

The economics of productivity growth

- 6.1 This chapter discusses the technical means by which productivity growth occurs. This can inform how governments use policy settings to facilitate productivity.

The production possibility frontier

- 6.2 To evaluate targets and policies to improve productivity it is important to first understand the economics that underlie productivity measurement and growth.
- 6.3 From a theoretical perspective productivity growth can be decomposed into improvements in efficiency, given current levels of knowledge and technology and the discovery of new methods for production, such as the invention of new equipment. Both are measured with reference to the production possibility frontier.
- 6.4 The production possibility frontier represents the maximum amount of output that can be produced with given inputs. In colloquial terms it represents 'best practice'. It identifies how products should be produced, such as the type of capital equipment to use and the number of workers to employ. The production possibility frontier identifies firms that are producing the maximum amount possible with their inputs and those firms that are inefficient, as they are not achieving the same level of output with their inputs.
- 6.5 Productivity growth can occur when inefficient firms adopt best practice production methods to enable them to 'catch up' to the most efficient firms. Productivity growth can also occur by discovering new ways of

producing products that redefine what is identified as the most efficient production method.

How productivity growth can be boosted

- 6.6 Immediate causes, underlying factors and fundamental influences are the determinants of productivity growth in the economy.
- 6.7 *Intermediate causes* of productivity growth are those which 'have a close a tangible link to input/output relationships in production'.¹ They occur at the firm level, and are discussed in detail below.
- 6.8 *Underlying factors* promote the immediate causes of productivity growth by helping to 'shape up the extent to which the immediate determinants of productivity growth evolve'. These factors can be influenced by public policy. They include the level of competition in a market; trade and investment openness; and general supply and demand conditions.²
- 6.9 Government has a role to play in ensuring that the *fundamental influences* of productivity growth are conducive to an economy maximising its productivity. These influences include the policy environment, particularly the level of investment in productivity-boosting initiatives such as education and infrastructure; institutional settings which govern how governments, firms and individuals interact; and social capability, which refers to the orientation of a people to effect change to bring about productivity growth.³

Immediate causes

- 6.10 Firms are able to increase productivity growth in three main ways: technological change, improvements in technical efficiency, and changing the scale or mix of inputs and outputs. These are discussed with examples below.
- 6.11 Various submissions, including those received from Treasury, the Australian Chamber of Commerce and Industry (ACCI), the Australian Bureau of Agricultural and Resource Economics (ABARE), and the

1 Productivity Commission (PC), *Submission no. 20*, p. 7.

2 Australian Chamber of Commerce and Industry (ACCI), *Submission no. 7*, p. 22.

3 ACCI, *Submission no. 7*, pp. 20-21.

Productivity Commission (PC), referenced these intermediate drivers of productivity growth, albeit using different terminology.

Technological change

6.12 Technological change can be defined as:

...change, in a very broad sense, in the stock of knowledge – what we know we can or cannot do.⁴

6.13 In simple terms, the building of a railroad constitutes technological change, while the actual use of the railroad contributes to technical efficiency. In terms of knowledge, basic research often contributes to the stock of knowledge which can then be used by firms to develop new products and ideas.⁵

6.14 The development of new technologies aid productivity growth by enabling more efficient means of production. Government policy decisions can provide the impetus for technological change, as demonstrated by the National Broadband Network (NBN). Dr Lee advocated a two-phase approach in pushing such development:

The path towards long-term growth would involve two subsequent phases. First in the short term, policy reforms advocating the adoption of ICTs and other technologies should be embraced and employed. Second and more significantly in the long term, creative innovation in technology and creative thinking in the work force and education system (ie. from content learning to applied learning) should be developed resulting in new technologies, new ideas and new entrepreneurship skills.⁶

6.15 Technological change also encompasses *smart infrastructure*, such as technology which provides clear warnings to motorists about congestion bottlenecks. This enables them to avoid the bottleneck, or plan a more efficient route to their destination.⁷ An Inquiry into Smart Infrastructure, of which the terms of reference includes the potential productivity benefits of smart infrastructure, is currently being conducted by the House of Representatives Standing Committee on Infrastructure, Transport, Regional Development and Local Government.

