

Does Australia have a Productivity Growth Problem?

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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.

Paul Krugman (1992: 9)

Little else is requisite to carry a state to the highest degree of opulence from the lowest barbarism, but peace, easy taxes, and a tolerable administration of justice; all the rest being brought about by the natural course of things.

Adam Smith (1776 [1976]: xl)

Introduction

Ever since Paul Krugman stated that productivity was 'almost everything', policy makers have been obsessed with improving it. This focus has led to a great deal of policy confusion. In this paper we will argue that, while productivity is important, it is not an active policy variable that policy makers can easily manipulate. While it is possible for policy to impact the determinants of long-term economic growth, the returns to public policy in that space are quickly exhausted.

Economic growth is ultimately driven by entrepreneurship. In short, policy makers should pay attention to Adam Smith's insight and restrict their policy making to maintaining 'peace, easy taxes, and a tolerable administration of justice'.

In this paper we canvass the debate surrounding productivity. The debate is conceptually complex and can become very technical very quickly. We do not provide a detailed technical analysis of the debate; rather we concentrate on issues that decision makers and policy makers overlook. In particular we highlight the difficulties introduced by aggregation in calculating productivity. Modern economics is predicated on specialisation, yet productivity statistics derived from the National Accounts assume homogeneity. Even within specific industries there are massive differences between firm productivity. Aggregating that diversity to a national level can give rise to very misleading inferences.

While Australians may be concerned about the low levels of measured productivity in recent years, there is little active intervention that government can undertake to improve that situation. That isn't to suggest that government does nothing to promote productivity. Rather it is to argue that government already undertakes the functions (i.e. maintains rule of law) that are known to promote productivity.

The Australian debate around productivity has degenerated somewhat into a series of competing claims of dubious import. It likely that entrepreneurial action rather than government design will promote productivity growth in the long run. When thinking about productivity a lot more thought needs to be given to industry specifics and even to firm specifics.

1. What is productivity?

Arthur Seldon defines productivity as ‘the output of a unit of a factor of production in a stated period’. That very dry and somewhat bland definition masks extraordinary complexity. In the first instance we might define productivity as output per worker per year – that could be a measure of labour productivity. For this measure to convey any information we need to make some assumptions about the ‘worker’ in the definition. In short there must be some homogeneity about the worker. We know, however, that workers are not homogeneous.

Work that takes place in a modern capitalist economy is specialised. Some jobs are more capital intensive than others, while some require more or less investment in human capital. Workers that make greater use of capital goods in their work will appear to be more productive than those that do not. Similarly, those who rely on greater levels of human capital may appear to be more productive than those who do not. This appearance, however, is incorrect. So observed productivity may be very different from actual productivity. Economists attempt to untangle all of these issues when they measure so-called multi-factor productivity. Here economists attempt to allocate productivity returns to the various factors of production (land, labour, capital, entrepreneurship).

When thinking about productivity it is also important to differentiate between ‘inspiration’ and ‘perspiration’. This distinction was highlighted in a very controversial 1994 article by Paul Krugman. In that article Krugman explained that the huge economic growth in east-Asia could be explained by increased inputs and not increased productivity. Given that inputs cannot expand forever, that implied that east-Asian growth would eventually decline too.

The way to understand that prediction is to recognise that GDP per capita is simply labour productivity multiplied by the labour participation rate.¹ It is possible to increase GDP per capita (i.e. increase the measured standard of living in the population) by increasing the participation rate even if productivity is low. Krugman argued that east-Asian economies (and before then, the Soviet bloc) had increased output by increasing inputs. The key to east-Asian success was perspiration – everyone was working harder. There are, however, diminishing returns to working harder. Improved productivity, however, results in increased output (in this case higher GDP per capita) with the same level of inputs.

It is important to differentiate productivity from efficiency. Efficiency is about making the best use of inputs to create outputs. Productivity relates to transforming inputs into outputs irrespective of efficiency. Improving efficiency is one way of improving productivity but not the only way.

¹ $(\text{GDP}/\text{Pop}) = (\text{GDP}/\text{Workers}) \times (\text{Workers}/\text{Pop})$

2. How is Productivity Measured?

In practice there are many different measures of productivity. These measures relate to differing treatment of the data employed to calculate the productivity measure itself. Two sets of problems arise; measurement issues and conceptual issues.

