South African Manufacturing Performance in International Perspective, 1970-1999

Research Memorandum GD-58

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Groningen Growth and Development Centre
November 2002

This paper is published jointly with
the Department of Technology and Development Studies,
Eindhoven University of Technology

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Abstract

This paper analyses the historical performance of the South African manufacturing sector in an international perspective. After a brief overview of the industrialisation process of South Africa during the 20th century, a binary comparison of manufacturing output and productivity between South Africa and the US is presented. The industry-of-origin approach is used to construct unit value ratios (UVRs), as an alternative to the exchange range for converting US and South African output data into the same currency. Subsequently, the UVRs are used to estimate labour and total factor productivity *levels* for total manufacturing and 13 manufacturing branches for the period 1970-1999 in comparison to the USA. Next, these results are used to compute relative unit labour costs, which shed light on the international competitiveness of the South African manufacturing sector at a detailed level. The study is part of the International Comparisons of output and Productivity (ICOP) project carried out at the universities of Groningen and Eindhoven.

We find that there exists a considerable labour and total productivity gap between the US and South Africa, which is continuously widening over time. In 1970, labour productivity stood at 32 percent of US level, while it was only 20 percent in 1999. With respect to relative unit labour costs, the results show that on average, South Africa is competitive with the USA, albeit there are some industries which show consistent relative unit labour costs above US level.

Acknowledgements

I would like to thank TIPS for granting access to the South African Standardised Industry Indicator Database and supporting me to present this paper at the TIPS 2002 Annual Forum; Lawrence Edwards and a TIPS referee for critical comments; and Eddy Szirmai, Marcel Timmer, Edwin Stuivenwold and Nanno Mulder for supplying the data used and various comments. Financial Support from SOBU is also gratefully acknowledged.

1 Introduction

The last decade, South Africa went through a period of economic and social turbulence. After years of struggle, the first democratic elections in 1994 marked the end of the apartheid system. In the same year, GDP growth per capita became positive again after almost 8 years of economic crisis. The new government now faces the difficult task to define industrial policy to put the economy on a new path of economic growth and development, an absolute requirement to solve the poverty problem and unemployment problem of the, mainly black, population. In 1996, the South African government formulated the GEAR (Growth Employment And Redistribution) strategy. Following a long period of protectionist policies, GEAR aims to stimulate economic growth by liberalising the economy, in particular with reference to international trade. For this strategy to succeed, it is of great importance that the manufacturing sector, considered to be the "engine" of economic growth, will increase its performance to gain international competitiveness.

In this paper we analyse the historical performance of the South African manufacturing sector in an international context. Industry specific currency converters are constructed, to estimate labour and total factor productivity *levels* for total manufacturing and 13 manufacturing branches for the period 1970-1999 in comparison with the USA. Next, these results are used to compute relative unit labour costs, in order to examine international competitiveness of the South African manufacturing sector at a detailed level. The results obtained in the analysis of this paper can be of great use in devising industrial policy since it identifies which sectors are performing well and which are falling behind. The study is part of the International Comparisons of output and Productivity (ICOP) project carried out at the universities of Groningen and Eindhoven.

The paper is structured as follows: After a brief overview of the industrialization process of South Africa during the 20th century, section two subsequently explains and applies the ICOP industry-of-origin approach, the methodology to construct unit value ratios for South Africa relative to the USA. In the next two sections, the unit value ratios are applied to estimate comparative labour- and total factor productivity levels for total manufacturing and 13 manufacturing branches, for the period 1970-1999. Section six puts the South African manufacturing performance in a broad international perspective by comparing its labour productivity level with several other countries. Section seven deals with the international competitiveness of South African manufacturing. In this section, relative unit labour costs and relative output prices are given vis-à-vis the USA. Finally, the last section concludes.

2 The South African Industrialisation Process

In this section the industrialisation process of South Africa is briefly sketched. We distinguish four periods: first steps towards industrialisation: ...-1925, import substitution led industrialisation 1925-1975, stagnation and transition: 1975-1994 and, finally, the present period of recovery: 1994-...[1] Table 1, gives an overview of basic growth figures in line with

1 The sections on industrialization up to 1970 are to a large extent based on Lumby (1981a, b). For the others sections use has been made of several sources mentioned in the text..

the four phases of South African development. Furthermore, the contribution of manufacturing growth, the subject of this study, to total gross domestic product (GDP) growth is given. The table shows that after 1975 growth stagnated until around 1994, when there seems to be a trend towards some recovery. Manufacturing was one of the engines behind total growth up to the middle of 1980s. Its share increased from 17% to 23% over the period 1946-1984 and contributed more than 25% to total growth of the economy over the same period. In the following periods, development of the manufacturing slowed down. At the end of the 1980s and beginning of the 1990s, during the crisis, manufacturing even negatively affected total growth. After 1994, manufacturing is expanding again, although its share in total GDP is diminishing.

Table 1

Total GDP and Manufacturing GDP (growth) Figures

Year	Share of Manufacturing in Total GDP	Period	Growth of GDP per Capita	Growth of GDP	Growth of Manufacturing GDP	Contribution of Manufacturing Growth to Total GDP Growth*
1946	16.74	1946-60	1.94	4.35	6.64	25.57
1960	20.07	1960-75	2.29	4.74	7.43	31.44
1975	22.70	1975-84	0.26	2.50	3.33	30.16
1984	23.02	1984-94	-1.29	0.76	-0.10	-3.06
1994	20.92	1994-97	1.20	3.24	3.45	22.51
1997	19.87	1997-01	0.05	2.15	1.40	12.91
2001	18.47					

* Begin of period shares of manufacturing in total and current GDP multiplied by real growth rate of manufacturing GDP and divided by total GDP Growth over the period considered (Timmer 2000).
Source: South African Reserve Bank (SARB), http://www.reservebank.co.za

2.1 First Steps to Industrialisation, ... -1925

The first steps to industrialisation in South Africa were set in the last quarter of the nineteenth century. The first discovery of diamonds and gold triggered the establishment of related industries, such as the manufacture of explosives, cement and engineering. The next 40 years industrialization was limited to the mining areas. A dispersed population and various conflicting tariffs and monopolistic policies of autonomous areas in South Africa prevented the introduction of large-scale manufacturing. Rapid industrial expansion halted with the end of the First World War. South Africa was forced to set up basic industries because imports were restricted in the post war period. Low foreign competition also made it easier for local entrepreneurs to set up new factories. Between 1915 and 1919 the number of firms increased by 45% from 3638 to 5287. After the war, increased foreign competition caused an economic downturn in South Africa.

2.2 Import Substitution Led Industrialization, 1925-1975

In 1924, the Pact government, an alliance between the former opposition of farmers and workers, came into power. The new government was confronted with a growing number of

white unemployment, caused by the recession. To solve this problem, two lines of policy were introduced, which have marked the development of the South African economy up to date. First, a deliberate policy to reserve jobs for whites in the labour market was initiated. 'From the mid-1920s a formal colour bar was erected that not only reserved the best jobs for whites but also instituted a "civilized labour policy giving whites precedence when competing with Africans for unskilled work" (Lundahl, p. 3, 1999). Discriminatory policies were even amplified with the election of the National Party in 1948. Since then, a full-scale policy of *apartheid*, systematically favouring whites above blacks throughout society, was implemented. One of the most influencing laws in this respect was the Bantu Education act, which made it virtually impossible for blacks to enter secondary schooling or higher (Lundahl, 1999).

Secondly, the Pact government commenced an explicit policy of import substitution. Through the introduction of Customs Tariff Act No. 36, industries were shielded from competition by quantitative restrictions and other protectionist measures. In line with import substitution policy, large parastatal companies, like the Iron and Steel Corporation of South Africa, ISCOR; the electricity generator, ESKOM; and the oil and energy company, SASOL, were set up. Another aim of import substitution industrialization was to achieve greater economic independence. Furthermore, it was recognised that the mining sector on which the economy mainly depended as a source of foreign exchange, needed to be replaced in the long run. Industrial output went up by 41% in the next four years. The contribution of manufacturing to total output increased while the share of mining and agriculture both declined.

Besides a period of depression in the beginning of the thirties caused by the world economic crisis, between 1925 and 1970 South African manufacturing grew rapidly with on average around 6% per year (table 1), mainly on the basis of import substitution. The ratio of domestic production to imports for total manufacturing decreased from 52% in 1926/27 to 29 percent in 1956/57 (Bell *et al.*, 1999). Up to the Second World War, the textile and clothing industries were the fast growing sectors, followed by paper and printing, wood and furniture, and food and beverages. Together, they accounted for almost 60% of total manufacturing production. These were also the industries, which received the largest protection. Other relatively fast growing industries were the chemical and metal industry, driven by growth in the mining industry to which they are strongly linked. After the Second World War the manufacturing sector started to mature. The share of more technological advanced industries, transport and general machinery, metal and chemical industry expanded rapidly, at the cost of basic consumer goods industries, except for the paper industry. The share of the food, beverages and tobacco industry declined from 32% in 1945 to 14% in 1976.

2.3 Stagnation and Transition, 1975-1994

1975-1994 was a period of stagnation and economic crisis in South Africa. The growth of GDP per capita stagnated at around 0% over 1975-1984. From 1990 to 1993, the growth rate was even negative, putting the economy in a severe economic crisis. The weaknesses of the

import substitution and apartheid policies pursued over the last five decades were clearly revealed.

Import substitution policy had created capital-intensive inefficient industries producing at high cost. Furthermore, the manufacturing sector was still highly dependent on exports of gold to provide foreign exchange. Only a small part of manufacturing output was exported while the rapid expansion in the previous decades had been accompanied by increasing imports of raw materials and machinery.[2] For example, in 1964 the plastics industry imported 70% of its intermediate goods and the clothing and car industry both 60% (Lumby, 1981a, b). A combination of fluctuating gold prices and increasing imports kept on causing balance of payments problems. As policy makers started to realize that import substitution was no longer sustainable, an attempt was made to switch to export led growth. In 1972, the Export Development Assistance programme was introduced to stimulate exports (Fallon and De Silva, 1994). Additionally, quantitative restrictions were replaced by tariffs and a more appropriate exchange rate policy was chosen to liberalise trade. However, because of the ambiguous nature of most reforms, no real progress was made until the end of the 1980s (Jenkins, 1999). Exports increased from 3.6 percent a year between 1972 and 1983 to about 10 percent over the period 1984-1990 (Fallon and De Silva, 1994). In 1990, the General Export Incentive Scheme (GEIS) was set up to help South African exporters overcome the price disadvantage they have in international markets. Exporters obtain a tax-free financial subsidy based on their value of exports and the local content in the products under GEIS.

Besides the import substitution policy, also the apartheid system was hampering further economic growth. Before, the policy had fuelled the mining and agriculture sector with low wage black labour, establishing a fast growing capital intensive 'white' manufacturing industry. The transformation to a more technologically advanced industrial structure demanded more high skilled labour, not available due to the apartheid regime. According to the population census of 1985, 25 percent of black workers had received no schooling while 99 percent of whites had obtained four or more years of schooling (Fallon and De Silva, 1994). Finally, also the high costs of maintaining the homeland administrations started to impede future growth and speeded up the end of the apartheid system.[3]

2.4 Period of Recovery 1994-...?

After a turbulent period of social and economic disruption, the first South African democratic elections were held in 1994, which marked the end of the apartheid system. From 1994 to 1997, GDP increased again with 3.24% of which manufacturing contributed more than 20% (table 1).

