



Information Paper Experimental Estimates of Industry Level KLEMS Multifactor Productivity

Australia 2015



Friday 27 November 2015

5260.0.55.003



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Multifactor Productivity**

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AUSTRALIAN BUREAU OF STATISTICS

EMBARGO: 11.30AM (CANBERRA TIME) FRIDAY 27 NOVEMBER 2015

ABS Catalogue No. 5260.0.55.003

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The ABS thanks Mr Dean Parham (Deepa Economics), Dr Shiji Zhao (Productivity Commission) and Professor Kevin Fox (UNSW) for their helpful comments on an earlier draft of this paper.

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1. INTRODUCTION

PURPOSE OF PAPER

This paper presents the first ABS experimental estimates of industry level KLEMS multifactor productivity (MFP) for the 16 market sector industries. The purpose of these estimates is to facilitate more in-depth analysis of the determinants of growth at the industry level.

In recent years, key users of macroeconomic performance indicators have advocated increasing the availability of more detailed productivity statistics as the main way to improving their overall fitness for purpose. In particular, expanding growth accounts to the industry level to meet the need for more granular measures of economic performance. In response to this, the ABS commenced research into developing estimates of industry level KLEMS MFP.

Moreover, the approach to compiling KLEMS MFP estimates follows the initiatives being developed and advocated by other national statistical organisations including USA, Canada, Japan, Korea, the EU, India, China, Brazil and Argentina. The term KLEMS represents the five input categories – Capital (K), Labour (L), Energy (E), Materials (M) and Services (S).

There are a number of challenging conceptual and measurement issues involved in compiling productivity statistics. The results in this paper should be considered experimental and hence, interpreted with reference to the qualifying discussions.

The paper is structured as follows. Chapter 2 discusses the methodology and interpretation of productivity measures. Chapter 3 presents a brief summary of results. Chapter 4 focuses on the analysis of individual industry estimates. Several areas still require further research and provide a basis for future work in this field. These topics are summarised in the concluding chapter.

The ABS plans to publish industry level KLEMS MFP estimates on an annual basis and welcomes user feedback regarding the results and methodology. An industry level KLEMS MFP data cube will become available on the ABS website at www.abs.gov.au in early 2016. Please forward any comments to Khanh Hoang (khanh.hoang@abs.gov.au).

BACKGROUND

The ABS has been producing aggregate MFP statistics since 1985. The ABS produces annual indexes of labour and multifactor productivity (MFP) for the “market sector”, and since 2007, for each industry division within the market sector. The market sector consists of industries which predominantly produce goods and services which are sold at “market prices”, that is, prices which determine the quantity of goods produced and sold and which over the business cycle cover the cost of production.¹

The annual productivity measures for the market sector are published in **Australian System of National Accounts** (cat. no. 5204.0), and annual industry level productivity indexes in **Estimates of Industry Multifactor Productivity** (cat. 5260.0.55.002). The ABS also produces quarterly estimates of labour productivity (i.e. GDP per hour worked) for the market sector and for the whole economy. These are published in **Australian National Accounts: National Income, Expenditure and Product** (cat. no. 5206.0).

¹ See Chapter 3 for a listing of market sector industries.

Table 1 provides an overview of the types of productivity measures currently published by the ABS including the new experimental KLEMS MFP estimates. The productivity indexes produced by the ABS are produced for each of two output measures: gross output (GO) and gross value added (GVA), and for one or more of the primary input measures: labour input (L) measured as either hours worked (H) or quality adjusted labour inputs (QALI), capital services (K), and intermediate inputs (II). The new experimental KLEMS MFP estimates separates intermediate inputs into energy (E), materials (M) and services (S).

Table 1: Summary of Productivity measures published by the ABS

<i>Productivity Type</i>	<i>Output</i>		<i>Inputs</i>		
	GO	GVA	Labour	Capital Services	Intermediate Inputs
Labour Productivity	–	Y	Y	–	–
Capital Productivity	–	Y	–	Y	–
Value added MFP	–	Y	Y	Y	–
Gross output MFP	Y	–	Y	Y	Y
KLEMS MFP	Y	–	Y	Y	Y

WHY KLEMS

KLEMS is a useful tool in addressing the challenge of developing more detailed industry performance indicators for the formulation and evaluation of policies involving long-term growth, efficiency and competitiveness. It provides, through a more detailed statistical decomposition, more information on the inputs contributing to output growth, and production efficiency. This helps policy makers and economists to identify factors associated with economic growth, such as structural changes in industry’s input mix, particularly with regards to the relative contribution from the intermediate inputs. This also facilitates a more disaggregated analysis of the industry origins of aggregate productivity growth, such as changes in the relative importance of input components over time.

Within intermediate inputs, the classification into energy (E), materials (M) and services (S) is beneficial in that they have distinctively different roles in the production process. This helps in evaluating trends in the way industries interact. One key interaction is that the intermediate input components reflect renting, hiring and out-sourcing between industries. An industry’s reliance on primary inputs relative to intermediate inputs may change due to changes in leasing and hiring arrangements rather than the productive process itself. When capital is rented under an operational lease arrangement from a firm in another industry, the use of the capital is classified as an intermediate input of the lessee. For example, a construction company may lease a crane from the rental and hiring industry, which is recorded as a service component in the intermediate inputs of the lessee and as capital services by the lessor in the rental and hiring industry.

2. METHODOLOGY AND INTERPRETATION

This section outlines the methodology for the measurement of the KLEMS MFP estimates presented in this paper.

PRODUCTIVITY

Productivity is defined as the ratio of a volume measure of output to a volume measure of inputs. Measures of productivity growth are useful in understanding the drivers of economic growth. At a general level, growth in output occurs through growth in inputs, more efficient use of inputs or a combination of both. Productivity growth is that part of output growth that is not accounted for by increases in the amount of inputs utilised.

There are different measures of productivity and the choice between them usually depends on the purpose of use and the availability of data. Broadly, productivity measures can be either single factor productivity measures, which relate a measure of output to a single measure of input, or multifactor productivity measures, which relate a measure of output to a combination of inputs.

GROWTH ACCOUNTING FRAMEWORK

The approach taken in this paper adapts the standard growth accounting framework, which originates from the neoclassical theory of economic growth formulated by Solow (1957). While the growth accounts in the early literature related value added aggregates to primary inputs of capital and labour, this framework can be adapted to other decompositions. For example, industry gross output can be decomposed to reveal the contributions from growth in labour, capital and intermediate inputs and from GO based MFP. This approach helps to identify the underlying drivers of industry (and aggregate) growth.

The gross output growth accounting framework extends the value added growth accounting framework to include intermediate inputs, in addition to capital and labour inputs (see Appendix 1 for more detail). The extended growth accounting framework, developed by Jorgenson, Ho, and Stiroh (2005) includes each of the three intermediate inputs components. In its multiplicative form, for a given industry, the KLEMS model can be written as

$$\left(\frac{GO_t}{GO_{t-1}} \right) = \left(\frac{K_t}{K_{t-1}} \right)^{\tilde{w}_t^K} \left(\frac{L_t}{L_{t-1}} \right)^{\tilde{w}_t^L} \left(\frac{E_t}{E_{t-1}} \right)^{\tilde{w}_t^E} \left(\frac{M_t}{M_{t-1}} \right)^{\tilde{w}_t^M} \left(\frac{S_t}{S_{t-1}} \right)^{\tilde{w}_t^S} \left(\frac{A_t}{A_{t-1}} \right) \quad (1)$$

where

GO_t is real gross output,

K_t is real capital services,

\tilde{w}_t^K is the two period average capital cost share,

L_t is real labour services (hours worked plus labour composition),

\tilde{w}_t^L is the two period average labour cost share,

E_t is real intermediate input: energy,

\tilde{w}_t^E is the two period average energy cost share,

M_t is real intermediate input: materials,

\tilde{w}_t^M is the two period average materials cost share,

S_t is real intermediate input: services,

\tilde{w}_t^S is the two period average services cost share, and

A_t is GO MFP.

Each of the input components is weighted by its respective two period averaged nominal cost shares.² By taking the natural log of equation (1), the KLEMS model can be expressed as contribution to output growth components that are additive

$$\Delta \ln GO_t = \tilde{w}_t^K \Delta \ln K_t + \tilde{w}_t^L \Delta \ln L_t + \tilde{w}_t^E \Delta \ln E_t + \tilde{w}_t^M \Delta \ln M_t + \tilde{w}_t^S \Delta \ln S_t + \Delta \ln A_t \quad (2)$$

where $\Delta \ln GO_t$ is the growth rate using natural logarithm.

Equation (2) shows that the rate of growth of output is a weighted average of the rates of growth of the various inputs, plus the GO based MFP term, A . Assuming ‘perfect market competition’ and ‘constant returns to scale’, the cost shares sum to unity, and the shares attached to each input are the output elasticities for each factor of production, i.e. the percentage change in output that can be attributed to a 1% addition of that input (OECD, 2001).

Since the KLEMS growth accounts are additive, it enables the input and MFP contributions to be quantified more precisely in terms of their contribution to industry’s output growth. In the Australian context, industry division level is chosen as the preferred level for growth accounting analysis as data relating to all of the components are available at this level of detail. It also supports analysis of the compositional change within industry over time due to changes between primary and intermediate inputs; or changes within the intermediate inputs of energy, materials and services. The above equation (in log form) provides the key components of the KLEMS growth account shown in Table 2.

Table 2: KLEMS Industry Growth Accounting Framework

KLEMS Components	Input component	Multiplied by cost share	Can be further decomposed into:
Growth in real gross output	$\Delta \ln GO_t$		
Contribution to output growth from			
Capital services (K)	$\Delta \ln K_t$	\tilde{w}_t^K	IT Capital Non IT Capital
Labour services (L)	$\Delta \ln L_t$	\tilde{w}_t^L	Hours worked (H) Labour composition (Q)
Energy (E)	$\Delta \ln E_t$	\tilde{w}_t^E	
Materials (M)	$\Delta \ln M_t$	\tilde{w}_t^M	
Services (S)	$\Delta \ln S_t$	\tilde{w}_t^S	
GO MFP	$\Delta \ln A_t$		

² See Appendix 1 for the definition of nominal cost shares.

To facilitate the increasing user requirement for understanding the productive contribution of information technologies, capital services can be decomposed into IT assets and non-IT assets.³ The contribution from capital services is then written as

$$\tilde{w}_t^K \Delta \ln K_t = \tilde{w}_t^K \tilde{\alpha}_t^{IT} \Delta \ln K_t^{IT} + \tilde{w}_t^K \tilde{\alpha}_t^N \Delta \ln K_t^N \quad (3)$$

where

K_t^{IT} is capital services from IT assets,

K_t^N is capital services from non-IT assets,

$\tilde{\alpha}_t^{IT}$ is the two period averages of the shares of capital income attributable to IT, and

$\tilde{\alpha}_t^N$ is the two period averages of the shares of capital income attributable to non-IT assets.

Similarly, the contributions from labour services can be separated into labour composition effect (due to education, experience and gender), and hours worked

$$\tilde{w}_t^L \Delta \ln L_t = \tilde{w}_t^L \Delta \ln Q_t + \tilde{w}_t^L \Delta \ln H_t. \quad (4)$$

Incorporating the additional decomposition in equations (3) and (4), the KLEMS growth account becomes

$$\begin{aligned} \Delta \ln GO_t &= \tilde{w}_t^K \tilde{\alpha}_t^{IT} \Delta \ln K_t^{IT} + \tilde{w}_t^K \tilde{\alpha}_t^N \Delta \ln K_t^N \\ &\quad + \tilde{w}_t^L \Delta \ln Q_t + \tilde{w}_t^L \Delta \ln H_t \\ &\quad + \tilde{w}_t^E \Delta \ln E_t + \tilde{w}_t^M \Delta \ln M_t + \tilde{w}_t^S \Delta \ln S_t \\ &\quad + \Delta \ln A_t. \end{aligned} \quad (5)$$

The following sections outline the choice of output, input, income, cost and index number measures used in deriving the estimates of industry level KLEMS MFP.

MEASURING OUTPUT AND INPUTS

The interpretation of productivity indexes depends on how output and inputs are measured. Ideally, the output indexes should measure all output produced from the input which is measured by the input indexes. In practice, because productivity is estimated as a residual, the period in which output and input are measured can affect productivity indexes. For example, there is a well-known timing issue between the commencement of large capital projects and the formation of productive capacity. This may result in capital services being recorded sooner than output, understating short run productivity growth. Generally, the timing issues are mitigated when estimates are averaged over the productivity cycle.

³ IT capital services refers to computers and software and non-IT capital refers to all other capital services.

OUTPUT

Both nominal and volume measures of output are used in the compilation of productivity indexes. Nominal gross output is defined to be the total value of goods and services produced at basic prices.⁴ Nominal value added is the difference between nominal gross output and nominal intermediate inputs, which is the value of goods and services used as inputs to the production process at purchaser's prices.⁵ The corresponding volume measures are obtained from the nominal measures using chained Laspeyres indexes to remove the effect of price change.

INDUSTRY GROSS OUTPUT

Gross output refers to the value of goods and services produced in the accounting period, including production that remains incomplete at the end of that accounting period. While this definition is straightforward for goods-producing industries, some clarification of treatment is useful for service industries such as Transport, postal and warehousing services, Wholesale trade and Retail trade.

- The gross output of transport services is measured by the amounts receivable for transporting goods or persons. That is, the transporting from one location to another is a process of production and is referred to as a transport margin that adds to the usefulness of a good by changing its location.
- The activity of warehousing relates to the "transporting" of goods from one point in time to another (as opposed to locations in the instance of transport services). So the storage itself is the production process.
- The main output of the Wholesale and Retail trade industries is the value of the service provided in making goods available and accessible to purchasers (i.e. goods purchased and resold are not treated as part of intermediate consumption). The value of the service is equal to the trade margins realised on the goods sold.

The measurement of these services at basic prices is analogous to that for goods producing industries: output at basic prices is the value of the trade margins, including the value of any subsidies received, and excluding taxes on production of the service.

Much of the gross output of the Finance and insurance industry needs to be estimated indirectly. In the Australian System of National Accounts (ASNA), FISIM (Financial intermediation services indirectly measured) is an output of banks, other depository corporations, central borrowing authorities and securitisers. For banks and other depository corporations it is the sum of the imputed service charges to both borrowers and depositors while, for central borrowing authorities and securitisers, it is the sum of the imputed service charge for borrowers. Similarly, the value of the insurance service charge, which forms part of the output of insurance and pension funds, is estimated indirectly from the total receivables and payables of insurance enterprises, including the income accruing from the investment of technical reserves.

INPUTS

The primary inputs (i.e. labour and capital) can also be further decomposed. Since replacement rates of IT capital tend to be faster than non-IT capital, innovation tends to be absorbed into IT capital at a faster rate. Thus separation of these components may support analysis of the linkages between IT use and productivity growth. Furthermore it is useful to separate labour input growth due to education and experience, as distinct from hours worked, as growth in that component varies across industries.

⁴ The basic price is the amount received by the producer from the sale of a good or service, minus tax and plus subsidies.

⁵ The purchaser's price is the amount paid by the purchaser when obtaining a good or service, and generally differs from the basic price.

CAPITAL INPUT

Capital input is measured as the flow of services, known as capital services, from the stock of capital. Capital services cannot be directly measured and are instead modelled. A Perpetual Inventory Model (PIM) is used to estimate the productive capital stock (that is, the volume of capital stock able to contribute to the production process) for each asset type. The capital services from a given asset type is assumed to be proportional to the corresponding estimate of the productive capital stock.

The (aggregate) capital services index for an industry is calculated as a Törnqvist index of the capital services indexes for each asset type. The weights are the (two period averages of the) corresponding shares of capital income. Capital income is split between asset types by estimating rental prices for each asset type. The rental price for a given asset type is an estimate of the annual cost of using a unit of that asset type.⁶ The capital income attributable to each asset type, from which the capital income shares of each asset type are determined, can then be calculated as the rental price times the corresponding volume of productive capital stock.

LABOUR INPUT

The ABS produces two measures of labour input including hours worked, a standard measure of labour input and quality adjusted labour input (QALI), a refinement to the standard measure that takes into account changes in the composition of the workforce as well as the volume of hours worked. The difference between hours worked and quality adjusted labour input yields a measure of composition change in the workforce. This can be interpreted as a shift in the skill mix of labour input.

The ABS QALI index was introduced in 2005 (Reilly, et al) and is based on the labour composition model (LCM) developed by Jorgenson, D.W., Gollop, F.M. and Fraumeni, B.M. (1987)⁷ and later adopted by the US Bureau of Labor Statistics (BLS, 1993). It is a Törnqvist index based on hours worked weighted by the wages of different groups of workers due to gender, education, and age composition using data from the Census of Population and Housing.

The industry hours worked index is derived using total hours worked in the industry. Industry total hours worked is calculated using the total number of people employed in each industry multiplied by the average number of hours worked per worker in that industry using data from the household Labour Force Survey (LFS). The contributions to output growth are provided for changes in hours worked and changes in labour composition separately. The contribution of the change in QALI to output growth is the sum of the contributions from changes in hours worked and changes in labour composition.

INTERMEDIATE INPUTS

Intermediate inputs are the value of goods and services consumed as inputs into the production process. These goods and services may be transformed or completely used up. Capital leased from other industries is also included in intermediate inputs and recorded in services. The boundary between consumption of intermediate inputs and gross fixed capital formation is not always clear. In general, intermediate inputs are goods and services that are immediately transformed or used up in the process of production within one year while gross fixed capital formation involves the acquisition of capital assets which contribute to production for more than a year. Also included in intermediate consumption is the value of all goods and services used as inputs into ancillary activities.

⁶ See ABS (2014) (cat. no. 5216.0), chapter 19 for a description of the asset type.

⁷ See Jorgenson, D.W., Gollop, F.M. and Fraumeni, B.M. (1987) *Productivity and U.S. Economic Growth*, Harvard Economic Studies, 159, Harvard University Press, Cambridge, MA.

The separation of intermediate inputs into the three categories – energy, materials and services can be useful for analysis of the effects of changes in the input mix on output growth. For example, increases in the proportion of services intermediate inputs could reflect growth in out-sourcing. Separate deflators are used to deflate each input to derive a Laspeyres volume index for intermediate inputs.

The intermediate inputs indices for energy, materials and services and their respective shares are sourced from the supply–use tables (SUT) compiled by the ABS (see illustration in Table 3). The classification of supply–use products into these three categories is provided in Appendix 2. Data for the three non–market industry divisions (i.e. Public administration and safety, Education and training, Health care and social assistance) are excluded.

The main advantage of deriving the indices and shares for energy, materials and services using this method is to control for heterogeneity in both the prices and volumes of the components and to recognise more explicitly that the way in which each of these components contributes to production differs. A key development in the SUT has been the wider application of the double deflation method, that is, real output and real intermediate inputs are derived separately for most industries. By sourcing more specific price deflators, the approach enables improved volume estimation, particularly for intermediate inputs.

The SUT is a powerful tool to compare and contrast data from various sources and improve the coherence of the economic information system. It reconciles the supply of products within the economy within an accounting period with their use for intermediate consumption, final consumption, capital formation, and exports. They permit an analysis of markets and industries and allow productivity to be studied at this level of disaggregation. The SUT tracks the production and consumption of 301 groups of products across 67 groups of industries in a time series stretching back to 1994–95. These groupings facilitate the aggregation of product groups into energy, materials and services. Shown in Table 3 is a representation of the intermediate use component of the SUT. The tables are calculated on both a current price basis (for estimating the KLEMS cost shares) and volume basis (for deriving the KLEMS indices for energy, materials and services).

Table 3: Total Intermediate Use Matrix

		Product use by Industry					
		16 Divisions	Agriculture	Mining	Manufacturing	etc.	Other services
		67 Subdivisions	1 – 2	3 – 8	9 – 23	etc.	66 – 67
		Time period	1994–95 to 2012–13				
Supply of 301 products	Energy	Product 1	Source data for intermediate input indices and shares				
		to					
	Materials	Product 6					
		Product 7					
		to					
	Services	Product 150					
		Product 151					
		to					
		Product 301					

INCOME SHARES

Under a VA based MFP approach, the contribution of each primary input to output is weighted using the income shares of labour and capital. For each industry, total income of labour and capital is defined as the sum of gross operating surplus (GOS)⁸ of corporations and government, gross mixed income of unincorporated enterprises (GMI), compensation of employees (COE) and other taxes less subsidies on production. Gross mixed income of unincorporated enterprises is the income earned by unincorporated enterprises and is split into labour and capital components. Other taxes less subsidies on production is also split into capital and labour components by proportional allocation using other income components attributable to capital and labour.

The capital income share is then derived as the sum of gross operating surplus and the capital components of gross mixed income of unincorporated enterprises and other taxes less subsidies on production, divided by total primary income. Similarly, the labour income share is calculated as the sum of compensation of employees and the labour component of gross mixed income of unincorporated enterprises and other taxes less subsidies on production, divided by total primary income. Alternatively, the labour income share can be derived as one (unity) less the capital income share.

COST SHARES

Under a GO based MFP approach, the contribution of each of the primary and intermediate inputs to output is weighted using the cost shares of each input. The cost shares for labour and capital are their respective primary incomes, divided by the current price value of gross output, while the cost shares for intermediate inputs are the expenditures on inputs, divided by the value of gross output.

INDEX NUMBER CHOICE

There are several different index number methods to use for measuring output and inputs. The estimates in this paper are derived using the following index number methods:

- The industry value added and gross output indexes are chained Laspeyres indexes, which are consistent with published aggregate market sector output and GDP.
- The intermediate input index is a Laspeyres index based on appropriate price deflators for energy, materials and services in each individual industry.
- The industry capital services index is a Törnqvist index based on weighted changes in productive capital stock derived using the perpetual inventory method (PIM).
- The hours worked index is a simple elemental index based on summing hours worked data.
- The quality adjusted labour index is a Törnqvist index based on weighted changes in hours worked by different groups defined by gender, education and age group as proxies to account for differences in skill sets.
- The combined input index of labour, capital and intermediate inputs is a Törnqvist index based on the respective income shares of labour and capital for value added and on the respective cost shares of labour, capital and intermediate inputs for gross output.

⁸ Total income includes the GOS of general government attributable to market sector industries, but not the GOS of dwellings owned by persons, as ownership of dwellings is excluded from the market sector.

While the Törnqvist index formula has an exact relationship with a flexible Translog production technology, and hence falls into the “superlative” class of index numbers regarded as desirable from the economic approach to index number theory (Diewert, 1976), it has not been applied universally to the ABS productivity measures. This is a minor compromise to maintain consistency with the chain volume measures published elsewhere in the ASNA, which use the Laspeyres formula. There are obvious benefits from the increased coherence with the ASNA. For example, to facilitate cross referencing to other key macroeconomic performance indicators, such as market sector value added per hour, and growth in real industry value added.

Appendix 1 provides a more detailed outline of the method used to compile estimates of industry level KLEMS MFP in this paper.

INTERPRETATION OF MULTIFACTOR PRODUCTIVITY

Although, from a conceptual standpoint, MFP can be interpreted in various ways, a key interpretation of MFP is as disembodied technological change attributable to improved use of factor inputs. Embodied technological change represents advances in the design and quality of new capital and intermediate inputs. Disembodied technological change is generally interpreted as representing costless improvements or knowledge, for example, network effects or spillovers from diffusion of publicly available R&D, and benefits to factor inputs from organisational change or better management. These spillovers and other benefits to factor inputs are generally not quantifiable within the KLEMS growth accounting framework.

At the industry level, ABS publishes both GO based MFP and VA based MFP – both are complimentary. One advantage of the GO based MFP approach is that it is a natural output concept (Balk, 2010) and consistent with the traditional production theory linking output to primary as well as intermediate inputs. By comparison, the VA based MFP approach assumes that the components of value added are separable from that of intermediate inputs (Bosworth et al., 2003).⁹

For a given industry, the relationship between GO based MFP and VA based MFP can be approximated by

$$\Delta \ln GO MFP_i \approx \frac{VA_i}{GO_i} \Delta \ln VA MFP_i \quad (6)$$

where VA_i / GO_i is the two period average of the ratio of nominal industry value added to nominal industry gross output.¹⁰ Since this ratio is always less than unity, GO based MFP will always have less amplitude than VA based MFP, i.e. rise less and fall less. However, the degree to which they differ varies from industry to industry, due to both the variation in each industry’s relative value added proportion, as well as the degree to which the ratio changes over time. At an aggregate level, the value added concept is more appropriate as it removes inter–industry transfers.

⁹ Changes in VA based MFP can also be driven by changes in the efficiencies of intermediate inputs, for example, due to the use of more refined oil or more refined metal ore.

¹⁰ The ratio was first described in Bruno (1978). For a more precise reconciliation, see Diewert (2014).

In interpreting MFP, it should be noted that measured productivity growth could include factors other than technological change, for example adjustment costs, cyclical effects and measurement errors (OECD, 2001). A limitation of MFP theory is that the assumptions of the neoclassical models do not necessarily hold in practice, which can affect the interpretation of the resulting estimates. For example, imperfect competition can result in gains from increasing market dominance being reflected as productivity gains. Additionally, in static models of production, such as the one used in estimating KLEMS MFP, capital is an exogenous input, which ignores dynamic feedback between MFP and capital. For example, if technological change increases output per person, the additional output per person may lead to further savings and investment and thus a rise in the capital-labour ratio. While traditional growth accounting identifies this induced effect as the contribution of capital growth, the effect can be attributed to an initial shift in technology. Therefore, MFP measures may understate the importance of productivity growth in contributing to output growth.

