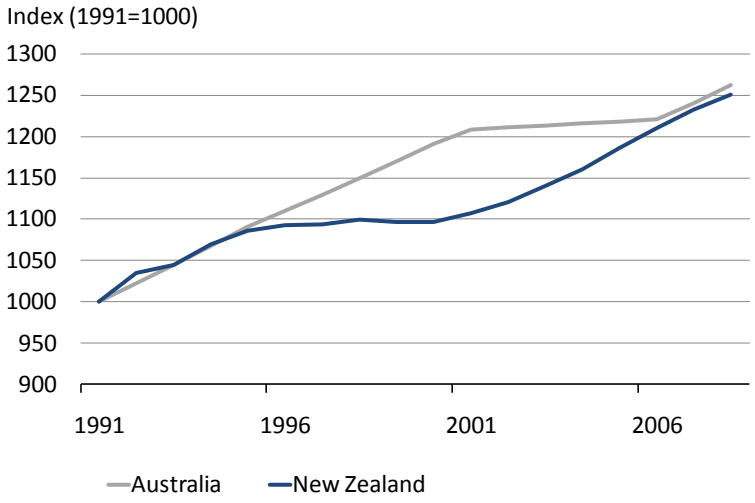
When calculating gross output, Statistics NZ uses the five-yearly Census to benchmark dwelling numbers for owner-occupiers, and demography estimates are used to interpolate between Census years. These totals are multiplied by an average rental price to calculate current price gross output. This average rental price is also benchmarked to the Census. It is the volume indicator – essentially growth in Census owner-occupied dwellings – which is of importance. The ABS approach is similar, in that the Census is used as a benchmark. Interpolation between the five-yearly points is achieved by utilising movements in the productive capital stock of residential buildings owned by the household sector. While this interpolation technique is different to that of Statistics NZ, it is unlikely to create long-run divergences in growth rates between the two countries. The derivation of intermediate consumption is similar in

both countries - that is, a current price measure is deflated using an appropriate producer price index.

However, there are two fundamental differences in the approaches. Firstly, the ABS 'ownership of dwellings' industry in the national accounts covers not only owner-occupiers, but also private rental dwellings. In the New Zealand National Accounts, private rental dwellings are included within the property services industry. While this has an impact on the relative size of the ownership of dwellings industry in the two countries, the impact on growth rates is less obvious and not thought to be significant. In fact, in volume terms owner-occupied dwellings have grown at 3.7% annually in Australia from 1988–2008, while private rental dwellings have grown at 3.0% annually. Owner-occupied dwellings comprise approximately 75% of the aggregate.

Secondly, the Statistics NZ gross output volume measure is essentially the growth in the number of owner-occupied dwellings. The ABS use this as a starting point and supplement it with a quality index, which uses number of bedrooms and region location as proxies for quality. The Australian line in Figure 6 above reflects this quality component. However, Figure 7 strips out the quality component and simply reflects increases in the *number* of dwellings in each country. Over the 17 years from 1991–2008, the growth rates have been very similar, at 1.4% annually for Australia and 1.3% for New Zealand. As noted above, the Australian series incorporates private rentals as well as owner-occupiers.

Figure 7 *– Growth in number of residential dwellings 1991-2008*



In conclusion, the difference between Figure 6 and 7 indicates that quality adjustment accounts for the trans-Tasman difference in the growth of ownership of dwellings. The Statistics NZ approach, if used in Australia, would lower economy-wide labour productivity growth by approximately 0.15% per year.

4.4 Property and business services

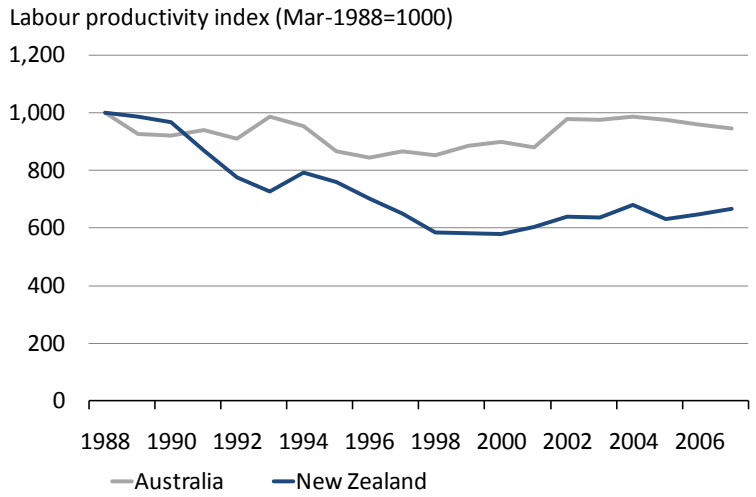
'Property and business services' is a relatively large industry at around 14% of New Zealand GDP and around 12% of Australian GDP. This is a diverse industry and in New Zealand can be broken down into two working industries:

