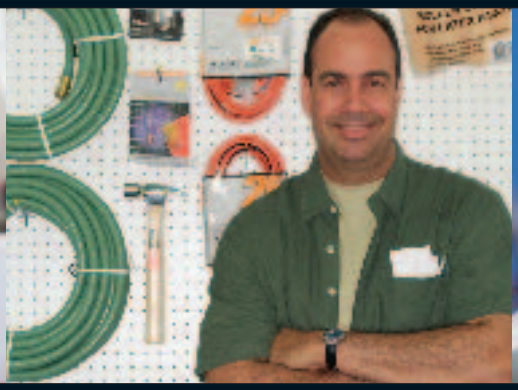
Australian Government

Department of Communications, Information Technology and the Arts

ESTIMATING AGGREGATE PRODUCTIVITY GROWTH FOR AUSTRALIA

The role of information and communications technology

OCCASIONAL ECONOMIC PAPER



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Estimating aggregate productivity growth for Australia

The role of information and communications technology

An occasional economic paper

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Foreword

This research paper is part of ongoing research commissioned and conducted by the Department of Communications, Information Technology and the Arts (DCITA) on the factors driving productivity growth in Australia and the role of information and communication technologies (ICT) in this growth. As such, it forms part of a series of projected research reports intended to assist public discussion of these issues.

Earlier reports dealing with *Productivity growth in Australian manufacturing*, published in March 2004 by the former National Office of the Information Economy, *Productivity growth in service industries* (August 2005), and *ICT and Australian productivity: methodologies and measurement* (October 2005), are part of this series. In the near future the following reports will also be published: *Forecasting productivity growth: 2004 to 2024*; and *An evolutionary approach to macroeconomic modelling: general purpose technologies and the information economy*.

This report was prepared by Professor Erwin Diewert and Dr Denis Lawrence from Meyrick and Associates and funded by the Department of Communications, Information Technology and the Arts. An earlier version of this paper was presented to an Australian Bureau of Statistics workshop on 10 December 2004 and tabled at the OECD Canberra Group on Capital Measurement in Canberra at the end of March 2005.

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Executive summary

In 2004 Diewert and Lawrence (DL) undertook research for the then National Office of the Information Economy on the assumptions underlying index number methods for estimating the contribution of information and communications technology (ICT) to productivity growth. We allowed for a divergence between the user cost of ICT and the value of ICT in production for each major Australian industry. We found consistent evidence across the industries examined that ICT contributes more to output than its cost to producers. This means that the standard growth accounting productivity measures do not adequately capture the 'information revolution' characteristics of ICT.

However, this work revealed a number of major weaknesses in the industry level National Accounts data used for productivity measurement in Australia. Given these shortcomings, we found the data was robust enough to support econometric estimation for only four out of the 12 included sectors.

In this report we have sought to address a number of the key problems identified with the National Accounts based productivity data in the earlier study. This has involved the construction of a new productivity database. We have then undertaken econometric modelling using this database and a more detailed model than that developed in our initial study.

Differences between the Diewert Lawrence and ABS productivity databases

The main differences between the Diewert Lawrence (DL) database and that used by the ABS in producing its multifactor productivity (MFP) estimates are the following.

- Broader coverage of the economy DL include 16 of the 17 major industrial sectors whereas the ABS 'market sector' only covers 12 of the 17 sectors. DL exclude Government administration and defence whereas the ABS also excludes Health, Education, Business and property services and Personal services. With the changing composition of the economy, the private sector now accounts for significant proportions of Health, Education and Personal services output and nearly all of the relatively large business and property services sector's output.
- Building up an output measure from final consumption components rather than sectoral gross value added—this allows a more accurate output measure to be used as interindustry flows of intermediates are netted out and more accurate records are available for end consumption components.
- Expressing both outputs and inputs in terms of producer prices—from the viewpoint of production theory, the appropriate prices are the prices that producers face, which should

not include final demand tax wedges but which should include subsidies and also commodity taxes falling on inputs to production.

- Constructing consistent capital and inventory inputs series—the US Bureau of Labor Statistics methodology currently used by the ABS for forming stocks and flows is not completely consistent. We use instead the Jorgenson geometric depreciation approach which is consistent. We also smooth the depreciation rates used by the ABS and push back ABS estimates for some capital stocks that start at substantial non-zero values part way through the time period.

Main findings

- TFP growth in the expanded market sector of the Australian economy has been very good over the past 45 years comprising a high average annual TFP growth over the 12 years to 1972 of around 1.66 per cent, more modest average growth of 1.22 per cent over the period 1972–95 and then very high average TFP growth of 1.85 per cent over the last decade.
- This compares with ABS multifactor productivity average annual changes of 1.19 per cent per annum for the seven years to 1972, 1.05 per cent for the period 1972–95 and 1.55 per cent per annum for the last decade.
- The DL database produces somewhat higher productivity growth rates on average than the narrower ABS multifactor productivity series demonstrating the importance of including the additional service sectors included in the DL database—to put this in perspective, the DL database covers around 95 per cent of value added in the economy whereas the narrower ABS coverage picks up around two–thirds of value added.
- There is evidence of modest increasing returns to scale (1.07 on average) in Australia's expanded market sector with a correspondingly modest markup of around 8 per cent.
- The large majority (around 85 to 90 per cent) of TFP growth is accounted for by technical progress rather than increasing returns to scale.
- Applying the more detailed econometric model to the aggregate level DL database has confirmed that ICT contributes more to output than its cost to producers [of other goods and services]. In fact, our estimates indicate that ICT inputs are worth around 40 per cent more to producers in terms of marginal product than they pay for them.
- The undervaluation of ICT inputs by producers is likely to be due to a combination of market disequilibrium, innovation related externalities and intangible investment in human capital associated with investment in ICT.

- The results of this study indicate that greater attention to the uptake of ICT will have an important role in further improving economic growth.

1 Introduction

Diewert and Lawrence (2004) undertook research for the National Office of the Information Economy on the assumptions underlying index number methods for estimating the contribution of information and communications technology (ICT) to productivity growth. A number of these assumptions are unlikely to be satisfied for this dynamic input. We allowed for a divergence between the user cost of ICT and the value of ICT in production for each major Australian industry. We found consistent evidence across the industries examined that ICT contributes more to output than its cost to producers. This means that the standard growth accounting productivity measures do not adequately capture the 'information revolution' characteristics of ICT. However, this work revealed a number of major weaknesses in the industry-level National Accounts data used for productivity measurement in Australia.

The most important of these weaknesses is the use of inconsistent rates of return when forming an index of aggregate inputs for each sector. Using consistent real rates of return produces considerably different productivity growth rates for several sectors compared to those reported by the Productivity Commission (PC). The PC uses sectoral data supplied by the Australian Bureau of Statistics (ABS). This National Accounts productivity database also produces implausible results for some sectors such as cultural and recreational services where both our results and those of the PC indicate consistent productivity falls of around 3 per cent per annum.

Other important shortcomings in the National Accounts productivity database include the use of consumer rather than producer prices in the aggregation of outputs and inputs and associated inadequate treatment of commodity taxes and subsidies, probable inadequate measurement of intermediate input flows between sectors, the exclusion of significant market sector service activities and the use of a methodology to form stocks and flows of capital and inventory inputs which is not fully consistent.

Given these shortcomings, Diewert and Lawrence (2004) found the data was robust enough to support econometric estimation for only four out of the 12 included sectors. The econometric model developed is a significant improvement over previous econometric studies but while the results are important and consistent across the four sectors, they only apply to four sectors and not the economy as a whole.

To obtain conclusive evidence on the role of ICT in Australia's productivity growth, in this project undertaken for the Department of Communications, Information Technology and the Arts (DCITA), we have formed a new aggregate level Australian database which addresses the data problems identified in the National Accounts productivity database. The Diewert-

Lawrence database follows a similar approach to that developed by Diewert and Lawrence (1999) for the New Zealand economy. In that study we were engaged by the New Zealand Treasury, the Reserve Bank of New Zealand and the Department of Labour to assess New Zealand's productivity performance over the past two decades and the impact of key economic reforms on productivity levels. The New Zealand report provides a template for assembling a consistent productivity database for Australia.

Having assembled the new aggregate level productivity database, we proceed to estimate a more detailed econometric model than that first developed in Diewert and Lawrence (2004) to establish the role of ICT in Australia's productivity growth. This more detailed model confirms that ICT contributes more to output than its cost to producers of other goods and services. In fact, ICT inputs are worth around 40 per cent more to producers in terms of marginal product than they pay for them. The results indicate that greater attention to the uptake of ICT will have an important role in improving economic growth.

In the following section of the report we summarise the key features of the database and examine Australia's productivity performance over the past 45 years. In section 3 we present our detailed econometric model before presenting results of the modelling work in section 4. Finally, we draw conclusions and lay out the priorities for future work in section 5. An appendix provides a detailed explanation of the formation of the Diewert-Lawrence productivity database and lists the variables used in the study.

2 Australia's productivity performance

2.1 The Diewert-Lawrence Australian productivity database

The Diewert-Lawrence (DL) total factor productivity (TFP) database constructed for DCITA contains value, price and quantity information on a total of 34 output and input categories. These are made up of an aggregate consumer commodity, one government consumption commodity, 11 investment commodities, 3 inventory change commodities, one export commodity, one import commodity, labour input, 10 capital stocks and 5 inventory stocks. Data on these variables cover the 45 year period from 1959–60 to 2003–04.

The main differences between the DL database and that used by the ABS in producing its multifactor productivity (MFP) estimates are the following.

- Broader coverage of the economy—DL include 16 of the 17 major industrial sectors whereas the ABS 'market sector' only covers 12 of the 17 sectors. DL exclude Government administration and defence whereas the ABS also excludes health, education, business and property services and personal services. With the changing composition of the economy, the private sector now accounts for significant proportions of health, education and personal services output and nearly all of the relatively large

business and property services sector's output. The DL approach of measuring output from sources of final demand enables us to cover more of the desired market-oriented parts of the economy than the ABS sectoral value added approach where measurement problems are more problematic. For clarity, we refer to our 16 sector coverage as the 'expanded market sector'.

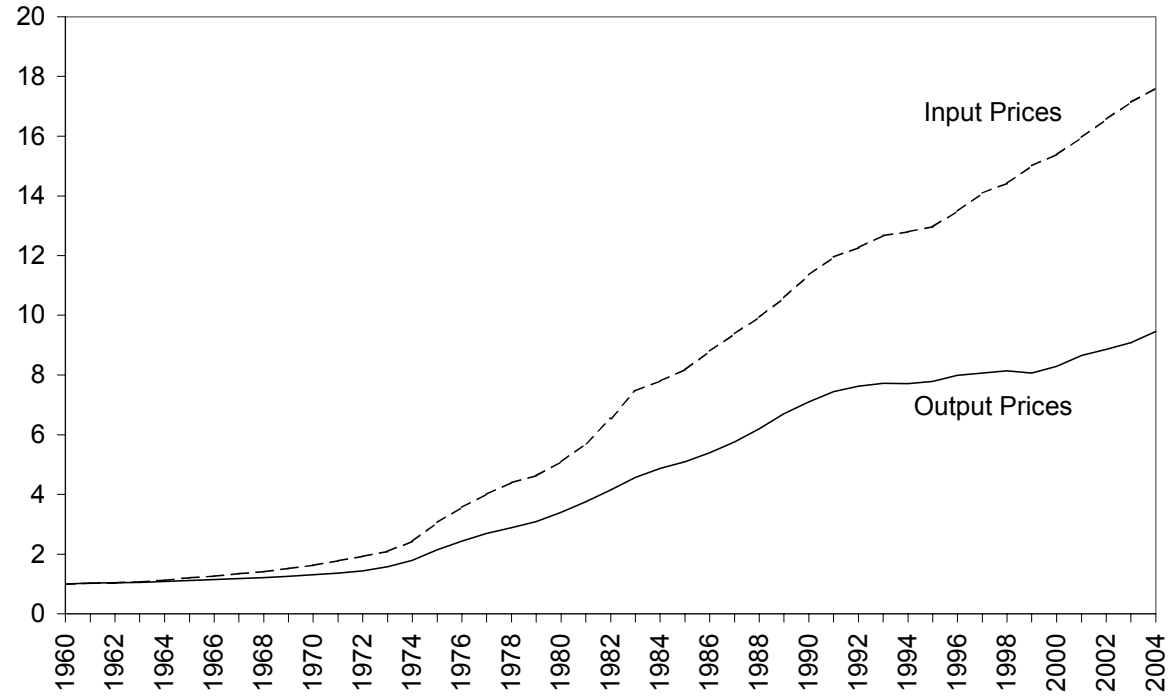
- Building up an output measure from final consumption components rather than sectoral gross value added—this allows a more accurate output measure to be used as inter-industry flows of intermediates are netted out and more accurate records are available for end consumption components.
- Expressing both outputs and inputs in terms of producer prices—from the viewpoint of production theory (which is the theoretical basis for making productivity comparisons), the appropriate prices are the prices that producers face, which should not include final demand taxes. However, some commodity taxes (such as property taxes and tariffs on imports) fall on inputs to the production sector and so these taxes should be included in producer prices for productivity purposes. Subsidies also create problems in trying to determine what the 'correct' producer prices are for subsidised outputs.
- Constructing consistent capital and inventory inputs series—the US Bureau of Labor Statistics methodology currently used by the ABS for forming stocks and flows is not completely consistent. We use instead the Jorgenson geometric depreciation approach which is consistent. We also smooth the depreciation rates used by the ABS and push back ABS estimates for some capital stocks that start at substantial non-zero values part way through the time period.

The derivation of the DL database is explained in detail in appendix A where the data are also listed.

2.2 Price movements

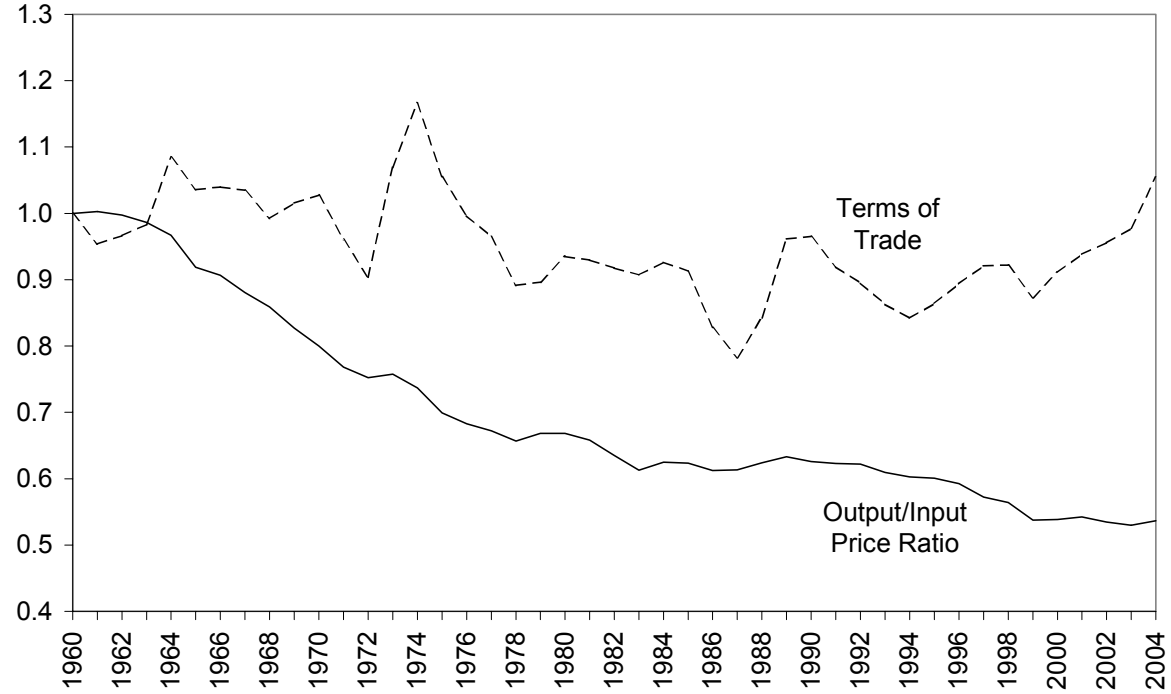
Output prices received by market sector producers increased at an average rate of around 5.1 per cent per annum between 1960 and 2004. However, the aggregate input price paid by producers increased at an average annual rate of around 7.5 per cent. As can be seen from figure 1, overall output and input prices remained relatively close for the first decade of the 45 year period but steadily diverged after 1970 with an increase in the rate of divergence over the last decade.

Figure 1: **Expanded market sector total output and input price indexes, 1960–2004**



Source: Diewert-Lawrence Australian productivity database

Figure 2: **Prices received to prices paid indexes, 1960–2004**



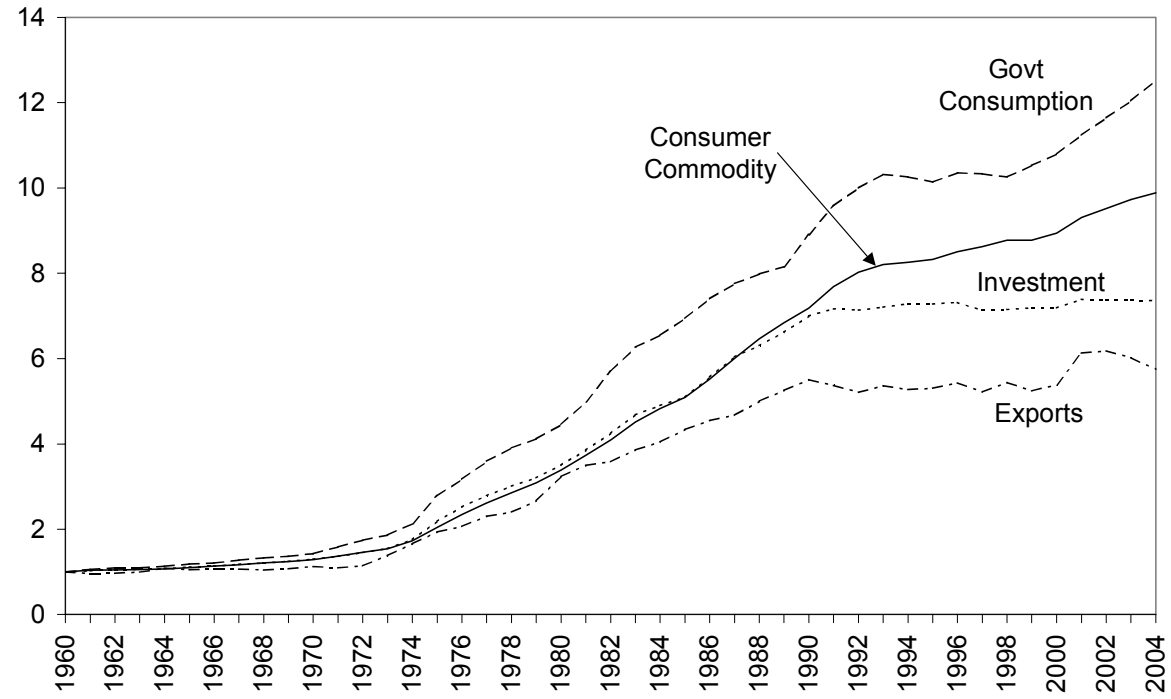
Source: Diewert–Lawrence Australian productivity database

The declining price situation faced by Australian producers is illustrated in figure 2 where the prices received to prices paid ratio for total outputs and inputs can be seen to have generally

declining over the whole period. The annual average rate of decline for the whole period was around 1.4 per cent. If producers are to maintain their profitability in the face of such declines in the prices received to prices paid ratio then offsetting productivity improvements must be made.

In terms of international price movements the Australian economy has fared better. The terms of trade graphed in figure 2 shows the ratio of export prices to import prices. It illustrates that since 1994 export prices have improved relative to import prices meaning that Australia's exports have been able to purchase an increasing quantity of imports. For the 45 year period as a whole the terms of trade annual average increase was 0.1 per cent. However, an average annual decline of 0.5 per cent between 1960 and 1994 has been more than offset by an average annual improvement in the terms of trade between 1994 and 2004 of around 2.3 per cent.

Figure 3: **Producer output price indexes, 1960–2004**

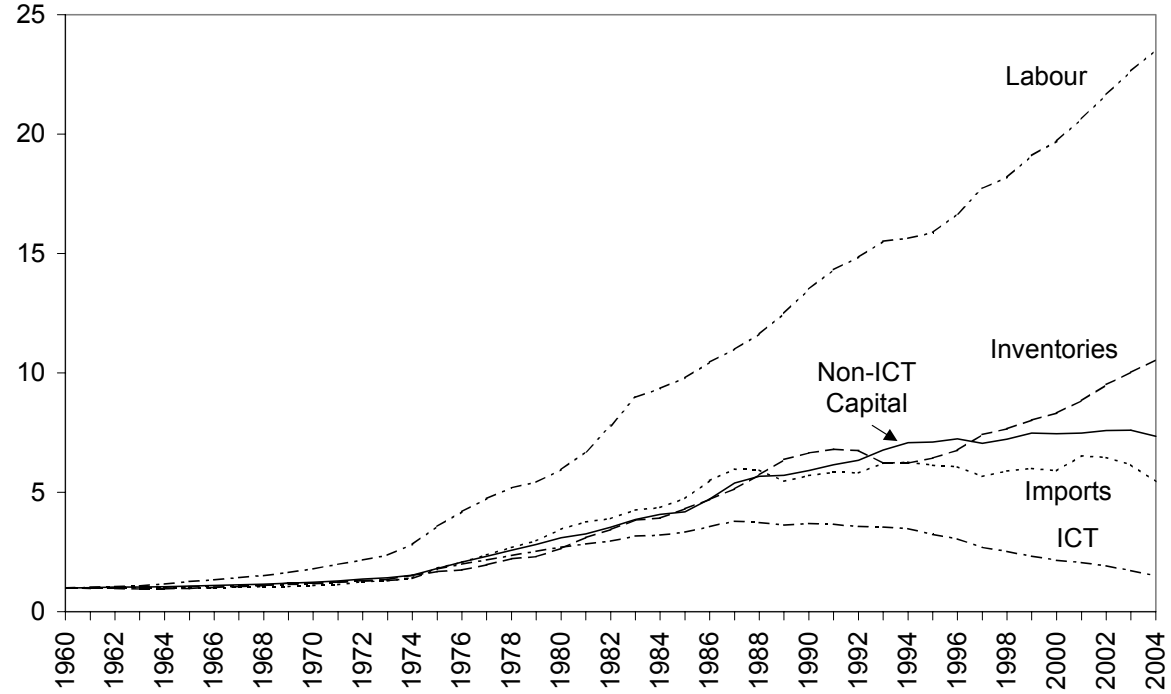


Source: Diewert–Lawrence Australian productivity database

Price indexes for 4 output components—the general consumer commodity, government consumption, investment goods and exports—are shown in figure 3. Producer prices for government consumption have increased the most rapidly with an average annual growth rate of around 5.7 per cent, followed by the general consumer commodity on 5.2 per cent. The price of investment goods and exports both increased up to 1990 but have largely levelled off since then. Export prices have increased the least rapidly with an average annual growth rate

of around 4 per cent while investment goods' prices increased by around 4.5 per cent on average.

Figure 4: **Producer input price indexes, 1960–2004**



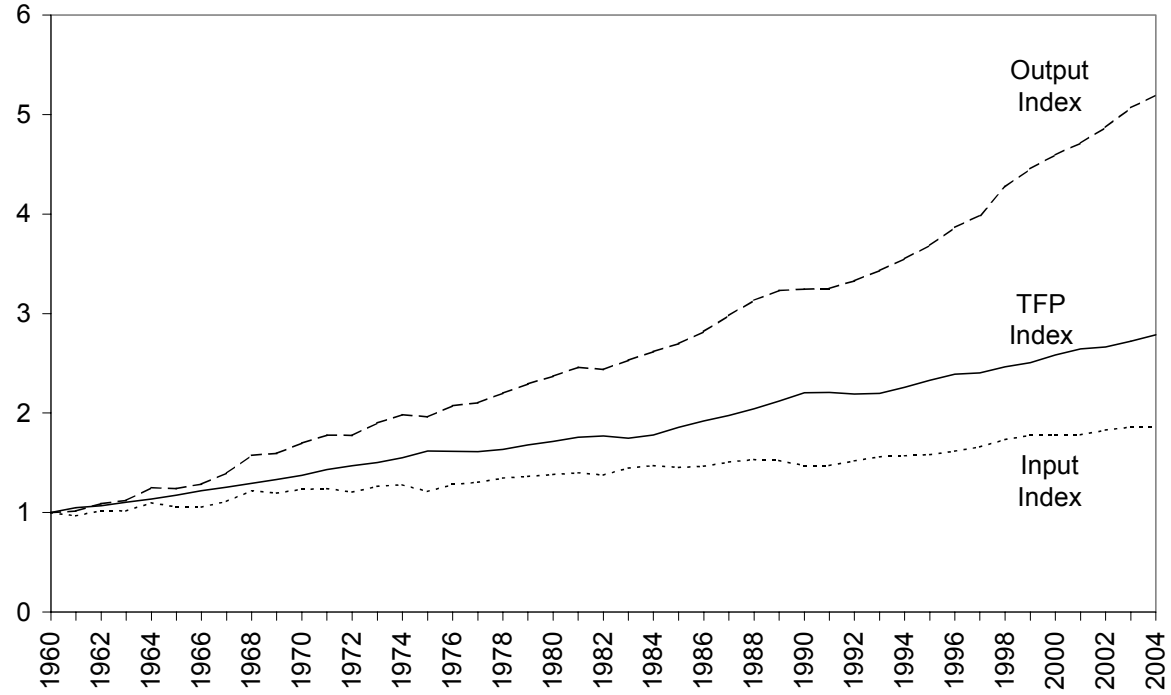
Source: Diewert-Lawrence Australian productivity database

Input prices shown in figure 4 have exhibited more variability with labour prices increasing the most steeply at an annual average rate of around 7.2 per cent. Inventories user cost prices increased the second most with an average annual growth rate of around 5.4 per cent. Non-ICT capital user cost prices increased at an average annual rate of around 4.5 per cent. Import prices, on the other hand, have largely levelled off since 1987 to produce an average annual increase of around 3.9 per cent. ICT (comprising computers, software and electrical machinery) capital user cost prices have increased the least with an average annual growth of around 0.9 per cent for the whole period. However, ICT user cost prices peaked in 1987 and have decreased at an average annual rate of 5.5 per cent since then.

2.3 Productivity indexes

The best summary measures of economic performance are total factor productivity and the economic rate of return. TFP measures the amount of total outputs produced per unit of overall inputs. Improvements in TFP can be brought about by technical change, improved management and the elimination of inefficient work practices. The economic rate of return provides a measure of economic profitability based on the current market value of assets.

Figure 5: **Output, input and total factor productivity indexes, 1960–2004**

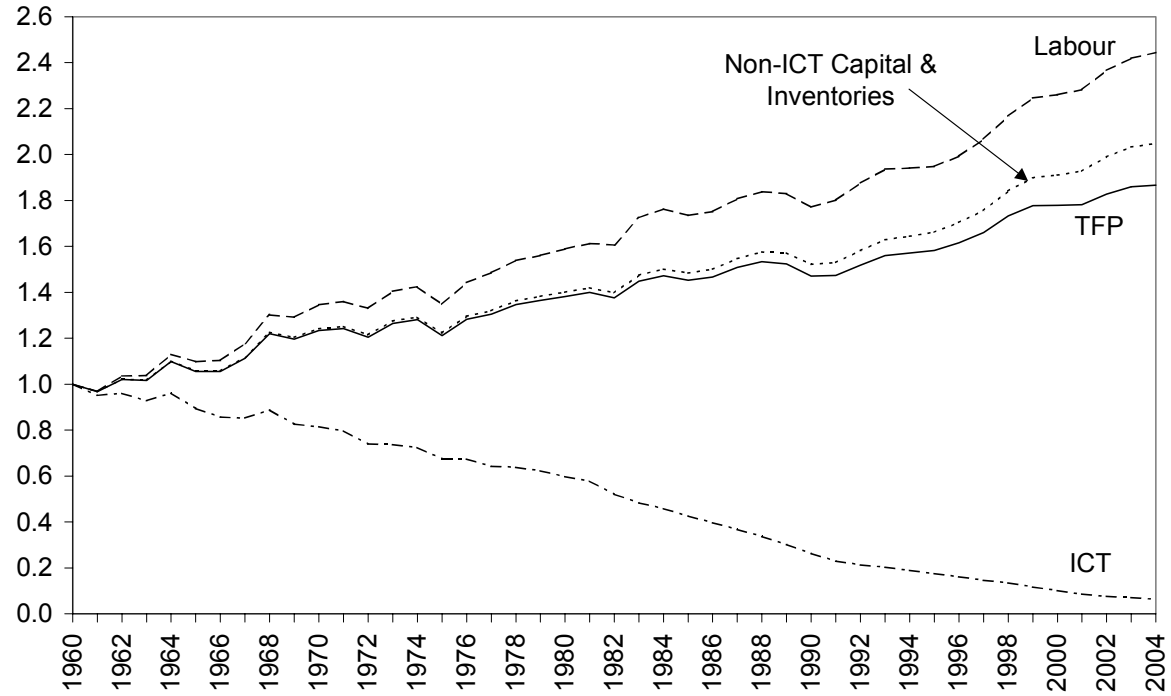


Source: Diewert-Lawrence Australian productivity database

The Australian economy's expanded market sector TFP is presented in figure 5 and table 1 along with total output and total input quantity indexes. TFP has increased relatively steadily over the 45 year period with an average annual change of 1.47 per cent. The average annual change for the first 25 years was 1.69 per cent compared to 1.21 per cent for the last 20 years. Greater volatility in TFP levels is observed in the early years of the 45 year period, probably due to poorer data quality initially.

The growth in TFP has been brought about by an average annual increase in outputs of 3.85 per cent over the 45 year period compared to 2.37 per cent for inputs. The output index is formed by aggregating the quantities of the consumer commodity, government consumption, exports, the 11 investment goods, the 3 inventory changes and the negative of the import quantity. The input index is formed by aggregating the quantities of labour, the 10 capital stocks and the 5 inventory stocks. There is one more investment good than capital stock because we do not include housing stocks as part of the production sector but we do include housing investment as a production sector output. We also do not include inventory change terms for the two types of land—rural and commercial.

