



## Productivity growth and its importance

### **The economic concept of productivity**

- 2.1 Productivity is the measure of production efficiency.<sup>1</sup> At a national level it captures the economy's ability to 'harness its physical and human resources to generate output and income'.<sup>2</sup> Productivity growth refers to an increase in the value of outputs produced for a given level of inputs, over a given period of time.
- 2.2 The Australian Bureau of Statistics (ABS) explained:
- In a very general sense, the best way to think about productivity is by thinking of production. You can have increased production from an increase in inputs, you can have increased production due to a more efficient use of those inputs or a combination of both of those things. In a growth accounting framework you can in simple terms measure productivity by looking at the ratio of output to one or more inputs. When you decompose it, in a sense, productivity is actually the residual of that calculation.<sup>3</sup>
- 2.3 The main theoretical approach to studying productivity is based on 'formal growth theory', where output growth is expressed as a function of growth in inputs and growth in the efficiency with which inputs are transformed into outputs.

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1 Productivity Commission (PC), *Submission no. 20*, p. 1.

2 PC, *A Quick Guide to the Productivity Commission*, 2009. p.1.

3 Mr J Russo, Australian Bureau of Statistics (ABS), *Transcript*, 23 October 2009, p. 21.

- 2.4 Different approaches to calculating productivity growth can be used, with the 'neoclassical' model treating growth as *exogenous* (based on capital accumulation and national savings); and 'new growth theory' incorporating growth as *endogenous* (through technical change, research and development and capability building activities).
- 2.5 Productivity as a component of economic growth models did not surface until the post Second World War era.<sup>4</sup> As such it was not closely monitored as an economic measure until the 1960s, coinciding with a time when Australia's productivity growth was relatively rapid.
- 2.6 During the 1980s, economic policy direction in Australia embraced the 'new growth theory'. This was characterised by the endorsement of competitive and flexible markets as the means to securing the most productive use of the nation's resources. The movement to economic management through new growth theory was based on the belief that this would deliver the economy a growth dividend and better living standards.

## The components of productivity

- 2.7 There are three commonly used measures of productivity:
- Partial Factor Productivity (PFP) – examples are capital productivity (measured as GDP per unit of capital)<sup>5</sup> and labour productivity. Labour productivity is the most used PFP measure. It is usually measured as the *volume* of output per *hour* worked.<sup>6</sup> Other measures of labour productivity used (mainly for international comparisons) include the *value* of output (GDP) per *employee* or per *capita*. Estimating labour productivity is a relatively straightforward exercise. The PC notes three reasons for this:  
  
...it is easier to measure as it avoids the need to estimate capital inputs and avoids the need to aggregate capital estimates and hours worked... a rough measure of labour productivity for the entire economy can easily be obtained by dividing GDP by official estimates of total hours worked in the economy (there are no official estimates of capital inputs for the whole economy)...and it

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4 The Harrod-Domar model, developed between 1939 and 1946, first included productivity as a component of economic growth. The model was refined and independently published in 1956 by American economist Robert Solow and Australian economist Trevor Swann.

5 ABS, *Submission no. 16*, p. 2.

6 ABS, *Submission no. 16*, p. 2.

allows for a comparison of levels of labour productivity (value added per hour worked) between different parts of the economy or between different economies.<sup>7</sup>

- Total Factor Productivity (TFP) – this is a true measure of productivity which encompasses all the factors of the productivity equation. As it is very difficult to measure all the factors of productivity a proxy measure was developed to take account of multiple factors, but not all factors. This is known as *multifactor productivity*.
- Multifactor productivity (MFP) – the volume of output from a bundle of both labour and capital inputs. Estimating MFP is a complex exercise. In simple terms, it involves the construction of three separate indexes for labour, capital and output. The contributions of labour and capital are weighted according to their respective input contributions, usually measured in value of payments to the factors of production. The calculation of productivity growth is the residual of any difference between the level of output growth and the level of input growth.

2.8 Labour productivity is only a partial measure as it does not take account of the contribution of other factors of production. As such, it needs to be interpreted carefully as changes in labour productivity may reflect factors that are outside of workers' influence (for example, improved capital input).

2.9 MFP provides the better indicator of the overall improvement in an economy's efficiency, as it measures the growth in economic output above that directly attributable to growth in measured capital and labour inputs. In other words, MFP informs whether GDP growth originates from productivity growth or merely from increased inputs of labour or capital.<sup>8</sup> As such, it captures the influence of improvements in production-related factors such as skills, technology, and management practices that are not incorporated in official capital and labour measures. The Treasury states:

MFP reflects technological changes, as well as a range of non-technological factors such as industry and firm level adjustment, economies of scale and cyclical effects (OECD 2001a).<sup>9</sup>

2.10 While estimates of output and hours worked are published for the whole economy, productivity is only well-measured in the part the ABS calls the

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7 PC, *Submission no. 20*, p. 1.