The new government set up the Reconstruction and Development Programme (RDP), which defined the economic and social agenda up to 1999.[4] Besides an elaborate basic needs programme, to promote redistribution and education, the document acknowledged explicitly

[2] South African international competitiveness was also hampered by Dutch-disease effects caused by the high share of mineral exports, mainly gold.
[3] We thank Dirk Ernst van Seventer for making this point.

that future growth should be achieved through trade liberalisation and increased competition. In accordance with this view, an agreement was signed to liberalize South African trade according to the WTO regulations in 1994. Within five years, tariff reductions should be reduced considerably and all quantitative restrictions on imports must be abolished. Also the import subsidies under GEIS have to be phased out within a certain period. The effect of these reforms is that the average nominal tariff on manufacturing will be decreased with 10.4% from 16.6% to 5.8%. Reductions especially apply to the tobacco, clothing, motor vehicles, textiles and footwear industry (Holden, 1996). Up to now, already a large number of protectionist barriers have been eliminated in accordance with the WTO rules. Other polices set up by the government to stimulate industrial output and exports are credit facilities and technological and marketing assistance. In 1996, the government formulated the Growth, Employment and Redistribution (GEAR) strategy. The programme follows the same lines as the RDP but was much more clear in its formulation how to achieve its goals (Nattrass and Seekings, 2000).

Unfortunately, recently there are signs of stagnating growth, of which a part can be contributed to the slowdown of the manufacturing sector. Manufacturing growth decreased from 3.45% from 1993-1997 to 1.40% over 1997-2001, which caused a downfall in contribution to total GDP growth of about 10% (table 1).

3 ICOP Methodology and Application

The scope of this paper is to make a *level* comparison of output and productivity between South Africa and the US. In contrast to *growth rate* comparisons, a conversion factor is required to express outputs and inputs in the same currency before they can be compared. The most straightforward conversion factor is the exchange rate. Although still frequently used in international level comparisons, one can raise a number of objections against its use (Timmer 1996; Timmer, 2000).[5] Firstly, the exchange rate only represents the comparative price level of tradable goods; prices of nontradabele goods are not reflected. Secondly, exchange rates are not only determined by relative price levels, political factors, capital movements and speculation also may cause the exchange rate to fluctuate heavily. Thirdly, the exchange rate is a summary measure of all the price levels of all goods produced in a country and, therefore, less suitable for industry-specific conversions.

There are two alternatives to the exchange rate, Purchasing Power Parities (PPPs), on the basis of the expenditure approach and unit value ratios (UVRs) derived by the industry-of-origin approach (Van Ark, 1996). PPPs are estimated by detailed price comparisons of a large number of final products in categories of private and public consumption and capital formation. Since 1967 the expenditure approach has been applied by the United Nations International Comparison Programme (ICP).[6] Expenditure PPPs, which are now regularly produced by EUROSTAT, World Bank and OECD, are frequently used to compare output

[4] The RDP was originally formulated by the African National Congress (ANC) and taken over by the new government after the elections (Lundahl, 1999).
[5] Kaplinsky (1995), National Productivity Institute (NPI) (1998) and Nordas (1996) use the exchange rate to compare the industrial performance of South Africa with other countries.

and productivity at the level of the total economy.[7] For industry comparisons, however, they are much less suitable. These PPPs are based only on final goods expenditures and, therefore, do not take into account intermediate goods, which make up substantial part of manufacturing. Furthermore, expenditure PPPs still include indirect taxes, subsidies, transport and distribution margins. Finally, adjustments are required to exclude relative prices of imported goods and include the prices of exports (Van Ark *et al.*, 2000). The industry-of-origin approach is more appropriate for industry and sectoral comparisons because conversion factors are estimated from the production side.[8] In this study, we apply the industry-of-origin methodology as used by the International Comparisons of Output and Productivity (ICOP) project to derive UVRs for the South Africa/US productivity comparison.

3.1 The ICOP methodology[9]

This study is part of the International Comparisons of output and Productivity (ICOP) project carried out at the universities of Groningen and Eindhoven.[10] The research project mainly focuses on international productivity comparisons of total manufacturing and thirteen manufacturing branches.[11] The ICOP project covers about 30 countries in the OECD area, Asia and Latin America. Recently, a start has been made to add African countries as well. So far, Egypt (Chevallier *et al.*, 2001), Morocco (Chevallier *et al.*, 2001), Tanzania (Szirmai *et al.*, 2001) and Zambia (Yamfwa *et al.*, 2002), and by means of this study, South Africa have been included.

In the ICOP studies, industry specific PPPs are estimated to compare output and productivity between countries. Ideally, one would like to compare producer prices of similar standardised goods across countries but, unfortunately, these are mostly not available. We adopt a second-best practice, by using unit values (uv) based on quantity and value data of product or product groups, instead. A product group is made up of goods with roughly similar characteristics, like carpets and rugs, car tyres, wines or sport shoes. The unit value can be regarded as the average ex-factory price of a product or product group in a given year. It is defined as

$$uv_i = \frac{o_i}{q_i}, \qquad (1)$$

where o is output value and q the quantity of goods produced. To derive industry specific PPPs, the unit value ratio (UVR) of matched products between two countries (i.e. similar

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6 The pioneers in this field are Gilbert and Kravis (1954). See also Kravis et al., (1982).
7 See for example, (Maddison, 1991, 1995, 2001) and Dollar and Wolff (1993).
8 O'Mahony (1996) provides an overview of the advantages and disadvantages of both the expenditure and the industry-of-origin approach. Also see Van Ark et al. (2000) for a discussion and comparison of various estimations of PPPs and UVRs.
9 This section draws heavily on Timmer (2000).
10 http://www.eco.rug.nl/ggdc/homeggdc.html
11 In addition, also efforts have been made to compare international productivity in services (transport and communication), agriculture and mining. For an overview of the ICOP project see Van Ark (1993b) and Van Ark and Timmer (2000).

products or product groups, produced in both countries), in this case South Africa (SA) and the USA, is computed.

$$UVR_i^{SA/US} = \frac{uv_i^{SA}}{uv_i^{US}}, \qquad (2)$$

Finally, using output as weights, UVRs are aggregated in three steps to provide industry, branch and total manufacturing specific conversion factors. Appendix 1 provides details about the aggregation procedure.

The main data source for the required data is industrial census. The advantage of these sources is that all data is coming from one primary source, which ensures that the UVRs are consistent among all levels of aggregation.[12] As production censes differ considerably in terms of product and industry classification and definitions of labour, value added and output, for practical reasons the ICOP industry-of-origin approach is applied on a bilateral basis, in which the US serves as the "numéraire" or base country.[13] The US has been selected as the base country because it is commonly considered to be the world technological leader. The productivity level of a country in terms of that of the US gives an indication of the technology gap of the country under study and its potential to catch-up. Moreover, since every country's productivity is compared with that of the US, mutual comparisons are easy to make.

The ICOP industry of origin approach has been criticised on various grounds of which the two most important are discussed below (Timmer, 1996; Van Ark *et al.*, 2000). These limitations should be taken in mind when interpreting the South African/US UVRs.

1. *Output coverage:* A disadvantage of UVRs with respect to expenditure PPPs is that their coverage is relatively less. An assumption of the industry-of-origin approach is that a limited number of UVRs are assumed to be representative for non-matched products in an industry or branch. Especially in comparisons between developed and developing countries, this might produce problems since some goods are simply not produced in less-industrialised countries. In ICOP studies it has been frequently found that the number of matches in industries which produce relative homogeneous, less sophisticated products, such as the pulp and paper industry or the food industry, are higher than in more advanced industries. A possible solution, already applied by Van Ark *et al.* (2001) is to use product data for more than one benchmark year to increase the number of products covered.
2. *Quality adjustments*: As mentioned above, most matches are between broad product groups in comparison to exactly defined products. In relation to this, two quality problems arise. First, within a group similar products may differ in quality between countries, i.e., the product content problem and secondly, the composition of products within a group can vary, i.e., the product mix problem (Timmer, 1996). Similar to the coverage problem,

12 National account data can also be used as a source for the industry output data but then the consistency between quantity and value data for products and output data disappears because different sources are used for both. On the other hand, the industrial census may not cover all establishments while national account data covers the entire manufacturing sector. Here we stick to the industrial census as main source for the data. See Mulder et al (2002) for a comparison of both data sources for Mexico, Brazil and the US.

13 See Van Ark and Timmer (2000) for preliminary research towards multilateralisation of UVRs in the ICOP project.

especially in developing/developed country comparisons, these problems might be considerable. Assuming that developing countries produce lower quality goods than industrialised countries, the product content problem might be an issue. The effect is a downward bias in UVRs, which consequently leads to an overestimation of output and productivity estimates. In addition, product listings of developing countries are usually less detailed, which increases the product mix problem.

Timmer (1996, 2000) has developed a method to compute the sampling variance of branch and total manufacturing UVRs, which measures the reliability of the conversion factors. The variance is higher (and reliability lower) when UVRs are more dispersed within a population (i.e. industry, branch or total manufacturing) and/or their coverage is lower. We also apply these measures to evaluate the quality of our UVRs. Appendix 1 describes the procedure.

3.2 South Africa/US Unit Value Ratios

For South Africa the main data source is the *Census of Manufacturing 1993*. In the USA, the industrial census is only undertaken every five year. We use the *1992 Census of Manufacturing* and updated the unit values to 1993 by using 4-7 digit producer price indices from the Bureau of Labour Statistics. Appendix 2 describes in detail the data sources used for this study.

Table 2 presents South Africa/US UVRs for 1993, aggregated at 13 ICOP branch levels. The weighted average UVR for total manufacturing is 3.76 Rand/US$, about 15% higher than the Rand/US$ exchange rate in 1993, measured by the relative price level in the last column. The ratio between UVR and exchange rate indicates whether South African products are relatively cheaper or more expensive than products produced in the US (also see section 7.2 below). Branch UVRs and relative price levels vary considerably, from 1.73 Rand/US$ for leather products to 5.51 Rand/US$ for chemicals, which is equal to relative prices between 53% and 169% of the US. A possible explanation for the wide dispersion among UVRs is the highly varying rates of protection per industry. High levels of protection reduce competition and are therefore correlated with high comparative price levels (i.e. high UVRs). Effective protection of 93.6% on textiles, wearing apparel and leather and 50.6% on chemicals seems to confirm this to some extent (Fallon and De Silva, 1994). However, in case of the paper industry this explanation does not hold because it combines a relatively low of tariff rate (22.2%) with above US comparative price level of 106%.