The methodology used in compiling the estimates implicitly assumes that the proportion of capital stock used in production (capital utilisation) does not change; therefore any real world change in the extent to which capital is utilised in production will be recorded as a change in productivity. Another assumption of the methodology is each hour of labour input is fully utilised in production. Further, improvements in output due to a firm's ability to produce more output because of their size, that is, economies of scale, will also appear as a measured productivity improvement.

RELIABILITY AND FUTURE REVISIONS

Productivity estimates are prepared from a wide range of statistical sources some of which are available quickly and some only with a delay of several years. Most of the basic data are derived from the regular program of statistical surveys undertaken by the ABS or as a by-product of government administrative processes. The frequency, detail and timeliness of these data sources are constrained by many factors, including the other statistical purposes which they must serve. Therefore, productivity estimates in the recent years are particularly sensitive to revisions as improved data become available.

Revisions arise from the progressive incorporation of more up to date data, re-weighting of chain volume series and from time-to-time the introduction of new economic concepts, data analysis and improved data sources and methods. Revisions are an inevitable consequence of the compilation process, reflecting both the complexity of economic measurement and the need to provide economic policy advisers and other users with initial estimates that are timely in order to maximise their use in analysis of current economic conditions.

3. SUMMARY OF RESULTS

This chapter presents a summary of the industry level KLEMS MFP estimates for the following 16 market sector industries.

- A Agriculture, Forestry and Fishing (AFF)
- B Mining (MIN)
- C Manufacturing (MAN)
- D Electricity, Gas, Water and Waste Services (EGW)
- E Construction (CON)
- F Wholesale Trade (WHO)
- G Retail Trade (RET)
- H Accommodation and Food Services (AFS)
- I Transport, Postal and Warehousing Services (TPW)
- J Information, Media and Telecommunication Services (IMT)
- K Financial and Insurance Services (FIS)
- L Rental, Hiring and Real Estate Services (RHR)
- M Professional, Scientific and Technical Services (PST)
- N Administrative and Support Services (ADM)
- R Arts and Recreation Services (ARS)
- S Other Services (OTH)

The estimates presented in this paper are based on data used to compile the 2014 edition of the **Australian System of National Accounts** (Cat. no. 5204.0). At the time of this publication, KLEMS MFP estimates are only available for the period from 1994–95 to 2012–13.

GROWTH IN KLEMS MFP

Table 4 provides an overall summary of the contributions to average Gross Output (GO) growth between 1995–96 and 2012–13 within each industry (i.e. each row is additive to the value of gross output growth). This table shows that

- The strongest GO based MFP growth industries are Agriculture, forestry and fishing, Financial and insurance services, Retail trade and Wholesale trade.
- IT capital contributes most strongly in Financial and insurance services, Rental, hiring and real estate services, and Electricity, gas, water and waste services and Wholesale trade.
- Non-IT capital contributes most strongly in Mining, Rental, hiring and real estate services, Information, media and telecommunication services and Electricity, gas, water and waste services.
- Hours worked contributes most strongly in the services industries, particularly Professional, scientific and technical services, Administrative and support services and Arts and recreation services.
- Intermediate inputs growth is mainly driven by the services component. However, the contribution of the materials component to intermediate inputs growth is particularly significant in Construction and Manufacturing.

TABLE 4: Gross Output Growth and Contributions, 1994–95 – 2012–13, Industries (a)(b)

Industry	Gross Output Growth	Contribution from Capital		Contribution from Labour		Contribution from Intermediate Input			Multifactor Productivity (b)
		IT (c)	Non-IT	Hours Worked	Composition	Energy	Materials	Services	
A AFF	2.1	0.0	0.2	-0.2	0.0	0.0	0.3	0.4	1.4
B MIN	3.3	0.1	3.1	0.7	0.0	0.2	0.1	0.8	-1.7
C MAN	1.4	0.1	0.2	-0.2	0.1	0.0	0.7	0.4	0.0
D EGW	1.2	0.5	1.0	0.3	0.0	0.2	0.3	0.1	-1.1
E CON	4.9	0.1	0.3	0.6	0.1	0.1	1.2	2.0	0.5
F WHO	4.2	0.4	0.5	0.0	0.2	0.0	0.4	2.0	0.8
G RET	2.4	0.3	0.3	0.4	0.1	0.0	0.0	0.3	0.9
H AFS	2.7	0.1	0.2	0.4	0.0	0.1	0.4	1.1	0.4
I TPW	3.1	0.1	0.5	0.4	0.1	0.2	0.1	1.2	0.4
J IMT	4.5	0.5	1.1	0.1	0.1	0.0	0.3	2.4	-0.1
K FIS	4.8	1.1	0.3	0.3	0.2	0.0	0.0	1.9	1.0
L RHR	2.4	0.6	1.5	0.4	0.1	0.0	0.0	1.2	-1.5
M PST	4.8	0.3	0.2	1.3	0.2	0.0	0.1	2.5	0.1
N ADM	3.6	0.2	0.1	1.0	0.2	0.0	0.1	2.2	-0.3
R ARS	3.2	0.1	0.7	0.8	0.0	0.0	0.4	1.3	-0.2
S OTH	2.1	0.2	0.6	0.1	0.0	0.0	0.6	0.5	0.0

(a) Differences in natural log x 100

(b) Quality adjusted hours worked basis

(c) IT refers to computers and software

INPUT COST SHARES

Chart 1 and 2 present the KLEMS input cost shares for each of the 16 market sector industries. The estimation of cost shares is described in Appendix 1. Cost shares are presented for the first year, last year, and the arithmetic average over all available years. The charts show that input cost shares vary considerably between industries. Within industries, the shares may also vary over time.

Chart 1: KLEMS input cost shares, Divisions A to H

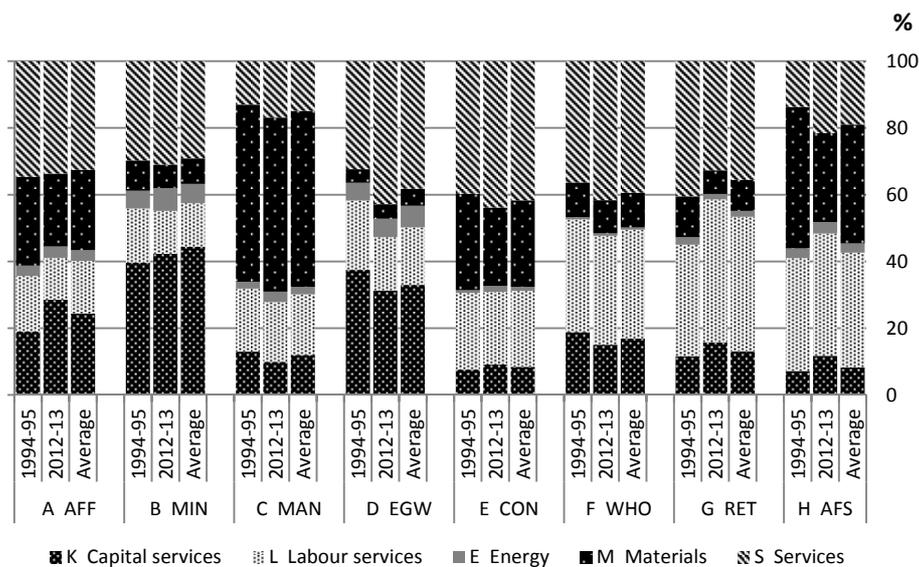
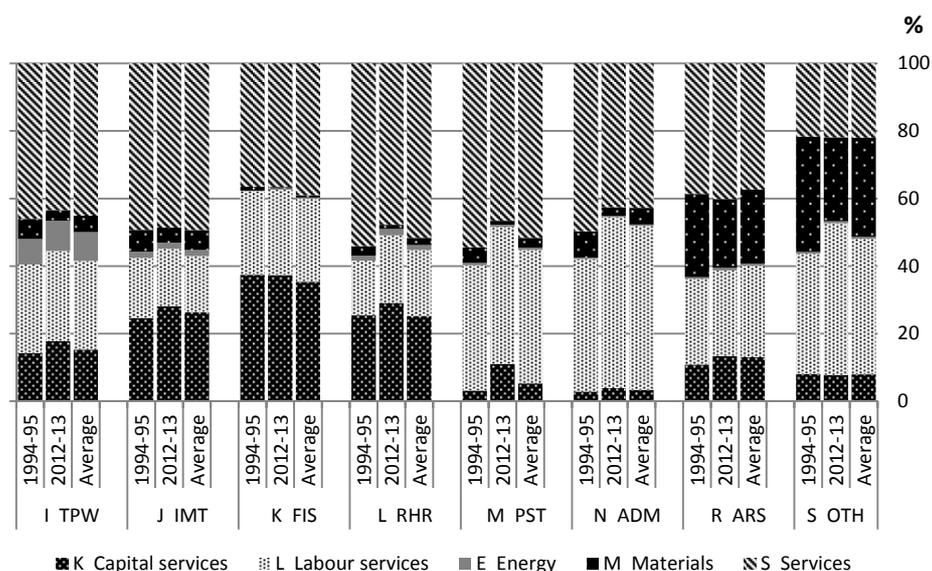


Chart 2: KLEMS input cost shares, Divisions I to S (excluding Div O, P & Q)(a)



(a) Divisions O Public admin and safety, P Education and training and Q Health and social assistance are outside of the 16 industry market sector grouping

Some key notable features are

- In terms of input cost, Mining, Electricity, gas, water and waste services and Finance and insurance services are the most capital intensive industries (exceeding 30% on average).
- Professional, scientific and technical services, Administrative and support services, Other services and Retail trade are the most labour intensive industries (at least 40% of average total input cost).
- With few exceptions, intermediate input cost shares (energy, materials and services combined) exceeded primary input cost shares (labour and capital).
- Manufacturing, Accommodation and food services and Other services are the most materials intensive industries in terms of their cost shares.
- Information, media and telecommunications, Rental, hiring and real estate services, Professional, scientific and technical services, Administration and support services and Construction all had services cost shares exceeding 40% on average.
- Transport, postal and warehousing, Mining and Electricity, gas, water and waste services had the largest energy cost shares (although less than 10% of total average cost).

INDUSTRY'S CONTRIBUTION TO MARKET SECTOR

The ABS does not aggregate the industry growth accounts to the market sector because value added is a more appropriate metric for aggregates. Table 5 provides average annual contributions for the market sector GVA growth over the period 1994–95 to 2012–13, presented using the decomposition framework adopted for the EU KLEMS developed by Timmer and O'Mahony (2009).¹¹ The first column in Table 5 shows the contributions from the growth rate of value added in the 16 market sector industries to the total market sector value added growth rate. The second and third columns divide that growth into changes in hours worked and changes in output per hour – or labour productivity. Columns 4–7 divide up the growth in labour productivity into four factors: changes in labour composition, increases in IT capital per hour (capital deepening), non-IT capital deepening and MFP growth.

¹¹ The Timmer and O'Mahony framework excludes land and inventories. However, these inputs are included in the ABS KLEMS model.

TABLE 5: Gross Value Added Rate of Growth and Contributions, 1994–95–2012–13, Market Sector (a)

Industry	GVA Growth Rate	Value added contribution from:		Labour productivity contributions from:			
		Hours worked	Labour Productivity	Labour Composition	IT capital deepening (b)	Non-IT capital deepening	VA MFP
	1=2+3	2	3=4+5+6+7	4	5	6	7
A AFF	0.15	-0.07	0.22	0.00	0.00	0.06	0.15
B MIN	0.34	0.56	-0.28	0.00	0.01	0.03	-0.32
C MAN	0.14	-0.16	0.33	0.04	0.08	0.18	0.03
D EGW	0.05	0.07	-0.01	0.00	0.03	0.04	-0.08
E CON	0.49	0.26	0.23	0.01	0.03	0.03	0.16
F WHO	0.24	-0.01	0.25	0.03	0.05	0.07	0.11
G RET	0.27	0.07	0.20	0.02	0.04	0.03	0.12
H AFS	0.09	0.04	0.05	0.00	0.01	0.01	0.03
I TPW	0.26	0.10	0.15	0.01	0.02	0.05	0.07
J IMT	0.20	0.04	0.17	0.01	0.05	0.11	0.00
K FIS	0.55	0.16	0.39	0.04	0.18	-0.02	0.19
L RHR	0.09	0.08	0.01	0.01	0.06	0.06	-0.12
M PST	0.37	0.27	0.11	0.03	0.03	0.01	0.03
N ADM	0.10	0.09	0.01	0.02	0.01	0.01	-0.02
R ARS	0.05	0.04	0.01	0.00	0.01	0.01	-0.01
S OTH	0.06	0.01	0.05	0.00	0.01	0.04	0.00
Market sector	3.47	1.58	1.89	0.23	0.62	0.71	0.35

(a) Contribution to average annual growth (change in natural logs x 100) are derived from 2013–14 release of Estimates of Industry Multifactor Productivity (cat. no. 5260.055.002);

(b) Computers and software capital services per hour (See Appendix 1 for derivation)

Some key notable results from Table 5 are:

- The largest contributors to market sector GVA growth of 3.5% per year are Finance and insurance services (0.55% points), Construction (0.49% points) and Professional, scientific and technical services (0.37% points).
- Mining (0.56% points) contributed more than one third of growth in market sector hours worked of 1.58% per year with other strong contributors from Construction (0.26% points) and Professional, scientific and technical services (0.27% points).
- The strongest contributors to market sector labour productivity growth of 1.89% per year are Finance and insurance (0.39% points), Manufacturing (0.33% points), Wholesale trade (0.25% points), and Construction (0.23% points). While Mining detracted -0.28% points from labour productivity growth (on average); it contributes significantly to the level of labour productivity, due to its high capital intensity.
- The Finance industry (0.18% points) is by far the strongest contributor to market sector IT capital per hour followed by Manufacturing (0.08% points).
- Manufacturing (0.18% points) is the strongest contributor to non-IT capital per hour followed by Information, media and telecommunications (0.11% points).
- MFP contributed 0.35% points to the GVA growth rate on average and 11 of the 16 industries recorded positive MFP growth.

4. INDUSTRY ANALYSIS

This chapter examines the growth performance for each market sector industry in the Australian economy for the period 1994–95 to 2012–13.

The results for the 16 market sector industries are set out after the industry analysis. The contribution to gross output growth for the period 1995–96 to 2012–13 from multifactor productivity and from labour services, capital services and intermediate inputs is presented. Also presented for each industry is a set of 4 charts comparing estimates of (i) GO based MFP index and VA based MFP index; (ii) gross output and gross value added chain volume indexes; (iii) intermediate inputs chain volume indexes and (iv) inputs chain volume indexes.

DIVISION A – AGRICULTURE, FORESTRY AND FISHING

The Agriculture, forestry and fishing industry represented a 2.4% share of Australian GVA in 2012–13. The industry includes units mainly engaged in growing crops, raising animals, growing and harvesting timber, and harvesting fish and other animals from farms or their natural habitats. Industry output is mainly by agriculture, with forestry and fishing making up around 13% of industry GVA.

Over the period 1994–95 to 2012–13, gross output for this industry grew 2.1% per annum on average. Although output for this industry has been trending upward, year to year growth may vary significantly, mainly due to variations in the weather and market conditions. Year to year MFP change needs to be interpreted with caution as the weather is a major conditioning factor, external to the model. That is, weather has a significant bearing on how inputs are transformed into outputs, but is outside of the productivity model. For example, the impact of drought was particularly evident in the gross output series for the drought years of 2002–03 (–21.1%) and 2006–07 (–13.0%).¹² Similarly, MFP recorded strong falls in drought years.

On average, hours worked declined over the same period, contributing –0.2% points to output growth, which with a positive contribution from capital, indicates a trend towards more capital intensive farming practices. That trend has accelerated over the last decade. By comparison, capital services contributed on average a modest 0.2% to output growth, offsetting the decline in hours worked. Therefore, the overall contribution from primary inputs (labour plus capital) was flat.

Intermediate inputs grew on average 0.7% per annum, mainly driven by services and materials. While energy grew significantly from 1995–96 to 2005–06, its influence on total intermediate inputs was not large due to its small cost share of income.

In contribution terms, two thirds of the 2.1% growth in gross output is attributable to MFP growth which contributed 1.4% points. This is the strongest MFP growth of all the industries in the market sector. The other significant contributors to output growth are Services (0.4% points), Materials (0.3% points) and non-IT capital (0.2% points). GO based MFP grew slower than growth in VA based MFP. This is due to intermediate inputs representing more than 50% of the total cost share.

¹² A more detailed discussion of weather conditions, such as the rainfall in the Murray-Darling Basin, is contained in the Productivity Commission's 2015 Productivity Update.

The positive MFP growth suggests the decline in the reliance of labour towards greater capital intensity has resulted in an improvement in the overall efficiency of total input use. Sheng, Jackson, Zhang and Zhao (2013) noted

“the use of advanced plant and machinery...has allowed farms access to the potential benefits of increasing returns to scale”.

Some key measurement issues for this industry include:

- The agriculture land capital services measure is assumed to be constant over time. The rental price of land is also volatile, and therefore land’s overall contributions to the capital services index may vary significantly over time. The ABS is currently working with the Department of Agriculture to improve the agricultural land capital services measure, using hectares of broad acre and crops.
- This industry has a large unincorporated sector. As a consequence, modelling assumptions necessary to attribute gross mixed income to labour and capital may have a significant bearing on their respective income shares.
- Hours worked estimates, sourced from the labour force survey are more volatile relative to other industries. This may be due to the representative week surveyed being more influenced by the weather and farming cycles, relative to other industries.

DIVISION B – MINING

The Mining industry represented an 8.2% share of Australian GVA in 2012–13. In current price terms, mining’s share has increased significantly, doubling since 1994–95. The Mining industry includes units that mainly extract naturally occurring mineral solids, such as coal and ores; liquid minerals, such as crude petroleum; and gases, such as natural gas. This industry distinguishes two basic activities: mine operation (making up around 92% of industry value added in 2012–13) and mining support activities (8%).

Over the period 1994–95 to 2012–13, gross output grew 3.3% per annum on average, with growth accelerating from 2003–04. Labour inputs contributed 0.7% points to output growth, with stronger contributions since 2002–03. Labour productivity is at significantly higher levels than other industries, due to relatively higher capital intensity. As workers move from other industries into the mining industry, the all–industries measure of labour productivity will inherently show increases.

Similarly, the contribution from growth in capital services has been particularly strong since 2003–04. Non-IT capital services are the strongest contributor to gross output growth with a 3.1% points contribution on average. The other significant contributors are Services (0.8% points) and Hours worked (0.7% points). GO based MFP recorded strong declines averaging –1.7% points contribution.

Overall contributions from inputs exceeded gross output, leading to GO based MFP declining –1.7% on average. By comparison, VA based MFP declined –3.0% on average over the same period. The smaller GO based MFP decline is due to a significant contribution from intermediate inputs, which grew at a significantly slower rate than primary inputs.

Some caution is required when interpreting MFP for mining, due to factors unable to be taken into consideration when estimating productivity. Notably, post 2004 significant infrastructure investment has resulted in input growth exceeding output growth, leading to persistent negative MFP recorded.¹³

¹³ For a more detailed discussion, see Topp et. al. (2008).

In addition, interpretation should factor into consideration:

- The absence of mineral and energy (subsoil) resources as a natural input;
- The greater effort required by mines to reach scarcer and less accessible resources over time;
- The capital services flows recorded for incomplete projects. For large projects, it may take several years before the mine actively contributes to production; and
- That capital services flows are not adjusted for capacity utilisation rates.

The KLEMS MFP for Mining does not account for mineral and energy (subsoil) resources as a natural input in the productive process. However, the ABS has produced experimental estimates of VA based MFP for Mining inclusive of mineral and energy resources (see ABS Cat. no. 5204.0.55.010). The experimental results suggest mineral and energy resource inputs may account for about half of the MFP decline in this industry and that it may be beneficial to integrate these with the KLEMS framework in the future as a way to improve MFP as an indicator of technical efficiency.

DIVISION C – MANUFACTURING

The Manufacturing industry includes units that are mainly engaged in the physical or chemical transformation of materials, substances or components into new products (except agriculture and construction).¹⁴ The materials, substances or components transformed by units in this division are raw materials that are products of agriculture, forestry, fishing and mining, or products of other manufacturing units.¹⁵ While the manufacturing industry has grown in absolute terms, its relative share of total Australian GVA has declined by almost half since 1994–95 to 7.1%.

Over the period of 1994–95 to 2012–13, gross output grew 1.4% per annum on average. However, the growth occurred mainly before 2008–09 when output averaged 2.5% per annum. Since 2008–09, output declined 1.5% per annum on average. A key contributor to the decline was the strong increase in the Australian dollar exchange rate, making imported goods cheaper and reducing demand for domestically manufactured goods.

Materials (0.7% points) contributed to half of the gross output growth in this industry, followed by services (0.4% points). Hours worked contributed –0.2% points. However, since 2008–09, hours worked has declined steadily due to a fall in the number of workers employed. Overall, there has been no long-term change in GO based MFP growth.

Since the most recent productivity growth cycle commencing 2007–08, there has been a continuous decline in business activity in this industry, represented by declining employment.¹⁶ Other major events include

- The conversion of coastal oil refineries to import terminals.¹⁷
- The decline in steel and automotive manufacturing.¹⁸
- The decline in printed media due to consumers' preference towards digital media.

¹⁴ Some units in other industries (especially Agriculture, Construction & Information Media and Communications) engage in similar activities but are not classified to Manufacturing.

¹⁵ ABS Cat. no. 1292.0, Australian and New Zealand Standard Industrial Classification (ANZSIC), 2006 (Revision 2.0).

¹⁶ ABS Cat. no. 8155.0, Australian Industry, 2013-14; Australian Industry by Division, Table 1.

¹⁷ For a more detailed discussion, see The Parliamentary Report (2013).

¹⁸ For example, see Productivity Commission Inquiry Report No. 70 (2014).

The post 2007–08 decline was wide spread across manufacturing subdivisions. However, a Productivity Commission staff paper noted that

“no systematic factors explain the decline for the whole industry. Instead different factors – such as lags between investment and output, unmeasured increases in quality, and lower capacity utilisation – applied to different subdivisions.”¹⁹

Some specific factors that the report identified are

- 'hidden output': e.g. new environmental standards for petroleum refineries required increased input and led to unmeasured quality improvement;
- import competition which led to lower domestic capacity utilisation,
- consumer preferences towards more labour intensive products (e.g. bakery products).

DIVISION D – ELECTRICITY, GAS, WATER AND WASTE SERVICES

The Electricity, Gas, Water and Waste Services Division comprise units engaged in the provision of electricity; gas through mains systems; water; drainage; and sewerage services. The division also includes units mainly engaged in the collection, treatment and disposal of waste materials; remediation of contaminated materials (including land); and materials recovery activities. The Electricity, gas, water and waste services industry represented a 3.1% share of total Australian GVA in 2012–13.

Over the period 1994–95 to 2012–13, gross output grew 1.2% per annum on average. Value added output has grown slightly faster than gross output. Output was particularly strong in 2008–09 and 2009–10.

The main contributor to gross output growth is non-IT capital (1.0% points), though IT-capital was also significant (0.5% points). The other significant contributors are hours worked (0.3% points) and materials (0.3% points).

The overall contributions from inputs exceeded gross output, leading to GO based MFP declining –1.1% on average. By comparison, VA based MFP declined –2.3% on average over the same period. The smaller GO based MFP decline is due to the large contribution from intermediate inputs, which grew at a slower rate than primary inputs.

Like agriculture, this industry is impacted by changes in the weather, making it difficult to interpret MFP. Drought conditions can impact the demand for electricity to power cooling systems, and the availability of water. While outputs of public utilities are marketed, they are also regulated. For example, if water restrictions are applied, output measured as a function of licensing services provisioned will grow slower than regulation-based inputs, reducing MFP.

In recent years, infrastructure in this industry has been improved to cope with weather extremes. For example, desalination plants to make water supply services more drought resistant. The type of infrastructure has also become more diverse, especially for electricity generation. In particular, the capital cost of electricity generation technology (e.g. the generating capacity cost per unit of output) varies significantly across a diverse range of technologies.²⁰

¹⁹ In their review of the Manufacturing industry, the Productivity Commission reduced the degree of heterogeneity by modelling productivity for eight ANZSIC93 subdivisions (Barnes et. al., 2013).

²⁰ See for example, ATSE (2011) p5.

The improvement to infrastructure improves supply reliability at the expense of capacity utilisation. For example, dam capacity has been upgraded, desalination plants constructed, undergrounding of electrical cabling introduced, and the electricity infrastructure upgraded to cope with the peak demands in summer. Reflecting this, non-IT capital service flows grew more strongly, particularly between 2002–03 and 2007–08. Put another way, these infrastructure upgrades do not necessarily deliver proportionally equivalent growth in output, resulting in lower MFP in the short term.²¹

DIVISION E – CONSTRUCTION

The Construction Division includes units mainly engaged in the construction of buildings and other structures, additions, alterations, reconstruction, installation, maintenance and repairs of buildings and other structures. Units engaged in demolitions or wrecking of buildings and other structures, and clearing of building sites are also included.

The Construction industry represented an 8.4% share of total Australian GVA in 2012–13. Since 2007–08 its share grew significantly, especially due to growth in Construction services and Heavy and civil engineering construction. The infrastructure produced by this industry enables all other industries to operate more efficiently.