- Industry ‘LA’ includes: residential property operators; commercial property operators and developers; real estate agents; investors in intellectual property and other non-financial assets; and machinery equipment hiring and leasing.

- Industry ‘LC’ (Business services) includes: scientific research and technical services; computer services; legal and accounting services; and other business services.

From 1988 to 2008, business services contributed about 55% of the aggregate value added of property and business services. Figure 8 plots the HLFS based labour productivity proxy series for property and business services and suggests that this industry could be a major part of the non-measured sector productivity puzzle, either due to real differences in productivity performance or simply different measurement.

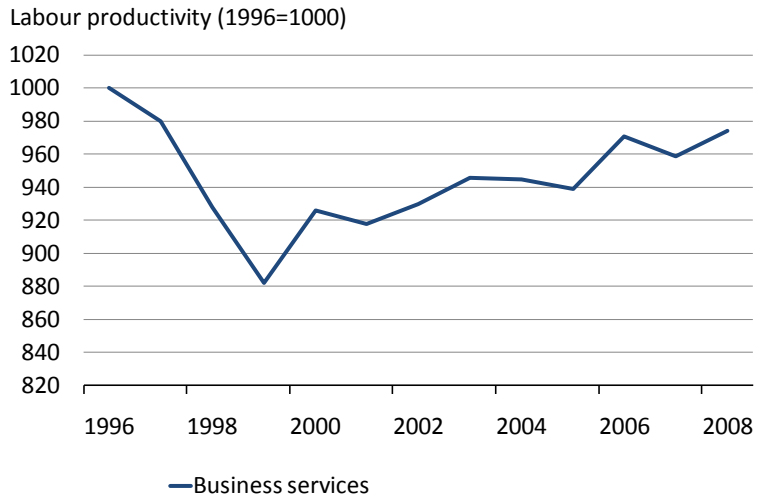
Figure 8 *– Property and business services labour productivity*



Importantly, prior to 1996, inputs in Business services are not distinguished independently from outputs in the Statistics NZ National Accounts. Business services are now included in New Zealand’s wider official measured sector from 1996, but not in Australia’s market sector. The official Statistics NZ series in Figure 9 below shows a similar picture to the HLFS-based series used in Figure 8, apart from the decline continuing for one more year, through to 1999.

There is some international evidence indicating low labour productivity growth in the business services industry – output growth is strong by economy-wide standards, but labour input growth is just as strong. Kox, van Leeuwen, and van der Wiel (2007) build on earlier work indicating that the cause of sluggish productivity growth is due to scale sub-optimality. The evidence suggested that the overwhelming majority of firms in the industry operated at a level where potential scale economies are left unexploited. The increasing contracting out of activities to firms in business services from firms in other sectors may also explain this underperformance if labour input is being attributed to business services but output is being mis-attributed.

***Figure 9** – Business services labour productivity*



4.5 Government administration and defence, Education, and Health

Three of the five industries outside the Statistics NZ former measured sector consist of goods and services produced mainly by government, with the role of the private sector varying between New Zealand and Australia (eg, in education). These industries (M, N, and O as shown in Table 1) are 'Government administration and defence', 'Education' and 'Health and community services'. Combined they comprise around 14.6% of GDP in New Zealand and 15.1% of GDP in Australia. Statistics NZ is undertaking work to include 'Education' and 'Health' into the measured sector. There are no plans to include Government administration and defence.

Measuring outputs in government industries is a serious challenge (the measurement of inputs is relatively straightforward, although far from trivial). First, government outputs are mainly services whose quantity let alone quality are inherently more difficult than goods to track and measure. Second, most government services are free at the point of use and do not have market prices associated with them. So the use of prices as weights to aggregate volume series of different outputs within an industry is unavailable.

