

Note on the separate identification of computer equipment in the analysis of gross fixed capital formation

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Introduction

This issue of the *Quarterly Bulletin* introduces estimates of expenditure on computer equipment as a separate category in the national accounts. Computer equipment is separately identified in the household final consumption expenditure tables and in the tables dealing with gross fixed capital formation by type of asset. In this note the focus is on the latter.

Computers² were invented as early as the 1930s, and South Africa has imported computers and related equipment from, *inter alia*, Europe, the United States (US) and Japan for more than half a century. With the industrialisation and advancement of economies, investment in computers as a factor of production became progressively more important. It has been noted³ that a substantial part of the very strong economic growth in the US in the 1990s could be attributed to the spectacular expansion of information technology.

2 By definition, a computer is a device that accepts data and converts it based on a program or sequence of instructions on how the data are to be processed.

3 See Magnien (2001).

The System of National Accounts 1993 (1993 SNA) includes under machinery and equipment, fixed assets⁴ such as transport equipment, furniture, computers, office equipment, and other machinery and equipment. In South Africa, computers and related equipment have always implicitly been included in gross fixed capital formation as part of machinery and other equipment. However, capital spending on computers has grown in importance over the years. Furthermore, the difference in the service life of computers relative to other machinery and equipment implies that separate identification of computers will have a significant effect on the capital stock and productivity analysis. It consequently became imperative to estimate this type of assets individually.

4 According to the 1993 SNA, fixed assets are tangible or intangible assets produced as outputs from processes of production that are themselves used continuously in other processes of production for more than one year.

This note firstly outlines how nominal capital expenditure on computer equipment was estimated from 1960. Secondly, the methodology used to estimate an appropriate deflator for computer equipment is discussed. Thirdly, the real capital formation data in respect of computer equipment are presented, followed by the capital stock of computer equipment. The note ends with some concluding observations.

Estimating capital expenditure on computer equipment

Since 2000 the *Economic Activity Survey* (EAS) of Statistics South Africa (Stats SA), which, among other things, surveys capital formation and provides for computer equipment as a separate asset type, was used to get a breakdown between computer equipment and machinery and other equipment. Prior to 2000, enterprise-surveyed data on capital formation obtained from official sources did not identify computers and related equipment as a separate type of asset. Accordingly, from 1960 to 1999 the imports of computers and related equipment, such as typing machines, calculating machines, statistical machines and parts, obtained from the foreign trade statistics published by government, were used in order to estimate the historical investment in computers. Prior to 1960 it was assumed that capital expenditure on computer equipment was negligible.

Figure 1 shows the estimated series for nominal capital expenditure on computer equipment. It should be noted that a semi-log scale is used and that inflation, relative price changes and structural developments all had a bearing on this nominal expenditure series.

Figure 1 Nominal capital expenditure on computer equipment

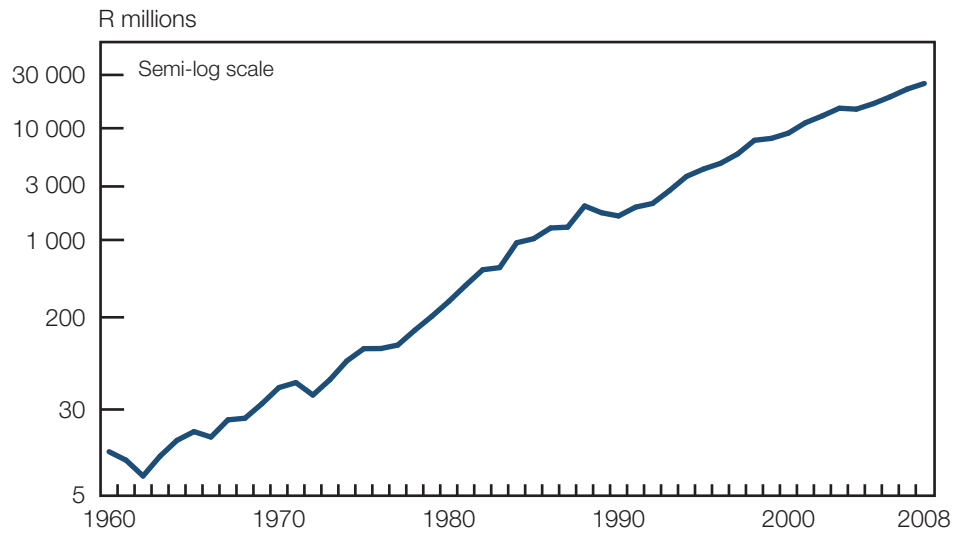


Table 1 illustrates the growing importance of expenditure on computer equipment in the economy. In the 1960s computers were relatively expensive, had limited capacity and were used by a very limited group of institutions. During the ensuing decades their usefulness and popularity rose at a stellar pace as their prices declined, and their capacity and range of applications expanded.