8 ABS, *Submission no. 16*, p. 2.

9 The Treasury, *Submission no. 10*, p. 4.

‘market sector’. A detailed description of the market sector is at paragraph 2.58.

- 2.11 In these market-sector industries, prices are indicators of quality that can be used to compare the value of new goods and services to that of the old versions they replace. For industries outside the market sector – health, education, government administration and property and business services – it is more difficult to separate price changes from changes in the quality and quantity of services. In addition, the voluntary sector is not incorporated in official measures.
- 2.12 The proportion of the economy which falls within the non-market sector has grown considerably over the last twenty years. In 2008-09 the services sector comprised 72.3 per cent of GDP; whereas it was 63% of GDP in 1983-84. In contrast, the proportion of the economy in the market-sector which the ABS includes in national productivity growth calculations has declined since 1994-95, going from around 73 per cent of GDP to 62 per cent of GDP in 2008-09.<sup>10</sup>
- 2.13 For the purposes of this report productivity refers to MFP unless stated otherwise.

## **Productivity growth is not production growth**

- 2.14 Productivity is often confused with production. Productivity is the measure of how efficient the production process is, irrespective of the stand-alone quality or quantity of output, or the stand-alone quality or quantity of inputs in that production process. It is a relative concept and can only be determined when assessing per unit output derived from per unit inputs in the production process.
- 2.15 This means that productivity will rise when inputs in the production process are optimally utilised to achieve greater levels of output. Achieving productivity gains is therefore not equivalent to working longer (eg longer labour hours) as this will result in a measure of greater inputs for every output. Nor does it necessarily correlate with higher volumes of outputs – as inputs could be increasing at the same or greater pace.

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10 PC, *Submission no. 16.1*, p. 3.

## Productivity levels versus productivity growth rates

- 2.16 Similarly, productivity levels are sometimes confused with the rate of growth of the productivity level. The calculation of both labour productivity and MFP provides estimates of the *level* of productivity. Analysis of trends in productivity levels tends to focus on *growth* rates.
- 2.17 Year-to-year changes in productivity growth can be volatile (reflecting changes in market conditions or the influence of the business cycle) – as a result, most research focuses on longer-term comparative changes, such as business-cycle to business-cycle or growth over a decade.

## Productivity cycles

- 2.18 Snapshots of productivity growth between specific periods of time are referred to as productivity cycles. The last complete cycle ended in 2003-04 with productivity in that cycle averaging 1.1 per cent.<sup>11</sup> The current cycle, since 2004, is considered incomplete, but to 2007-08 it has recorded negative growth of -0.3 per cent.<sup>12</sup>
- 2.19 International measurement agencies follow the convention of using an arbitrary productivity period for comparison purposes. These are average growth rates between growth-cycle peaks, which are determined as peak deviations of the market sector MFP index from its long-term trend. Although productivity cycles of peak-to-peak productivity often correlate to the business cycle this is incidental to their determination. Productivity cycles cannot be determined until after the cycle is completed.
- 2.20 This practice has been criticised by Professor John Quiggin as creating distortions in the measurement of productivity growth:

Although much was made of the claimed productivity ‘miracle’ in the mid-1990s, these claims depended critically on the way in which the time series was divided into hypothetical ‘productivity cycles’.<sup>13</sup>

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11 ABS, *Australian System of National Accounts*, Cat. no. 5204.0, 2007-08, p. 43.

12 ABS, *Australian System of National Accounts*, Cat. no. 5204.0, 2007-08, p. 42. (The average of 2004-05 of -0.6 per cent, 2005-06 of 0.3 per cent, 2006-07 of -0.3 per cent and 2007-08 of -0.4 per cent.)

13 Professor J Quiggin, *Submission no. 28*, p. 1.

## The importance of productivity growth

- 2.21 An often quoted summary of the importance of productivity growth is that of distinguished US economist Paul Krugman:

Productivity isn't everything, but in the long run it is almost everything. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker. World War II veterans came home to an economy that doubled its productivity over the next 25 years; as a result, they found themselves achieving living standards their parents had never imagined. Vietnam veterans came home to an economy that raised its productivity less than 10 percent in 15 years; as a result, they found themselves living no better - and in many cases worse - than their parents.<sup>14</sup>

- 2.22 Productivity growth at an economy-wide level means more aggregate outputs per aggregate inputs, which translates to greater returns on total inputs, thus more income is available to share around. The ABS notes:

Key to long term improvements in Australia's living standards is productivity growth and therefore enhancing national productivity is one of the basic goals of economic policy.<sup>15</sup>

- 2.23 At an industry level, productivity growth can be important to allow the industry to compete with other sectors of the economy for resources (labour, capital and raw materials) and maintain international competitiveness.<sup>16</sup>

- 2.24 It is important to note, however, that some sectors of the economy have traditionally had low productivity growth but are vitally important to aggregate productivity growth, for example, the health and education sectors. The outcomes from these sectors become the inputs to all sectors in the form of skilled, educated and healthy workers. This is also a reminder that government policies which only focus on sectors exhibiting productivity growth could be at the detriment of supporting productivity growth as a whole. The Productivity Commission (PC) stated:

If policy were directed at moving and supporting high productivity sectors, you would find that you were not actually

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14 Krugman, P, *The Age of Diminished Expectations: US Economic Policy in the 1980s*, MIT Press, Cambridge, 1992, p. 9.

