

Productivity perspectives 2006

Joint ABS/Productivity Commission Conference

Directions in Productivity Measurement in Australia

Carl Obst

Australian Bureau of Statistics

Productivity Perspectives 2006

Directions in Productivity Measurement in Australia

Introduction

The ABS has been producing productivity estimates for approximately 20 years. Considerable development work took place during the 1980s leading to the publication of the first estimates of multi-factor productivity (MFP) in 1985. Since then MFP estimates for the market sector have been produced each year and released in conjunction with the annual national accounts.

Since 1985, the only major change in methods used to compile the MFP estimates, aside from changes made to improve the underlying national accounts series, was the introduction of an improved approach for the measurement of capital inputs – the use of capital services rather than depreciation. Other work on productivity related topics has taken place, for example work on measuring the quality of labour inputs and the measurement of output in non-market industries such as health and education, however, this work has not impacted on the headline MFP estimates.

Over recent years the interest in productivity has increased significantly with particular interest in the productivity performance of individual industries and the performance of the Australian economy relative to other countries. In response to this increased demand, the ABS commenced a project in 2002 aimed at developing industry level estimates of MFP. Estimates were released in a research paper in 2005 (Zheng, 2005) and confirmed that while there were some limitations in the available data, meaningful estimates could be developed.

Following on from that positive finding, the ABS was funded to develop and release annual industry level MFP estimates. A small team has been established to complete this work and a range of other productivity related topics. Other areas in the ABS are also undertaking analysis and compilation associated with productivity. A Productivity Measurement Reference Group with representatives from key government agencies, academia and the business sector has also been formed to ensure that the program of work reflects key users interests and is compatible with current thinking on productivity measurement. This paper gives a brief overview of the projects that are underway and likely to be advanced in the near future and presents some preliminary results from a recent investigation.

Key projects underway

Industry MFP

As noted in the introduction, work released in 2005 presented estimates of industry level MFP for those industries in the market sector. The MFP estimates were

calculated on both a gross value added and gross output basis for each industry. Current work is aimed at developing this work further by

- operationalising the approaches to permit regular compilation and better connection to the source data; and
- undertaking reviews for each industry to assess the plausibility of results.

A significant issue that needs investigation and discussion is the question of aggregation. For presentational and analytical reasons it would be preferable to ensure that the link between the individual industry measures and an aggregate measure of MFP is simple and clear. However, there are numerous issues in aggregation that together mean a simple and clear choice is not available. Completing work on aggregation and on defining an appropriate headline measure will be important.

Labour input measures

The labour input measure currently used in the market sector MFP estimates is sourced from the ABS Labour Force Survey (LFS). This is the only source of data on hours worked by both employees and the self employed. The LFS also provides, on a quarterly basis, hours worked by industry and from these data a market sector estimate can be constructed. While there are some concerns about the accuracy of the LFS measures of hours worked due to reporting and recall issues for respondents, it is felt that the survey gives quite useful information on the concept that is being sought. Information on numbers of employees or numbers of jobs is not preferred for productivity analysis.

While the LFS is a good starting point there are some concerns in the context of compiling industry estimates. LFS industry allocations are based on statements by respondents about which industry they work in. Responses to this might be problematic, particularly in circumstances where employees are working through employment contractors. Also, since the remaining industry data for productivity analysis (output and capital input data) are sourced from business based collections, there is no direct assurance that the hours worked underlying the output estimates for a particular industry will be consistently reflected in the LFS responses.

One proposal to resolve this consistency issue is to use employment data from business based collections and combine it with hours worked data from the LFS to give both a good estimate of total, all industries, hours worked and a more consistent allocation to industry of that total. Work in this area is continuing.

The other general concern on hours worked data is the actual level of hours worked. For the purposes of productivity estimation in Australia an index of hours worked is created using movements in the LFS hours worked time series. However, for the purposes of international comparison the level of hours worked is important. While the ABS has not published estimates of the level of hours worked, the OECD has released estimates, based on ABS data, which derive the annual level by taking the four quarterly observations (February, May, August, November) of hours worked and multiplying by 4. The result is that Australia's level of hours worked is quite high compared to other countries and our labour productivity is lower. It is considered that the OECD published estimate is too high because it does not take into account the major holidays in Australia particularly those around Christmas and New Year. The

ABS is developing a new method which aims to produce more representative measures of the level of hours worked.

Wages, productivity and unit labour costs

The ABS produces a number of measures of changes in labour costs and related concepts. These include the Wage Price Index, Average Weekly Earnings and average Compensation of Employees. The Commonwealth Treasury produces nominal and real unit labour costs series on a quarterly basis, largely based on ABS data.