Figure 6: **Partial productivity indexes, 1960–2004**



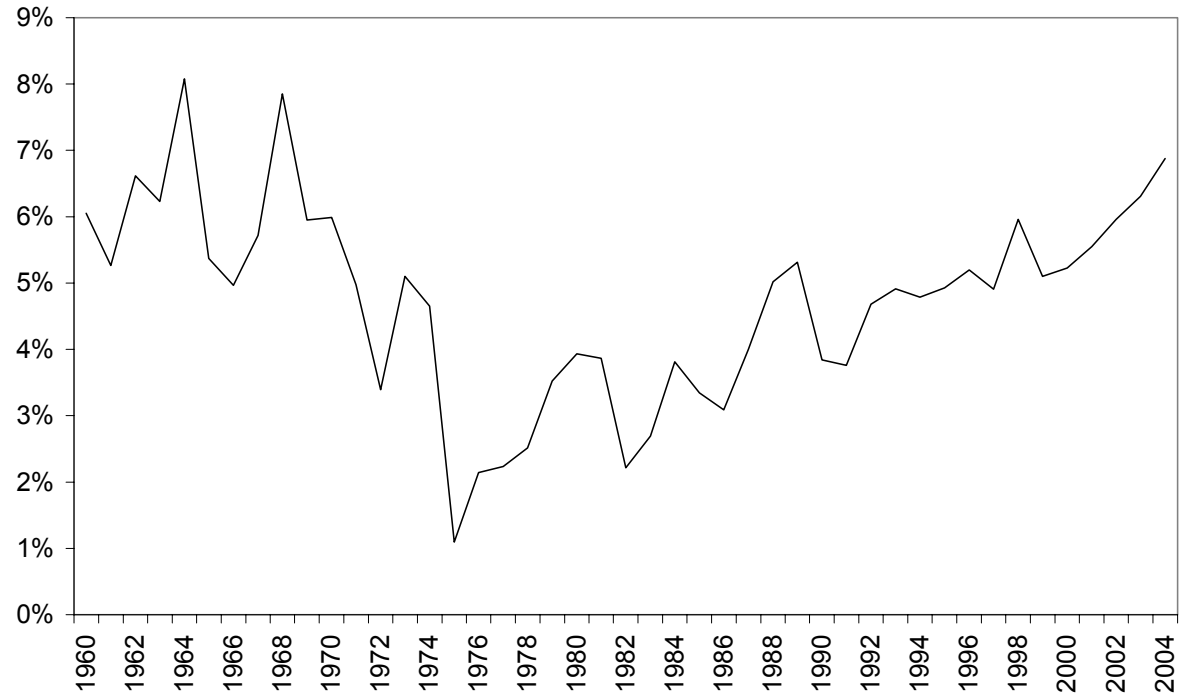
Source: Diewert-Lawrence Australian productivity database

In figure 6 we present the partial productivity indexes of the three main input groups along with the TFP index. The partial productivity indexes are formed by dividing the total output quantity index by the quantity index for the relevant input group. Labour productivity increased the most rapidly over the 45 year period with an average annual change of around 2 per cent. The partial productivity of non-ICT capital and inventory inputs increased slightly more than TFP with an average annual change of around 1.6 per cent. The partial productivity of ICT inputs, on the other hand, declined steadily by a quite large 6 per cent per annum on average. This reflects the rapidly increasing use of computers, software and electrical machinery from a low base over this period. Over the period, TFP increased with rapid technical change giving rise to new, more efficient, input combinations as ICT inputs progressively displaced other inputs.

The profitability of the expanded market production sector is reflected in the real pre-tax rates of return presented in figure 7. The real rate of return is derived as the ratio of the value of outputs less variable inputs less depreciation less business property taxes plus the rate of capital gains relative to the sum of capital and inventory asset values in each period. The before-tax real rate of return averaged 4.7 per cent for the 45 year period. The highest before-tax real rate of return achieved was 8.1 per cent in 1964 while the lowest was 1.1 per cent in 1975. Since 1975 the before-tax real rate of return has trended upwards to finish at 6.9 per cent in 2004. The post-tax real return, the return which drives investment decisions, averaged

around 2.3 per cent over the 45 year period although this increased to 3.1 per cent over the last decade and 4.5 per cent in 2004.

Figure 7: **Real, pre-tax rates of return in the expanded market sector, 1960–2004**



Source: Diewert-Lawrence Australian productivity database

It should be noted that the size of the real rate of return will, of course, depend on the range of assets included in the calculation. Our real pre-tax and post-tax rates of 4.7 and 2.3 per cent, respectively, are relative to a comprehensive range of assets including productive capital, inventories and land. If only productive capital is included in the denominator then the average real pre-tax rate of return increases to 7.8 per cent. If non-farm, farm and livestock inventories are also included then the average real pre-tax rate falls to 5.8 per cent. Then adding land stocks leads to a further fall to the 4.7 per cent reported above.

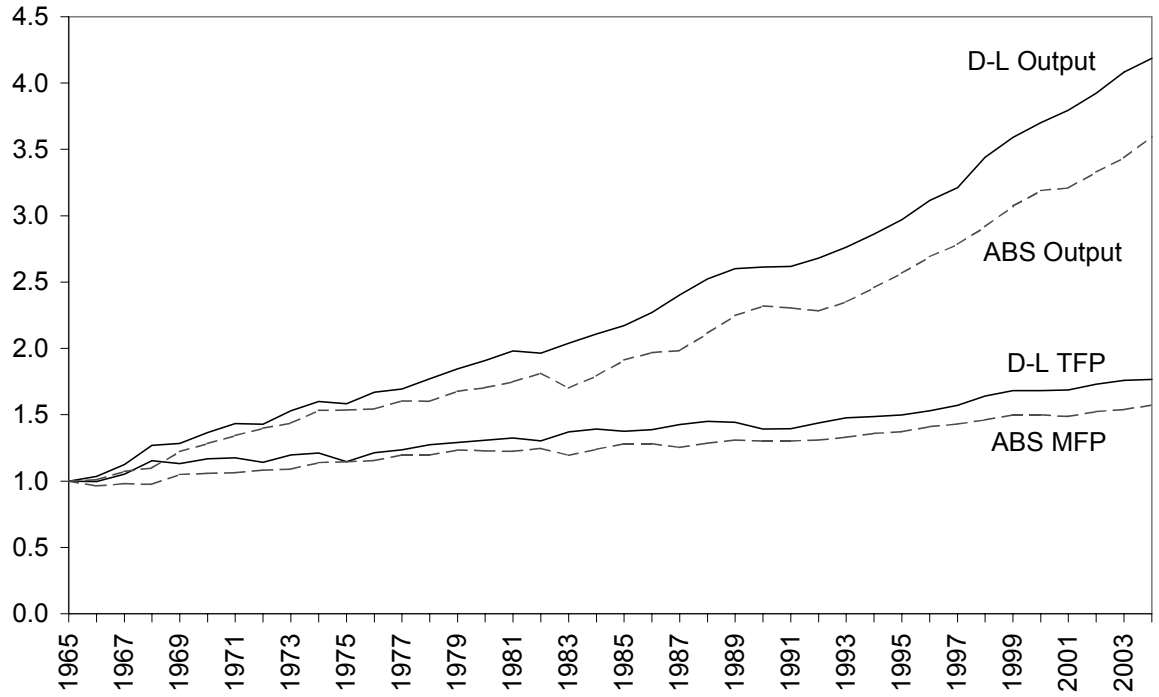
The real after-tax rate of return for most western countries has been found to be in the range of 3 to 5 per cent (Robbins and Robbins 1992). The average real after-tax rate of return for the United States was found to be 3.3 per cent for the period from 1954 to 1990. At 2.3 per cent the average real after-tax rate of return observed for Australia over the 45 years to 2004 was below this range although the 3.1 per cent average for the past decade is just above the minimum of the range.

2.4 Comparison with ABS multifactor productivity

As noted in section 2.1, there are a number of important differences between the DL Australian productivity database and that used by the ABS in forming its MFP estimates. The

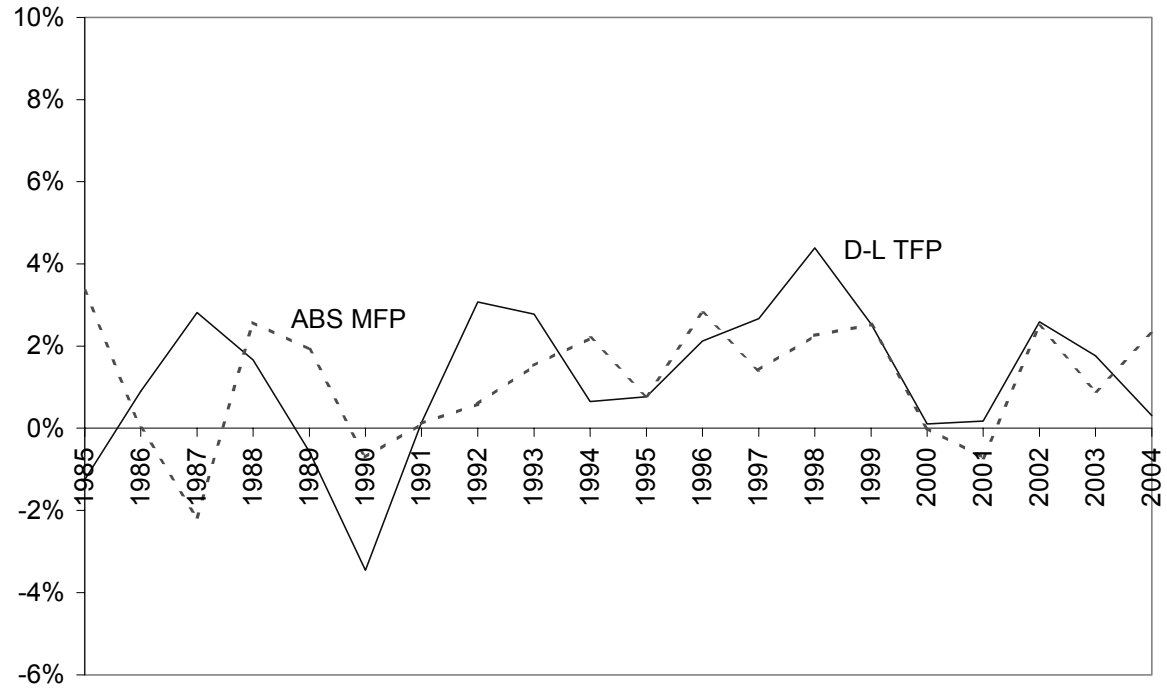
DL database covers a much broader section of the economy, uses producers' prices to aggregate outputs and inputs, is based on sources of final demand and uses a consistent approach to forming capital stocks and flows. Given these differences, it is worthwhile comparing the productivity results obtained from the two databases.

Figure 8: **DL and ABS productivity and output indexes, 1965–2004**



Source: Diewert-Lawrence Australian productivity database and ABS Cat No 5204, Table 22.

Figure 9: **Yearly changes in the DL and ABS productivity indexes, 1985–2004**



Source: Diewert-Lawrence Australian productivity database and ABS Cat No 5204, Table 22.

Table 1: **DL output, input and productivity indexes, 1960–2004**

Year	*Output* *index*	*Labour* *index*	*Capital* *index*	*TFP* *index*	*Partial Pr Labour* *index*	*Partial Pr ICT* *index*	*Partial Pr Non–ICT* *index*	*ABS MFP* *index*
1960	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
1961	1.0153	1.0480	1.0542	0.9672	0.9688	0.9507	0.9675	
1962	1.0905	1.0523	1.1102	1.0209	1.0363	0.9603	1.0218	
1963	1.1213	1.0802	1.1649	1.0163	1.0381	0.9279	1.0178	
1964	1.2494	1.1048	1.2256	1.0984	1.1309	0.9625	1.1007	
1965	1.2414	1.1309	1.2986	1.0562	1.0977	0.8943	1.0589	1.0000
1966	1.2881	1.1664	1.3749	1.0549	1.1043	0.8573	1.0584	0.9646
1967	1.3974	1.1869	1.4533	1.1131	1.1774	0.8523	1.1178	0.9800
1968	1.5772	1.2114	1.5336	1.2197	1.3019	0.8884	1.2259	0.9754
1969	1.5946	1.2340	1.6324	1.1960	1.2922	0.8254	1.2031	1.0508
1970	1.6971	1.2612	1.7246	1.2342	1.3456	0.8145	1.2424	1.0585
1971	1.7792	1.3082	1.8152	1.2425	1.3600	0.7966	1.2514	1.0631
1972	1.7741	1.3334	1.9105	1.2054	1.3305	0.7400	1.2148	1.0831
1973	1.9005	1.3533	1.9863	1.2642	1.4043	0.7375	1.2752	1.0908
1974	1.9858	1.3935	2.0605	1.2804	1.4251	0.7241	1.2921	1.1400
1975	1.9638	1.4575	2.1493	1.2114	1.3474	0.6755	1.2228	1.1462
1976	2.0737	1.4374	2.2202	1.2825	1.4427	0.6751	1.2957	1.1554
1977	2.1037	1.4163	2.2913	1.3054	1.4854	0.6425	1.3203	1.1969
1978	2.2008	1.4296	2.3536	1.3469	1.5394	0.6384	1.3631	1.1954
1979	2.2925	1.4691	2.4216	1.3649	1.5605	0.6233	1.3823	1.2338
1980	2.3704	1.4921	2.5109	1.3820	1.5887	0.5971	1.4010	1.2292
1981	2.4605	1.5256	2.5898	1.3997	1.6128	0.5784	1.4202	1.2246
1982	2.4381	1.5185	2.7010	1.3763	1.6056	0.5210	1.3987	1.2477
1983	2.5306	1.4677	2.8191	1.4479	1.7242	0.4845	1.4748	1.1938
1984	2.6191	1.4856	2.9144	1.4719	1.7630	0.4581	1.5014	1.2400
1985	2.6969	1.5546	3.0116	1.4535	1.7348	0.4257	1.4844	1.2815
1986	2.8186	1.6094	3.1233	1.4666	1.7513	0.3976	1.5003	1.2815
1987	2.9816	1.6501	3.2412	1.5078	1.8069	0.3680	1.5464	1.2538
1988	3.1335	1.7044	3.3579	1.5328	1.8385	0.3371	1.5763	1.2862
1989	3.2300	1.7648	3.4919	1.5240	1.8302	0.3026	1.5715	1.3108
1990	3.2443	1.8320	3.6531	1.4713	1.7709	0.2626	1.5215	1.3015
1991	3.2518	1.8052	3.7986	1.4734	1.8013	0.2297	1.5296	1.3031
1992	3.3298	1.7744	3.8715	1.5187	1.8765	0.2139	1.5816	1.3108
1993	3.4304	1.7719	3.9178	1.5608	1.9361	0.2038	1.6295	1.3308
1994	3.5518	1.8303	3.9885	1.5710	1.9405	0.1897	1.6444	1.3600
1995	3.6873	1.8930	4.0692	1.5831	1.9479	0.1759	1.6618	1.3708
1996	3.8656	1.9403	4.1939	1.6167	1.9923	0.1614	1.7035	1.4092
1997	3.9882	1.9296	4.3314	1.6598	2.0668	0.1472	1.7561	1.4292
1998	4.2720	1.9712	4.4985	1.7326	2.1672	0.1356	1.8408	1.4615
1999	4.4557	1.9837	4.7079	1.7765	2.2461	0.1177	1.8986	1.4985
2000	4.5939	2.0329	4.9134	1.7784	2.2598	0.1023	1.9107	1.4985
2001	4.7126	2.0649	5.1409	1.7816	2.2822	0.0859	1.9275	1.4877
2002	4.8711	2.0587	5.3279	1.8277	2.3661	0.0763	1.9894	1.5246
2003	5.0665	2.0947	5.5126	1.8600	2.4188	0.0706	2.0327	1.5385

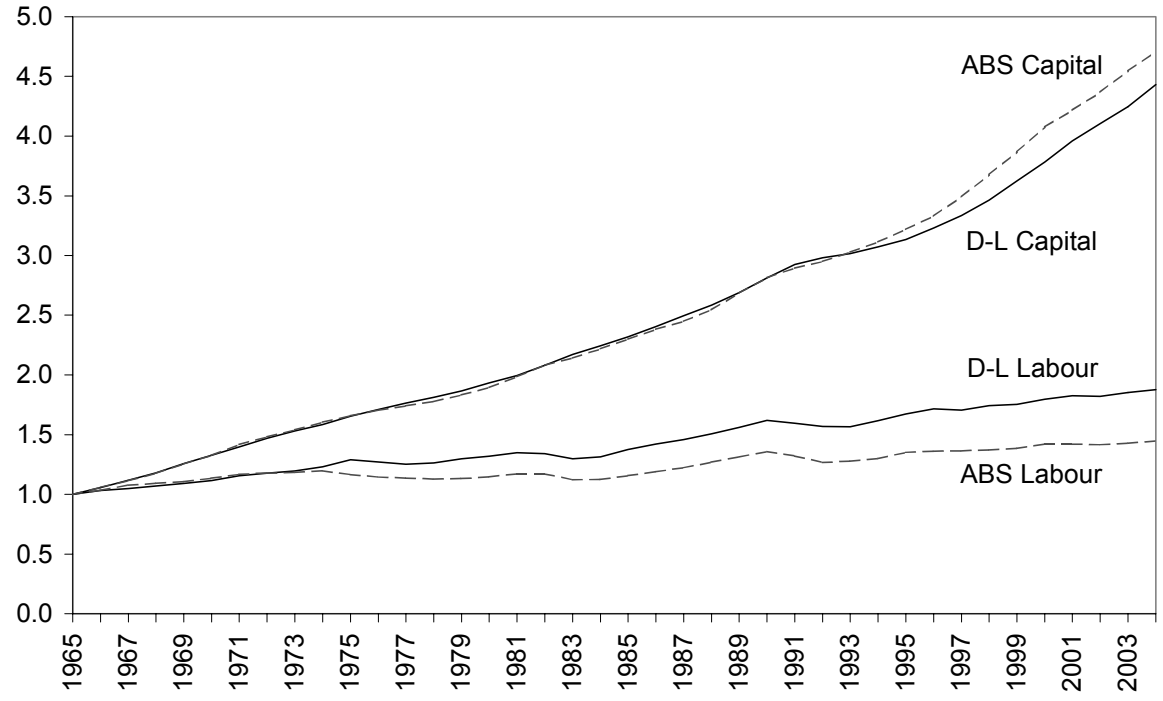
2004	5.1952	2.1251	5.7542	1.8657	2.4447	0.0635	2.0480	1.5738

The ABS MFP series is only available for the shorter period 1964–65 to 2003–04 so comparisons concentrate on this period. DL TFP growth has been an average of 1.51 per cent per annum for the 40 year period 1964–65 to 2003–04, 1.34 per cent per annum for the 20 year period 1984–85 to 2003–04, 1.72 per cent per annum for the 15 year period 1989–90 to 2003–04, and 1.85 per cent per annum for the 10 year period 1994–95 to 2003–04.

This compares with ABS MFP average changes of 1.19 per cent per annum for the 40 year period 1964–65 to 2003–04, 1.10 per cent per annum for the 20 year period 1984–85 to 2003–04, 1.37 per cent per annum for the 15 year period 1989–90 to 2003–04, and 1.55 per cent per annum for the 10 year period 1994–95 to 2003–04.

The DL database, thus, produces somewhat higher productivity growth rates on average than the narrower ABS series. This demonstrates the importance of including the additional service sectors included in the DL database. To put this in perspective, the DL database covers around 93 per cent of labour inputs in the economy whereas the narrower ABS coverage picks up less than 60 per cent of labour inputs by value (ABS 2004, Cat No 5204, table 59). In terms of output, the DL database covers around 95 per cent of value added in the economy whereas the narrower ABS coverage picks up around two-thirds of value added (ABS 2004, Cat No 5204, table 11).

Figure 10: **DL and ABS labour and capital input indexes, 1965–2004**



Source: Diewert-Lawrence Australian productivity database and ABS Cat No 5204, Table 22.

The DL and ABS productivity and output indexes are presented in figure 8 while yearly changes in the productivity indexes for the last two decades are presented figure 9. Output has increased more rapidly in the broader DL expanded market sector than the narrower ABS market sector—3.67 per cent per annum on average compared to 3.28 per cent.

Inputs have increased more rapidly in the broader DL expanded market sector than the narrower ABS market sector—2.21 per cent per annum on average compared to 2.12 per cent. However, labour inputs have increased much more rapidly in the broader DL expanded market sector than the narrower ABS market sector—1.62 per cent per annum on average compared to 0.95 per cent. This divergence has occurred progressively since around 1975. The increase in the broader DL labour input is in line with increases in the working age population and the increasing importance of the services sector in the economy. Labour and capital inputs from the two databases are plotted in figure 10.

Capital inputs have increased marginally less rapidly in the broader DL expanded market sector than the narrower ABS market sector—3.82 per cent per annum on average compared to 3.97 per cent reflecting the relative labour intensity of the key services sectors not included in the ABS coverage.

3 Modelling the role of ICT

3.1 The basic production function methodology

Our goal in this report is to accomplish two things:

- to decompose Australian expanded market sector total factor productivity growth into a part that is due to technical change (a shift in the production function) and a part that is due to nonconstant returns to scale (a movement along the production function); and
- to determine whether ICT inputs contribute more or less to output growth than their cost.

Our basic approach is to estimate a four input, one output aggregate production function model for the Australian expanded market sector. Our output is a Fisher chained aggregate of:

- consumer commodities;
- government consumption;
- exports; and
- investment in non-residential and other construction, software, mineral exploration, artistic originals, dwellings, computers, electrical machinery, industrial machinery, motor vehicles, other transport equipment, other machinery, changes in non-farm inventories,

change in farm inventories other than livestock and changes in livestock inventories and gross fixed capital formation.

Our four inputs are:

- imports;
- labour;
- non-ICT capital service inputs consisting of a Fisher chained aggregate of the capital services of the following components: non-residential and other construction, mineral exploration, artistic originals, industrial machinery, motor vehicles, other transport equipment, other machinery, non-farm inventories, farm inventories, livestock, commercial land and rural land; and
- ICT capital service inputs consisting of a Fisher chained aggregate of software, computers and electrical machinery.

Although it would be useful to disaggregate further, our use of a very flexible functional form for the production function means that the number of parameters that would have to be estimated grows as the square of the number of commodities in the production function model. Since our final model with just four inputs had 40 unknown parameters, we decided to estimate a model with only one output and four inputs.

As noted above, in order to minimise the number of parameters that must be estimated, we have simplified the Australian expanded market sector to a considerable degree: we have only one economy-wide output, y, only one aggregate imports input, x_1, only one aggregate labour input, x_2, an aggregate of all non-ICT inputs into the expanded market sector, x_3, and an aggregate of software, computers and electrical equipment to represent ICT input, x_4. We assume that there is an aggregate market sector production function f of the form $y = f(x_1,x_2,x_3,x_4,t)$ for each year t. We also assume that the economy faces an aggregate inverse demand function for its output in year t of the form $p = P(y,t)$, where p is the selling price in period t if y units are placed on the market during that period and P(y,t) is the industry inverse demand function.

If there are increasing returns to scale in the industry, we cannot assume competitive profit maximising behaviour, since it is well known that competitive behaviour is not consistent with this situation. Hence, we consider the following *period t monopolistic profit maximisation problem*:

(1) $\max_x P[f(x,t),t]f(x,t) - w_1^t x_1 - w_2^t x_2 - w_3^t x_3 - w_4^t x_4$

where $x \equiv [x_1,x_2,x_3,x_4]$. The first order necessary conditions for the period t input vector $xt \equiv [x_1^t,x_2^t,x_3^t,x_4^t]$ to solve (1) are:

(2) $p^t \nabla_x f(x^t,t) + \{\partial P[y^t,t]/\partial y\} y^t \nabla_x f(x^t,t) = w^t$; $t = 0,1,\ldots,T$

where $p^t \equiv P[y^t,t]$ is the period t output price, $y^t \equiv f(x^t,t)$ is the period t output produced, $x^t \equiv [x_1^t,x_2^t,x_3^t,x_4^t]$ is the period t input vector, $w^t \equiv [w_1^t,w_2^t,w_3^t,w_4^t]$ is the period t input price vector and $\nabla_x f(x^t,t) \equiv [\partial f(x^t,t)/\partial x_1, \partial f(x^t,t)/\partial x_2, \partial f(x^t,t)/\partial x_3, \partial f(x^t,t)/\partial x_4]$ is the vector of first order partial derivatives of the period t production function with respect to the components of the input vector. Our data runs from 1960 to 2004 so we have 45 years of data and so we let t run from 0 to 44 = T.

It should be the case that the inverse demand curve is downward sloping so that:

(3) $\partial P(y^t,t)/\partial y \leq 0$; $t = 0,1,\ldots,T.$

If this is the case, then we can define the period t nonnegative markup m^t as follows:

(4) $m^t \equiv -[\partial P(y^t,t)/\partial y]y^t/P(y^t,t) \geq 0$; $t = 0,1,\ldots,T.$

Note that m^t is an elasticity (it gives minus the percentage change in selling price due to a one percent change in the output quantity supplied to the market) and so it is a pure number. We use the markup m^t to define the *markup factor* M^t as follows:

(5) $M^t \equiv 1 - m^t$; $t = 0,1,\ldots,T.$

We assume that M^t is greater than 0 for each t and it should be equal to or less than 1. M^t will equal 1 if m^t equals 0 so that we have competitive behaviour in this case.

If we make use of (4) and (5), we can rewrite equations (2) as follows:

(6) $w^t = p^t M^t \nabla_x f(x^t,t)$; $t = 0,1,\ldots, T.$

Now divide both sides of (6) by the period t output price p^t, assume that the elasticity of demand is constant over time, and then the resulting four equations become the following four estimating equations:

(7) $w_1^t/p^t = M\, \partial f(x^t,t)/\partial x_1$; $t = 0,1,\ldots,T;$

$w_2^t/p^t = M\, \partial f(x^t,t)/\partial x_2$;

$w_3^t/p^t = M\, \partial f(x^t,t)/\partial x_3$;

$w_4^t/p^t = M\, \partial f(x^t,t)/\partial x_4$.

However, this is not quite the end of our theoretical specification. *We also want to allow for a systematic over or undervaluation of the ICT input.* In particular, we would like to determine whether there is any evidence that producers systematically undervalue ICT inputs. To allow for this possibility, we generalise the fourth equation in (7) to the following equation:

(8) $w_4^t/p^t = M\phi\partial f(x_1^t,x_2^t,x_3^t,x_4^t,t)/\partial x_4$; $\quad t = 0,1,\ldots,T$

where ϕ is the ICT *relative efficiency factor*. If producers consistently undervalue the contribution of ICT relative to other inputs, then ϕ will be a positive constant that is less than one. If producers consistently overvalue the contribution of ICT inputs to production, then ϕ will be a positive constant that is greater than one.

In the following section, we consider the problems involved in picking a functional form for the production function f.

3.2 Choosing a functional form for the production function

A starting point for the functional form for the production function that we will use is the following variant of a *normalised quadratic functional form*:[1]

(9) $f(x_1,x_2,x_3,x_4,t) \equiv b + c_1x_1 + c_2x_2 + c_3x_3 + c_4x_4 + d_1x_1t + d_2x_2t + d_3x_3t + d_4x_4t + et$

$$- (1/2)\, x^TSx/(\theta_1x_1 + \theta_2x_2 + \theta_3x_3 + \theta_4x_4)$$

where $x^TSx \equiv \sum_{i=1}^4\sum_{j=1}^4 s_{ij}\, x_i\, x_j$ and $S \equiv [s_{ij}]$ is a 4 by 4 symmetric positive semidefinite substitution matrix of unknown parameters and the θ_i are predetermined positive parameters. In our empirical work, we calculated the sample means of the x_i, call these means x_i^* say, and then set θ_i equal to $x_i^*/(x_1^*+x_2^*+x_3^*+x_4^*)$ for i = 1,2,3,4. The other unknown parameters are b, the four c_i and e. Assuming for the moment that c equals 0, the parameter b determines the *degree of returns to scale*: if b = 0, then there are constant returns to scale in production; if b is less than 0, then there are increasing returns to scale and if b is greater than 0, then there are decreasing returns to scale. The parameter e is a *technical progress parameter*; ie if e is greater than 0, then there is *output augmenting technical progress*. However, if e is greater than 0, then if inputs remain constant, this will tend to decrease the degree of returns to scale over time, so that e plays two roles in our model. The c_i parameters are essentially *marginal productivity parameters*: the bigger c_i is, the bigger will be the increase in output if a marginal unit of x_i is added. The d_i parameters change the baseline marginal productivity parameters over time and hence they are essentially *input augmenting technical progress parameters*; ie if d_i is greater than 0, then over time, the same amount of input i will produce a greater amount of output.

In order to identify all of the parameters (and to reduce multicollinearity), it is necessary to place some linear restrictions on the matrix S. We choose the following four linear restrictions:

[1] This functional form is a generalization of a functional form due to McFadden (1978; 279) and is due to Diewert and Wales (1987; 53-54) in the cost function context, who called it the Generalized McFadden Symmetric functional form. Diewert and Wales (1992) later applied this functional form in the cost and profit function contexts and called it the Normalized Quadratic functional form.

(10) $\sum_{j=1}^{4} s_{ij} = 0$; $\quad i = 1,2,3,4.$

It can be shown, using the techniques in Diewert and Wales (1987, p.54) that with the parameters b and e equal to 0, the normalised quadratic production function defined by (9) and (10) is flexible in the class of constant returns to scale production functions. The extra parameter b allows us to achieve any degree of returns to scale locally. Hence, the functional form defined by (9) and (10) appears to be sufficiently flexible for our purposes.

As was shown in Diewert and Wales (1987, p.54), the positive semidefiniteness condition on the symmetric matrix S can be imposed without destroying the flexibility properties of the normalised quadratic functional form by setting S equal to the following matrix product:

(11) $S = UU^T$

where $U \equiv [u_{ij}]$ is a 4 by 4 lower triangular matrix[2] and U^T is the transpose of U. The restrictions (10) on S can be imposed by imposing the following restrictions on U:

(12) $U^T 1_4 = 0_4$

where 1_4 and 0_4 are vectors of 1's and 0's respectively of dimension 4. The restrictions (12) on the elements of U can be used to solve for the main diagonal u_{ii} in terms of the off diagonal u_{ij}. Hence, as a result of using the restrictions (12) on U and the fact that U is lower triangular, there are only 6 independent nonzero parameters in the U matrix: u_{21}, u_{31}, u_{41}, u_{32}, u_{42} and u_{43}.

