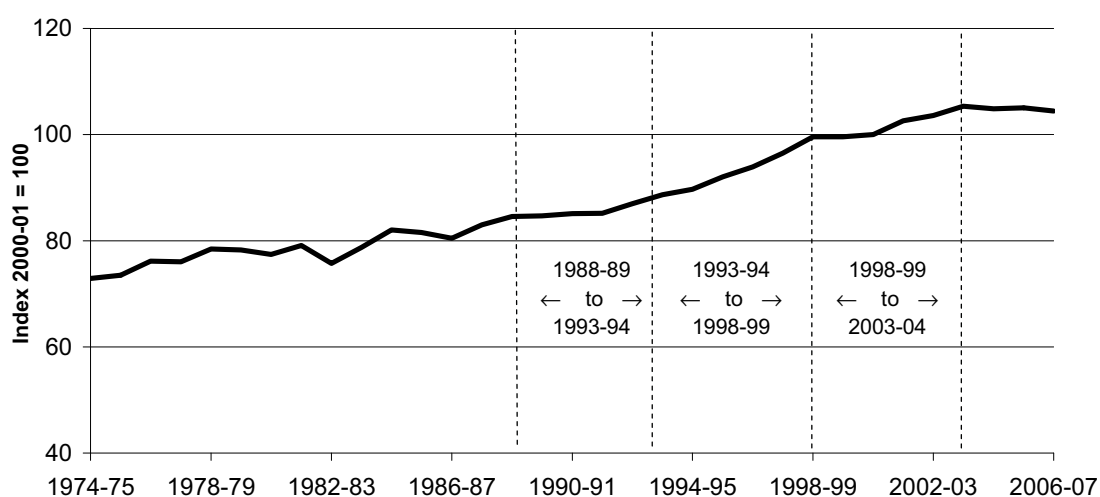

1 Introduction

1.1 Background

Australia's aggregate productivity growth has been weaker in the 2000s compared with the strong performance in the 1990s (figure 1.1). The trend rate of multifactor productivity (MFP) growth, as represented by the annual average over a productivity cycle, dropped from an exceptionally-high 2.3 per cent in the cycle from 1993-94 to 1998-99 to 1.1 per cent in the next cycle ending in 2003-04.¹ (However, the latter rate is still only a little below the 1.3 per cent average over the period 1964-65 to 2003-04.) The years since 2003-04 have only covered an incomplete 'down' part of a cycle. While there is therefore no comparable trend figure as yet, it can be noted that productivity growth in the three years since 2003-04 has been unusually weak (see figure 1.1 and table 1.1)

Figure 1.1 **Market sector MFP, 1974-75 to 2006-07**

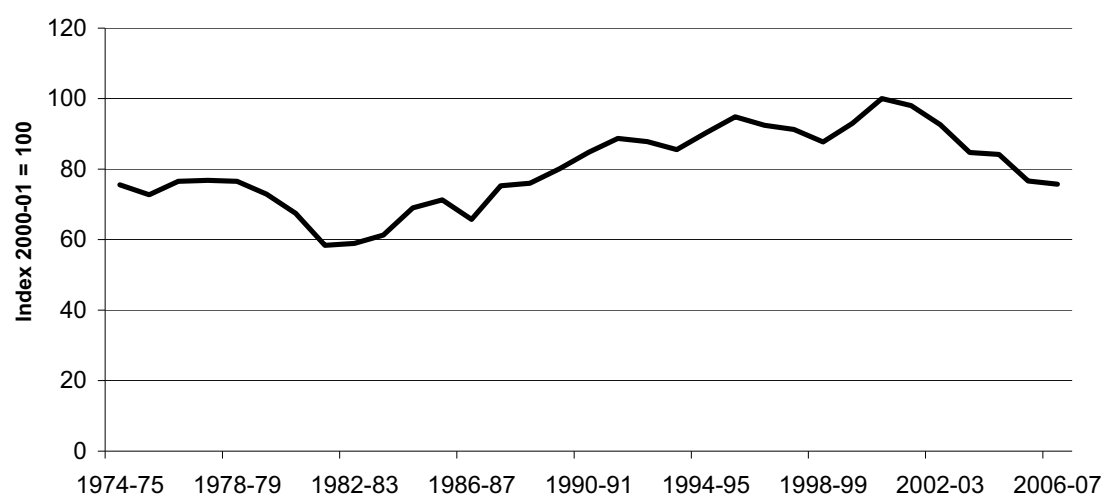


Data source: ABS (Australian System of National Accounts 2007-08, Cat. no. 5204.0).

¹ Productivity data are volatile from year to year and are also cyclical for a number of reasons, including that employment growth tends to lag output growth. To overcome these problems, the ABS measures underlying productivity trends by calculating annual average rates of growth between peaks in productivity cycles. For more information see the Productivity Commission website: <http://www.pc.gov.au/research/productivity/estimates-trends/trends>.