4 Professor C O'Donnell, *Transcript*, 4 February 2010, p. 4.

5 Department of Innovation, Industry, Science and Research (DIISR), *Submission no. 26*, p. 12.

6 Dr B Lee, *Submission no. 3*, p. 1.

7 Ms P O'Connell, Department of Infrastructure, Transport, Regional Development and Local Government, *Transcript*, 26 November 2009, p. 11.

- 6.16 Technological change can be developed through local R&D, imported from overseas, or adapted from overseas using locally developed complementary products. Evidence of all three approaches can be seen in the ICT sector.⁸
- 6.17 Australia stands out as a leader amongst OECD countries in the adoption of ICT capital. An International Monetary Fund Working Paper found that countries with flexible labour markets and best practice product markets have higher levels of ICT capital deepening. Reforms undertaken in Australia over the last two decades have enabled firms to take advantage of ICT developments, which has assisted productivity growth.⁹
- 6.18 Professor Green stated that technological change does not need to be inspired by existing demand from business or consumers. He noted the marketing strategy of Apple, which regularly releases cutting-edge products:

Apple, for example, does not do any marketing; it only reviews the impact that it has on markets it has actually created for itself, because it assumes that the customer does not know what he or she wants — Apple will work it out for them. That is a pretty radical and extreme example, but it shows how some companies are thinking: that they are not there to follow the market trends, they are there to create them.¹⁰

Improvements in the technical efficiency of the production process

- 6.19 Professor O'Donnell described technical efficiency as:
- ...moving closer to a best-practice frontier. This can involve adopting best-practice technology – for example, minimum tillage in agriculture – or simply eliminating mistakes in the production process.¹¹
- 6.20 He went on to discuss the importance of adopting technology and using it in an efficient manner, citing how using the NBN might contribute to technical efficiency:

The sort of thing I had in mind, from an economic viewpoint, that it is not just enough to employ the right people and install

8 PC, *Econometric Modelling of R&D and Australia's Productivity*, p. xxx.

9 International Monetary Fund, *Does Technological Diffusion Explain Australia's Productivity Performance?*, January 2008.

10 Professor R Green, *Transcript*, 11 March 2010, p. 8.

11 Professor C O'Donnell, *Transcript*, 4 February 2010, p. 1.

broadband technology in your company. You need to be able to use that effectively. You need to be able to manage those resources effectively within the firm and eliminate mistakes in the production process. That is what this economic measure of technical efficiency picks up. So, yes: the bottom line here is that it is one thing to acquire these resources, but a very important part of the productivity story is how those resources are used.¹²

- 6.21 Utilising technology enables firms to develop new mechanisms and processes to make their production more efficient. While discussing the NBN, Mr Windeyer of the Department of Broadband, Communications and the Digital Economy described the new technology as:

...a general purpose technology that enables other industries and firms to change the way they do business.¹³

- 6.22 Mr Windeyer went on to discuss research being conducted by CSIRO and NICTA (formerly National ICT Australia), among others, into 3-D photo technology. When utilised by firms in conjunction with the high-speed NBN, this will enable such information to be shared widely.¹⁴ This technology could be used for purposes such as costing vehicle repairs, as it offers people:

...better and more efficient ways to carry out their existing business.¹⁵

- 6.23 Improved education and training enables firms to access skilled labour, which is important for productivity growth. A more skilled workforce will lead to:

...new technologies, new ideas and new entrepreneurship skills. These approaches will thus form the stepping stone to development and changes in other sectors of the economy which in the long term, will lead to gains in productivity growth.¹⁶

- 6.24 Dr Lee described how Singapore's skills development system contributes to that country's skills base. It is expected to bring significant productivity benefits in the next ten to fifteen years. Education has been reformed in

12 Centre for Efficiency and Productivity Analysis, University of Queensland, *Submission no. 11*, p. 6.

13 Mr R Windeyer, Department of Broadband, Communications and the Digital Economy (DBCDE), *Transcript*, 25 February 2010, p. 9.