Over the period 1994–95 to 2012–13, gross output grew strongly at 4.9% per annum on average. Value added output grew slightly faster than gross output and has grown steadily since 2001–02. Relative to the 2000–01 contraction in output (–21.8%) and GO based MFP (–3.8%), output grew 1.9% in 2008–09 and the GO based MFP decline of –0.3% was small, due to infrastructure upgrades and expansion projects, funded in part through the post-GFC government stimulus programs.

The main contributors to gross output growth are services (2.0% points), and materials (1.2% points). The other significant contributor is hours worked (0.6% points) while GO based MFP contributed 0.5% points on average. By comparison, VA based MFP grew much stronger, 1.7% on average.

The relative significance of services and materials contribution was attributable to their relatively large cost shares (about 40% and 27% for services and materials respectively)²². The weaker GO based MFP result (relative to VA based MFP) suggests an increased reliance on intermediate inputs, relative to primary inputs, in the production process.

Since 2009–10, the hours worked contribution has noticeably weakened. However, the strong growth in intermediate inputs services suggests this decline was due to a change in the way labour is hired, with an increased preference for subcontracted labour services.

MFP in this industry needs to be interpreted with consideration to its qualifying factors, mainly due to changes to the regulated building standards and taxation frameworks. Most of these changes to quality will be captured in the real capital services estimates (via quality adjusted price indices), but to the extent that quality change is difficult to measure, it is assumed that some elements remain uncaptured and embedded in MFP.

²¹ For a more detailed discussion, see Topp and Kulys (2012).

²² Energy contribution is lower because the site's owner generally holds the energy accounts rather than the construction provider.

DIVISION F – WHOLESALE TRADE

The Wholesale trade industry includes units mainly engaged in the purchase and on-selling, the commission-based buying, and the commission-based selling of goods, without significant transformation, to businesses. The industry represented a 4.4% share of total Australian GVA in 2012–13. While this share has been trending down, the absolute size of the industry continues to grow.

Over the period 1994–95 to 2012–13, gross output grew 4.2% per annum. The main contributor to output growth was services (2.0% points) and GO based MFP (0.8% points). Other key contributors were Non-IT capital and IT capital, contributing 0.5% and 0.4% points respectively. Hours worked was flat (no change) although change in labour composition contributed positively.

Gross output grew faster than value added as this industry has become more reliant on intermediate inputs, which grew significantly faster than primary inputs. The output of this industry represents the mark-up of goods sold on to other businesses, also referred to as the trade margin. Therefore, intermediate inputs are restricted to the costs of running the business before the acquisition or sale of wares are considered. The greater reliance on intermediate inputs is mainly attributable to the services component, especially transportation services, business services and rental and hiring services.

Online wholesaling is also significant. According to **Summary of IT Use and Innovation in Australian Business, 2013–14** (cat.no. 8166.0), of all the industries, businesses in Wholesale trade were the most likely have received orders via the internet during 2013–14 (60%).

DIVISION G – RETAIL TRADE

The Retail trade industry includes units mainly engaged in the purchase and on-selling, commission based buying, and commission based selling of goods, without significant transformation, to the general public. It also includes units that purchase and on-sell goods to the general public using the internet. As at 2012–13, this industry represented a 4.8% share of total Australian GVA.

Over the period 1994–95 to 2012–13, gross output grew 2.4% per annum. The main contributor to output growth is GO based MFP (0.9% points). Other key contributors are hours worked (0.4% points), Non-IT capital, IT capital, and services (each contributing 0.3% points).

Within intermediate inputs, the main driver is services, with more than a 75% average cost share. The contribution from services increased rapidly from 2007–08, while the contribution from hours worked has declined over the same period. While the materials index declined significantly prior to 2000–01 it had no significant influence as its cost share is relatively small. The industry is also undergoing structural change, due to the growth in internet commerce, reflecting a cultural change in how the community is conducting economic transactions.²³

²³ The Productivity Commission Inquiry Report No.56 (2011) noted that the growth of online shopping has occurred in the context of greater familiarity and confidence in the use of the internet across a range of activities. ABS data (cat.no. 8166.0) shows that 43% of Retail business received orders via the internet during 2013-14.

DIVISION H – ACCOMMODATION AND FOOD SERVICES

The Accommodation and Food Services Division comprises units providing short-term accommodation for visitors and/or meals, snacks, and beverages for consumption by customers both on and off-site. Food and beverage services is the larger of the two subdivisions, accounting for 77% of industry GVA in 2012–13, with the remainder going to the Accommodation subdivision. As at 2012–13, this industry represented a 2.5% share of total Australian GVA.

Over the period 1994–95 to 2012–13, gross output grew 2.7% per annum. The main contributors to output growth are Services (1.1% points), with hours worked, materials and MFP each contributing 0.4% points.

Both gross output and value added have behaved similarly over the time series. After peaking in 2006–07, gross output and value added declined but have since mostly recovered. GO based MFP recorded less than half the growth of VA based MFP. The stronger VA based MFP result is due to the much slower growth in primary inputs, relative to intermediate inputs. Therefore, the decline in MFP post 2006–07 is much more pronounced than for GO based MFP. Within intermediate inputs, about two thirds of the cost share is materials, although there has been a gradual growth in the services share.

DIVISION I – TRANSPORT, POSTAL AND WAREHOUSING

The Transport, Postal and Warehousing industry includes units mainly engaged in providing transportation of passengers, freight, postal services, and pipeline transport activities. The industry is dominated by subdivisions for Road transport (31% of GVA), Transport support services and warehousing and storage services (38% of GVA). As at 2012–13 this industry represented a 5.2% share of total Australian GVA.

Over the period 1994–95 to 2012–13, gross output grew 3.1% per annum. The main contributors to output growth are services (1.2% points), non-IT capital (0.5% points), hours worked (0.4% points) and GO MFP (0.4% points).

Nearly half of the total inputs index is represented by services (45% average share). This industry is also labour intensive (26%) and is the highest user of energy inputs (fuel and electricity).

DIVISION J – INFORMATION MEDIA AND TELECOMMUNICATIONS

The Information Media and Telecommunications industry includes units mainly engaged in creating, enhancing and storing information products in media for dissemination; transmitting information (via electronic, wireless, optical and other means); and providing transmission services. As at 2012–13, this industry represented a 3.0% share of total Australian GVA.

Over the period 1994–95 to 2012–13, gross output grew 4.5% per annum, reflecting increases in the overall demand for telecommunication services. This reflects improvements to digital technology, particularly with the expansion of digital mobile phone networks since the mid-1990s, and the further development of 3G networks since 2005–06. The main contributors to output growth are Services (2.4% points), non-IT capital (1.1% points), and IT capital (0.5% points). In real terms, total inputs grew faster than gross output, with a small decline in GO based MFP of –0.1% recorded.

Gross output and value added grew at similar rates overall. Within intermediate inputs, the main driver is overwhelmingly services, with an 87% average cost share.

The value of a service is embedded in their content rather than in the format in which they are distributed. For example, a movie can be screened at a cinema, telecast on television or copied to video for sale or rental. These products do not usually require direct contact between the supplier/producer and the consumer, which distinguishes them from distribution activities included in the Wholesale trade and Retail trade.

With nearly one third of capital services growth contribution from IT–capital, this industry demonstrates significant technology embodied in its capital. Furthermore, with subdued growth in hours worked against stronger growth in capital services, there has been significant capital deepening. Though intermediate input services, this industry also utilises contracted labour services abroad (such as through the offshoring of some telecommunication services).

DIVISION K – FINANCIAL AND INSURANCE SERVICES

The Financial and Insurance Services Division includes units mainly engaged in financial transactions involving the creation, liquidation, or change in ownership of financial assets, and/or in facilitating financial transactions. The largest subdivision is Finance (70% of industry GVA in 2012–13) with the remainder representing insurance, superannuation and auxiliary services. As at 2012–13, this industry represented an 8.8% share of total Australian GVA.

Over the period 1994–95 to 2012–13, gross output grew 4.8% per annum. The main contributors to output growth were services (1.9% points), IT capital (1.1% points), and GO based MFP (1.0% points).

Gross output and value added grew at a similar rate overall. Gross output growth was positive since 1994–95, with the exception of the period during the Global Financial Crisis in 2008–09 (–0.2%). Since 2009–10, output growth has been more subdued compared to earlier years.

On average VA based MFP (1.7%) grew stronger than GO based MFP (1.0%). This is because intermediate inputs, particularly services, account for a substantial portion of gross output and grew significantly faster than primary inputs, therefore reducing growth in GO based MFP.

Within intermediate inputs, the main driver is services, representing more than a 90% average cost share. There has also been significant capital deepening in this industry as growth in hours worked has contributed to output modestly (0.3%) relative to capital. IT capital has significantly transformed industry practices, such as through on–line banking.

DIVISION L – RENTAL, HIRING AND REAL ESTATE SERVICES

The Rental, Hiring and Real Estate Services industry includes units engaged in the renting and hiring of tangible (as in the case of real estate and equipment) and intangible assets (as in the case with patents and trademarks). The division also includes non–residential property operators and units providing real estate services such as selling, renting and/or buying real estate for others and appraising real estate. As at 2012–13, this industry represented a 2.8% share of total Australian GVA.

Over the period 1994–95 to 2012–13, gross output grew 2.4% per annum on average. The largest contributors to output were non-IT capital services (1.5% points), services (1.2% points) and IT capital services (0.6% points). Overall, total inputs grew far stronger than output, resulting in a GO based MFP decline of –1.5% on average, the strongest decline by industry in the market sector. However, since 2008–09, total inputs growth has been more subdued, resulting in positive GO based MFP growth in four out of the last five years.

Intermediate inputs growth was dominated by the growth in services (representing more than 90% share of intermediate inputs). Intermediate inputs growth was more subdued than primary inputs growth. However, since intermediate inputs represents more than half of the total inputs by cost share, the decline in GO based MFP (–1.5%) was significantly less than the decline in VA based MFP (–3.8%) over the same period.

The overall GO MFP decline of –1.5% on average was mainly due to the real estate activity, which dominates the industry.²⁴ The strong decline suggests this industry is arguably not well suited to analysis confined to the productivity growth accounting framework. While rents are a key contributor to output, holders of the real estate may derive significant income through holding gains due to the growth in property value over time.²⁵ Furthermore, that interpretation of productivity in this industry is more complex due to the leasing of assets to other industries.

DIVISION M – PROFESSIONAL, SCIENTIFIC AND TECHNICAL SERVICES

The division has two subdivisions: Professional, Scientific and Technical Services (76% of industry GVA in 2012–13) and Computer System Design and Related Services (24%). Units in this division provide highly specialised services including scientific research, architecture, engineering, computer systems design, law, accountancy, market research, veterinary science and professional photography. As at 2012–13, this industry represented a 7.1% share of total Australian GVA.

Over the period 1994–95 to 2012–13, gross output grew 4.8% per annum on average. The largest contributors to output are services (2.5% points) and hours worked (1.3% points). Overall, GO based MFP was recorded as flat (0.1% per annum).

Both gross output and value added output grew strongly over the time series at approximately 4.8% per annum. With the exception of 2002–03 when output growth was slightly negative (–0.3%), gross output grew between 1.8% and 13.2% per annum. The late 1990s was a period of high growth for the industry. During the mid–2000s growth was slower, but input growth was even higher leading to a decrease in MFP.

The intermediate inputs index is driven mainly by the services input as materials and energy inputs account for very little of the cost share. The growth in services mainly occurred during the late 1990s and mid–2000s. Use of materials inputs grew strongly in the late 1990s but has since declined.

²⁴ Ownership of Dwellings is excluded from this Division (and therefore the market sector) and instead recorded as a separate industry. Ownership of Dwellings is the mechanism by which owner-occupiers provide dwelling services to themselves, such as imputed rent, combined with the transactions between landlords and tenants. It is characteristically a part of the households sector.

²⁵ While income from holding gains is not recorded as part of nominal output, they are a component in the user cost of capital as they can influence the rents the owners of capital offer to the market.

DIVISION N – ADMINISTRATIVE AND SUPPORT SERVICES

The Administrative and Support Services industry includes units mainly engaged in performing routine support activities for the day-to-day operations of their clientele in activities such as office administration; hiring and placing personnel; preparing documents; telephone services; credit reporting or collecting services; and travel agency services., and support services such as building and other cleaning services; pest control services; gardening services; and packaging products for others. As at 2012–13, this industry represented a 3.0% share of total Australian GVA.

Over the period 1994–95 to 2012–13, gross output grew 3.6% per annum on average. The largest contributors to output were services (2.2% points) and hours worked (1.0% points). Overall, GO based MFP fell –0.3% per annum.

Gross output grew steadily from 1995–96. Intermediate input growth slowed in the early 2000s and value added grew faster than gross output during this time. Recent high growth in intermediate inputs (mainly services) has led to little growth in value added over the last five years.

VA based MFP and GO based MFP were particularly strong from 2005–06 to 2007–08. However, from 2008–09, both measures saw sharp declines, offsetting all of the earlier gains. There were two spikes in productivity in the years 2001–02 and 2007–08. The spike in 2001–02 was mainly the result of decreasing inputs, while the spike in 2007–08 was mainly due to increasing outputs. Both MFP peaks coincide with a decrease in hours worked. However, some caution needs to be exercised as the hours worked recorded for this industry tend to be volatile from year to year, resulting in some noise in the MFP residual.

DIVISION R – ARTS AND RECREATION SERVICES

The Arts and Recreation Services Division is a diverse industry that includes units mainly engaged in the exhibition of objects of historical, cultural or educational interest; the production of original artistic works and/or participation in live performances, events or exhibits intended for public viewing; and sporting or recreational activities, or amusement interests.

Heritage activities and creative and performing arts activities accounted for 31% of industry GVA in 2012–13, while sports and recreation activities and gambling activities accounted for 69%. As at 2012–13, this industry represented a 0.8% share of total Australian GVA. This industry has a strong focus on the arts and significant public funding is provided for heritage management.

Over the period 1994–95 to 2012–13, gross output grew 3.2% per annum on average. The largest contributors to output were services (1.3% points), hours worked (0.8% points) and non-IT capital (0.7% points). Overall, GO based MFP recorded a slight fall (–0.2% per annum) on average.

Both real gross output and value added grew steadily from 1995–96, although output slowed in the three years to 2012–13. Intermediate inputs grew more slowly than primary inputs. Consequently, the decline in GO based MFP was less than recorded for VA based MFP.

DIVISION S – OTHER SERVICES

The Other Services Division includes a broad range of personal services, religious, civic, professional and other interest group services; selected repair and maintenance activities (except ships, boats, aircraft, or railway rolling stock, and buildings); and private households employing staff; hair, beauty and weight management services; and funeral services.²⁶ As at 2012–13, this industry represented a 1.9% share of total Australian GVA.

Over the period 1994–95 to 2012–13, gross output grew 2.1% on average. The largest contributors to output were non-IT capital and materials, both contributing 0.6% points, and services (0.5% points).

Overall, GO based MFP growth has been flat, with the growth prior to 2000–01 offset by declines thereafter. While output growth has been strong, even during the post GFC period, this is almost entirely explained by input growth, rather than MFP growth. Although labour's contribution to output growth is small, the industry is increasingly labour intensive (over 40% of total input costs and growing). The high labour intensity and low take-up of IT suggests innovation and technology is not a significant factor in this industry.

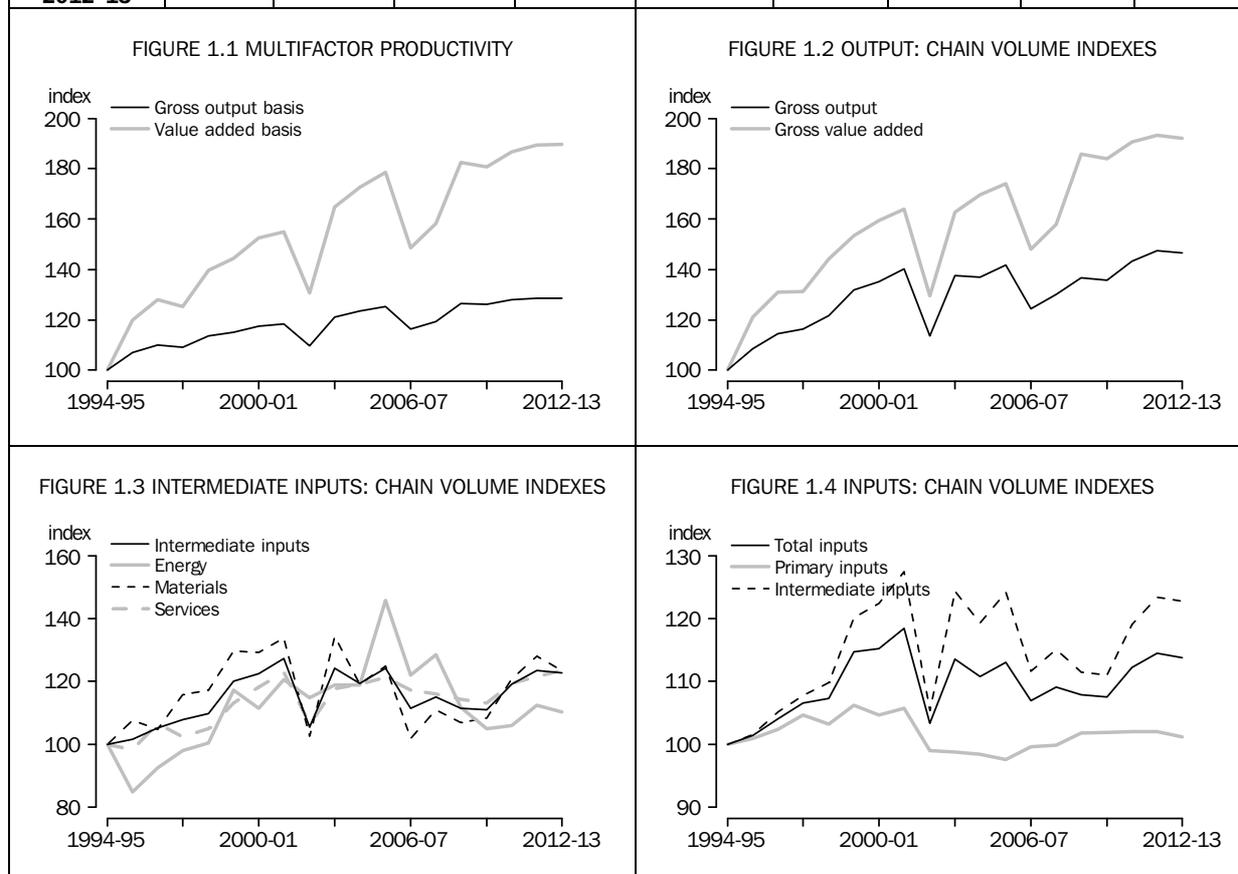
ADDITIONAL INFORMATION

For further information on the conceptual and measurement issues on productivity estimates, readers should refer to the **Australian National Accounts: Concepts, Sources and Methods** (Cat. no. 5216.0 Chapter 19), the 2007 Information Paper **Experimental Estimates of Industry Multifactor Productivity** (Cat. no. 5260.0.55.001), or 2005 Research Paper **Estimating Industry-Level Multifactor Productivity for the Market Sector Industries in Australia: Methods and Experimental Results**, (Cat no. 1351.0.55.004) which are available on the ABS website.

²⁶ The composition of the Other Services Division was amended significantly during the ANZSIC 2006 conversion, and reflects a more supply side approach. For example, this division picks up repairs and maintenance, various household repair services and parking services, previously assigned to other industries in a demand side compilation. Due to these factors, and coverage issues, the industry estimates are less reliable prior to 2006-07.

FIGURE 1: AGRICULTURE, FORESTRY AND FISHING (1994–95=100)

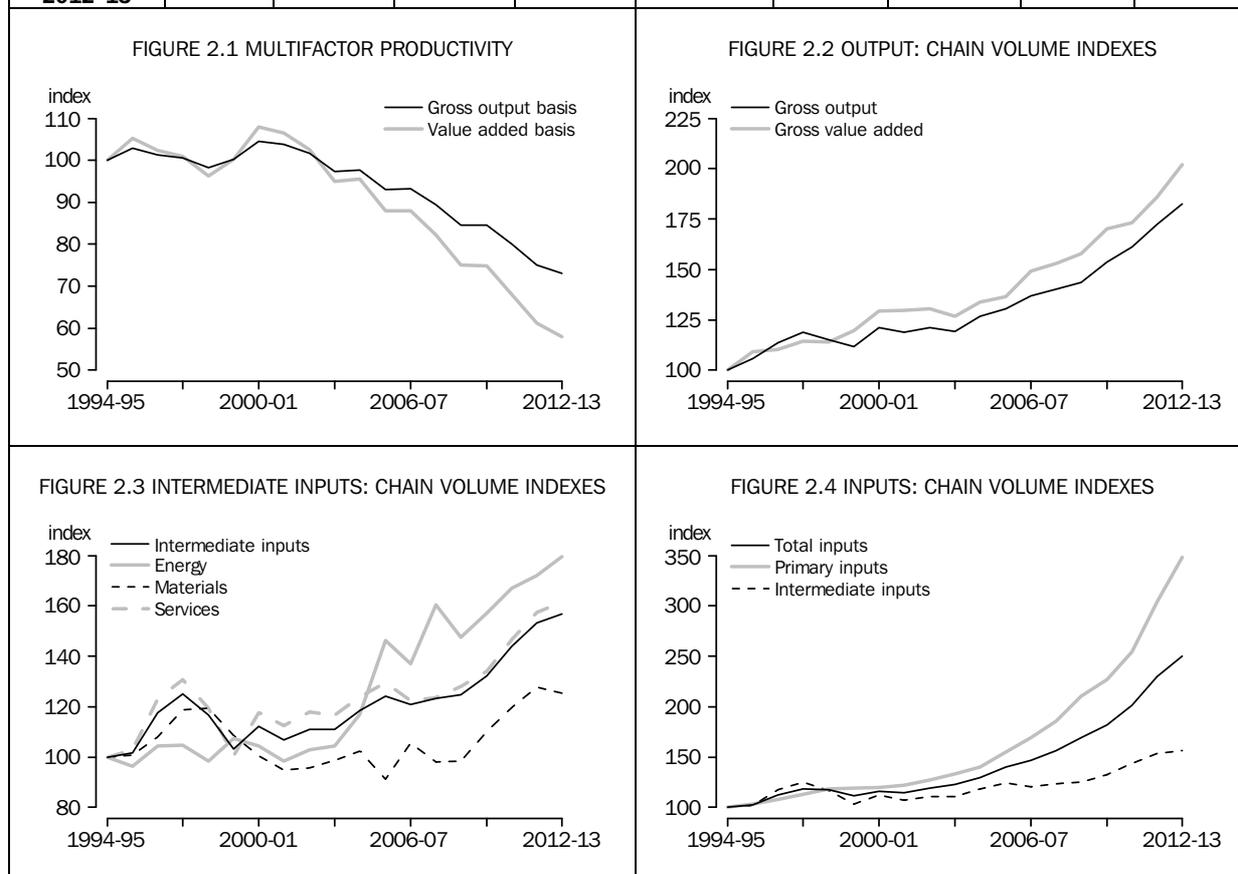
Year	Gross Output Growth	Contribution from Capital Services		Contribution from Labour Services		Contribution from Intermediate Inputs			MFP Growth (b)
		IT	Non-IT	Hours Worked	Composition	Energy	Materials	Services	
1995–96	8.2	0.0	0.1	0.3	0.0	-0.5	2.0	-0.5	6.9
1996–97	5.2	0.0	0.1	0.4	0.1	0.2	-0.7	2.6	2.6
1997–98	1.6	0.1	0.0	0.6	0.1	0.2	2.7	-1.3	-0.8
1998–99	4.6	0.0	0.0	-0.7	0.1	0.1	0.3	0.8	4.0
1999–00	8.0	0.0	0.0	1.0	0.1	0.5	2.7	2.4	1.3
2000–01	2.6	0.0	0.0	-0.8	0.1	-0.2	-0.1	1.4	2.2
2001–02	3.5	0.0	0.0	0.4	0.1	0.2	0.9	1.2	0.7
2002–03	-21.1	0.0	-0.2	-2.7	0.1	-0.2	-6.3	-4.4	-7.4
2003–04	19.2	0.0	0.2	-0.5	0.1	0.1	6.3	3.1	9.7
2004–05	-0.5	0.0	0.4	-0.6	0.0	0.0	-2.7	0.4	2.0
2005–06	3.4	0.0	0.5	-0.8	0.0	0.7	1.0	0.5	1.5
2006–07	-13.0	0.0	0.2	0.6	0.0	-0.7	-4.5	-1.1	-7.5
2007–08	4.5	0.0	0.3	-0.1	0.0	0.2	2.0	-0.3	2.5
2008–09	4.9	0.0	0.3	0.5	0.0	-0.5	-0.9	-0.5	6.0
2009–10	-0.6	0.0	0.2	-0.1	0.0	-0.2	0.3	-0.4	-0.4
2010–11	5.5	0.0	0.6	-0.5	0.0	0.0	2.2	1.8	1.4
2011–12	2.6	0.0	0.6	-0.6	0.0	0.2	1.2	0.6	0.6
2012–13	-0.6	0.0	0.6	-0.9	0.0	-0.1	-0.8	0.5	0.1
1995–96 to 2012–13	2.1	0.0	0.2	-0.2	0.0	0.0	0.3	0.4	1.4



(a) Differences in natural logs x 100
 (b) Quality adjusted hours worked basis

FIGURE 2: MINING (1994-95=100)