Partially differentiate the $f(x_1,x_2,t)$ defined by (9) with respect to x_1 to x_4 and substitute these derivatives into the estimating equations (7) and (8). The resulting estimating equations become the following 4 equations:

(13) $w_i^t/p^t = M\{c_i + d_i t - \sum_{j=1}^{4} s_{ij} x_j^t/\theta^T x^t + (1/2)x^{tT}Sx^t\, \theta_i/[\theta^T x^t]^2\}$; i=1,2,3; t=0,…,44;

(14) $w_4^t/p^t = M\phi\{c_4 + d_4 t - \sum_{j=1}^{4} s_{4j} x_j^t/\theta^T x^t + (1/2)x^{tT}Sx^t\, \theta_4/[\theta^T x^t]^2\}$; t = 0,…,44

where $\theta^T x^t \equiv \sum_{j=1}^{4} \theta_j x_j^t$. We may add the production function equation (9) for each time period to equations (13) and (14) as a fifth estimating equation—in fact, the production function equation has to be added in order to identify the parameters in (13) and (14):

(15) $y^t = b + c^T x^t + t d^T x^t + et - (1/2)\, x^{tT}Sx^t/\theta^T x^t$; $\quad t = 0,\ldots,44.$

Note that we have simplified our notation in (15) by defining $c^T x^t \equiv c_1 x_1^t + c_2 x_2^t + c_3 x_3^t + c_4 x_4^t$ and $t d^T x^t \equiv d_1 x_1^t\, t + d_2 x_2^t\, t + d_3 x_3^t\, t + d_4 x_4^t\, t$. The endogenous variables in (13)–(15) are w_i^t/p^t for i = 1,2,3,4 (the price of input i divided by the price of output where the inputs are imports, labour, non-ICT and ICT capital services) and y^t (output in period t). The variables

[2] The matrix U is lower triangular if and only if $u_{ij} = 0$ if $i < j$.

that we condition on are the four inputs, x_1^t to x_4^t, and time, t.[3] Note that if M and ϕ were equal to one and we ignored the restrictions on the matrix S in (11), our estimating equations would be linear in the unknown parameters. Taking into account the restrictions on the elements of S given by (11) and (12), there are six unknown u_{ij} parameters, one b, four c_i, four d_i, one e, one M and one ϕ parameter to estimate, or 18 parameters in all to estimate. Since we have 5 equations and 45 years of data, we have a total of 225 degrees of freedom.

In order to check the reasonableness of our estimates, it is useful to calculate the degree of returns to scale that are implied by our estimated production function at each data point. Thus, denote the estimates of b and e by b* and e*, the vectors of estimated c_i and d_i coefficients by c* and d* and the matrices of estimated U and S coefficients by U* and S* where $S^* = U^*U^{*T}$. Define the year t *estimated output level*, y^t*, as follows:

$$(16)\quad y^{t*} \equiv f^*(x^t,t) \equiv b^* + c^{*T}x^t + td^{*T}x^t + e^*t - (1/2)\, x^{tT}S^*x^t/\theta^T x^t\,; \qquad t = 0,1,\ldots,44.$$

Returns to scale in year t, ρ^t, can be defined as follows:

$$(17)\quad \rho^t \equiv \{\textstyle\sum_{j=1}^4 x_j^t\, \partial f^*(x^t,t)/\partial x_j\}/f^*(x^t,t) \qquad t = 0,1,\ldots,44$$

$$= \{f^*(x^t,t) - b^* - e^*t\}/f^*(x^t,t)$$

where $f^*(x^t,t)$ is defined by (16) and the second line in (17) follows from differentiating (16). If ρ^t equals one, then there are locally constant returns to scale in year t; if ρ^t is greater than one, then there are locally increasing returns to scale in year t and if ρ^t is less than one, then there are locally decreasing returns to scale in year t. The number ρ^t can be interpreted as the year t percentage increase in output that would result if the year t inputs were all increased by one percent.

It is also useful to calculate the amount of technical progress (or shift in the production function) that is implied by our estimates for each year as a further check on the reasonableness of our estimates. Thus, define the year t *technical progress coefficient*, τ^t, as follows:

$$(18)\quad \tau^t \equiv \{\partial f^*(x^t,t)/\partial t\}/f^*(x^t,t) \qquad t = 0,1,\ldots,44$$

$$= \{d^{*T}x^t + e^*\}/f^*(x^t,t)$$

where the second equation in (18) follows by differentiating the f* defined by (16) with respect to t. From the first equation in (18), it can be seen that τ^t is the percentage increase in

[3] We have not attempted to control for any possible simultaneous equations bias by using an instrumental variables method of estimation since different choices of instruments frequently lead to very different parameter estimates and hence this method of estimation suffers from a lack of reproducibility. In addition, the estimated error variances in our simple nonlinear regression model were relatively small.

output (at year t input levels) that has resulted from technical progress over the output level that could have been produced in the previous year using the same input levels[4].

As a final check on the reasonableness of the estimated production function parameters, it is useful to calculate the inverse elasticities of demand that are implied by our estimates. Again we define the estimated production function, f*, by (16). The estimated *i^{th} inverse input demand function*, $\omega_i(x,t)$, is defined as follows:

$$(19) \quad \omega_i(x,t) \equiv \partial f^*(x,t)/\partial x_i \; ; \qquad i = 1,2,3,4.$$

Equations (13) and (14) when M and ϕ equal one corresponds to a situation where the economy behaves in a perfectly competitive manner and so in this case, it can be seen that $\omega_i(x^t,t)$ equals w_i^t/p^t, the year t i^{th} input price divided by the year t output price, which we can call a *normalised input price*. Thus in the competitive case, the functions defined by (19) give the normalised input prices as functions of inputs x used in year t and hence these functions can be regarded as inverse demand functions. The ij^{th} element of the matrix of year t *inverse input elasticities of demand*, e_{ij}^t, that are implied by our estimated production function can be defined as follows:

$$(20) \quad e_{ij}^t \equiv x_j^t\{\partial\omega_i(x^t,t)/\partial x_j\}/\omega_i(x^t,t) \equiv x_j^t\{\partial^2 f^*(x^t,t)/\partial x_i\partial x_j\}/\partial f^*(x^t,t)/\partial x_i \; ; \quad i,j = 1,2,3,4.$$

3.3 The problem of trending elasticities

The production function defined by (9) proved to be not quite flexible enough to adequately model the Australian expanded market sector. It turns out that if there are strong trends in prices and quantities (as there are in the Australian data), then the elasticities defined by (20) in the previous section will also exhibit strong trends. This is a characteristic of the normalised quadratic functional form and the reason why these trending elasticities occur in the context of trending data was explained in the profit function context by Diewert and Lawrence (2002, pp.149–150).

However, Diewert and Lawrence (2002, p.150) also explained how to deal with this problem. We have followed the example of most applied production function researchers and allowed technical progress to affect the constant terms in the system of inverse demand functions defined by (13) and (14) but we have left the substitution matrix S unchanged over time. To solve the problem of trending elasticities, all we have to do is allow S to change over time as well. Thus, simply set the matrix B in (9) and (13)–(15) equal to a weighted average of a matrix A (which characterises substitution possibilities at the beginning of the sample period)

[4] Note that changes in the competitive environment and regulatory reforms can also shift the aggregate production function over time. Thus, the shift in the aggregate production function could more accurately be described as technical and organisational progress. However, we use the standard short hand term of technical progress in the remainder of the report.

and a matrix B (which characterises substitution possibilities at the end of the sample period); ie define s as follows in terms of A and B and the time variable t:

(21) $S^t = (1 - [t/44])A + [t/44]B$; $t = 0,1,2,\ldots,44.$

Note that there are 45 sample observations. Essentially, we now let technical progress affect not only the constant terms in (13)–(15) but we also allow it to affect substitution possibilities as well. Another way of viewing our new functional form is that we allow the functional form to be flexible at two points (the first sample point and the last) instead of the usual one point.

As usual, the correct curvature conditions can be imposed globally by setting A and B equal to the product of UU^T and VV^T respectively, where U and V are lower triangular matrices; i.e., set:

(22) $C = UU^T$ and $D = VV^T$; U and V lower triangular.

We also impose the following normalisations on the matrices U and V:

(23) $U^T 1_4 = 0_4$; $V^T 1_4 = 0_4$.

The net effect of all of this algebra is to add an additional 6 parameters to the 18 parameters identified earlier; ie in addition to the u_{21}, u_{31}, u_{41}, u_{32}, u_{42} and u_{43} independent parameters in the U matrix, we now have the 6 new independent parameters v_{21}, v_{31}, v_{41}, v_{32}, v_{42} and v_{43} in the V matrix. Thus, the total number of parameters to be estimated in our model is now 24. This technique of imposing price flexibility at two points is due to Diewert and Lawrence (2002, p.150).

There remains another problem with our initial production function model—it does not model adequately the complex way in which technical progress takes place. In the following section, we discuss how our model can be generalised in order to deal with these complexities.

3.4 Modelling technical progress

Technical progress does not take place in the very smooth way that is implied by our production function model. Instead, there appear to be periods of time where technical progress is rapid and other periods where it seems to be negligible. In addition, there are biases in the way technical progress occurs; at times, it can be labour saving and at other times, output augmenting. In order to be able to capture the changing nature of technical progress, we now generalise the production function defined by (9) and (21) above to the following *splined normalised quadratic production function*:

(24) $f(x,t) \equiv b + g(t) + c^T x^t + \sum_{j=1}^4 h_j(t)x_j - (1/2)x^{tT}\{1-[t/44])A+[t/44]B\}x^t/\theta^T x^t$; t=0,..,44

where the functions of time t g(t) and $h_j(t)$ are linear spline functions. These spline functions are piecewise linear functions of time t that are also continuous. The number of linear segments depends on the number of break points chosen. A break point is a positive integer t_k which is less than 44. We illustrate how g(t) is defined if we choose three break points, $0 < t_1 < t_2 < t_3 < 44$:

$$
\begin{aligned}
(25)\quad g(t) &\equiv e_1 t && \text{for } t = 0,1,2,\ldots, t_1 ;\\
&\equiv e_1 t_1 + e_2(t - t_1) && \text{for } t = t_1+1, t_1+2, \ldots, t_2 ;\\
&\equiv e_1 t_1 + e_2(t_2 - t_1) + e_3(t - t_2) && \text{for } t = t_2+1, t_2+2, \ldots, t_3 ;\\
&\equiv e_1 t_1 + e_2(t_2 - t_1) + e_3(t_3 - t_2) + e_4(t - t_3) && \text{for } t = t_3+1, t_3+2, \ldots, 44 ;
\end{aligned}
$$

The e_i are unknown parameters to be estimated. Thus, with three break points, there are four e_i that need to be estimated. Note that if $e_1 = e_2 = e_3 = e_4 = e$, then g(t) equals e_t, and hence our new spline model for output augmenting technical change boils down to our earlier smooth output augmenting technical change model. We can similarly illustrate how to define say $h_1(t)$ if we choose the two break points t_1 and t_2:

$$
\begin{aligned}
(26)\quad h_1(t) &\equiv d_{11} t && \text{for } t = 0,1,2,\ldots, t_1 ;\\
&\equiv d_{11} t_1 + d_{12}(t - t_1) && \text{for } t = t_1+1, t_1+2, \ldots, t_2 ;\\
&\equiv d_{11} t_1 + d_{12}(t_2 - t_1) + d_{13}(t - t_2) && \text{for } t = t_2+1, t_2+2, \ldots, 44.
\end{aligned}
$$

Thus, with the choice of two break points, there are three new parameters to be estimated in our new model, d_{11}, d_{12} and d_{13}, which replace the single parameter d_1 in our old model. The function $h_1(t)$ defined by (26) simply decomposes the time trend t over the entire sample period into the sum of three partial time trends. The first partial time trend increases linearly until period t_1 is reached and then a new linear time trend takes over until year t_2 is reached. At that point, a final linear time trend takes over until the end of the sample period has been reached.

Essentially, the production function defined by (24) allows for differential rates of output and input augmenting technical progress over the various time intervals defined by the break points pertaining to the five linear spline functions. This increases the flexibility of the functional form but at a cost: we now have to estimate many more technical change parameters instead of the previous five technical change parameters, d_1, d_2, d_3, d_4 and e. In our empirical work, we found that in order to adequately fit the data, we required from one to five break points in each of our five estimating equations. Thus, the previous five technical change parameters were replaced by a total of 21 technical change parameters, leading to a model with a total of 40 unknown parameters.

Once the parameters for the new production function defined by (24) have been estimated we can use the first equation in definition (17) to define the corresponding returns to scale in each year, ρ^t, and we can use the first equation in definition (18) to calculate the year t technical progress coefficient, τ^t. Similarly, we can use equations (20) in order to calculate the inverse input elasticities of demand, e_{ij}^t, that are implied by the estimated production function.

4 Econometric results

Since our final econometric model is a nonlinear, five equation regression model with 40 parameters to be estimated, the estimation process is not straightforward. Our estimating strategy was to start with a very simple model, obtain parameter estimates for the simple model and then use these estimates as starting values at the next stage where we estimated a more complicated model. The preliminary model defined by equations (13)–(15) was our starting point. We started with the competitive special case of this model which sets b = 0, e = 0, M = 1 and $\phi = 1$ and so the resulting model has 14 unknown parameters. We used the Nonlinear option in SHAZAM to do the estimation (see Whistler, White, Wong and Bates 2001). The final log likelihood for this model was 272.96.

Next, we added 6 extra parameters to this preliminary model by setting the substitution matrix equal to a weighted average of the beginning and end of sample period substitution matrices; recall equations (21) and (22) above. Thus, this second model has 20 unknown parameters. Using the finishing values from the previous model as starting values for the parameters in this new model led to new parameter estimates with no problems in obtaining convergence. The final log likelihood for this 20 parameter model was 300.45 and hence the additional 6 substitution parameters proved to be significant.

Next, we allowed for nonconstant returns to scale and the possibility that the value of ICT inputs is higher or lower than its user cost, ie we allowed the parameters b, e, M and ϕ to be estimated. The final log likelihood for this 24 parameter model was 314.15 and so the additional 4 parameters added to our previous model also proved to be significant.

Finally, we implemented the spline model described in the previous section. This entailed dropping the 5 technical change parameters in the previous model (d_1, d_2, d_3, d_4 and e) and replacing them by a total of 21 technical change parameters in the linear spline functions, leading to a model with a total of 40 unknown parameters. The single break point for the production function equation was chosen to be at the year 1975 or $t_1 = 15$. The break points for the first inverse demand function were $t_1 = 13$, $t_2 = 26$ and $t_3 = 32$; for the second inverse demand function were $t_1 = 16$, $t_2 = 20$, $t_3 = 23$ and $t_4 = 35$; for the third inverse demand function were $t_1 = 15$, $t_2 = 23$ and $t_3 = 35$ and for the fourth inverse demand function were $t_1 =$

11, $t_2 = 14$, $t_3 = 15$, $t_4 = 19$ and $t_5 = 24$. The final log likelihood for this 40 parameter model was 439.98 and so the additional 16 parameters added to our previous model proved to be highly significant. The parameter estimates for our final model are listed in table 2.

Table 2: **Estimated parameters for the expanded market sector production function**

Parameter	*Estimate*	*Std Error*	*t–statistic*	*Parameter*	*Estimate*	*Std Error*	*t–statistic*
b	0.7202	0.771	0.934	d_{41}	0.0318	0.018	1.738
e_1	-0.2911	0.060	-4.841	d_{42}	-0.0091	0.012	-0.735
e_2	-0.0472	0.084	-0.561	d_{43}	0.1105	0.044	2.533
c_1	1.2076	0.167	7.250	d_{44}	0.0330	0.017	1.956
c_2	1.4505	0.243	5.957	d_{45}	0.0256	0.015	1.695
c_3	1.8585	0.286	6.491	d_{46}	0.0389	0.019	2.102
c_4	-1.1429	0.680	-1.680	v_{21}	0.9255	0.086	10.744
d_{11}	-0.0362	0.007	-4.972	v_31	0.1116	0.092	1.214
d_{12}	0.0049	0.005	0.999	v_{41}	-0.2669	0.091	-2.921
d_{13}	-0.0196	0.005	-3.837	v_{32}	0.5804	0.151	3.843
d_{14}	0.0338	0.007	4.523	v_{42}	0.4133	0.154	2.683
d_{21}	0.0777	0.007	11.666	v_{43}	0.2790	0.163	1.713
d_{22}	0.0199	0.010	1.923	u_{21}	-0.3270	0.248	-1.319
d_{23}	0.0330	0.015	2.179	u_{31}	-0.5285	0.240	-2.205
d_{24}	0.0079	0.005	1.456	u_{41}	1.3441	0.445	3.017
d_{25}	-0.0195	0.016	-1.193	u_{32}	-0.4445	0.267	-1.662
d_{31}	-0.0334	0.007	-4.614	u_{42}	0.9342	0.398	2.349
d_{32}	-0.0148	0.008	-1.754	u_{43}	0.0000	0.580	0.000
d_{33}	-0.0143	0.008	-1.817	M*	0.9205	0.042	21.687
d_{34}	-0.0010	0.009	-0.113	ϕ*	0.7048	0.271	2.598

The R^2 squared between the observed and predicted values for the production function equation was 0.9986 and the R^2 for the four inverse input demand equations was 0.9280 for imports, 0.9938 for labour, 0.9408 for non-ICT capital services and 0.9991 for ICT capital services.

Note that the estimated markup factor, M*, was approximately 0.92, which is consistent with a modest monopolistic markup of 8 percent. The estimated relative efficiency factor for ICT inputs, ϕ*, was equal to 0.705 and hence, using this estimate, a marginal unit of ICT added to production that cost one dollar would produce on average approximately $1/0.705 \approx 1.42$ dollars worth of output over the sample period[5]. That is, the standard user cost formulation underestimates the contribution of ICT.

There are a number of reasons why we might expect the value marginal product of ICT inputs to exceed their cost as measured by the standard user cost formula. Firstly, this may arise because rapidly falling ICT prices leave the market in an ongoing state of disequilibrium. If

[5] The standard error for ϕ^* is rather wide so this estimate is only approximate.

users do not correctly anticipate the true benefits from ICT, they will lag behind in acquiring the most appropriate technologies and, at any given point of time, the marginal product of the ICT technology purchased will tend to exceed its marginal cost.

Secondly, there may be innovation related externalities associated with investment in ICT technologies. While much attention has been focused on innovation related externalities, usually concentrating on research and development, it should be noted that currently a significant proportion of business research and development carried out in Australia (and other OECD countries) is ICT related.

Finally, there may be intangible investment in human capital associated with the acquisition and operation of ICT technologies in the business sector. This is commonly referred to as 'learning-by-doing' and enjoys strong empirical support in the economic growth literature. For instance, DeLong and Summers (1991, 1992) found from a cross-country econometric study that investment in new machinery and equipment (including ICT equipment) tends to contribute significantly more to GDP growth than equal investment in structures and transport equipment. This implies that the social rate of return to different forms of investment is not the same and it tends to be higher for machinery and equipment because of the learning-by-doing process associated with investment in modern equipment. This 'intangible' investment in learning helps to raise productivity but is not reflected in the national accounts capital expenditure data. The intangible investment in learning associated with ICT inputs is, in turn, likely to be higher than for other forms of machinery and equipment.

The finding that the standard user cost formulation underestimates the contribution of ICT capital is consistent with earlier studies using detailed firm level databases. For instance, using a database spanning five years and 367 US firms, Brynjolfsson and Hitt (1996) found that the net marginal product of computer capital was significantly higher than for non-computer capital and labour. Dewan and Min (1997) also found evidence of excess returns to IT capital using a similar database.

Returns to scale for year t, ρ^t, was defined in equation (17) and technical progress, τ^t, for year t was defined in equation (18). These annual variables for the Australian expanded market sector are listed in table 3. From table 3 it can be seen that, except for the first three years in our sample, the expanded market sector in Australia exhibits a modest degree of increasing returns to scale with the sample mean degree of returns to scale averaging 1.0745.

The average amount of technical progress that is consistent with our estimated production function is 0.982 per cent or about 1 per cent per year. If we calculate a Fisher chained index of our four types of input and then calculate the rate of growth of output divided by the corresponding rate of growth of input for each year, we find that the average rate of (gross)

total factor productivity growth was 1.0117 or about 1.17 percent per year. It should be noted this rate of TFP growth is less than the rates computed earlier in the report because the earlier estimates subtracted imports from output to form a GDP type net output aggregate whereas our present specification uses a gross output aggregate. In the gross output framework imports appear on the input side leading to a larger denominator and this automatically reduces observed TFP growth rates.

Table 3: **Returns to scale and technical progress for the expanded market sector**

Year	ρ^t	τ^t	*Year*	ρ^t	τ^t	*Year*	ρ^t	τ^t
1960	0.953	0.0038	1976	1.114	0.0296	1992	1.083	0.0020
1961	0.974	0.0051	1977	1.113	0.0095	1993	1.082	0.0148
1962	0.992	0.0046	1978	1.113	0.0090	1994	1.079	0.0147
1963	1.009	0.0059	1979	1.110	0.0093	1995	1.074	0.0155
1964	1.024	0.0068	1980	1.108	0.0091	1996	1.072	0.0106
1965	1.038	0.0080	1981	1.104	0.0139	1997	1.070	0.0114
1966	1.050	0.0085	1982	1.101	0.0146	1998	1.067	0.0117
1967	1.062	0.0088	1983	1.104	0.0142	1999	1.065	0.0116
1968	1.072	0.0094	1984	1.102	0.0068	2000	1.061	0.0121
1969	1.081	0.0097	1985	1.096	0.0077	2001	1.060	0.0113
1970	1.089	0.0102	1986	1.093	0.0073	2002	1.059	0.0113
1971	1.096	0.0105	1987	1.093	0.0019	2003	1.056	0.0119
1972	1.105	0.0098	1988	1.089	0.0019	2004	1.053	0.0125
1973	1.112	0.0099	1989	1.084	0.0022			
1974	1.112	0.0187	1990	1.081	0.0021	Average	1.075	0.0098
1975	1.115	0.0204	1991	1.083	0.0019			

Table 4: **Sample average inverse elasticities of demand, e_{ij}**

		j =			
		Imports	*Labour*	*Non-ICT Capital*	*ICT*
	Imports	–0.4836	0.5685	–0.0411	–0.0438
i =	*Labour*	0.1990	–0.3264	0.0974	0.0300
	Non-ICT Capital	–0.0339	0.2830	–0.2501	0.0010
	ICT	–0.2895	0.4660	0.0624	–0.2390

Combining the estimates of technical progress and gross TFP, technical change accounts for approximately 0.98/1.17 or 84 per cent of gross TFP growth and increasing returns to scale accounts for approximately 16 percent of TFP growth. However, this simple calculation does not adjust the traditional index number estimates of (gross) TFP growth for the relative undervaluation of ICT inputs that is implied by our model. We can readily do this by multiplying our previous prices for ICT capital services by 1.4188 and then recomputing our Fisher index of input growth. The resulting average rate of (gross) TFP growth changes from 1.0117 to 1.0111. The new rate of TFP growth is lower because the new input aggregate gives a higher weight to ICT, which is the fastest growing input. Thus, technical change

accounts for around 0.98/1.11 or 88.5 per cent of (gross) TFP growth. Note also that according to our model, the undervaluation of ICT inputs overstates TFP growth by 0.06 percentage points per year on average.

We will not list the inverse demand elasticities defined by (20) for each year but we list the sample average inverse demand elasticities in table 4. The average elasticities listed in table 4 all appear to be reasonable.

5 Conclusions

In this report we have sought to address a number of key problems identified with National Accounts based productivity data by Diewert and Lawrence (2004). This has involved the construction of a database which covers a much broader section of the economy, uses producers' prices to aggregate outputs and inputs, is based on sources of final demand and uses a more consistent approach to forming capital stocks and flows than that used by the ABS. We have then undertaken econometric modelling using this database and a more detailed model than that developed by Diewert and Lawrence (2004).

The main findings of the current study are:

- Relative to the US/OECD 1 per cent per annum benchmark, TFP growth in the expanded market sector of the Australian economy has been very good over the past 45 years. It comprised a high average TFP growth over the 12 years to 1972 of around 1.66 per cent, more modest average growth of 1.22 per cent over the period 1972–95 and then very high average TFP growth of 1.85 per cent over the last decade;
- the DL database produces somewhat higher productivity growth rates on average than the narrower ABS multifactor productivity series demonstrating the importance of including the additional services sectors included in the DL database;
- there is evidence of modest increasing returns to scale (1.07 on average) in Australia's expanded market sector with a correspondingly modest markup of around 8 per cent;
- the large majority (around 85–90 per cent) of TFP growth is accounted for by technical progress rather than increasing returns to scale;
- applying the more detailed econometric model to the aggregate level DL database has confirmed that ICT contributes more to output than its cost to producers—in fact, our estimates indicate that ICT inputs are worth around 40 per cent more to producers in terms of marginal product than they pay for them;

- the undervaluation of ICT inputs by producers is likely to be due to a combination of market disequilibrium, innovation related externalities and intangible investment n human capital associated with investment in ICT; and,
- the results of this study indicate that greater attention to the uptake of ICT will have an important role in further improving economic growth.

Our methodology could be extended and applied at the industry and even the firm level, if sufficient data were available. Thus, our methodology might be able to help firms determine their optimal level of investment in ICT—a question which is important to most firms and which has significant public policy implications given the key role of ICT in driving economic growth.

APPENDIX A The Diewert-Lawrence database

The construction of reliable total factor productivity (TFP) estimates requires comprehensive information on the full range of outputs produced by the economy (excluding the government administration and defence sector) as well as on all inputs used in the production process. Furthermore, to be consistent with the underlying economic theory of productivity measurement, output and input quantities need to be valued at the prices actually faced by the production sector. As a result, taxes and subsidies which drive a wedge between producers' and consumers' prices need to be allowed for. To enable these effects to be adequately taken into account and to provide as much information as is currently possible on the full range of Australia's outputs and inputs, an important part of this project has been developing a detailed productivity database similar to the one Diewert and Lawrence (1999) developed for the New Zealand economy.

The TFP database we have constructed for this project contains value, price and quantity information on a total of 34 output and input categories. These are made up of an aggregate consumer commodity, one government consumption commodity, 11 investment commodities, 3 inventory change commodities, one export commodity, one import commodity, labour input, 10 capital stocks and 5 inventory stocks. Data on these variables covers the 45 year period from 1959–60 to 2003–04. In our Tables, the entries for the year 1960 refer to the June year that ends on June 30 of 1960, etc. In constructing the database we have drawn on Australian Bureau of Statistics (ABS) data wherever possible. In some cases this has been supplemented by data from the Organisation for Economic Cooperation and Development's Economic Outlook database (OECDEOL) and the Reserve Bank of Australia's Australian Economic Statistics database (RBAAES). A detailed listing of all 34 commodities is presented in Table A1.

An important distinction that arises in all productivity studies is the difference between stocks and flows. Most outputs from the production sector and some of the inputs to it are produced and consumed in the one period. This makes their measurement relatively easy. However, many of the inputs used in the production process are durable assets and last several periods (or decades in some cases). Measuring the amount of these durable items consumed in any one period becomes problematic and requires measurement of the flow of services provided by the asset over its lifetime. Measurement of the stock, or total value of the asset held is also not straight forward due to the presence of inflation and alternative assumptions about depreciation rates. Consequently, in this study considerable time has been spent constructing the major stocks and flows in a consistent manner using economic conventions. This has been particularly important given the focus of the econometric work on modelling the role of ICT inputs in productivity growth.

Table A1: **Full listing of variables contained in the TFP database**

Broad category	*Individual components*
Consumer commodity	Aggregate consumption excluding housing services
Government consumption	Government consumption of intermediates
Investment goods	Non-residential and other construction
	Software
	Mineral exploration
	Artistic originals
	Dwellings
	Computers
	Electrical machinery
	Industrial machinery
	Motor vehicles
	Other transport equipment
	Other machinery
Inventory changes	Non-farm inventories
	Farm inventories
	Livestock
Exports	Aggregate exports
Imports	Aggregate imports
Labour	Person-hours
Capital	Non-residential and other construction
	Software
	Mineral exploration
	Artistic originals
	Computers
	Electrical machinery
	Industrial machinery
	Motor vehicles
	Other transport equipment
	Other machinery
Inventories	Non-farm inventories
	Farm inventories
	Livestock
	Commercial land
	Rural land

The main differences between the database developed here and that used by the ABS in producing its multifactor productivity (MFP) estimates are the following:

- broader coverage of the economy—we include 16 of the 17 major industrial sectors whereas the ABS 'market sector' only covers 12 of the 17 sectors. We exclude

Government administration and defence whereas the ABS also excludes Health, Education, Business and property services and Personal services. With the changing composition of the economy, the private sector now accounts for significant proportions of Health, Education and Personal services output and nearly all of the relatively large Business and property services sector's output. Our approach of measuring output from sources of final demand enables us to cover more of the desired market-oriented parts of the economy than the ABS sectoral value added approach where measurement problems are more problematic. For clarity, we refer to our 16 sector coverage as the 'expanded market sector'.

- building up an output measure from final consumption components rather than sectoral gross value added—this allows a more accurate output measure to be used as interindustry flows of intermediates are netted out and more accurate records are available for end consumption components.
- expressing both outputs and inputs in terms of producer prices—from the viewpoint of production theory (which is the theoretical basis for making productivity comparisons), the appropriate prices are the prices that producers face, which should not include final demand tax wedges. However, some commodity taxes (such as property taxes and tariffs on imports) fall on inputs to the production sector and so these taxes should be included in producer prices for productivity purposes. Subsidies also create problems in trying to determine what the 'correct' producer prices are for subsidised outputs.
- constructing consistent capital and inventory inputs series—the US Bureau of Labor Statistics methodology currently used by the ABS for forming stocks and flows is not completely consistent. We use instead the Jorgenson geometric depreciation approach which is consistent. We also smooth the depreciation rates used by the ABS and push back ABS estimates for some capital stocks that start at substantial non-zero values part way through the time period.

In the remainder of this appendix we outline the sources for each of the variables in our TFP database, list some of the data used in constructing the variables and, finally, list the values and prices of all 34 variables.

Consumer commodity

The consumer commodity we include in the database is an aggregate of all household final consumption excluding housing services. While it would be ideal to include actual household rent paid as the purchase of rental accommodation from the production sector, there is insufficient data available to reliably separate the actual rental and imputed rental components of the National Accounts. Consequently, we exclude Rent and other dwelling

services from household final consumption. The production of new dwellings, alterations and additions by the production sector is captured as an investment output.

ABS (2004, Cat No 5206, Tables 57 and 58) present constant and current dollar series for Total household final consumption and rent and other dwelling services for the period 1959–60 to 2003–04.

Having value, price and quantity estimates for the rent and other dwelling services and total household final consumption categories it was then necessary to recover consistent estimates of the price and quantity of the residual category, Household final consumption excluding housing services. This was done by assuming that the overall price index was a chain Laspeyres index of the two components. This permits the residual or second component price index to be recovered as follows:

$$P_3^t = V_T^{t-1} P_T^t / \left(P_T^{t-1} X_3^{t-1}\right) - \left(P_1^t X_1^{t-1} + P_2^t X_2^{t-1}\right) / X_3^{t-1} \quad \text{(A1)}$$

where P_T, X_T and V_T are the price, quantity and value of the overall aggregate category, respectively, and 1 and 2 refer to the two components. By setting the period t–1 price of Rent and other dwelling services and the residual equal to one, the period t price of the residual can be recovered using equation (1) above. The period t residual quantity, X_2^t, is then obtained by dividing the residual value by its price for that period. This permits (1) to be used to recover the residual price for period t+1 and so on.