14 Mr R Windeyer, DBCDE, *Transcript*, 25 February 2010, p. 12.

15 Mr R Windeyer, DBCDE, *Transcript*, 25 February 2010, p. 10.

16 Dr B Lee, *Submission no. 3*, p.1.

Singapore, and bodies established to match supply and demand for skills in the economy. Further, incentives have been offered to foreign investors to participate in skills development of the workforce, benefiting both those investors and local workers.¹⁷

- 6.25 Management capability within firms contributes to the level of technical efficiency of that firm. In a study commissioned by the Department of Innovation, Industry, Science and Research, Professor Roy Green found that management practices in Australian firms are moderately above average when benchmarked against other advanced economies. Of particular note was the finding that large firms are performing better in quality of management practices than smaller firms.¹⁸ This is of concern as Australia has a larger proportion of smaller firms in comparison with major economies such as the United States, Germany and the UK.¹⁹
- 6.26 At a public hearing, Professor Green stated the benefits of programs which improve management capability in firms:

Certainly we know from experience overseas that this is one of the most cost effective ways of improving the productivity performance of organisations to investment in workplace development, including innovation capability.²⁰

- 6.27 He went on to describe the benefits of an ICT entrepreneurs program he was involved with previously:

...the key thing for them [the participants] was personal transformation. It had transformed their ability and their confidence and they were able to form connections and joint ventures and to collaborate as well as have a greater confidence in attacking their key markets both locally and globally.²¹

- 6.28 The Centre for Law and Economics stressed the need for 'IT penetration' in the economy in order to boost productivity growth, submitting that it is not sufficient for people to adopt new technology, they needed to be actively using it:

A moment's reflection makes one realise that it is not simply the spread of computers that will generate productivity increases, but the incentives and capability to use them effectively which the

17 Dr B Lee, *Transcript*, 19 November 2009, pp. 3-4.

18 DIISR, *Exhibit no. 11*, pp. 5-6.

19 Professor R Green, *Transcript*, 11 March 2010, p. 6.

20 Professor R Green, *Transcript*, 11 March 2010, p. 4.

21 Professor R Green, *Transcript*, 11 March 2010, p. 5.

microeconomic reforms allowed – including the enormous investments in modern communication systems following privatisation and deregulation of telecommunications globally.²²

Changing the scale or mix of inputs and outputs

- 6.29 With Australia's population predicted to grow from 22 million currently to 35.9 million by 2050 (see paragraph 5.42) the scale of production within the Australian economy will expand.
- 6.30 Larger populations bring efficiencies of scale to production which cannot be achieved by smaller economies. For example, the United States' large population gives it advantages of scale, and provides larger markets which enable specialisation to be viable. The PC has also noted that supply chains in the United States are concentrated on a small number of hubs which serve several major cities. Accordingly, producers have access to several very large markets. In comparison, there are large distances between major cities in Australia, adding to transport costs.²³
- 6.31 A PC Staff Working Paper argues that the United States benefits from having a number of very large cities, whereas Australia has smaller cities and is sparsely settled. Our remoteness from foreign markets means Australian producers pay more for capital equipment and to take their products to foreign consumers.²⁴
- 6.32 The agricultural sector illustrates how productivity rises within firms as scales of production increase:

Agriculture is changing, as all industries are changing. Agriculture is changing, with farms leaving the industry. Typically, of those that leave, other farms either take over the whole operation or perhaps blend it in with their operations. So farms are steadily getting larger. Those ones that are getting larger are those that have actually been more productive.²⁵

22 Centre for Law and Economics, Australian National University, *Submission no. 6*, p. 6.

23 Dolman, B, Parham, D, Zheng, S, *Can Australia Match US Productivity Performance?* PC Staff Working Paper, March 2007, p. 42.