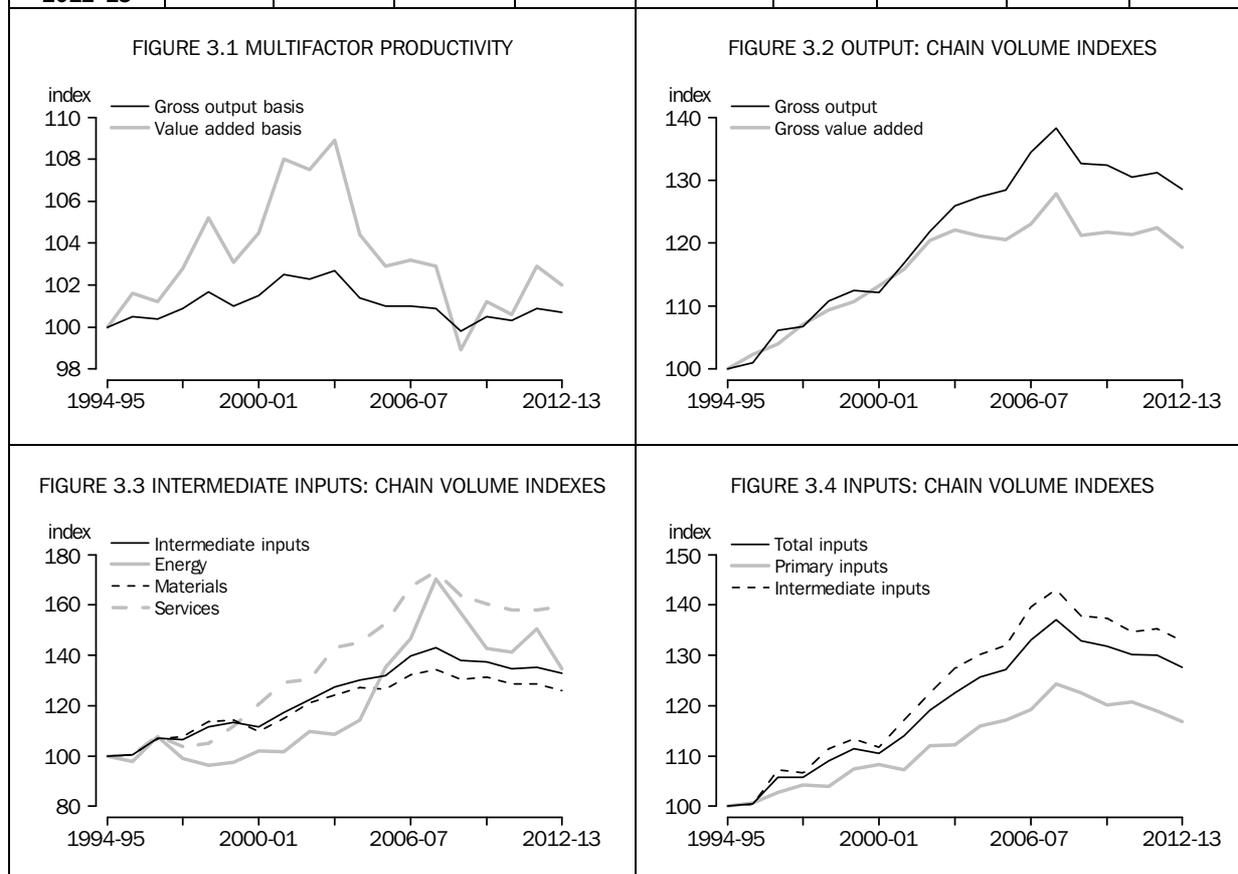
Year	Gross Output Growth	Contribution from Capital Services		Contribution from Labour Services		Contribution from Intermediate Inputs			MFP Growth (b)
		IT	Non-IT	Hours Worked	Composition	Energy	Materials	Services	
1995-96	5.6	0.1	1.9	-0.2	0.1	-0.2	0.1	0.9	2.9
1996-97	7.1	0.1	2.2	0.0	0.1	0.4	0.6	5.4	-1.6
1997-98	4.7	0.2	2.5	-0.3	0.1	0.0	0.8	2.0	-0.7
1998-99	-3.3	0.2	1.5	0.6	0.1	-0.3	0.1	-3.0	-2.5
1999-00	-3.0	0.2	0.5	-0.4	0.1	0.5	-0.9	-5.2	2.2
2000-01	8.1	0.1	0.2	0.0	0.1	-0.2	-0.7	4.4	4.2
2001-02	-1.9	0.1	0.7	0.1	0.0	-0.3	-0.5	-1.3	-0.7
2002-03	1.9	0.2	1.1	1.1	0.0	0.2	0.1	1.3	-2.1
2003-04	-1.5	0.2	1.6	1.0	0.0	0.1	0.2	-0.3	-4.3
2004-05	5.9	0.2	1.4	1.1	0.0	0.7	0.3	1.9	0.3
2005-06	3.0	0.2	3.8	2.1	0.0	1.3	-0.7	1.2	-4.9
2006-07	4.8	0.1	4.7	0.8	0.0	-0.4	0.9	-1.5	0.3
2007-08	2.4	0.2	5.0	0.6	0.0	1.0	-0.5	0.3	-4.2
2008-09	2.3	0.1	5.6	1.7	0.0	-0.6	0.0	0.9	-5.6
2009-10	6.9	0.1	4.3	0.3	0.0	0.4	0.7	1.3	-0.2
2010-11	4.7	0.1	4.8	1.9	0.0	0.4	0.5	2.5	-5.5
2011-12	6.8	0.1	8.1	2.2	0.0	0.2	0.4	2.0	-6.2
2012-13	5.7	0.0	6.7	0.8	0.0	0.3	-0.1	0.8	-2.7
1995-96 to 2012-13	3.3	0.1	3.1	0.7	0.0	0.2	0.1	0.8	-1.7



(a) Differences in natural logs x 100
 (b) Quality adjusted hours worked basis

FIGURE 3: MANUFACTURING (1994–95=100)

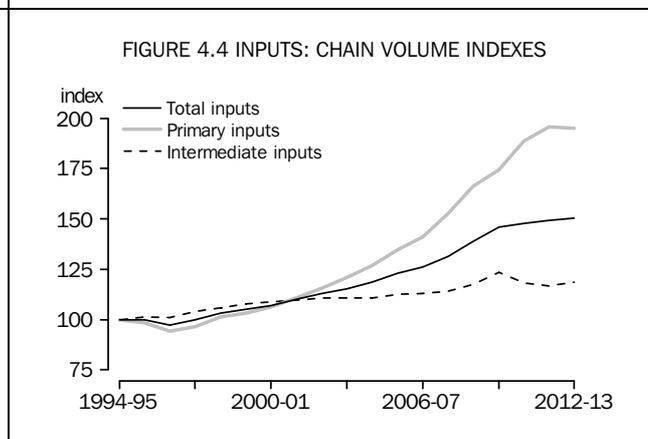
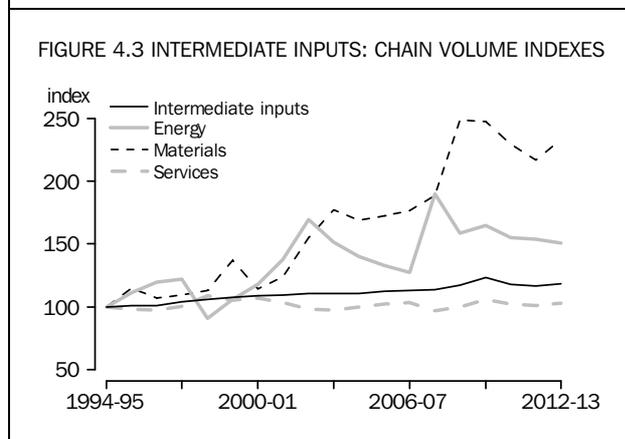
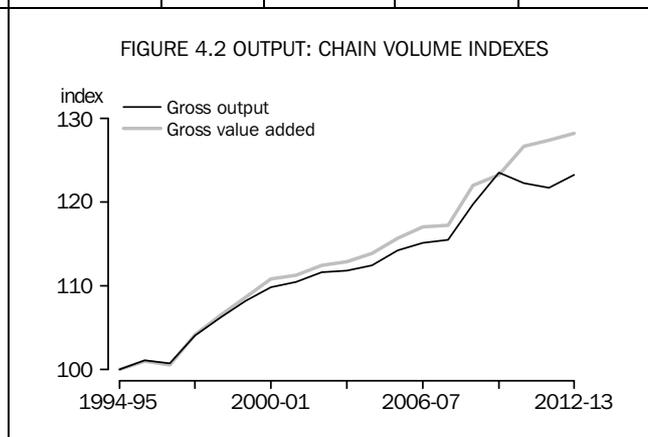
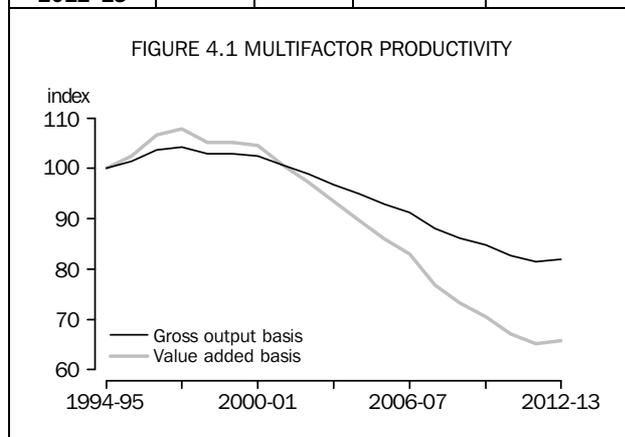
Table 3.1 Annual Points Contribution to Growth, 1995–96 to 2012–13 (a)									
Year	Gross Output Growth	Contribution from Capital Services		Contribution from Labour Services		Contribution from Intermediate Inputs			MFP Growth (b)
		IT	Non-IT	Hours Worked	Composition	Energy	Materials	Services	
1995–96	1.0	0.2	0.3	-0.4	0.1	0.0	0.2	0.1	0.5
1996–97	5.0	0.2	0.1	0.2	0.1	0.2	3.3	1.0	-0.1
1997–98	0.5	0.3	0.2	-0.2	0.1	-0.2	0.3	-0.5	0.5
1998–99	3.8	0.2	0.2	-0.6	0.1	-0.1	3.0	0.1	0.8
1999–00	1.5	0.2	0.3	0.5	0.1	0.0	0.3	0.8	-0.6
2000–01	-0.3	0.1	0.1	-0.1	0.1	0.1	-2.1	1.0	0.5
2001–02	4.0	0.1	0.1	-0.6	0.1	0.0	2.4	1.0	1.0
2002–03	4.2	0.2	0.3	0.7	0.1	0.1	2.8	0.1	-0.1
2003–04	3.2	0.2	0.5	-0.8	0.1	0.0	1.4	1.4	0.4
2004–05	1.2	0.2	0.5	0.2	0.1	0.1	1.1	0.2	-1.3
2005–06	0.8	0.2	0.7	-0.6	0.1	0.4	-0.3	0.8	-0.4
2006–07	4.6	0.1	0.4	-0.1	0.1	0.2	2.3	1.5	0.1
2007–08	2.9	0.2	0.4	0.5	0.1	0.4	0.8	0.6	-0.1
2008–09	-4.2	0.1	0.1	-0.7	0.1	-0.2	-1.6	-0.9	-1.1
2009–10	-0.1	0.1	0.0	-0.7	0.1	-0.2	0.3	-0.3	0.6
2010–11	-1.5	0.0	0.1	-0.1	0.1	0.0	-1.1	-0.3	-0.2
2011–12	0.5	0.0	0.1	-0.6	0.1	0.2	0.1	0.0	0.6
2012–13	-2.0	0.0	0.0	-0.5	0.1	-0.3	-1.1	0.2	-0.2
1995–96 to 2012–13	1.4	0.1	0.2	-0.2	0.1	0.0	0.7	0.4	0.0



(a) Differences in natural logs x 100
 (b) Quality adjusted hours worked basis

FIGURE 4: ELECTRICITY, GAS, WATER AND WASTE SERVICES (1994–95=100)

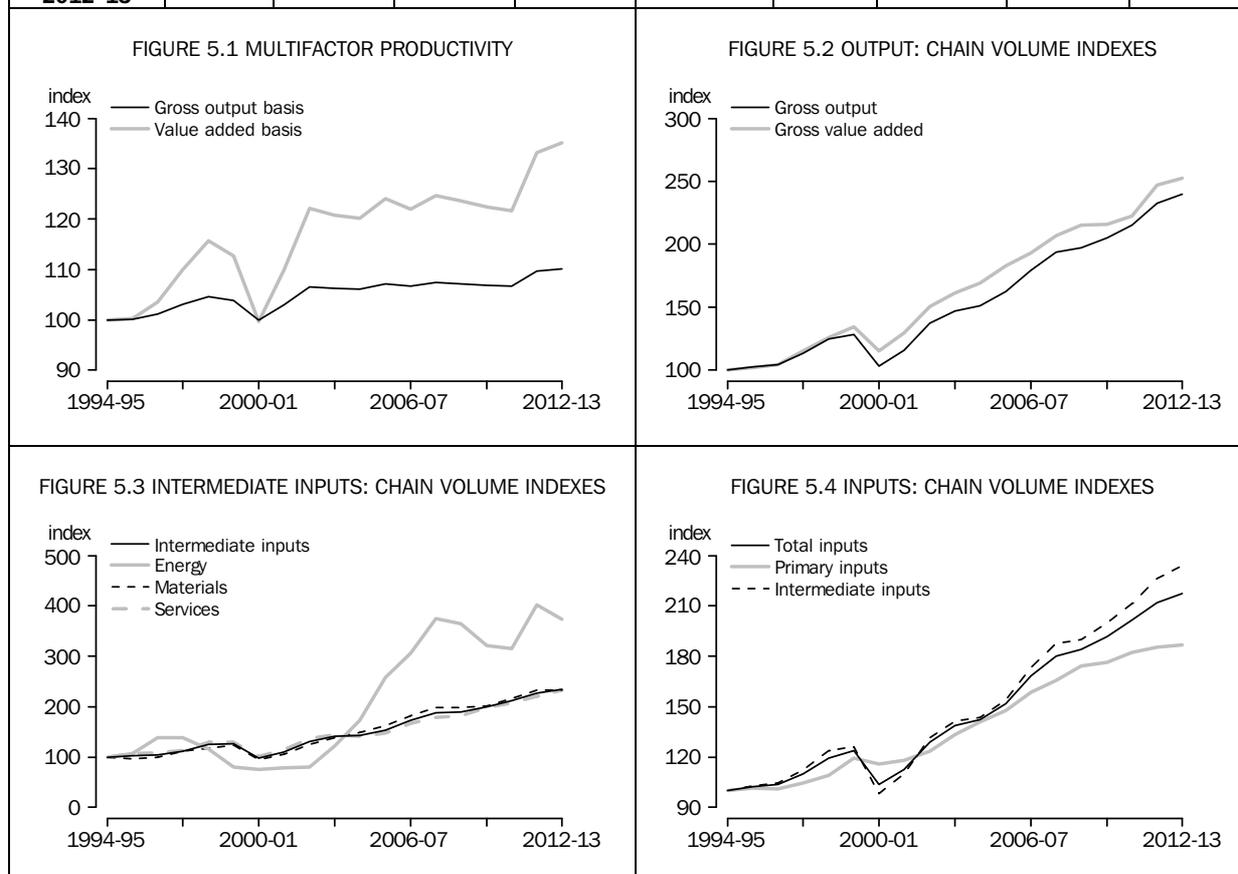
Table 4.1 Annual Points Contribution to Growth, 1995–96 to 2012–13 (a)									
Year	Gross Output Growth	Contribution from Capital Services		Contribution from Labour Services		Contribution from Intermediate Inputs			MFP Growth (b)
		IT	Non-IT	Hours Worked	Composition	Energy	Materials	Services	
1995–96	1.1	0.4	0.1	-1.5	0.2	0.6	0.6	-0.7	1.4
1996–97	-0.3	0.6	0.0	-3.1	0.2	0.5	-0.3	-0.2	2.1
1997–98	3.2	0.7	0.5	0.0	0.1	0.1	0.1	1.1	0.6
1998–99	2.0	0.7	0.6	0.9	0.1	-2.2	0.2	2.9	-1.2
1999–00	1.9	0.7	0.7	-0.5	0.1	1.1	1.1	-1.3	0.0
2000–01	1.4	0.4	0.7	0.2	0.1	0.7	-1.0	0.7	-0.4
2001–02	0.6	0.4	0.9	0.8	0.0	1.2	0.4	-1.2	-1.9
2002–03	1.1	0.5	0.9	0.9	0.0	1.5	1.2	-2.1	-1.8
2003–04	0.1	0.6	1.2	0.5	0.0	-0.7	0.7	-0.1	-2.0
2004–05	0.5	0.4	1.3	0.8	0.0	-0.5	-0.3	0.8	-2.0
2005–06	1.6	0.3	1.2	1.5	0.0	-0.3	0.1	1.0	-2.1
2006–07	0.8	0.4	1.6	0.4	0.0	-0.3	0.2	0.4	-1.8
2007–08	0.4	0.6	1.8	1.3	0.0	2.6	0.4	-2.6	-3.6
2008–09	3.5	0.4	1.5	2.1	0.0	-1.2	1.6	1.2	-2.1
2009–10	3.2	0.3	1.4	0.4	0.0	0.3	0.0	2.5	-1.7
2010–11	-1.0	0.3	1.5	1.8	0.0	-0.4	-0.4	-1.5	-2.4
2011–12	-0.4	0.3	1.1	0.3	0.0	0.0	-0.3	-0.4	-1.4
2012–13	1.2	0.2	1.0	-1.3	0.0	-0.1	0.3	0.6	0.5
1995–96 to 2012–13	1.2	0.5	1.0	0.3	0.0	0.2	0.3	0.1	-1.1



(a) Differences in natural logs x 100
 (b) Quality adjusted hours worked basis

FIGURE 5: CONSTRUCTION (1994–95=100)

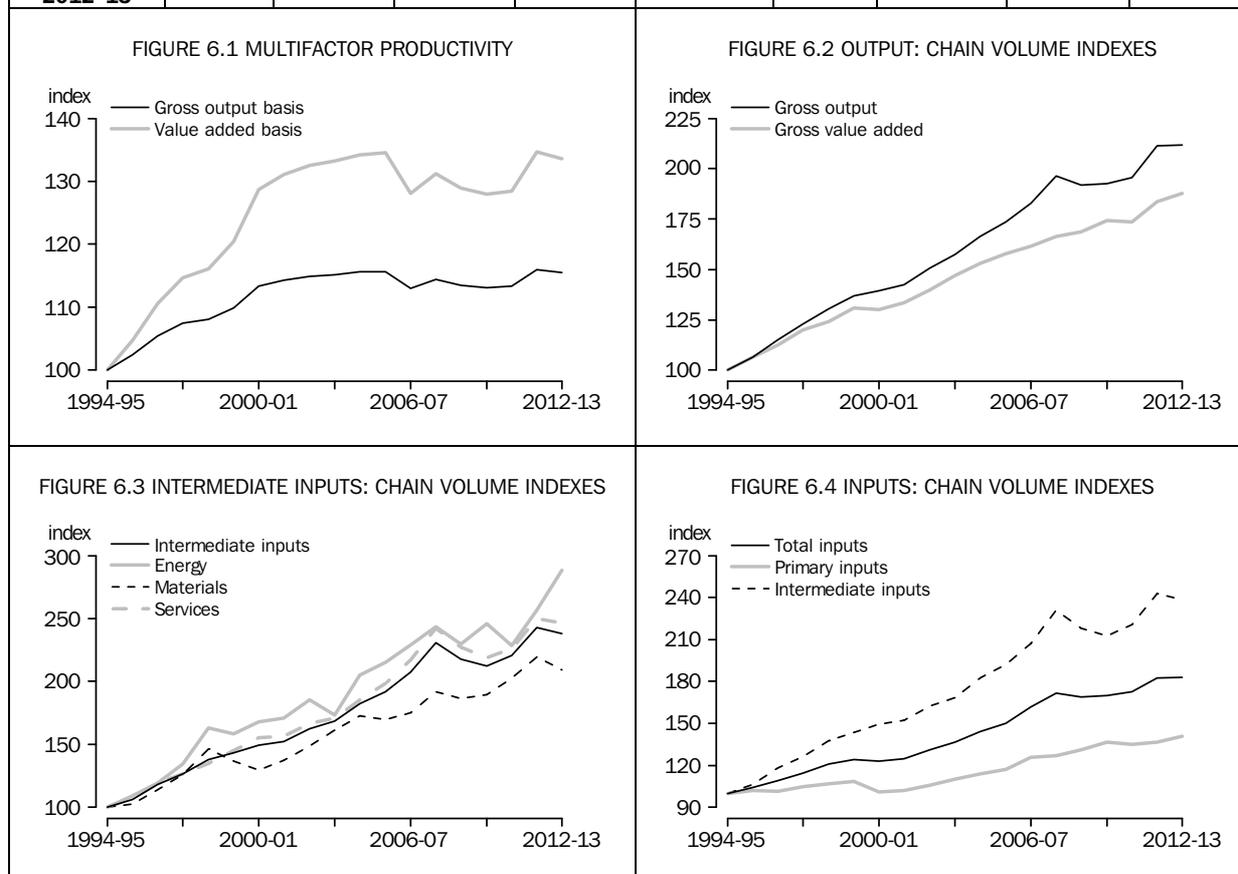
Year	Gross Output Growth	Contribution from Capital Services		Contribution from Labour Services		Contribution from Intermediate Inputs			MFP Growth (b)
		IT	Non-IT	Hours Worked	Composition	Energy	Materials	Services	
1995–96	2.4	0.2	0.3	0.0	0.0	0.1	-1.0	2.8	0.1
1996–97	2.2	0.1	0.0	-0.3	0.1	0.3	0.8	0.2	1.0
1997–98	7.7	0.2	0.0	0.8	0.1	0.0	2.8	1.9	1.9
1998–99	9.8	0.1	0.1	0.9	0.1	-0.2	1.4	5.8	1.4
1999–00	2.9	0.1	0.1	2.4	0.1	-0.3	1.4	-0.2	-0.8
2000–01	-21.8	0.1	0.1	-1.3	0.1	0.0	-6.8	-10.0	-3.8
2001–02	11.4	0.1	0.1	0.4	0.0	0.0	2.7	4.9	3.1
2002–03	17.0	0.1	0.2	1.1	0.0	0.0	4.4	7.7	3.4
2003–04	7.1	0.2	0.2	2.1	0.0	0.3	2.4	2.1	-0.3
2004–05	2.6	0.1	0.4	1.2	0.0	0.3	1.8	-1.0	-0.2
2005–06	7.2	0.1	0.4	1.0	0.0	0.5	2.3	1.8	1.0
2006–07	10.0	0.1	0.4	1.6	0.1	0.3	3.0	5.0	-0.5
2007–08	7.6	0.2	0.6	0.5	0.1	0.4	2.2	2.9	0.7
2008–09	1.9	0.1	0.7	0.5	0.1	-0.1	-0.1	1.0	-0.3
2009–10	3.8	0.1	0.5	-0.2	0.1	-0.2	0.4	3.4	-0.3
2010–11	4.8	0.1	0.4	0.5	0.1	0.0	1.8	2.2	-0.2
2011–12	7.9	0.1	0.5	-0.2	0.1	0.4	1.7	2.5	2.8
2012–13	3.0	0.1	0.4	-0.4	0.1	-0.1	0.1	2.4	0.4
1995–96 to 2012–13	4.9	0.1	0.3	0.6	0.1	0.1	1.2	2.0	0.5



(a) Differences in natural logs x 100
 (b) Quality adjusted hours worked basis

FIGURE 6: WHOLESALE TRADE (1994–95=100)