The consumption data components are listed in tables B2 and B3 in current prices and in constant 1959–60 prices. The data presented in tables B2 and B3 are all in consumer prices, ie at the prices which consumers face. The series used in our TFP model are valued at producer prices, ie at the prices producers face. These series are reported later in the appendix after we have described the allocation of consumer taxes.

Government consumption of intermediates

The expanded market sector of the economy supplies intermediate inputs used by the government sector. Consequently, in forming a series for government purchases from the expanded market sector we need to exclude Government administration and defence wages payments and consumption of fixed capital from total government consumption.

Total government consumption in constant and current dollars was obtained from ABS (2004, Cat No 5206, Tables 42 and 43). The derivation of the price and quantity of Government administration and defence labour inputs is described in the labour subsection below while Government administration and defence consumption of fixed capital in current and constant dollars was obtained from ABS (2004, Cat No 5204, Tables 92 and 93). An

expanded version of equation (A1) was used to obtain the required residual government consumption commodity.

The relevant series are presented in Table A3.

Investment goods and inventory changes

Estimates of economy-wide current dollar investment (or gross fixed capital formation in current dollars) are available from ABS (2004, Cat No 5204, Table 90) for the years 1960-2004 for the following six assets: (i) non-dwelling construction; (ii) livestock; (iii) computer software; (iv) mineral and petroleum exploration; (v) artistic originals and (vi) dwellings. The same table lists the current dollar purchases of these six asset types by the Government administration and defence industry (there were only purchases of non-dwelling construction and computer software by this general government sector). We will require this information on purchases by the general government sector later. Estimates of economy-wide constant dollar investment (gross fixed capital formation, chain volume measures) are available for the same six asset types from ABS (2004, Cat No 5204, table 91) for the years 1960-2004.

We divided the six value series by the corresponding volume or constant dollar series in order to obtain implicit price indexes for the six investment asset classes. Several problems were encountered:

- The ABS tables did not report the data for the early years for some components in the period 1960 to 2004 with a sufficient number of digits and so the resulting implicit price indexes sometimes showed unwarranted fluctuations. This was true for computer software, mineral and petroleum exploration and artistic originals.
- The value data and the corresponding chain volume data for computer software started abruptly at 1963 and 1965 respectively and the artistic originals value data and the corresponding chain volume data started abruptly at 1970 and 1972, respectively. It is certainly likely that there was investment in these assets in the years 1960–1962 and 1960–1969, respectively.
- It proved to be difficult to reconcile the ABS information on livestock stocks with the gross fixed capital formation information on livestock investment. A further complication is that the ABS is somehow able to distinguish livestock gross fixed capital formation from changes in livestock inventory.

We discuss the last problem first. We decided to combine livestock investment with livestock changes in inventories. We also found that the implicit prices that were obtained by dividing current dollar inventory change by the corresponding constant dollar inventory change were frequently difficult to interpret. The implicit prices corresponding to inventory change

components of GDP can often be nonsensical because normal index number theory breaks down when an aggregate can be either positive or negative. Hence, we made our own estimates of constant dollar inventory change based on deflating inventory stocks and then inventory change series were generated by taking differences between the resulting beginning and end of year stocks. Our methodology for dealing with inventory change will be explained at the end of this section.

Turning to the first problem flagged above, the implicit price series for computer software investment was erratic over the period 1965 to 1980 due to rounding errors in the listing of the current and constant dollar data in tables 90 and 91. The ABS (2000, Chapter 16, Paragraph 16.66) explained how it constructed its price series for software as follows:

> There is no Australian software price index currently available, although several countries have initiated development work to construct such indexes, and several experimental indexes over a limited time span have been published. Statistics Canada has developed an intuitive software price index in the Canadian SNA Input–Output Tables, which declines by 6% a year. This estimate is constructed by observing the trend of software prices over time for popular PC software. The ABS has chosen to use this index for the time being.

We adopted the ABS methodology by assuming that software prices declined at a 6 percent rate from 1960 to 1978 and then we linked the resulting price series to the 1978 ABS implicit price.

A rather similar methodology was adopted to obtain estimates for the missing prices for artistic originals. Using the implicit prices that corresponded to the ABS data in tables 90 and 91, we found that the price of artistic originals in 1972 was 0.161 and in 1982 was 0.307. The implied annual geometric rate of price increase between 1972 and 1982 turns out to be 1.066428 or 6.6428 percent per year and we simply extrapolated this rate of price increase backwards from 1972 to 1960. The implicit price for mineral and petroleum exploration was missing for 1960 and so we set it equal to 0.080 as the corresponding implicit prices implied by the ABS data in tables 90 and 91 for the years 1961-1964 were 0.082, 0.082, 0.085 and 0.087, respectively.

We now turn to the problems involved in extending either the value or volume data for computer software and artistic originals back to 1960. The value of computer software investment in 1963 was $10 million and the corresponding 1973 value was $28 million. The implied annual geometric growth rate over this 10-year period was 1.108449 or 10.8449 percent per year. We used this growth rate to extrapolate the value data back to 1960 from the 1963 value for computer software. A similar strategy was used to extend the artistic originals series for volumes. The 1972 volume estimate for artistic originals from ABS table 91 was

$155 million and for 1982 was $365 million. The implied annual geometric growth rate between these two years was 1.089422 and we used this growth rate to extrapolate backwards from the 1972 volume estimate for artistic originals.

The above paragraphs explain how we constructed value, price and quantity (or volume) series for the five investment (or gross fixed capital formation) components: (i) non-dwelling construction; (ii) computer software; (iii) mineral and petroleum exploration; (iv) artistic originals and (v) dwellings. For purposes of reporting our data in the tables below, we renormalised the price and quantity data so that all price indexes were set equal to 1 in 1960. Thus, the corresponding quantity series can be interpreted as constant 1960 dollar series. These current and constant dollar series can be found in tables A5 and A6.

In order to form investment aggregates that are delivered to the expanded market sector, it is necessary to subtract the value of gross fixed capital formation in the Government administration and defence industry for non-dwelling construction and for computer software. These value data can be found in ABS table 90. After this subtraction was done, the resulting value series were deflated by the implicit price data described in the paragraph above in order to obtain constant 2003 dollar estimates for market sector investment. These series will be used subsequently in order to construct market sector capital stock series for these assets.

We now turn our attention to the problems associated with the construction of machinery and equipment investment aggregates. Estimates of economy-wide current dollar investment (or gross fixed capital formation in current dollars) are available from ABS (2004, Cat No 5204, table 96) for the years 1960–2004 for the following six assets: (i) computers and peripherals; (ii) electrical and electronic equipment; (iii) industrial machinery and equipment; (iv) motor vehicles; (v) other transport equipment; (vi) other machinery and equipment. The same table lists the current dollar purchases of these six asset types by the Government administration and defence industry. In a manner that is similar to that explained in the paragraph above, we will use this information on purchases by the general government sector later in order to obtain machinery and equipment investment aggregates that are delivered to the expanded market sector so that these latter market sector investment aggregates can be used to form expanded market sector capital stock aggregates. Estimates of economy-wide constant dollar investment (gross fixed capital formation, chain volume measures) are available for the same six machinery and equipment asset types from ABS (2004, Cat No 5204, table 97) for the years 1960–2004.

We divided the six value series by the corresponding volume or constant dollar series in order to obtain implicit price indexes for the six machinery and equipment investment asset classes. Again, some problems were encountered.

- The ABS tables did not report the data for computers and peripherals for the years in the period 1971 to 1985 with a sufficient number of digits and so the resulting implicit price indexes sometimes showed unwarranted fluctuations.
- The value data and the corresponding chain volume data for computers started at 1961 and 1971 but it is likely that there was investment in these assets for the missing years.

The value of gross fixed capital formation for computers in 1961 was $4 million and in 1962 was $9 million. We set the value of computer investment in 1960 equal to $2 million.

In order to deal with the problem of fluctuating computer prices in the early years due to rounding problems, we calculated the annual geometric average rate of decrease in computer prices going from 1972 to 1986, which was 1 minus 0.8626534 or 13.73466 percent per year. We extrapolated prices backwards to 1960 from 1986 using this annual rate of decrease. We then generated new volume estimates for the years 1960 to 1985 by dividing the value series by these newly generated computer and peripherals prices.

The above paragraphs explain how we constructed value, price and quantity (or volume) series for the six machinery and equipment investment components. We then renormalized the price and quantity data so that all price indexes were set equal to 1 in 1960. Thus, the corresponding quantity series can be interpreted as constant 1960 dollar series. These current and constant dollar investment series can be found in tables A5 and A6.

We conclude this section with a description of our methods used to construct measures of inventory change. Before discussing the data, it is first necessary to provide a theoretical framework for measuring inventory change. As mentioned above, normal index number theory breaks down if the value aggregate switches sign going from the base period to the current period or if the value aggregate approaches 0 in the base period. (To see why there is a problem, consider the problem of calculating a Laspeyres price or quantity index when the base period value for the aggregate approaches 0). The framework described below avoids these technical problems and is based on the work of Diewert and Smith (1994).

Consider a firm that perhaps produces a *noninventory output* during period t, Y^t, uses a *noninventory input* X^t, *sells* the amount S^t of an *inventory item* during period t and makes *purchases* of the *inventory item* during period t in the amount B^t. Suppose that the *average prices* during period t of Y^t, X^t, S^t and B^t are P_Y^t, P_X^t, P_S^t and P_B^t , respectively. Then neglecting balance sheet items, the firm's period t *cash flow* is:

(A2) $CF^t \equiv P_Y^t Y^t - P_X^t X^t + P_S^t S^t - P_B^t B^t$.

Let the firm's *beginning of period* t *stock of inventory* be K^t and let its *end of period stock of inventory* be K^{t+1}. These inventory stocks are valued at the *balance sheet prices* prevailing at the *beginning and end* of period t, P_K^t and P_K^{t+1} , respectively. Note that in principle, all four prices involving inventory items, P_S^t, P_B^t, P_K^t and P_K^{t+1} can be different.

The firm's period t *economic income* is defined as its cash flow plus the value of its end of period t stock of inventory items less $(1+r^t)$ times the value of its beginning of period t stock of inventory items:

(A3) $EI^t \equiv CF^t + P_K^{t+1} K^{t+1} - (1+r^t) P_K^t K^t$

where r^t is the *nominal cost of capital* that the firm faces at the beginning of period t. Thus, in definition (A3), we assume that the firm has to borrow financial capital or raise equity capital at the cost r^t in order to finance its initial holdings of inventory items. This cost could be real (in the case of a firm whose initial capital is funded by debt) or it could be an opportunity cost (in the case of a firm entirely funded by equity capital).

The end of period stock of inventory is related to the beginning of the period stock by the following equation:

(A4) $K^{t+1} = K^t + B^t - S^t - U^t$

where U^t denotes inventory items that are *lost, spoiled, damaged or are used internally* by the firm. However, in the case of livestock inventories, there is a *natural growth rate of inventories* over the period so equation (A4) is replaced by:

(A5) $K^{t+1} = K^t + B^t - S^t + G^t$

where G^t denotes the natural growth of the stock over period t.

Define the *change in inventory stocks* over period t as:

(A6) $\Delta K^t \equiv K^{t+1} - K^t$.

Using (A6), both (A4) and (A5) can be written as:

(A7) $K^{t+1} = K^t + \Delta K^t$.

Now substitute (A7) into the definition of economic income (A3) and we obtain the following expression:

(A8) $EI^t \equiv CF^t + P_K^{t+1} [K^t + \Delta K^t] - (1+r^t) P_K^t K^t$

$= CF^t + P_K^{t+1} \Delta K^t - [r^t P_K^t - (P_K^{t+1} - P_K^t)] K^t$.

Thus *economic income is equal to cash flow plus the value of the change in inventory (valued at end of period balance sheet prices) minus the user cost of inventories times the starting stocks of inventories* where this period t *user cost* is defined as

(A9) $P_I^t \equiv r^t P_K^t - (P_K^{t+1} - P_K^t)$.

Note that the above algebra works for both livestock and ordinary inventory items and can be implemented if we have price and quantity information on balance sheet assets.

Of course, there can be two versions of the user cost:

- an *ex post version* where the actual end of period balance sheet price of inventories is used; or,
- an *ex ante version* where at the beginning of period t, we estimate a predicted value for the end of period balance sheet price.

Formula (A9) can be further simplified. Define the period t *asset inflation rate* i_K^t that corresponds to the inventory asset K under consideration by:

(A10) $1+i_K^t \equiv P_K^{t+1}/P_K^t$.

Substitution of (A10) into (A9) leads to the following formula for the *user cost of inventories*:

(A11) $P_u^t = (r^t - i_K^t) P_K^t \equiv r_K^{t*} P_K^t$

Note that $r_K^{t*} \equiv r^t - i_K^t$ is the nominal interest rate r^t less an asset specific (anticipated or ex post) inflation rate i_K^t. Thus, this difference can be set equal to an asset specific *real interest rate*. In our empirical work, we assumed that r_K^{t*} equals 0.04, ie we followed the conventions of the ABS and assumed that each of these asset specific real interest rates was equal to 4 percent. Substituting (A11) into (A8) and using the assumption that the real interest rate equals 4 percent leads to the following formula for economic income:

(A12) $EI^t = CF^t + P_K^{t+1} \Delta K^t - 0.04 P_K^t K^t$.

Using (A12), we see that the value of capital services that the beginning of period t stock of inventories yields is $0.04 P_K^t K^t$ and the value of the change in inventories for period t is equal to $P_K^{t+1} \Delta K^t$. The ABS (and other sources to be noted later) provide estimates of the beginning of the period value of various inventory stocks in current and constant dollars and so the beginning of period t prices, P_K^t, and the corresponding constant (chained) dollar stocks, K^t, can be identified from this official information for various types of inventories. Then these stock components can be differenced to form the corresponding change in stocks, ΔK^t, and according to our theoretical methodology, these measures of stock change should be valued at the end of period t prices, P_K^{t+1}. This is the methodology that we used for three types of inventory change: (i) non-farm inventories; (ii) farm inventories and (iii) livestock

inventories. The details of the sources of our data for these three types of inventory are in the inventory section below.

The three series on the value of inventory change using the above methodology can be found in table A4 while the corresponding constant dollar measures can be found in table A5.

Exports and imports

Constant and current price series for aggregate exports and imports of goods and services were obtained from ABS (2004, Cat No 5206, tables 42 and 43). They are presented in table A6 along with the corresponding price indexes.

Labour

We assemble the price and quantity of labour input series from a number of sources. We have the number of hours worked by employed persons by industry from ABS (2004, Cat No 6291, table 11) covering the years 1985–86 to 2003–04. We subtract the number of hours worked in the Government administration and defence industry from the total number of hours worked by employed persons to obtain the quantity of labour used in the expanded market sector. We extend the total hours worked and Government administration and defence industry hours worked back to 1974–75 using the index series presented in Industry Commission (1997). The total hours worked is indexed back by the IC's All Industries index and the Government administration and defence industry hours worked is indexed back by the IC's Other activities index, the closest proxy available. For the 10 year overlap period the Government administration and defence industry hours worked index moves closely with the IC's Other activities index.

We then index the total hours worked and Government administration and defence industry hours worked series back to 1960–61 using changes from the total employment and general government employment series, respectively, in OECDEOL. The series are then indexed back to 1959–60 using the change in total employment from the RBAAES Butlin series, table 4.7.

We derive the cost of employees from ABS (2004, Cat No 5204, table 59) on compensation of employees by industry for 1989–90 to 2003–04 and for all industries for 1959–60 to 2003-04. For the years where industry detail is available we subtract Government administration and defence industry compensation from that for all industries. For the years prior to 1989–90 we scale the total for all industries down by the proportion accounted for by Government administration and defence in 1989–90 multiplied by the ratio of Other activity hours to All industry hours from IC (1997) for 1974–75 to 1989–90 and by the ratio of General government to Total employment from OECDEOL for 1960–61 to 1973–74—the

latter terms reflecting the more rapid growth in government hours worked in the earlier years. We then scale the resulting compensation of employees series up by the ratio of self employed hours worked to employees hours worked to obtain an estimate of the total cost of labour inputs in the expanded market sector.

We form estimates of the hours worked per week by self employed persons for the years 1978–79 to 1999–2000 from ABS table 6203A in EconData (2000). This table provides the distribution of numbers of self employed by ranges of number of hours worked per week. The number of hours worked is formed by assuming those in each hours per week range work the midpoint number of hours for that range. This series is updated to 2003–04 by assuming self employed hours are the same proportion of total employee hours as they were in 1999–2000. Similarly, the series is backdated to 1974–75 by assuming the same proportion of total employee hours worked as in 1978–79. The self employed hours series is indexed back for the years 1960–61 to 1973–74 using the self employed numbers series in OECDEOL. It is again extended back to 1959–60 using the change in total employment from the RBAAES Butlin series, table 4.7.

In table A7 we present the total weekly number of hours worked in the expanded market sector, the total estimated weekly number of hours worked by the self employed (including unincorporated employers) and the value, price and implicit quantity of the labour input for the sector.

Taxation

To allow the formation of a database in producers' prices we have to identify those taxes and subsidies falling on the production sector. The principal data source we use is ABS (2004, Cat No 5206, table 72) which contains the main tax aggregates for the entire 45 year period and a detailed breakdown of indirect taxes from 1972–73 onwards.

Aggregate consumption taxes (excluding import duties) are formed by aggregating the following ABS components from 1972–73 onwards: sales tax, goods and services tax, excise duties, gambling taxes, taxes on insurance, motor vehicle taxes, gas and petroleum taxes, tobacco and liquor taxes and other taxes. The 1972–73 value is indexed back to 1960–61 using changes in OECDEOL Indirect taxes less Import Duties. The 1959–60 value is obtained by indexing the 1959–60 value back by an analogous series from RBAAES.

Import duties are obtained from the ABS source from 1972–73 onwards and from RBAAES table 2.17 for earlier years.

Business property taxes were assembled from a number of sources. Firstly, land tax was available from the ABS source from 1972–73 onwards. This was indexed back to 1959–60

using changes in RBAAES, table 2.19, Receipts of state & local general government from other property taxes, fees and fines. Secondly, total municipal rates were formed in an analogous manner from ABS from 1972–73 onwards and the same RBAAES series for earlier years. Next, the ABS supplied us with the value of municipal rates paid by domestic households for the years 1989–90 to 2002–03. This was estimated for earlier years by multiplying estimated total municipal rates by the proportion of domestic municipal rates in total rates in 198–90. Finally, business property taxes were formed as the sum of estimated land tax plus total municipal rates less estimated domestic municipal rates.

The value of subsidies is obtained from ABS (2004, Cat No 5204, table 40).

Consumption taxes are assumed to apply to the consumer commodity and government consumption. Import duties only apply to the imports while subsidies are assumed to apply to the production of the consumer commodity, government consumption and exports. Business property taxes are assumed to apply to non-residential and other construction, commercial land and rural land. Tax and subsidy rates are formed by dividing the value of the tax or subsidy by the value of items it is spread over. Taking the consumer commodity as an example, producer prices are formed as follows:

$$PP_C = CP_C\,(1 + s)\,(1 - t_c) \tag{A13}$$

where PP_C and CP_C are the consumer commodity producer price and consumer price, respectively, and s and t_c are the subsidy rate and consumption tax rate, respectively.

In table A8 we present the values of consumption taxes, import duties, subsidies and business property taxes and the corresponding tax and subsidy rates.

Capital stocks and capital service flows

Recall that in the 'Investment goods and inventory changes' section above, we described how investment aggregates that were delivered to the expanded market sector were formed for 11 reproducible capital stock components. In this section, we denote these constant 2003 chained dollar investment demands by the expanded market sector for asset n in year t by Q_n^t, where n = 1,…,11 and t = 1960, 1961,…, 2004.

Economy wide net capital stock (in constant 2003 chained dollars) estimates for the Australian economy are available for most years in our sample from the ABS. The source for the first five assets (non-dwelling construction, computer software, mineral and petroleum exploration, artistic originals and dwellings) is ABS (2004, Cat No 5204, table 89) and the source for the next six assets (computers and peripherals, electrical and electronic equipment, industrial machinery and equipment, motor vehicles, other transport equipment, and other machinery and equipment) is ABS (2004, Cat No 5204, table 95). These two tables also have

industry estimates for the net capital stock in constant 2003 chained dollars so we subtracted the net capital stock estimates for government administration and defence from the corresponding total economy estimates to obtain net capital stock estimates for the above 11 asset classes for our expanded market sector. Denote the resulting expanded market sector beginning of year t constant chained 2003 dollar estimated net capital stock for asset n by K_n^t for n = 1,2,…,11.

The ABS constructed its net capital stocks using a variety of methods and it is unlikely that the ABS user costs for these 11 capital stock inputs are exactly consistent with the ABS methodology used to construct these net stocks; for additional materials on obtaining consistent stock and flow estimates, see Hulten (1990) (1996), Diewert and Lawrence (2000) and Diewert (2004). In order to make our capital input flow estimates consistent with our stock estimates, we decided to use the geometric (or declining balance) depreciation model pioneered by Dale Jorgenson and his associates due to its simplicity; see Jorgenson (1989) (1996), Jorgenson and Griliches (1967) (1972) and Christensen and Jorgenson (1969) for examples of the use of this method.

If we have estimates for the beginning of year t constant chained dollar net capital stock for the expanded market sector, K_n^t, and say 10 years later at the beginning of year t+10, K_n^{t+10}, for a capital stock component n and if we have the corresponding annual constant chained dollar investments for the years t, t+1, … , t+9, Q_n^t, Q_n^{t+1}, … , Q_n^{t+9}, and if there is a constant annual geometric depreciation rate δ_n over these years, then the beginning and end of decade net stocks of capital for this asset class are related by the following equation if the geometric model of depreciation is true:

$$(A14)\ K_n^{t+10} = Q_n^{t+9} + (1-\delta_n) Q_n^{t+8} + (1-\delta_n)^2 Q_n^{t+7} + (1-\delta_n)^3 Q_n^{t+6} + \ldots + (1-\delta_n)^9 Q_n^t + (1-\delta_n)^{10} K_n^t .$$

The above equation implicitly assumes that investments made in year t do not contribute to production until the following year.

We can now explain how we constructed capital stocks that were consistent with the geometric model of depreciation. For each of the 11 asset classes, we took benchmark data on beginning and ending capital stocks from tables 89 and 95 that corresponded to our expanded market sector, took the corresponding expanded market sector investment data and used equation (A14) (or a modification of it to cover different starting and ending periods) and found for the geometric depreciation rate δ_n that solved equation (A14) or its counterpart. Once this balancing depreciation rate has been found, we can build up the corresponding geometric capital stock for all of the years in the decade by using the following equation in a recursive manner:

(A15) $K_n^{t+1} = Q_n^t + (1-\delta_n) K_n^t$.

The resulting internally generated capital stock series will be exactly consistent with the corresponding official ABS series at the two endpoints but will not necessarily be consistent in between the endpoints. Our strategy was to pick the reference endpoint capital stocks to be as far apart as possible initially and we then compared our constructed geometric depreciation rate stocks with the corresponding ABS stock. If we found that our internally generated series did not track the corresponding ABS series well, we then chose reference endpoint capital stocks that were closer together and estimated constant geometric rates between these new more closely spaced endpoints. We continued this process until our stocks were reasonably close to the corresponding ABS net capital stock series. In some cases where ABS reference stocks were not available for the early years in our sample, we extrapolated the stocks backwards using the last available ABS stocks and the depreciation rates that were estimated by our procedure that pertained to the last available ABS stocks.

The resulting geometric depreciation rates are listed in table A9. Given these depreciation rates, the expanded market sector constant 2003 dollar investment series Q_n^t and the 2004 expanded market sector constant 2003 dollar ABS end of 2004 capital stock estimates, equation (A15) can be rearranged to recursively define beginning of the year capital stocks back to 1960. These capital stock estimates were then multiplied by the corresponding constant 2003 chained dollar investment prices that were described earlier in order to obtain current dollar geometric net capital stock series for each of our 11 reproducible capital assets. These current dollar estimates can be found in table A10. The 2003 chained dollar investment prices were then renormalized so that they equalled unity in 1960 and thus they became chained 1960 capital stock prices, P_{Kn}^t**.** These 1960 chained prices were then divided into the corresponding capital stock values in order to obtain the constant 1960 chained dollar capital stock estimates that appear in table A11.

Recall equation (A11) above, which gave the user cost or rental price of inventory components. The corresponding *user cost* for reproducible capital stock component n in year t, P_{un}^t, under the geometric model of depreciation is:

(A16) $P_{un}^t = (r^t + \delta_n^t - i_n^t) P_{Kn}^t \equiv (r_n^t{}^* + \delta_n^t) P_{Kn}^t$

where again, $r_n^t{}^* \equiv r^t - i_n^t$ is the nominal interest rate in year t r^t less the asset specific (anticipated or ex post) inflation rate i_n^t in year t for the reproducible capital stock component n. This user cost formula was first derived by Christensen and Jorgenson (1969). In our empirical work, we again assumed that each of the real interest rates $r_n^t{}^*$ was equal to a *common real interest rate* equal to 4 percent. The relevant information on user costs and user cost components can be found in tables A8, A9 and A12.

Inventory stocks

Data on chain volume (stock) measures of inventories and land for the years 1963–64 to 2003–04 were obtained from data the ABS supplies annually to the Productivity Commission and from which the Productivity Commission then derives industry MFP measures. These data are contained in a spreadsheet the ABS labels 'Prodcom2004.xls'. The ABS also supplied us with corresponding price indices by industry for the years 1963–64 to 2002–03. The price indices were updated to 2003–04 by assuming the same percentage change as occurred in 2002–03 and backdated to 1959–60 by assuming the same percentage change in each of the years before 1963–64 as occurred on average over the 5 years 1963–64 to 1968-69.

The chain volume measures were initially summed across the corporate and unincorporated sectors for each industry (because each sector has the same price index) and then aggregated over industries using the price indexes supplied by ABS. The resulting aggregates were then compared with data available from alternative sources including other ABS tables and an earlier Australian database assembled by Diewert and Lawrence (1999, 2002). Where the alternative series coincided reasonably closely the 'Prodcom2004.xls' based source was used. Where a series from this source diverged from alternative sources which appeared more reliable over some periods, a composite series was formed.

The 'Prodcom2004.xls' based series were used for commercial land and farm and non-farm inventories as these series coincided closely with alternative information available. However, the 'Prodcom2004.xls' based series for agricultural land and livestock exhibited erratic behaviour compared to alternative series. Consequently, we have formed an agricultural land value series from 'Prodcom2004.xls' for the years 1959–60 to 1966–67, from Diewert and Lawrence (1999) for the years 1967–68 to 1987–88 and from ABS (2004, Cat No 5204, table 83) for the years 1988–89 to 2003–04. A livestock series is formed by joining series from 'Prodcom2004.xls' for the years 1959–60 to 1966–67, from Diewert and Lawrence (1999) for the years 1967–68 to 1987–88 and from ABS (2004, Cat No 5204, table 81) for the years 1988–89 to 2003–04. The Diewert and Lawrence (1999) agricultural land series was based on unpublished data compiled by Robert Dippelsman while the corresponding livestock series were built up from ABS data on the numbers of four different types of livestock and corresponding price indexes from ABARE's *Commodity Statistical Bulletins*.

In table A9 we present the depreciation rates used in the study while in tables A10 and A11 we present the current and constant price estimates, respectively, of the capital and inventory stocks. In table A12 we present the current price estimates of the user costs of capital and inventories.

TFP database

The data listed in tables A1 to A12 which are used to form the TFP database are in consumer prices. As noted at the outset, the data used in the TFP database itself are all in producer prices. The values, price indexes and quantities of the 34 output and input variables in the TFP database are listed in tables A13, A14 and A15, respectively.