15 ABS, Submission no. 16, p. 2.

16 Master Builders Australia, *Submission no. 17*, p. 4.

supporting the sectors that in the long term were so important to wellbeing and living standards.<sup>17</sup>

- 2.25 At a firm level, productivity growth is important because it can allow the firm to remain competitive within the industry, through paying higher wages or returns to shareholders or to provide funds for investment.
- 2.26 Raising productivity has been a focus for governments over the last two decades, particularly with the transition to a more open economy as levels of protection have fallen, or have been removed and the greater flows of foreign capital and production links in the economy.
- 2.27 The importance of having robust national productivity has increased since the worldwide economic downturn and the emergence of new demographic and environmental challenges. The Chairman of the PC stated in evidence:
- It will also affect how well the country recovers from the impact of the global financial crisis as well as its capacity to meet longer term challenges such as population ageing and climate change.<sup>18</sup>
- 2.28 The challenges ahead for productivity growth are discussed in further detail in Chapter 5.

## Economic growth

- 2.29 The measure of production for an economy as a whole is gross domestic product (GDP). GDP is the sum, for a particular period, of the gross value added of all resident producers, where gross value added is equal to output (value of goods and services produced at economically significant prices) less intermediate consumption (value of goods and services consumed in the production process).<sup>19</sup>
- 2.30 Economic growth is measured by the change in the level of real gross domestic product from one measurement period to another.
- 2.31 Although Australia is still a relatively young country it is now a mature developed economy. It was, however, up until mid last century, subject to the developing industrialised economy pattern. This was characterised by a small population with steady population growth up until the post war 'baby boom era' coupled with an economy focussed on a rich endowment

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17 Mr G Banks, PC, *Transcript*, 23 October 2009, p. 6.

18 Mr G Banks, PC, *Transcript*, 23 October 2009, p. 2.

19 ABS, *Australian National Accounts: Concepts, Sources and Methods*, Cat. no. 5216.0, 2000, p. 20.

of natural resources. This led to very high economic growth in the 1950s and 1960s, with per capita growth rates around four per cent per annum.

2.32 However, an economy highly reliant on the production of commodities with relatively low income elasticities of demand may have difficulty maintaining very high levels of economic growth on that basis alone. This was the story in Australia in the late 1970s, early 1980s when real GDP started to fall and annual per capita growth rates fell to around two per cent.<sup>20</sup>

2.33 At an economy-wide level, the importance of continuing to achieve historically high rates of productivity growth can be seen in the difference between projections (and associated outcomes) in recent Treasury documents:

- The sensitivity of the budget bottom line of a negative scenario modelled as part of the 2009-10 Budget Papers – a combination of an equal 0.5 per cent decrease in the participation rate and in labour productivity, resulting in a 1 per cent decrease in real GDP by Year 2 – is to decrease in the underlying cash balance of around \$2.5 billion in Year 1 and around \$4.0 billion in Year 2;<sup>21</sup>
- The Australian Treasury forecasts that achieving long-term productivity growth of only 1.2 per cent to 2046-47 (below an historical rate of 1.75 per cent) would see a fall in income (GDP per capita) of almost 20 per cent. In contrast, achieving long-term productivity growth of 2 per cent to 2046-47 would see a rise in income (GDP per capita) of around 10 per cent.<sup>22</sup>

2.34 The historical average for labour productivity growth over the last three decades has been 1.6 per cent, which attributed to most of the increase in GDP over this time.<sup>23</sup>

## Living standards

2.35 Realising improved living standards or maintaining high living standards is the main reason why governments strive to improve economy-wide productivity growth.

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20 Steve Dowrick, *The Determinants of Long-Run Growth, Proceedings of a Conference – Productivity and Growth*, Reserve Bank of Australia (RBA), July 1995, p.12.