Table 1 Share of computer equipment in nominal gross fixed capital formation

Per cent

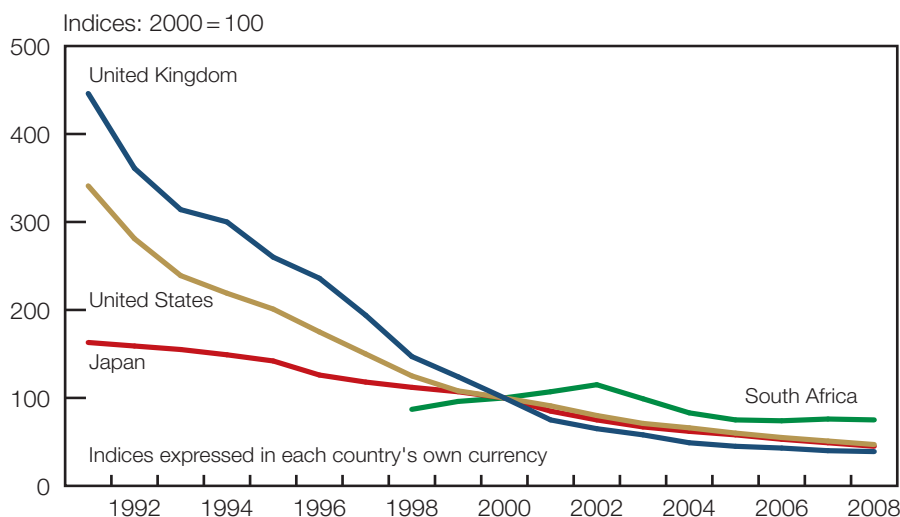
	Share of computer equipment in:	
	Total machinery and equipment*	Overall fixed capital formation
1960s.....	3,2	1,0
1970s.....	4,0	1,3
1980s.....	8,6	3,2
1990s.....	11,8	4,7
2000–2008	16,0	6,6

* Total of computer equipment and machinery and other equipment

Methodology used to derive a price index for computers

In the absence of an official price index for computer equipment in South Africa that could be used historically, relevant price indices from selected countries were used to compile a price index to deflate computer equipment for the years prior to 2000.

Figure 2 Price indices for computers in selected countries



Sources: Office for National Statistics (UK), Bureau of Labor Statistics (US), Bank of Japan and Statistics South Africa

As illustrated in Figure 2, the United Kingdom's (UK) price index for computer equipment shows a relatively fast decline, with less rapid declines in the price indices compiled by the US and Japan. Both the US and Japan use hedonic methods⁵ to derive a price index. The UK's statistical office uses other methods to calculate quality change in computer models, such as option pricing or expert opinions where a manufacturer gives an assessment of the cost of adding the improvement that reflects the additional cost of the change in specification.⁶ As noted by Schreyer (2002), methodologies to derive price indices for information technology products vary between national statistics offices. The methodology used in South Africa's national accounts to compile a price index from 1960 was to combine different price indices from different sources.

5 Hedonic methods are regression-based methods that may be applied to goods, such as computers, for which quality and characteristics are changing rapidly, in order to develop unit prices. In this way technological changes such as improvements on memory and speed are excluded from the index so as to include underlying price changes. See Triplett (2004).

6 See Schreyer (2002).

For the period 2000 to date the price index for computer equipment as published by Stats SA was used. Between 1991 and 1999, an unweighted average of the price indices for computer equipment in the UK, US and Japan were used, while the price index of the US Bureau of Economic Analysis (BEA) was used for the period 1960 to 1990. In order to have comparable indices, all the foreign price indices were converted to rand using the rand exchange rate against each currency. The international price indices (in rand) were linked to Stats SA's price index, to obtain a comparable time series for the deflation of gross fixed capital formation on computer equipment from 1960.

