What Do We Know About the Productivity Slowdown? Evidence from Australian Industry Data

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Abstract

The productivity slowdown across industrialised countries since around 2004 is a topic of much interest to academic researchers and policy makers alike. As we search for explanations for the slowdown, it is useful to consider what the performance has been at the industry level. This article provides some evidence and perspectives from official Australian industry-level data. While industries have experienced different productivity growth profiles since 1989-90, they all experienced a slowdown after 2003-04. A rise in inefficiency may be one source of this slowdown. Some suggestions for future research directions that may provide a deeper understanding of productivity growth are suggested, in the spirit of a slowdown being too valuable to waste.

Diversity of the Productivity Experience Across Industries

As we puzzle over the productivity slowdown that is afflicting industrialised countries,[2] and contemplate appropriate policy responses, it is worthwhile keeping in mind that performance at the level of specific industries can be very diverse. This is illustrated in Chart 1, for the twelve core industries of the Australian market sector.

The aggregate twelve-industry market sector is represented by the black line with square boxes (Market Sector (12)). The slowdown from the mid-2000s is very noticeable through a flattening out of this line compared to the earlier period. What is also very evident is the diversity of productivity performance across industries.

Agriculture, forestry and fishing is the stand out productivity performer, even with two large downward spikes (in 2002-03 and 2006-07) which repre-

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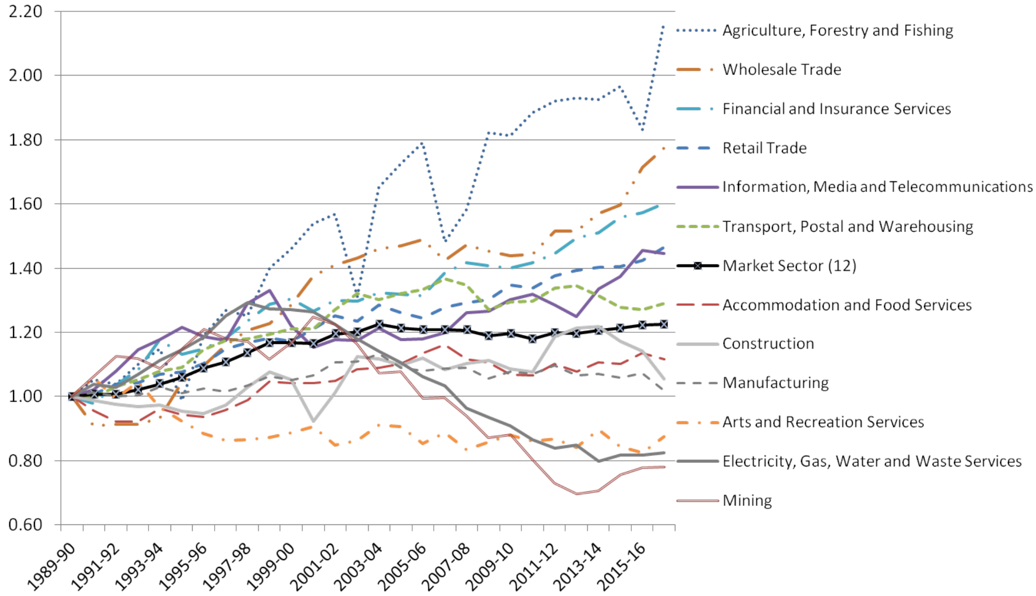
2 For recent aggregate productivity trends across OECD countries, see OECD (2018).

Chart 1: Multifactor Productivity in Australia, by Industry (1989-90=100)



Source: Australian Bureau of Statistics (2018). Note that the indicated years are fiscal years, which run from July 1 to 30 June. The plotted series are cumulated indexes, indicating the level of productivity relative to the base year of 1989-90.

sent the effects of drought. Water is a missing input in almost all productivity analyses, as is the case for the official Australian statistics. Hence the disappearance of a non-measured input has no effect on the input index, but it does have an input on output, reducing productivity growth.[3]

Another standout productivity performer is mining, but at the opposite end of the spectrum. High mining commodity prices led to a mining investment boom. There was much additional input (through major investments in mine development), but with lags in producing output. Combined with falling yields, this led to falling mining productivity.[4]