21 Budget Strategy and Outlook 2009-10, Budget Paper No. 1, The Treasury, p. 3-21.

22 The Treasury, *Intergenerational Report 2007*, p. 99.

23 The Treasury, *Intergenerational Report 2010*, p. 21. Also, The Treasury, *Submission no. 10*, p.3.



- 2.36 In order to improve or maintain living standards and maintain fiscal health, an economy must improve long-term economic growth. Productivity growth is one contributor of improved economic growth.
- 2.37 Per capita incomes across world regions, but particularly in Western Europe and Western off-shoots have risen dramatically over the last 60 years.<sup>24</sup> These increases were accompanied by other improvements in well-being and quality of life.<sup>25</sup>
- 2.38 What constitutes higher living standards is not clearly defined. This is because there are qualitative as well as quantitative factors involved. Therefore, it can be argued that increased income per capita may not necessarily equal higher living standards; and this can be further complicated by unequal distribution of wealth in the economy.
- 2.39 However, from an economic viewpoint, living standards are assessed by the ability of a country to produce or acquire the goods and services it demands, and this is mostly measured using GDP per capita. Although not a perfect measure of overall living standards, it is a quantifiable and internationally comparable approximation.<sup>26</sup> The ABS supported the quality of GDP as a measure, explaining that 'generally it is accepted as a reasonably robust and established measurement.'<sup>27</sup> Mr Davies emphasised the international comparability of the national accounts in that 'they are more widespread than electricity and telephone plugs'.<sup>28</sup>
- 2.40 There is also an argument for using GDP per capita to determine living standards because a country with higher GDP per capita will tend to have better social and environmental outcomes, ergo the wellbeing of its people will be high.<sup>29</sup>
- 2.41 Productivity growth is a critical factor in attaining high living standards; however other frameworks conducive to achieving high average incomes must also be in place.
- 2.42 One example of this is where a country has productivity gains without strong labour utilisation. This was summarised in a 2007 PC Staff Working

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24 RBA, 50<sup>th</sup> Anniversary Symposium, Sydney 9 February 2010, "Increased Understanding of Supply Side Economics", Anne O Krueger, Professor of International Economics, John Hopkins University, Ritch Professor Emeritus, Stanford University, Table 1, p. 32.

25 Including life expectancy increases of around 10 years in industrialised countries and a doubling of literacy rates.

26 Wellbeing and productivity measures are discussed in Chapter 8.

27 Mr M Davies, ABS, *Transcript*, 23 October 2009, p. 26.

28 Mr M Davies, ABS, *Transcript*, 23 October 2009, p. 26.

29 OECD, *OECD in Figures: Statistics on Member Countries*, Paris, 2002

Paper.<sup>30</sup> The paper noted that productivity growth in Norway in 2002 (abundant oil extraction production) was leading the productivity frontier, but that poor labour utilisation had reduced average welfare in the economy.<sup>31</sup> A number of other European countries also recorded stronger productivity growth than the US but the PC concluded that the US was more appropriately at the productivity frontier because it had productivity improvements through technological progress, not merely through policy or industry distortions. Professor Quiggin supported this view:

You see, for example, in the data that countries which score very well on productivity numbers often do not do so well on employment. What that suggests is that some of the more problematic participants in the labour force in all countries tend to be shunted out of the workforce. The more that happens, the more your measured productivity can increase, but that is obviously not a socially desirable way of proceeding.<sup>32</sup>

- 2.43 Dr de Brouwer of the Department of the Prime Minister and Cabinet supported the view that boosting productivity is not desirable where it comes at the expense of workforce participation:

Economists generally, and others, would say that the wellbeing of people is also enhanced by participating in society and participating in the workforce. There is a stronger sense of belonging, of social cohesion, that goes with that, and it is also important in its own right. So we would not use a very narrow metric of, 'Is it just increasing productivity?' There may be economic output increases from participation, which are important, but also the value of people – their sense of self-worth and their wellbeing – is also enhanced by that participation, and that is a broader measure. So that would certainly be in the national interest.<sup>33</sup>

- 2.44 The Treasury agree that workforce participation is indeed another component of achieving growth in living standards, as well as population growth. Their submission shows, however, that the contribution of labour

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30 Dolman, B, Parham, D, Zheng, S, *Can Australia Match US Productivity Performance?* PC Staff Working Paper, March 2007, p. 12

31 Dolman, B, Parham, D, Zheng, S, *Can Australia Match US Productivity Performance?* PC Staff Working Paper, March 2007, p. 12

32 Professor J Quiggin, *Transcript*, 19 November 2009, p. 18.

33 Dr G de Brouwer, Department of the Prime Minister and Cabinet, *Transcript*, 4 February 2010, p. 13.

productivity in Australia since 1977-78 has far exceeded the contribution of population and participation.<sup>34</sup>

- 2.45 Australia has experienced a favourable shift in the terms of trade over the past decade which has raised prosperity for Australians by delivering higher purchasing power. The question which has arisen is whether Australia can rely on favourable terms of trade (due mostly to our rich resource endowments) for future prosperity, or whether increasing productivity growth is required.
- 2.46 History reveals that changes in Australia's terms of trade between 1960 and 2004 have contributed less than five per cent to the increase in real income, yet real income over the same period has increased by almost four fold.<sup>35</sup> Productivity improvements during this time have been cited as the 'largest single source of improvements in real income followed by labour force increases and capital stock increases'.<sup>36</sup> The Chairman of the PC stated that over the past four decades MFP growth had 'directly accounted for over one-third of total real income growth in Australia, with the remaining growth attributable to growth in labour and capital and changes in the terms of trade, with the terms of trade being dominant in more recent times.'<sup>37</sup>
- 2.47 It must be borne in mind that a large part of this period was not characterised by the resources boom of the recent 'noughties' magnitude and that real income improvements in this century can be largely attributed to this. Income improvements through price effects reflect a cyclical trend rather than a structural trend and long-term growth depends on sustainability.