It may be noted that the rand price index of computer equipment rose by less than 2 per cent per annum from 1960 to 2008 whereas consumer prices, for instance, rose by almost 9 per cent per annum, illustrating the magnitude of the relative price decline recorded by computer equipment.

Using the deflator as constructed for South Africa, the series for nominal gross fixed capital expenditure on computers was adjusted to obtain a real fixed capital formation series. The results are shown in Figure 3.

Figure 3 Real capital expenditure on computer equipment

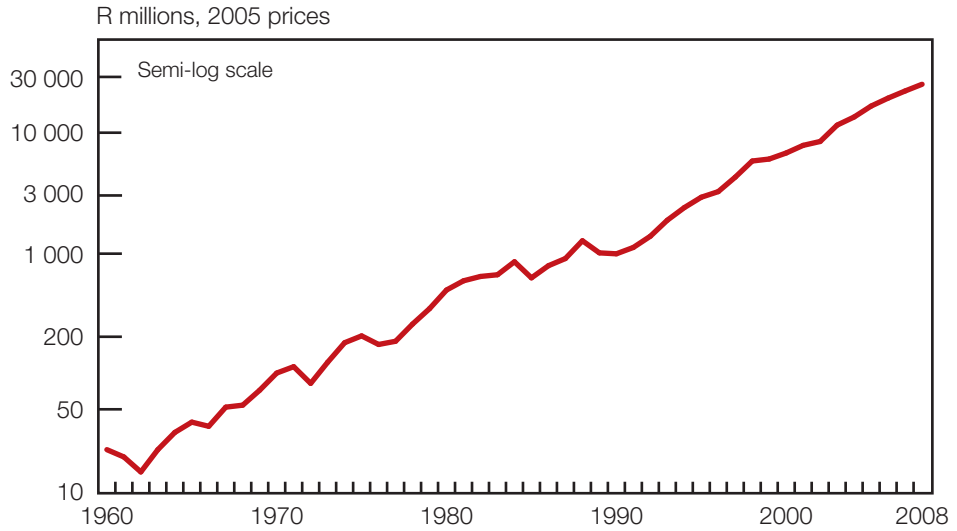
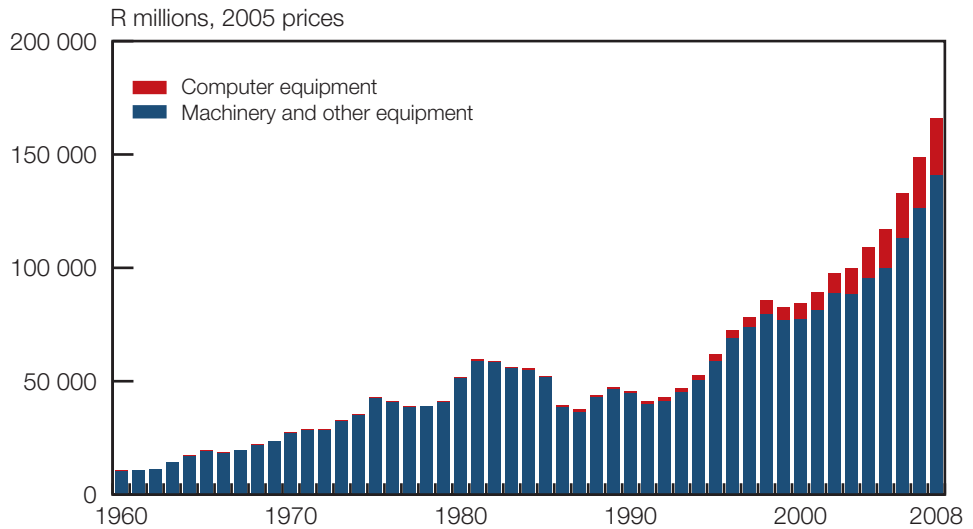


Figure 4 indicates the real investment in computer equipment together with that in machinery and other equipment. While both components started picking up in the 1990s, there has been a noticeable increase in the contribution of investment in computer equipment since the turn of the century. Along with trade liberalisation and increasing globalisation, South Africa had to forcefully expand its use of computer-related technologies and internationally competitive computer software packages.