24 Dolman, B, Parham, D, Zheng, S, *Can Australia Match US Productivity Performance?* PC Staff Working Paper, March 2007, pp. 35-44.

25 Dr T Sheales, Australian Bureau of Agricultural and Resource Economics (ABARE), *Transcript*, 23 October 2009, p. 61.

6.33 Family-run businesses in Australia stand out for poor productivity performance.²⁶ In addition to being generally small scale, Professor Green also attributed the lower productivity growth in these firms to a lack of:

...the necessary long-term commitment to building professional management capability with key positions attained by merit rather than family affiliation. This long term commitment and strategic approach is required for success in both domestic and global markets. It should also be acknowledged that some family firms have different drivers that may result in relatively 'poorer' productivity performance, but do deliver other benefits.²⁷

6.34 However, the benefits of relying upon this driver of productivity growth on an economy-wide level (as distinguished from GDP growth) are open to question. The Centre for Efficiency and Productivity Analysis submitted that:

...levels of scale and input-oriented mix efficiency are already high, suggesting that capital investment will not yield significant productivity gains.²⁸

6.35 At a public hearing, Professor O'Donnell expanded on this point, citing the mining industry as an example of an industry which is expanding, but where productivity is actually declining. He went on to say:

...further expansion of the economy, out into the region of decreasing returns to scale, is unlikely to yield significant productivity gains. It does not mean that incomes will not rise. It just means that productivity may not rise.²⁹

6.36 Changing the mix of inputs and outputs may also lift productivity growth. This can be achieved by using inputs in different combinations, and/or altering the mix of outputs produced.

6.37 One means of changing the mix of inputs is a shift in the labour and capital components of production. This has been seen in many manufacturing industries, where processes once completed by people have been automated.

26 DIISR, *Exhibit no. 11*, p. 7.

27 DIISR, *Exhibit no. 11*, p. 7.

28 Centre for Efficiency and Productivity Analysis, University of Queensland, *Submission no. 11*, p. 7.

29 Professor C O'Donnell, *Transcript*, 4 February 2010, p. 3.

- 6.38 A change in the mix of outputs is also described as a change in the scope of outputs.³⁰ For example, ABARE cited strong productivity gains in the agricultural sector during the 1990s, brought about by a shift from sheep into cropping. This shift occurred due to relatively lower wool prices during that period. Crop enterprises and remaining wool producers were more productive than the previous output mix in that sector.³¹

Productivity growth in the economy

- 6.39 Having efficient firms in an economy increases the likelihood of having high aggregate productivity growth. Thus productivity growth can be targeted at firms or the overall framework firms operate in.
- 6.40 The frameworks and systems are mostly developed and overseen by government. Thus there is a role for government to intervene in the market to influence the efficient allocation of resources. This may be achieved directly, through direct fiscal means, or through microeconomic reforms and regulatory structures.

Government policies to influence productivity growth

- 6.41 As government policies affect the environment in which firms operate they play a considerable role in influencing productivity growth.
- 6.42 Public policy also supports the proper functioning of markets (for example, strong prudential regulations stood Australia in good stead during the Global Financial Crisis), improves the efficient allocation of resources in the economy and can remove market distortions (for example, removing trade barriers). Public policy can also promote flexibility in firms, and encourage workplace skills development – all drivers of productivity growth.³²
- 6.43 The Treasury stated that:
- Addressing market failures in the areas of infrastructure, innovation and human capital also provides an important avenue for productivity gains.³³

30 PC, *Submission no. 20*, p. 8.

31 ABARE, *Submission no. 23*, p. 11.

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

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

- 6.44 Mr Robert Griew, from the Department of Education, Employment and Workplace Relations, also noted that appropriate macroeconomic and microeconomic policies form part of the mix of components required for productivity growth:

The terms of reference for this inquiry reflect the reality that productivity will be a function of a range of factors: macroeconomic stability, microeconomic reform, technological improvements, private and public capital investment, research and development, and training and development of the workforce.³⁴

Macroeconomic

- 6.45 Macroeconomic policies affect certainty and stability of prices of inputs.³⁵ They can also affect the pace of technological change and freight efficiencies through public investment. These sorts of policies are interventionist. They may influence the level of technological change (i.e. via public investment), technical efficiency (improved capabilities of workers through skills and training) and also the scale of outputs and ratio of inputs.

- 6.46 The *Intergenerational Report 2010* noted that:

A stable macroeconomic environment increases the level of certainty that people and businesses have in making decisions. By ensuring macroeconomic stability, public policy frameworks can promote economic growth and improve efficiency in the allocation of resources across the country. This is positive for productivity.³⁶

Microeconomic

- 6.47 Microeconomic policies may affect technical efficiency (e.g. regulatory burdens), technological change (regulation of radio-spectrum) and the scale and input mix of capital versus labour (e.g. capital subsidies, tax depreciation, on-costs of labour).
- 6.48 Professor Chris O'Donnell noted that microeconomic reforms may affect technical efficiency generally:

34 Mr R Griew, Department of Education, Employment and Workplace Relations, *Transcript*, 30 October 2009, p. 2.

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

36 The Treasury, *Intergenerational Report 2010*, p. 22.

Microeconomic reform is also something that can lead to improvements in technical efficiency because that leads to increased competition and firms that operate in highly competitive environments must be technically efficient if they are going to survive.³⁷

6.49 ACCI and Master Builders Australia espoused, in both their submissions and appearances before the committee, the need for reduced business taxation, including the reduction in capital gains tax. The only other specific area of tax reform the committee received evidence on was R&D tax concessions.³⁸ This will be discussed under *Innovation and R&D* in Chapter 7.

6.50 Treasury and the PC explained the need for a tax regime to be neutral, but neither responded in any detail, referring tax reform expertise to the tax review currently being undertaken by Treasury. The Chairman of the PC noted:

Clearly, Australia's tax system has evolved considerably over time in ways that are productivity enhancing – for example, by reducing punitive marginal tax rates, which have been an impediment to effort in the past, and lowering taxation on capital to ensure that we are still attractive as a destination for investment and so on.³⁹

6.51 The Secretary to the Treasury recently publicly remarked about the factors that affect participation in the workforce:

If the policy settings aren't right, if the incentives are misaligned, the tax and transfer system can deprive individuals of the opportunity to develop their capabilities; perversely, it can lock disadvantaged groups into cycles of dependence.⁴⁰

6.52 None of the economists who provided evidence to the inquiry suggested significant taxation reform as a main driver of productivity and in fact one economist, Professor Chris O'Donnell, pointed out the dangers in attempting to drive productivity through price signals:

37 Professor C O'Donnell, *Transcript*, 4 February 2009, p. 3.

38 Received from Innovation Australia, *Submission no. 25*; DIISR, *Submission no. 26*; PC, *Submission no. 20*; and Australasian Institute of Mining and Metallurgy, *Submission no. 13*.

39 Mr G Banks, PC, *Transcript*, 23 October 2010, p. 13.

40 Dr K Henry, *Fiscal Policy: more than just a national budget*, Address to the 2009 Whitlam Institute Symposium, 30 November 2009, p. 20.

There are three main drivers of productivity growth, and two of these are associated with improvements in net income – technical efficiency improvement and technical progress – and one is associated with decreases in net incomes, and that is changes in relative prices. If we really want to improve productivity, then the message is that we need to make sure that we do it in a way that also improves net incomes.⁴¹

- 6.53 Similarly, Mr Simon Mottram noted that tax changes which increase the value, but not the volume of output, are not measures to actively promote productivity growth. He cites as an example the recent changes to Section 23AG of the *Income Tax Assessment Act (1936)* (foreign income tax exemption):

The reform agenda here has taken a passive approach, looking at potential for increase to an existing income stream while assuming the reform applied will not have any impact upon it. Microeconomic reform in this case is ineffective, creating disincentive and curtailing the growth rate of productivity in this area.