SNA93 encourages direct measurement of the actual volume of goods and services produced in government industries, while recognising that this is not always practical given currently available data. In their absence SNA93 acknowledges that national income statisticians may have to proxy outputs by using deflated expenditure on inputs (labour, capital, and intermediate consumption). This is sometimes referred to as the 'output = inputs' approach. Given that the growth of productivity is the growth of output less the growth of inputs, this proxy method would clearly give productivity growth measures a value of zero regardless of the economic reality. The output = input approach is used in Government administration and defence.

From the 1990s, Statistics NZ and the ABS have progressively introduced direct output measures for significant parts of the government sector, for example in health and

education. Statistics NZ produces output indexes of health and education services that feed into the measurement of aggregate output in the national income accounts.

The reality is that within the government industries, the extent and quality of direct volume measurement is variable. For example coverage is broader in education compared with health. Health outputs in New Zealand that are measured are hospital in-patient and day-patient services. Together they comprise only around 31% of total Ministry of Health expenditure (with out-patient and long-term care absorbing around 34% and 20% respectively of the remainder).[10] So for nearly 70% of government health expenditure[11], the output = inputs methodology is still the main method of estimating the contribution of health to overall output in the national accounts.

In the case of education, Statistics NZ uses roll numbers as the main volume measure of output for the early-childhood, primary, and secondary sectors, and full-time student equivalents in the tertiary sector. Roll numbers are less than ideal for early-childhood education, where international best practice is to use actual pupil-hours. At school, best practice is to adjust raw pupil numbers for attainment and at tertiary best practice is to use course credits as the output measure.

The current New Zealand National Accounts treatment of education therefore falls short of international best practice, with a 2006 Eurostat and OECD survey of methods of National Accounts estimates of outputs for education services putting New Zealand in an intermediate category along with Australia.[12]

***Table 4** – Output measures in education*

Quality adjusted quantity measure	Austria, France, Hungary, Italy, Latvia, Lithuania, Malta, Spain, Sweden, UK
Quantity measure only, no quality adjustment	**Australia**, Belgium, Czech Republic, Finland, Germany, Greece, **New Zealand**
Output=inputs	Canada, Denmark, Japan, Korea, Luxembourg, Switzerland, US

Source: OECD

Input measures for labour, capital, and intermediate consumption in government industries are less contentious than for outputs. The methods and challenges for calculating them appear to be generally within the range of those for industries within the measured sector. As described above, Statistics NZ uses a variety of data sources to calculate its preferred labour input series by industry within the measured sector. Such series do not yet exist for the government and non-government industries outside the measured sector.

Table 2 uses measures of hours worked from the HLFS to calculate labour productivity series for industries outside the measured sector, including the three government dominated industries. Statistics NZ note that the quality of industry coding prior to 1996 (and the introduction of ANZSIC) is less robust and the three government industries display some marked changes in labour input in the early 1990s. This suggests combining them into a single government dominated sector, as is done in Table 5 and Figure 10.

[10] See Statistics NZ (2010), section 6.2.4.

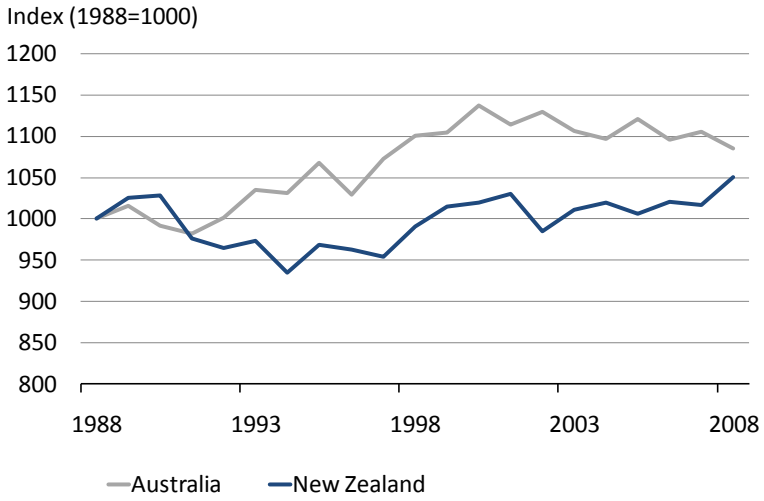
[11] The outputs of private health services such as those funded by private insurance and delivered in private hospitals do generally get measured independently of output.