Table 2

Manufacturing Unit Value Ratios, 1993 South Africa/US Benchmark

	Laspeyres UVR Rand/$	Paasche UVR Rand/$	Fisher UVR Rand/$	Relative price level* %
Food, beverages and tobacco	3.23	2.75	2.98	91.08
Textile mill products	4.57	3.48	3.99	122.05
Wearing apparel	2.87	1.99	2.39	73.05
Leather products and footwear	1.84	1.62	1.73	52.86
Wood products and furniture	2.82	2.43	2.62	79.99
Paper products	3.46	3.46	3.46	105.81
Chemicals	5.80	5.23	5.51	168.39
Rubber and plastics	4.66	4.02	4.33	132.29
Non-metallic mineral products	2.98	2.92	2.95	90.21
Basic and fabricated metal products	4.03	2.65	3.27	99.86
Machinery and transport equipment	5.54	5.29	5.42	165.60
Electrical machinery and equipment**	-	-	3.76	115.04
Other industry	2.62	2.82	2.72	83.10
Total manufacturing	4.32	3.28	3.76	115.04
Exchange rate			3.27	

Source: Own calculations, see text. Basic sources are CSS, Census of Manufacturing, 1993 and Bureau of the Census, US census of Manufactures, 1992. Exchange rate taken from Penn World Tables version 6.0 (Heston *et al*., 2001).

*Comparative price level is the UVR divided by the exchange rate

** Same as total manufacturing because no matches could be made.

Table 3 gives additional information on the number, coverage and reliability of matches per branch and for total manufacturing. In total 189 matches are made, covering 17% of US and 26% of South African output. For the electric machinery branch no products could be matched due to lack of detailed product information in the South African census. The average of all other branches is taken as a proxy instead. As explained in section 3.1, coverage of relative low-tech industries, food, beverages and tobacco, textile mill products and leather products and footwear is high in comparison with the other more advanced industries. An exception is the wearing apparel branch. Coverage in this sector is low because US data on clothes, which makes up the largest part of wearing apparel, are not published for 1992. Table 3 also presents the coefficient of variation for the Paasche and Laspeyres index. Obviously, reliability is less when the coverage rate is lower, such as in the wearing apparel, rubber and other industry branches. These outcomes should be interpreted with care. In contrast, although coverage is relative low, the low coefficient of variation indicates that the UVRs for the non-metallic mineral products and the machinery and are transport sector are reliable.

Table 3

Matching details, 1993 South Africa/US Benchmark

	Number of product matches	Coverage Ratio USA (%)	Coverage Ratio SA (%)	Coefficient of variation Laspeyres	Coefficient of variation Paasche
Food, beverages and tobacco	78	48	53	0.04	0.10
Textile mill products	13	44	51	0.08	0.12
Wearing apparel	3	2	2	0.38	0.58
Leather products and footwear	7	70	44	0.09	0.13
Wood products and furniture	22	21	29	0.06	0.08
Paper products	10	15	37	0.07	0.06
Chemicals	22	28	27	0.04	0.05
Rubber and plastics	4	7	13	0.16	0.20
Non-metallic mineral products	4	7	19	0.01	0.02
Basic and fabricated metal products	18	6	11	0.07	0.11
Machinery and transport equipment	4	0	1	0.07	0.02
Electrical machinery and equipment	0	0	0	-	-
Other industry	4	1	2	0.20	0.12
Total manufacturing	189	17	26	0.03	0.03

Source: see Table 1.

4 The South Africa/US Productivity Benchmark

In this section we estimate relative labour and total factor productivity of South Africa vis-à-vis US for the benchmark year 1993, using the UVRs of the previous section. First, it is important to reconcile the value added, labour and capital data of both countries. As mentioned before, there are no clear international guidelines for industrial census and, therefore, each country has a tendency to use its own definitions, concepts and classifications. We start out by addressing these issues in the South Africa/US benchmark.[14] In the next two parts, subsequently, labour and total factor productivity levels are presented.

4.1 Reconciliation of South African and US Data

The data main source used for both countries is the industrial census (see Appendix 2 for details). Their design differs with respect to coverage, classification and definition of value added and employment. In the South African census all establishments are surveyed, while in the US only firms only establishments with one or more employees are part of the census. We assume the output and inputs of firms with no employees is negligible. To make branches comparable between the two countries, several industries have to be reclassified. For the US, leather gloves and mittens (SIC 3021) is moved from the leather and footwear to the wearing apparel branch, rubber and plastics footwear (3151 SIC) from rubber and plastics to the leather and footwear branch. For South Africa, coffins are transferred from wood products to other manufacturing and carpets, rugs and mats; cordage rope, twine and netting; and other

[14] See also (Van Ark, 1996) for an overview of measurement issues in international comparisons of productivity.

textiles, from wearing apparel to textile products. One industry, household appliances, is very difficult to classify because there is no product listing available. It is assumed that this industry represents all electrical household appliances, not presented in the product listing at all, and is therefore reclassified from the machinery and transport equipment to the electrical machinery and equipment branch.

It is not clear if the definition used for value added in both censes is the same for South Africa and the US. The US uses the "census" concept of value added, which still includes services purchased from outside manufacturing such as business services (Van Ark, 1993a). The South African definition is not very clear. It seems as if services are included in gross value added (called net output in the South African census). According to the Census of Manufacturing (1993, p. viii), "charges for work done, that is, repair work, installation, erection or assembly and manufacturing of goods from materials of clients" and "sales of articles manufactured by other establishments from an establishment's materials" are still part of value added. For the time being we assume that value added is similarly defined in both countries and can be compared without modifications. With respect to employment, two adjustments are made. The US survey explicitly excludes head office and auxiliary employment, while this is not the case for the South African data. The US branch figures for employment were scaled up with head office and auxiliary employment, presented in the *1993 Annual Survey of Manufactures.* The second problem is the treatment of self-employment and unpaid family workers. In the US, they are excluded from employment. Fortunately, the South African census provides separate information on self-employment and unpaid family workers and is adjusted accordingly. If the number of self-employed would be high in South Africa, productivity might be overestimated. This is not the case. About 1 percent of the manufacturing labour force in South Africa are self employed (Central Statistical Service, Census of Manufacturing 1993, report NO 30-01-01) in 1993. The number for the USA is 2 percent in 1987 (Timmer, 2000). Capital stock data for the benchmark is discussed in Section 4.3 below along with the total factor productivity estimates. Table 4 gives the Basic manufacturing data, which is used for constructing the 1993 productivity benchmarks. Hours worked are also presented.

4.2 Labour Productivity levels

As is common in productivity studies, we measure labour productivity as value added per worker. The alternative would be gross value of output. However, this measure involves a considerable part of double counting because part of the output is used as intermediate inputs in other firms and industries. The Fisher UVRs in Table 1 are used to convert South African and US gross value added in Table 4 to same currency.[15] Their ratio is computed in the first column of Table 5. South African value added is only 1.6% of that of the US. In addition, relative labour productivity levels per employee and per hour worked are presented for thirteen branches. On average, South African labour productivity is 21.6% of the US level. The productivity gap across branches is fairly constant around the total manufacturing average. Remarkable is the high relative labour productivity in the leather and footwear branch of 41.4% of US level. Furthermore, it is striking that this branch in the US is so small

[15] Theoretically it would be more sound use double deflation, i.e. to convert output and intermediate goods separately, to derive value added in a common currency. However, for practical and methodological reasons, only single deflation is used in ICOP studies (Van Ark, 1993a).

in comparison to its South African peer. These findings are also found for a range of Asian countries (Timmer, 2000) indicating that either the US leather industry performs exceptionally bad and is relatively small or there are inconsistencies in the data. Further research is warranted to explain this phenomenon. The lowest relatively labour productivity levels of 17.5% and 15.6% are found in the chemicals and machinery and transport industry, respectively. All other figures are above 20% of the US level. Further detailed industry studies are required to investigate the relative low performance of these branches.

Table 4

Basic Manufacturing Data, South Africa and USA, 1993

	US					South Africa				
	Gross value of output at factor cost mil US$	Gross value added at factor cost mil US$	Persons (000)	Annual hours worked per person	Gross fixed capital stock mil US$	Gross value of output at factor cost mil Rand	Gross value added at factor cost mil Rand	Persons (000)	Annual hours worked per person*	Gross fixed capital stock mil Rand
Food, beverages and tobacco	451,641	187,500	1,701	1,939	198,816	45,940	17,183	222	2,182	18,195
Textile mill products	73,951	30,980	635	2,024	45,129	6,037	2,624	65	2,132	2,021
Wearing apparel	74,163	37,189	1,016	1,824	16,035	7,029	3,318	140	2,059	755
Leather products and footwear	10,621	4,962	112	1,869	3,802	2,968	1,302	41	2,039	433
Wood products and furniture	141,896	61,970	1,198	1,998	68,761	6,597	3,098	92	2,234	1,785
Paper products	306,223	176,369	2,253	1,897	269,425	16,850	7,960	95	2,020	5,667
Chemicals	459,459	194,794	1,254	2,018	353,091	35,200	15,721	105	2,187	55,288
Rubber and plastics	121,980	62,969	962	2,026	59,787	8,055	3,993	62	2,128	1,787
Non-metallic mineral products	65,574	35,784	494	2,058	64,098	6,928	3,730	70	2,161	5,655
Basic and fabricated metal products	317,522	143,279	2,089	2,037	249,196	31,258	12,786	192	2,226	30,892
Machinery and transport equipment	692,572	306,538	3,605	2,037	384,570	30,679	11,712	163	2,090	9,386
Electrical machinery and equipment	233,343	128,484	1,451	1,969	196,929	8,732	3,826	57	2,148	2,528
Other industry	179,342	115,450	1,345	1,926	71,971	3,504	1,356	27	2,128	647
Total manufacturing	3,128,284	1,486,266	18,114	1,980	1,981,609	209,778	88,610	1,330	2,144	135,039

Source: Gross value of output, gross value of output and employment for the USA from 1993 Annual Survey of Manufactures (ASM), Statistics for industry Groups and Industries, annual hours worked from US Bureau of Labour Statistics, International Comparisons of Manufacturing Productivity and Unit Labour Costs Trends, (Http://stats.bls.gov/news.release/prod4.toc.htm). For South Africa, Gross value of output, gross value of output and employment form CSS report NO 30-01-01, Census of Manufacturing 1993, Statistics According to Major Groups and Subgroups: South Africa. Annual hours worked from South African Statistics, 1995.

* Based on 1992 data but aggregated to branches using 1993 labour data.

Labour productivity on the basis of hours worked is slightly less for all manufacturing branches, indicating that South African employees on average work somewhat longer than their American colleagues.

Table 5

Value added and Labour Productivity, South Africa as % of USA, 1993

	Value added	Persons	Hours worked	Value added per person	Value added per hour worked
Food, beverages and tobacco	3.1	13.1	14.7	23.5	20.9
Textile mill products	2.1	10.2	10.8	20.8	19.7
Wearing apparel	3.7	13.7	15.5	27.2	24.1
Leather products and footwear	15.2	36.8	40.2	41.3	37.8
Wood products and furniture	1.9	7.6	8.6	25.0	22.3
Paper products	1.3	4.2	4.5	31.0	29.1
Chemicals	1.5	8.4	9.1	17.5	16.2
Rubber and plastics	1.5	6.4	6.7	22.9	21.8
Non-metallic mineral products	3.5	14.1	14.8	25.1	23.9
Basic and fabricated metal products	2.7	9.2	10.1	29.7	27.1
Machinery and transport equipment	0.7	4.5	4.6	15.6	15.2
Electrical machinery and equipment	0.9	3.9	4.3	20.1	18.4
Other industry	0.4	2.0	2.2	21.4	19.4
Total manufacturing	1.6	7.3	7.9	21.6	19.9

Source: table 1 and table 3. Value added converted by Fisher unit value ratios.