Productivity can be measured either as single factor productivity or multi-factor productivity. Single factor productivity measures relate a measure of output to a single measure of input. For example labour productivity measures output in relation to one input (labour). As we indicated above labour is a heterogeneous input and care should be taken when using this measure. Multi-factor productivity measures output in relation to a bundle of inputs (usually capital and labour). This measure is probably the most commonly used when comparing economies. Yet it too is problematic because capital, like labour, is also heterogeneous.

Multi-factor productivity is measured as a residual. Economists count up the outputs and the inputs and the difference between the two is defined as multi-factor productivity. This is why multi-factor productivity is sometimes referred to as 'the coefficient of ignorance'.

In addition to inputs being heterogeneous, outputs can be measured differently too. Output can be measured as gross output or in value added form. The value added form is typically more used as it captures intermediate flows between industries appropriately. Specifically, the gross output approach double counts intermediate flows making it difficult to use when comparing across different levels of aggregation.

Problems that arise when measuring productivity relate to straightforward measurement issues and aggregation issues.

Measuring capital and labour inputs are non-trivial. In principle labour should be measured as the quality number of hours worked. No such measure exists however. Theoretically inferior proxy measures must be used as a substitute. The most obvious alternative is a head count of jobs. Another option is number of hours actually worked, however, this variable is heavily impacted by economic conditions. Most importantly it cannot take account of individual differences amongst workers.

An additional consideration to bear in mind is structural change within industries. The car manufacturing industry, for example, was once dominated by low-skill workers. Today the skill mix is considerably different with machines and human operators now characterising the production process (Productivity Commission 2002). Skilled workers are now required for tasks that were previously non-existent, thus making comparisons over time difficult to interpret unless data at the micro (firm) level is available.

As with labour there are different ways to measure capital. Ideally, the capital input into the productivity measure should be capital services. What makes this measure particular troublesome is that unlike labour there is no recorded transaction between the firm and (the provider of) capital as the firm often owns the capital. Therefore, a proxy must be found. Once again different options are available, however as with labour these options are far from perfect. A particularly important limitation is that capital utilisation is also unobservable and often assumed to be constant. Assuming

a constant rate of utilisation is likely to be inconsistent with reality as over time utilisation will change in response, for example, to demand and seasonal variations.

Aggregation is a problem that bedevils all macro-economic analysis. Paul Schreyer (2001: 38), writing on behalf of the OECD, indicates that productivity measures are better measured at the industry level because ‘the underlying methodology relies on the theory of production and on the assumption that there are similar production activities across [firms in an industry].’ That latter assumption is quite heroic – as Chad Syverson (2011: 326 – 327) explains.

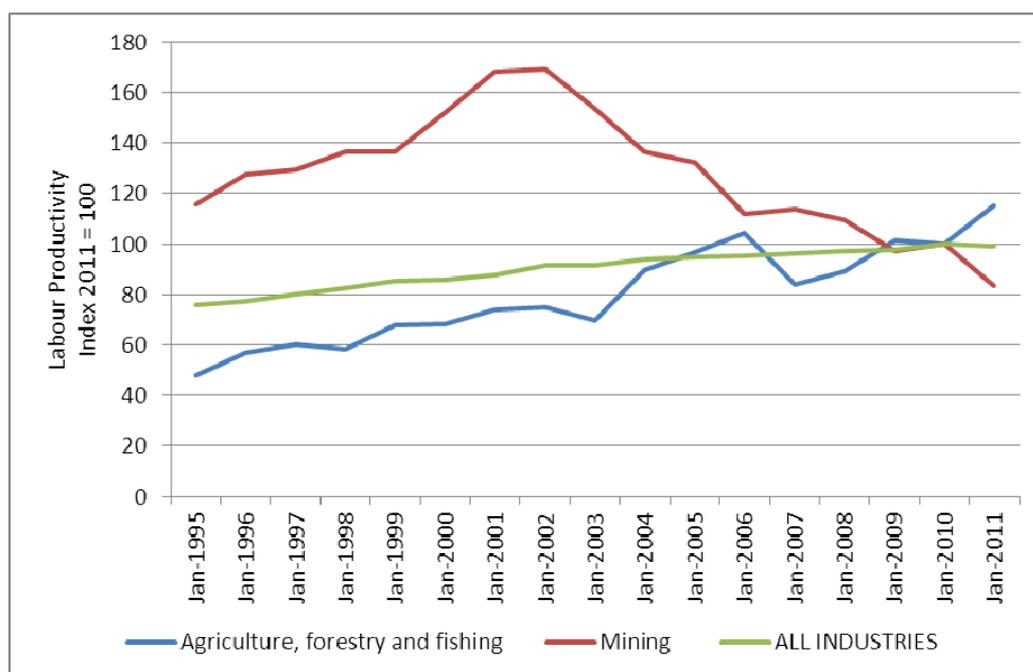
... within four digit SIC industries in the U.S. manufacturing sector, ... the plant at the 90th percentile of the productivity distribution makes almost *twice* as much output with *the same measured inputs* as the 10th percentile plant. Note that this is the average 90–10 range. ... so several industries see much larger productivity differences among their producers. U.S. manufacturing is not exceptional in terms of productivity dispersion. Indeed, if anything, it is small relative to the productivity variation observed elsewhere. Chang-Tai Hsieh and Peter J. Klenow (2009), for example, find even larger productivity differences in China and India, with average 90–10 [Total Factor Productivity] ratios over 5:1.1