To help users better understand the differences and uses of these measures, the ABS is doing some descriptive work in this area. One particular aim is to describe the theoretical links between the different measures, and labour productivity is one important linking factor.

Improvements in measures of capital

The measurement of capital inputs is one of the most complex in productivity measurement. Generally, the actual volume of capital stock cannot be directly observed and hence a range of models and assumptions are required in order to generate appropriate estimates. This approach generates a number of areas in which review is warranted. Three key areas have been identified.

- The basic data feeding into the capital input estimates are flows of capital investment by asset type by industry. Since different asset types have different price movements and different asset lives, and since each industry uses a different asset mix, then inaccuracies in allocation of asset type to industry may be of importance. While there are few data available to directly confront the current estimates we plan to undertake some plausibility checks of the current estimates based on general knowledge of the industries and also do some sensitivity analysis to understand what impact changing allocations of assets to industries might have on the productivity estimates.
- Once appropriate capital investment series are defined, the derivation of measures of capital stock, depreciation and capital services require assumptions regarding asset lives, exit functions, depreciation rates and efficiency patterns. All of these assumptions may generate measurement impacts.
- More broadly, a choice can be made between the use of endogenous or exogenous rates of return when deriving a measurement of the user cost of capital. This choice may impact on the estimates of capital services and is described further below.

The calculation of user costs of capital is central to the derivation of flows of capital services. The aim in measuring capital services is to derive a volume of rental services provided by each asset, thus treating all assets as though they were rented from an owner. To appropriately measure such a concept it is necessary to estimate the rental price of each asset.

The method used involves a two step process. First, an endogenous rate of return is estimated for each industry using industry operating surplus. This rate of return is

used to estimate a rental price for each asset within an industry. These rental prices are used to form weights for each asset. Industry capital service flows are then determined by applying the asset rental price weights to the asset's productive capital stock. Through aggregation this gives a flow of capital services for each industry. Second, these industry level flows are aggregated to a market sector level using industry operating surplus as weights.

The endogenous rates of return for each industry often seem to provide odd estimates, at times being very low, or alternatively very high. While some variation is expected the amount of variation is somewhat surprising. The results at the aggregate level however seem plausible. To deal with the industry level results a "floor" is placed on the rates of return of around 4% in order to remove the impact of very low or negative endogenous weights on the overall rental price weights. This approach is satisfactory from the perspective of deriving an aggregate market sector estimate of productivity but does raise concerns if industry level estimates are required.

Two approaches are being investigated to advance the issue. First, a detailed reconciliation and understanding of the reasons for "odd" rates of return will be undertaken. In some cases it may be that the result is appropriate for the given asset base (for example low rates of return to land for agriculture). Second, a sensitivity analysis will be completed. That is to say that one can test to see how much impact the endogenous rates of return have on the final result at an industry level by comparison to the use of exogenous rates of return.

Preliminary results from such a sensitivity analysis are in the graphs below. For Manufacturing (figure 1) there is no difference between the use of endogenous and exogenous rates as the endogenous rate is just slightly below the generally applied exogenous rate of 4 per cent plus the CPI increase. For Finance and Insurance (figure 2), while there is clearly a difference between the results, the impact does not seem large and indeed over the 40 year time frame the growth rates between the series are very aligned. The preliminary conclusion, therefore, is that the impact of the use of endogenous or exogenous rates of return is not significant but further testing will seek to confirm this result.

Figure 1: Manufacturing capital services, exogenous and endogenous internal rates of return, 1964-65 to 2004-05
Index 2003-04 = 100