Table A2: **Final Consumption Components, 1960–2004, current and constant prices**

Year	*Total $m*	*Rent, etc $m*	*Residual $m*	*Total $m1960*	*Rent, etc $m1960*	*Residual $m1960*
1960	9,378	815	8,563	9,378	815	8,563
1961	9,957	934	9,023	9,568	837	8,730
1962	10,260	1,038	9,222	9,805	878	8,924
1963	10,985	1,148	9,837	10,362	920	9,440
1964	11,928	1,260	10,668	11,091	962	10,132
1965	12,931	1,371	11,560	11,644	1,006	10,643
1966	13,746	1,495	12,251	11,960	1,056	10,903
1967	14,848	1,664	13,184	12,558	1,122	11,431
1968	16,212	1,848	14,364	13,212	1,176	12,033
1969	17,656	2,062	15,594	13,925	1,235	12,687
1970	19,532	2,336	17,196	14,772	1,302	13,472
1971	21,515	2,704	18,811	15,352	1,370	13,974
1972	23,853	3,098	20,755	15,937	1,440	14,481
1973	26,690	3,535	23,155	16,743	1,511	15,215
1974	31,692	4,112	27,580	17,741	1,587	16,145
1975	38,688	5,052	33,636	18,418	1,661	16,741
1976	45,460	6,264	39,196	18,675	1,735	16,859
1977	52,831	7,588	45,243	19,484	1,821	17,565
1978	58,875	8,924	49,951	19,872	1,919	17,792
1979	65,686	10,343	55,343	20,325	2,021	18,109
1980	73,828	11,906	61,922	20,785	2,135	18,346
1981	84,097	13,743	70,354	21,563	2,252	18,950
1982	96,451	15,876	80,575	22,595	2,372	19,865
1983	108,702	18,125	90,577	22,982	2,469	20,125
1984	118,840	19,877	98,963	23,403	2,555	20,409
1985	128,746	21,883	106,863	23,895	2,660	20,813
1986	144,503	24,621	119,882	24,969	2,768	21,613
1987	158,640	27,577	131,063	25,233	2,861	21,730
1988	177,450	31,424	146,026	26,063	2,955	22,449
1989	197,426	36,035	161,391	27,255	3,068	23,510
1990	218,729	40,370	178,359	28,582	3,180	24,709
1991	233,726	43,954	189,772	28,770	3,287	24,722
1992	245,463	46,283	199,180	29,351	3,386	25,152
1993	255,545	48,146	207,399	29,896	3,482	25,556
1994	265,897	50,427	215,470	30,589	3,601	26,080
1995	282,870	52,891	229,979	32,089	3,731	27,436
1996	301,069	55,987	245,082	33,308	3,864	28,487
1997	314,566	59,319	255,247	34,274	3,985	29,291
1998	335,102	63,055	272,047	35,917	4,108	30,805
1999	354,419	66,984	287,435	37,649	4,252	32,402
2000	374,921	70,838	304,083	39,174	4,388	33,775
2001	404,270	75,213	329,057	40,314	4,534	34,714
2002	426,155	79,003	347,152	41,626	4,681	35,841
2003	452,045	82,507	369,538	43,213	4,863	37,199
2004	483,416	86,478	396,938	45,612	5,040	39,413

Table A3: **Govt Consumption Components, 1960–2004, current and constant prices**

Year	*Total $m*	*Wages $m*	*Cons Cap $m*	*Residual $m*	*Total $m1960*	*Wages $m1960*	*Cons Cap $m1960*	*Residual $m1960*
1960	1,804	317	53	1,434	1,804	317	53	1,434
1961	1,952	327	59	1,566	1,875	332	57	1,485
1962	2,089	368	64	1,657	1,947	355	62	1,531
1963	2,215	397	70	1,748	2,037	358	67	1,613
1964	2,426	433	76	1,917	2,139	357	72	1,713
1965	2,766	496	87	2,183	2,331	386	80	1,868
1966	3,146	555	100	2,491	2,577	408	90	2,086
1967	3,556	632	116	2,808	2,759	434	101	2,232
1968	4,111	716	132	3,263	3,042	456	112	2,488
1969	4,358	813	150	3,395	3,093	471	123	2,512
1970	4,839	910	168	3,761	3,250	472	132	2,668
1971	5,547	1,008	189	4,350	3,393	486	142	2,792
1972	6,336	1,245	213	4,878	3,534	550	151	2,846
1973	7,197	1,569	242	5,386	3,654	575	161	2,930
1974	8,592	1,787	285	6,520	3,733	522	170	3,096
1975	11,768	2,247	383	9,138	4,058	579	180	3,351
1976	14,715	2,611	471	11,633	4,410	589	191	3,703
1977	16,695	2,958	538	13,199	4,468	609	200	3,730
1978	18,612	3,282	605	14,725	4,599	629	208	3,834
1979	20,534	3,732	664	16,138	4,763	659	215	3,961
1980	23,116	4,325	762	18,029	4,879	669	221	4,065
1981	27,123	5,113	866	21,144	5,111	699	227	4,265
1982	31,042	5,827	985	24,230	5,164	719	233	4,288
1983	35,346	6,400	1,139	27,807	5,324	719	239	4,453
1984	39,266	7,337	1,242	30,687	5,587	759	248	4,669
1985	44,793	8,095	1,335	35,363	6,005	799	258	5,049
1986	49,760	8,814	1,527	39,419	6,257	808	271	5,296
1987	54,287	9,933	1,732	42,622	6,456	827	285	5,470
1988	58,277	11,243	1,883	45,151	6,662	866	301	5,619
1989	63,178	12,637	2,019	48,522	6,829	799	316	5,926
1990	68,597	12,903	2,248	53,446	6,988	868	338	5,969
1991	74,663	13,575	2,444	58,644	7,230	919	363	6,136
1992	79,553	14,272	2,557	62,724	7,380	876	388	6,354
1993	83,037	14,754	2,674	65,609	7,512	909	411	6,429
1994	84,440	15,486	2,844	66,110	7,570	932	437	6,438
1995	87,736	16,019	2,990	68,727	7,817	908	467	6,732
1996	92,956	16,993	3,103	72,860	8,134	972	495	6,953
1997	96,173	18,582	3,120	74,471	8,251	939	521	7,133
1998	101,332	19,229	3,200	78,903	8,562	861	543	7,645
1999	108,266	20,053	3,345	84,868	8,909	886	569	7,975
2000	113,305	20,139	3,488	89,678	9,169	884	607	8,253
2001	120,390	21,219	3,633	95,538	9,356	934	645	8,346
2002	127,413	23,684	3,787	99,942	9,554	993	680	8,434
2003	136,819	25,530	4,072	107,217	9,970	1,074	724	8,722
2004	146,807	27,626	4,103	115,078	10,294	1,098	766	9,018

Table A4: **Investment goods and inventory changes, 1960–2004, current prices**

Year	*Non-Res & Oth Const.* $m	*Software* $m	*Mineral Exploration* $m	*Artistic Originals* $m	*Dwellings* $m	*Computers* $m	*Electrical machinery* $m
1960	1,164	7	21	4	666	2	201
1961	1,274	8	25	5	731	4	211
1962	1,394	9	36	6	669	9	225
1963	1,463	10	52	6	741	14	251
1964	1,673	12	63	8	850	19	266
1965	1,926	12	82	9	997	30	307
1966	2,179	14	95	10	1,018	40	352
1967	2,311	14	103	12	1,086	50	370
1968	2,454	15	128	14	1,222	65	410
1969	2,803	16	158	16	1,403	75	426
1970	3,067	16	210	19	1,608	85	448
1971	3,483	17	253	22	1,694	106	499
1972	3,805	21	220	25	1,984	132	548
1973	3,933	28	211	28	2,374	150	555
1974	4,669	42	209	33	2,920	178	593
1975	5,941	56	203	35	2,904	258	774
1976	6,677	105	178	41	4,060	318	904
1977	7,563	151	222	46	5,124	345	911
1978	8,153	188	285	50	5,599	434	1,113
1979	9,092	217	369	56	5,862	560	1,357
1980	9,932	253	617	68	6,850	648	1,461
1981	11,669	366	912	92	8,649	839	1,830
1982	14,300	473	1,439	112	9,549	1,027	2,219
1983	15,376	529	1,423	119	8,361	1,134	2,383
1984	15,452	760	1,295	127	9,609	1,319	2,563
1985	17,361	1,051	1,257	172	11,492	1,527	2,765
1986	20,963	1,356	1,190	207	12,500	2,002	3,364
1987	23,131	1,950	755	187	12,025	2,419	3,759
1988	25,765	2,408	1,302	220	13,600	2,726	3,782
1989	28,030	2,624	1,334	174	18,763	3,218	4,144
1990	31,844	3,573	1,192	366	20,450	3,690	4,354
1991	29,552	3,886	1,186	238	19,068	3,561	3,687
1992	26,046	4,056	1,075	171	19,228	3,710	3,479
1993	24,514	5,060	1,244	246	22,262	4,275	3,639
1994	25,252	5,316	1,301	306	24,803	5,076	4,106
1995	28,056	5,386	1,582	240	26,738	6,048	4,662
1996	31,294	5,411	1,685	274	23,753	6,377	4,951
1997	34,402	6,344	2,001	390	23,596	6,413	5,099
1998	36,803	7,328	2,049	374	28,021	7,947	5,229
1999	40,457	9,162	1,706	431	30,833	8,195	5,412
2000	38,882	10,883	1,400	428	37,335	9,495	4,955
2001	33,885	12,718	1,727	478	33,322	8,561	6,649
2002	37,045	12,282	1,523	494	39,957	9,027	5,632
2003	44,937	12,235	1,727	525	47,926	9,818	7,242
2004	50,134	12,235	1,731	567	55,345	9,861	7,344

Table A4: **Investment goods and inventory changes, 1960–2004, current prices** (cont'd)

Year	*Industrial machinery* $m	*Motor vehicles* $m	*Oth transp. equipment* $m	*Other machinery* $m	*Non–farm inventories* $m	*Farm inventories* $m	*Livestock* $m
1960	385	485	90	344	194	209	41
1961	436	504	83	366	214	202	39
1962	454	489	90	374	235	196	34
1963	501	540	96	405	258	190	35
1964	523	654	91	431	504	478	-117
1965	656	711	110	521	193	-67	-22
1966	745	719	126	578	230	-367	85
1967	774	779	131	592	324	-156	232
1968	822	794	166	640	472	1,215	344
1969	917	905	153	683	513	-26	357
1970	998	884	160	720	882	-563	468
1971	1,166	937	152	822	10	-33	584
1972	1,240	1,016	201	882	203	-1,756	152
1973	1,179	1,214	198	877	461	-1,349	423
1974	1,279	1,394	216	949	1,155	81	371
1975	1,534	1,630	295	1,195	106	-654	111
1976	1,762	2,172	307	1,371	886	-958	-159
1977	1,902	2,553	296	1,407	-620	-520	-203
1978	2,230	2,767	388	1,627	595	-1,085	-202
1979	2,863	3,453	406	1,962	1,009	-1,192	-80
1980	2,888	3,796	479	2,027	1,069	-736	-296
1981	3,772	4,458	629	2,492	796	317	-4
1982	4,829	5,063	746	2,982	-2,244	-699	-893
1983	4,949	4,551	812	3,037	821	-112	-216
1984	5,000	5,441	961	3,189	1,910	1	285
1985	5,686	6,273	1,045	3,561	344	-306	-446
1986	6,377	7,037	1,531	4,036	-1,643	-890	-287
1987	7,199	8,112	1,760	4,447	574	-1,059	280
1988	7,959	9,365	1,479	4,460	3,578	-594	259
1989	8,915	10,399	1,589	5,104	5,644	414	1,401
1990	8,564	10,209	2,103	5,164	-813	952	-719
1991	7,348	8,951	1,604	4,476	-2,282	-1,054	615
1992	6,807	8,527	1,575	4,226	1,275	-868	29
1993	7,810	9,852	1,355	4,549	1,328	-266	117
1994	9,698	8,581	1,312	5,096	2,039	126	-404
1995	11,038	10,998	1,523	5,477	219	959	401
1996	10,871	12,203	1,597	6,301	2,019	-857	282
1997	10,374	12,993	1,699	6,797	-697	-1,781	-163
1998	10,286	13,921	2,445	6,866	4,998	175	15
1999	10,367	14,198	2,542	7,081	3,320	-311	167
2000	10,785	13,298	4,706	7,982	1,664	-1,920	-191
2001	11,280	15,831	2,502	7,677	1,365	-714	-12
2002	11,660	16,412	4,489	8,865	726	-830	-571
2003	12,407	17,713	6,395	8,495	6,327	113	-196
2004	11,840	17,542	6,003	8,248	6,823	124	-185

Table A5: **Investment goods and inventory changes, 1960–2004, constant prices**

Year	*Non-Res & Oth Const. $m1960*	*Software $m1960*	*Mineral Exploration $m1960*	*Artistic Originals $m1960*	*Dwellings $m1960*	*Computers $m1960*	*Electrical machinery $m1960*
1960	1,164	7	21	4	666	2	201
1961	1,233	9	24	5	706	5	207
1962	1,286	10	35	5	647	12	218
1963	1,335	12	49	5	715	22	241
1964	1,486	15	58	6	802	34	255
1965	1,630	16	69	6	916	63	286
1966	1,812	20	78	7	907	97	319
1967	1,828	22	82	8	941	141	327
1968	1,879	25	99	8	1,029	212	356
1969	2,054	28	118	9	1,149	283	357
1970	2,148	30	149	10	1,260	372	361
1971	2,298	34	171	11	1,263	538	381
1972	2,336	44	135	12	1,371	777	394
1973	2,227	63	119	12	1,495	1,024	385
1974	2,266	100	99	12	1,518	1,408	385
1975	2,224	142	73	11	1,236	2,366	406
1976	2,126	283	55	13	1,499	3,381	416
1977	2,182	432	61	14	1,689	4,252	377
1978	2,174	573	71	15	1,741	6,201	412
1979	2,274	674	86	16	1,767	9,275	457
1980	2,205	840	129	19	1,929	12,441	447
1981	2,297	1,285	174	25	2,170	18,672	516
1982	2,486	1,756	243	27	2,131	26,495	582
1983	2,341	2,087	217	25	1,699	33,914	561
1984	2,221	3,168	187	25	1,863	45,727	577
1985	2,365	4,644	172	33	2,078	61,366	608
1986	2,611	6,362	155	36	2,078	93,265	681
1987	2,677	9,696	94	30	1,878	125,131	696
1988	2,793	12,699	157	32	2,002	177,981	684
1989	2,824	14,633	154	23	2,376	257,256	743
1990	2,994	21,148	130	44	2,320	308,552	763
1991	2,697	24,368	122	27	2,087	332,645	643
1992	2,419	26,951	109	18	2,098	387,827	608
1993	2,307	35,629	123	25	2,421	487,310	613
1994	2,360	39,535	128	31	2,653	637,311	686
1995	2,544	42,449	154	24	2,791	929,542	791
1996	2,751	45,210	161	25	2,435	1,191,461	837
1997	2,963	56,141	189	35	2,403	1,667,113	917
1998	3,085	68,738	189	32	2,828	2,468,415	935
1999	3,309	91,019	155	36	3,051	3,102,618	978
2000	3,073	115,030	122	34	3,523	4,864,550	808
2001	2,608	142,986	145	37	2,795	4,605,740	1,119
2002	2,819	146,867	126	37	3,300	5,558,598	952
2003	3,302	155,673	138	39	3,806	7,630,636	1,277
2004	3,497	165,827	135	41	4,088	10,684,290	1,394

Table A5: **Investment goods and inventory changes, 1960–2004, const. prices** (cont'd)

Year	*Industrial machinery* *$m1960*	*Motor vehicles* *$m1960*	*Oth transp. equipment* *$m1960*	*Other machinery* *$m1960*	*Non–farm inventories* *$m1960*	*Farm inventories* *$m1960*	*Livestock* *$m1960*
1960	385	485	90	344	188	221	45
1961	427	495	82	359	199	225	45
1962	440	475	86	362	212	230	45
1963	481	521	92	388	225	235	46
1964	502	629	86	412	424	626	-139
1965	612	665	101	485	157	-93	-22
1966	675	653	114	523	181	-502	89
1967	686	691	115	523	247	-203	232
1968	717	693	143	556	349	1,553	362
1969	769	760	128	571	369	-38	381
1970	808	725	128	581	616	-798	490
1971	892	750	115	627	7	-43	624
1972	895	778	144	635	132	-2,220	154
1973	818	897	136	607	286	-1,368	329
1974	833	962	139	616	654	69	381
1975	806	942	154	626	51	-567	179
1976	812	1,057	141	630	373	-775	-248
1977	789	1,117	122	582	-235	-380	-248
1978	828	1,111	143	603	209	-752	-214
1979	967	1,263	136	661	327	-718	-51
1980	885	1,275	146	619	306	-371	-152
1981	1,068	1,392	176	703	206	144	-2
1982	1,271	1,442	195	783	-538	-315	-492
1983	1,169	1,238	190	715	180	-47	-114
1984	1,129	1,391	215	716	395	1	133
1985	1,255	1,561	228	781	68	-118	-196
1986	1,266	1,517	276	784	-301	-329	-131
1987	1,286	1,455	280	775	99	-358	116
1988	1,347	1,558	246	746	573	-177	100
1989	1,503	1,685	293	866	870	114	794
1990	1,400	1,611	366	846	-122	272	-535
1991	1,153	1,378	262	691	-337	-329	476
1992	1,037	1,254	241	654	188	-256	24
1993	1,125	1,333	188	677	192	-74	99
1994	1,356	1,071	169	761	294	35	-309
1995	1,552	1,339	213	824	31	257	314
1996	1,496	1,457	223	927	278	-243	245
1997	1,437	1,632	255	1,006	-98	-530	-129
1998	1,377	1,740	330	998	697	50	11
1999	1,296	1,786	295	1,004	464	-90	112
2000	1,375	1,682	542	1,125	228	-552	-107
2001	1,405	2,070	266	1,091	178	-169	-5
2002	1,403	2,195	448	1,222	94	-173	-252
2003	1,529	2,298	662	1,169	809	22	-92
2004	1,549	2,308	693	1,160	864	22	-91

Table A6: **Aggregate exports and imports, 1960–2004, current and constant prices**

	Exports			*Imports*		
Year	*$m*	*Price index*	*$m1960*	*$m*	*Price index*	*$m1960*
1960	2,147	1.000	2,147	2,332	1.000	2,332
1961	2,168	0.962	2,254	2,636	1.005	2,624
1962	2,468	0.964	2,561	2,243	0.997	2,250
1963	2,489	0.994	2,504	2,656	1.006	2,640
1964	3,158	1.083	2,916	2,920	0.994	2,936
1965	3,050	1.049	2,908	3,535	1.011	3,497
1966	3,136	1.063	2,949	3,683	1.025	3,593
1967	3,484	1.064	3,274	3,770	1.032	3,653
1968	3,574	1.041	3,432	4,224	1.052	4,015
1969	3,897	1.066	3,656	4,360	1.050	4,153
1970	4,765	1.120	4,256	4,871	1.083	4,499
1971	5,086	1.090	4,667	5,214	1.124	4,637
1972	5,685	1.133	5,017	5,351	1.248	4,288
1973	7,016	1.371	5,117	5,512	1.268	4,346
1974	7,896	1.643	4,807	7,996	1.414	5,656
1975	10,114	1.918	5,273	10,510	1.815	5,792
1976	11,225	2.045	5,490	11,163	2.027	5,507
1977	13,425	2.284	5,877	14,106	2.339	6,030
1978	14,245	2.371	6,009	15,342	2.669	5,748
1979	16,910	2.628	6,436	18,260	2.938	6,214
1980	22,017	3.196	6,890	21,444	3.447	6,221
1981	22,604	3.448	6,556	25,530	3.751	6,807
1982	23,696	3.531	6,711	29,660	3.901	7,603
1983	25,632	3.798	6,748	29,667	4.260	6,963
1984	28,892	3.977	7,266	32,162	4.355	7,385
1985	35,739	4.262	8,385	40,790	4.742	8,602
1986	38,948	4.475	8,703	47,199	5.500	8,582
1987	44,306	4.602	9,627	49,032	5.997	8,176
1988	51,742	4.930	10,496	54,080	5.954	9,083
1989	55,354	5.191	10,663	62,296	5.518	11,289
1990	60,899	5.443	11,189	68,771	5.774	11,911
1991	66,259	5.303	12,495	66,948	5.962	11,230
1992	70,080	5.145	13,622	69,269	5.951	11,639
1993	76,899	5.292	14,530	79,077	6.392	12,371
1994	83,015	5.207	15,942	85,396	6.469	13,200
1995	87,654	5.243	16,718	97,654	6.349	15,381
1996	99,095	5.377	18,429	101,078	6.317	16,002
1997	105,160	5.165	20,360	103,590	5.889	17,591
1998	113,744	5.388	21,112	118,482	6.139	19,301
1999	112,025	5.200	21,542	126,456	6.250	20,233
2000	126,222	5.347	23,607	140,811	6.167	22,834
2001	153,854	6.071	25,341	153,205	6.796	22,545
2002	153,340	6.116	25,074	154,573	6.706	23,049
2003	148,530	5.956	24,939	167,169	6.391	26,157
2004	143,178	5.689	25,168	167,275	5.655	29,582

Table A7: **Expanded market sector labour inputs, 1960–2004**

Year	*Total weekly hours '000 hours*	*Self employed weekly hours '000 hours*	*Value $m*	*Price Index*	*Quantity $m1960*
1960	146,302	24,264	8,286	1.000	8,286
1961	153,330	25,430	8,939	1.029	8,684
1962	153,899	25,571	9,194	1.054	8,720
1963	157,988	26,237	9,735	1.088	8,950
1964	161,624	26,819	10,645	1.163	9,155
1965	165,384	27,489	11,946	1.275	9,371
1966	170,684	28,281	12,913	1.336	9,665
1967	173,501	28,894	14,119	1.436	9,835
1968	177,882	28,962	15,284	1.523	10,038
1969	182,191	28,822	16,793	1.642	10,225
1970	187,445	28,607	18,778	1.797	10,451
1971	194,625	29,539	21,589	1.992	10,840
1972	198,591	29,951	23,954	2.168	11,049
1973	201,157	30,682	26,565	2.369	11,214
1974	207,706	31,187	32,571	2.821	11,547
1975	211,273	36,660	43,280	3.584	12,077
1976	208,363	36,155	49,981	4.196	11,911
1977	208,092	33,770	55,597	4.738	11,736
1978	207,821	35,575	61,533	5.194	11,846
1979	212,962	36,953	66,046	5.425	12,174
1980	215,600	37,979	73,558	5.950	12,364
1981	220,741	38,638	84,769	6.706	12,641
1982	220,470	37,961	98,061	7.794	12,582
1983	212,148	37,309	109,196	8.979	12,161
1984	214,380	37,995	115,109	9.351	12,310
1985	224,933	39,371	126,219	9.799	12,881
1986	232,141	41,227	139,371	10.451	13,336
1987	239,167	41,524	150,274	10.990	13,673
1988	247,867	42,340	164,288	11.633	14,123
1989	257,848	43,052	182,777	12.499	14,623
1990	269,832	43,233	205,135	13.513	15,180
1991	264,609	43,468	214,362	14.330	14,958
1992	258,473	43,808	218,280	14.846	14,703
1993	257,176	44,351	227,809	15.516	14,682
1994	265,821	45,707	237,081	15.632	15,166
1995	277,775	45,381	249,133	15.883	15,686
1996	284,728	46,500	267,850	16.660	16,077
1997	285,926	44,365	283,351	17.721	15,989
1998	290,565	46,364	297,088	18.189	16,334
1999	295,332	44,644	314,027	19.104	16,437
2000	302,802	45,651	332,035	19.711	16,845
2001	307,568	46,370	353,027	20.632	17,110
2002	306,638	46,229	369,407	21.655	17,059
2003	311,997	47,037	392,892	22.636	17,357
2004	316,529	47,721	414,157	23.520	17,609

Table A8: **Taxes and subsidies, 1960–2004**

Year	*Consumption tax* $m	*Import duties* $m	*Subsidies* $m	*Bus property tax* $m	*Capital taxes* $m
1960	1,099	168	66	107	895
1961	1,142	202	77	116	915
1962	1,126	170	115	129	936
1963	1,163	210	101	138	982
1964	1,266	232	135	149	1,165
1965	1,367	268	123	161	1,310
1966	1,537	271	167	172	1,269
1967	1,643	275	191	190	1,354
1968	1,797	312	207	207	1,583
1969	1,999	346	289	223	1,724
1970	2,189	414	281	237	2,127
1971	2,358	466	358	258	2,093
1972	2,676	469	465	278	2,279
1973	3,026	515	509	306	2,851
1974	3,675	616	604	349	3,450
1975	4,302	882	773	458	3,367
1976	5,545	1,048	861	563	4,221
1977	6,138	1,334	1,038	642	4,776
1978	6,777	1,232	1,339	696	4,514
1979	7,973	1,518	1,595	755	4,775
1980	9,424	1,630	1,831	838	6,456
1981	10,734	1,916	2,244	944	7,101
1982	12,089	2,158	2,576	1,045	6,557
1983	14,404	2,104	3,178	1,230	6,344
1984	16,591	2,398	3,525	1,334	8,535
1985	18,812	2,995	3,957	1,488	10,083
1986	20,557	3,358	4,352	1,690	10,596
1987	22,145	3,314	4,581	1,879	15,003
1988	24,485	3,711	4,778	2,105	18,565
1989	26,088	3,831	4,642	2,366	20,858
1990	28,799	4,026	4,820	2,842	22,589
1991	29,601	3,377	5,739	3,349	23,179
1992	28,700	3,350	6,017	3,535	21,047
1993	30,421	3,337	6,492	3,315	20,858
1994	34,282	3,231	6,662	3,165	24,095
1995	37,586	3,479	6,309	2,973	25,155
1996	40,970	3,129	6,351	3,310	25,570
1997	42,398	3,295	7,020	3,558	30,463
1998	43,622	3,644	7,200	3,869	33,618
1999	47,138	3,748	6,490	3,615	35,438
2000	47,958	3,799	6,335	3,722	43,614
2001	56,835	4,606	8,442	4,218	47,859
2002	60,083	5,214	9,605	4,317	48,271
2003	65,602	5,572	10,264	4,843	56,226
2004	69,511	5,647	10,732	5,000	62,380

Table A8: **Taxes and subsidies, 1960–2004** (cont'd)

Year	*Consumption tax rate* %	*Import duty rate* %	*Subsidy rate* %	*Business property tax rate* %	*Capital tax rate on assets* %
1960	10.99	7.20	0.54	0.57	1.98
1961	10.79	7.66	0.60	0.57	1.95
1962	10.35	7.58	0.86	0.58	1.90
1963	10.04	7.91	0.72	0.58	1.93
1964	10.06	7.95	0.86	0.59	2.18
1965	9.95	7.58	0.73	0.58	2.26
1966	10.42	7.36	0.93	0.58	2.04
1967	10.28	7.29	0.98	0.56	2.01
1968	10.20	7.39	0.98	0.57	2.19
1969	10.53	7.94	1.26	0.53	2.10
1970	10.44	8.50	1.09	0.51	2.43
1971	10.18	8.94	1.27	0.50	2.18
1972	10.44	8.76	1.48	0.48	2.14
1973	10.60	9.34	1.43	0.48	2.49
1974	10.78	7.70	1.44	0.47	2.59
1975	10.06	8.39	1.46	0.46	2.02
1976	10.91	9.39	1.39	0.48	2.21
1977	10.50	9.46	1.44	0.48	2.20
1978	10.48	8.03	1.70	0.46	1.85
1979	11.15	8.31	1.80	0.46	1.80
1980	11.79	7.60	1.80	0.45	2.10
1981	11.73	7.50	1.97	0.43	1.99
1982	11.53	7.28	2.00	0.41	1.60
1983	12.17	7.09	2.21	0.41	1.34
1984	12.80	7.46	2.22	0.42	1.68
1985	13.23	7.34	2.22	0.43	1.82
1986	12.90	7.11	2.20	0.43	1.70
1987	12.75	6.76	2.10	0.43	2.15
1988	12.81	6.86	1.97	0.43	2.42
1989	12.43	6.15	1.75	0.43	2.47
1990	12.42	5.85	1.65	0.47	2.45
1991	11.92	5.04	1.82	0.53	2.39
1992	10.96	4.84	1.81	0.56	2.16
1993	11.14	4.22	1.86	0.53	2.14
1994	12.18	3.78	1.83	0.50	2.41
1995	12.58	3.56	1.63	0.45	2.43
1996	12.89	3.10	1.52	0.48	2.35
1997	12.86	3.18	1.61	0.48	2.69
1998	12.43	3.08	1.55	0.49	2.83
1999	12.66	2.96	1.34	0.44	2.81
2000	12.18	2.70	1.22	0.42	3.28
2001	13.39	3.01	1.46	0.45	3.43
2002	13.44	3.37	1.60	0.45	3.31
2003	13.76	3.33	1.64	0.48	3.69
2004	13.58	3.38	1.64	0.45	3.87

Table A9: **Capital depreciation rates, 1960–2004**

Year	*Non-Residential & Other Constr.* %	*Software* %	*Mineral Exploration* %	*Artistic Originals* %	*Computers* %
1960	3.60	12.29	6.26	59.04	9.86
1961	3.60	12.29	6.26	59.04	9.86
1962	3.60	12.29	6.26	59.04	9.86
1963	3.60	12.29	6.26	59.04	9.86
1964	3.60	12.29	6.26	59.04	9.86
1965	3.60	12.29	6.26	59.04	9.86
1966	3.60	12.29	6.26	59.04	9.86
1967	3.60	12.29	6.26	59.04	9.86
1968	3.60	12.29	6.26	59.04	9.86
1969	3.60	12.29	6.26	59.04	9.86
1970	3.60	12.29	6.26	59.04	9.86
1971	3.60	12.29	6.26	59.04	9.86
1972	3.60	12.29	6.26	59.04	9.86
1973	3.60	12.29	6.26	59.04	9.86
1974	3.60	15.00	6.26	59.04	9.86
1975	3.60	17.00	6.26	59.04	9.86
1976	3.60	19.12	6.26	60.71	9.86
1977	3.60	19.12	6.26	60.71	9.86
1978	3.60	19.12	6.26	60.71	9.86
1979	3.60	19.12	6.26	60.71	9.86
1980	3.60	19.12	6.26	60.71	9.86
1981	3.60	19.12	6.26	62.38	9.86
1982	3.60	19.12	6.26	62.38	9.86
1983	3.60	19.12	6.26	62.38	9.86
1984	3.60	19.12	6.26	62.38	9.86
1985	3.60	19.12	6.26	62.38	15.00
1986	3.60	19.12	6.26	62.38	20.00
1987	3.60	19.12	6.26	62.38	24.00
1988	3.60	19.12	6.26	62.38	28.00
1989	3.60	19.12	6.26	62.38	31.00
1990	3.60	20.00	6.26	62.38	34.00
1991	3.60	22.00	6.26	62.38	36.00
1992	3.60	23.00	6.26	62.38	38.00
1993	3.60	24.00	6.26	62.38	39.00
1994	3.60	25.00	6.26	62.38	40.31
1995	3.60	26.00	6.26	62.38	40.40
1996	3.60	27.00	6.26	62.38	40.40
1997	3.60	27.99	6.26	62.38	40.40
1998	3.60	27.99	6.26	62.38	40.40
1999	3.60	27.99	6.26	62.38	40.40
2000	3.60	27.99	6.26	62.38	40.40
2001	3.60	27.99	6.26	62.38	40.40
2002	3.60	27.99	6.26	62.38	40.40
2003	3.60	27.99	6.26	62.38	40.40
2004	3.60	27.99	6.26	62.38	40.40

Table A9: **Capital depreciation rates, 1960–2004** (continued)

Year	*Electrical machinery* %	*Industrial machinery* %	*Motor vehicles* %	*Other transport equipment* %	*Other machinery* %
1960	10.25	11.52	13.66	11.65	13.21
1961	10.25	11.52	13.66	11.65	13.21
1962	10.25	11.52	13.66	11.65	13.21
1963	10.25	11.52	13.66	11.65	13.21
1964	10.25	11.52	13.66	11.65	13.21
1965	10.25	11.52	13.66	11.65	13.21
1966	10.25	11.52	13.66	11.65	13.21
1967	10.25	11.52	13.66	11.65	13.21
1968	10.25	11.52	13.66	11.65	13.21
1969	10.25	11.52	13.66	11.65	13.21
1970	10.25	11.52	13.66	11.65	13.21
1971	10.25	11.52	13.66	11.65	13.21
1972	10.25	11.52	13.66	11.65	13.21
1973	10.25	11.52	13.66	11.65	13.21
1974	10.25	11.52	13.66	11.65	13.21
1975	11.41	11.58	11.58	11.61	13.15
1976	11.41	11.58	11.58	11.61	13.15
1977	11.41	11.58	11.58	11.61	13.15
1978	11.41	11.58	11.58	11.61	13.15
1979	11.41	11.58	11.58	11.61	13.15
1980	11.41	11.58	11.58	11.61	13.15
1981	11.41	11.58	10.41	11.61	13.15
1982	11.41	11.58	10.41	11.61	13.15
1983	11.41	11.58	10.41	11.61	13.15
1984	11.41	11.58	10.41	11.61	13.15
1985	11.41	11.58	10.41	11.61	13.15
1986	11.41	11.58	10.41	11.61	13.15
1987	11.41	11.58	10.41	11.61	13.15
1988	11.41	11.58	10.41	11.61	13.15
1989	11.41	11.58	10.41	11.61	13.15
1990	11.41	11.58	10.41	11.61	13.15
1991	11.41	11.58	10.41	11.61	13.15
1992	11.41	11.58	10.41	11.61	13.15
1993	11.41	11.58	10.41	11.61	13.15
1994	11.41	11.58	10.41	11.61	13.15
1995	11.41	11.58	10.41	11.61	13.15
1996	11.41	11.58	10.41	11.61	13.15
1997	11.41	11.58	10.41	11.61	13.15
1998	11.41	11.58	10.41	11.61	13.15
1999	11.41	11.58	10.41	11.61	13.15
2000	11.41	11.58	10.41	11.61	13.15
2001	11.41	11.58	10.41	11.61	13.15
2002	11.41	11.58	10.41	11.61	13.15
2003	11.41	11.58	10.41	11.61	13.15
2004	11.41	11.58	10.41	11.61	13.15