In other words, even an industry measure of productivity masks huge amounts of variation between firms. Productivity is best understood at a micro-economic level and not at a macro-economic level.

The aggregation problem can be illustrated by considering just two industries compared to overall Australian labour productivity. Overall labour productivity has risen since 1995. Despite Australia being in the midst of a mining boom mining labour productivity has fallen. At the same time there has been a massive increase in agriculture, forestry and fishing productivity.

The first thing to bear in mind, however, is that the graph shows index values. The actual mining productivity figure is very high.

Chart 1: Labour Productivity of Selected Sectors



Source: ABS Cat. 5204.0 Table 15

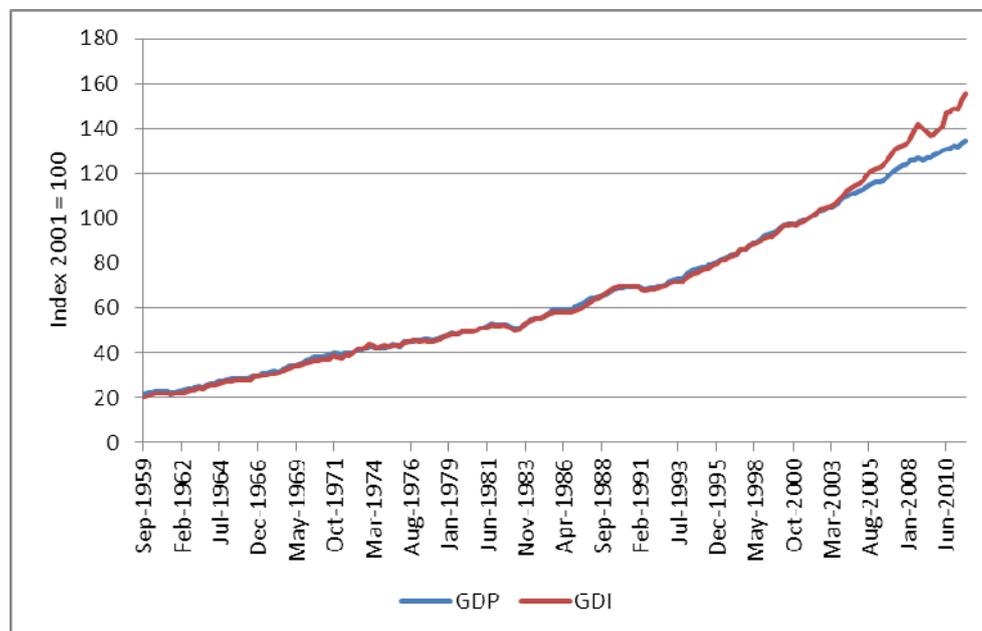
The apparent decline in mining labour productivity raises a conceptual problem with measured productivity. The empirical link between increased productivity and rising living standards relies on some strict assumptions – in particular a constant price assumption.

In the Canadian context Stephen Gordon of Laval University Quebec argues that a concern about declining mining productivity is misplaced.² Multi-factor productivity in the Canadian mining industry has generally declined since the 1970s and particularly declined since the early 1990s. As Gordon indicates

Here is where one's faith in MFP [multi-factor productivity] starts to falter. Whatever MFP is measuring in the mining, oil and gas extraction sector, it cannot possibly be technical progress. No-one would seriously claim that output in this sector would be tripled if they returned to 1960s-era technology. It's much more easy to believe that technical change in this sector takes the form of making it possible to extract resources that were previously unreachable.