- 6.54 Mr Andrew Thomas, appearing at a hearing in Sydney for the Australian Rail, Tram and Bus Industry Union also gave an example of how taxation can skew the use of resources in an economy and create inefficiencies:

Another issue is that company cars have a fringe benefits tax applied to them; rail does not. If you have a company car and you drive to work, they can apply a fringe benefits tax, which is offset by the company.⁴²

- 6.55 Directing productivity growth through tax mechanisms, things that influence the prices of inputs or value or outputs, can have unintended consequences or provide no real incentives for productivity growth.
- 6.56 One example of this provided by the Australian Institute of Mining and Metallurgy is a tax deduction for mining exploration expenditure but which is generally not applicable to junior companies who comprise 70 per cent of this market – they do not earn enough revenue to take advantage of it.⁴³ At a time when current mining productivity growth is declining, partly due to the diminishing returns on existing mines, this

41 Professor Chris O'Donnell, *Transcript*, 4 February, 2010.

42 Mr A Thomas, Australian Rail Tram and Bus Industry Union, *Transcript*, 4 December 2010, p. 5.

43 Australian Institute of Mining and Metallurgy, *Submission no. 13*, p. 10.

provides a cautionary tale in putting weight on tax incentives to drive productivity growth.

- 6.57 Another example of an unintended consequence of fringe benefits tax was noted by Mr Catchpole of the Australian Institute of Mining and Metallurgy on company provided childcare at remote mining locations. He noted the importance of having childcare near mines to increase participation but that:

...the numbers are not enough to justify building a childcare centre, but if you try to choose a more flexible option then you get hit with the fringe benefits tax. Increasingly, it is not just female participation. Our latest remuneration in employment survey has indicated that something like 20 per cent of the members, I cannot remember how many, identify themselves as carers.⁴⁴

Committee conclusion

- 6.58 Improvements in technology and technical efficiency at the firm level will lead to improvements in productivity and income. Changing the scale and/or mix of inputs and outputs will not always lead to improvements in productivity, even if higher income is achieved. This has been borne out recently in the mining sector with higher output prices inducing firms to employ more inputs, without a commensurate increase in output volume – thus higher incomes but falling productivity growth.
- 6.59 Where governments intervene in the market in an attempt to boost aggregate productivity the focus should be on improving firms' access to technological capacity and on improving technical efficiencies within the firm. The focus of public policy should not be on increasing the scale of outputs or the prices of inputs or outputs. Although these may result in income gains they will not necessarily result in productivity gains.
- 6.60 Actions by government to influence the scale of production or the prices of inputs or outputs will create distortions in the allocation of resources and will not lead to long-term productivity growth. Thus the committee does not believe the primary impetus of productivity growth will emanate from tax reform which affects the cost of inputs or value of outputs. Tax policy is directed at income and equity effects rather than efficiency outcomes.

44 Mr M Catchpole, Australasian Institute of Mining and Metallurgy, *Transcript*, 20 November 2009, p. 19.

- 6.61 Tax reform is essential where there are distortions in the system which prevents resources flowing to their most efficient use, for example, punitive marginal tax rates which diminish the incentive to work and reduce participation. This will be particularly important as the highly-experienced portion of the workforce ages and considers retirement or ongoing participation.
- 6.62 The focus of government policy must be on maintaining a stable macroeconomic environment and continuing the microeconomic reform agenda to ensure the environment firms operate in is conducive to efficient production. The secondary focus should be on supporting the improvement in the capability of the inputs to production; be that through technology advances that are fully utilised by firms, and/or through greater technical efficiencies in firms.