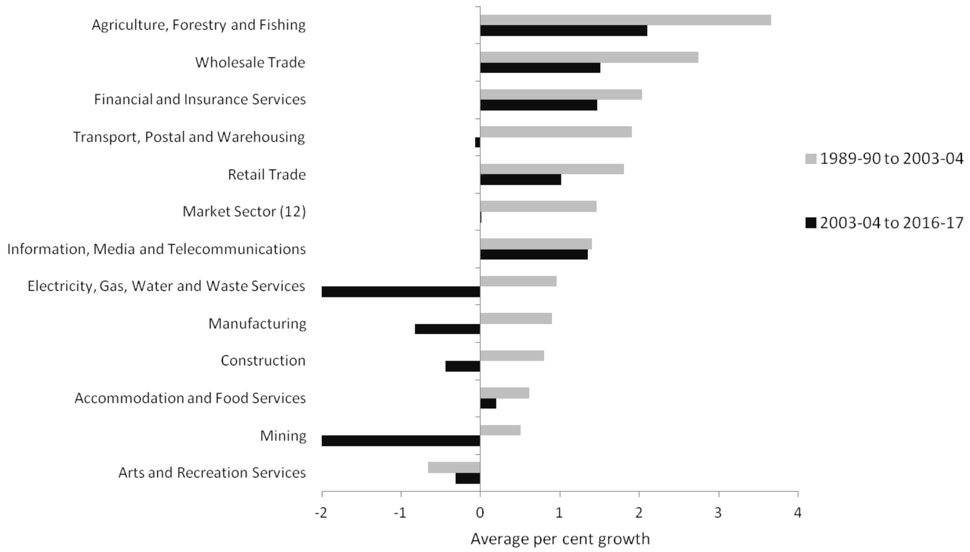
Between these extremes, there are many other industries for which further examination can reveal particular developments which can go some way to explaining their productivity performance over time.[5] Looking at Chart 1, the problem is whether or not there are policies to address the aggregate productivity slowdown when the experiences of the industries seem so diverse. Some commonality of experience across in-

3 Productivity growth, as calculated by national statistical offices, is defined as an output index divided by an input index. That is, it is the growth in output not explained by the growth in input.

4 See Topp, Soames, Parham and Bloch (2008) who found that around a third of the decline in mining multifactor productivity between 2000-01 and 2006-07 was due to long lead times between investment in new capacity in mining and the associated output response. See also Topp and Kulys (2014) on the role of natural resource inputs. For more on industry productivity performance in Australia, see Parham (2012), Connolly and Gustafsson (2013) and Capeluck (2016).

5 For electricity, gas, water and waste services, investment in electricity grid upgrades and the building of idle desalination plants are a major part of the explanation for the performance.

Chart 2: Industry Multifactor Productivity in Australia, by Industry, by Sub-Period



Source: Australian Bureau of Statistics (2018). Note that the indicated years are fiscal years, which run from July 1 to 30 June.

dustries would be encouraging for the prospect of a policy, or policies, which may assist in raising the performance of all industries.

Commonality of the Productivity Experience Across Industries

While Chart 1 suggests diversity, Chart 2 provides some evidence of commonality. It can be seen that all industries had a slower productivity growth in the later period, 2003-04 to 2016-17 with the exception of arts and recreation services.[6] Thus, while overall the productivity experience of these industries is very diverse, there seems to have been something in common which affected their respective productivity, causing it to slow in each case. This may be considered rather surprising. While the strength of the slowdown differs, to have such commonality of experience is somewhat startling and puzzling. It suggests that whatever is driving the slowdown may be mitigated by technological change, but even then no industry has avoided the effect of some seemingly fundamental drag on growth.

The possibility of mismeasurement has been raised to explain productivity slowdowns, past and present.[7] Chart 2 could be interpreted as evidence of increased mismeasurement; perhaps the increasing complexity of the modern economy means that measurement be-

6 The negative productivity growth of -0.6 per cent in arts and recreation services in the earlier period eased to -0.3 per cent in the latter period. This performance hardly suggests this industry as a model for other industries in terms of productivity growth.

7 See, for example, Diewert and Fox (1999) for discussion and references regarding the computer productivity paradox of (particularly) the 1970s and 1980s. See Byrne, Fernald and Reinsdorf (2016) on mismeasurement and the current slowdown.

came more difficult after 2004, resulting in either missing output or an overestimation of input usage, or both. However, given the diverse nature of these industries, in terms of their outputs and inputs, it is hard to see how mismeasurement could have affected all industries to such a sufficient extent as to overwhelm gains from technical change over this period.[8]

Digging Deeper: Decomposing Productivity Growth

Chart 3 provides a decomposition of aggregate market sector productivity, as measured by the Australian Bureau of Statistics.[9] The method is that of Diewert and Fox (2018), which provides contributions of technical progress, inefficiency and input prices to productivity growth. In Chart 3, as logs have been taken, the three components add up to the solid line, which is the path of officially measured multifactor productivity (MFP) growth.[10]