High prices and increased profitability in the industry have two effects. First it ensures that previously non-viable deposits can now be mined. Second it attracts additional resources to the industry from other industries. Both those effects indicate that mining productivity should fall. National income could rise, however, because of a change in that country's terms of trade. Gordon is able to show that Gross Domestic Income (GDI) and Gross Domestic Product (GDP) have diverged in Canada since the mining boom began and ABS data show the same thing for Australia.

Chart 2: Australian Gross Domestic Product and Gross Domestic Income



Source: ABS Cat. 5206.0 Table 1.

The massive increase in commodity prices has driven a wedge between output (measured by GDP) and income (measured by GDI). Productivity measures assume output is the appropriate measure of economic welfare – but that is only true if that output can be sold at a profit. Value is defined as price times quantity. Productivity measures overlook price.

² http://worthwhile.typepad.com/worthwhile_canadian_initi/2011/07/value.html

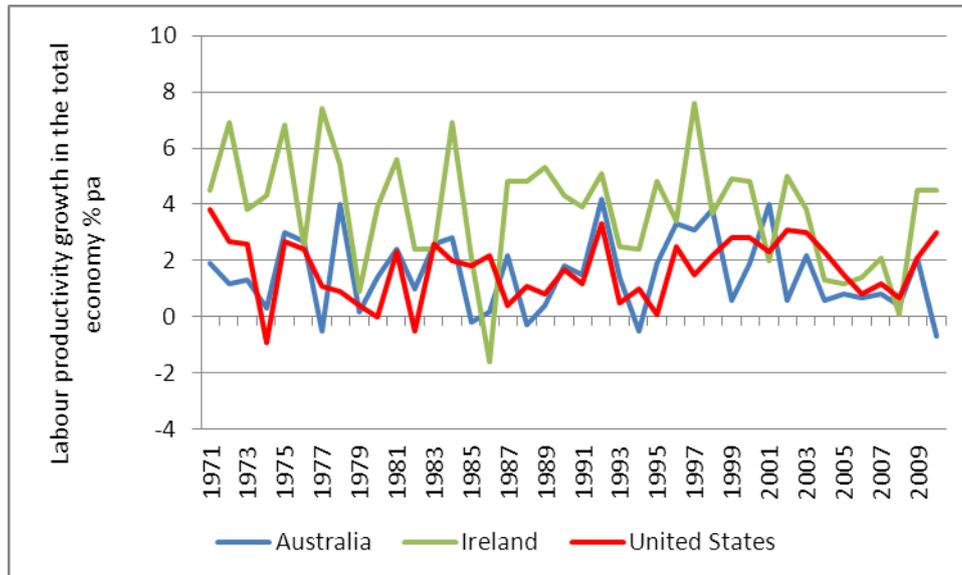
That raises another conceptual problem. Technical progress in the mining industry, for example, allows for the extraction of previously non-viable resources. So in the mining industry, at least, innovation can lead to reduced productivity growth not increased productivity growth. Paul Schreyer and Dirk Pilat (2001: 162) argue that the economic theory underpinning productivity measures is 'firmly rooted in a neo-classical equilibrium concept'. Innovation and productivity growth, however, must be non-equilibrium concepts. That suggests that we are using static economic ideas and concepts to measure what must be a dynamic economic process.

Overall, this section suggests that we should be very cautious when discussing productivity as a concept and particularly cautious when thinking about measured productivity. It is clearly shown, that to have a proper understanding of changes in productivity it is necessary to have information at the micro (firm) level.

3. Productivity Growth: International and Historical Comparisons

The OECD emphasises GDP per hour worked as its measure of labour productivity. It releases productivity growth estimates each year for its member states. We graph that data for Australia, the United States, and (as a cautionary tale) Ireland for the period 1970 – 2010.

Chart 3: Annual Productivity Growth



Source: OECD (<http://stats.oecd.org/Index.aspx?DatasetCode=PDYGTH>)

There are a number of obvious points that are immediately apparent in Chart 3.

First, productivity growth in Ireland has tended to be very high. In the short run high productivity does not insulate the economy from economic downturns or policy mistakes.