## Committee conclusion

- 2.48 Productivity growth is an economic concept derived from national accounting statistics designed to give a measure of efficiency in economic activity. It is not a concept which directly takes into account contributions outside the market sector. The committee notes that although unpaid

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34 The Treasury, *Submission no. 10*, p. 3.

35 W. Erwin Diewert, Denis Lawrence and Meyrick and Associates, *Measuring the Contributions of Productivity and Terms of Trade to Australia's Economic Welfare*, Consultancy Report, Report to the PC, March 2006, p. ix.

36 W. Erwin Diewert, Denis Lawrence and Meyrick and Associates, *Measuring the Contributions of Productivity and Terms of Trade to Australia's Economic Welfare*, Consultancy Report, Report to the PC, March 2006, p. ix.

37 Mr G Banks, PC, *Transcript*, 23 October 2009, p. 2.

productivity contributions are not identified in the productivity function they may be potentially reflected within the aggregate MFP measure in the 'unmeasured' component. Unpaid productivity growth contributions will be discussed in more detail in Chapter 7.

- 2.49 Healthy aggregate productivity growth means that an economy is making efficient use of its resources to produce a given level of outputs which therefore results in higher living standards. Productivity growth is vitally important in a developed economy to obtain strong economic growth (GDP growth) and thus high GDP per capita.
- 2.50 GDP per capita is the most internationally recognised measure of living standards. Although there is considerable debate over whether real GDP per capita is an appropriate measure for overall community wellbeing it is a widely recognised and comparable measure. OECD analysis has also found that higher GDP per capita tends to correlate with higher social and environmental living standards as well as higher income standards.
- 2.51 Whilst long-term productivity growth is very important for the future growth of an economy, it cannot be the only goal. There are other features of an economy which are necessary to lead to overall improvements in prosperity and distribution of that wealth.
- 2.52 Australia is heading into an era where economic resources will become ever more constrained and need to be utilised in a smarter way. Australian businesses must be vigilant to ensure underlying firm productivity is robust, and all levels of government should ensure policies encourage aggregate productivity growth. This is because long-term prosperity relies on 'achieving more with a given quantity of resources, or equivalently achieving constant results with a lower resource footprint.'<sup>38</sup>

## **The official productivity measures**

### **What they are designed to measure**

- 2.53 Official productivity estimates are designed to measure productivity in the income generating economy. They are, as the ABS pointed out at a public

hearing in October 2009, 'economic statistics'.<sup>39</sup> Mr Don Brunker of the PC reinforced this fact:

I think it is also worth stepping back and recognising that productivity measures try to serve a particular purpose, and the particular purpose is about efficiency within business organisations. They were never really designed to give us an understanding of how well the community in aggregate is going, although they are clearly a very important ingredient to that.<sup>40</sup>

- 2.54 The ABS official productivity measure is derived from statistics 'compiled on the basis of the standard growth accounting framework, which is widely adopted by leading statistical agencies and recommended by the OECD.'<sup>41</sup> The Australian System of National Accounts 'provides a record of Australia's economic wealth and the changes to that wealth brought about by economic activity.'<sup>42</sup> It is important to note this economic measure is only an estimate. For example, when experimental data is included, a different result is achieved.

## The ABS methodology

- 2.55 The ABS adopts a productivity measurement methodology based on *neoclassical* economic theory. The ABS calculates single factor productivity estimates (for labour and for capital)<sup>43</sup> and also multifactor productivity estimates. The calculation of MFP itself is a relatively straightforward exercise once separate indexes for output growth, labour growth and capital growth have been constructed; however, the calculation of the capital component is complex.
- 2.56 Once the separate indices are obtained the relative weights for the contribution of labour and capital are taken by the income shares of these factors of production.

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39 Mr M Davies, ABS, *Transcript*, 23 October 2009, p. 23.

40 Mr D Brunker, PC, *Transcript*, 23 October 2009, p. 16.

41 ABS, *Submission no. 16*, p. 1.

42 ABS, *Australian National Accounts: Concepts, Sources and Methods*, Cat. no. 5216.0, 2000, p.12.

43 A measure of real output per unit of labour is conventionally referred to as labour productivity. The measure of labour input used is hours worked. Measures of real output per unit of capital are referred to as measures of capital productivity. The capital input measure used is the flow of capital, which is calculated by weighting chain volume measures of the productive capital stock of different asset types together using their rental prices as weights.