[12] For more detail on measuring education output in New Zealand see Statistics NZ (2010), Chapter 7.

Table 5 *– Average annual growth rates in government administration and defence, health and education 1988–2008*

	Australia	New Zealand
Output	2.9	2.6
Labour input	2.4	2.5
Labour productivity	0.5	0.1

Figure 10 *– Government administration and defence, education, and health services labour productivity 1988-2008*

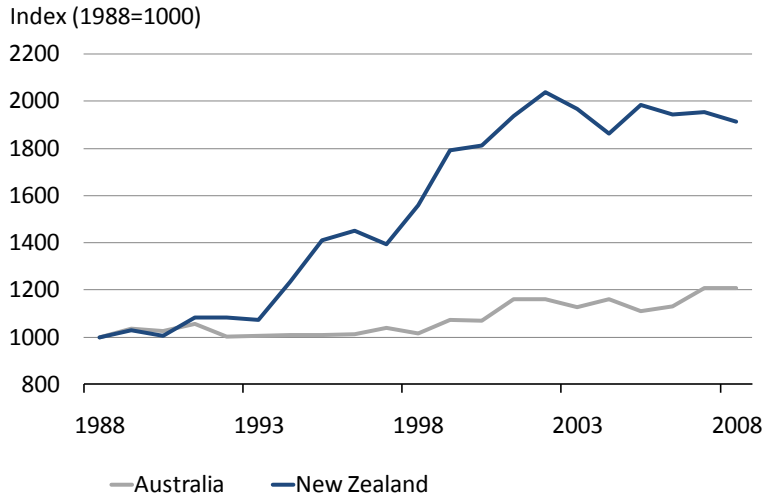


Notwithstanding the likely trans-Tasman difference in the roles of the public and private sectors in these industries, labour productivity growth across the 1988 to 2008 period was higher in Australia. However, given the issues around the robustness of HLFS industry data in the earlier part of this period, there is a case for treating the post-1996 estimates as having greater reliability. In the post-1996 period labour productivity in the New Zealand aggregate grows at 0.7% per year, with Australia at 0.4%.

4.6 Personal and other community services

The last of the five other industries outside the former measured sector is 'Personal and other community services', which includes a variety of activities (eg, hiring of personal and household goods; hairdressing; religious organisations; business, professional and labour organisations). This is a relatively small industry at around 1.4% of GDP in New Zealand and 2% of GDP in Australia. This industry is in the current official Statistics NZ measured sector from 1996. Figure 11 plots the unofficial productivity data for the ABS (GDP / LFS hours worked, under ANZSIC93) and an unofficial series for New Zealand (GDP / HLFS hours worked).

Figure 11 *– Personal and other community services labour productivity 1988-2008*