The relatively high TFP growth in the 1990s is usually attributed to the benefits of microeconomic reforms. In other countries, which did not have microeconomic reforms around this time, similar growth is usually attributed to the finally realized benefits of investments in computers over multiple years.[11] The poor growth performance in the 2000s can then be interpreted as a result of the gains from microeconomic reforms having been exhausted. This has led to recent calls for another round of microeconomic reforms to stimulate another golden age of productivity growth.[12]

What can be seen from Chart 3 is that technical progress (T) was rapid through the 1990s, tapered off in the 2000s, and has started to pick up again from 2012. The slowdown in technical progress obviously affected productivity growth, but as the method excludes the possibility of technical regress, it cannot explain falling productivity levels.[13]

Inefficiency (E) has increased dramatically since 2003-04.[14] Thus this increase in inefficiency corresponds with the pro-

8 Syverson (2017) noted that an aggregate productivity slowdown is observed across many countries with diverse industry structures, making mismeasurement of economic activity an unlikely candidate to explain away the slowdown.

9 Further results of applying this method to Australian productivity data, for individual industries and states, are available in Zeng, Parsons, Diewert and Fox (2018).

10 The series which is decomposed is not exactly the same as the official productivity series, but it is very close. It differs because of the way in which the official data are aggregated to form the market sector results.

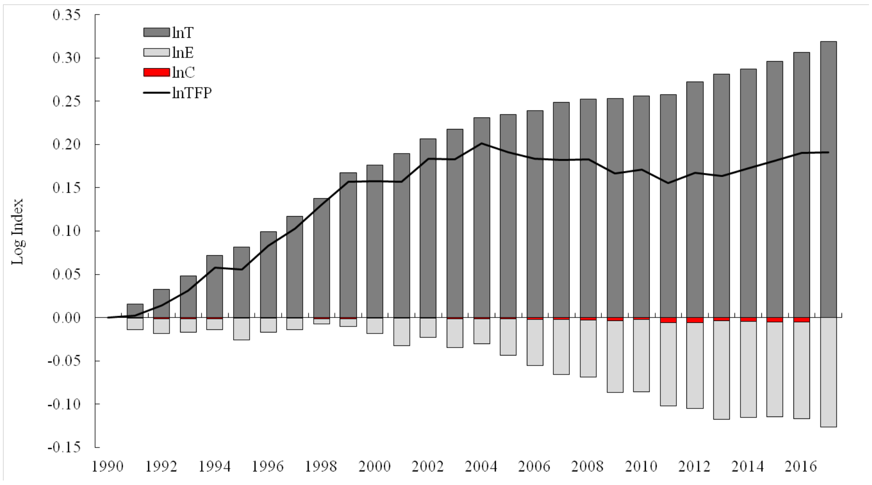
11 A popular argument is that it took a while for firms to re-organise the workplace in order to take advantage of the capabilities of computers.

12 There appears to be no consensus on the nature of any future round of microeconomic reforms, besides perhaps the removal of bureaucratic red tape.

13 It seems reasonable in a modern economy that technological capability is not lost. Puzzling about their empirical results which seemed to show technological degradation for countries with very low capital-labour ratios, Kumar and Russell (2002) asked the following: Does knowledge decay? Were blueprints lost? See also Aiyar, Dalgaard and Moav (2008).

14 The other component is the effect from changes in input prices, C. This is tiny relative to the contributions of technical progress and inefficiency, and hence will not be discussion further.

Chart 3: Decomposition of Market Sector TFP in Australia into Technical Progress (T), Inefficiency (E) and Input Prices (C), 1990-2017



Source: Zeng, Parsons, Diewert and Fox (2018), using data from Australian Bureau of Statistics (2018).

ductivity slowdown. It can be argued that this is more reasonable than interpreting the productivity slowdown as a decline in the pace of advancement of technology. The increase in inefficiency can be interpreted as a direct consequence of the technological disruption that leads to the stranding of assets.

For example, if Airbnb leads to hotels having a decline in occupancy rates, it is difficult for an established hotel to downsize; how to sell off a just one corridor of excess rooms? Similar examples can be easily thought of for almost all of the industries within the market sector.

If a firm is underutilizing an asset (through facing excess capacity or technological obsolescence) and cannot dispose of it, it remains on its books. The fact it is underutilized is typically not captured by the national statistical office. At the same time, the firm may be investing in new capital, in order to take advantage of new technologies; old and new technologies may exist in parallel within the same firm, due to stranded capital. This leads to a measured rise in inefficiency, which appears as a decline in productivity. Similarly a national statistical office may not capture asset disposals appropriately, so that even if the firm does dispose of the asset, this may not be reflected in the productivity statistics.