- 2.57 The ABS calculates productivity estimates in 12 of 20 industry areas as recognised by the Australia and New Zealand Standard Industrial Classification 2006 (ANZSIC06) system.<sup>44</sup>
- 2.58 The majority of industries included in the 'market sector' are those which have satisfactory estimates of the growth in the volume of output. As such, industries where economic values cannot be readily assigned to outputs are excluded (for example, government services). The market sector comprises the following 16 industries (Categories A-N and R-S):
- Category A: Agriculture, forestry, and fishing;
  - Category B: Mining;
  - Category C: Manufacturing;
  - Category D: Electricity, gas, water and waste services;
  - Category E: Construction;
  - Category F: Wholesale trade;
  - Category G: Retail trade;
  - Category H: Accommodation and food services;
  - Category I: Transport, postal and warehousing;
  - Category J: Information media and telecommunications;
  - Category K: Financial and insurance services;
  - Category L: Rental, hiring and real estate services;
  - Category M: Professional, scientific and technical services;
  - Category N: Administrative and support services;
  - Category R: Arts and recreation services; and
  - Category S: Other services.
- 2.59 Industries excluded from the market sector are (Categories O-Q and T):
- Category O: Public administration and safety;
  - Category P: Education and training;

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44 Prior to December 2009 the ABS used ANZSIC93, which contained 16 industry categories, 12 of which were represented in the official productivity estimates. The move to ANZSIC06 reflects the growing influence of services industries in the Australian economy; the market sector now including categories L, M, N and S. ABS, *Supplementary submission no. 16.1*, p. 1.

- Category Q: Health care and social assistance; and
  - Category T (special industry category): Ownership of dwellings.
- 2.60 The ABS does not present MFP measures for industries excluded from the market sector because the volume estimates of gross value added are derived using a method in which input data are used as measures of output. As a result, meaningful productivity measures cannot be derived for these industries at present. The ABS noted the limitations in calculating output where there is no market value transaction:
- The basic set of output measures that we use in our economic statistics are based around actual monetary transactions – people putting their hand in their pocket and paying for things. Our basic concept of a transaction is the amount someone has parted with in order to receive the good or service.<sup>45</sup>
- 2.61 Of the 16 industries included in the market sector four categories are excluded from the official productivity estimates. These include industry categories L, M, N and S. The official MFP market sector therefore includes categories A-K plus category R.
- 2.62 In 2008-09 the ABS released experimental estimates for an expanded market sector which included these four sectors with a time series dating back to 1994-95.<sup>46</sup> These estimates will be incorporated into the Australian System of National Accounts in 2010. The impact of this will be discussed in Chapter 4.
- 2.63 The ABS derives its estimates of MFP for the market sector by forming a combined chain volume measure (using constant price estimates)<sup>47</sup> of labour and capital inputs and dividing it into the chain volume measure of the gross value added of the market sector (the output of the market).

### Measuring the individual components of MFP

- 2.64 Capital is measured on the basis of the 'flow' of services from the capital stock, with the flows weighted by a rental value, somewhat analogous to the concept of depreciation in an accounting profit and loss statement.

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45 Mr M Davies, ABS, *Transcript*, 23 October 2009, p. 24.

46 ABS, *Supplementary submission 16.1*, p. 2.

47 The ABS computes chain volume measures by linking together movements in volumes, calculated using the average prices of the previous financial year, and applying the compounded movements to the current price estimates of the reference year.

2.65 The single index of capital services derived to calculate MFP is itself a combination of 13 separate indexes covering major asset types including machinery, computer software and inventories over the market sector industries. An aggregate chain volume measure of capital services for the whole market sector is then weighted with a measure of hours worked using estimates of capital and labour income as weights.

2.66 The ABS note that estimates of capital services productivity is the most unreliable productivity estimate:

Of all the constituents of the MFP measures, capital input poses the most problems. A major weakness of the estimates of capital services stems from the uncertain quality of the data used in their construction, such as mean asset lives and asset life distributions.<sup>48</sup>

2.67 Constructing capital input indices is very complicated and relies on assumptions which are not universally agreed. The ABS states:

The construction of capital stock series, based on some cumulated function of past investment expenditures (the so called perpetual inventory model (PIM)), critically depends on the availability of constant quality price indexes and assumptions regarding the capital decay process.<sup>49</sup>

2.68 Just one example of the detailed calculations in capital stock indices is the required finessing of rental values for tax and tax incentive/allowance impacts applicable to different capital equipment, in different industries.

2.69 Due to the inherent issues in calculating the capital service index, the ABS is currently reviewing its methodology and is also developing ways to capitalise research and development expenditure into the index.<sup>50</sup>

2.70 In contrast, calculating the labour index is relatively uncomplicated. Estimates for hours worked are derived as the product of employment and average hours worked. Using an index of hours worked provides a better measure of labour input than using employment, because hours worked captures changes in overtime worked, standard weekly hours, leave taken, and changes in the proportion of part-time employees.<sup>51</sup>

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48 ABS, *Australian National Accounts: Concepts, Sources and Methods*, Cat. no. 5216.0, 2000, p. 365.