5. Industries within the former measured sector

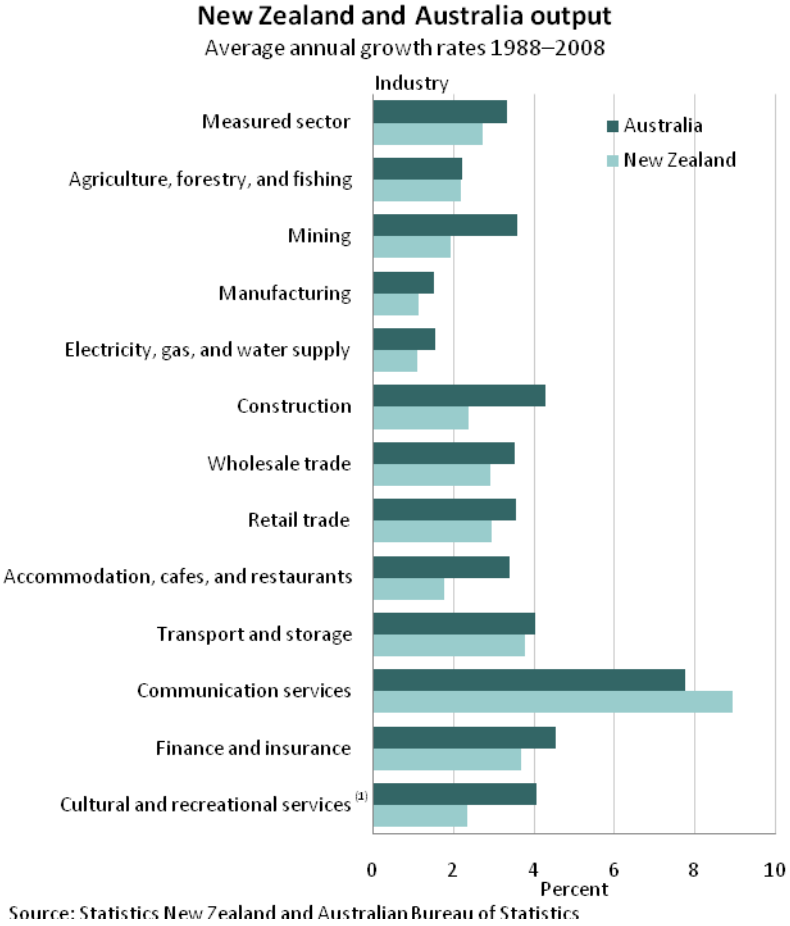
Overall, the reconciliation of the economy-wide versus measured sector labour productivity puzzle requires a detailed examination of the inputs used to calculate productivity (in this paper we focus on labour) and of the industries outside the measured sector. The non-uniform labour productivity growth across the non-measured industries, some of it measurement and some real, suggests the possibility of trans-Tasman industry differences *within* the former measured – even if the aggregate growth rates are similar.

This section focuses on New Zealand versus Australia measured sector industry growth comparisons (see Statistics NZ, 2010). Consistent with the earlier sections, comparisons are made over the 1988 to 2008 period, for output, labour input and labour productivity. The one exception to this is the Cultural and recreational services industry (division P in Table 1) – due to the availability of industry data in New Zealand, average growth rates in both countries cover the 1996–2008 period only.

From 1988–2008, measured sector output increased by 2.7% annually in New Zealand, and by 3.2% in Australia. For both countries, output was higher in all measured sector industries in 2008 than it was in 1988. Australia's output growth was higher in 11 industries, with just communication services growing faster in New Zealand. In the agriculture, forestry and fishing industry, both countries had very similar average annual growth rates.

Australia's strongest performing industries relative to New Zealand were mining and construction. The mining industry recorded growth of 3.6% annually in Australia, compared with 1.9% in New Zealand. Growth in the construction industry was 4.3% and 2.4%, in Australia and New Zealand, respectively. From 1988–2008, Australia's fastest-growing industries were communication services, finance and insurance, construction, and cultural and recreational services. All grew at more than 4% per year over their respective time series.