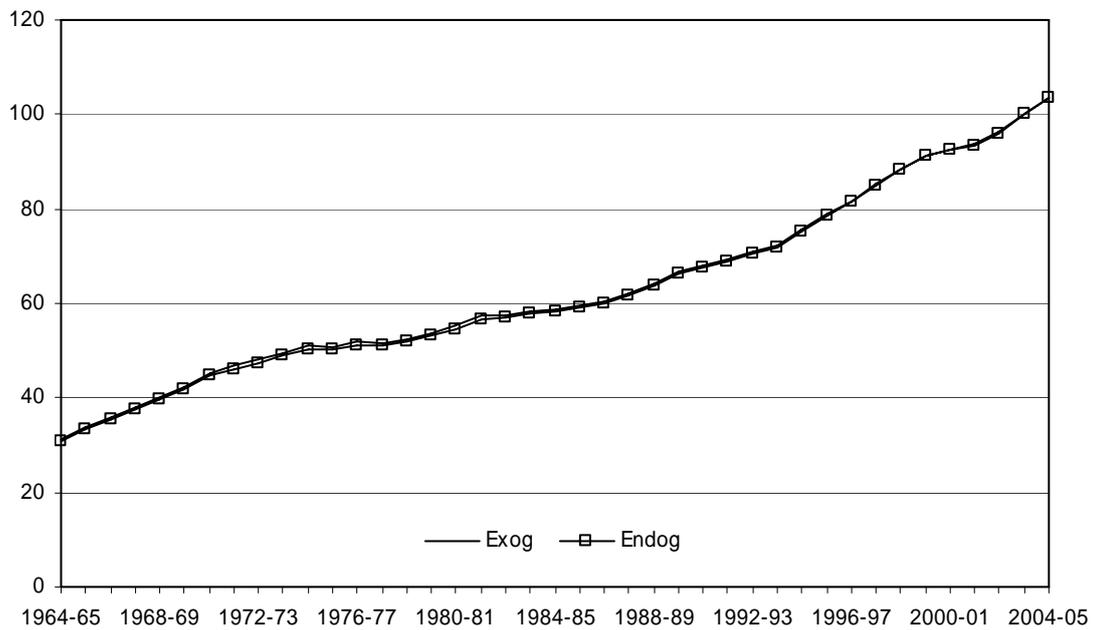
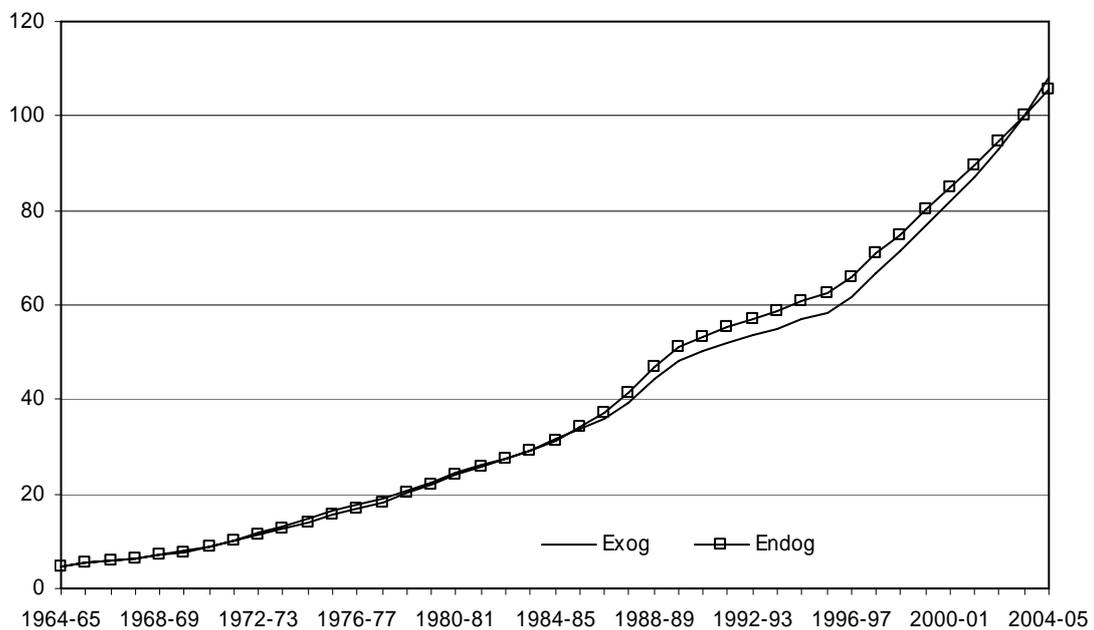


Figure 2: Finance and insurance, exogenous and endogenous internal rates of return, 1964-65 to 2004-05
Index 2003-04 = 100



One other area to test is the two step aggregation method described above in which exogenous rates are used at the asset type level but endogenous rates are used at the industry level. While this may be a less than perfect aggregation method, a quick review of the alternative approaches suggests that some compromises may be essential in deriving aggregate measures of capital services within the broader

accounting framework. Further analysis of different aggregation measures will be an important part of future work in this area.

Human capital

The ABS has had a project on the measurement and valuation of human capital running for the last few years. Some results were presented at the last Productivity Perspectives conference in December 2004. At that time work had been completed on measuring the stock of human capital. The approach used was developed in the US by Jorgenson and Fraumeni (1989) and is known as the lifetime labour income approach. The approach has been applied in Australia using population census data from 1981, 1986, 1991, 1996 and 2001. Data on age, sex, educational achievement and income levels have been combined to estimate the future income stream that would apply to each individual of a given age, sex and educational achievement. By discounting and aggregating these various income streams the value of human capital in Australia is estimated.

Work since then has concentrated on measuring the flows of human capital considering the impact of investment in education and training, and demographic changes such as migration and population ageing. This work is nearing completion.