Table A10: **Capital and inventory stocks, 1960–2004, current prices**

Year	*Non-Res & Oth Const.* $m	*Software* $m	*Mineral Exploration* $m	*Artistic Originals* $m	*Computers* $m	*Electrical machinery* $m	*Industrial machinery* $m
1960	10,004	7	44	7	8	1,181	1,912
1961	11,068	12	63	7	8	1,278	2,114
1962	12,434	18	85	8	9	1,368	2,326
1963	13,417	23	119	10	14	1,458	2,529
1964	14,666	29	168	11	22	1,550	2,736
1965	16,464	30	240	13	32	1,693	3,018
1966	17,946	31	315	15	48	1,865	3,413
1967	20,247	33	404	17	69	2,057	3,839
1968	22,282	35	495	20	94	2,234	4,224
1969	24,750	37	615	23	124	2,484	4,726
1970	27,621	40	771	27	156	2,732	5,266
1971	31,225	43	980	32	189	3,043	5,969
1972	35,780	45	1,287	37	232	3,403	6,819
1973	41,146	51	1,554	44	287	3,715	7,542
1974	50,422	58	1,980	52	344	4,123	8,353
1975	68,558	72	2,733	62	410	5,284	10,719
1976	84,006	94	3,229	60	523	6,169	12,516
1977	96,004	156	3,606	68	659	7,027	14,218
1978	107,603	246	3,939	75	786	7,915	16,119
1979	118,551	362	4,255	82	961	8,887	18,094
1980	138,176	453	4,856	92	1,203	10,106	20,732
1981	160,665	559	5,693	107	1,460	11,220	22,935
1982	187,777	737	7,053	149	1,816	12,587	25,819
1983	221,984	963	8,910	191	2,253	14,824	30,772
1984	241,897	1,189	10,290	207	2,665	16,143	33,566
1985	261,247	1,559	11,584	214	3,094	17,177	35,441
1986	293,140	2,083	12,681	277	3,458	19,433	41,091
1987	325,180	2,752	13,643	335	4,143	22,393	47,408
1988	357,794	3,785	14,016	344	4,242	23,988	51,796
1989	397,400	5,017	15,094	393	4,512	25,118	53,909
1990	439,374	6,075	16,484	348	5,778	26,857	58,281
1991	467,711	7,583	17,651	533	6,338	28,111	62,559
1992	470,555	8,901	17,991	460	6,438	28,420	64,444
1993	472,008	9,904	18,328	361	6,623	29,648	67,425
1994	481,459	11,439	18,522	387	7,116	30,080	69,433
1995	503,041	12,566	18,870	460	7,135	30,174	70,651
1996	527,521	13,272	19,647	441	7,875	31,440	75,057
1997	549,452	13,699	20,339	454	7,511	30,775	76,680
1998	578,119	14,787	21,544	584	8,580	32,507	80,860
1999	607,907	16,434	22,528	609	10,271	33,617	87,473
2000	647,115	19,026	23,933	694	10,053	38,930	85,966
2001	679,207	22,240	24,580	702	14,158	38,118	88,794
2002	695,323	26,115	25,118	761	14,445	40,076	92,909
2003	730,832	28,357	26,007	794	13,582	39,285	91,555
2004	787,984	29,611	26,691	856	12,475	38,826	87,826

Table A10: **Capital and inventory stocks, 1960–2004, current prices** (cont'd)

Year	*Motor vehicles* $m	*Oth transp. equipment* $m	*Other machin'y* $m	*Non–farm invent's* $m	*Farm invent's* $m	*Livestock* $m	*Commer-cial land* $m	*Rural land* $m
1960	2,173	429	1,770	3,063	10,139	5,767	3,017	5,689
1961	2,401	474	1,895	3,365	9,816	5,395	3,293	5,866
1962	2,596	514	2,017	3,696	9,504	5,047	3,597	6,050
1963	2,746	544	2,122	4,060	9,201	4,439	3,932	6,239
1964	2,915	581	2,231	4,460	8,908	4,536	4,301	6,434
1965	3,250	622	2,402	5,120	8,919	4,883	4,710	6,635
1966	3,610	672	2,641	5,492	8,383	5,826	5,184	6,842
1967	3,914	739	2,896	5,927	8,087	5,593	5,670	7,740
1968	4,210	797	3,109	6,406	8,344	6,106	6,209	7,706
1969	4,589	898	3,423	7,102	9,726	6,153	6,787	10,698
1970	4,968	984	3,734	7,800	8,588	6,404	7,396	11,067
1971	5,281	1,085	4,142	8,928	8,179	7,006	8,117	11,898
1972	5,725	1,173	4,626	9,118	8,882	7,451	8,944	12,828
1973	6,158	1,288	5,038	9,746	7,381	8,041	9,900	12,571
1974	6,966	1,423	5,533	10,722	7,858	10,884	11,254	13,030
1975	8,814	1,821	7,043	12,904	9,416	8,581	13,172	16,900
1976	11,142	2,161	8,219	15,246	8,615	5,601	15,651	17,667
1977	13,328	2,460	9,337	18,349	8,273	5,616	18,618	19,622
1978	15,576	2,761	10,508	19,738	8,642	6,957	21,866	21,441
1979	18,108	3,102	11,714	21,898	8,024	7,842	24,929	19,126
1980	21,139	3,464	13,262	24,819	8,046	13,053	27,590	20,890
1981	24,152	3,833	14,547	29,168	8,864	15,805	30,384	27,559
1982	28,563	4,313	16,139	32,990	10,148	15,629	33,946	32,850
1983	32,037	5,079	18,813	33,409	9,542	13,800	38,009	41,559
1984	35,338	5,539	20,172	37,353	10,282	14,118	42,138	36,654
1985	37,998	5,983	21,002	41,515	10,786	16,287	46,704	42,000
1986	46,438	7,678	24,392	43,751	10,722	16,887	53,358	46,600
1987	58,315	9,402	27,839	45,538	10,283	15,975	62,378	51,100
1988	64,900	9,617	29,503	49,250	10,214	17,864	73,787	55,600
1989	69,175	9,012	29,331	56,309	10,992	19,478	86,944	60,100
1990	74,127	10,115	31,307	64,153	12,260	14,651	98,325	62,300
1991	78,280	11,741	33,866	65,195	12,805	10,444	102,346	64,600
1992	82,503	12,818	33,419	63,888	10,661	10,664	98,408	66,700
1993	89,268	14,172	34,198	65,343	10,437	9,648	91,311	56,600
1994	97,001	14,934	33,746	67,750	10,735	9,844	88,446	59,800
1995	97,524	13,393	33,808	70,008	10,844	10,528	92,320	65,100
1996	99,849	13,356	35,264	72,520	12,268	10,712	99,957	67,800
1997	96,231	12,450	36,424	75,598	10,754	9,915	107,568	86,300
1998	99,363	14,124	38,894	73,043	8,458	10,740	113,649	91,200
1999	101,933	17,372	41,477	78,961	8,936	12,071	120,508	100,500
2000	104,585	17,988	43,156	82,190	8,513	12,824	129,723	104,800
2001	103,012	21,902	44,542	85,494	6,694	15,245	139,880	109,900
2002	105,181	23,233	47,243	90,893	7,412	19,919	148,149	120,200
2003	113,357	24,054	49,231	92,675	7,592	18,677	154,600	133,100
2004	116,773	24,697	49,209	99,959	8,312	17,269	159,666	151,600

Table A11: **Capital and inventory stocks, 1960–2004, constant prices**

Year	*Non-Res & Oth Const. $m1960*	*Software $m1960*	*Mineral Exploration $m1960*	*Artistic Originals $m1960*	*Computers $m1960*	*Electrical machinery $m1960*	*Industrial machinery $m1960*
1960	10,004	7	44	7	8	1,181	1,912
1961	10,716	13	62	7	9	1,254	2,072
1962	11,467	20	83	7	13	1,324	2,255
1963	12,240	28	112	8	22	1,398	2,429
1964	13,028	37	154	9	40	1,486	2,625
1965	13,930	41	203	9	67	1,577	2,816
1966	14,923	46	259	10	117	1,688	3,094
1967	16,014	52	321	11	195	1,818	3,401
1968	17,064	58	383	12	305	1,941	3,683
1969	18,138	65	458	13	468	2,079	3,961
1970	19,343	75	547	14	682	2,204	4,261
1971	20,606	84	662	16	961	2,324	4,566
1972	21,966	95	791	17	1,364	2,448	4,919
1973	23,303	113	876	19	1,960	2,574	5,235
1974	24,475	139	941	19	2,722	2,676	5,437
1975	25,661	182	981	20	3,759	2,769	5,630
1976	26,753	253	992	20	5,562	2,837	5,768
1977	27,703	447	985	21	8,118	2,907	5,895
1978	28,694	748	984	23	11,236	2,933	5,987
1979	29,647	1,126	994	24	15,914	2,992	6,108
1980	30,679	1,504	1,018	26	23,089	3,089	6,354
1981	31,628	1,963	1,083	29	32,484	3,165	6,491
1982	32,649	2,736	1,189	36	46,861	3,302	6,794
1983	33,800	3,798	1,357	41	67,393	3,491	7,266
1984	34,765	4,958	1,489	41	92,386	3,634	7,578
1985	35,583	6,890	1,583	40	124,353	3,779	7,820
1986	36,509	9,775	1,656	48	161,079	3,937	8,158
1987	37,638	13,686	1,707	54	214,302	4,147	8,471
1988	38,781	19,960	1,695	50	276,930	4,340	8,766
1989	40,043	27,977	1,746	51	360,721	4,501	9,088
1990	41,307	35,956	1,791	42	483,130	4,705	9,527
1991	42,688	47,548	1,809	59	592,047	4,904	9,815
1992	43,708	59,142	1,817	49	672,976	4,969	9,822
1993	44,412	69,739	1,812	37	755,000	4,995	9,714
1994	45,000	85,075	1,821	39	893,486	5,025	9,707
1995	45,605	99,040	1,835	45	1,096,646	5,123	9,932
1996	46,366	110,894	1,874	41	1,471,372	5,317	10,326
1997	47,319	121,228	1,917	40	1,952,516	5,537	10,620
1998	48,460	138,710	1,986	50	2,665,160	5,811	10,821
1999	49,718	163,265	2,050	51	3,888,731	6,074	10,939
2000	51,137	201,102	2,077	55	5,150,244	6,349	10,963
2001	52,281	250,042	2,069	55	7,616,811	6,417	11,060
2002	52,903	312,278	2,085	58	8,894,428	6,778	11,178
2003	53,698	360,803	2,081	59	10,555,834	6,926	11,280
2004	54,969	401,332	2,088	61	13,516,672	7,369	11,491

Table A11: **Capital and inventory stocks, 1960–2004, constant prices** (cont'd)

Year	*Motor vehicles* *$m1960*	*Oth transp. equipment* *$m1960*	*Other machin'y* *$m1960*	*Non–farm invent's* *$m1960*	*Farm invent's* *$m1960*	*Livestock* *$m1960*	*Commer-cial land* *$m1960*	*Rural land* *$m1960*
1960	2,173	429	1,770	3,063	10,139	5,767	3,017	5,689
1961	2,357	468	1,860	3,251	10,360	5,812	3,112	5,689
1962	2,524	494	1,952	3,450	10,585	5,857	3,213	5,689
1963	2,648	522	2,035	3,662	10,816	5,902	3,319	5,689
1964	2,802	552	2,133	3,887	11,051	5,948	3,432	5,689
1965	3,038	574	2,234	4,311	11,677	5,809	3,551	5,689
1966	3,278	607	2,388	4,468	11,584	5,787	3,694	5,689
1967	3,471	649	2,557	4,649	11,081	5,876	3,821	5,689
1968	3,675	688	2,703	4,896	10,879	6,108	3,965	5,689
1969	3,852	749	2,860	5,245	12,431	6,470	4,117	5,689
1970	4,073	788	3,015	5,614	12,394	6,852	4,266	5,689
1971	4,229	823	3,161	6,230	11,596	7,342	4,422	5,689
1972	4,385	841	3,330	6,236	11,553	7,966	4,565	5,689
1973	4,548	885	3,487	6,369	9,333	8,120	4,675	5,689
1974	4,806	917	3,592	6,655	7,965	8,449	4,778	5,689
1975	5,093	948	3,690	7,309	8,034	8,830	4,864	5,689
1976	5,423	989	3,779	7,360	7,467	9,009	4,930	5,689
1977	5,829	1,013	3,860	7,734	6,692	8,761	5,006	5,689
1978	6,254	1,016	3,893	7,498	6,312	8,513	5,082	5,689
1979	6,623	1,039	3,945	7,707	5,560	8,299	5,167	5,689
1980	7,103	1,053	4,052	8,034	4,843	8,248	5,249	5,689
1981	7,541	1,075	4,104	8,340	4,472	8,096	5,345	5,689
1982	8,134	1,125	4,235	8,546	4,616	8,094	5,459	5,689
1983	8,717	1,188	4,431	8,008	4,301	7,602	5,558	5,689
1984	9,032	1,239	4,528	8,188	4,254	7,488	5,630	5,689
1985	9,459	1,308	4,607	8,583	4,255	7,621	5,704	5,689
1986	10,009	1,383	4,736	8,651	4,137	7,425	5,793	5,689
1987	10,458	1,497	4,849	8,350	3,807	7,294	5,877	5,689
1988	10,799	1,603	4,933	8,448	3,450	7,410	5,958	5,689
1989	11,206	1,662	4,977	9,021	3,273	7,510	6,050	5,689
1990	11,694	1,761	5,130	9,892	3,387	8,304	6,155	5,689
1991	12,047	1,921	5,232	9,770	3,659	7,769	6,224	5,689
1992	12,129	1,959	5,175	9,433	3,330	8,245	6,276	5,689
1993	12,074	1,970	5,086	9,621	3,074	8,269	6,320	5,689
1994	12,110	1,929	5,042	9,813	3,000	8,369	6,365	5,689
1995	11,876	1,872	5,083	10,107	3,035	8,059	6,426	5,689
1996	11,923	1,866	5,190	10,138	3,292	8,373	6,500	5,689
1997	12,090	1,870	5,393	10,416	3,049	8,618	6,580	5,689
1998	12,418	1,906	5,654	10,318	2,519	8,489	6,670	5,689
1999	12,821	2,013	5,882	11,015	2,569	8,500	6,777	5,689
2000	13,226	2,072	6,080	11,478	2,479	8,612	6,845	5,689
2001	13,467	2,328	6,328	11,706	1,926	8,505	6,874	5,689
2002	14,066	2,321	6,511	11,885	1,757	8,500	6,920	5,689
2003	14,704	2,491	6,774	11,979	1,584	8,247	7,004	5,689
2004	15,364	2,852	6,920	12,788	1,606	8,155	7,093	5,689

Table A12: **Capital and inventory annual user costs, 1960–2004, current prices**

Year	*Non-Res & Oth Const.* $m	*Software* $m	*Mineral Exploration* $m	*Artistic Originals* $m	*Computers* $m	*Electrical machinery* $m	*Industrial machinery* $m
1960	817.3	1.1	4.5	4.2	1.1	168.3	296.7
1961	904.0	2.0	6.5	4.6	1.1	182.1	328.0
1962	1,017.0	2.9	8.7	5.2	1.3	195.0	361.0
1963	1,097.3	3.8	12.3	6.0	2.0	207.7	392.4
1964	1,199.8	4.6	17.3	7.0	3.1	220.9	424.5
1965	1,345.6	4.9	24.6	8.1	4.4	241.2	468.3
1966	1,466.4	5.1	32.3	9.4	6.7	265.8	529.6
1967	1,652.1	5.4	41.4	11.0	9.6	293.1	595.8
1968	1,819.8	5.7	50.7	12.7	13.0	318.3	655.4
1969	2,010.7	6.1	63.1	14.8	17.2	354.0	733.3
1970	2,239.8	6.6	79.1	17.2	21.6	389.4	817.1
1971	2,529.0	6.9	100.6	20.0	26.2	433.7	926.3
1972	2,890.5	7.4	132.0	23.2	32.1	485.0	1,058.2
1973	3,323.2	8.2	159.4	27.9	39.8	529.5	1,170.3
1974	4,065.2	11.1	203.2	32.6	47.7	587.6	1,296.1
1975	5,525.5	15.1	280.4	39.3	56.8	814.5	1,670.2
1976	6,783.9	21.8	331.3	39.0	72.5	950.8	1,950.3
1977	7,751.2	36.1	370.0	43.8	91.3	1,083.2	2,215.4
1978	8,669.7	56.8	404.2	48.5	109.0	1,220.0	2,511.7
1979	9,555.3	83.8	436.7	52.9	133.2	1,369.7	2,819.4
1980	11,116.0	104.8	498.3	59.3	166.7	1,557.7	3,230.4
1981	12,897.0	129.3	584.2	71.0	202.4	1,729.4	3,573.6
1982	15,033.8	170.4	723.7	99.0	251.8	1,940.1	4,023.0
1983	17,766.5	222.6	914.3	126.5	312.4	2,284.9	4,794.8
1984	19,379.6	275.0	1,055.9	137.5	369.5	2,488.2	5,230.3
1985	20,954.0	360.5	1,188.7	142.0	587.9	2,647.6	5,522.4
1986	23,526.4	481.7	1,301.2	184.0	829.8	2,995.3	6,402.7
1987	26,092.7	636.4	1,399.9	222.5	1,160.0	3,451.5	7,387.0
1988	28,722.6	875.1	1,438.2	228.0	1,357.3	3,697.4	8,070.8
1989	31,912.2	1,160.0	1,548.9	261.1	1,579.3	3,871.5	8,400.1
1990	35,454.5	1,457.9	1,691.5	231.3	2,195.6	4,139.6	9,081.4
1991	37,993.8	1,971.5	1,811.1	353.8	2,535.2	4,332.9	9,747.9
1992	38,358.5	2,403.2	1,846.0	305.1	2,703.9	4,380.6	10,041.6
1993	38,376.1	2,773.2	1,880.7	239.9	2,848.1	4,569.8	10,506.2
1994	38,989.8	3,317.4	1,900.5	256.9	3,153.5	4,636.4	10,819.0
1995	40,473.6	3,769.9	1,936.3	305.1	3,168.3	4,650.9	11,008.8
1996	42,580.0	4,114.4	2,016.0	292.5	3,496.8	4,846.0	11,695.4
1997	44,364.5	4,382.5	2,087.0	301.4	3,335.1	4,743.5	11,948.3
1998	46,768.7	4,730.8	2,210.7	387.8	3,810.0	5,010.4	12,599.6
1999	48,825.6	5,257.6	2,311.6	404.3	4,560.8	5,181.5	13,630.1
2000	51,884.5	6,086.8	2,455.8	461.0	4,463.7	6,000.5	13,395.3
2001	54,674.1	7,115.0	2,522.1	465.9	6,286.6	5,875.3	13,835.9
2002	55,929.2	8,354.6	2,577.4	505.0	6,413.8	6,177.1	14,477.1
2003	58,986.5	9,072.0	2,668.6	527.3	6,030.9	6,055.1	14,266.1
2004	63,436.7	9,473.1	2,738.8	567.9	5,539.1	5,984.4	13,685.0

Table A12: **Capital and inventory annual user costs, 1960–2004, current prices** (cont'd)

Year	*Motor vehicles* $m	*Oth transp. equipment* $m	*Other machin'y* $m	*Non–farm invent's* $m	*Farm invent's* $m	*Livestock* $m	*Commer-cial land* $m	*Rural land* $m
1960	383.8	67.1	304.5	122.5	405.6	230.7	138.0	260.2
1961	423.9	74.3	326.1	134.6	392.7	215.8	150.6	268.2
1962	458.3	80.5	347.0	147.8	380.2	201.9	164.9	277.3
1963	484.9	85.1	365.1	162.4	368.0	177.6	180.2	285.9
1964	514.7	91.0	384.0	178.4	356.3	181.4	197.2	295.0
1965	573.9	97.3	413.3	204.8	356.7	195.3	215.6	303.7
1966	637.5	105.2	454.6	219.7	335.3	233.0	237.2	313.0
1967	691.1	115.7	498.4	237.1	323.5	223.7	258.8	353.3
1968	743.3	124.8	535.1	256.2	333.8	244.2	283.8	352.3
1969	810.3	140.6	589.1	284.1	389.0	246.1	307.4	484.5
1970	877.2	154.0	642.7	312.0	343.5	256.2	333.8	499.5
1971	932.6	169.8	712.9	357.1	327.1	280.2	365.6	535.9
1972	1,010.9	183.6	796.1	364.7	355.3	298.1	400.9	575.1
1973	1,087.4	201.6	867.0	389.8	295.2	321.6	443.6	563.3
1974	1,230.0	222.7	952.1	428.9	314.3	435.4	502.7	582.0
1975	1,373.3	284.3	1,207.6	516.2	376.7	343.2	588.0	754.4
1976	1,736.0	337.4	1,409.3	609.9	344.6	224.0	701.1	791.4
1977	2,076.6	384.1	1,601.1	733.9	330.9	224.6	833.7	878.7
1978	2,426.9	431.2	1,801.7	789.5	345.7	278.3	975.6	956.6
1979	2,821.3	484.3	2,008.6	875.9	321.0	313.7	1,112.9	853.9
1980	3,293.5	540.8	2,274.0	992.8	321.8	522.1	1,227.5	929.4
1981	3,479.6	598.5	2,494.3	1,166.7	354.6	632.2	1,346.5	1,221.3
1982	4,115.1	673.5	2,767.4	1,319.6	405.9	625.2	1,497.2	1,448.9
1983	4,615.5	793.0	3,225.9	1,336.4	381.7	552.0	1,675.4	1,831.9
1984	5,091.1	864.8	3,458.8	1,494.1	411.3	564.7	1,860.8	1,618.6
1985	5,474.4	934.2	3,601.3	1,660.6	431.4	651.5	2,066.7	1,858.5
1986	6,690.3	1,198.8	4,182.4	1,750.0	428.9	675.5	2,363.7	2,064.4
1987	8,401.4	1,468.1	4,773.5	1,821.5	411.3	639.0	2,762.4	2,262.9
1988	9,350.2	1,501.6	5,058.9	1,970.0	408.6	714.6	3,270.3	2,464.2
1989	9,966.1	1,407.1	5,029.4	2,252.4	439.7	779.1	3,855.6	2,665.2
1990	10,679.4	1,579.3	5,368.1	2,566.1	490.4	586.0	4,398.7	2,787.1
1991	11,277.8	1,833.3	5,807.1	2,607.8	512.2	417.8	4,633.9	2,924.9
1992	11,886.3	2,001.5	5,730.3	2,555.5	426.4	426.6	4,483.6	3,038.9
1993	12,860.9	2,212.9	5,863.9	2,613.7	417.5	385.9	4,140.7	2,566.7
1994	13,974.9	2,331.7	5,786.5	2,710.0	429.4	393.8	3,982.4	2,692.6
1995	14,050.3	2,091.1	5,797.0	2,800.3	433.8	421.1	4,108.4	2,897.0
1996	14,385.3	2,085.4	6,046.7	2,900.8	490.7	428.5	4,474.2	3,034.8
1997	13,864.0	1,944.0	6,245.6	3,023.9	430.1	396.6	4,817.6	3,865.1
1998	14,315.3	2,205.3	6,669.1	2,921.7	338.3	429.6	5,107.5	4,098.7
1999	14,685.5	2,712.4	7,112.0	3,158.4	357.5	482.9	5,345.9	4,458.3
2000	15,067.5	2,808.7	7,400.0	3,287.6	340.5	512.9	5,736.6	4,634.4
2001	14,841.0	3,419.7	7,637.7	3,419.8	267.7	609.8	6,230.3	4,895.0
2002	15,153.4	3,627.6	8,100.8	3,635.7	296.5	796.8	6,589.6	5,346.5
2003	16,331.4	3,755.9	8,441.6	3,707.0	303.7	747.1	6,919.1	5,956.9
2004	16,823.5	3,856.2	8,437.8	3,998.4	332.5	690.8	7,112.9	6,753.6

Table A13: **TFP database outputs and inputs, 1960–2004, current prices**

Year	*Consumer commodity* *$m*	*Govt con-sumption* *$m*	*Exports* *$m*	*Investment - NROC* *$m*	*Investment - Software* *$m*	*Investment - Exploration* *$m*	*Investment – Artist. orig.* *$m*
1960	7,663.0	1,283.2	2,158.7	1,164.0	7.3	21.0	4.1
1961	8,098.4	1,405.2	2,181.1	1,274.0	8.1	25.0	4.8
1962	8,338.7	1,497.9	2,489.3	1,394.0	9.0	36.0	5.6
1963	8,913.1	1,584.2	2,506.9	1,463.0	10.0	52.0	6.5
1964	9,676.8	1,738.5	3,185.1	1,673.0	12.0	63.0	7.5
1965	10,486.0	1,980.2	3,072.3	1,926.0	12.0	82.0	8.8
1966	11,076.5	2,251.7	3,165.3	2,179.0	14.0	95.0	10.2
1967	11,945.2	2,544.0	3,518.2	2,311.0	14.0	103.0	11.8
1968	13,025.3	2,958.5	3,608.9	2,454.0	15.0	128.0	13.7
1969	14,128.9	3,075.8	3,946.2	2,803.0	16.0	158.0	15.9
1970	15,568.3	3,405.1	4,817.1	3,067.0	16.0	210.0	18.5
1971	17,110.1	3,956.7	5,150.5	3,483.0	17.0	253.0	21.5
1972	18,864.7	4,433.9	5,769.4	3,805.0	21.0	220.0	25.0
1973	20,996.3	4,883.5	7,116.4	3,933.0	28.0	211.0	28.0
1974	24,961.6	5,901.4	8,009.6	4,669.0	42.0	209.0	33.0
1975	30,697.2	8,339.3	10,261.8	5,941.0	56.0	203.0	35.0
1976	35,404.6	10,507.9	11,380.7	6,677.0	105.0	178.0	41.0
1977	41,077.1	11,983.3	13,618.9	7,563.0	151.0	222.0	46.0
1978	45,478.6	13,405.6	14,486.7	8,153.0	188.0	285.0	50.0
1979	50,058.2	14,596.3	17,215.1	9,092.0	217.0	369.0	56.0
1980	55,604.9	16,189.1	22,412.3	9,932.0	253.0	617.0	68.0
1981	63,319.8	19,030.6	23,048.6	11,669.0	366.0	912.0	92.0
1982	72,710.8	21,865.2	24,171.0	14,300.0	473.0	1,439.0	112.0
1983	81,311.9	24,963.0	26,197.6	15,376.0	529.0	1,423.0	119.0
1984	88,220.6	27,355.0	29,534.4	15,452.0	760.0	1,295.0	127.0
1985	94,792.1	31,367.8	36,533.6	17,361.0	1,051.0	1,257.0	172.0
1986	106,702.9	35,085.4	39,803.0	20,963.0	1,356.0	1,190.0	207.0
1987	116,751.5	37,968.8	45,237.1	23,131.0	1,950.0	755.0	187.0
1988	129,826.1	40,142.4	52,759.7	25,765.0	2,408.0	1,302.0	220.0
1989	143,804.6	43,235.2	56,322.7	28,030.0	2,624.0	1,334.0	174.0
1990	158,772.2	47,576.7	61,901.8	31,844.0	3,573.0	1,192.0	366.0
1991	170,205.6	52,598.1	67,467.4	29,552.0	3,886.0	1,186.0	238.0
1992	180,565.9	56,862.8	71,350.2	26,046.0	4,056.0	1,075.0	171.0
1993	187,707.9	59,379.9	78,325.7	24,514.0	5,060.0	1,244.0	246.0
1994	192,691.7	59,122.0	84,531.9	25,252.0	5,316.0	1,301.0	306.0
1995	204,326.7	61,060.3	89,085.3	28,056.0	5,386.0	1,582.0	240.0
1996	216,752.1	64,437.9	100,604.1	31,294.0	5,411.0	1,685.0	274.0
1997	226,013.7	65,942.4	106,857.5	34,402.0	6,344.0	2,001.0	390.0
1998	241,924.6	70,166.2	115,506.4	36,803.0	7,328.0	2,049.0	374.0
1999	254,408.2	75,116.0	113,526.1	40,457.0	9,162.0	1,706.0	431.0
2000	270,304.7	79,715.3	127,759.8	38,882.0	10,883.0	1,400.0	428.0
2001	289,177.7	83,957.5	156,099.3	33,885.0	12,718.0	1,727.0	478.0
2002	305,307.8	87,895.2	155,792.9	37,045.0	12,282.0	1,523.0	494.0
2003	323,922.4	93,981.7	150,968.1	44,937.0	12,235.0	1,727.0	525.0
2004	348,667.1	101,084.1	145,523.2	50,134.0	12,235.0	1,731.0	567.0

Table A13: **TFP database outputs and inputs, 1960–2004, current prices** (cont'd)