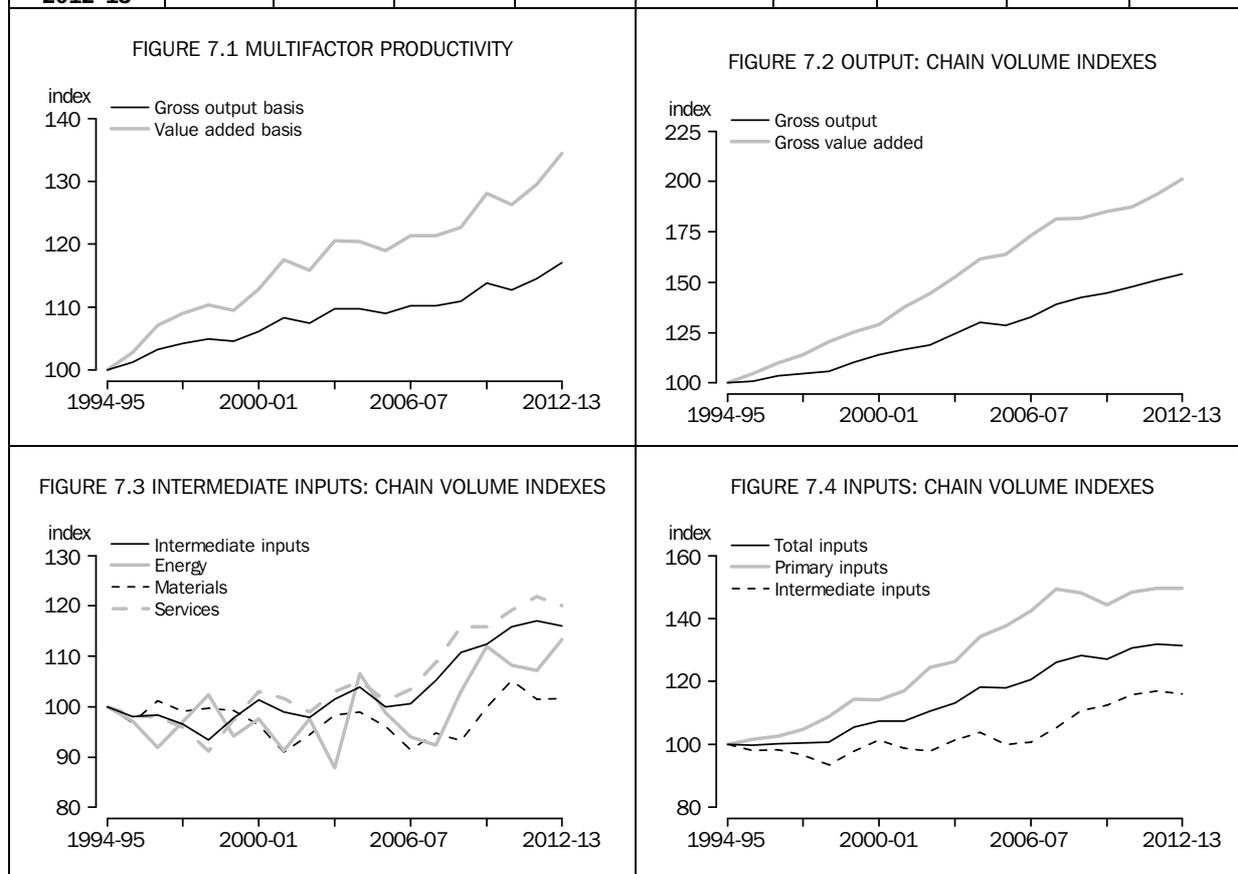
Table 6.1 Annual Points Contribution to Growth, 1995–96 to 2012–13 (a)									
Year	Gross Output Growth	Contribution from Capital Services		Contribution from Labour Services		Contribution from Intermediate Inputs			MFP Growth (b)
		IT	Non-IT	Hours Worked	Composition	Energy	Materials	Services	
1995–96	6.4	0.3	0.2	0.4	0.1	0.1	0.3	2.6	2.4
1996–97	7.7	0.4	0.5	-1.1	0.1	0.1	1.0	3.8	2.9
1997–98	6.5	0.5	0.5	0.3	0.1	0.1	1.0	2.2	1.9
1998–99	6.1	0.5	0.4	0.1	0.1	0.1	1.7	2.6	0.6
1999–00	4.6	0.4	0.4	-0.1	0.1	0.0	-0.8	3.0	1.7
2000–01	1.9	0.3	0.1	-3.8	0.1	0.0	-0.6	2.7	3.0
2001–02	2.1	0.2	0.3	-0.3	0.2	0.0	0.6	0.3	0.8
2002–03	5.7	0.4	0.4	0.7	0.2	0.1	0.8	2.5	0.5
2003–04	4.2	0.6	1.1	0.3	0.2	0.0	0.8	0.9	0.3
2004–05	5.8	0.6	1.2	-0.2	0.2	0.1	0.6	3.0	0.3
2005–06	4.1	0.5	1.0	-0.2	0.2	0.0	-0.2	2.7	0.1
2006–07	5.2	0.4	0.5	2.3	0.2	0.0	0.3	3.7	-2.3
2007–08	7.1	0.5	0.9	-1.3	0.2	0.0	0.9	4.7	1.2
2008–09	-2.3	0.2	0.3	0.8	0.2	0.0	-0.3	-2.7	-0.8
2009–10	0.3	0.2	0.2	1.4	0.2	0.0	0.2	-1.5	-0.4
2010–11	1.7	0.1	0.1	-0.8	0.2	-0.1	0.7	1.2	0.2
2011–12	7.7	0.1	0.4	-0.2	0.2	0.1	0.8	4.1	2.3
2012–13	0.1	0.1	0.0	1.2	0.2	0.1	-0.5	-0.7	-0.4
1995–96 to 2012–13	4.2	0.4	0.5	0.0	0.2	0.0	0.4	2.0	0.8



(a) Differences in natural logs x 100
 (b) Quality adjusted hours worked basis

FIGURE 7: RETAIL TRADE (1994–95=100)

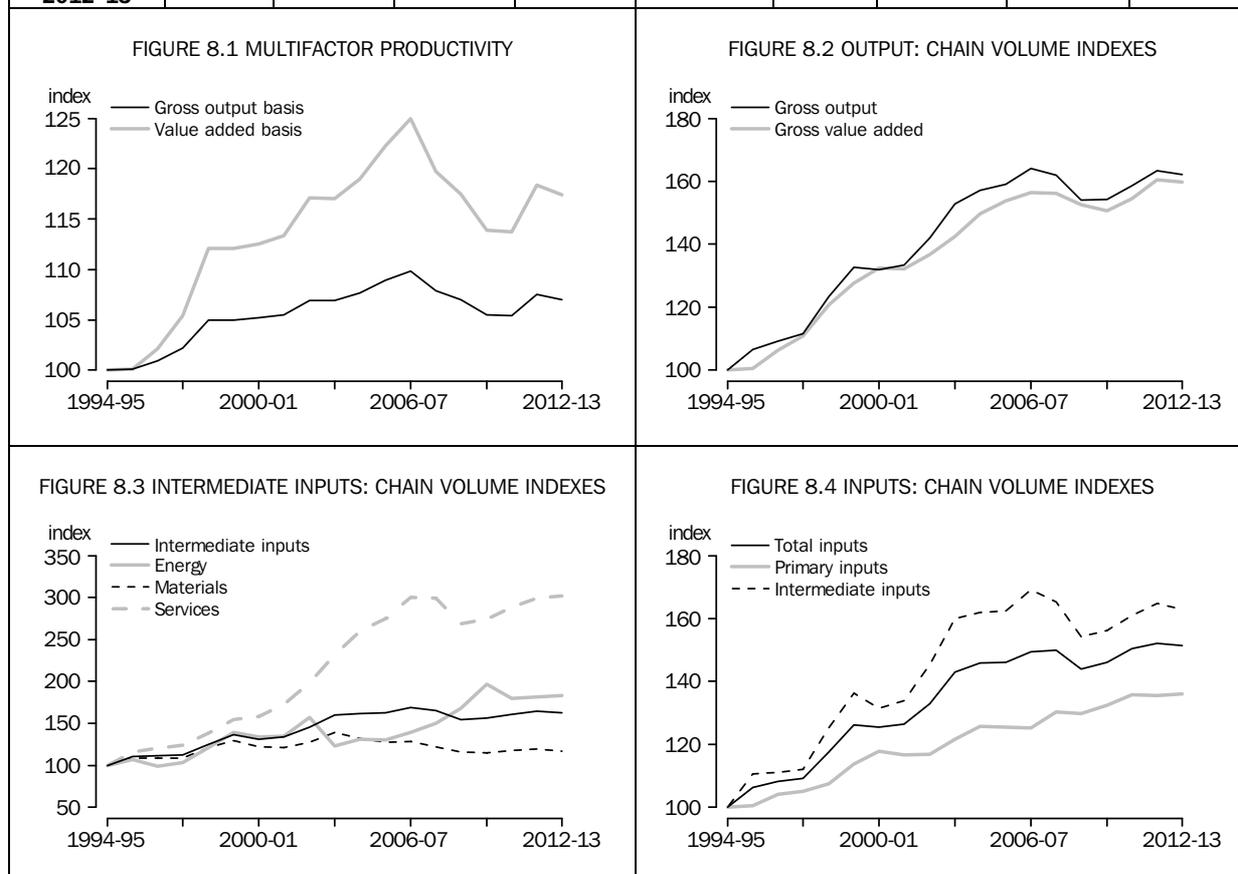
Year	Gross Output Growth	Contribution from Capital Services		Contribution from Labour Services		Contribution from Intermediate Inputs			MFP Growth (b)
		IT	Non-IT	Hours Worked	Composition	Energy	Materials	Services	
1995–96	1.0	0.4	0.2	0.1	0.1	-0.1	-0.4	-0.7	1.3
1996–97	2.6	0.3	0.3	-0.2	0.1	-0.1	0.5	-0.2	2.0
1997–98	1.0	0.4	0.2	0.3	0.1	0.1	-0.2	-0.8	0.9
1998–99	1.1	0.4	0.4	1.1	0.1	0.1	0.1	-1.8	0.7
1999–00	4.2	0.3	0.3	1.7	0.1	-0.2	0.0	2.5	-0.4
2000–01	3.2	0.3	0.4	-0.9	0.1	0.1	-0.3	2.1	1.5
2001–02	2.1	0.2	0.2	0.7	0.1	-0.1	-0.6	-0.5	2.1
2002–03	1.9	0.4	0.4	2.3	0.1	0.1	0.4	-1.0	-0.8
2003–04	4.6	0.5	0.4	-0.1	0.1	-0.2	0.4	1.4	2.2
2004–05	4.4	0.5	0.5	2.2	0.1	0.3	0.1	0.7	0.0
2005–06	-1.0	0.4	0.5	0.3	0.1	-0.1	-0.3	-1.3	-0.7
2006–07	3.3	0.4	0.4	0.9	0.2	-0.1	-0.4	0.7	1.1
2007–08	4.7	0.5	0.6	1.5	0.2	0.0	0.3	1.6	0.0
2008–09	2.2	0.2	0.2	-1.1	0.2	0.1	-0.1	2.0	0.7
2009–10	1.7	0.2	0.3	-2.2	0.2	0.1	0.5	0.0	2.5
2010–11	2.0	0.2	0.2	0.9	0.2	-0.1	0.4	0.9	-0.8
2011–12	2.3	0.1	0.2	-0.1	0.2	0.0	-0.3	0.7	1.5
2012–13	1.9	0.1	0.2	-0.4	0.2	0.1	0.0	-0.5	2.2
1995–96 to 2012–13	2.4	0.3	0.3	0.4	0.1	0.0	0.0	0.3	0.9



(a) Differences in natural logs x 100
 (b) Quality adjusted hours worked basis

FIGURE 8: ACCOMMODATION AND FOOD SERVICES (1994–95=100)

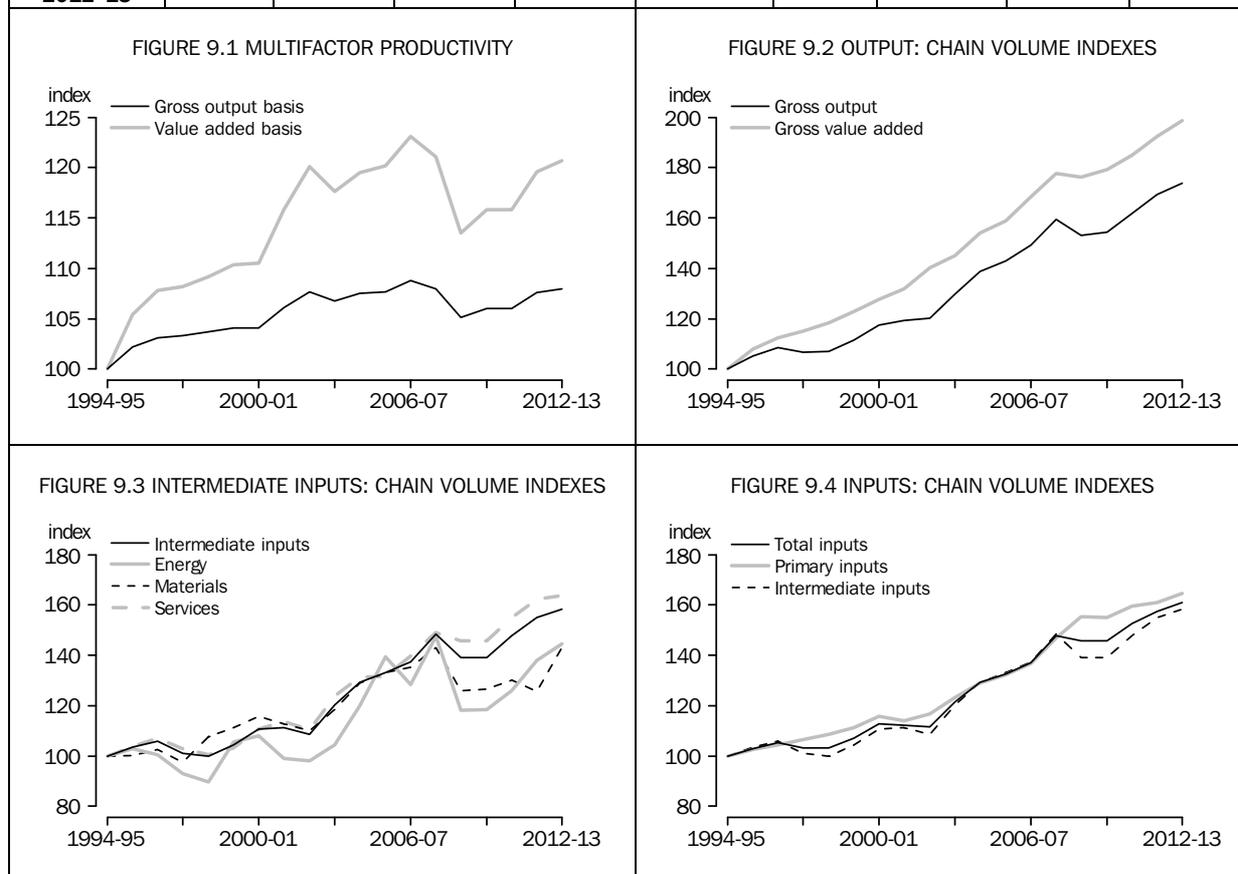
Table 8.1 Annual Points Contribution to Growth, 1995–96 to 2012–13 (a)									
Year	Gross Output Growth	Contribution from Capital Services		Contribution from Labour Services		Contribution from Intermediate Inputs			MFP Growth (b)
		IT	Non-IT	Hours Worked	Composition	Energy	Materials	Services	
1995–96	6.3	0.0	0.1	0.1	0.0	0.2	3.7	2.1	0.1
1996–97	2.5	0.1	0.3	1.1	0.0	-0.2	-0.1	0.5	0.8
1997–98	2.2	0.1	0.3	0.0	0.0	0.1	-0.1	0.4	1.3
1998–99	10.0	0.2	0.4	0.4	0.0	0.4	4.4	1.6	2.6
1999–00	7.2	0.1	0.4	1.9	0.0	0.4	2.7	1.7	0.0
2000–01	-0.5	0.1	0.1	1.2	0.0	-0.1	-2.3	0.3	0.2
2001–02	1.1	0.1	0.1	-0.7	0.1	0.0	-0.3	1.4	0.3
2002–03	6.2	0.1	0.2	-0.4	0.1	0.5	1.8	2.6	1.3
2003–04	7.4	0.1	0.4	1.1	0.1	-0.7	3.3	3.1	0.0
2004–05	2.8	0.1	0.4	0.7	0.1	0.1	-1.9	2.5	0.7
2005–06	1.2	0.1	0.3	-0.6	0.1	0.0	-1.2	1.3	1.1
2006–07	3.1	0.1	0.3	-0.6	0.0	0.2	0.2	2.1	0.9
2007–08	-1.5	0.1	0.3	1.2	0.0	0.2	-1.5	-0.1	-1.8
2008–09	-4.9	0.1	0.1	-0.4	0.0	0.3	-1.7	-2.5	-0.9
2009–10	0.1	0.1	0.1	0.8	0.0	0.4	-0.3	0.4	-1.4
2010–11	2.8	0.0	0.1	1.1	0.0	-0.3	0.8	1.1	0.0
2011–12	3.0	0.0	0.0	-0.2	0.0	0.0	0.4	0.8	1.9
2012–13	-0.8	0.0	0.1	0.2	-0.1	0.0	-0.8	0.2	-0.4
1995–96 to 2012–13	2.7	0.1	0.2	0.4	0.0	0.1	0.4	1.1	0.4



(a) Differences in natural logs x 100
 (b) Quality adjusted hours worked basis

FIGURE 9: TRANSPORT, POSTAL AND WAREHOUSING (1994–95=100)

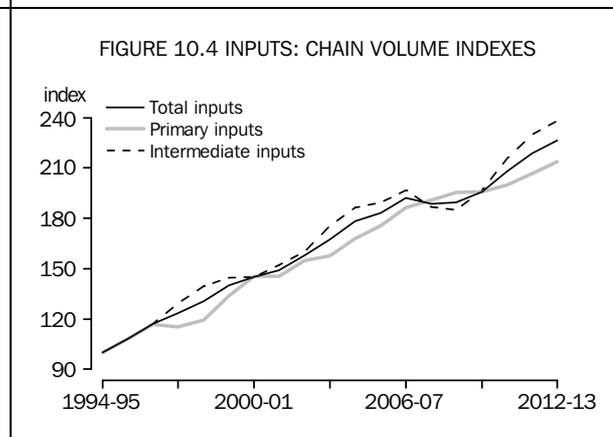
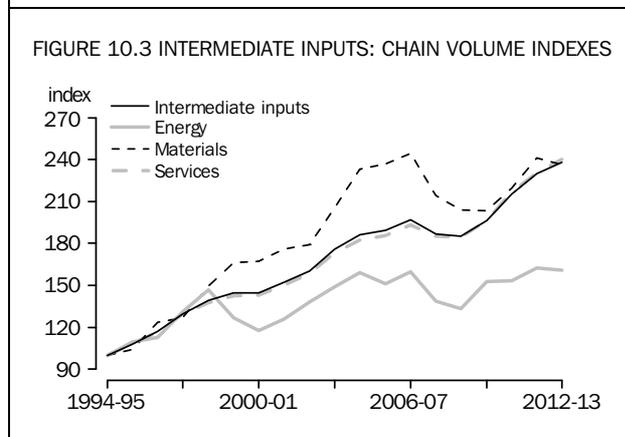
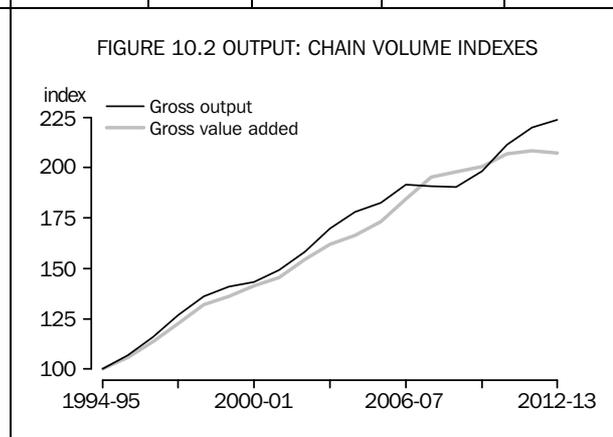
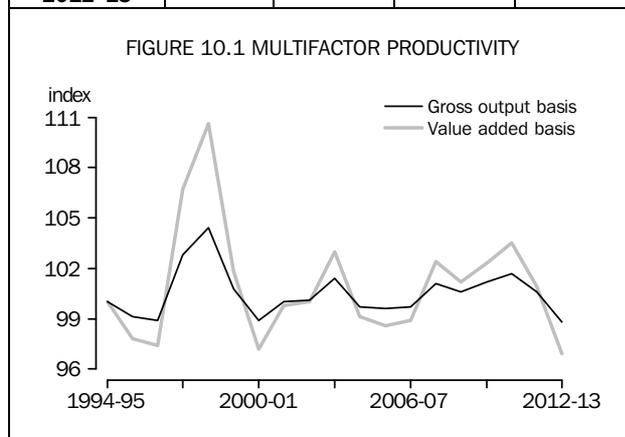
Year	Gross Output Growth	Contribution from Capital Services		Contribution from Labour Services		Contribution from Intermediate Inputs			MFP Growth (b)
		IT	Non-IT	Hours Worked	Composition	Energy	Materials	Services	
1995–96	5.1	0.1	0.1	0.7	0.1	0.2	0.0	1.7	2.1
1996–97	3.0	0.1	0.3	0.2	0.1	-0.2	0.1	1.5	0.9
1997–98	-1.8	0.1	0.1	0.4	0.1	-0.6	-0.3	-1.9	0.2
1998–99	0.4	0.1	0.3	0.3	0.1	-0.2	0.6	-1.1	0.4
1999–00	4.2	0.2	0.3	0.4	0.1	1.2	0.2	1.3	0.4
2000–01	5.0	0.1	0.2	1.1	0.1	0.2	0.2	3.1	0.0
2001–02	1.5	0.1	0.3	-1.1	0.1	-0.8	-0.1	1.2	1.9
2002–03	1.0	0.2	0.6	0.1	0.1	-0.1	-0.1	-1.3	1.5
2003–04	7.5	0.2	0.8	1.2	0.1	0.5	0.4	5.1	-0.9
2004–05	6.8	0.2	0.8	0.8	0.1	1.2	0.4	2.7	0.7
2005–06	3.0	0.2	0.7	0.0	0.1	1.4	0.1	0.2	0.2
2006–07	4.3	0.2	0.7	0.5	0.1	-0.8	0.1	2.5	1.0
2007–08	6.7	0.2	0.8	1.9	0.1	1.4	0.2	2.7	-0.7
2008–09	-4.0	0.1	0.8	1.4	0.1	-2.2	-0.5	-1.0	-2.7
2009–10	0.8	0.1	0.7	-1.0	0.1	0.0	0.0	0.0	0.8
2010–11	4.8	0.0	0.7	0.5	0.1	0.5	0.1	2.8	0.0
2011–12	4.4	0.1	0.8	-0.6	0.1	0.8	-0.1	1.9	1.4
2012–13	2.7	0.1	0.6	0.2	0.1	0.4	0.4	0.4	0.4
1995–96 to 2012–13	3.1	0.1	0.5	0.4	0.1	0.2	0.1	1.2	0.4



(a) Differences in natural logs x 100
 (b) Quality adjusted hours worked basis

FIGURE 10: INFORMATION MEDIA AND TELECOMMUNICATIONS (1994–95=100)

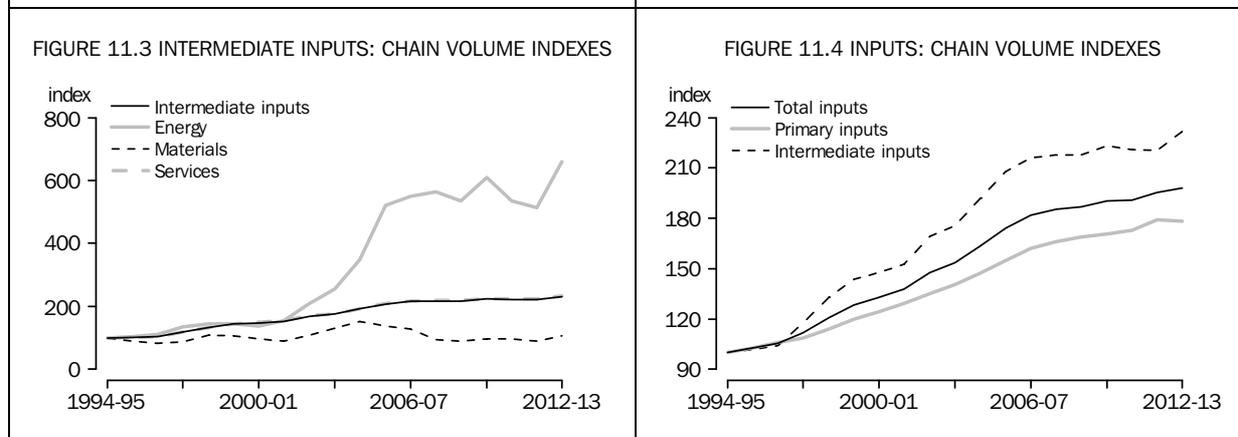
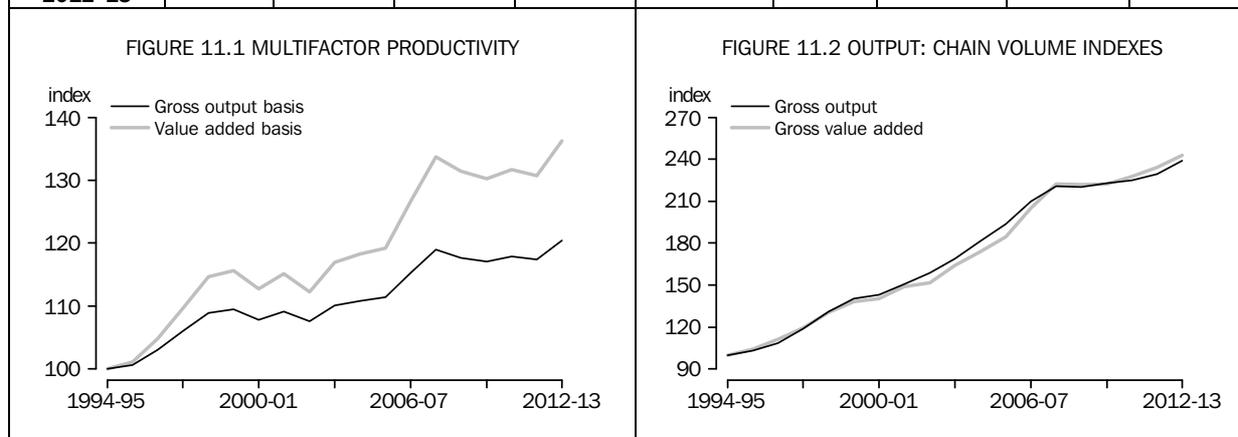
Year	Gross Output Growth	Contribution from Capital Services		Contribution from Labour Services		Contribution from Intermediate Inputs			MFP Growth (b)
		IT	Non-IT	Hours Worked	Composition	Energy	Materials	Services	
1995–96	6.8	0.9	1.4	0.9	0.1	0.2	0.3	4.0	-0.9
1996–97	7.8	0.8	1.5	0.8	0.1	0.1	1.1	3.7	-0.2
1997–98	9.0	0.6	0.9	-2.1	0.1	0.3	0.2	5.3	3.9
1998–99	7.3	0.6	1.0	-0.2	0.1	0.2	1.1	3.0	1.5
1999–00	3.4	0.7	1.5	2.5	0.1	-0.3	0.7	1.7	-3.5
2000–01	1.6	0.7	1.4	1.3	0.1	-0.1	0.0	0.2	-1.9
2001–02	4.0	0.5	1.0	-1.5	0.1	0.1	0.4	2.3	1.1
2002–03	5.7	0.4	0.9	1.2	0.1	0.2	0.1	2.8	0.1
2003–04	7.3	0.4	0.9	-0.6	0.1	0.1	0.8	4.3	1.3
2004–05	4.6	0.4	1.2	1.0	0.1	0.1	0.8	2.5	-1.6
2005–06	2.6	0.4	1.1	0.3	0.1	-0.1	0.1	1.0	-0.2
2006–07	4.9	0.2	1.7	0.4	0.2	0.1	0.2	2.0	0.1
2007–08	-0.5	0.3	1.5	-0.9	0.1	-0.2	-0.7	-2.0	1.5
2008–09	0.0	0.2	1.2	-0.5	0.1	-0.1	-0.2	-0.2	-0.5
2009–10	3.9	0.3	0.8	-1.1	0.1	0.2	0.0	3.0	0.5
2010–11	6.4	0.2	0.6	0.0	0.1	0.0	0.3	4.7	0.5
2011–12	4.0	0.2	0.7	0.5	0.1	0.1	0.4	3.0	-1.1
2012–13	1.7	0.4	0.9	0.1	0.1	0.0	-0.1	2.0	-1.8
1995–96 to 2012–13	4.5	0.5	1.1	0.1	0.1	0.0	0.3	2.4	-0.1