49 ABS, *Submission no. 16*, p. 4.

50 ABS, *Submission no. 16*, p. 5.

51 However, changes in the skill level of the labour force are not captured in hours worked, and so are reflected in the productivity estimates. To obtain a measure of productivity that excluded the effect of changing skill levels, it would be necessary to adjust hours worked for changes in the quality of the labour force.



## Productivity growth measurement—statistical limitations

2.71 As noted earlier, estimating productivity, particularly MFP, is complex and subject to a number of measurement issues. Estimates are also based on a number of underlying theoretical assumptions that may not necessarily reflect the nature of production processes.

2.72 The ABS note that caution needs to be exercised in interpreting productivity measures which are derived as a residual and are therefore subject to any errors in the output and input measures. Furthermore, because productivity growth is comparatively low, such errors assume relatively greater importance with respect to productivity estimates.<sup>52</sup>

2.73 The ABS also advise of the need to take a longer term view of MFP estimates, which are subject to the vagaries of the growth in the business cycle (as capacity utilisation varies so does MFP growth). The ABS note that:

Taking into account all of these factors, MFP estimates are probably most useful when computed as average growth rates between growth-cycle peaks, which are determined as peak deviations of the market sector MFP index from its long-term trend. In this way, most of the effects of variations in capacity utilisation and much of the random error are removed. However, average growth rates still reflect any systematic bias resulting from the methodology and data used.<sup>53</sup>

2.74 The volatility in short-term MFP can be seen in the recent incomplete productivity cycle with annual averages ranging from -0.6 to 0.3 per cent growth.<sup>54</sup>

2.75 The PC also stressed the business-cycle nature of productivity trends. In reference to a chart in their submission which depicted productivity growth cycles back to the mid-sixties Mr Terry O'Brien stated:

It is just a powerful reminder that productivity growth is intrinsically cyclical for reasons interactive with cycles in the broader economy.<sup>55</sup>

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52 ABS, *Australian National Accounts: Concepts, Sources and Methods*, Cat. no. 5216.0, 2000, p. 375.

53 ABS, *Australian National Accounts: Concepts, Sources and Methods*, Cat. no. 5216.0, 2000, p. 376.

54 ABS, *Australian System of National Accounts*, Cat. no. 5204.0, 2007-8, p. 42.

55 Mr T O'Brien, PC, *Transcript*, 23 October 2009, p. 5—referring to PC, *Submission no. 20*, p. 14.

- 2.76 Measurement issues also arise from the accuracy of the statistical data and some of the assumptions made in their compilation. The main sources of data for productivity are output and capital stock measures from the National Accounts (ABS cat no 5206.0), with estimates of hours worked drawn from the ABS's labour force survey (ABS cat no 6203.0). The capital stock measures are mostly derived from surveys of businesses on the ABS 'business register' so the quality of responses to the surveys is important.
- 2.77 The fact that the official MFP calculation excludes six service sector industries is a statistical limitation which may prove increasingly troublesome as this part of the economy grows. The rise of the services sector is a phenomenon which occurs as economies advance. The fact that most of this sector is excluded from the ABS productivity growth measure makes it increasingly more difficult to determine the relative contributions of different sectors to aggregate productivity.
- 2.78 Currently, statistical agencies have not formulated a robust and comparable statistical method to account for the complexity of inputs and outputs in the service sector of their economies; so by and large they are omitted from the MFP measurement. The main problems that are encountered in trying to account for service sector inputs and outputs are summarised by Professors Cooper and Sheen in their submission:
- ...the distinction between inputs and outputs is difficult to resolve, where outputs may not be physical products and hence may be difficult to measure, and where complex interrelationships in the production of goods and services mean that the contribution of individuals is increasingly an unobservable task and not a specifically measurable component.<sup>56</sup>
- 2.79 Their submission stresses the need to invest in finding better ways of measuring the outputs of a 'modern service oriented economy – where trading in tasks is increasingly dominant'.<sup>57</sup> They propose that with relatively poor information of what a modern economy actually does, coupled with the lack of an adequate measure of service outputs may mean countries fail to record the 'flow-on effects of technological advances, a failure which could lead to poor policy prescriptions'.<sup>58</sup>
- 2.80 The ABS recognises this problem, stating that:

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56 Professors & Professor J Sheen, *Submission no. 5*, p. 1.