Year	*Investment - Dwellings $m*	*Investment - Computers $m*	*Investment – Elec. mach. $m*	*Investment – Indust. mac. $m*	*Investment - vehicles $m*	*Investment - Oth transp. $m*	*Investment - Oth mach. $m*
1960	666.0	2.0	201.0	385.0	485.0	90.0	344.0
1961	731.0	4.0	211.0	436.0	504.0	83.0	366.0
1962	669.0	9.0	225.0	454.0	489.0	90.0	374.0
1963	741.0	14.0	251.0	501.0	540.0	96.0	405.0
1964	850.0	19.0	266.0	523.0	654.0	91.0	431.0
1965	997.0	30.0	307.0	656.0	711.0	110.0	521.0
1966	1,018.0	40.0	352.0	745.0	719.0	126.0	578.0
1967	1,086.0	50.0	370.0	774.0	779.0	131.0	592.0
1968	1,222.0	65.0	410.0	822.0	794.0	166.0	640.0
1969	1,403.0	75.0	426.0	917.0	905.0	153.0	683.0
1970	1,608.0	85.0	448.0	998.0	884.0	160.0	720.0
1971	1,694.0	106.0	499.0	1,166.0	937.0	152.0	822.0
1972	1,984.0	132.0	548.0	1,240.0	1,016.0	201.0	882.0
1973	2,374.0	150.0	555.0	1,179.0	1,214.0	198.0	877.0
1974	2,920.0	178.0	593.0	1,279.0	1,394.0	216.0	949.0
1975	2,904.0	258.0	774.0	1,534.0	1,630.0	295.0	1,195.0
1976	4,060.0	318.0	904.0	1,762.0	2,172.0	307.0	1,371.0
1977	5,124.0	345.0	911.0	1,902.0	2,553.0	296.0	1,407.0
1978	5,599.0	434.0	1,113.0	2,230.0	2,767.0	388.0	1,627.0
1979	5,862.0	560.0	1,357.0	2,863.0	3,453.0	406.0	1,962.0
1980	6,850.0	648.0	1,461.0	2,888.0	3,796.0	479.0	2,027.0
1981	8,649.0	839.0	1,830.0	3,772.0	4,458.0	629.0	2,492.0
1982	9,549.0	1,027.0	2,219.0	4,829.0	5,063.0	746.0	2,982.0
1983	8,361.0	1,134.0	2,383.0	4,949.0	4,551.0	812.0	3,037.0
1984	9,609.0	1,319.0	2,563.0	5,000.0	5,441.0	961.0	3,189.0
1985	11,492.0	1,527.0	2,765.0	5,686.0	6,273.0	1,045.0	3,561.0
1986	12,500.0	2,002.0	3,364.0	6,377.0	7,037.0	1,531.0	4,036.0
1987	12,025.0	2,419.0	3,759.0	7,199.0	8,112.0	1,760.0	4,447.0
1988	13,600.0	2,726.0	3,782.0	7,959.0	9,365.0	1,479.0	4,460.0
1989	18,763.0	3,218.0	4,144.0	8,915.0	10,399.0	1,589.0	5,104.0
1990	20,450.0	3,690.0	4,354.0	8,564.0	10,209.0	2,103.0	5,164.0
1991	19,068.0	3,561.0	3,687.0	7,348.0	8,951.0	1,604.0	4,476.0
1992	19,228.0	3,710.0	3,479.0	6,807.0	8,527.0	1,575.0	4,226.0
1993	22,262.0	4,275.0	3,639.0	7,810.0	9,852.0	1,355.0	4,549.0
1994	24,803.0	5,076.0	4,106.0	9,698.0	8,581.0	1,312.0	5,096.0
1995	26,738.0	6,048.0	4,662.0	11,038.0	10,998.0	1,523.0	5,477.0
1996	23,753.0	6,377.1	4,951.0	10,871.0	12,203.0	1,597.0	6,301.0
1997	23,596.0	6,413.1	5,099.0	10,374.0	12,993.0	1,699.0	6,797.0
1998	28,021.0	7,947.1	5,229.0	10,286.0	13,921.0	2,445.0	6,866.0
1999	30,833.0	8,194.9	5,412.0	10,367.0	14,198.0	2,542.0	7,081.0
2000	37,335.0	9,495.1	4,955.0	10,785.0	13,298.0	4,706.0	7,982.0
2001	33,322.0	8,561.1	6,649.0	11,280.0	15,831.0	2,502.0	7,677.0
2002	39,957.0	9,027.2	5,632.0	11,660.0	16,412.0	4,489.0	8,865.0
2003	47,926.0	9,818.3	7,242.0	12,407.0	17,713.0	6,395.0	8,495.0
2004	55,345.0	9,860.5	7,344.0	11,840.0	17,542.0	6,003.0	8,248.0

Table A13: **TFP database outputs and inputs, 1960–2004, current prices** (cont'd)

Year	*Inventories ch non-farm* *$m*	*Inventories change farm* *$m*	*Inventories ch livestock* *$m*	*Imports* *$m*	*Labour* *$m*	*User cost - NROC* *$m*	*User cost - Software* *$m*
1960	194.4	209.0	41.4	2,500.0	8,286.2	817.3	1.1
1961	213.5	202.4	38.8	2,838.0	8,939.3	904.0	2.0
1962	234.6	195.9	34.1	2,413.0	9,194.3	1,017.0	2.9
1963	257.7	189.7	34.8	2,866.0	9,735.1	1,097.3	3.8
1964	503.9	477.9	-117.3	3,152.0	10,644.9	1,199.8	4.6
1965	193.3	-67.5	-22.0	3,803.0	11,945.5	1,345.6	4.9
1966	230.3	-366.5	84.8	3,954.0	12,913.1	1,466.4	5.1
1967	323.5	-155.5	232.3	4,045.0	14,119.1	1,652.1	5.4
1968	472.3	1,214.8	344.2	4,536.0	15,284.0	1,819.8	5.7
1969	513.0	-26.2	356.6	4,706.0	16,793.5	2,010.7	6.1
1970	882.3	-562.7	467.6	5,285.0	18,777.9	2,239.8	6.6
1971	9.7	-32.9	584.1	5,680.0	21,588.6	2,529.0	6.9
1972	202.6	-1,755.5	152.3	5,820.0	23,953.9	2,890.5	7.4
1973	460.8	-1,349.3	423.3	6,027.0	26,565.5	3,323.2	8.2
1974	1,155.2	80.6	370.7	8,612.0	32,571.0	4,065.2	11.1
1975	105.9	-653.9	111.2	11,392.0	43,280.2	5,525.5	15.1
1976	885.8	-958.4	-158.9	12,211.0	49,980.9	6,783.9	21.8
1977	-619.9	-520.1	-202.8	15,440.0	55,597.4	7,751.2	36.1
1978	594.8	-1,084.7	-202.1	16,574.0	61,533.2	8,669.7	56.8
1979	1,009.3	-1,192.5	-80.5	19,778.0	66,045.9	9,555.3	83.8
1980	1,069.3	-735.7	-296.5	23,074.0	73,558.3	11,116.0	104.8
1981	796.0	317.4	-3.7	27,446.0	84,768.6	12,897.0	129.3
1982	-2,244.2	-698.7	-893.4	31,818.0	98,060.9	15,033.8	170.4
1983	820.8	-112.5	-215.8	31,771.0	109,195.9	17,766.5	222.6
1984	1,909.9	1.3	285.0	34,560.0	115,109.2	19,379.6	275.0
1985	343.6	-306.4	-445.7	43,785.0	126,219.5	20,954.0	360.5
1986	-1,643.0	-889.8	-286.7	50,557.0	139,371.1	23,526.4	481.7
1987	574.3	-1,059.3	279.6	52,346.0	150,274.4	26,092.7	636.4
1988	3,577.8	-593.9	258.7	57,791.0	164,287.9	28,722.6	875.1
1989	5,644.1	413.8	1,400.9	66,127.0	182,777.3	31,912.2	1,160.0
1990	-812.9	952.0	-718.9	72,797.0	205,135.0	35,454.5	1,457.9
1991	-2,281.7	-1,054.0	615.1	70,325.0	214,361.8	37,993.8	1,971.5
1992	1,275.2	-868.4	28.6	72,619.0	218,280.0	38,358.5	2,403.2
1993	1,327.6	-266.2	116.9	82,414.0	227,809.0	38,376.1	2,773.2
1994	2,038.6	126.3	-404.1	88,627.0	237,081.1	38,989.8	3,317.4
1995	218.7	959.1	401.3	101,133.0	249,132.9	40,473.6	3,769.9
1996	2,019.4	-857.2	282.2	104,207.0	267,850.2	42,580.0	4,114.4
1997	-697.2	-1,781.3	-163.5	106,885.0	283,351.2	44,364.5	4,382.5
1998	4,998.4	175.0	15.3	122,126.0	297,088.2	46,768.7	4,730.8
1999	3,319.8	-310.6	166.6	130,204.0	314,027.4	48,825.6	5,257.6
2000	1,664.2	-1,919.5	-191.4	144,610.0	332,035.5	51,884.5	6,086.8
2001	1,364.7	-713.7	-12.2	157,811.0	353,027.2	54,674.1	7,115.0
2002	726.5	-830.0	-571.5	159,787.0	369,406.6	55,929.2	8,354.6
2003	6,326.9	113.5	-195.6	172,741.0	392,892.4	58,986.5	9,072.0
2004	6,822.6	124.3	-185.3	172,922.0	414,157.4	63,436.7	9,473.1

Table A13: **TFP database outputs and inputs, 1960–2004, current prices** (cont'd)

Year	*User cost - Exploration* *$m*	*User cost – Artist. Orig.* *$m*	*User cost - Computers* *$m*	*User cost – Elec. mach.* *$m*	*User cost – Indust. mac.* *$m*	*User cost - Vehicles* *$m*	*User cost - Oth transp.* *$m*
1960	4.5	4.2	1.1	168.3	296.7	383.8	67.1
1961	6.5	4.6	1.1	182.1	328.0	423.9	74.3
1962	8.7	5.2	1.3	195.0	361.0	458.3	80.5
1963	12.3	6.0	2.0	207.7	392.4	484.9	85.1
1964	17.3	7.0	3.1	220.9	424.5	514.7	91.0
1965	24.6	8.1	4.4	241.2	468.3	573.9	97.3
1966	32.3	9.4	6.7	265.8	529.6	637.5	105.2
1967	41.4	11.0	9.6	293.1	595.8	691.1	115.7
1968	50.7	12.7	13.0	318.3	655.4	743.3	124.8
1969	63.1	14.8	17.2	354.0	733.3	810.3	140.6
1970	79.1	17.2	21.6	389.4	817.1	877.2	154.0
1971	100.6	20.0	26.2	433.7	926.3	932.6	169.8
1972	132.0	23.2	32.1	485.0	1,058.2	1,010.9	183.6
1973	159.4	27.9	39.8	529.5	1,170.3	1,087.4	201.6
1974	203.2	32.6	47.7	587.6	1,296.1	1,230.0	222.7
1975	280.4	39.3	56.8	814.5	1,670.2	1,373.3	284.3
1976	331.3	39.0	72.5	950.8	1,950.3	1,736.0	337.4
1977	370.0	43.8	91.3	1,083.2	2,215.4	2,076.6	384.1
1978	404.2	48.5	109.0	1,220.0	2,511.7	2,426.9	431.2
1979	436.7	52.9	133.2	1,369.7	2,819.4	2,821.3	484.3
1980	498.3	59.3	166.7	1,557.7	3,230.4	3,293.5	540.8
1981	584.2	71.0	202.4	1,729.4	3,573.6	3,479.6	598.5
1982	723.7	99.0	251.8	1,940.1	4,023.0	4,115.1	673.5
1983	914.3	126.5	312.4	2,284.9	4,794.8	4,615.5	793.0
1984	1,055.9	137.5	369.5	2,488.2	5,230.3	5,091.1	864.8
1985	1,188.7	142.0	587.9	2,647.6	5,522.4	5,474.4	934.2
1986	1,301.2	184.0	829.8	2,995.3	6,402.7	6,690.3	1,198.8
1987	1,399.9	222.5	1,160.0	3,451.5	7,387.0	8,401.4	1,468.1
1988	1,438.2	228.0	1,357.3	3,697.4	8,070.8	9,350.2	1,501.6
1989	1,548.9	261.1	1,579.3	3,871.5	8,400.1	9,966.1	1,407.1
1990	1,691.5	231.3	2,195.6	4,139.6	9,081.4	10,679.4	1,579.3
1991	1,811.1	353.8	2,535.2	4,332.9	9,747.9	11,277.8	1,833.3
1992	1,846.0	305.1	2,703.9	4,380.6	10,041.6	11,886.3	2,001.5
1993	1,880.7	239.9	2,848.1	4,569.8	10,506.2	12,860.9	2,212.9
1994	1,900.5	256.9	3,153.5	4,636.4	10,819.0	13,974.9	2,331.7
1995	1,936.3	305.1	3,168.3	4,650.9	11,008.8	14,050.3	2,091.1
1996	2,016.0	292.5	3,496.8	4,846.0	11,695.4	14,385.3	2,085.4
1997	2,087.0	301.4	3,335.1	4,743.5	11,948.3	13,864.0	1,944.0
1998	2,210.7	387.8	3,810.0	5,010.4	12,599.6	14,315.3	2,205.3
1999	2,311.6	404.3	4,560.8	5,181.5	13,630.1	14,685.5	2,712.4
2000	2,455.8	461.0	4,463.7	6,000.5	13,395.3	15,067.5	2,808.7
2001	2,522.1	465.9	6,286.6	5,875.3	13,835.9	14,841.0	3,419.7
2002	2,577.4	505.0	6,413.8	6,177.1	14,477.1	15,153.4	3,627.6
2003	2,668.6	527.3	6,030.9	6,055.1	14,266.1	16,331.4	3,755.9
2004	2,738.8	567.9	5,539.1	5,984.4	13,685.0	16,823.5	3,856.2

Table A13: **TFP database outputs and inputs, 1960–2004, current prices** (cont'd)

Year	*User cost - Other mach. $m*	*User cost - Non-farm inv. $m*	*User cost - Farm invent. $m*	*User cost - Livestock $m*	*User cost – Comm. land $m*	*User cost - Rural land $m*
1960	304.5	122.5	405.6	230.7	138.0	260.2
1961	326.1	134.6	392.7	215.8	150.6	268.2
1962	347.0	147.8	380.2	201.9	164.9	277.3
1963	365.1	162.4	368.0	177.6	180.2	285.9
1964	384.0	178.4	356.3	181.4	197.2	295.0
1965	413.3	204.8	356.7	195.3	215.6	303.7
1966	454.6	219.7	335.3	233.0	237.2	313.0
1967	498.4	237.1	323.5	223.7	258.8	353.3
1968	535.1	256.2	333.8	244.2	283.8	352.3
1969	589.1	284.1	389.0	246.1	307.4	484.5
1970	642.7	312.0	343.5	256.2	333.8	499.5
1971	712.9	357.1	327.1	280.2	365.6	535.9
1972	796.1	364.7	355.3	298.1	400.9	575.1
1973	867.0	389.8	295.2	321.6	443.6	563.3
1974	952.1	428.9	314.3	435.4	502.7	582.0
1975	1,207.6	516.2	376.7	343.2	588.0	754.4
1976	1,409.3	609.9	344.6	224.0	701.1	791.4
1977	1,601.1	733.9	330.9	224.6	833.7	878.7
1978	1,801.7	789.5	345.7	278.3	975.6	956.6
1979	2,008.6	875.9	321.0	313.7	1,112.9	853.9
1980	2,274.0	992.8	321.8	522.1	1,227.5	929.4
1981	2,494.3	1,166.7	354.6	632.2	1,346.5	1,221.3
1982	2,767.4	1,319.6	405.9	625.2	1,497.2	1,448.9
1983	3,225.9	1,336.4	381.7	552.0	1,675.4	1,831.9
1984	3,458.8	1,494.1	411.3	564.7	1,860.8	1,618.6
1985	3,601.3	1,660.6	431.4	651.5	2,066.7	1,858.5
1986	4,182.4	1,750.0	428.9	675.5	2,363.7	2,064.4
1987	4,773.5	1,821.5	411.3	639.0	2,762.4	2,262.9
1988	5,058.9	1,970.0	408.6	714.6	3,270.3	2,464.2
1989	5,029.4	2,252.4	439.7	779.1	3,855.6	2,665.2
1990	5,368.1	2,566.1	490.4	586.0	4,398.7	2,787.1
1991	5,807.1	2,607.8	512.2	417.8	4,633.9	2,924.9
1992	5,730.3	2,555.5	426.4	426.6	4,483.6	3,038.9
1993	5,863.9	2,613.7	417.5	385.9	4,140.7	2,566.7
1994	5,786.5	2,710.0	429.4	393.8	3,982.4	2,692.6
1995	5,797.0	2,800.3	433.8	421.1	4,108.4	2,897.0
1996	6,046.7	2,900.8	490.7	428.5	4,474.2	3,034.8
1997	6,245.6	3,023.9	430.1	396.6	4,817.6	3,865.1
1998	6,669.1	2,921.7	338.3	429.6	5,107.5	4,098.7
1999	7,112.0	3,158.4	357.5	482.9	5,345.9	4,458.3
2000	7,400.0	3,287.6	340.5	512.9	5,736.6	4,634.4
2001	7,637.7	3,419.8	267.7	609.8	6,230.3	4,895.0
2002	8,100.8	3,635.7	296.5	796.8	6,589.6	5,346.5
2003	8,441.6	3,707.0	303.7	747.1	6,919.1	5,956.9
2004	8,437.8	3,998.4	332.5	690.8	7,112.9	6,753.6

Table A14: **TFP database outputs and inputs, 1960–2004, price indexes**

Year	*Consumer commodity Index*	*Govt con-sumption Index*	*Exports Index*	*Investment - NROC Index*	*Investment - Software Index*	*Investment - Exploration Index*	*Investment – Artist. orig. Index*
1960	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1961	1.0366	1.0572	0.9623	1.0329	0.9400	1.0212	1.0664
1962	1.0442	1.0933	0.9668	1.0844	0.8836	1.0274	1.1373
1963	1.0551	1.0973	0.9958	1.0962	0.8306	1.0621	1.2128
1964	1.0672	1.1341	1.0864	1.1257	0.7807	1.0892	1.2934
1965	1.1010	1.1844	1.0508	1.1819	0.7339	1.1850	1.3793
1966	1.1353	1.2060	1.0674	1.2026	0.6899	1.2167	1.4709
1967	1.1677	1.2734	1.0687	1.2644	0.6485	1.2586	1.5686
1968	1.2096	1.3289	1.0460	1.3058	0.6096	1.2924	1.6728
1969	1.2444	1.3684	1.0734	1.3646	0.5730	1.3426	1.7840
1970	1.2914	1.4262	1.1258	1.4279	0.5386	1.4098	1.9025
1971	1.3682	1.5838	1.0975	1.5154	0.5063	1.4820	2.0288
1972	1.4557	1.7411	1.1438	1.6289	0.4759	1.6272	2.1636
1973	1.5420	1.8626	1.3831	1.7657	0.4474	1.7725	2.3924
1974	1.7277	2.1302	1.6572	2.0601	0.4205	2.1052	2.6829
1975	2.0490	2.7810	1.9357	2.6717	0.3953	2.7854	3.0888
1976	2.3467	3.1712	2.0617	3.1401	0.3716	3.2529	3.0726
1977	2.6132	3.5904	2.3047	3.4655	0.3493	3.6609	3.2139
1978	2.8564	3.9070	2.3979	3.7500	0.3283	4.0028	3.3204
1979	3.0889	4.1176	2.6605	3.9988	0.3218	4.2827	3.4146
1980	3.3869	4.4498	3.2354	4.5040	0.3013	4.7726	3.5493
1981	3.7339	4.9860	3.4968	5.0798	0.2848	5.2559	3.6513
1982	4.0902	5.6976	3.5820	5.7514	0.2694	5.9326	4.1162
1983	4.5149	6.2636	3.8611	6.5675	0.2535	6.5661	4.6676
1984	4.8302	6.5467	4.0430	6.9581	0.2399	6.9118	5.0703
1985	5.0893	6.9418	4.3336	7.3418	0.2263	7.3184	5.2919
1986	5.5168	7.4023	4.5488	8.0293	0.2131	7.6596	5.8092
1987	6.0039	7.7561	4.6737	8.6397	0.2011	7.9911	6.2556
1988	6.4624	7.9827	4.9994	9.2260	0.1896	8.2698	6.8632
1989	6.8350	8.1524	5.2537	9.9242	0.1793	8.6444	7.7288
1990	7.1804	8.9064	5.5026	10.6368	0.1689	9.2032	8.3640
1991	7.6932	9.5793	5.3702	10.9565	0.1595	9.7597	8.9681
1992	8.0220	10.0008	5.2096	10.7658	0.1505	9.9024	9.4011
1993	8.2074	10.3207	5.3614	10.6280	0.1420	10.1171	9.8801
1994	8.2561	10.2614	5.2739	10.6992	0.1345	10.1704	10.0117
1995	8.3222	10.1348	5.3000	11.0305	0.1269	10.2834	10.1882
1996	8.5024	10.3560	5.4296	11.3773	0.1197	10.4841	10.8744
1997	8.6224	10.3302	5.2201	11.6118	0.1130	10.6075	11.2267
1998	8.7758	10.2558	5.4415	11.9299	0.1066	10.8482	11.6946
1999	8.7737	10.5254	5.2415	12.2270	0.1007	10.9866	11.9951
2000	8.9430	10.7930	5.3826	12.6544	0.0946	11.5207	12.6184
2001	9.3086	11.2408	6.1266	12.9915	0.0889	11.8808	12.8499
2002	9.5187	11.6448	6.1798	13.1434	0.0836	12.0491	13.1744
2003	9.7306	12.0406	6.0208	13.6100	0.0786	12.5000	13.4144
2004	9.8854	12.5251	5.7507	14.3351	0.0738	12.7806	13.9304

Table A14: **TFP database outputs and inputs, 1960–2004, price indexes** (cont'd)

Year	*Investment - Dwellings Index*	*Investment - Computers Index*	*Investment – Elec. mach. Index*	*Investment – Indust. mac. Index*	*Investment - vehicles Index*	*Investment - Oth transp. Index*	*Investment - Oth mach. Index*
1960	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1961	1.0351	0.8627	1.0193	1.0202	1.0187	1.0144	1.0187
1962	1.0347	0.7442	1.0333	1.0317	1.0286	1.0407	1.0331
1963	1.0371	0.6420	1.0429	1.0408	1.0369	1.0415	1.0426
1964	1.0594	0.5538	1.0426	1.0420	1.0404	1.0523	1.0458
1965	1.0882	0.4777	1.0735	1.0716	1.0697	1.0838	1.0751
1966	1.1225	0.4121	1.1048	1.1031	1.1015	1.1070	1.1060
1967	1.1541	0.3555	1.1313	1.1289	1.1276	1.1385	1.1328
1968	1.1877	0.3067	1.1506	1.1470	1.1454	1.1589	1.1501
1969	1.2210	0.2646	1.1949	1.1930	1.1912	1.1991	1.1969
1970	1.2760	0.2282	1.2395	1.2358	1.2196	1.2489	1.2388
1971	1.3410	0.1969	1.3096	1.3072	1.2489	1.3186	1.3103
1972	1.4473	0.1698	1.3900	1.3862	1.3057	1.3952	1.3892
1973	1.5884	0.1465	1.4433	1.4406	1.3540	1.4549	1.4449
1974	1.9235	0.1264	1.5407	1.5362	1.4495	1.5518	1.5405
1975	2.3504	0.1090	1.9086	1.9039	1.7306	1.9207	1.9087
1976	2.7085	0.0941	2.1744	2.1699	2.0548	2.1844	2.1750
1977	3.0329	0.0811	2.4178	2.4119	2.2865	2.4282	2.4190
1978	3.2166	0.0700	2.6988	2.6923	2.4906	2.7187	2.6990
1979	3.3172	0.0604	2.9704	2.9622	2.7342	2.9856	2.9693
1980	3.5511	0.0521	3.2713	3.2626	2.9761	3.2895	3.2729
1981	3.9856	0.0449	3.5448	3.5334	3.2030	3.5663	3.5441
1982	4.4803	0.0388	3.8114	3.8003	3.5117	3.8334	3.8107
1983	4.9217	0.0334	4.2462	4.2352	3.6754	4.2750	4.2461
1984	5.1587	0.0288	4.4427	4.4292	3.9125	4.4718	4.4552
1985	5.5291	0.0249	4.5455	4.5323	4.0173	4.5739	4.5586
1986	6.0141	0.0215	4.9365	5.0366	4.6395	5.5511	5.1504
1987	6.4030	0.0193	5.4001	5.5965	5.5763	6.2800	5.7414
1988	6.7925	0.0153	5.5270	5.9089	6.0099	6.0002	5.9802
1989	7.8983	0.0125	5.5801	5.9318	6.1730	5.4214	5.8934
1990	8.8165	0.0120	5.7084	6.1175	6.3389	5.7442	6.1023
1991	9.1375	0.0107	5.7323	6.3741	6.4977	6.1119	6.4734
1992	9.1668	0.0096	5.7193	6.5612	6.8023	6.5437	6.4576
1993	9.1956	0.0088	5.9359	6.9411	7.3933	7.1926	6.7235
1994	9.3500	0.0080	5.9866	7.1529	8.0098	7.7433	6.6935
1995	9.5810	0.0065	5.8902	7.1135	8.2118	7.1524	6.6506
1996	9.7542	0.0054	5.9129	7.2684	8.3742	7.1587	6.7951
1997	9.8195	0.0038	5.5583	7.2204	7.9592	6.6578	6.7537
1998	9.9082	0.0032	5.5936	7.4725	8.0013	7.4099	6.8787
1999	10.1050	0.0026	5.5346	7.9966	7.9506	8.6302	7.0514
2000	10.5981	0.0020	6.1320	7.8413	7.9073	8.6799	7.0976
2001	11.9212	0.0019	5.9406	8.0286	7.6494	9.4074	7.0391
2002	12.1077	0.0016	5.9131	8.3115	7.4778	10.0101	7.2560
2003	12.5931	0.0013	5.6716	8.1169	7.7093	9.6556	7.2674
2004	13.5370	0.0009	5.2685	7.6431	7.6005	8.6601	7.1114

Table A14: **TFP database outputs and inputs, 1960–2004, price indexes** (cont'd)

Year	*Inventories ch non-farm Index*	*Inventories change farm Index*	*Inventories ch livestock Index*	*Imports Index*	*Labour Index*	*User cost - NROC Index*	*User cost - Software Index*
1960	1.0350	0.9475	0.9282	1.0000	1.0000	0.0817	0.1629
1961	1.0712	0.8978	0.8616	1.0089	1.0294	0.0844	0.1531
1962	1.1087	0.8507	0.7520	1.0005	1.0544	0.0887	0.1439
1963	1.1475	0.8061	0.7625	1.0128	1.0877	0.0897	0.1353
1964	1.1877	0.7638	0.8407	1.0013	1.1628	0.0921	0.1272
1965	1.2292	0.7237	1.0068	1.0145	1.2747	0.0966	0.1195
1966	1.2750	0.7298	0.9519	1.0266	1.3360	0.0983	0.1124
1967	1.3083	0.7670	0.9997	1.0328	1.4356	0.1032	0.1056
1968	1.3541	0.7824	0.9509	1.0540	1.5226	0.1066	0.0993
1969	1.3894	0.6929	0.9347	1.0570	1.6424	0.1109	0.0933
1970	1.4331	0.7053	0.9543	1.0957	1.7968	0.1158	0.0877
1971	1.4620	0.7688	0.9354	1.1426	1.9916	0.1227	0.0825
1972	1.5302	0.7908	0.9903	1.2660	2.1681	0.1316	0.0775
1973	1.6112	0.9865	1.2882	1.2937	2.3690	0.1426	0.0729
1974	1.7655	1.1720	0.9717	1.4204	2.8208	0.1661	0.0799
1975	2.0715	1.1536	0.6217	1.8346	3.5837	0.2153	0.0830
1976	2.3726	1.2362	0.6410	2.0685	4.1963	0.2536	0.0859
1977	2.6325	1.3691	0.8173	2.3884	4.7375	0.2798	0.0808
1978	2.8412	1.4430	0.9450	2.6898	5.1944	0.3021	0.0759
1979	3.0892	1.6614	1.5825	2.9688	5.4254	0.3223	0.0744
1980	3.4975	1.9823	1.9522	3.4598	5.9495	0.3623	0.0697
1981	3.8603	2.1984	1.9308	3.7612	6.7056	0.4078	0.0658
1982	4.1719	2.2184	1.8153	3.9037	7.7935	0.4605	0.0623
1983	4.5618	2.4166	1.8855	4.2559	8.9788	0.5256	0.0586
1984	4.8369	2.5349	2.1371	4.3652	9.3510	0.5574	0.0555
1985	5.0574	2.5918	2.2743	4.7480	9.7986	0.5889	0.0523
1986	5.4539	2.7007	2.1901	5.4952	10.4510	0.6444	0.0493
1987	5.8297	2.9610	2.4107	5.9720	10.9905	0.6933	0.0465
1988	6.2418	3.3586	2.5936	5.9347	11.6330	0.7406	0.0438
1989	6.4856	3.6196	1.7643	5.4640	12.4990	0.7969	0.0415
1990	6.6731	3.4993	1.3443	5.7011	13.5134	0.8583	0.0405
1991	6.7730	3.2016	1.2934	5.8415	14.3305	0.8900	0.0415
1992	6.7919	3.3950	1.1667	5.8199	14.8456	0.8776	0.0406
1993	6.9042	3.5788	1.1763	6.2140	15.5162	0.8641	0.0398
1994	6.9265	3.5730	1.3063	6.2630	15.6322	0.8664	0.0390
1995	7.1534	3.7262	1.2794	6.1332	15.8826	0.8875	0.0381
1996	7.2578	3.5265	1.1505	6.0746	16.6601	0.9183	0.0371
1997	7.0795	3.3578	1.2651	5.6679	17.7214	0.9376	0.0362
1998	7.1686	3.4783	1.4202	5.9023	18.1886	0.9651	0.0341
1999	7.1604	3.4344	1.4891	6.0028	19.1044	0.9820	0.0322
2000	7.3032	3.4748	1.7924	5.9076	19.7110	1.0146	0.0303
2001	7.6478	4.2180	2.3435	6.5294	20.6324	1.0458	0.0285
2002	7.7367	4.7932	2.2646	6.4665	21.6551	1.0572	0.0268
2003	7.8166	5.1762	2.1177	6.1603	22.6363	1.0985	0.0251
2004	7.8955	5.5899	2.0288	5.4527	23.5199	1.1540	0.0236

Table A14: **TFP database outputs and inputs, 1960–2004, price indexes** (cont'd)