(a) Differences in natural logs x 100
 (b) Quality adjusted hours worked basis

FIGURE 11: FINANCIAL AND INSURANCE SERVICES (1994–95=100)

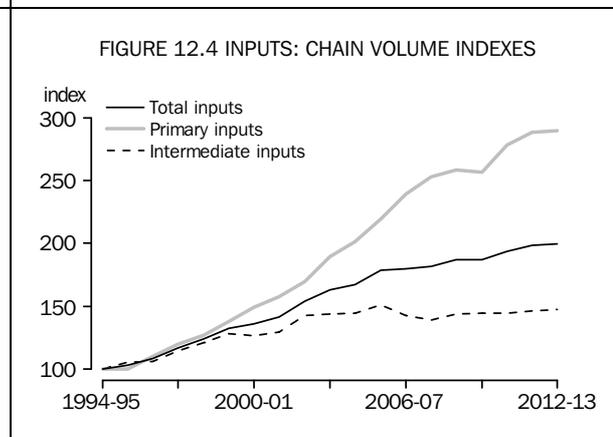
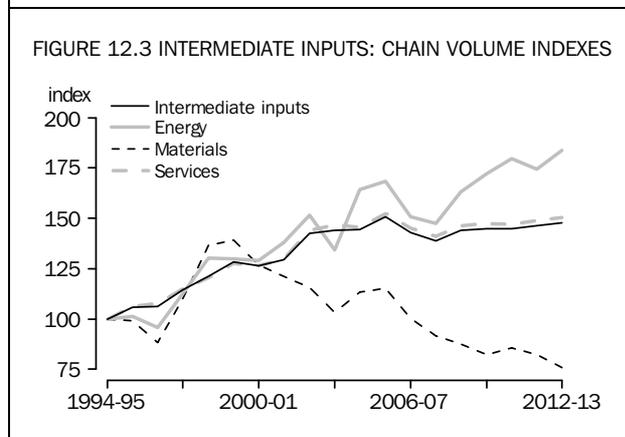
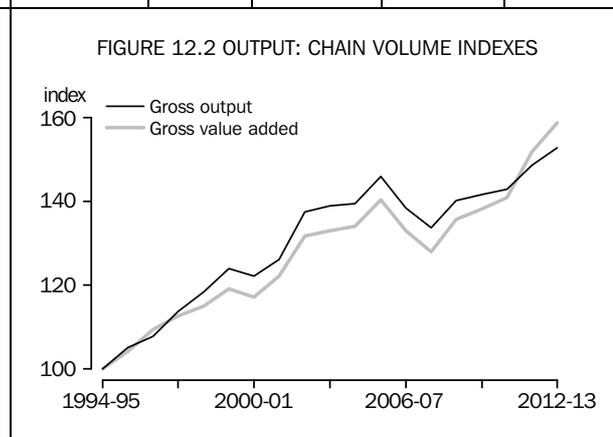
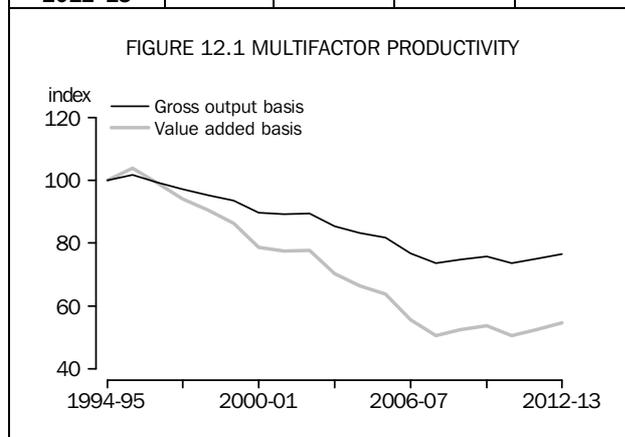
Table 11.1 Annual Points Contribution to Growth, 1995–96 to 2012–13 (a)									
Year	Gross Output Growth	Contribution from Capital Services		Contribution from Labour Services		Contribution from Intermediate Inputs			MFP Growth (b)
		IT	Non-IT	Hours Worked	Composition	Energy	Materials	Services	
1995–96	3.2	0.7	0.2	0.6	0.3	0.0	-0.1	0.8	0.7
1996–97	5.0	1.5	0.3	0.0	0.2	0.0	-0.1	0.8	2.3
1997–98	8.8	1.6	0.3	-0.5	0.2	0.0	0.1	4.4	2.8
1998–99	10.3	1.4	0.5	0.7	0.2	0.0	0.2	4.5	2.7
1999–00	6.7	1.5	0.7	0.6	0.2	0.0	0.0	3.3	0.5
2000–01	1.9	1.4	0.6	0.2	0.2	0.0	-0.1	1.2	-1.5
2001–02	5.0	1.2	0.4	0.5	0.2	0.0	-0.1	1.5	1.3
2002–03	5.3	1.4	0.6	0.2	0.2	0.1	0.1	4.2	-1.5
2003–04	6.2	1.4	0.2	0.3	0.2	0.1	0.1	1.5	2.3
2004–05	7.1	1.4	0.4	0.6	0.2	0.1	0.1	3.6	0.6
2005–06	6.8	1.1	0.2	1.2	0.2	0.2	-0.1	3.4	0.5
2006–07	7.8	1.0	0.2	1.2	0.2	0.0	-0.1	1.7	3.4
2007–08	5.1	1.0	0.1	0.3	0.2	0.0	-0.2	0.5	3.2
2008–09	-0.2	0.7	0.0	-0.1	0.2	0.0	0.0	0.0	-1.1
2009–10	1.2	0.5	0.1	0.0	0.2	0.1	0.0	0.9	-0.5
2010–11	1.0	0.4	0.2	0.0	0.2	-0.1	0.0	-0.4	0.7
2011–12	1.8	0.4	0.2	1.5	0.2	0.0	0.0	0.0	-0.5
2012–13	4.1	0.5	0.3	-1.3	0.2	0.1	0.1	1.6	2.6
1995–96 to 2012–13	4.8	1.1	0.3	0.3	0.2	0.0	0.0	1.9	1.0



(a) Differences in natural logs x 100
 (b) Quality adjusted hours worked basis

FIGURE 12: RENTAL, HIRING AND REAL ESTATE SERVICES (1994–95=100)

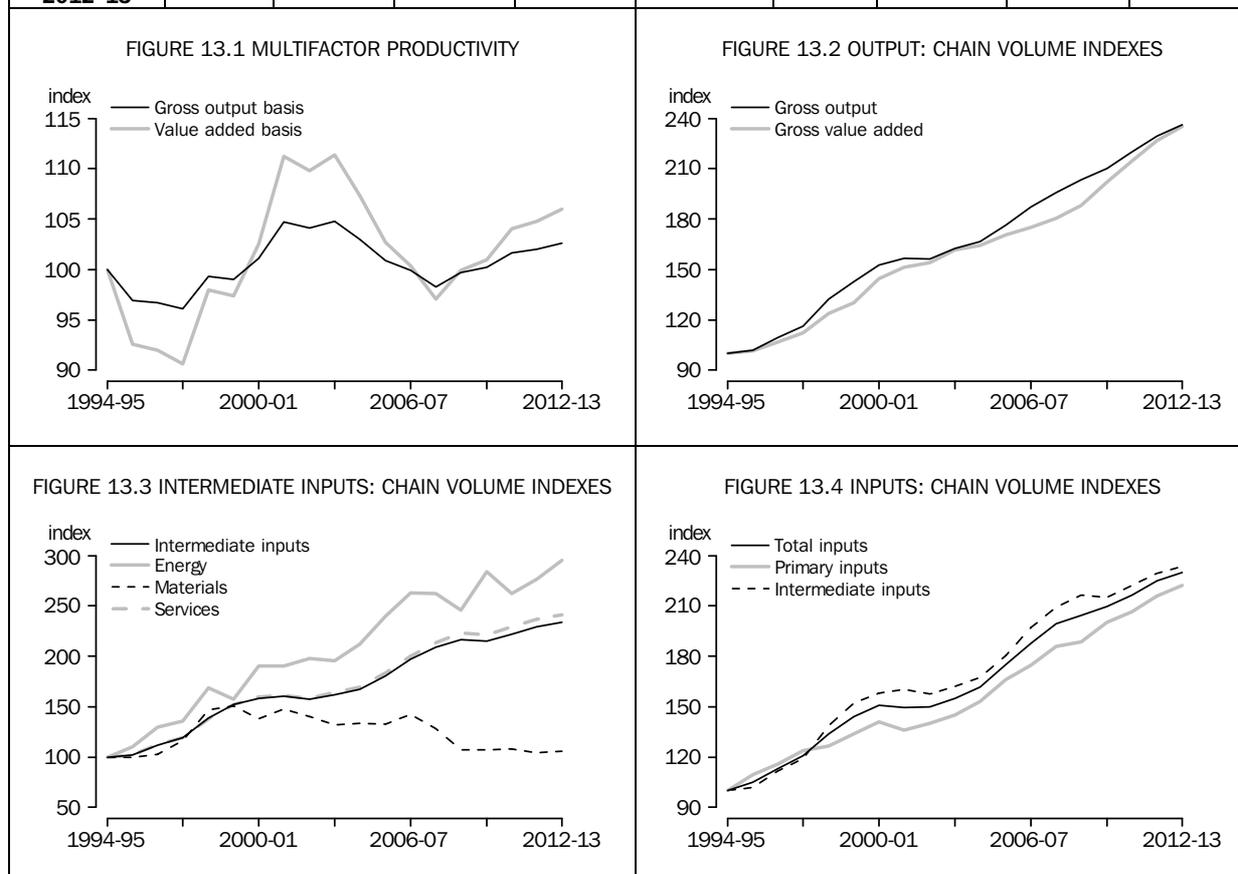
Table 12.1 Annual Points Contribution to Growth, 1995–96 to 2012–13 (a)									
Year	Gross Output Growth	Contribution from Capital Services		Contribution from Labour Services		Contribution from Intermediate Inputs			MFP Growth (b)
		IT	Non-IT	Hours Worked	Composition	Energy	Materials	Services	
1995–96	5.0	0.6	1.2	-1.8	0.1	0.0	0.0	3.2	1.6
1996–97	2.5	0.7	1.7	2.0	0.0	-0.1	-0.3	0.7	-2.2
1997–98	5.3	1.2	2.1	0.4	0.1	0.2	0.5	3.3	-2.4
1998–99	4.0	0.8	1.5	0.3	0.1	0.2	0.6	2.4	-1.8
1999–00	4.6	0.8	1.8	0.8	0.1	0.0	0.1	3.0	-1.9
2000–01	-1.5	0.7	1.8	0.7	0.1	0.0	-0.3	-0.5	-4.0
2001–02	3.2	0.6	1.5	0.4	0.0	0.1	-0.1	1.4	-0.7
2002–03	8.7	0.7	1.5	1.1	0.0	0.1	-0.1	5.1	0.2
2003–04	1.0	1.0	2.0	2.0	0.1	-0.2	-0.2	1.0	-4.6
2004–05	0.4	0.9	2.0	-0.1	0.1	0.3	0.2	-0.4	-2.5
2005–06	4.5	0.7	1.8	1.2	0.1	0.0	0.0	2.4	-1.8
2006–07	-5.4	0.7	1.9	1.1	0.1	-0.2	-0.3	-2.6	-6.2
2007–08	-3.4	0.8	1.9	-0.3	0.1	0.0	-0.2	-1.5	-4.2
2008–09	4.6	0.4	1.2	-0.7	0.1	0.1	-0.1	2.0	1.7
2009–10	1.1	0.1	0.9	-1.4	0.1	0.1	-0.1	0.3	1.1
2010–11	0.8	0.1	1.0	2.4	0.1	0.1	0.1	-0.1	-2.8
2011–12	4.0	0.0	0.9	0.7	0.1	-0.1	-0.1	0.6	1.8
2012–13	2.7	0.1	0.8	-0.7	0.1	0.1	-0.1	0.5	2.0
1995–96 to 2012–13	2.4	0.6	1.5	0.4	0.1	0.0	0.0	1.2	-1.5



(a) Differences in natural logs x 100
 (b) Quality adjusted hours worked basis

FIGURE 13: PROFESSIONAL, SCIENTIFIC AND TECHNICAL SERVICES (1994–95=100)

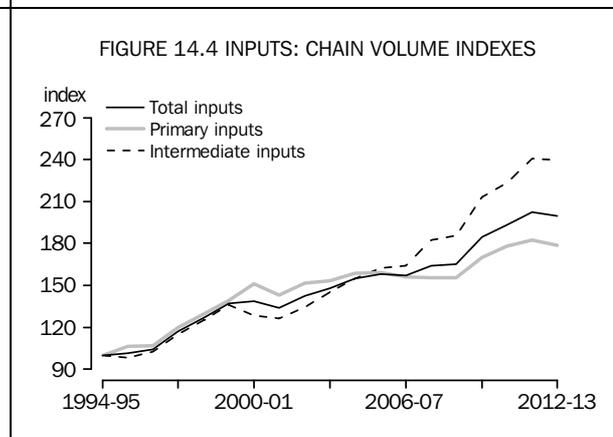
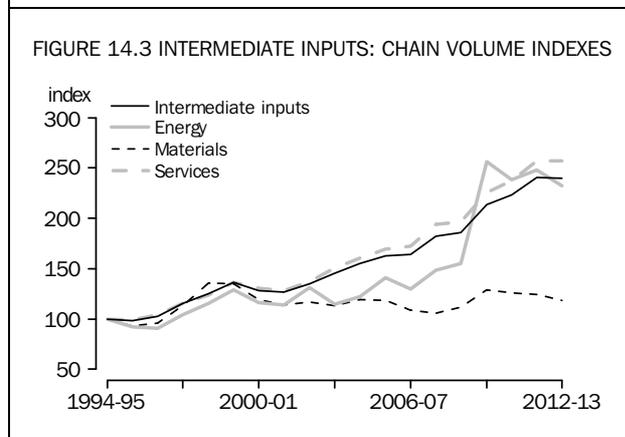
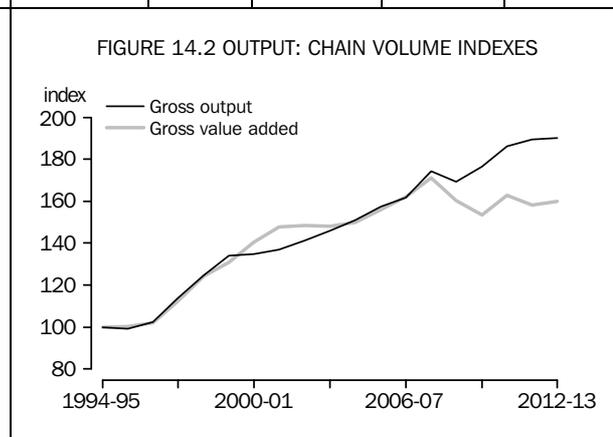
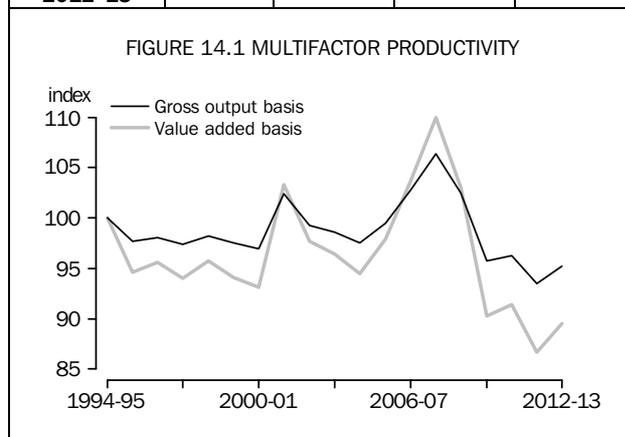
Year	Gross Output Growth	Contribution from Capital Services		Contribution from Labour Services		Contribution from Intermediate Inputs			MFP Growth (b)
		IT	Non-IT	Hours Worked	Composition	Energy	Materials	Services	
1995–96	1.8	0.2	0.2	3.2	0.2	0.1	0.0	1.1	-3.1
1996–97	7.3	0.3	0.1	1.6	0.2	0.1	0.1	5.1	-0.2
1997–98	5.9	0.3	0.1	2.2	0.2	0.0	0.5	3.2	-0.7
1998–99	13.2	0.2	0.1	0.4	0.2	0.2	1.0	7.9	3.3
1999–00	7.4	0.2	0.1	1.7	0.2	0.0	0.1	5.4	-0.3
2000–01	6.5	0.2	0.1	1.7	0.2	0.1	-0.3	2.4	2.1
2001–02	2.7	0.1	0.1	-1.9	0.1	0.0	0.2	0.6	3.5
2002–03	-0.3	0.2	0.1	0.9	0.2	0.0	-0.2	-0.9	-0.6
2003–04	3.8	0.3	0.1	1.0	0.2	0.0	-0.2	1.8	0.6
2004–05	2.5	0.3	0.2	1.8	0.2	0.1	0.0	1.6	-1.7
2005–06	5.8	0.3	0.2	3.1	0.2	0.1	0.0	3.9	-2.1
2006–07	5.9	0.4	0.2	1.5	0.2	0.1	0.2	4.4	-1.0
2007–08	4.5	0.4	0.3	2.0	0.2	0.0	-0.2	3.4	-1.5
2008–09	3.8	0.3	0.2	0.0	0.2	0.0	-0.3	2.1	1.3
2009–10	3.2	0.3	0.3	2.1	0.2	0.1	0.0	-0.4	0.5
2010–11	4.6	0.2	0.3	0.8	0.2	-0.1	0.0	1.6	1.4
2011–12	4.3	0.2	0.4	1.5	0.2	0.0	0.0	1.6	0.4
2012–13	2.8	0.1	0.3	0.8	0.2	0.0	0.0	0.8	0.6
1995–96 to 2012–13	4.8	0.3	0.2	1.3	0.2	0.0	0.1	2.5	0.1



(a) Differences in natural logs x 100
 (b) Quality adjusted hours worked basis

FIGURE 14: ADMINISTRATIVE AND SUPPORT SERVICES (1994–95=100)

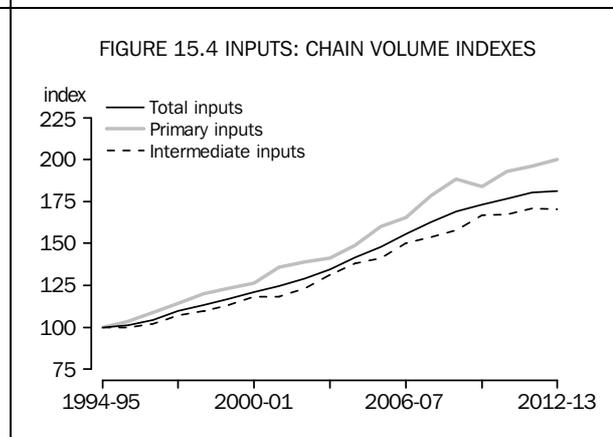
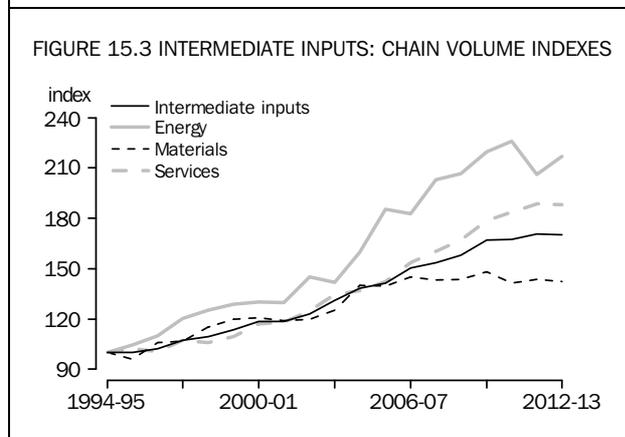
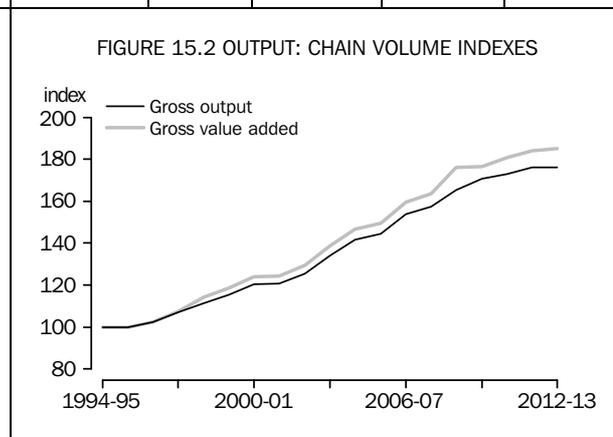
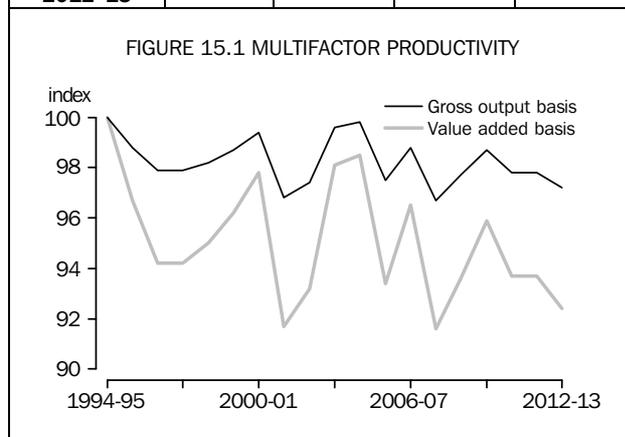
Table 14.1 Annual Points Contribution to Growth, 1995–96 to 2012–13 (a)									
Year	Gross Output Growth	Contribution from Capital Services		Contribution from Labour Services		Contribution from Intermediate Inputs			MFP Growth (b)
		IT	Non-IT	Hours Worked	Composition	Energy	Materials	Services	
1995–96	-0.8	0.3	0.2	1.8	0.2	0.0	-0.5	-0.4	-2.4
1996–97	3.3	0.2	0.2	-0.4	0.2	0.0	0.2	2.4	0.4
1997–98	10.6	0.3	0.3	4.0	0.2	0.1	1.2	5.3	-0.7
1998–99	9.0	0.2	0.1	3.1	0.2	0.0	1.3	3.4	0.8
1999–00	7.0	0.2	0.1	2.7	0.2	0.0	0.0	4.5	-0.7
2000–01	0.5	0.1	0.2	3.6	0.2	0.0	-0.8	-2.1	-0.6
2001–02	1.8	0.1	0.2	-3.4	0.2	0.0	-0.3	-0.5	5.5
2002–03	3.2	0.2	0.0	3.1	0.2	0.0	0.1	2.5	-3.1
2003–04	3.1	0.2	0.0	0.2	0.2	0.0	-0.1	3.4	-0.7
2004–05	3.3	0.2	0.1	1.5	0.2	0.0	0.2	2.3	-1.2
2005–06	4.2	0.2	0.0	-0.3	0.2	0.0	0.0	2.0	2.0
2006–07	2.7	0.2	0.1	-1.7	0.3	0.0	-0.3	0.8	3.3
2007–08	7.6	0.2	0.1	-0.9	0.3	0.0	-0.1	4.4	3.4
2008–09	-3.0	0.1	0.1	-0.5	0.2	0.0	0.2	0.6	-3.7
2009–10	4.2	0.1	0.1	4.4	0.2	0.2	0.5	5.7	-6.9
2010–11	5.3	0.1	0.2	2.2	0.2	0.0	-0.1	2.1	0.7
2011–12	1.7	0.1	0.1	0.9	0.2	0.0	0.0	3.3	-2.9
2012–13	0.4	0.1	0.0	-1.5	0.3	0.0	-0.1	-0.1	1.8
1995–96 to 2012–13	3.6	0.2	0.1	1.0	0.2	0.0	0.1	2.2	-0.3