Business longitudinal database

At the previous Productivity Perspectives conference a new ABS project to develop a Business Longitudinal Database (BLD) was introduced. The aim of a BLD is to provide information on business characteristics and financial performance at a fine level of detail for a selected panel of businesses over a long period of time. There are a range of methodological issues in establishing such a database but there are well known benefits in the longer term from starting such a collection.

Since the last conference in December 2004 much work has been undertaken and funding has also been received to progress further with the work. The first results should be available towards the end of 2006 but clearly the benefits will build over time.

The BLD will consist of panels of 3000 small/medium sized businesses who will be followed for 5 years each. New panels will be selected each year. A business characteristics survey will be undertaken and this information will be combined with the financial and employment already collected for those businesses through regular collections. The main links being targeted at this stage are towards the activities that are thought to enable productivity growth (such as innovation) and the capacity of businesses to undertake these activities. The BLD's finance and employment data will also allow users to assess the outcomes of these various activities, although the data available will only enable proxy measures of labour and capital input to be estimated.

The ability to investigate and better understand firm level behaviour is seen as an important improvement in the available data set. While every effort has been made to make the BLD as comprehensive as possible it will undoubtedly develop over time particularly as researchers begin to understand the data and how better questions

might be posed. Further development of productivity measures will also occur over time.

Future work

The field of productivity measurement in Australia and internationally is being opened up significantly at present. By setting up a separate team to investigate the relevant issues, the ABS has recognised this development and is participating actively. There are numerous areas that warrant further investigation and review, many of which have been highlighted in this paper. Other areas and questions that we would like to pursue include:

- How to best obtain aggregate measures of productivity for the market sector
- Estimating growth cycles at aggregate and industry levels
- Separating gross mixed income into labour and capital income shares
- Measuring MFP for the Property and business services industry
- Improving output measures for the non-market sector components of the economy – e.g. health and education output
- Developing a productivity measurement database to allow researchers more capacity to use alternative assumptions and aggregation techniques.

The ABS would welcome comment and contributions on the work program and issues that might be examined in improving Australia's measures of productivity and their relevance for policy development and analysis.

Further information

For further information on the ABS productivity measurement work program please contact Paul Roberts, paul.roberts@abs.gov.au.

For further information on the ABS human capital work program please contact Hui Wei, hui.wei@abs.gov.au.

For further information on the ABS business longitudinal database work program please contact John Blanchette, john.blanchette@abs.gov.au.

References

Aspden, C. (1990) *Estimates of Multifactor Productivity, Australia*, Occasional Paper, (cat. no. 5233.0), ABS, Canberra.

Australian Bureau of Statistics (2000) *Australian System of National Accounts: Concepts, Sources and Methods*, (cat. no. 5216.0), ABS, Canberra.

Australian Bureau of Statistics (2001) 'Further Developments in the Analysis of Productivity Growth in Australia', Feature Article in *Australian National*

- Accounts: National Income, Expenditure and Product*, (cat. no. 5206.0), September 2001 ABS, Canberra.
- Australian Bureau of Statistics (2005) 'Estimates of Productivity in the Australian National Accounts', Feature Article, in *Australian National Accounts: National Income, Expenditure and Product*, (cat. no. 5206.0), September 2005, ABS, Canberra.
- Australian Bureau of Statistics (2005), *Australian System of National Accounts*, 2004-05, (cat. no. 5204.0_ ABS, Canberra.
- Blanchette, J. 2005, *ABS Business Longitudinal Database*, paper presented to Economic Statistics User Group, December.
- Jorgenson, D.W. and Fraumeni, B.M. 1989, 'The Accumulation of Human and Non-Human Capital 1948-1984', in R.E. Lipsey and H.S. Tice (eds) *The Measurement of Savings, Investment, and Wealth*, University of Chicago Press, Chicago, pp227-82.
- Wei, H. (2004) *Measuring the Stock of Human Capital for Australia*, Research Paper, Working papers in Econometrics and Applied Statistics, Working paper no. 2004/1 (cat. no. 1351.0.55.001), ABS, Canberra.
- Wei, H. (2004) *Measuring Human Capital Formation for Australia: A Lifetime Labour Income Approach*, paper presented at the 33rd Annual Conference of Economists, Sydney.
- Wei, H. (2004) *Measuring Human Capital for Australia: Issues and Estimates*, paper presented at the 2004/5 Australian Labour Market Research Workshop, Perth.
- Zheng, S. (2005) *Estimating Industry-Level Multifactor Productivity for the Market-Sector Industries in Australia: Methods and Experimental Results*, Research Paper, (cat. no. 1351.0.55.004), ABS, Canberra.