Year	*User cost - Exploration Index*	*User cost – Artist. Orig. Index*	*User cost - Computers Index*	*User cost – Elec. mach. Index*	*User cost – Indust. mac. Index*	*User cost - Vehicles Index*	*User cost - Oth transp. Index*
1960	0.1026	0.6304	0.1386	0.1425	0.1552	0.1766	0.1565
1961	0.1048	0.6723	0.1196	0.1453	0.1583	0.1799	0.1588
1962	0.1054	0.7169	0.1032	0.1473	0.1601	0.1816	0.1629
1963	0.1090	0.7645	0.0890	0.1486	0.1615	0.1831	0.1630
1964	0.1118	0.8153	0.0768	0.1486	0.1617	0.1837	0.1647
1965	0.1216	0.8695	0.0662	0.1530	0.1663	0.1889	0.1696
1966	0.1248	0.9272	0.0571	0.1575	0.1712	0.1945	0.1733
1967	0.1291	0.9888	0.0493	0.1612	0.1752	0.1991	0.1782
1968	0.1326	1.0545	0.0425	0.1640	0.1780	0.2023	0.1814
1969	0.1378	1.1246	0.0367	0.1703	0.1851	0.2103	0.1877
1970	0.1447	1.1993	0.0316	0.1766	0.1918	0.2153	0.1955
1971	0.1521	1.2789	0.0273	0.1866	0.2028	0.2205	0.2064
1972	0.1670	1.3639	0.0235	0.1981	0.2151	0.2305	0.2184
1973	0.1819	1.5081	0.0203	0.2057	0.2235	0.2391	0.2277
1974	0.2160	1.6912	0.0175	0.2196	0.2384	0.2560	0.2429
1975	0.2858	1.9472	0.0151	0.2942	0.2967	0.2696	0.2999
1976	0.3338	1.9882	0.0130	0.3351	0.3381	0.3201	0.3411
1977	0.3757	2.0797	0.0112	0.3727	0.3758	0.3562	0.3791
1978	0.4107	2.1486	0.0097	0.4160	0.4195	0.3880	0.4245
1979	0.4395	2.2095	0.0084	0.4578	0.4616	0.4260	0.4662
1980	0.4897	2.2967	0.0072	0.5042	0.5084	0.4637	0.5136
1981	0.5393	2.4235	0.0062	0.5464	0.5506	0.4615	0.5568
1982	0.6087	2.7321	0.0054	0.5875	0.5922	0.5059	0.5986
1983	0.6738	3.0981	0.0046	0.6545	0.6599	0.5295	0.6675
1984	0.7092	3.3654	0.0040	0.6848	0.6902	0.5637	0.6982
1985	0.7509	3.5125	0.0047	0.7006	0.7062	0.5788	0.7142
1986	0.7860	3.8558	0.0052	0.7609	0.7848	0.6684	0.8668
1987	0.8200	4.1522	0.0054	0.8323	0.8720	0.8034	0.9806
1988	0.8486	4.5555	0.0049	0.8519	0.9207	0.8659	0.9369
1989	0.8870	5.1300	0.0044	0.8601	0.9243	0.8893	0.8465
1990	0.9444	5.5516	0.0045	0.8799	0.9532	0.9132	0.8969
1991	1.0015	5.9526	0.0043	0.8835	0.9932	0.9361	0.9543
1992	1.0161	6.2400	0.0040	0.8815	1.0224	0.9800	1.0217
1993	1.0381	6.5579	0.0038	0.9149	1.0816	1.0652	1.1231
1994	1.0436	6.6453	0.0035	0.9227	1.1146	1.1540	1.2090
1995	1.0552	6.7624	0.0029	0.9079	1.1084	1.1831	1.1168
1996	1.0758	7.2179	0.0024	0.9114	1.1326	1.2065	1.1178
1997	1.0885	7.4517	0.0017	0.8567	1.1251	1.1467	1.0396
1998	1.1131	7.7623	0.0014	0.8622	1.1644	1.1527	1.1570
1999	1.1274	7.9617	0.0012	0.8531	1.2460	1.1454	1.3475
2000	1.1822	8.3755	0.0009	0.9452	1.2218	1.1392	1.3553
2001	1.2191	8.5291	0.0008	0.9156	1.2510	1.1020	1.4689
2002	1.2364	8.7445	0.0007	0.9114	1.2951	1.0773	1.5630
2003	1.2826	8.9038	0.0006	0.8742	1.2648	1.1107	1.5076
2004	1.3114	9.2463	0.0004	0.8121	1.1909	1.0950	1.3522

Table A14: **TFP database outputs and inputs, 1960–2004, price indexes** (cont'd)

Year	*User cost - Other mach. Index*	*User cost - Non-farm inv. Index*	*User cost - Farm invent. Index*	*User cost - Livestock Index*	*User cost – Comm. land Index*	*User cost - Rural land Index*
1960	0.1721	0.0400	0.0400	0.0400	0.0457	0.0457
1961	0.1753	0.0414	0.0379	0.0371	0.0484	0.0472
1962	0.1778	0.0428	0.0359	0.0345	0.0513	0.0487
1963	0.1794	0.0443	0.0340	0.0301	0.0543	0.0503
1964	0.1800	0.0459	0.0322	0.0305	0.0575	0.0519
1965	0.1850	0.0475	0.0306	0.0336	0.0607	0.0534
1966	0.1903	0.0492	0.0289	0.0403	0.0642	0.0550
1967	0.1949	0.0510	0.0292	0.0381	0.0677	0.0621
1968	0.1979	0.0523	0.0307	0.0400	0.0716	0.0619
1969	0.2060	0.0542	0.0313	0.0380	0.0746	0.0852
1970	0.2132	0.0556	0.0277	0.0374	0.0783	0.0878
1971	0.2255	0.0573	0.0282	0.0382	0.0827	0.0942
1972	0.2391	0.0585	0.0308	0.0374	0.0878	0.1011
1973	0.2487	0.0612	0.0316	0.0396	0.0949	0.0990
1974	0.2651	0.0644	0.0395	0.0515	0.1052	0.1023
1975	0.3273	0.0706	0.0469	0.0389	0.1209	0.1326
1976	0.3729	0.0829	0.0461	0.0249	0.1422	0.1391
1977	0.4148	0.0949	0.0494	0.0256	0.1666	0.1545
1978	0.4628	0.1053	0.0548	0.0327	0.1920	0.1682
1979	0.5092	0.1136	0.0577	0.0378	0.2154	0.1501
1980	0.5612	0.1236	0.0665	0.0633	0.2339	0.1634
1981	0.6077	0.1399	0.0793	0.0781	0.2519	0.2147
1982	0.6534	0.1544	0.0879	0.0772	0.2743	0.2547
1983	0.7281	0.1669	0.0887	0.0726	0.3014	0.3220
1984	0.7639	0.1825	0.0967	0.0754	0.3305	0.2845
1985	0.7817	0.1935	0.1014	0.0855	0.3623	0.3267
1986	0.8831	0.2023	0.1037	0.0910	0.4081	0.3629
1987	0.9845	0.2182	0.1080	0.0876	0.4701	0.3978
1988	1.0254	0.2332	0.1184	0.0964	0.5489	0.4332
1989	1.0105	0.2497	0.1343	0.1037	0.6373	0.4685
1990	1.0464	0.2594	0.1448	0.0706	0.7147	0.4899
1991	1.1100	0.2669	0.1400	0.0538	0.7445	0.5142
1992	1.1073	0.2709	0.1281	0.0517	0.7144	0.5342
1993	1.1529	0.2717	0.1358	0.0467	0.6551	0.4512
1994	1.1477	0.2762	0.1432	0.0471	0.6256	0.4733
1995	1.1404	0.2771	0.1429	0.0523	0.6394	0.5093
1996	1.1652	0.2861	0.1490	0.0512	0.6884	0.5335
1997	1.1581	0.2903	0.1411	0.0460	0.7322	0.6794
1998	1.1795	0.2832	0.1343	0.0506	0.7658	0.7205
1999	1.2091	0.2867	0.1391	0.0568	0.7888	0.7837
2000	1.2170	0.2864	0.1374	0.0596	0.8380	0.8147
2001	1.2070	0.2921	0.1390	0.0717	0.9064	0.8605
2002	1.2442	0.3059	0.1687	0.0937	0.9522	0.9398
2003	1.2461	0.3095	0.1917	0.0906	0.9879	1.0471
2004	1.2194	0.3127	0.2070	0.0847	1.0029	1.1872

Table A15: **TFP database outputs and inputs, 1960–2004, constant prices**

Year	*Consumer commodity $m1960*	*Govt con-sumption $m1960*	*Exports $m1960*	*Investment - NROC $m1960*	*Investment - Software $m1960*	*Investment - Exploration $m1960*	*Investment – Artist. orig. $m1960*
1960	7,663.0	1,283.2	2,158.7	1,164.0	7.3	21.0	4.1
1961	7,812.5	1,329.2	2,266.5	1,233.4	8.7	24.5	4.5
1962	7,985.9	1,370.1	2,574.6	1,285.5	10.2	35.0	4.9
1963	8,448.0	1,443.7	2,517.4	1,334.6	12.0	49.0	5.3
1964	9,067.0	1,532.9	2,931.7	1,486.2	15.4	57.8	5.8
1965	9,524.0	1,671.9	2,923.7	1,629.5	16.4	69.2	6.3
1966	9,756.7	1,867.0	2,965.4	1,811.9	20.3	78.1	6.9
1967	10,229.6	1,997.7	3,291.9	1,827.8	21.6	81.8	7.5
1968	10,768.2	2,226.3	3,450.3	1,879.4	24.6	99.0	8.2
1969	11,353.8	2,247.7	3,676.3	2,054.1	27.9	117.7	8.9
1970	12,055.8	2,387.5	4,278.8	2,147.8	29.7	149.0	9.7
1971	12,505.6	2,498.3	4,692.8	2,298.5	33.6	170.7	10.6
1972	12,958.7	2,546.6	5,044.1	2,335.9	44.1	135.2	11.6
1973	13,616.0	2,621.8	5,145.2	2,227.4	62.6	119.0	11.7
1974	14,448.3	2,770.3	4,833.1	2,266.4	99.9	99.3	12.3
1975	14,981.2	2,998.7	5,301.4	2,223.7	141.7	72.9	11.3
1976	15,087.0	3,313.6	5,520.2	2,126.4	282.6	54.7	13.3
1977	15,719.0	3,337.6	5,909.3	2,182.4	432.3	60.6	14.3
1978	15,921.8	3,431.2	6,041.5	2,174.1	572.6	71.2	15.1
1979	16,205.6	3,544.8	6,470.6	2,273.7	674.4	86.2	16.4
1980	16,417.6	3,638.2	6,927.3	2,205.1	839.8	129.3	19.2
1981	16,958.0	3,816.8	6,591.3	2,297.1	1,285.2	173.5	25.2
1982	17,777.0	3,837.6	6,748.0	2,486.3	1,756.0	242.6	27.2
1983	18,009.7	3,985.4	6,784.9	2,341.2	2,086.8	216.7	25.5
1984	18,264.2	4,178.4	7,305.1	2,220.7	3,168.4	187.4	25.0
1985	18,625.8	4,518.7	8,430.2	2,364.7	4,644.5	171.8	32.5
1986	19,341.5	4,739.8	8,750.3	2,610.8	6,362.3	155.4	35.6
1987	19,445.9	4,895.3	9,679.1	2,677.3	9,696.1	94.5	29.9
1988	20,089.4	5,028.7	10,553.3	2,792.7	12,699.1	157.4	32.1
1989	21,039.4	5,303.4	10,720.6	2,824.4	14,633.3	154.3	22.5
1990	22,111.9	5,341.9	11,249.7	2,993.8	21,148.3	129.5	43.8
1991	22,124.1	5,490.8	12,563.2	2,697.2	24,367.6	121.5	26.5
1992	22,508.9	5,685.8	13,696.0	2,419.3	26,950.7	108.6	18.2
1993	22,870.5	5,753.5	14,609.3	2,306.5	35,628.9	123.0	24.9
1994	23,339.4	5,761.6	16,028.4	2,360.2	39,535.3	127.9	30.6
1995	24,552.1	6,024.8	16,808.6	2,543.5	42,449.2	153.8	23.6
1996	25,493.0	6,222.3	18,528.7	2,750.6	45,210.5	160.7	25.2
1997	26,212.4	6,383.4	20,470.5	2,962.7	56,140.9	188.6	34.7
1998	27,567.4	6,841.6	21,226.8	3,084.9	68,738.3	188.9	32.0
1999	28,996.6	7,136.7	21,659.3	3,308.8	91,019.0	155.3	35.9
2000	30,225.4	7,385.8	23,735.7	3,072.6	115,030.3	121.5	33.9
2001	31,065.5	7,469.0	25,478.8	2,608.2	142,986.3	145.4	37.2
2002	32,074.5	7,548.0	25,210.0	2,818.5	146,867.3	126.4	37.5
2003	33,289.1	7,805.4	25,074.5	3,301.8	155,672.7	138.2	39.1
2004	35,270.8	8,070.5	25,305.2	3,497.3	165,826.9	135.4	40.7

Table A15: **TFP database outputs and inputs, 1960–2004, constant prices** (cont'd)

Year	*Investment - Dwellings $m1960*	*Investment - Computers $m1960*	*Investment – Elec. mach. $m1960*	*Investment – Indust. mac. $m1960*	*Investment - vehicles $m1960*	*Investment - Oth transp. $m1960*	*Investment - Oth mach. $m1960*
1960	666.0	2.0	201.0	385.0	485.0	90.0	344.0
1961	706.2	4.6	207.0	427.4	494.7	81.8	359.3
1962	646.5	12.1	217.8	440.1	475.4	86.5	362.0
1963	714.5	21.8	240.7	481.3	520.8	92.2	388.4
1964	802.3	34.3	255.1	501.9	628.6	86.5	412.1
1965	916.2	62.8	286.0	612.2	664.7	101.5	484.6
1966	906.9	97.1	318.6	675.4	652.7	113.8	522.6
1967	941.0	140.6	327.1	685.6	690.9	115.1	522.6
1968	1,028.9	211.9	356.3	716.7	693.2	143.2	556.5
1969	1,149.0	283.5	356.5	768.6	759.7	127.6	570.6
1970	1,260.2	372.4	361.4	807.6	724.8	128.1	581.2
1971	1,263.2	538.4	381.0	892.0	750.3	115.3	627.3
1972	1,370.8	777.2	394.2	894.6	778.2	144.1	634.9
1973	1,494.5	1,023.8	384.5	818.4	896.6	136.1	607.0
1974	1,518.1	1,408.4	384.9	832.6	961.7	139.2	616.0
1975	1,235.5	2,366.3	405.5	805.7	941.9	153.6	626.1
1976	1,499.0	3,381.0	415.8	812.0	1,057.0	140.5	630.3
1977	1,689.5	4,252.1	376.8	788.6	1,116.6	121.9	581.6
1978	1,740.6	6,200.6	412.4	828.3	1,111.0	142.7	602.8
1979	1,767.2	9,274.6	456.8	966.5	1,262.9	136.0	660.8
1980	1,929.0	12,440.8	446.6	885.2	1,275.5	145.6	619.3
1981	2,170.1	18,672.3	516.3	1,067.5	1,391.8	176.4	703.1
1982	2,131.3	26,495.4	582.2	1,270.7	1,441.8	194.6	782.5
1983	1,698.8	33,913.8	561.2	1,168.6	1,238.2	189.9	715.2
1984	1,862.7	45,727.0	576.9	1,128.9	1,390.7	214.9	715.8
1985	2,078.4	61,366.4	608.3	1,254.5	1,561.5	228.5	781.2
1986	2,078.4	93,265.1	681.5	1,266.1	1,516.7	275.8	783.6
1987	1,878.0	125,130.6	696.1	1,286.3	1,454.7	280.3	774.6
1988	2,002.2	177,980.8	684.3	1,346.9	1,558.3	246.5	745.8
1989	2,375.6	257,256.1	742.6	1,502.9	1,684.6	293.1	866.1
1990	2,319.5	308,551.9	762.7	1,399.9	1,610.5	366.1	846.2
1991	2,086.8	332,645.4	643.2	1,152.8	1,377.6	262.4	691.4
1992	2,097.6	387,827.2	608.3	1,037.5	1,253.6	240.7	654.4
1993	2,420.9	487,309.9	613.1	1,125.2	1,332.6	188.4	676.6
1994	2,652.7	637,311.3	685.9	1,355.8	1,071.3	169.4	761.3
1995	2,790.7	929,541.8	791.5	1,551.7	1,339.3	212.9	823.5
1996	2,435.1	1,191,461.2	837.3	1,495.6	1,457.2	223.1	927.3
1997	2,403.0	1,667,113.0	917.4	1,436.8	1,632.4	255.2	1,006.4
1998	2,828.1	2,468,415.3	934.8	1,376.5	1,739.9	330.0	998.2
1999	3,051.3	3,102,617.7	977.8	1,296.4	1,785.8	294.5	1,004.2
2000	3,522.8	4,864,550.2	808.1	1,375.4	1,681.7	542.2	1,124.6
2001	2,795.2	4,605,739.6	1,119.3	1,405.0	2,069.6	266.0	1,090.6
2002	3,300.1	5,558,597.7	952.5	1,402.9	2,194.8	448.4	1,221.8
2003	3,805.7	7,630,636.4	1,276.9	1,528.5	2,297.6	662.3	1,168.9
2004	4,088.4	10,684,290.0	1,394.0	1,549.1	2,308.0	693.2	1,159.8

Table A15: **TFP database outputs and inputs, 1960–2004, constant prices** (cont'd)

Year	*Inventories ch non-farm $m1960*	*Inventories change farm $m1960*	*Inventories ch livestock $m1960*	*Imports $m1960*	*Labour $m1960*	*User cost - NROC $m1960*	*User cost - Software $m1960*
1960	187.8	220.6	44.6	2,500.0	8,286.2	10,004.2	6.6
1961	199.3	225.4	45.0	2,812.8	8,684.2	10,715.5	13.2
1962	211.6	230.3	45.3	2,411.8	8,719.6	11,466.9	20.2
1963	224.6	235.3	45.7	2,829.8	8,950.4	12,239.6	27.9
1964	424.3	625.6	-139.5	3,147.8	9,154.9	13,028.3	36.5
1965	157.3	-93.2	-21.9	3,748.5	9,371.0	13,929.6	41.0
1966	180.6	-502.2	89.1	3,851.7	9,665.3	14,922.9	45.5
1967	247.3	-202.7	232.4	3,916.6	9,834.7	16,013.7	51.5
1968	348.8	1,552.7	362.0	4,303.7	10,038.2	17,064.0	57.5
1969	369.2	-37.8	381.5	4,452.2	10,225.0	18,137.5	65.2
1970	615.7	-797.8	490.1	4,823.4	10,450.6	19,343.1	74.7
1971	6.6	-42.8	624.4	4,971.3	10,840.1	20,605.6	84.0
1972	132.4	-2,219.9	153.8	4,597.3	11,048.5	21,965.9	95.4
1973	286.0	-1,367.7	328.6	4,658.8	11,213.9	23,302.6	113.1
1974	654.3	68.7	381.4	6,063.0	11,546.6	24,475.3	138.6
1975	51.1	-566.8	178.8	6,209.4	12,077.0	25,660.6	181.6
1976	373.3	-775.3	-247.9	5,903.4	11,910.7	26,752.8	253.2
1977	-235.5	-379.9	-248.1	6,464.7	11,735.6	27,702.9	447.0
1978	209.4	-751.7	-213.8	6,161.8	11,846.1	28,694.4	748.0
1979	326.7	-717.8	-50.9	6,662.0	12,173.5	29,646.9	1,125.8
1980	305.7	-371.1	-151.9	6,669.2	12,363.8	30,678.5	1,504.1
1981	206.2	144.4	-1.9	7,297.2	12,641.4	31,628.3	1,963.4
1982	-537.9	-315.0	-492.1	8,150.7	12,582.4	32,648.8	2,736.2
1983	179.9	-46.5	-114.4	7,465.1	12,161.5	33,800.4	3,798.2
1984	394.9	0.5	133.4	7,917.2	12,309.9	34,764.9	4,957.5
1985	67.9	-118.2	-196.0	9,221.9	12,881.4	35,583.2	6,890.3
1986	-301.3	-329.5	-130.9	9,200.2	13,335.6	36,508.7	9,775.3
1987	98.5	-357.8	116.0	8,765.3	13,673.1	37,638.0	13,686.5
1988	573.2	-176.8	99.8	9,737.8	14,122.6	38,781.2	19,959.9
1989	870.3	114.3	794.0	12,102.3	14,623.4	40,043.4	27,977.3
1990	-121.8	272.0	-534.8	12,768.9	15,180.2	41,307.0	35,955.6
1991	-336.9	-329.2	475.5	12,038.9	14,958.5	42,688.1	47,548.2
1992	187.8	-255.8	24.5	12,477.7	14,703.3	43,708.4	59,142.4
1993	192.3	-74.4	99.3	13,262.5	14,682.0	44,411.6	69,739.4
1994	294.3	35.3	-309.3	14,150.9	15,166.2	44,999.6	85,074.7
1995	30.6	257.4	313.6	16,489.5	15,685.9	45,604.8	99,039.8
1996	278.2	-243.1	245.3	17,154.6	16,077.3	46,366.0	110,894.3
1997	-98.5	-530.5	-129.2	18,858.0	15,989.2	47,318.5	121,228.4
1998	697.3	50.3	10.8	20,691.4	16,333.8	48,459.8	138,709.7
1999	463.6	-90.4	111.9	21,690.5	16,437.5	49,718.4	163,264.5
2000	227.9	-552.4	-106.8	24,478.5	16,845.2	51,137.5	201,102.3
2001	178.4	-169.2	-5.2	24,169.2	17,110.4	52,280.7	250,042.3
2002	93.9	-173.2	-252.4	24,709.8	17,058.6	52,902.8	312,277.9
2003	809.4	21.9	-92.3	28,041.0	17,356.7	53,698.3	360,803.4
2004	864.1	22.2	-91.3	31,713.1	17,608.8	54,968.8	401,332.1

Table A15: **TFP database outputs and inputs, 1960–2004, constant prices** (cont'd)

Year	*User cost - Exploration $m1960*	*User cost – Artist. Orig. $m1960*	*User cost - Computers $m1960*	*User cost – Elec. mach. $m1960*	*User cost – Indust. mac. $m1960*	*User cost - Vehicles $m1960*	*User cost - Oth transp. $m1960*
1960	43.7	6.6	7.8	1,180.8	1,912.4	2,173.3	428.7
1961	62.0	6.8	9.0	1,253.8	2,072.1	2,356.5	467.7
1962	82.6	7.3	12.8	1,324.4	2,254.9	2,523.5	494.0
1963	112.5	7.9	22.2	1,397.7	2,429.5	2,648.4	522.0
1964	154.4	8.6	40.3	1,486.4	2,625.3	2,801.7	552.4
1965	202.6	9.3	67.0	1,576.7	2,816.2	3,038.1	573.5
1966	259.1	10.2	116.9	1,688.0	3,093.7	3,277.5	607.3
1967	320.9	11.1	195.2	1,818.2	3,401.0	3,470.8	649.4
1968	382.7	12.1	305.3	1,941.2	3,682.5	3,675.2	688.0
1969	457.8	13.1	467.6	2,078.5	3,961.1	3,852.5	749.3
1970	546.8	14.3	682.3	2,204.4	4,261.0	4,073.5	787.9
1971	661.5	15.6	961.1	2,323.7	4,566.5	4,228.8	822.6
1972	790.8	17.0	1,364.1	2,448.2	4,919.5	4,384.7	840.5
1973	876.5	18.5	1,959.6	2,574.2	5,235.2	4,547.9	885.2
1974	940.7	19.3	2,721.9	2,676.1	5,437.5	4,805.7	916.8
1975	981.0	20.2	3,758.8	2,768.5	5,630.1	5,093.1	947.8
1976	992.5	19.6	5,561.8	2,837.1	5,768.0	5,422.6	989.3
1977	985.1	21.0	8,117.7	2,906.5	5,894.9	5,829.3	1,013.1
1978	984.0	22.6	11,236.2	2,932.9	5,987.1	6,254.2	1,015.7
1979	993.6	23.9	15,914.1	2,991.7	6,108.2	6,622.9	1,039.0
1980	1,017.6	25.8	23,088.9	3,089.2	6,354.4	7,102.7	1,052.9
1981	1,083.1	29.3	32,484.1	3,165.2	6,490.8	7,540.5	1,074.7
1982	1,188.8	36.2	46,861.5	3,302.4	6,793.8	8,133.9	1,125.2
1983	1,357.0	40.8	67,392.6	3,491.2	7,265.8	8,716.6	1,188.1
1984	1,488.7	40.9	92,385.5	3,633.7	7,578.4	9,032.0	1,238.6
1985	1,582.9	40.4	124,353.4	3,779.0	7,819.6	9,458.6	1,308.1
1986	1,655.5	47.7	161,078.8	3,936.6	8,158.4	10,009.1	1,383.1
1987	1,707.2	53.6	214,301.7	4,146.7	8,470.9	10,457.7	1,497.2
1988	1,694.8	50.1	276,930.1	4,340.2	8,765.7	10,798.8	1,602.8
1989	1,746.1	50.9	360,721.5	4,501.3	9,088.1	11,206.1	1,662.3
1990	1,791.1	41.7	483,130.4	4,704.9	9,527.0	11,693.9	1,760.8
1991	1,808.5	59.4	592,047.4	4,904.0	9,814.5	12,047.4	1,921.1
1992	1,816.8	48.9	672,976.0	4,969.2	9,822.0	12,128.8	1,958.9
1993	1,811.6	36.6	754,999.7	4,994.8	9,713.9	12,074.1	1,970.4
1994	1,821.1	38.7	893,486.3	5,024.6	9,707.0	12,110.2	1,928.6
1995	1,835.0	45.1	1,096,646.3	5,122.8	9,932.0	11,876.1	1,872.5
1996	1,874.0	40.5	1,471,371.8	5,317.2	10,326.5	11,923.4	1,865.7
1997	1,917.4	40.4	1,952,515.7	5,536.8	10,619.9	12,090.5	1,870.0
1998	1,986.0	50.0	2,665,160.5	5,811.5	10,821.0	12,418.5	1,906.1
1999	2,050.5	50.8	3,888,731.4	6,073.9	10,938.9	12,820.8	2,012.9
2000	2,077.4	55.0	5,150,244.4	6,348.7	10,963.3	13,226.4	2,072.4
2001	2,068.8	54.6	7,616,811.1	6,416.5	11,059.7	13,466.8	2,328.1
2002	2,084.7	57.8	8,894,427.7	6,777.5	11,178.4	14,065.7	2,320.9
2003	2,080.5	59.2	10,555,833.8	6,926.5	11,279.6	14,704.0	2,491.2
2004	2,088.4	61.4	13,516,672.1	7,369.4	11,490.9	15,363.8	2,851.8

Table A15: **TFP database outputs and inputs, 1960–2004, constant prices** (cont'd)

Year	*User cost - Other mach. $m1960*	*User cost - Non-farm inv. $m1960*	*User cost - Farm invent. $m1960*	*User cost - Livestock $m1960*	*User cost – Comm. land $m1960*	*User cost - Rural land $m1960*
1960	1,769.7	3,063.3	10,139.4	5,767.5	3,016.8	5,688.7
1961	1,859.9	3,251.1	10,360.0	5,812.1	3,112.4	5,688.7
1962	1,951.9	3,450.4	10,585.4	5,857.1	3,213.1	5,688.7
1963	2,034.8	3,662.0	10,815.8	5,902.4	3,319.4	5,688.7
1964	2,133.4	3,886.6	11,051.1	5,948.1	3,431.8	5,688.7
1965	2,234.1	4,310.9	11,676.8	5,808.6	3,551.4	5,688.7
1966	2,388.3	4,468.2	11,583.6	5,786.7	3,694.2	5,688.7
1967	2,556.5	4,648.8	11,081.3	5,875.8	3,821.5	5,688.7
1968	2,703.5	4,896.1	10,878.6	6,108.2	3,965.0	5,688.7
1969	2,860.2	5,244.8	12,431.3	6,470.2	4,117.4	5,688.7
1970	3,014.6	5,614.1	12,393.5	6,851.7	4,266.1	5,688.7
1971	3,161.3	6,229.7	11,595.7	7,341.7	4,422.4	5,688.7
1972	3,329.8	6,236.4	11,553.0	7,966.1	4,565.4	5,688.7
1973	3,486.7	6,368.8	9,333.1	8,120.0	4,675.1	5,688.7
1974	3,591.6	6,654.8	7,965.4	8,448.6	4,778.2	5,688.7
1975	3,689.7	7,309.1	8,034.1	8,830.0	4,863.8	5,688.7
1976	3,778.9	7,360.2	7,467.3	9,008.8	4,930.2	5,688.7
1977	3,860.0	7,733.5	6,692.0	8,761.0	5,005.6	5,688.7
1978	3,893.2	7,498.1	6,312.1	8,512.9	5,082.3	5,688.7
1979	3,944.9	7,707.4	5,560.5	8,299.0	5,166.6	5,688.7
1980	4,052.0	8,034.1	4,842.7	8,248.2	5,248.8	5,688.7
1981	4,104.4	8,339.9	4,471.6	8,096.3	5,345.5	5,688.7
1982	4,235.2	8,546.1	4,616.0	8,094.4	5,458.6	5,688.7
1983	4,430.8	8,008.1	4,301.0	7,602.2	5,558.2	5,688.7
1984	4,527.7	8,188.1	4,254.5	7,487.8	5,630.1	5,688.7
1985	4,607.2	8,582.9	4,255.0	7,621.1	5,704.0	5,688.7
1986	4,735.9	8,650.9	4,136.8	7,425.2	5,792.5	5,688.7
1987	4,848.7	8,349.6	3,807.3	7,294.3	5,876.7	5,688.7
1988	4,933.4	8,448.1	3,449.6	7,410.3	5,958.4	5,688.7
1989	4,976.9	9,021.3	3,272.7	7,510.0	6,050.2	5,688.7
1990	5,130.3	9,891.6	3,387.1	8,304.0	6,154.5	5,688.7
1991	5,231.6	9,769.8	3,659.1	7,769.2	6,224.0	5,688.7
1992	5,175.1	9,432.9	3,329.9	8,244.8	6,275.8	5,688.7
1993	5,086.3	9,620.6	3,074.1	8,269.3	6,320.3	5,688.7
1994	5,041.7	9,812.9	2,999.7	8,368.6	6,365.2	5,688.7
1995	5,083.4	10,107.2	3,035.1	8,059.3	6,425.6	5,688.7
1996	5,189.6	10,137.8	3,292.5	8,372.9	6,499.8	5,688.7
1997	5,393.1	10,416.0	3,049.4	8,618.2	6,579.8	5,688.7
1998	5,654.2	10,317.6	2,518.9	8,489.0	6,669.9	5,688.7
1999	5,882.1	11,014.8	2,569.2	8,499.8	6,777.0	5,688.7
2000	6,080.4	11,478.5	2,478.8	8,611.7	6,845.4	5,688.7
2001	6,327.8	11,706.3	1,926.3	8,504.9	6,874.0	5,688.7
2002	6,511.0	11,884.8	1,757.1	8,499.7	6,920.3	5,688.7
2003	6,774.2	11,978.7	1,584.0	8,247.3	7,003.7	5,688.7
2004	6,919.7	12,788.1	1,605.9	8,155.0	7,092.5	5,688.7

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