(a) Differences in natural logs x 100
 (b) Quality adjusted hours worked basis

FIGURE 15: ARTS AND RECREATION SERVICES (1994–95=100)

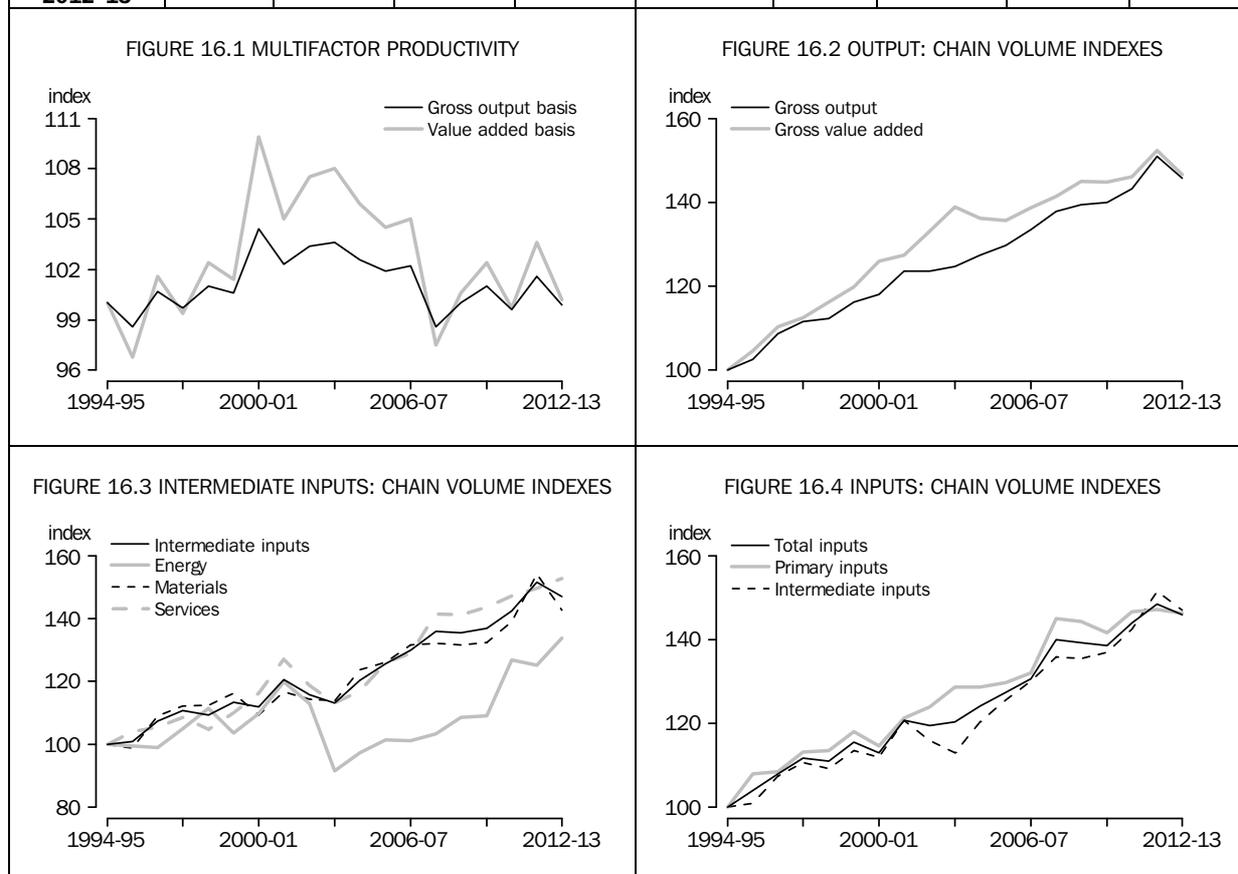
Table 15.1 Annual Points Contribution to Growth, 1995–96 to 2012–13 (a)									
Year	Gross Output Growth	Contribution from Capital Services		Contribution from Labour Services		Contribution from Intermediate Inputs			MFP Growth (b)
		IT	Non-IT	Hours Worked	Composition	Energy	Materials	Services	
1995–96	-0.1	0.1	0.8	0.3	0.0	0.0	-1.0	0.9	-1.2
1996–97	2.5	0.1	0.8	1.0	0.0	0.0	2.3	-0.8	-0.9
1997–98	4.7	0.1	0.7	1.0	0.0	0.0	0.3	2.6	0.0
1998–99	3.7	0.1	1.2	0.8	0.0	0.0	1.7	-0.4	0.3
1999–00	3.6	0.1	0.8	0.2	0.0	0.0	0.9	1.2	0.5
2000–01	4.2	0.1	0.8	0.2	0.0	0.0	0.1	2.3	0.7
2001–02	0.3	0.1	0.7	2.1	0.0	0.0	-0.3	0.3	-2.7
2002–03	3.9	0.1	0.5	0.4	0.0	0.1	0.2	2.0	0.6
2003–04	6.6	0.1	0.6	0.0	0.0	0.0	0.9	2.8	2.2
2004–05	5.3	0.1	0.6	1.5	0.0	0.1	2.3	0.6	0.2
2005–06	2.1	0.1	0.7	2.4	0.0	0.1	-0.1	1.3	-2.3
2006–07	6.4	0.1	0.6	0.6	0.0	0.0	0.8	2.8	1.4
2007–08	2.3	0.1	0.8	2.2	0.0	0.1	-0.3	1.6	-2.1
2008–09	4.8	0.1	0.6	1.5	0.0	0.0	0.1	1.6	1.0
2009–10	3.4	0.0	0.6	-1.5	0.0	0.0	0.7	2.5	1.0
2010–11	1.1	0.0	0.5	1.3	0.0	0.0	-1.0	1.1	-0.9
2011–12	1.9	0.0	0.5	0.2	0.0	-0.1	0.3	1.1	0.0
2012–13	0.0	0.0	0.5	0.3	0.0	0.0	-0.1	-0.1	-0.6
1995–96 to 2012–13	3.2	0.1	0.7	0.8	0.0	0.0	0.4	1.3	-0.2



(a) Differences in natural logs x 100
 (b) Quality adjusted hours worked basis

FIGURE 16: OTHER SERVICES (1994–95=100)

Year	Gross Output Growth	Contribution from Capital Services		Contribution from Labour Services		Contribution from Intermediate Inputs			MFP Growth (b)
		IT	Non-IT	Hours Worked	Composition	Energy	Materials	Services	
1995–96	2.4	0.3	0.7	2.2	0.2	0.0	-0.4	0.9	-1.5
1996–97	5.9	0.3	0.7	-0.9	0.1	0.0	3.1	0.3	2.1
1997–98	2.5	0.3	0.6	0.7	0.1	0.0	1.0	0.7	-0.9
1998–99	0.7	0.4	0.4	-0.8	0.2	0.0	0.0	-0.8	1.3
1999–00	3.5	0.3	0.6	0.7	0.2	0.0	1.1	1.0	-0.4
2000–01	1.6	0.3	0.4	-2.3	0.2	0.0	-1.9	1.2	3.7
2001–02	4.6	0.2	0.3	1.9	0.1	0.0	2.0	2.0	-2.0
2002–03	0.0	0.3	0.5	0.1	0.1	0.0	-0.6	-1.5	1.1
2003–04	0.9	0.3	0.9	0.6	0.1	-0.1	-0.1	-1.0	0.2
2004–05	2.1	0.3	0.7	-1.1	0.1	0.0	2.3	0.7	-1.0
2005–06	1.9	0.2	0.5	-0.4	0.1	0.0	0.5	1.6	-0.7
2006–07	2.8	0.2	0.6	0.1	-0.1	0.0	1.2	0.6	0.2
2007–08	3.2	0.2	0.7	3.7	-0.1	0.0	0.1	2.2	-3.6
2008–09	1.1	0.2	0.5	-0.8	-0.1	0.0	-0.1	-0.1	1.5
2009–10	0.4	0.1	0.7	-1.7	-0.1	0.0	0.1	0.4	0.9
2010–11	2.4	0.1	0.5	1.4	-0.2	0.1	1.2	0.6	-1.4
2011–12	5.1	0.1	0.6	-0.2	-0.2	0.0	2.6	0.3	2.0
2012–13	-3.5	0.1	0.7	-0.8	-0.3	0.0	-1.9	0.5	-1.8
1995–96 to 2012–13	2.1	0.2	0.6	0.1	0.0	0.0	0.6	0.5	0.0



(a) Differences in natural logs x 100
 (b) Quality adjusted hours worked basis

5. FUTURE DIRECTIONS

The publication of industry level KLEMS MFP represents the result of research over a number of years to improve the estimation of productivity statistics to enable analysis of industry level productivity performance. There are several conceptual and measurement issues that can be investigated through further research. For these reasons, these initial estimates should be considered experimental.

The ABS invites comments on these initial experimental estimates from readers. Suggestions from users will be taken into account in making further improvements to data sources and methods. The first updated estimates of industry level KLEMS MFP are expected to be released in 2016.

The ABS undertakes ongoing research to improve and enhance productivity measures. Several areas that warrant further research are summarised below. Some of the areas flagged for future research are considered longer term projects as these areas are challenges in statistical measurement that are still being resolved internationally. For example, measurement issues such as adjusting for quality change in service industries are an ongoing challenge for practical statisticians.

OUTPUT

An important area for output measurement is the treatment of quality change. The output of service industries is intangible in nature and can change rapidly over time. As a result, output volume indexes may not fully capture changes in the composition and quality of output within an industry. This is particularly the case for difficult to measure yet economically significant services such as Finance and insurance, and Information media and telecommunications. Improved price indices and volume indicators for output measures at the industry level can assist to improve productivity measures. The ABS is committed to ongoing research to address these measurement challenges with the view to improving the estimates for the services industries for future releases.

CAPITAL INPUT

A number of areas in capital measurement require further research. As the flow and price of capital services are not directly observable, they need to be imputed under a number of assumptions. Firstly, capital input is estimated under the assumption that capital services are in constant proportion to the volume of productive capital stock of the asset. However, there are many reasons for the rate of capital utilisation to vary over time. These include changes in demand or supply conditions or seasonal variations. If variations in output are more adequately captured, while variations in capital utilisation are less adequately captured, then productivity estimates can show pro-cyclical patterns that reflect swings in output and demand instead of improvements in efficiency. For example, lags in capacity utilisation can lead to underestimates of productivity growth.

Secondly, the rental prices or user cost of capital are unobservable and therefore need to be approximated. In its basic form, the user cost of capital equation is comprised of three components, including the depreciation of the asset, a rate of return and a capital gain/loss component. Currently, the ABS uses a combination of endogenous and exogenous rates of return to impute the rate of return. However, estimates of MFP can be sensitive to the method used to estimate the rate of return and depreciation rate, as well as capital gains/loss.

Future research is expected to involve sensitivity analysis on using different rates of return and different methods for estimating depreciation or capital gains. Additionally, investigations can be conducted into the use of age-efficiency profiles, mean asset lives or asset life distributions.

LABOUR INPUT

Labour is the single most important input to the production process. There are challenges associated with the accurate measurement of hours worked by industry. For each industry, hours worked is estimated as the product of average hours worked per person and industry employment from the labour force survey (LFS). While the LFS has the advantage of including data on employees and self-employed, it is not stratified by industry. Business based surveys, such as the Economic Activity Survey are stratified by industry, which provides the advantage of more accurate industry allocation. An area for further research is to develop a method to combine data from business and household surveys to derive industry hours worked.

INTERMEDIATE INPUTS

As discussed earlier, a key development in the SUTs has been the wider application of the double deflation method, that is, real output and real intermediate inputs are derived separately for most industries. By sourcing more specific price deflators, the approach enables improved volume estimation, particularly for intermediate inputs.

The KLEMS framework will inevitably bring more focus upon the data quality of the intermediate inputs components. For example, partial productivity analysis commonly applied to primary inputs (labour and capital) can now be extended to the three intermediate inputs components.

APPENDIX 1 DETAILS ON METHODOLOGY

This Appendix provides additional details on methodology and data sources that were discussed in Chapter 1. The theoretical framework underpinning the methodology is not presented in detail in this appendix. For the theoretical framework see **Measuring Productivity, OECD Manual** (OECD, 2001) and the **Australian National Accounts: Concepts, Sources and Methods** (Cat.no. 5216.0, Chapter 19).

CONCEPT

Productivity is typically measured as output per unit of input. Productivity growth is calculated as output growth less input growth, with different types of output and input measures leading to different productivity indexes. Thus, productivity growth measures the extent to which output growth differs from the growth in inputs. This difference has multiple causes including changes in the efficiency of the use of inputs, changes in the use of unmeasured inputs, and measurement errors. The interpretation and use of a given productivity measure depends on how output and input are measured.

Partial measures of productivity take into consideration a single factor input. For example, labour productivity, which is simply measured as output per hour worked, is frequently used as a productivity indicator. Labour productivity is often used as a standard of living type indicator since in the long run, labour productivity can fund the growth in real wages. Using the growth accounting framework, labour productivity growth can be decomposed into contributions from capital services per hour worked (capital deepening) labour composition, and multifactor productivity.²⁷

When multiple inputs such as labour and capital are taken into consideration, the measure is called multifactor productivity (MFP). It can be measured as output per unit of a combined bundle of labour and capital (Value added based MFP), or output per unit of a combined bundle of labour, capital and intermediate inputs (Gross output based MFP).

THE GROWTH ACCOUNTING FRAMEWORK

The MFP measures are compiled in the standard growth accounting framework, which originates from the neoclassical theory of economic growth formulated by Solow (1957). Specifically, industry output is defined as a function of a combination of labour, capital, intermediate inputs and technology, which is indexed by time. For each industry, the production function is defined as

$$Y = A f(K, L, I) \quad (A1)$$

where Y is an index of gross output, A is growth in GO MFP, K is an index of capital input, L is an index of labour input, I is an index of intermediate input. To estimate the growth in combined inputs, a Törnqvist index with nominal shares as the weights is used. For example, inserting a time subscript, the input index used for estimating GVA based MFP combines just the primary inputs capital and labour as

$$\left(\frac{K_t}{K_{t-1}} \right)^{\tilde{s}_t^K} \left(\frac{L_t}{L_{t-1}} \right)^{\tilde{s}_t^L} \quad (A2)$$

where \tilde{s}_t^K and \tilde{s}_t^L are the two period averages of the capital and labour shares of nominal value added, respectively.

²⁷ For a more detailed discussion of labour productivity growth accounts now available, see the feature article, Experimental Productivity Growth Accounts, in the 2013-14 issue of Estimates of Industry Multifactor Productivity, cat. no. 5260.0.55.002.

Under the KLEMS growth accounting framework, intermediate inputs are added back into both the numerator (i.e. gross output) and the denominator. KLEMS MFP is the same as GO MFP except that in the growth accounts, the energy (E), materials (M), and services (S) input indexes are separately derived, which aggregate to the intermediate inputs index. That is:

$$\left(\frac{II_t}{II_{t-1}} \right) = \left(\frac{E_t}{E_{t-1}} \right)^{\tilde{v}_t^E} \left(\frac{M_t}{M_{t-1}} \right)^{\tilde{v}_t^M} \left(\frac{S_t}{S_{t-1}} \right)^{\tilde{v}_t^S} \quad (A3)$$

where \tilde{v}_t^E , \tilde{v}_t^M , and \tilde{v}_t^S are the two period averages of the energy, materials, and services shares of the intermediate input costs, respectively. Recall from Chapter 2 that in the KLEMS growth account, the weights are expressed in terms to shares of gross output. Thus

$$\begin{aligned} \Delta \ln GO_t &= \tilde{w}_t^K \tilde{\alpha}_t^{IT} \Delta \ln K_t^{IT} + \tilde{w}_t^K \tilde{\alpha}_t^N \Delta \ln K_t^N \\ &\quad + \tilde{w}_t^L \Delta \ln Q_t + \tilde{w}_t^L \Delta \ln H_t \\ &\quad + \tilde{w}_t^E \Delta \ln E_t + \tilde{w}_t^M \Delta \ln M_t + \tilde{w}_t^S \Delta \ln S_t \\ &\quad + \Delta \ln A_t. \end{aligned} \quad (A4)$$

First we define the shares used in the calculation of the contributions to gross output growth. So let *Total income_t* be nominal industry gross output in year *t*. We can then write

$$\begin{aligned} Total\ income_t &= GOS_t + GMI(K)_t + GMI(L)_t + COE_t + IBT(K)_t \\ &\quad + IBT(L)_t + II\$, \end{aligned} \quad (A5)$$

where

GOS_t is gross operating surplus²⁸,

GMI(K)_t is gross mixed income attributable to capital,

GMI(L)_t is gross mixed income attributable to labour,

COE_t is compensation of employees,

IBT(K)_t is other taxes less subsidies on production attributable to capital,

IBT(L)_t is other taxes less subsidies on production attributable to labour, and

II\$_t is nominal intermediate inputs

Thus the initial income shares of capital, labour and intermediate inputs are, respectively

$$w_t^K = \frac{GOS_t + GMI(K)_t + IBT(K)_t}{Total\ Income_t}, \quad w_t^L = \frac{COE_t + GMI(L)_t + IBT(L)_t}{Total\ Income_t}, \quad w_t^H = \frac{II\$_t}{Total\ Income_t} \quad (A6)$$

We then define the two period (Törnqvist) averages of the above shares as

$$\tilde{w}_t^K = \frac{w_t^K + w_{t-1}^K}{2}, \quad \tilde{w}_t^L = \frac{w_t^L + w_{t-1}^L}{2}, \quad \text{and} \quad \tilde{w}_t^H = \frac{w_t^H + w_{t-1}^H}{2}$$

²⁸ Includes general government GOS attributable to market sector industries.

The next three sections describe how the input indexes are calculated. The multifactor productivity index is calculated as the residual using the above equation.

DETAILED FORMULA FOR IT AND NON-IT CAPITAL SERVICES

The corporate component of capital income GOS_t is further split by asset type. In particular, for each asset type j we let $K_{j,t}$ be the volume of productive capital stock of asset type j . Then we define the rental price of a unit of productive capital stock $r_{j,t}$ so that

$$GOS_t = \sum_j r_{j,t} K_{j,t} \quad (A7)$$

Rental prices are calculated based on the arbitrage assumption that assumes producers are indifferent to renting capital and buying and then selling that capital.²⁹

The capital services index is the Törnqvist index of the productive capital stock indexes using the two period averages of the shares of capital income by asset (derived using the rental prices). That is, we define

$$\Delta \ln K_t = \sum_j \tilde{w}_{j,t}^K \Delta \ln K_{j,t} \quad (A8)$$

where

$$\tilde{w}_{j,t}^K = \frac{1}{2} \left(\frac{r_{j,t} K_{j,t}}{\sum_j r_{j,t} K_{j,t}} + \frac{r_{j,t-1} K_{j,t-1}}{\sum_j r_{j,t-1} K_{j,t-1}} \right)$$

To decompose the capital services index in (A8) into an IT-capital services index and a non-IT capital services index, we let IT be the set of IT assets (that is, computers and software) and we let N be the set of non-IT assets. Then the IT capital services index is defined to be

$$\Delta \ln K_t^{IT} = \sum_{j \in IT} \tilde{w}_{j,t}^{IT} \Delta \ln K_{j,t} \quad (A9)$$

where

$$\tilde{w}_{j,t}^{IT} = \frac{1}{2} \left(\frac{r_{j,t} K_{j,t}}{\sum_{j \in IT} r_{j,t} K_{j,t}} + \frac{r_{j,t-1} K_{j,t-1}}{\sum_{j \in IT} r_{j,t-1} K_{j,t-1}} \right)$$

Similarly, the non-IT capital services index is defined to be

$$\Delta \ln K_t^N = \sum_{j \in N} \tilde{w}_{j,t}^N \Delta \ln K_{j,t} \quad (A10)$$

where

²⁹ For a more detailed discussion of rental price derivation, including those for unincorporated entities, see chapter 19 of Australian System of National Accounts, Concepts Sources and Methods (Cat. 5216.0).

$$\tilde{W}_{j,t}^N = \frac{1}{2} \left(\frac{r_{j,t} K_{j,t}}{\sum_{j \in N} r_{j,t} K_{j,t}} + \frac{r_{j,t-1} K_{j,t-1}}{\sum_{j \in N} r_{j,t-1} K_{j,t-1}} \right)$$

Combining the IT and non-IT capital services indexes as a Törnqvist index gives an approximation to the full capital services index.³⁰ That is,

$$\Delta \ln K_t \approx \tilde{\alpha}_t^{IT} \Delta \ln K_t^{IT} + \tilde{\alpha}_t^N \Delta \ln K_t^N$$

where

$$\tilde{\alpha}_t^{IT} = \frac{1}{2} \left(\frac{\sum_{j \in IT} r_{j,t} K_{j,t}}{\sum_j r_{j,t} K_{j,t}} + \frac{\sum_{j \in IT} r_{j,t-1} K_{j,t-1}}{\sum_j r_{j,t-1} K_{j,t-1}} \right) \text{ and}$$

$$\tilde{\alpha}_t^N = \frac{1}{2} \left(\frac{\sum_{j \in N} r_{j,t} K_{j,t}}{\sum_j r_{j,t} K_{j,t}} + \frac{\sum_{j \in N} r_{j,t-1} K_{j,t-1}}{\sum_j r_{j,t-1} K_{j,t-1}} \right)$$

LABOUR PRODUCTIVITY GROWTH ACCOUNTING DECOMPOSITION

This section describes how the industry labour productivity contributions reported in Table 5 are derived. Starting with a gross value added growth account, for a given industry

$$\begin{aligned} \Delta \ln GVA_t &= \tilde{s}_t^K \tilde{\alpha}_t^{IT} \Delta \ln K_t^{IT} + \tilde{s}_t^K \tilde{\alpha}_t^N \Delta \ln K_t^N \\ &+ \tilde{s}_t^L \Delta \ln Q_t + \tilde{s}_t^L \Delta \ln H_t + \Delta \ln A_t^v. \end{aligned} \quad (A11)$$

Where GVA_t is chain volume gross value added, A_t^v is GVA based MFP, and the other components as described above. Subtracting the growth in hours worked from both sides

$$\begin{aligned} \Delta \ln \left(\frac{GVA_t}{H_t} \right) &= \tilde{s}_t^K \tilde{\alpha}_t^{IT} \Delta \ln K_t^{IT} + \tilde{s}_t^K \tilde{\alpha}_t^N \Delta \ln K_t^N \\ &+ \tilde{s}_t^L \Delta \ln Q_t + \tilde{s}_t^L \Delta \ln H_t + \Delta \ln A_t^v - \Delta \ln H_t. \end{aligned} \quad (A12)$$

Since the income shares \tilde{s}_t^K and \tilde{s}_t^L sum to unity, and the IT and non IT proportions $\tilde{\alpha}_t^{IT}$ and $\tilde{\alpha}_t^N$ also sum to unity, the growth in industry hours worked can be written as

$$\begin{aligned} \Delta \ln H_t &= \tilde{s}_t^K \Delta \ln H_t + \tilde{s}_t^L \Delta \ln H_t \\ &= \tilde{s}_t^K \tilde{\alpha}_t^{IT} \Delta \ln H_t + \tilde{s}_t^K \tilde{\alpha}_t^N \Delta \ln H_t + \tilde{s}_t^L \Delta \ln H_t. \end{aligned} \quad (A13)$$

Substituting the RHS of (A13) into (A12) and grouping the terms, equation (A12) can be written as

³⁰ The difference to growth in capital services index due to the different aggregation method is negligible.

$$\Delta \ln \left(\frac{GVA_t}{H_t} \right) = \tilde{s}_t^K \tilde{\alpha}_t^{IT} \Delta \ln \left(\frac{K_t^{IT}}{H_t} \right) + \tilde{s}_t^K \tilde{\alpha}_t^N \Delta \ln \left(\frac{K_t^N}{H_t} \right) + \tilde{s}_t^L \Delta \ln Q_t + \Delta \ln A_t^v. \quad (A14)$$

Equation (A14) provides the labour productivity growth accounting decomposition. It describes labour productivity growth in terms of the weighted contributions from the change in IT capital deepening (IT capital services per hour) K_t^{IT} / H_t , the change in non-IT capital deepening (non-IT capital services per hour) K_t^N / H_t , the change in labour composition Q_t , and the change in GVA based MFP, A_t^v .

Finally, to derive each industry's contribution in Table 5, each of the components in (A14) is scaled according to industry's share of the market sector. These shares are based on current price gross value added share of total gross value added for the market sector. The shares are averaged over the period 1994-95 to 2012-13 and the scaled results provide the industry contributions for Table 5 columns 3 to 7.

DETAILED FORMULA FOR LABOUR COMPOSITION AND HOURS WORKED

The quality adjusted labour inputs (QALI) index is calculated as a Törnqvist index of hours worked indexes for subgroups of workers. In particular, we split the workforce into groups based on age cohort, highest level of education (high school, vocational degree, bachelor degree, postgraduate degree), and gender.