The weaker productivity performance of the market sector since 1998-99 has been characterised by slower rates of MFP growth across nearly all industries, including mining in more recent years. The wholesale trade, electricity, gas and water, and communications services industries have had the sharpest decline in the rate of MFP growth over the 1998-99 to 2003-04 period compared to the 1993-94 to 1998-99 period.² Since 2003-04, most industries have had lacklustre MFP growth, with the agriculture, mining and manufacturing industries in particular contributing negatively to overall productivity (table 1.1). With respect to the mining industry, measured productivity has fallen consistently since 2000-01 (figure 1.2), with the negative effect on aggregate productivity being especially strong in 2005-06, when a 8.8 per cent decline in mining MFP took almost one percentage point off market-sector productivity growth.

Figure 1.2 Mining: MFP, 1974-75 to 2006-07



Data source: Estimates are provided by the ABS for the period 1985-86 to 2006-07 (*Experimental Estimates of Industry Multifactor Productivity 2007*, Cat. no. 5260.0.55.002). The Productivity Commission extends the ABS estimates by calculating productivity related indexes for the period 1974-75 to 1985-86. These estimates are based on published and unpublished data provided by the ABS.

² The industry contributions to weaker aggregate productivity growth are highlighted and discussed in Parham (2005) and Parham and Wong (2006).

Table 1.1 Selected productivity estimates

Per cent

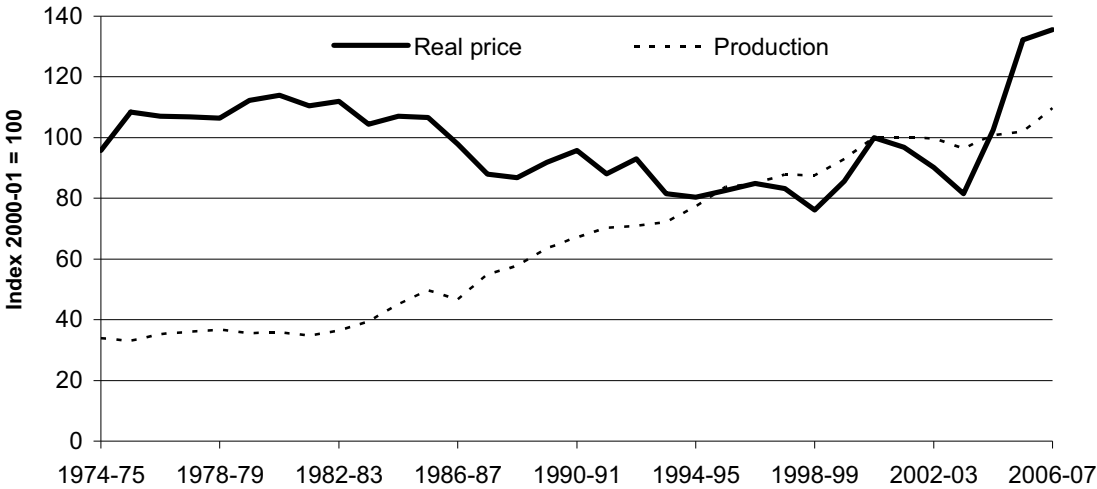
	1993-94 to 1998-99	1998-99 to 2003-04	2004-05	2005-06	2006-07	1974-75 to 2003-04
Market sector						
Labour productivity	3.3	2.1	0.3	2.5	0.4	2.1
MFP	2.3	1.1	-0.5	0.2	-0.6	1.1
Multifactor productivity (MFP)^a						
AFF ^b	3.8	3.4	4.4	3.8	-23.9	1.8
Mining	0.5	-0.7	-0.6	-8.8	-1.3	0.0
Manufacturing	0.9	1.8	-3.5	-0.4	1.3	1.3
EGW ^c	2.0	-2.3	-1.8	-4.7	-4.7	1.4
Construction	2.7	0.9	-0.5	3.6	1.3	1.1
Wholesale trade	5.7	1.7	2.1	0.4	-4.2	0.7
Retail trade	1.9	1.3	-0.3	-0.1	3.1	1.0
ACR ^d	2.1	0.7	0.2	4.0	-1.9	-0.6
Transport and storage	2.2	2.4	1.8	-0.2	2.7	2.2
Communication services	4.7	0.1	-2.5	5.4	3.6	3.8
Finance and insurance	2.9	0.7	0.5	1.1	0.8	0.6
CRS ^e	-1.3	1.4	-0.6	-2.2	3.5	-0.6
Industry contributions to market sector MFP growth (percentage points)^f						
AFF ^b	0.2	0.2	0.3	0.3	-1.3	
Mining	0.0	-0.1	0.0	-0.8	0.0	
Manufacturing	0.2	0.4	-0.8	-0.2	0.2	
EGW ^c	0.1	-0.1	-0.1	-0.1	-0.2	
Construction	0.3	0.1	-0.1	0.4	0.1	
Wholesale trade	0.5	0.1	0.2	0.1	-0.3	
Retail trade	0.2	0.1	-0.1	0.0	0.3	
ACR ^d	0.1	0.0	-0.1	0.2	-0.1	
Transport and storage	0.2	0.2	0.2	0.0	0.3	
Communication services	0.3	0.0	-0.1	0.2	0.2	
Finance and insurance	0.3	0.1	0.2	0.3	0.3	
CRS ^e	0.0	0.0	0.0	-0.1	0.1	

^a Calculated as a value-added basis. ^b Agriculture, Forestry and Fishing. ^c Electricity, gas and water supply. ^d Accommodation, cafes and restaurants. ^e Cultural and recreational services. ^f Productivity Commission estimates.