Hence, we return to the possibility that mismeasurement potentially underlies at least some of the measured TFP slowdown. However, this time it is from the mismeasurement of capital input, rather than the mismeasurement of market output, which has been the emphasis in much of the literature to date.

Research Directions

It seems that we are still lacking the certainty to declare the direction and extent of future productivity growth. We are currently in a period of perhaps unprecedented technological change, yet there exists significant anxiety about the contemporaneous decline in measured productivity growth. Throughout history, technological change, a main driver of productivity, has either been a source of inspiration or despair, either being the driver of higher standards of living or a source of our (employment and social) worries.[15] A better understanding of the performance and measurement of economies during periods of technological disruption can go a long way to easing anxieties, and to the design of effective growth policies. Some research directions in which understanding can be profitably advanced are provided below.

The treatment of new and disappearing goods.

Statistical agencies are typically unable to appropriately measure the effects of new and disappearing goods on inflation and economic growth. The problem is that prices of the goods are obviously missing when they do not exist, or are not included in the statistical agency survey. This obviously creates problems for the construction of price deflators and the corresponding measures of real economic activity. This is not a new problem statistical agencies have long implemented strategies for replacement sampling[16] but one that may have become more important given a proliferation of new and specialized goods and services, often related to the digital economy.[17] With increasing availability of transaction level data and electronic sourcing of product characteristics, it is possible to explore different choices for handling this problem, and the implicit quality adjustment that alternative methods imply.[18]

Valuation of new free goods and services.

Free goods and services characterize much of the digital economy, represented by Facebook, YouTube and popular applications such as Whatsapp. With news, entertainment and communication services increasingly moving to such plaforms, they are replacing services which have observed market prices. The result is lower measured economic activity, resulting in lower measured economic growth and hence productivity. Again the problem can be thought of as one of missing prices even free goods have a value to consumers. There have been attempts at eliciting valuations using (laboratory and online) experiments and to examine the impact on economic growth of including these valuations in augmented measures of GDP.[19]

15 See, for example, Mokyr, Vickers and Ziebarth (2015) for a broad historical perspective.

16 Statistical agencies refresh their sample of products by substituting replacement products for the disappearing products. They may make some quality adjustments to the new products, making replacement products comparable to the disappearing products.

17 This is not limited to services and software design. The cost of designing and producing new and specialized products has likely been significantly reduced through computer aided design and technologies such as 3D printing.

18 See Diewert, Fox and Schreyer (2018) and Adams and Klayman (2018) for more on this problem.

19 See Brynjolfsson, Collis, Diewert, Eggers and Fox (2018).

Better time-use data

Few countries have detailed and regular data on how time is used.[20] Such data can be used to understanding production in the home. This can help beyond learning about the distribution of household work across gender and age groups, but also about the impact of the digital economy on the production and consumption of entertainment services. The production and consumption of free digital entertainment (such as YouTube videos) has an opportunity cost, and this provides another way to place a value on such goods. It can also aid in the measurement and valuation of the labour that goes into the production of community-developed software, such as the program R, and household innovation (Sichel and von Hippel, 2018).

Firm-level data

Finally, the increasing availability of firm-level data, and linked longitudinal employer-employee data, provides the opportunity to examine productivity from the firm level. Berlingieri, Blanchenay, Calligaris and Criscuolo (2017) describes the OECD MultiProd project, which provides harmonised micro-aggregated data of paramount importance for investigating the extent to which different policy frameworks can shape firm productivity and examining the way resources are allocated to more productive firms. There is much policy relevant research emerging using firm-level data, and the scope will increase as other (administrative) data sets are linked, such as detailed traded data.[21]

What should be clear is that while there are measurement problems which may be created or exacerbated by the modern economy, there are also opportunities facilitated by new data and research methods becoming available due to the digital economy.

Conclusion

So what do we know about the productivity slowdown? Clearly not enough, but with the emergence of new data sources and methodologies there are increasing opportunities to understand sources of productivity. Combined with heightened interest from policy makers, the potential for researchers to advance understanding of sources of productivity is great. It could be said that no slowdown should go to waste.

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20 The last time-use survey in Australian was in 2006. Funding for a new time use survey has been announced recently, by the Minister for Women, for 2020-21; see Craig (2018).

21 In Australia, the Australian Treasurys Firming up Productivity in Australia project is seeking to build capability in microdata analysis and improve the microdata access environment. There is a focus on developing a productivity growth narrative from the firm level to inform structural policy; Australian Treasury (2018).

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