57 Professors & Professor J Sheen, *Submission no. 5*, p. 3.

58 Professors & Professor J Sheen, *Submission no. 5*, p. 3.

...recent decades have witnessed the gradual shift in the composition of aggregate output towards service-producing industries and there is strong support to expand productivity measurement to these sectors, despite the significant measurement challenges that may be involved.<sup>59</sup>

- 2.81 Measuring the productivity of public sector services is particularly difficult.<sup>60</sup> This issue is discussed in Chapter 8.
- 2.82 In their submission, Professors Cooper and Sheen proposed extending the 'attributes' methodology to measure outputs in an increasingly service-based economy:
- Approaches to indirect measurement of changes in the quality of attributes also need to be developed and these would require sophisticated economic modelling. For example, it may be possible to examine changes in individuals' economic behaviour to infer improvement in quality of attributes where switches in purchasing occur that are incompatible with the implications of price movements....In summary, there is an increased need for integration of data measurement and economic modelling tasks in the future economy.<sup>61</sup>
- 2.83 Despite its statistical drawbacks, the ABS outlines the unique advantages and features of the MFP estimate:
- MFP takes account of several factor inputs at the same time, and is largely a measure of the effects of technical progress, improvements in the work force, improvements in management practices, economies of scale, and so on.<sup>62</sup>
- 2.84 Yet they also recognise the measure's non-statistical limitations: 'MFP can also be affected in the short to medium term by other factors such as the weather, and by variations in capacity utilisation associated with the business cycle.'<sup>63</sup> These non-statistical limitations will be discussed in greater detail in Chapter 3, in terms of recent productivity trends and in Chapter 8 about issues that are taking on greater importance as the composition of the economy changes.

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59 ABS, *Submission no. 16*, p. 3.

60 ABS, *Submission no. 16*, p. 3.

61 Professors & Professor J Sheen, *Submission no. 5*, p. 4.

62 ABS, *Australian National Accounts: Concepts, Sources and Methods*, Cat. no. 5216.0, 2000, p. 362.

63 ABS, *Australian National Accounts: Concepts, Sources and Methods*, Cat. no. 5216.0, 2000, p. 362.

## International comparability of Australian productivity measures

2.85 Unlike macroeconomic measures such as GDP, which are mature measures incorporated into international standards which have been adopted by most countries around the world, there is less consensus about productivity measures worldwide. The ABS commented that productivity measures:

..are in some kind of intermediate state of maturity...it is recognised as a field where there is still a lot of merit in letting people experiment, stretch and try different things. So there is far less commitment and drive towards international standardisation.<sup>64</sup>

2.86 However, the ABS has adopted all the main productivity measurement methodologies used by other countries; its methods align with those used in most OECD countries. This includes the standard growth accounting framework recommended by the OECD which has been adopted by leading statistical agencies.<sup>65</sup>

2.87 The ABS is advancing its studies into increasing the coverage of industries included in the market sector of the productivity estimates. Experimental estimates have already been released for the ANZSIC categories of Rental, Hiring and Real Estate Services; Professional, Scientific and Technical Services; Administration and Support Services and "Other" Services.<sup>66</sup>

2.88 The ABS is also leading other statistical agencies in the development of experimental MFP estimates. The ABS has already developed productivity estimates for individual industries and also quality adjusted labour input measures, both of which have been released. That said, the ABS recognises many challenges remain, including the international standardisation of new measures:

...it will be some while before there is enough consensus and similar thinking to establish an international standard, which is where the issues of international comparability come up.<sup>67</sup>

2.89 The impact of the inclusion of experimental estimates is discussed further in Chapter 5.

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64 Mr M Davies, ABS, *Transcript*, 23 October 2009, p. 27.

65 PC, *Submission no. 20*, p. 1.

66 ABS, *Experimental estimates of industry multifactor productivity*, Cat. no. 5260.0.55.002, 2008-09, February 2010.

67 Mr M Davies, ABS, *Transcript*, 23 October 2009, p. 27.

## Committee conclusion

- 2.90 The statistical measurement of capital services productivity, and thus multi-factor productivity, is complex. The ABS cautions the interpretation of MFP productivity measures due to the complexity of the capital index construction, and as the available margin of error is very low caution should be used in interpreting short-term productivity. Therefore, annual productivity averages, which vary greatly from year to year, contain a lot of 'noise' and so the interpretation of growth is best performed on a cyclical basis.
- 2.91 That said the growth rates in the present unfinished productivity cycle, which now spans five years, provide enough trend information to expect the cycle to finish with negative growth.
- 2.92 The calculation of MFP is a partial estimate as it excludes six industry sectors which currently have outputs which are difficult to quantify. These sectors are predominantly service sectors and government sectors which do not produce tangible outputs and the outputs/outcomes from these industries are hard to disaggregate and value. They are, however, very important contributors to GDP and the measurement of productivity in these sectors is becoming increasingly important.
- 2.93 The ABS is progressing work into the viability of including a number of service sectors into the market sector but there is still a long way to go before a suitable services sector measurement is found. This will require ongoing commitment from the ABS and from international statistical agencies in adopting a standardised approach.
- 2.94 Despite the statistical limitations of multi-factor productivity as a methodology of measuring the aggregate productivity growth in an economy, it has some clear advantages over partial measures, like labour productivity. MFP accounts fully for capital and labour costs and can reflect changes in the operational environment of businesses, like management effectiveness and the capabilities of the primary inputs of capital and labour. Boosting this 'value-add' productivity stemming from the interactions between the primary inputs will be important for Australian businesses going forward.