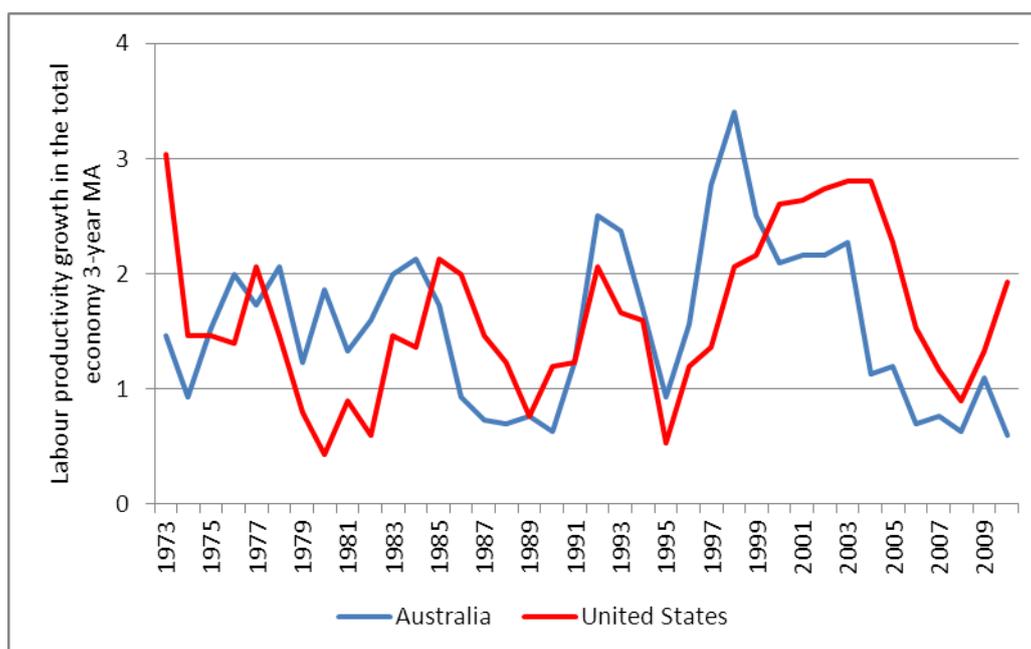
Second, Australian and US productivity growth appears to be very similar.

Third, in 2010 it does appear that Australian productivity growth and US productivity growth did move in opposite directions. The gap between the two growth rates in 2010 was the largest it had been over that 40 year period. It would be premature, however, to make too much of that development.

Fourth, the variance in productivity growth is higher for Australia than it is for the US (although it is higher still for Ireland).

In order to remove that variance from the series and get an understanding of productivity growth trends, we calculated a three-year moving average of productivity growth and graphed the data (for Australia and the US only).

Chart 4: Annual Labour Productivity Growth Rates (3-year Moving Averages)