Figure 12

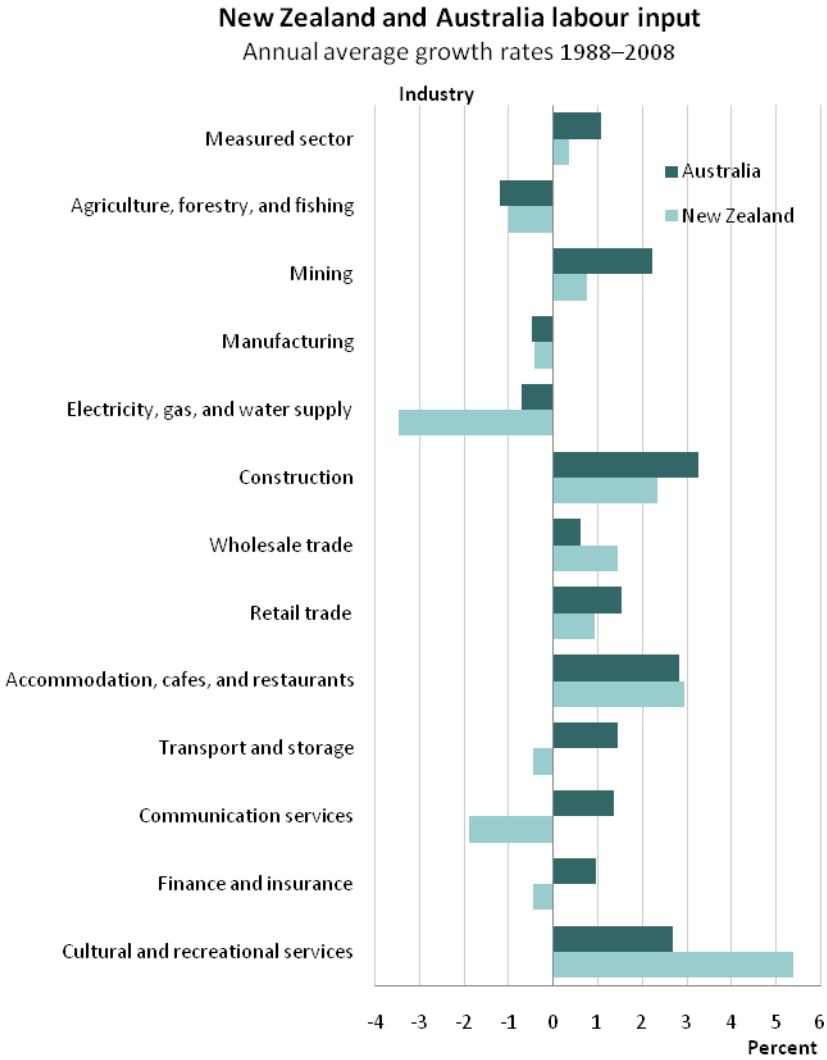


From 1988–2008, measured sector labour input in New Zealand grew by just 0.3% annually, compared with 1.1% in Australia. In New Zealand, labour input fell in six of the industries, while rising in the other six. This compares with Australia, where labour input declined in just three industries. Of these three – electricity, gas and water supply; manufacturing; and agriculture, forestry and fishing – labour input also declined in New Zealand.

The three fastest growing industries were common to both countries, although ordered differently. These were cultural and recreational services (top in NZ but only from 1996 and third in Australia), accommodation, cafes, and restaurants (second in both NZ and Australia), and construction (third in NZ and top in Australia).

From 1988–2008, measured sector labour productivity in New Zealand grew by 2.4% annually, compared with 2.2% in Australia. However, there were some marked differences at the industry level (see figure below). In both countries, the communications services industry was comfortably the strongest performer, growing at 11.0% per year in New Zealand, and 6.3% per year in Australia.

Figure 13



Source: Statistics New Zealand and Australian Bureau of Statistics

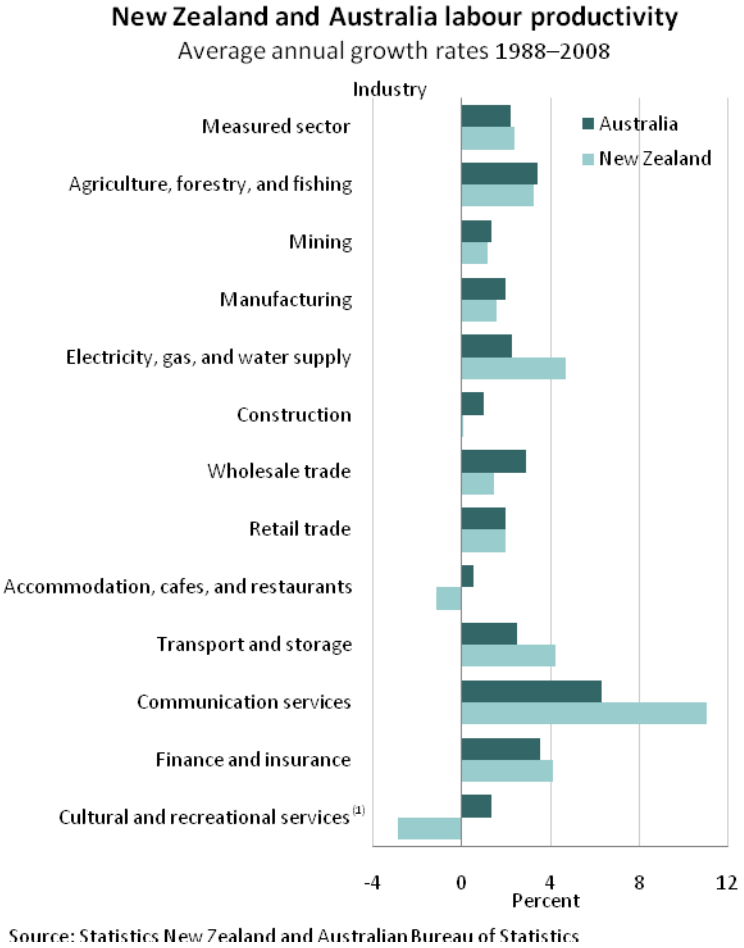
The other industries in which New Zealand outperformed Australia were electricity, gas, and water supply; transport and storage; agriculture, forestry, and fishing; and finance and insurance. Aside from electricity, gas, and water supply in Australia, these industries were among the strongest performers in both countries. That is, New Zealand's labour productivity performance was strong in these industries, but Australia's was still above its measured sector average.