4.3 Capital intensity

Two proximate sources of increased labour productivity are commonly distinguished, capital accumulation and total factor productivity growth (Solow, 1957; Maddison, 1987). We start out with discussing the role of capital intensity, followed by a total factor productivity analysis.

Capital inputs are not part of the industrial census. In theory, capital input, the flow of capital services from capital stock installed, can be measured using detailed data on the composition of capital stock and rental prices (Jorgenson and Griliches, 1967). Such data, however, is rarely available, therefore we adopt the standard assumption that capital input is proportional to the capital stock. US gross fixed capital stock for branches and total manufacturing is taken from Timmer (2000) and updated to 1997 with real investment data from Bureau of Economic Analysis (BEA), National Accounts, various issues. Series are generated applying the perpetual inventory method (PIM), assuming a rectangular retirement pattern (Goldsmith, 1951; Harris, 1996). Two assets are distinguished, non-residential buildings and equipment including vehicles, using average service lifes in OECD countries of 45 and 17 years, respectively (Van Ark and Pilat, 1993). South African gross fixed capital stocks is obtained from the South African Standardised Industry Indicator Database, maintained by Trade and Industrial Policy Secretariat (TIPS) (see Appendix 2 for details). The stocks are computed by applying PIM to published Stats SA investment series of three assets, non-residential

buildings, transport and machinery and other equipment with life times of 33, 8 and 4 years respectively.[16]

Table 6 shows the capital stocks in local currency for the benchmark year 1993 for South Africa and the US. For both countries, total investment deflators are used to rebase the stock series to 1993 prices.[17] Similar to value added, specific capital converters are required to express capital stocks into a common currency for comparison. We use investment PPPs from the Penn World Tables version 6 (Heston *et al.*, 2001). Since investments are expenditures on capital goods, the inclusion of retail and transport margins, and import prices is allowed (Timmer, 2000). Using investment PPPs, capital stocks of both countries is expressed in international dollars first, after which their relative level is estimated (Table 6). Especially, the chemical and the basic metal industry are, in comparison with other branches, capital-intensive vis-à-vis the US. We suspect that strong linkages, with the large mining industry in South Africa have triggered investment in heavy machinery and equipment in these branches, and in particular the chemical industry.

4.4 Total Factor Productivity Levels

Total factor productivity (TFP) growth is normally defined the portion of labour productivity growth not accounted for by measured input (here capital and labour) growth (Steindel and Stiroh, 2001).[18] In this study, we apply a level instead of a growth accounting framework to measure total factor productivity of South African manufacturing relative to the USA. It reflects differences in economies of scale, efficiency, general knowledge and organisation between the two countries not captured by differences in the use of capital and labour. Relative total factor productivity is computed by the following equation, based on a translog production function, replacing points in time by countries (Van Ark, 1993a):

$$\ln \frac{A^{SA}}{A^{US}} = \ln \frac{Y^{SA} / L^{SA}}{Y^{US} / L^{US}} - (1 - \bar{v}_L^{SA\,US}) \ln \frac{K^{SA} / L^{SA}}{K^{US} / L^{SA}} \qquad (3)$$

where Y is gross value added, L is number of employees, K is gross fixed capital stock, A is the level of TFP and $\bar{v}_L^{SA\,US}$ is the average labour share in gross value added for South Africa (SA) and the United States (US).[19] The total factor productivity level of South Africa vis-à-vis the US is defined as relative labour productivity minus relative capital intensity, weighted by the average capital share of both countries. US Labour shares are taken from Timmer (2000) updated to 1997 with data from Bureau of Economic Analysis (BEA). South African labour shares are presented in the South African Standardised Industry Indicator Database. Table 6 shows the outcomes.

[16] We thank a referee for informing us about the life time of the South Afican assets.
[17] The capital stocks series generated by using PIM are in 1985 and 1995 (if i'm not mistaken) prices, respectively for the US and South Africa.
[18] In the KLEM growth accounting framework, energy and materials growth are also accounted for (Jorgenson *et al.*, 1987).
[19] See Jorgenson (1995a, b) for a detailed explanation and application of translog production functions and related total factor productivity index. Dollar and Wolff (1993) also use this function to analyse US competitiveness in an international setting.

Average South African total manufacturing productivity is 34.5% of US. The highest relative total factor productivity is recorded in the leather industry and paper industry. As explained in the section on labour productivity, the high figure for the leather industry is caused by underperformance of this branch in the US. South Africa shows low total factor productivity in chemicals and machinery and transport equipment (under 30%). In line with the results for labour productivity, the total factor productivity gap is increased with about three percent because of shorter working hours in the USA in comparison to South Africa.

Table 6

Capital Stock and TFP, South Africa as % of USA, 1993

	Capital stock	Capital stock per person	Capital stock per hour worked	Total factor productivity person based	Total factor productivity hours worked based
Food, beverages and tobacco	2.3	17.7	15.8	56.1	52.9
Textile mill products	1.1	11.1	10.5	39.9	38.5
Wearing apparel	1.2	8.7	7.7	47.0	42.8
Leather products and footwear	2.9	7.8	7.2	88.8	83.5
Wood products and furniture	0.7	8.6	7.7	56.7	52.6
Paper products	0.5	12.7	11.9	65.4	62.8
Chemicals	4.0	47.5	43.8	25.0	23.9
Rubber and plastics	0.8	11.8	11.3	55.7	54.1
Non-metallic mineral products	2.2	15.9	15.1	45.8	44.3
Basic and fabricated metal products	3.1	34.1	31.2	42.5	40.1
Machinery and transport equipment	0.6	13.7	13.3	28.3	27.8
Electrical machinery and equipment	0.3	8.3	7.6	34.9	32.6
Other industry	0.2	11.3	10.2	56.5	53.4
Total manufacturing	1.7	23.5	21.7	36.3	34.5
Investment PPP	US (US$/I$): 0.85			SA (Rand/I$): 3.35	

Source: Table 2, 4, for capital stock see Appendix 2. Relative TFP computed using equation 3. Investment PPP in national currency per international dollar (I$) for 1993 calculated by multiplying price level of investment with the exchange rate, taken from Penn world Tables version 6.0 (Heston *et al*., 2001)

5 South Africa/US Productivity Dynamics, 1970-1999

To investigate the degree of catch-up or falling behind of South Africa industrial performance with respect to the USA, the 1993 labour and total factor productivity benchmark estimates are extrapolated back and forward. In the first section labour productivity trends are discussed, followed by an investigation of long run capital intensity and total factor productivity dynamics.

5.1 Labour productivity Trends

The investigate the South African/US labour productivity gap on a per worker basis, in the long run, we link the 1993 benchmark with growth indices of labour productivity for each country. For the US the indices are based on times series of real GDP and employment from the national accounts for the

period 1970-1999. The South African data is based on a variety of sources undelying the Standardised Industry database that is also used for the capital stock data. Appendix 2 provides the details concerning the data and Appendix 3 presents the primary data used.

Table 7 shows the extrapolated relative labour productivity for selected years. The bottom line clearly indicates the falling behind of South African manufacturing performance relative to the US. The labour productivity gap increased steadily with 12% points from 32.0% to 19.8%. Looking at the detailed branch level, the food, beverages and tobacco industry, non-metallic mineral industry and basic and fabricated metal industry have managed to close a (small) part of the productivity gap. For example, in 1994 the Columbus stainless steel plant was taken into production which probably also has boosted labour productivity over the last couple of years (Lundahl, 1999). All other industries are falling behind with respect to US performance, considering the complete period analysed. This is especially true for the leather branch and the electrical machinery and equipment industry. We believe that results for both branches are not caused by a slowdown in South African labour productivity, but to exceptional growth on the US side. Outcomes of the leather industry already have been discussed in previous sections and will not be addressed here anymore. The US times series data (not presented here) confirms the rapid growth of labour productivity in the US electrical machinery and equipment branch, which increased more than thirteen times between 1970 and 1999, by far the highest increase of all branches. Van Ark *et al.* (2000), who use the same dataset for a US-Canada productivity comparison, argue that, besides real productivity increases, a possible explanation for the widening gap are the use of hedonic price indices for computers and semiconductors, which make up a large share of the electrical and machinery equipment. On average, the steepest fall in relative productivity is found between 1975 and 1994, corresponding with the period of stagnation in South Africa. Positive is that, more than half of the industries, textile mill products, wood products, paper and printing, chemicals, rubber and plastic, non-metallic mineral products, basic and fabricated mineral products and other manufacturing, experience a small increase in relative performance, since 1994, possibly indicating recovery.

Table 7

Labour Productivity in Manufacturing, South Africa as % of USA, 1970-1999

	1970	1975	1984	1994	1999
Food, beverages and tobacco	22.1	20.0	20.8	24.0	27.5
Textile mill products	43.7	42.2	30.2	20.8	21.4
Wearing apparel	46.5	34.4	34.0	25.6	24.4
Leather products and footwear	77.3	71.6	63.5	36.4	25.9
Wood products, furniture and fixtures	31.3	31.2	25.6	25.0	25.4
Paper and printing	34.9	29.8	34.6	31.5	33.0
Chemicals	24.3	19.9	23.1	17.3	17.8
Rubber and Plastic	44.8	38.8	35.0	23.3	24.0
Non-metallic mineral products	28.8	29.0	28.2	25.6	35.2
Basic and fabricated metal products	32.5	37.0	32.5	28.8	36.5
Machinery and Transport	25.3	23.8	18.4	14.8	12.6
Electrical Machinery and Equipment	58.2	67.6	56.1	18.1	9.6
Other manufacturing	29.4	29.9	26.4	20.9	25.1
Total manufacturing	32.0	30.7	27.2	20.9	19.8

Source: Table 3 and labour and output time series for both countries, see Appendix 2.

5.2 Capital Intensity and Total Factor Productivity Trends

Analogue to the extrapolation of labour productivity we extend the capital intensity and TFP levels of the benchmark year in Table 6 to investigate their dynamics. Capital intensity levels are estimated using capital stock series at the branch level, discussed in Section 4.2. For the TFP extrapolation we merge the TFP level in the benchmark year with national TFP growth series, applying a standard translog production function, for each country:

$$\ln \frac{A_{t+1}}{A_t} = \ln \frac{Y_{t+1} / L_{t+1}}{Y_t / L_t} - (1 - \bar{v}_L) \ln \frac{K_{t+1} / L_{t+1}}{K_t / L_t}, \qquad (4)$$

where, A is TFP, Y is value added, L is labour, K is capital, $\bar{v}_L = 1/2(v_t + v_{t+1})$, the average labour share in value added, over period t and t+1. In contrast to value added and labour, capital stock data for the US is only available up to 1997.

Table 8 presents South African capital intensity and TFP levels as percentage of the USA for selected years. A striking result is the increase of relative capital intensity for total manufacturing from 20.8% to 25.3% between 1970 and 1997. This contrasts our earlier finding of a decrease in labour productivity level over the same period (table 7). Consequently, TFP has decreased considerably in comparison with the US. Like before, the results of the leather industry and the electrical machinery and equipment industry stand out and are likely to be responsible for the steep fall in aggregate TFP. At the branch level, there seems ample space for catch-up through capital investment because capital intensity is under 50% of that of the USA, except for chemicals and metal industry. In particular the latter went through a phase of rapid expansion since 1970. TFP level

decreased for most branches. Only the food and paper industry managed to maintain their productivity level over the period analysed.