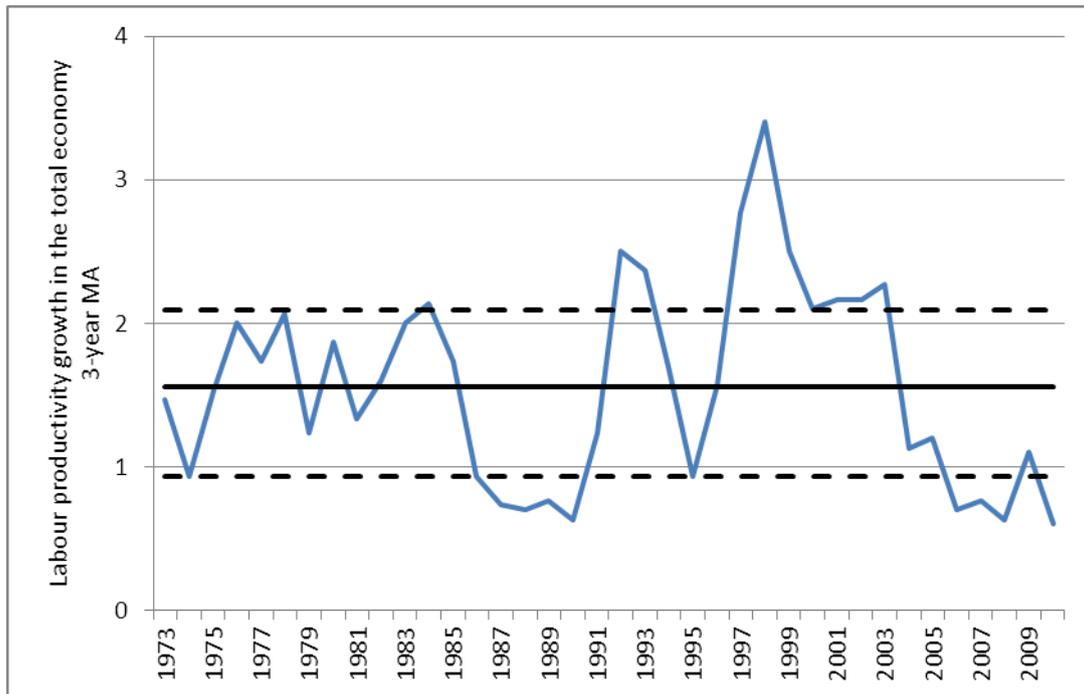
Source: OECD and Authors' calculations

Australian productivity growth has declined since the late 1990s. While it is true that the US also experienced a decline in productivity growth in the past decade, that decline began long after the Australian decline began (mid-2000s as opposed to late 1990s) and appears to have reversed. Looking at figures such as that, however, it is not clear that Australia has a productivity growth problem. It is only when you consider the Australian historical context that potential for concern arises. In Chart 5 we plot the three-year moving average of Australian productivity growth, the average of that productivity growth and the 25th and 75th percentiles of that productivity growth.

The average three-year productivity growth for the period 1970 – 2010 is 1.56 per cent. The 25th percentile is 0.93 per cent and the 75th percentile is 2.09 per cent. The measured three-year moving average productivity growth for 2010 is 0.6 per cent (the actual 2010 figure is -0.7 per cent). By Australian historical standards (at least since 1970) the current level of productivity growth is low. The three-year moving average has been below the 25th percentile since the middle of the last decade. There is a massive drop between 2003 and 2004. Current levels of productivity growth were last seen in the late 1980s.

Similar to the decline between 2003 and 2004 there was a previous large decline between 1993 and 1995. That was followed, however, by a massive increase in productivity growth between 1995 and 1998. In fact the period 1997 to 2003 is characterised by unusually high productivity growth.

Chart 5: Australian Productivity Growth (p.a.) together with 25th, 75th Percentiles and average growth rates for the same period.



Source: OECD and Authors' calculations

Any explanation of (recent) Australian productivity growth must explain two features. First, the unusually high productivity growth in the mid- to late-1990s, and, second, the current level of unusually low productivity growth. Importantly, to properly understand these different growth phases the industries and firms driving these phases must be identified. It is only once these firms and industries are accurately identified can productivity measures be used to correctly inform future policy directions.

4. What have Australian economists been saying?

One of the most common arguments explaining the poor productivity performance of recent years has been a reduction in significant economic reform. Saul Eslake (2011: 238), for example, has argued

It seems eminently plausible that at least part of the slowdown in productivity growth is attributable to the fading of the impact of the reforms which are widely agreed to have been a substantial driver of the acceleration in productivity growth during the 1990s.

While economic reformers are likely to approve of that argument it is very difficult to make the link between important economic reform and productivity improvements. Productivity fell during much of the 1980s – a period that was characterised by a reforming government. For this argument to be plausible there has to have been an important productivity enhancing reform in the late 1980s and mid-1990s. John Edwards (2011: 360) points to two reforms that could qualify, at least in terms of their timing; tariff reduction in the late 1980s and the end of centralised wage bargaining in the 1990s.

Assuming that view is correct, that implies that while productivity enhancing reform can lead to an increase in productivity growth and presumably a sustained increase in the level of productivity itself, economic reform cannot drive increased productivity growth in the long-run. Tariffs can only be reduced to zero and centralised bargaining can only be abolished once. In other words, while economic reform is important in the short run and important in improving the level of productivity, in the long-run productivity growth will be determined by other factors.

John Quiggin (2000, 2004, 2011) has long argued that the high productivity gains in the 1990s were illusory; resulting from an increase in work intensity. Instead of there being a productivity miracle in the 1990s, he suggests there was a productivity mirage. His argument is that the 1990s saw an increase in work intensity and over time employees have managed to reduce that work intensity back to their desired level. Quiggin argues that an increase in work intensity does not constitute an increase in productivity; this constitutes an increase in inputs.

We do not totally agree; an increase in work intensity does not *necessarily* constitute an increase in productivity. Nevertheless, while his argument is somewhat plausible, it is difficult to prove. Quiggin (2011) points to anecdotal evidence such as increases in reported work stress and the like. He does have the benefit, however, of having correctly forecast (in 2000) that productivity growth was likely to decline if his work intensity theory was correct.