Figure 4 Real fixed capital expenditure on computer equipment and on machinery and other equipment



Consumption of fixed capital and the capital stock of computer equipment

The consumption of fixed capital, often referred to as ‘depreciation’, relates to the decline in the current value of the stock of fixed assets owned by a producer as a result of physical deterioration, technological obsolescence or normal accidental damage in the course of time. Different asset types have a different service life and in South Africa’s

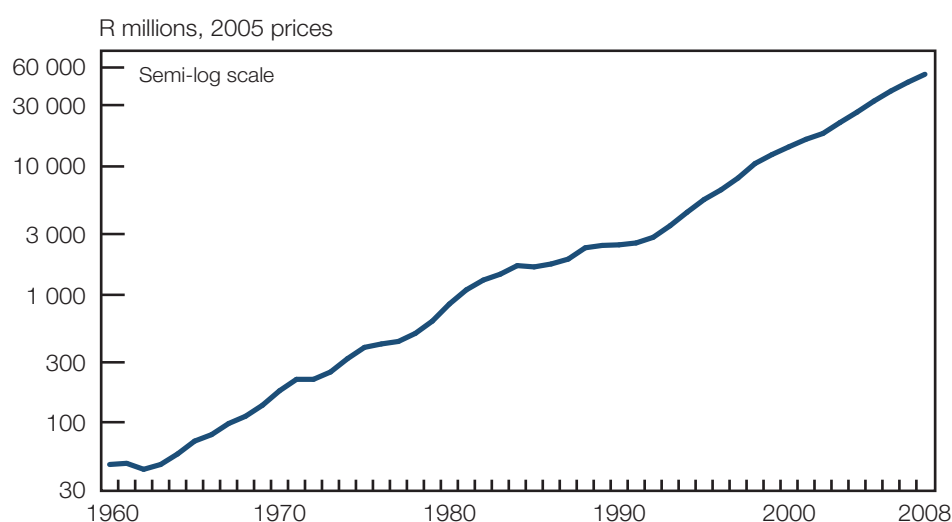
national accounts the assumed service life ranges from 80 years for construction works in the agricultural sector to 8 years for transport equipment. In the case of computer equipment, the service life was estimated to be 5 years. The time span was chosen mainly based on expert opinions, but also mindful that the average service life as measured by some other countries⁷ such as the US and Japan is somewhat longer, while in the UK it is shorter (Nomura, University and Momose, 2008).

⁷ The service life of computers in the US (BLS) is 6 years, for Japan it is 7,8 years and for the UK it is 3,2 years.

The standard or traditional procedure to calculate capital stock values is the Perpetual Inventory Method (PIM). Estimates of the net capital stock (as published in the *Quarterly Bulletin* of the South African Reserve Bank) are obtained by applying a capital consumption function based on the expected economic life of the various asset types. In South Africa, estimates of net capital stock are based on a straight-line retirement function.

Figure 5 shows the real fixed capital stock of computer equipment. As may be expected, it increased rapidly over time as the use of computer equipment became widespread. The fixed capital stock of machinery and equipment, including computer equipment, according to the old methodology and the capital stock obtained if computer equipment is treated separately differ in terms of level.

Figure 5 Fixed capital stock: Computer equipment



The difference can be ascribed to the fact that the service life that was used for depreciation of computer equipment when it was included in the machinery and equipment was 10 years instead of 5 years. The capital stock of machinery and other equipment that includes the computer equipment separately calculated shows stock levels that are lower. This can be attributed to the computer investment portion of capital formation that depreciates at a rate of 20 per cent per year instead of the 10 per cent previously used.

Conclusion

Since the 1990s there has been a noticeable increase in nominal investment in computer equipment in South Africa, as elsewhere in the world. At the same time, the prices of computer equipment have declined significantly. International price indices for computers, adjusted for exchange rate changes, were combined and linked to the computer equipment price index for South Africa to obtain a deflator series going back to 1960.

Applying the deflator series to nominal capital formation, a rapidly increasing series for real capital expenditure on computer equipment is obtained. These estimates are also used to refine the South African Reserve Bank's capital stock series. Since computer equipment has an assumed life-span of only 5 years – significantly shorter than that of other capital goods – the separation of computer equipment from machinery and other equipment has improved the estimates of the capital stock by type of asset.

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