Table 8

Capital intensity and TFP, South Africa as % of USA, 1970-1997

	Capital stock per person					Total factor productivity				
	1970	1975	1984	1994	1997	1970	1975	1984	1994	1997
Food, beverages and tobacco	18.3	17.2	18.8	18.9	19.8	57.0	51.5	49.2	54.8	57.5
Textile mill products	13.8	10.1	9.4	10.3	9.9	83.7	87.0	61.2	41.2	38.6
Wearing apparel	27.9	18.0	12.3	8.6	7.7	62.4	51.0	54.7	44.3	39.7
Leather products and footwear	16.3	14.1	10.4	8.1	7.6	145.7	137.7	130.6	77.1	72.4
Wood products, furniture and fixtures	14.8	12.3	13.3	8.4	9.7	61.3	63.5	50.2	57.4	54.3
Paper and printing	19.3	18.7	29.5	13.4	15.8	66.6	56.3	54.2	64.9	66.6
Chemicals	81.8	74.4	80.8	51.7	67.6	28.2	23.7	24.8	23.5	21.8
Rubber and Plastic	19.4	17.5	14.2	13.1	12.3	89.5	80.7	79.5	54.3	50.5
Non-metallic mineral products	12.9	14.0	20.4	16.9	19.7	58.1	55.5	47.0	45.7	44.0
Basic and fabricated metal products	26.9	36.1	28.4	39.8	55.4	55.8	55.0	50.9	38.9	41.5
Machinery and Transport	12.4	12.5	11.9	12.9	12.3	53.3	49.1	36.2	27.3	26.5
Electrical Machinery and Equipment	37.2	32.5	30.4	8.4	8.6	73.8	88.4	72.9	31.2	23.2
Other manufacturing	30.2	23.5	19.6	9.4	7.9	58.2	62.5	57.2	60.2	69.3
Total manufacturing	20.8	21.0	27.1	24.1	25.3	63.5	58.2	44.8	34.8	33.3

Source: Table 3 and labour, output and capital stock time series for both countries, see Appendix 2.

6 South African Productivity in an International Perspective

To put the production performance of South Africa in a broader international perspective we compare its labour manufacturing productivity with a sample of other countries, also studied within the ICOP project, using the same methodologies used here.[20] The countries have been selected because they represent various stages of industrialisation and, hence, offer ample opportunity for comparison with South African development. Germany and Japan are high-income country, South Korea is one of the best-known examples of countries that managed to transform from low-income to high-income countries (World Bank, 1993); Brazil, Mexico, Egypt and Morocco are, like South Africa, classified as middle-income countries; and Zambia and Tanzania are low-income countries.[21]

Figure 1 shows the evolution of labour productivity level for the ten countries from 1970 to 2000 as percentage of USA. The results resemble the income classification, mentioned above: Zambia and Tanzania have the lowest relative productivity of around 10 percent; Brazil, Mexico, Egypt, Morocco and South Africa perform at between 15% and 40% of USA level, although Brazil used to do much better between 1970 and 1990. Korea started at a level slightly above the low-income

[20] See Van Ark and Timmer (2000) and ICOP Industry Database (2002) for labour productivity estimates for all ICOP countries.

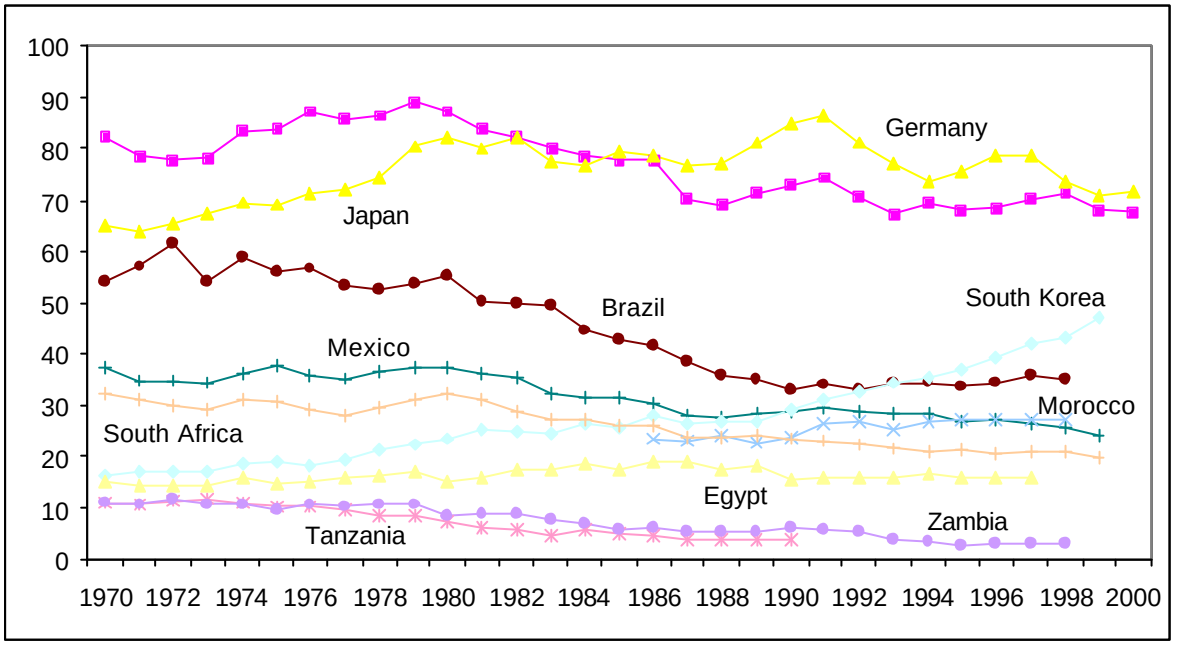
[21] The classification is taken from the World Bank's website on country data and statistics (http://www.worldbank.org/data/countrydata/countrydata.html) and is based on gross national income (GNI) per capita. Taiwan is not part of the classification because it is considered part of China. The World Bank makes a further distinction between lower- and upper-middle-income countries. South Africa belongs to the former group while Mexico and Brazil are part of the latter.

countries but managed to catch-up with the USA and reach labour productivity levels of around 50% and 30%, respectively, in 1993. Labour productivity of Germany and Japan are the closest to that of the USA.

Striking, in the figure is the increase of the productivity gap between seven of the countries and the USA. This result has also been found for some OECD countries, studied in the ICOP project, such as Canada, Australia and the United Kingdom (Van Ark *et al.*, 2000). As already outlined above, the widening of the gap is not due to slowdown of lagging countries but to the forging ahead of the USA, especially in the electrical machinery and equipment branch.

Figure 1

Labour Productivity for Total Manufacturing, selected countries (USA=100)



Source: ICOP Industry Database (2002), the database also contains references to the specific country studies.

7 Unit Labour Costs and Relative Prices

Besides productivity, costs are also an important determinant of countries international competitiveness. A direct measure of the relation between productivity and cost are unit labour costs, defined as the ratio between labour costs (compensation per employee) and labour productivity. Since labour is in general less mobile than other factors of production, capital and intermediate goods, unit labour costs are one of the most important determinants of competitiveness. Moreover, labour costs make up 70% to 80% of value added in industrialised countries (Pilat, 1994). International unit labour cost comparisons are not easy to make because, similar to relative productivity levels, an appropriate conversion factor for output is required. Also here the UVRs provide a solution. In the first part of this section, we estimate unit labour costs in comparison with the USA for manufacturing, to assess South Africa's international competitiveness. For emerging economies, like South Africa other costs (e.g. capital, materials and energy costs) may be more important than labour costs. In the final section, we discuss relative prices, which gives an impression of overall price competitiveness.

7.1 Unit labour costs

To analyse the trade-off between labour costs and labour productivity of South Africa vs. the USA, we compute relative unit labour costs (RULC).[22] RULC is defined as the ratio of between relative labour costs and relative labour productivity of South African vis-à-vis the US, formally defined as:

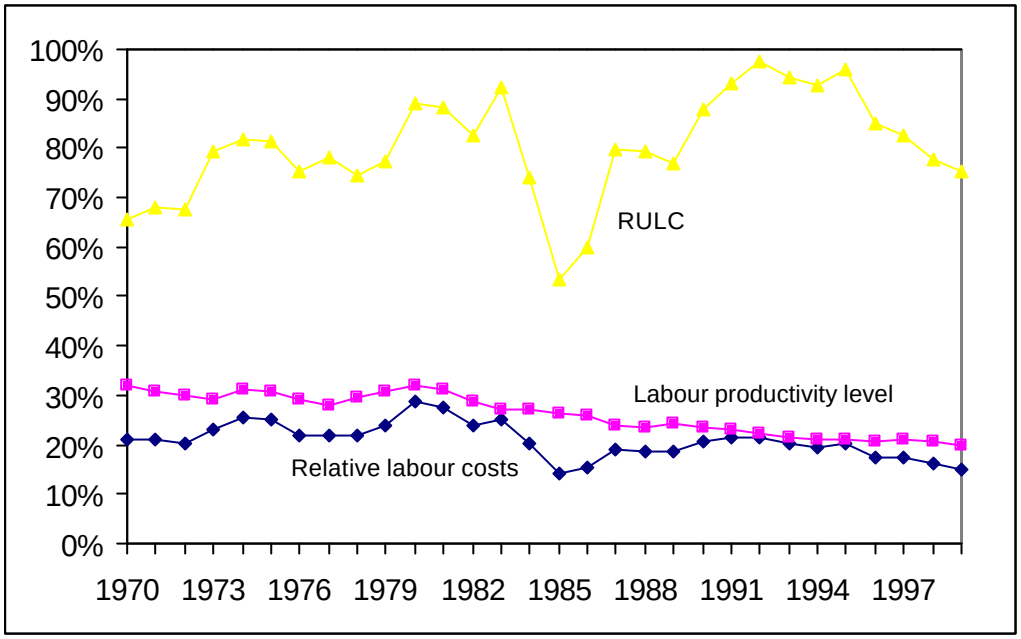
$$RULC^{SAUS} = \left(\frac{\left(\frac{W^{SA}}{L^{SA}} \right) / NER^{SA/US}}{\left(\frac{W^{US}}{L^{US}} \right)} \right) / \left(\frac{\left(\frac{Y^{SA}}{L^{SA}} \right) / UVR^{SA/US}}{\frac{Y^{US}}{L^{US}}} \right), \qquad (5)$$

where W is compensation for total labour, L is labour, $NER^{SA/US}$ is nominal exchange rate expressed in Rand per US$, Y is value added and $UVR^{SA/US}$ is unit value ratio.[23] As usual, SA and US denote South Africa and USA. For South Africa, labour costs and employment are directly taken from the South African Standardised Industry Database. US labour costs are computed by multiplying labour share data, also used for computing TFP, with current value added. Both data series are based on national accounts data. RULC based on census data, for the benchmark year 1993, resulted in dramatically different and unreasonable results, especially with respect to the US. The reason for this is differences in the definition of labour compensation between census data and national accounts data.[24] The former does not include employers' social security contributions, some fringe benefits or payments to self-employed, which are included in the latter.[25] In order to compute meaningful RULC estimates, it is important that labour compensation is standardised between countries. South African data for total economy is directly comparable to those of the US because they use the same definitions.[26]

[22] See Pilat (1994) and Mulder *et al.* (2002) for relative unit labour costs of South Korea, Japan, Mexico and Brazil, as percentage of the USA, using the same methodology.
[23] In the actual calculation, labour drops out.
[24] Also differences in the definition of value added play a role, see section 4.1.
[25] we want to thank Marcel Timmer for clarifying this point.
[26] We thank a referee for clarifying this.