Then we use census data to determine the hours worked $H_{a,e,g,t}$ by workers of age cohort a , education e , and gender g in year t , and total income $I_{a,e,g,t}$ of workers of age cohort a , education e , and gender g in year t .

Then the QALI index L_t / L_{t-1} is given by

$$\Delta \ln L_t = \sum_{a,e,g} \gamma_{a,e,g,t} \Delta \ln H_{a,e,g,t} \quad (A15)$$

where

$$\gamma_{a,e,g,t} = \frac{1}{2} \left(\frac{I_{a,e,g,t}}{\sum_{a,e,g} I_{a,e,g,t}} + \frac{I_{a,e,g,t-1}}{\sum_{a,e,g} I_{a,e,g,t-1}} \right)$$

By dividing the QALI index by the aggregate hours worked index, we obtain an index that measures the changes in the age, education, and gender composition of the workforce. We call this index the labour composition index Q_t / Q_{t-1} . In log form we can write $\Delta \ln L_t = \Delta \ln Q_t + \Delta \ln H_t$. More detail is given in Chapter 19, of Australian System of National Accounts, Concepts Sources and Methods (Cat. 5216.0).

DETAILED FORMULA FOR INTERMEDIATE INPUTS

We let I be the set of intermediate input products (that is, goods and services). For each intermediate input $j \in I$, we let $p_{j,t}$ be the price of input j in year t and $q_{j,t}$ be the quantity of input j in year t . We split I into energy, materials, and services, denoted E , M , and S respectively. Then we define an initial estimate of the Laspeyres volume index for energy, materials, and services indexes as:

$$\frac{E_t^*}{E_{t-1}^*} = \sum_{j \in E} \frac{p_{j,t-1} q_{j,t}}{p_{j,t-1} q_{j,t-1}}, \quad \frac{M_t^*}{M_{t-1}^*} = \sum_{j \in M} \frac{p_{j,t-1} q_{j,t}}{p_{j,t-1} q_{j,t-1}}, \quad \text{and} \quad \frac{S_t^*}{S_{t-1}^*} = \sum_{j \in S} \frac{p_{j,t-1} q_{j,t}}{p_{j,t-1} q_{j,t-1}} \quad (\text{A16})$$

The initial three indexes for E, M & S are combined into a total intermediate input index, using Törnqvist two period averages of the shares of nominal intermediate inputs attributable to energy, materials, and services. These shares are calculated as

$$\sigma_t^X = \frac{1}{2} \left(\frac{\sum_{j \in X} p_{j,t} q_{j,t}}{\sum_{j \in I} p_{j,t} q_{j,t}} + \frac{\sum_{j \in X} p_{j,t-1} q_{j,t-1}}{\sum_{j \in I} p_{j,t-1} q_{j,t-1}} \right) \quad (\text{A17})$$

for $X = E$, M , and S .

The Törnqvist two period averages leads to slightly different results than if an index of total intermediate inputs was directly compiled. We thus scale the initial E, M & S indexes based on their cost shares in order to preserve component behaviour. This ensures that the adjusted final indexes for E, M and S are consistent with the separately derived Laspeyres intermediate input index published in Table 18 of **Estimates of Industry Multifactor Productivity, Australia** (Cat. 5260.0.55.002) and sum to the same result within the KLEMS growth accounting framework.

APPENDIX 2 COMMODITY CLASSIFICATION

This Appendix details a list of 5-digit Supply and Use Product Classification (SUPC), which underpin the product classes used in compiling intermediate inputs in the S-U tables. The product classes are assigned to the energy, materials or services category based on the primary use of the products within the class. For example, Oil is primarily used in chemical refining and hence allocated as a materials product, whereas Coal is primarily combusted to generate heat for turbines and thus allocated as an energy product. Timber, while capable of being consumed as a furnace fuel, is most commonly used to manufacture paper or other wood products, and is thus allocated to materials.

Energy products are defined as those, which are used to power capital services. Notably, foods are not considered energy products, as they power labour services rather than capital services. Trade and Transport Margin products are allocated as a services product due to their role within the supply chain, irrespective of what other products are associated with their trade or transport.

Energy Products			
SUPC	Product Description	SUPC	Product Description
06005	Coal	17010	Kerosene (incl kerosene type jet fuel)
07005	Gas (natural and LPG)	17015	Automotive petroleum and coal products
17005	Liquefied petroleum gas produced at refineries	26011	Electricity generation

Materials Products			
SUPC	Product Description	SUPC	Product Description
01005	Sheep, lambs, cattle and calves	13005	Wool, scoured and carbonised; wool tops and noils: wool grease
01010	Milk	13010	Textile fabrics, yarns, threads and fibres
01015	Wool	13015	Carpets, textile and felt floor coverings (excl underfelt)
01025	Fodder and grass	13020	Wadding, cotton wool, powder puffs, gauze and bandages
01030	Plants and flowers	13025	Textile tarpaulins (incl canvas), sails, tents, pneumatic mattresses and motor vehicle covers; rope, cable and products thereof (incl netting)
01035	Fruits, nuts and vegetables	13030	Bags, sacks and packets of textile or canvas
01040	Wheat	13040	Textile products nec
01045	Barley, oats, rice, sorghum and cereal grains nec	13045	Leather
01050	Other grains nec	13050	Leather travelling products (including purses and wallets)
01055	Sugar cane	13055	Leather products nec
01060	Other agriculture	13060	Knitted or crocheted fabrics and products (excluding wearing apparel)
01065	Pigs, deer, poultry for slaughtering and egg laying hens	13065	Knitted or crocheted wearing apparel
01070	Eggs and honey	13070	Clothing (excluding knitted or crocheted)
01075	Pets and live animals nec	13075	Footwear
02005	Forestry and logging	14005	Sawmill products (incl bark and woodchips)
02010	Farmed fish, crustaceans and molluscs	14010	Other wood products
02015	Fish; crustaceans and molluscs (excl farmed)	15005	Pulp, newsprint and paper stock
02020	Skins, pieces (raw); hunting and trapping	15010	Paper and paperboard
02025	Cotton (ginned); cotton seed and waste from cotton	15015	Corrugated paperboard sheeting, paperboard containers and paper bags
07010	Oil	15020	Paper and paperboard trays, dishes, plates, cups, cones, egg containers and box files
08105	Iron ores	15025	Toiletry towels and tissues; baby wipes, nappies and other sanitary paper products
08205	Non-ferrous metal ores (excl gold)	15030	Paper stationery
08210	Gold ores	15035	Other paper and paperboard products
09005	Other mining	16015	Recorded media reproduction
11005	Edible meat, offal and meat products	17020	Other Petroleum and Coal Products
11010	Blood meal and inedible meat	18005	Industrial gases
11015	Raw hides and skins	18010	Other chemicals
11020	Processed seafood	18015	Synthetic resins, synthetic rubbers and other basic polymers
11025	Dairy products	18020	Fertilisers and pesticides
11030	Other meat products	18025	Medicinal and pharmaceutical products
11035	Fruit and vegetable products	18030	Veterinary products
11040	Refined animal oils and fats; vegetable oils and fats	18035	Glycerol and candles
11045	Grain mill products; pasta and prepared baking mixes	18040	Soap, perfumes and toiletry products
11050	Glucose, glucose syrup and modified starches	18045	Cleaning products nec
11055	Bakery products	18050	Other chemical products
11060	Confectionery and sugar	19005	Adhesives, fillers, rubbing compounds, paints and paint related products (incl thinners, stains, paint removers)
11070	Other food products	19010	Inks
12005	Non-alcoholic beverages (excl fruit juice and flavoured milk) and ice	19015	Pneumatic tyres (motor car and motor cycles) and tubes
12011	Beer	19020	Plastic textile fabrics
12012	Other alcoholic beverages	19025	Plastic floor coverings and tiles
12015	Tobacco products	19030	Plastic tableware and utensils

Materials Products (cont.)			
SUPC	Product Description	SUPC	Product Description
19035	Plastic domestic furniture	23025	Marine vessels (over 50 tonnes, incl submarines and floating structures)
19040	Plastic non-domestic furniture	23030	Boats and watercraft (under 50 tonnes)
19045	Natural rubber products	23050	Aircraft and component parts
19050	Other synthetic rubber and polymer products	23060	Motor vehicle parts (excluding engines and panels) and accessories
20005	Glass containers and tableware	23065	Motor vehicle engines, chassis and panels; transport equipment nec
20010	Glass and glass products	24005	Photographic goods (incl optical fibres) and ophthalmic equipment (excl spectacles)
20015	Ceramic containers and tableware	24010	Medical aids, equipment (excl x-ray) and therapeutic appliances (including spectacles and hearing aids)
20020	Ceramic products	24015	Watches (incl metal watch straps), watch cases, clocks and parts
20025	Plaster, plaster board and plaster products	24020	Professional and scientific equipment (incl x-ray)
20030	Cement, lime and ready mixed concrete	24025	Computer hardware and peripherals (incl photocopiers and parts)
20035	Concrete products	24030	Telecommunication and audio visual equipment
20040	Other non-metallic mineral products	24035	Vending, video, monetary, office and other electronic hardware nec
21005	Basic ferrous metals and metal products	24040	Electric lights (including torches); cables and batteries (excluding automotive)
20040	Other non-metallic mineral products	24045	Automotive wet cell batteries
21005	Basic ferrous metals and metal products	24050	Household appliances
21010	Basic non-ferrous metals	24055	Compressors for domestic refrigerators and air conditioners
21015	Aluminium foil	24060	Electrical equipment and parts
21020	Basic non-ferrous metal products	24065	Specialised machinery and equipment
22005	Iron or steel forged products	24070	Agricultural machinery; garden tools and equipment (powered)
22010	Structural metal products		
22015	Metal containers	24075	Other machinery and equipment
22020	Sheet metal non-electric tableware	25005	Furniture (excl plastic)
22025	Sheet metal products nec	25010	Toys and sporting equipment and parts
22030	Metal cutlery and non-electric tableware	25015	Musical instruments (incl parts and accessories)
22035	Fabricated metal household goods	25020	Badges, coins and medals; umbrellas
22040	Fabricated metal hand tools; fire extinguishers	25025	Jewellery and silverware
22045	Firearms (incl parts)	25030	Metal ornaments and articles of precious metals (excl jewellery)
22050	Munitions and ammunition (incl cartridges)	25035	Paint brushes
22055	Fabricated metal products nec	25040	Pens, pencils, crayons and typewriter ribbons
23005	Motor cars	25045	Other manufacturing
23010	Trucks, buses, semi-trailers, utilities and vans		
23015	Second hand motor vehicles		
23020	Caravans and trailers		

Services Products			
SUPC	Product Description	SUPC	Product Description
01020	Sheep and beef cattle agistment services	31020	Second hand heavy and civil engineering construction nec
01080	Livestock products nec; horse agistment services	31025	Road, bridge, heavy and civil engineering construction nec – Repair and maintenance
02030	Services to agriculture	31030	General government consumption of fixed capital – Heavy and civil engineering construction (3101–3109)
02035	Services to forestry and fishing	32005	Construction trade services repair and maintenance
10005	Services to mining	32010	Other construction trade services
13035	Textile finishing (excluding labels and badges)	32015	General government consumption of fixed capital – Construction services (3211–3299)
16005	Printing	33005	Wholesale margin
16010	Printing trade services	33010	Other wholesale trade
23035	Boats and ships repair and maintenance services	39005	Retail margin
23045	Railway equipment repair and maintenance services	39010	Other retail trade
23055	Aircraft repair and maintenance services	44005	Accommodation services
23070	Transport equipment repair and maintenance nec (excl motor vehicles, trucks, motor cycles and trailers) (incl factory engine repair or replacment)	45005	Food and beverage margin
26005	Margin – Electricity transmission, distribution and on selling	45010	Takeaway food
26012	Other electricity service income	45015	Meal preparation and presentation & beverage services
27005	Margin – gas distribution	45020	Net losses from gambling – clubs
27010	Other gas service income	46005	Margin – road freight transport services
28005	Water supply; sewerage and drainage services	46010	Road freight transport services
29005	Waste collection, treatment and disposal services	46015	Bus and tramway transport services
30105	Residential building construction	46020	Taxi and hire car with driver; road passenger transport services nec
30110	Second hand residential buildings	46025	Margin – Transport Services
30205	Non-residential building construction	47005	Margin – railway freight transport services
30210	Second hand non-residential buildings	47010	Railway freight transport services
30215	General government consumption of fixed capital – Non Residential building construction (3020)	47015	Rail passenger transport services
31005	Road and bridge construction	48005	Margin – ocean and inland water freight transport services
31010	Second hand roads and bridges	48010	Ocean and inland water freight and passenger transport services
31015	Heavy and civil engineering construction nec	48015	Ship charter or rental services

Services Products (cont.)			
SUPC	Product Description	SUPC	Product Description
48020	Margin – pipeline transport services	67210	Non-residential property operator services
48025	Sightseeing and other transport services nec	69010	Engineering, technical testing and analysis services
48030	Pipeline transport services	69015	Architectural, commercial art and specialised design services nec
49005	Margin – air freight transport services	69020	Legal, accounting and management services
49010	Air freight transport services	69025	Advertising services
49015	Air passenger transport services	69030	Market research and statistical services
49020	Aircraft charter or rental services	69035	Veterinary services
51005	Postal services including hire of post boxes and courier services	69040	Photographic services
52005	Margin services to water transport	69045	Research and development services
52010	Stevedoring and port handling services	69050	Own account research and development
52015	Other support services to water transport	69055	Other professional, scientific and technical services
52020	Airport operations and other air transport support services nec	70005	Computer consultancy, systems design and related services
52025	Other transport support services (incl customs agency services)	72005	Employment placement and recruitment services
52030	Warehousing and storage	72010	Travel and tourist agency services
54005	Newspaper, magazine and book publishing	72015	Office administration, fund raising, event management or administration services nec
54010	Software publishing	72020	Cleaning, pest control and gardening services
54015	Advertising sales publishing (excl internet)	72025	Bottling, crating and packing services
54020	Copyright leasing	75005	Government administrative services
54025	Other publishing (excl software, music and internet)	76005	Defence services
55005	Motion picture production	77005	Public order and safety services nec
55010	Motion picture and video distribution services	80105	Primary and secondary education services
55015	Motion picture theatre services	80205	Technical, vocational and tertiary education services
55020	Music publishing; music and other sound recording activities	80305	Sporting and recreational education services
55025	Post-production services and other motion picture and video activities nec	80310	Arts, adult and other education services
56005	Radio and TV broadcasting services	84005	General practice and specialist medical services
56010	Cable (Pay TV) and other subscription broadcasting services	84010	Hospital and ambulance services
57005	Internet publishing and broadcasting	84016	Allied health and health services nec
57010	Internet publishing advertising sales	84020	Nursing home care services
57015	Internet services	84025	Residential care services nec
57020	Data processing and information storage services	84030	Child care services
58005	Telecommunication services (excluding equipment)	84036	Social assistance services nec
60005	Library, news collection and other information services	89005	Museums and parks and gardens operations
62005	Financial services nec – FISIM	89010	Performing arts venue operations
62010	Bank and non-bank financial services	89015	Performing arts operations and creative artists services nec
63005	Casualty insurance of householders effects	91006	Sporting and recreational services n.e.c.
63010	Motor vehicle comprehensive and compulsory third party insurance services	91010	Net losses from gambling – gambling services
63015	Health insurance services	94005	Automotive repair and maintenance services
63020	Fire and public liability insurance	94010	Machinery and equipment repair and maintenance services
63025	Life insurance and superannuation	94015	Other repair and maintenance services nec
63030	Workers compensation	95005	Hairdressing and beauty salon services
63035	Margin – marine insurance services	95010	Funeral services
63040	Insurance provisions and insurance services nec	95015	Dry cleaning and laundry services
64005	Services to insurance, finance and investment	95020	Photographic film processing
66005	Motor vehicle hire	95025	Parking services
66010	Hiring of transport equipment nec (incl trucks, buses, caravans, ships, trailers)	95035	Religious services
66015	Video and other electronic media rental or hire	95040	Services to students at post-secondary institutions by their sports and student unions
66020	Non-financial intangible asset leasing	95045	Domestic services
66025	Hiring of heavy machinery and other goods and equipment nec (incl farm animals and art works)	95050	Civic, professional and other interest group services
67105	Ownership of dwellings	95055	Other personal services nec
67205	Real estate agent services		

GLOSSARY

ASSETS	Store of value over which ownership rights are enforced by institutional units, individually or collectively, and from which economic benefits may be derived by their owners by holding them, or using them, over a period of time (the economic benefits consist of primary incomes derived from the use of the asset and the value, including possible holding gains/losses, that could be realised by disposing of the asset or terminating it).
BASIC PRICES	The amount receivable by the producer from the purchaser for a unit of a good or service produced as output, minus any tax payable plus any subsidy receivable, on that unit as a consequence of its production or sale; it excludes any transport charges invoiced separately by the producer.
CAPITAL INCOME	The sum of gross operating surplus and the proportion of gross mixed income that would represent a return on the owner's capital.
CAPITAL PRODUCTIVITY	Indexes of real output per unit of capital services used in production. Derived by dividing an index of chain volume industry or market sector gross value added by an index of capital services. The capital productivity indexes reflect not only the contribution of capital to changes in production, but also the contribution by labour and other factors affecting production.
CAPITAL SERVICES	Capital services reflect the amount of 'service' each asset provides during a period. For each asset, the services provided in a period are directly proportional to the asset's productive capital value in the period. As an asset ages and its efficiency declines so does the productive capital value and the services the asset provides.
COMPENSATION OF EMPLOYEES	Total remuneration, in cash or in kind, payable by an enterprise to an employee in return for work done by the employee during the accounting period. It is further classified into two sub-components: wages and salaries; and employers' social contributions. Compensation of employees is not payable in respect of unpaid work undertaken voluntarily, including the work done by members of a household within an unincorporated enterprise owned by the same household. Compensation of employees excludes any taxes payable by the employer on the wage and salary bill (e.g. payroll tax).
CONSUMPTION OF FIXED CAPITAL	The value of the reproducible fixed assets used up during a period of account as a result of normal wear and tear, foreseen obsolescence and the normal rate of accidental damage. Unforeseen obsolescence, major catastrophes and the depletion of natural resources are not taken into account.
CURRENT PRICES	Estimates are valued at the prices of the period to which the observation relates. For example, estimates for this financial year are valued using this financial year's prices. This contrasts to chain volume measures where the prices used in valuation refer to the prices of the previous year.

ENERGY	The subgroup of intermediate inputs in KLEMS related to energy. It includes coal, jet fuel, natural gas, liquid petroleum gas, automotive petrol and electricity. For a more comprehensive list, see Appendix 2.
GROSS FIXED CAPITAL FORMATION	Expenditure on new fixed assets plus net expenditure on second-hand fixed assets, including both additions and or replacements. Expenditure on repair and maintenance of fixed assets is excluded, being chargeable to the production account. Compensation of employees and other costs paid by corporations in connection with own-account capital formation are included.
GROSS MIXED INCOME OF UNINCORPORATED ENTERPRISES	The surplus or deficit accruing from production by unincorporated enterprises. It includes elements of both compensation of employees (returns on labour inputs) and operating surplus (returns on capital inputs).
GROSS OPERATING SURPLUS	The operating surplus accruing to all enterprises, except unincorporated enterprises, from their operations in Australia. It is the excess of gross output over the sum of intermediate consumption, compensation of employees, and taxes less subsidies on production and imports. It is calculated before deduction of consumption of fixed capital, dividends, interest, royalties and land rent, and direct taxes payable, but after deducting the inventory valuation adjustment. Gross operating surplus is also calculated for general government and it equals general government's consumption of fixed capital.
GROSS OUTPUT	The total value of industry output measured at basic prices. Basic prices valuation of output removes the distortion caused by variations in the incidence of commodity taxes and subsidies across the output of individual industries.
GROSS VALUE ADDED	The value of output at basic prices minus the value of intermediate consumption at purchasers' prices. The term is used to describe gross product by industry and by sector.
HOURS WORKED	The hours worked by all labour engaged in the production of goods and services, including hours worked by civilian wage and salary earners, employers, self-employed persons, persons working one hour or more without pay in a family business or on a farm, and members of the Australian defence forces.
INTERMEDIATE INPUTS	Consists of the value of the goods and services consumed as inputs by a process of production, excluding the consumption of fixed capital. Also known as intermediate consumption. For the KLEMS growth account, it comprises the energy, materials and services inputs.
KLEMS	A growth accounting framework where the growth in real gross output is described by contributions to growth from real capital services (K), labour services (L), energy (E), materials (M) services (S), and the growth in gross output based multifactor productivity.

KLEMS MULTIFACTOR PRODUCTIVITY	Indexes of real industry gross output per combined unit of labour, capital and intermediate inputs. They have been derived by subtracting the weighted natural log growth in hours worked, capital services and intermediate inputs from the natural log growth in chain volume estimates of industry gross output. Also referred to as Gross output based multifactor productivity.
LABOUR COMPOSITION	The change in labour services attributable to changes in the education, experience and gender of the workforce over time. When combined with hours worked, it is referred to as the Quality adjusted labour input.
LABOUR INCOME	The sum of compensation of employees and the proportion of gross mixed income that would represent a return on the owner's labour.
LABOUR PRODUCTIVITY	Indexes of real output per person employed or per hour worked. The estimates in the ASNA have been derived by dividing the chain volume measure of gross value added or GDP by hours worked. Labour productivity indexes not only reflect the contribution of labour to changes in product per labour unit, but are also influenced by the contribution of capital and other factors affecting production.
LASPEYRES VOLUME INDEX	A weighted arithmetic average of quantity relatives using the values of the earlier period as weights.
MARKET SECTOR	The Market Sector consists of industries which predominantly produce goods and services which are sold at "market prices", that is, prices which determine the quantity of goods produced and sold and which over the business cycle cover the cost of production. It includes Agriculture, forestry and fishing, Mining, Manufacturing, Electricity, gas, water and waste services, Construction, Wholesale trade, Retail trade, Accommodation and food services, Transport, postal and warehousing services, Information, media and telecommunication services, Financial and insurance services, Rental, hiring and real estate services, Professional, scientific and technical services, Administrative and support services, Arts and recreation services, and Other services. It excludes Public administration and safety, Education and training, Health care and social assistance and Ownership of dwellings.
MATERIALS	The subgroup of intermediate inputs in KLEMS related to materials. Examples include wool, cotton, metal, plastic and wood products. For a more comprehensive list, see Appendix 2.
MULTIFACTOR PRODUCTIVITY	Indexes of gross value added per combined unit of labour and capital (in the case of GVA based MFP) or indexes of gross output per combined unit of labour, capital and intermediate input (in the case of Gross output or KLEMS multifactor productivity).

OUTPUT	This consists of those goods and services that are produced within an establishment that become available for use outside that establishment, plus any goods and services produced for own final use. See also Gross output and Gross value added.
PERPETUAL INVENTORY METHOD	A method of constructing estimates of capital stock and consumption of fixed capital from time series of gross fixed capital formation. It allows an estimate to be made of the stock of fixed assets in existence and in the hands of producers which is generally based on estimating how many of the fixed assets, installed as a result of gross fixed capital formation undertaken in previous years, have survived to the current period.
PRIMARY INCOMES	Consist of incomes that accrue to institutional units as a consequence of their involvement in processes of production or their ownership of assets that may be needed for the purposes of production. For example, it includes Compensation of employees (Wages and salaries plus Employers social contributions), Gross operating surplus, and Gross mixed income of unincorporated enterprises.
PRODUCTIVE CAPITAL STOCK	A measure of productive capacity and forms the basis for the measure of capital services. Productive capital stock estimates are derived as the written down value of each asset in accordance with its decline in efficiency due to age.
PURCHASERS' PRICES	The amount paid by the purchaser, excluding any deductible tax, in order to take delivery of a unit of a good or service at the time and place required by the purchaser. The purchasers' price includes any transport charges paid separately by the purchaser to take delivery at the required time and place.
QUALITY ADJUSTED LABOUR INPUT	This measure of labour input takes account of changes in the aggregate quality of labour due to changes in educational attainment and the length of experience in the workforce. Labour productivity and multifactor productivity estimates based on quality adjusted hours worked are also calculated.
RENTAL PRICES	This is also referred to as the user cost of capital. The rental price is the unit cost for the use of an asset for one period. That is, the price for employing or obtaining one unit of capital services.
SERVICES	The subgroup of intermediate inputs in KLEMS related to services. Examples include Architectural services, Legal, accounting and management services, Advertising services, Market research services, Internet services, Data processing services, and Telecommunication services (excluding equipment). For a more comprehensive list, see Appendix 2.
SUPPLY AND USE TABLES	Matrices that record how supplies of different kinds of goods and services originate from domestic industries and imports, and how those supplies are allocated between various intermediate or final uses, including exports.

TAXES LESS SUBSIDIES ON PRODUCTION AND IMPORTS	Defined as 'taxes on products' plus 'other taxes on production' less 'subsidies on products' less 'other subsidies on production'.
TÖRNQVIST VOLUME INDEX	A weighted geometric average of the quantity relatives using arithmetic averages of the value shares in the two periods as weights.
WAGES AND SALARIES	Consist of amounts payable in cash including the value of any social contributions, income taxes, fringe benefits tax, etc., payable by the employee even if they are actually withheld by the employer for administrative convenience or other reasons and paid directly to social insurance schemes, tax authorities, etc., on behalf of the employee. Wages and salaries may be paid as remuneration in kind instead of, or in addition to, remuneration in cash. Separation, termination and redundancy payments are also included in wages and salaries.

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