Sources: ABS (*Australian System of National Accounts 2006-07*, Cat no. 5204.0); ABS (*Experimental Estimates of Industry Multifactor Productivity 2007*, Cat no. 5260.0.55.002).

The extent and duration of the decline in mining productivity has been surprising in view of the substantial increase in activity in the industry, especially in recent years. A ‘once-in-a-generation’ shock to demand for, and prices of, mining commodities has stimulated very substantial growth in new investment, employment and profits. And yet output growth has been weak at best and productivity has been in decline (figure 1.3).

Figure 1.3 Mineral and energy commodities: production and output prices, 1974-75 to 2006-07^a



^a 'Real price' is a composite index based on prices of: coal, crude oil, condensate and LPG, natural gas, iron ore, bauxite, nickel, manganese, uranium, tin, silver, lead, zinc, gold, copper, ilmenite, rutile, and zircon. Nominal prices deflated by the GDP deflator. Production is ABS Mining value added in CVM (Chain volume measure) terms with a reference year of 2006-07.

Data sources: Authors' estimates using data from ABARE (*Australian Commodity Statistics*, various issues); ABS (*Australian System of National Accounts 2007-08*, Cat. no. 5204.0 Table 9).

Indeed, developments in mining appear to be one of the factors at the heart of a more general paradox, most apparent in recent years. At the same time that there has been very strong growth in inputs, there has not been as strong growth in output and so there has been weak or negative growth in productivity. Income growth has been sustained, however, by the rise in commodity prices and the increase in the terms of trade. The sustainability of income growth driven by higher commodity prices is a key issue however, particularly in light of recent developments in global commodity markets and global financial sector. As a result, it is important that attention is given to explaining the comparatively slow rate of growth in real output so far this decade, including that observed in the mining industry.

1.2 Objectives and scope of the paper

This paper looks at mining industry productivity in depth. Its specific objectives are:

- to develop a better understanding of the factors that contribute to trends in mining productivity over long periods;
- to explore the reasons for the decline in productivity since the turn of the century; and
- to assess the implications of the movements in mining productivity and other developments in the sector for the economy as a whole and for growth in living standards.

The productivity measurement challenges in mining are different in several important respects from those in other sectors. Understanding the nature of mining activity, and in particular the nature of capital investment, is one key to understanding the factors that determine mining's productivity 'profile'. The nature of mining activity and the characteristics of mining productivity are discussed in the next chapter.

Mining differs from most other industries in its hefty reliance on natural resource inputs. Changes in the quality of these inputs are not generally taken into account in traditional productivity measurement methods. That would not be a big concern if an essentially continuous supply of constant grade resources or constant quality resources could be tapped.³ But, if ore grades or other aspects of resource quality decline as deposits are depleted, then, the measured productivity of mining may decline (as it will take more inputs to produce a unit of output). Such a decline in measured productivity arguably does not represent a decline in production efficiency in mining activity. And so, some movements in mining productivity need to be interpreted differently.

The role of natural resource inputs, and the effects of depletion and new discoveries of deposits, in conditioning mining productivity has been somewhat overlooked or underplayed in the resource economics literature. It is given special attention in chapter 3.

Resource depletion plays a role in the decline in measured productivity observed since the turn of the century, along with another factor — the limited flexibility of capital in the mining industry to respond to a prices 'shock' of the like witnessed in recent years. Chapter 4 details the issue of long lead times in bringing new

³ This is ultimately impossible with respect to non-renewable resources. However, the negative effect of depletion of deposits may be counterbalanced by new resource discoveries and the development of new mining techniques over time.

productive capacity on-line in mining, and the consequences for MFP, while chapter 5 reviews the extent to which a commodity price ‘shock’ impacts on mining MFP through greater incentives to produce from poorer quality deposits, or using lower quality inputs. Chapter 5 also reviews other factors that impact on mining MFP, and assesses the overall contributions made by resource depletion and capital lag effects to the decline in mining productivity.

Productivity is usually interpreted as an indicator of efficiency and productivity growth is usually viewed as the principal source of improvement in living standards. But, as suggested above, the decline in measured mining productivity has to be viewed in context. It is not necessarily indicative of a decline in the technical ability of miners to produce output from a given quantity (and quality) of inputs. In addition, the sharp increase in mining commodity prices counteracts the effect of lower measured productivity on prosperity. The recent contributions of prices and productivity to improvements in prosperity are assessed in chapter 6.