Figure 2

RULC, labour productivity and labour costs, as % of USA, 1970-1999



Source: for labour productivity levels see table 7 data; relative labour costs computed using times series data on labour costs, also see text; RULC is computed using equation 5.

Figure 2 plots labour productivity, labour costs per employee and unit labour costs of South Africa as percentage of US for total manufacturing between 1970 and 1999. Over the whole period, labour costs are below labour productivity levels, meaning that South African unit labour costs are below US figures. In the beginning of the 1980s, there is a large decrease of RULC, due to the strong depreciation of the Rand, after which it rebounced to a level almost equal to the USA between 1991 and 1995. The last couple of years, the Rand has rapidly depreciated again leading to a second wave of declining RULC. Table 9 shows RULCs for thirteen industrial branches. In 1970, all levels in South Africa are below the US level. Three industries show consistent RULC over 100%, rubber and plastics, machinery and transport, and electrical machinery and equipment, meaning that they are not competitive with the USA in terms of labour costs. RULC for other industries, although below the US level are still relatively high. In contrast, estimates of Mexico/US RULC for 1988 were all, except one, lower than 50% (Mulder *et al.*, 2002), where all the South African RULCs are above 50%. High relative wages, rather than, low labour productivity are the cause of the differences between the results of the two countries as is shown by the small productivity gap between Mexico and South Africa in Figure 1. The high level of wages in South Africa has also been confirmed in other studies.[27] The high relative wage/productivity ratio implies that it will be difficult for South Africa to compete in the international market, especially in low wage labour intensive industries in which developing countries have a comparative advantage.

To assess the robustness of the RULC figures, it is useful to compare them briefly with other studies that investigate RULC for South Africa. Nordas, (1996), using the same methodology but using the exchange rate instead of UVRs as conversion factor, investigates South African unit labour

[27] See studies quoted in Nattrass and Seekings (2000).

costs in comparison with the US for 22 manufacturing industries in 1990. She finds that the only competitive industry (i.e. RULC lower than 100) is non-ferrous metals. Furthermore, the iron and steel, paper and printing and shipbuilding industry have RULC slightly above the US level. The results of the analysis here only partly confirm Nordas study. We also find that RULC of the basic and fabricated metal industry of which non-ferrous metals and iron and steel industry are part, are among the lowest. However, for other branches outcomes differ. A likely cause for the discrepancy is the use of different conversion factors. Golub (2000) uses the real effective exchange rate (REER) to transform labour productivity into the same currency.[28] His findings resemble the results obtained here. In 1990, South African wages and labour productivity are around 25 percent of the US level, indicating that unit labour costs are approximately equal between South Africa and the US. In our estimates (not shown), relative wages for manufacturing in 1990 are 21 percent and labour productive is 24 percent, resulting in relative unit labour costs of 88 percent of the USA. Golub concludes that South Africa is competitive with almost all industrialised countries but not with many developing countries, mainly caused by the high South African wage level. This finding is also supported by our brief comparison with Mexico.

Table 9

Relative Unit Labour Costs, as % of USA, selected years

	1970	1975	1984	1994	1999
Food, beverages and tobacco	80.0	106.4	86.3	86.0	60.2
Textile mill products	47.7	63.9	76.2	111.0	96.7
Wearing apparel	62.2	86.9	64.3	84.5	69.2
Leather products and footwear	33.3	48.6	37.1	43.6	39.1
Wood products, furniture and fixtures	65.8	79.5	65.9	65.7	54.6
Paper and printing	95.3	124.2	86.8	92.0	68.8
Chemicals	77.1	111.9	89.6	116.4	80.5
Rubber and Plastic	58.0	84.2	102.8	148.4	112.6
Non-metallic mineral products	53.5	67.4	57.3	84.1	54.8
Basic and fabricated metal products	65.2	72.3	67.8	85.4	54.6
Machinery and Transport	94.2	118.3	117.0	141.9	124.5
Electrical Machinery and Equipment	51.5	50.5	45.3	81.0	125.5
Other manufacturing	82.3	90.0	77.6	93.1	51.9
Total manufacturing	65.5	81.5	74.0	92.7	75.4

Source: See figure 2

7.2 Relative prices

Relative prices are defined as PPP (or UVR) divided by the exchange rate. In section 3.2 relative prices for the benchmark year are already briefly discussed. To derive insights on the dynamics of South African/US price levels, we extrapolate the benchmark estimate for total manufacturing using manufacturing deflators for South Africa and USA. The deflators are obtained by dividing current value added by constant value added. Figure 3 shows that South African prices have steadily

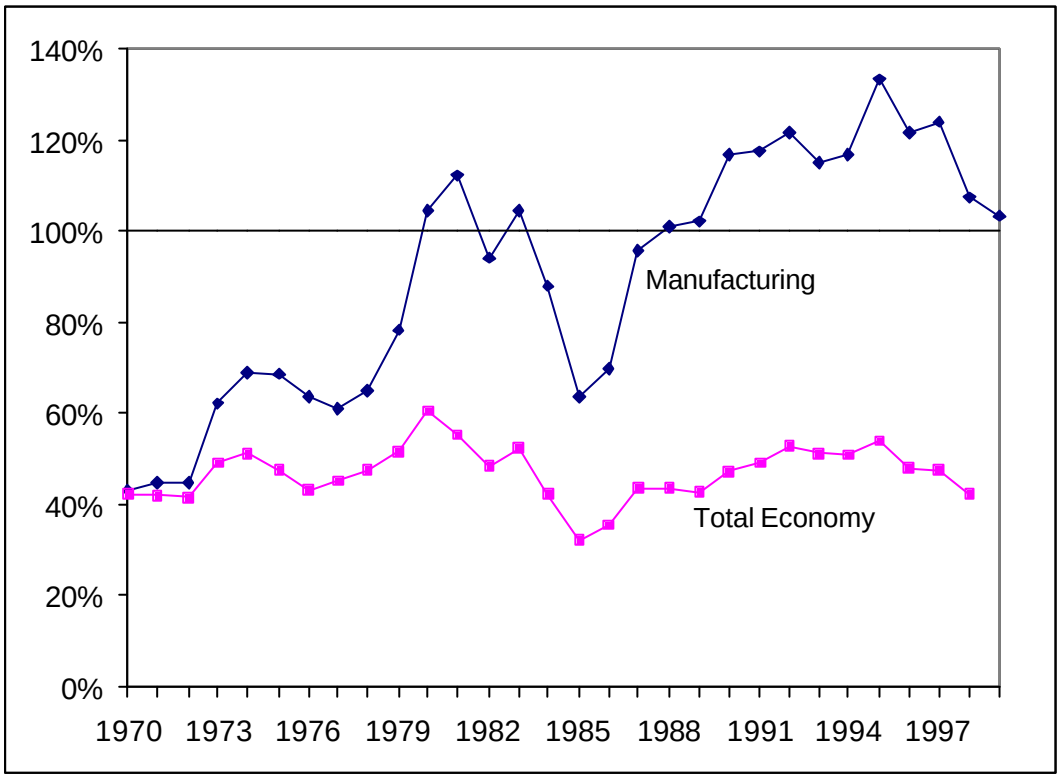
[28] As Golub points out rightfully, at the time of his study neither PPPs nor UVRs were available for South Africa.

increased from about 40% in 1970 to a maximum of 133% in 1995, interrupted by a decline in the beginning of the 1980s due to rapid depreciation of the Rand. Between 1995 and 1999, South African prices decreased to the US level again. This is the same pattern as shown in figure 2 for RULC.

Figure 3 also shows the relative price level of the total economy, computed as PPP divided by exchange rate, which is far below the price level for total manufacturing. Similar results have been found by Pilat (1994) for Korea and, Japan and by Mulder et al. (2002) for Mexico and is a well-known phenomenon for developing countries. Overall price levels in developing countries are lower than in industrialised countries because nontradables (i.e. services) are relatively cheap. Prices of tradables, of which manufacturing makes up the largest share, are assumed to be roughly equal, across countries (Balassa, 1964; Bhagwati, 1984).

Figure 3

South African Relative Price Levels, as % of USA, 1970-1999



Source: Manufacturing: UVR taken from table 1 and extrapolated with GDP deflator for total manufacturing, divided by exchange rate (Rand/US$) from Penn World Tables version 6.0 (Heston *et al*., 2001); total economy: PPP divided by exchange rate, also both from Penn World Tables version 6.0

8 Conclusion

The main aim of this paper is to determine the economic performance of South African Manufacturing in a comparative international perspective. We construct industry specific purchasing power parities (PPPs) (here called unit value ratios (UVRs), which are used to compute labour and total factor productivity levels for total manufacturing and 13 manufacturing branches, relative to the USA, for the period 1970-1999. The data points out that there exists a considerable labour and total productivity gap between the US and South Africa, which is continuously widening over time. In

1970, labour productivity stood at 32 percent of US level, while it was only 20 percent in 1999. A positive development is that the majority of the industrial branches show an, although slight, increase in labour productivity over the last five years.

The overall increase in the gap is not due to a slowdown in South African labour productivity growth but rather because of an acceleration of US labour productivity growth. An international comparison shows that other countries, also have experienced deteriorating performance levels. The comparative analysis also shows that South Africa is performing on a level between Indonesia and Brazil, almost equal to Mexico.

To investigate international competitiveness of South African manufacturing, we computed relative unit value costs, the ratio between labour costs and labour productivity and relative price levels. The results show that on average, South Africa is competitive with the USA, albeit there are some industries which show consistent relative unit labour costs above US level. Furthermore, a brief comparison with a study on Mexico indicates that South Africa is relatively uncompetitive with developing countries, mainly because of the high wage level. More research is required to give a detailed picture of South African manufacturing performance and competitiveness in an international perspective. In this paper we mainly focussed at an US/South Africa comparison. A fruitful way forward would be to combine the results here, with other International Comparisons of Output and Productivity (ICOP) studies. Already a brief start with this has been made in terms of an international labour productivity analysis.

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Appendix 1: ICOP Industry-of-Origin Approach[29]

This appendix describes aggregation procedure to derive industry, branch and total manufacturing UVRs from product or product group UVRs. Each of these four levels of aggregation is a subset of the other. Manufacturing output is the sum of output of branches, which in turn is the sum of the industries' output value. The value of an industry's output equals the sum of the values of the produced products. Within the comparison of each industry between two countries, only part of products can be matched as quantity information often lacks, it may be difficult to find comparable products, or countries produce unique products. The matched products can be considered as a sampled subset of products within an industry which relative price, under certain conditions, may be considered representative for the non-matched part.