Industries in which Australia outperformed New Zealand were agriculture, forestry and fishing; mining; manufacturing; construction; wholesale trade; retail trade; accommodation, cafés, and restaurants; and cultural and recreational services. As expected, these were the lowest-performing industries in New Zealand, all below the measured sector average of 2.4% with the exception of agriculture, forestry and fishing.

As noted above, three of these industries were the fastest growing in terms of labour input in both countries – cultural and recreational services; accommodation, cafes and

restaurants; and construction. In both countries, all three recorded weak productivity growth, or falling productivity.

Figure 14



Despite manufacturing productivity growth being lower than the measured sector average in both New Zealand and Australia, it is easily the highest weighted industry in the measured sector, and therefore contributes strongly. Other key contributors in New Zealand are those industries which have had the highest growth rates – communication services; agriculture, forestry and fishing; transport and storage; and finance and insurance. All have contributed more than 0.3% annually to productivity growth. In Australia, the industry drivers are slightly different. Finance and insurance is a key contributor, but this is followed by wholesale trade and retail trade, both contributing more than 0.25% annually to growth.

6. Conclusions

Productivity statistics for the measured sector have been published by Statistics NZ since 2006, with the current version of the measured sector covering around 74% of the economy. Use of the same industrial classification system, as well as similar, internationally-accepted methodologies for measuring productivity, allows for official New Zealand and Australian productivity data to be compared across 12 broad

industries. These industries constitute a 'former' measured sector that accounts for approximately 60% of both the Australian and New Zealand economy.

The OECD publishes economy-wide productivity statistics for all its member countries. Both countries' economy-wide labour productivity growth performance is lower than their official measured-sector performance, and this is especially so in New Zealand.

In the case of the productivity puzzles, the existence of alternative data sources and methods creates a trade-off between what is optimal for official national productivity statistics and what is required for consistent cross-country comparisons. There is generally less of a trade-off in the case of output, but much more of one with labour input. The role of capital in explaining the puzzles, particularly in the context of multifactor productivity growth, is subject to further analysis. Trade-offs are also created by the varying quality of data sources over time (especially prior to 1996 for New Zealand), as well as methodological choices made by statistical agencies (eg, quality treatment of residential dwellings). Our main findings and suggestions for further analysis include:

- It appears that the choice of labour input does make a small contribution to the productivity puzzle. For example, over the period 1988-2008, use of HLFS hours worked for measured sector labour input in New Zealand reduces measured sector labour productivity growth from 2.4% to 2.2%. This is equivalent to Australia and so removes a part of the puzzle, at least over this particular time period.

- The effect of FISIM on productivity growth will depend on the actual allocations.

- In the case of residential dwellings the different methodologies adopted by Statistics NZ and the ABS regarding quality adjustment contribute to the puzzle. The Statistics NZ approach, if used in Australia, would lower economy-wide labour productivity growth by approximately 0.15% per year.

- Of the five non-measured sector industries, 'Property and business services' and an amalgam of 'Government administration and defence, Education, and Health' have lower (unofficial) labour productivity growth in New Zealand over the period 1988-2008. Because these industries make up the bulk of the non-measured industries they contribute a large part of the puzzle over this period. However, if we focus on the period where the data is more robust, that is from the mid-1990s, the differences are less marked though worth further investigation.

- The new industry-level productivity dataset allows for robust growth comparisons with Australia at the industry level, including a growth accounting decomposition that is currently unavailable for the non-measured industries.

- A complete analysis of productivity performance and puzzles would supplement the existing growth rate work with more official information on levels, including capital intensity, across more industries.

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