John Edwards (2011) points to Australia's industrial structure as contributing to measured productivity declines. Productivity varies between industries and within industries. Edwards (2011: 360) argues that the high actual mining productivity figure biases the average level of productivity upwards – only six of 19 industries have above-average productivity levels. Employment growth over the past ten years has tended to occur in those industries with lower productivity. This argument is quite plausible – after all the Australian economy is dominated by service industries. It is well-known

that productivity growth in service industries is likely to be low – this is Baumol’s cost disease at work.³

Related to Edwards’ argument is the fact that productivity follows the business cycle. Inputs and outputs are a function of general economic conditions that are subject to fluctuations. The ABS also publishes measures of what it calls productivity ‘growth cycles’. Paula Barnes (2011) has mapped out variations in productivity over the cycle. She is able to identify both industry cycles and market cycles that impact upon productivity measures. These two types of cycle may have confounding effects on a particular industry. This type of argument, of course, explains the decrease in productivity growth in the mining industry.

Interestingly Paul Barnes (2011) shows that industry cycles are different amongst industries. This once again reiterates that micro level information is needed to understand overall productivity measures.

³ Productivity in labour-intensive sectors is likely to be low due to the inherent limitations on increasing productivity. For example, a hairdresser can only cut one person’s hair at a time and a university professor can still mark one essay at a time irrespective of increased human capital or technological progress. Baumol’s cost-disease relates to salary growth in the service sectors responding not to increases in labour productivity but to salary growth in other related jobs.

5. Productivity as a policy objective

John Quiggin (2011: 370) makes the important point

In summary, productivity is not a particularly useful measure of economic performance. Even when correctly measured, productivity estimates combine the effects of long-term technological growth with a subset of the factors that determine variations in short-term performance.

Australian politicians like to embed their policy proposals in a productivity framework. For example, much of the current debate around Australian productivity relates to the debate around industrial relations. Since the 2004 election the industrial relations system has been somewhat controversial. In that time we have seen the introduction of the WorkChoices system, its repeal and then the introduction of the FairWork system. Both sides of politics have made various claims as to the impact the industrial relations system will have on productivity. We are inclined to agree with Andrew Charlton (2007: 34).

The Left is engaged in a futile war with the Right over the link between productivity and industrial relations. But it's a war that won't be won by rapid-fire exchanges of bogus economic statistics. ... Nobody knows if there is a strong link between productivity and industrial relations systems. The truth is that there are probably lots of potentially contradictory effects, which nobody can precisely quantify because they are indirect.

In a recent paper, published by the Cato Institute, Randall Holcombe and James Gwartney make much the same point.⁴

Labor market regulations, including the laws outlining the rights and obligations of unions, are a component of economic freedom, but one can see from the [Economic Freedom of the World] index that many other factors come into play. Thus, one would be hard-pressed to find a simple correlation between union activity, labor law, and prosperity. Regulation of labor markets is a small component of economic freedom, and while its effects on prosperity are important, they will be small compared with other aspects of economic freedom.

The United States provides an ideal testing ground for the impact of industrial relations systems on productivity. Industrial relations in the US vary from state to state. Some states have so-called 'Right to Work' laws which are considered to be anti-union while others have laws that are considered to be pro-unions. The Americans for Prosperity think-tank have provided a very simple comparison of labour productivity (over the period 1997 – 2007) between Right to Work states and non-Right to Work states.⁵

	Right-to-Work states	Non-Right-to-Work states
Productivity Growth	18.6%	17.6%

⁴ Holcombe and Gwartney (2010: 13) claim that Moore (1998) reports empirical studies that show right-to-work laws do affect productivity, but Moore (1998: 462) argues that the relationship between unionisation and productivity is 'controversial'.

⁵ <http://www.americansforprosperity.org/021909-right-work-and-productivity-numbers>

While it is true that productivity growth does appear to be higher in the right to work states, the analysis makes no formal test to determine whether that difference is statistically significant. Furthermore given the differences in demographics and industrial base it is likely that those two figures are not economically different from each other. In short, while there might be very good reasons why a flexible industrial relations system is valuable it is not going to be possible to capture that importance by simply looking at productivity figures.