Aggregation Step One: from Product to Industry Level UVRs

The UVR for an industry is the weighted mean of the product UVRs, using output values of base country (USA) or the other country (South Africa) as weights. The UVR for an industry using US weights is estimated as follows:

$$UVR_j^{xu(u)} = \sum_{i=1}^{I_J} \left(\frac{UV_i^{x(x)}}{UV_i^{u(u)}} \times w_{ij}^{u(u)} \right) \quad \text{with} \quad w_{ij}^{u(u)} = \frac{o_{ij}^{u(u)}}{\sum_{i=1}^{I_J} o_{ij}^{u(u)}} \tag{6}$$

with i=1,.,I_J the matched products in industry j, w_{ij} the output share of the ith commodity in industry j. $UVR_j^{xu(u)}$ indicates the unit value ratio between country x and the base country (USA) weighted at base country quantities indicated by the u in brackets. This equation can be rewritten to show that the use of base country value weights leads to the Laspeyres index:

$$UVR_j^{xu(u)} = \frac{\sum_{i=1}^{I_J} q_{ij}^u * UV_{ij}^{x(x)}}{\sum_{i=1}^{I_J} q_{ij}^u * UV_{ij}^{u(u)}} \tag{7}$$

Instead of US weights, one can also weight the product UVRs by the quantities of the "other" country (South Africa):

$$UVR_j^{xu(x)} = \frac{1}{\sum_{i=1}^{I_J} \left(\frac{UV_i^{x(x)}}{UV_i^{u(u)}} \times w_{ij}^{u(x)} \right)} \quad \text{with} \quad w_{ij}^{u(x)} = \frac{o_{ij}^{u(x)}}{\sum_{i=1}^{I_J} o_{ij}^{u(x)}} \tag{8}$$

Again this index can be easily rewritten to show that it is a Paasche index:

[29] This section draws heavily on Mulder et al. (2002), Van Ark et al. (2000) and Timmer *et al* (2001).

$$UVR_j^{xu(x)} = \frac{\sum_{i=1}^{I_J} q_{ij}^x * UV_{ij}^{x(x)}}{\sum_{i=1}^{I_J} q_{ij}^x * UV_{ij}^{u(u)}} \tag{9}$$

Aggregation Step Two: from Industry to Branch Level UVRs

The aggregation to branch UVRs is done by weighting the industry UVRs, by either US quantities:

$$UVR_k^{xu(u)} = \sum_{j=1}^{J_k} \left(\frac{UV_j^{x(x)}}{UV_j^{u(u)}} \times w_{jk}^{u(u)} \right) \tag{10}$$

with j=1,., J_k the number of industries in branch k for which a UVR has been calculated (the sample industries); w_{jk} the output share of the j^{th} industry in branch k. The weight of industries depends not only on the size of their output but also on the reliability of the industry UVR, being lower the lower the reliability, as unreliable UVRs should have a limited influence on the branch UVR. Therefore the set of industries J_k is split into two, $J_k(a)$ and $J_k(b)$ depending on their reliability. UVRs of industries belonging to the first set ($J_k(a)$) are weighted with the total industry output at own prices: $o_{jk}^{T\,u(u)}$. The UVRs from the other industries (belonging to $J_k(b)$) are weighted only by the output value of the matched products in the industry: $o_{jk}^{M\,u(u)} = \sum_{i=1}^{I_j} uv_{ij}^u q_{ij}^u$. Hence the weights are given by

$$\begin{aligned} w_{jk}^{u(u)} &= o_{jk}^{T\,u(u)} / o_k^{M\,u(u)} \qquad \forall j \in J_k(a) \\ w_{jk}^{u(u)} &= o_{jk}^{M\,u(u)} / o_k^{M\,u(u)} = \sum_{i=1}^{I_j} uv_{ij}^u q_{ij}^u / o_k^{M\,u(u)} \qquad \forall j \in J_k(b) \end{aligned} \tag{11}$$

with $o_k^{M\,u(u)} = \sum_{J_k(a)} o_{jk}^{T\,u(u)} + \sum_{J_k(b)} o_{jk}^{M\,u(u)}$

To arrive at the Paasche index, the US weights are replaced by South African output valued at US prices:

$$UVR_k^{xu(x)} = \frac{1}{\sum_{j=1}^{J_k} \left(\frac{UV_j^{x(x)}}{UV_j^{u(u)}} \times w_{jk}^{u(x)} \right)} \tag{12}$$

with

$$\begin{aligned} w_{jk}^{u(x)} &= o_{jk}^{T\,u(x)} / o_k^{M\,u(x)} \qquad \forall j \in J_k(a) \\ w_{jk}^{u(x)} &= o_{jk}^{M\,u(x)} / o_k^{M\,u(x)} \sum_{i=1}^{I_j} uv_{ij}^u q_{ij}^x / o_k^{M\,u(x)} \qquad \forall j \in J_k(b) \end{aligned} \tag{13}$$

with $o_k^{M\,u(x)} = \sum_{J_k(a)} o_{jk}^{T\,u(x)} + \sum_{J_k(a)} o_{jk}^{M\,u(x)}$

The split in the industry set is based on an assessment of the reliability of the industry UVRs. Given the homogeneous character of the products belonging to an industry, it is expected that product UVRs in an industry do not differ much. Hence, if the variation of the product UVRs is high, this is an indication of unreliability. Also, reliability increases the higher the percentage of industry output covered by matched products. Therefore the coverage ratio is also taken into account when assessing the industry UVR reliability. The following decision rule is used: when the coefficient of variation is less than 0.1, the industry is assigned to $J_k(a)$, other wise to $J_k(b)$:

$$\begin{aligned} &\text{if} \quad cv\left[UVR_j\right] < 0.1 \quad \text{then} \quad j \in J_k(a) \\ &\text{otherwise} \qquad\qquad\qquad\quad j \in J_k(b) \end{aligned} \tag{14}$$

The coefficient of variation of industry j (cv_j) is measured as follows:

$$cv\left[UVR_j\right] = \frac{\sqrt{var\left[UVR_j\right]}}{UVR_j} \tag{15}$$

The variance of the industry UVRs is given by the mean of the weighted deviations of the product UVRs around the industry UVR:

$$Var\left[UVR_J\right] = (1 - f_j)\frac{1}{I_j - 1}\sum_{i=1}^{I_j} w_{ij}\left(UVR_{ij} - UVR_j\right)^2 \tag{16}$$

with *Ij* the number of products matched in industry i and f_j the share of industry output which is covered by the matched products within an industry. (1- f_j) is also referred to as the "finite population correction", and ensures that an increase in the coverage of the sample reduces its variance. This formula can be applied to either the Laspeyres or Paasche UVR using output value weights of the base country for the variance of the Laspeyres, and quantity weights of the other country valued at US prices for the variance of the Paasche. To allocate an industry to one of the two sets, a decision is made on the basis of the (geometric) average variance for the Paasche and Laspeyres.

Aggregation Step Three: From Branch to Total Manufacturing UVRs

The aggregation of branch to total manufacturing UVRs is done in the same way as that from the industry to the branch UVRs. US country output weights are used to arrive at the Laspeyres index, and the South African quantities valued at US prices are used to arrive at the Paasche index. The Laspeyres and Paasche indices are combined into a Fisher index when a single currency conversion factor is required. It is defined as the geometric average of the Laspeyres and the Paasche.

There is one important difference between aggregation steps two and three, i.e. the output weights of the branch do not depend on the reliability of their UVRs. Branches always enter the weighting system with their total production. This is because the estimated UVRs are the most "characteristic" for the branch even when their variance is high or their representativeness low. Nevertheless, it should be stressed that the UVRs for this branch have to be interpreted with caution.

At the branch level, we can also estimate the reliability of the UVRs. As indicated by the stratified sampling theory, branch variance is calculated by the quadratic output weighted average of the corresponding industry UVRs:

$$Var[UVR_k] = (1 - f_k) \sum_{j=1}^{J_j} w_{jk}^2 \, \mathrm{var}[UVR_{jk}] \tag{17}$$

with f_k the share of branch output covered by the matched products within a branch. Two variances are estimated: one using US and one using "other" country weights, of which a geometric average is taken. Finally, the sample variance of the UVR for total manufacturing given by the quadratic output weighted average of the corresponding branch UVR variances:

$$Var[UVR] = \sum_{k=1}^{K} w_k^2 \, \mathrm{var}[UVR_k] \tag{18}$$

Appendix 2: Data Sources

South Africa

The primary data source for South African benchmark is the *Census of Manufacturing, 1993*, published by the Central Statistical Service (CSS). Only the *CSS report NO 30-01-01, Census of Manufacturing 1993, Statistics According to Major Groups and Subgroups: South Africa*, which describes aggregate data on labour, gross output and value added on industry and branch level and *CSS report NO 30-01-02, Census of Manufacturing 1993, Materials Purchased and Manufactured Articles Sold* (unpublished), which contains data on quantity and value of about 4000 goods produced, are relevant for this study. The Census covers all establishments conducting activities in connection with, the manufacture, processing, making or packaging of goods and commodities; the Slaughtering of animals, including poultry; and installation, assembly, completion, repair and related work. For unclear reasons, there is a lack of any formal codification to link product information to industry output data. This relation is required for the aggregation procedure and to compute the UVR variances. In most cases, the US classification provides a guideline. In case of doubt, several industries are taken together to guarantee that all products fall within its boundaries. A disadvantage is that the coverage ratio of any matches within an industry is lower, which reduces reliability. In total 35 industries have been be defined. In addition, for some reason, product data in the tobacco industry was not reported. Annual hours worked is taken from South African Statistics (1995).

Time series for value added (current and constant terms), labour, labour costs and capital are taken from the South African Standardised Industry Indicator Database, maintained by the Trade and Industrial Policy Secretariat (TIPS) to which access is granted on request. Data is provided for 28 manufacturing industries (3-digit SIC sheme). These industries were aggregated to match the 13 branch ICOP sector classification. The manufactured of knitted and crocheted fabrics industry (313) and manufacture of household appliances (358) could not be classified as textile mill products and electrical machinery equipment, respectively, because they are part of other industries. South African capital stocks are discussed in chapter 4.

US

The *1992 Census of Manufactures, Industry Series* published by the Bureau of the Census reports quantity and value data for approximately 11000 products, presented in branch specific volumes, classified according to the standard industrial classification (SIC). All establishments with one or more employee are surveyed. Branch and industry data on labour, value added and output (shipments) are taken from the *1993 Annual Survey of Manufactures(ASM), Statistics for industry Groups and Industries*. The ASM is conducted in each of the four years between the industrial censuses. It is a sample of approximately 62.000 (the census covers approximately 380.000 establishments) largest US establishments, which cover approximately 80 percent of the total value of shipments. The data collected by the ASM is subsequently scaled up on the basis complete coverage census estimates to provide estimations for value added, labour and output in accordance with census data. 1992 unit values were extrapolated to 1993 using 4-7 digit producer price indices from the Bureau of Labour Statistics obtained through the internet (http://146.142.4.24/cgi-bin/dsrv). Annual hours worked hours worked are from US Bureau of Labor Statistics (BLS), International Comparisons of Manufacturing

Productivity and Unit Labour Costs Trends, (downloadable from: http://stats.bls.gov/news.release/prod4.toc.htm)

Time series for gross real and current value added have been constructed using several sources. Data for the period 1970-1977 taken from a print out of the *National Income and Product Accounts of the United States (NIPA), 1929-82*, Bureau of economic Analysis (BEA), 1986, for the period 1977-1982 from various issues of the *Survey of Current Business*, BEA and for 1987-1999 from a data file on the website of BEA (downloadable from: Http://www.bea.doc.gov/bea/dn2/gpo.htm). The three series are linked by using data for overlapping years and chain indices. For more information, there is a document with the a detailed description of the construction of the industry data, available from the author on request. For labour, the same sources as for value added are used to derive consistent series. In accordance with the benchmark, labour data represents part-time and full time employment excluding self-employment and unpaid family workers. Data and construction of the capital stock are described in chapter 4.