Education is another policy area where productivity is invoked to justify greater expenditure. Yet it is not clear that spending more money on education or requiring more qualifications has a large impact on productivity. Surprisingly the economic literature that relates human capital (education) to individual productivity is not well-developed. This is due to a lack of detailed data. Syverson (2011: 340) reports that productivity does tend to increase with both education levels and with age. The problem, however, is that human capital explains very little of the intra-industry variation in productivity.

William Lewis (2004) relates an anecdote of illiterate Latin American agricultural workers being able to attain world's best practice in the US construction industry. He also points to several multi-national corporations that are able to train up local staff to (close to) world standard in underdeveloped economies. The argument here is that it is not education *per se* that is important, but rather the trainability of the workforce. As Lewis (2004: ix) summarises

The importance of the education of the workforce has been taken way too far. In other words, education is not the way out of the poverty trap. A high education level is no guarantee of high productivity. The truth of the matter is that regardless of institutional educational level, workers around the world can be adequately trained on the job for high productivity.

As general evidence for his argument, Lewis points to William Easterly's discussion on education in his book *The Elusive Quest For Growth*. Easterly (2002: 84) sums up the education-for-development experience as 'the returns to the educational explosion of the past four decades has been disappointing'. To be clear, it is not that education is not valuable; the argument that education drives productivity is over-sold.

In his case study analysis of productivity around the world Lewis (2004) comes to the conclusion that productivity should be evaluated at the industry level and that the single best thing that government can do to promote productivity is to promote product market competition. In his summary of the academic literature Syverson (2011) agrees that competition is important, but has an open mind as to it being the single most important consideration. At the firm level he points to factors such as managerial talent, high quality labour and capital inputs, information technology and research and development, learning by doing, innovativeness, and firm structure as all playing a role in promoting firm productivity. External factors that drive productivity include competition policy, appropriate regulations, productivity spillovers, and flexible input markets.

While it is all well and good identifying the factors that might drive productivity at the firm level, we know that productivity levels between firms, even in the same industry, vary substantially. We know that aggregation masks that variation and also introduces measurement distortions into measured productivity. In the end it is difficult to match any particular government policy with immediate productivity gains.

6. The Determinants of Long-Term Economic Growth

Establishing the determinants of long-term economic growth is much like the search for the Holy Grail. Everyone knows what it is, yet finding its exact location is problematic. As Adam Smith indicated, 'peace, easy taxes and a tolerable administration of justice' seems to work well. Robert Barro (1997) has provided an econometric confirmation of the Smith prescription. Barro (1997: 119) reports that GDP per capita growth is 'enhanced by better maintenance of the rule of law, smaller government consumption, and lower inflation'.

Economists tend to agree that in the long run economic growth is a function of technological progress. In summary, long run growth is an entrepreneurial activity. There is little that government can do to foster entrepreneurship beyond providing an appropriate environment. As Hendrik Van den Berg (2001: 549) explains

For innovators to profit from their efforts, there must be rule of law, property rights must be consistently protected, and contracts must be enforced. Sophisticated institutions such as patents and copyright, impartial judicial systems, universities, freedom from censorship, free international trade, equal treatment of foreign and domestic investors, efficient banking regulations, predictable fiscal policy, and non-inflationary monetary policy also help to foster innovation and entrepreneurship.

While we may quibble about the precise details of Van den Berg's explanation the fact remains that Australia already has all of those institutions and mechanisms that enhance and promote long-term economic growth.

Conclusion

Productivity measures should only be used to inform economic policy when micro level data is available. As demonstrated by Chad Syverson, even when industry groups are defined such that they contain a set of reasonably homogeneous firms, productivity varies considerably.

Unfortunately, when productivity measures are gathered at higher (aggregated) levels – for example, at an industry level – crucial information is indiscernible. In the Australian context we believe that this is a particularly acute problem given productivity measures are available only at very high levels of aggregation. This means that policy formation using this measure is highly problematic making it impossible to target as well as assess policy initiatives appropriately.

The problem associated with aggregation increases exponentially when considered at the macro-economic level. Aside from the conceptual issues relating productivity to economic wealth, macro-economic productivity measures are at best indicative as they “average out” firm and industry dynamics, this in turn may result in misleading policy makers on where to allocate scarce resources.

To summarise, forming policy on productivity measures calculated at aggregated levels is courageous when micro information is not taken into account. Specifically, the lack of micro information means any policy formulated using only aggregated data is at best a gamble.

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