Appendix 3: Time Series

Table 3a

Value added (million 1995 Rand), South Africa, 1970-2000

	Food Beverages and Tobacco	Textile Mill Products	Wearing Apparel	Leather Products and Footwear	Wood Products, Furniture, Fixtures	Paper and Printing	Chemicals	Rubber and Plastic	Non Metallic Mineral Products	Basic and Fabricated Metal Products	Machinery and Transport	Electrical Machinery and Equipment	Other Manu-facturing	Total Manu-facturing
1970	8918	2720	1459	935	1927	5089	4866	1404	2794	11320	9575	1666	3254	55928
1971	9036	2821	1547	1006	2055	5382	5033	1532	2979	12451	10324	1925	3337	59429
1972	8966	2626	1553	945	2207	5568	4765	1630	3075	13629	11256	2200	3254	61674
1973	9811	2713	1631	1007	2490	5782	5108	1886	3246	14417	12084	2500	4726	67401
1974	10748	2724	1645	1143	2622	5741	5134	1845	3426	16095	12930	2979	4759	71791
1975	11853	3108	1771	1247	2580	5536	5432	1824	3458	16834	12907	3343	4679	74573
1976	12742	3445	1919	1176	2690	6013	5963	1830	3307	17185	12185	3665	4438	76559
1977	12023	3212	1869	1113	2609	5948	6079	1872	3109	16167	12497	3674	3821	73992
1978	12759	3571	1980	1201	2710	6386	6753	2270	3126	17009	13524	3890	4260	79436
1979	13864	3922	2186	1131	3009	7070	7022	2333	3373	18144	14922	4172	4622	85771
1980	14277	4200	2398	1233	3137	7177	7610	2545	3721	19549	17183	4675	5054	92759
1981	14738	4523	2689	1387	3385	7543	9162	2842	4103	21269	18942	5235	5351	101168
1982	14244	4259	2812	1385	3163	7100	9612	2558	3926	19693	17339	5247	4289	95626
1983	15072	3813	2706	1373	3054	7319	11221	2461	3728	17594	15588	4857	5134	93919
1984	15825	3853	2754	1418	3098	8285	13388	2736	3917	18249	15409	4980	6023	99933
1985	16404	3675	2610	1330	3090	8599	12268	2499	3644	17590	14467	4420	6114	96711
1986	16786	3785	2699	1380	3380	8778	12863	2733	3688	17212	12711	4160	6667	96842
1987	16886	3854	2766	1416	3422	8677	13608	3156	3627	17057	13384	4666	6818	99338
1988	17183	3675	2826	1428	3519	8827	14955	3329	4334	17957	15653	4901	7312	105898
1989	18120	3535	3067	1549	3210	8945	15189	3241	4335	17993	16267	5118	7492	108060
1990	17680	3196	2765	1374	3274	8849	14547	3312	4172	18234	15049	5227	8171	105849
1991	17437	3052	2658	1389	3121	8322	14140	3116	3794	16646	14094	5651	7615	101035
1992	17639	2849	2546	1233	2966	8572	13590	3283	3690	16286	12570	5605	7391	98221
1993	17289	2490	2877	1170	3316	8802	13399	3373	3863	15942	11501	5470	7994	97486
1994	17042	2720	2831	1154	3458	8925	14036	3394	3943	16321	11926	5810	8042	99602
1995	17476	2704	3186	1202	3528	9260	15211	3735	4256	17734	13636	6131	7839	105900
1996	17803	2601	3089	965	3327	8920	15831	3722	4222	19179	13963	5816	8190	107629
1997	18164	2876	3051	980	3346	9110	16085	3753	4153	20069	13665	6362	8466	110080
1998	17874	2445	3173	735	3783	8337	16859	4097	3874	19081	13432	6443	8061	108194
1999	17222	2288	3484	722	3557	8657	17127	4579	3568	17828	14137	6314	8337	107820
2000	16533	2195	3226	702	3595	8838	17583	5336	3671	18871	16055	6577	8547	111728

Source: http://www.tips.org.za/data

Table 3b

Persons Engaged, South Africa, 1970-2000

	Food Beverages and Tobacco	Textile Mill Products	Wearing Apparel	Leather Products and Footwear	Wood Products, Furniture, Fixtures	Paper and Printing	Chemicals	Rubber and Plastic	Non Metallic Mineral Products	Basic and Fabricated Metal Products	Machinery and Transport	Electrical Machinery and Equipment	Other Manu-facturing	Total Manu-facturing
1970	164163	96739	86053	32521	72003	63774	67910	31194	76118	195073	143698	53530	67560	1150335
1971	170685	99116	89661	32573	75239	65978	69816	31665	79149	200260	149665	58928	66409	1189143
1972	172263	100894	92526	33214	75048	66153	71262	32133	80787	203957	151765	60415	61917	1202332
1973	180560	106325	97975	34375	77310	68350	76082	35025	82234	216979	159283	64556	84750	1283803
1974	190651	109300	103375	34350	80776	70675	79338	37700	85322	233371	169223	72511	82237	1348830
1975	200069	110300	107675	35750	79788	71875	81879	38575	86496	249479	180573	77346	76943	1396749
1976	210147	112763	111427	36382	81086	73563	86980	39594	84919	256431	188023	82224	70843	1434380
1977	210998	108450	109250	33825	78510	72925	87944	39625	80784	250299	178993	77705	59710	1389018
1978	211340	107200	110075	34550	77445	72350	92822	41450	79448	251756	181935	75372	62836	1398578
1979	214889	108032	113138	35568	81638	73467	95279	43268	80015	257634	186562	75768	67147	1432403
1980	220994	110950	121125	38750	88417	75975	100341	46425	84831	253057	204329	83727	73613	1502535
1981	225444	113475	129625	42625	93123	79025	107450	49075	88881	287925	223631	89503	78675	1608456
1982	226937	111142	133816	42574	95135	80146	114691	49639	91306	290536	230130	88661	68296	1623008
1983	226485	101875	128625	40425	96759	81600	114798	47300	90033	265725	213552	82699	78040	1567915
1984	231417	98300	127975	40025	96386	85100	118586	48700	93733	260309	209635	83159	82015	1575340
1985	233661	95095	124710	38469	94693	87448	120119	48181	88724	246007	198912	76539	80769	1533328
1986	235134	97125	127250	41100	98873	87700	118387	50550	86007	244769	193156	78263	86794	1545108
1987	241155	100075	134250	45375	103815	90200	123207	54025	88467	245128	191564	81466	87874	1586602
1988	245016	101419	138160	47287	109933	93753	124463	57940	89867	242132	197346	85960	94573	1627849
1989	248737	100200	132525	47650	107541	95575	125482	60975	87789	236281	194970	94027	98752	1630504
1990	248070	96350	125950	44000	107265	99075	125752	62625	86973	240830	188753	100630	113703	1639975
1991	244627	89075	120325	41300	105068	101550	126001	63525	84043	229291	176245	106983	111908	1599941
1992	244352	82100	113500	36575	102538	104025	123570	64425	81540	216102	164700	111648	109622	1554697
1993	237475	65137	125297	35339	109713	102910	123180	62831	82490	204230	151014	111383	117061	1528058
1994	225527	68386	125020	36109	115793	102005	117900	59704	77042	201990	156276	111435	122100	1519287
1995	219155	65410	133989	36955	114362	103648	115360	66072	74382	198605	166941	109250	120603	1524731
1996	221426	77402	149908	32803	113668	100425	112866	64483	75687	200415	172051	103386	123708	1548226
1997	209686	75844	139604	31164	111876	98573	107571	64424	71967	193497	163990	98499	123498	1490192
1998	201738	56491	129372	29401	121300	96767	118516	69722	55695	179589	159694	95360	111010	1424654
1999	203321	53951	138320	27732	118269	103151	111987	67961	47029	162044	157690	90224	107330	1389008
2000	189480	55616	139596	25569	125284	105727	116174	76742	41798	149805	152572	89138	108796	1376296

Source: http://www.tips.org.za/data

Table 3c

Capital Stock (million 1995 Rand), South Africa, 1970-2000

	Food Beverages and Tobacco	Textile Mill Products	Wearing Apparel	Leather Products and Footwear	Wood Products, Furniture, Fixtures	Paper and Printing	Chemicals	Rubber and Plastic	Non Metallic Mineral Products	Basic and Fabricated Metal Products	Machinery and Transport	Electrical Machinery and Equipment	Other Manu-facturing	Total Manu-facturing
1970	8061	2824	1010	375	1444	3502	3502	1247	3423	14502	3155	1706	490	52858
1971	8231	2912	1048	381	1572	3870	3870	1339	3825	15754	3678	1868	487	56962
1972	8678	2953	1074	390	1611	4038	4038	1465	4150	18573	3949	2129	484	61564
1973	9378	2917	1097	418	1651	4244	4244	1624	4230	23069	4204	2495	496	67761
1974	10087	2902	1126	445	1709	4468	4468	1786	4371	27352	4447	2846	513	73937
1975	10850	2940	1162	457	1791	4550	4550	1894	4767	30183	4635	3131	543	79737
1976	11422	2979	1178	450	1850	4462	4462	1909	5182	31498	4758	3313	560	83793
1977	11966	2928	1129	438	1902	4318	4318	1921	5082	32415	4493	3344	551	88650
1978	12367	2814	1071	435	1820	4143	4143	1836	5057	31886	4363	3286	535	95232
1979	12514	2817	1045	433	1911	4079	4079	1751	5136	31945	4446	3336	548	103700
1980	13579	3093	1074	471	2062	4340	4340	1733	6108	33068	4975	3619	583	117879
1981	14615	3161	1120	507	2342	4829	4829	1766	6810	33325	5744	3805	598	130131
1982	15578	3173	1189	531	2492	5728	5728	1816	7532	34963	6350	4095	583	138615
1983	17347	3039	1174	526	2539	7946	7946	1900	8438	35084	6557	4103	574	145508
1984	18187	3094	1214	528	2677	9995	9995	1994	9217	34377	6818	4143	606	149037
1985	18410	3004	1203	516	2637	9402	9402	2185	9545	33689	6957	4115	582	147489
1986	18116	2795	1125	499	2557	8247	8247	2150	9003	32948	6645	4012	583	143067
1987	17925	2694	1077	485	2409	7463	7463	2050	8338	31883	6216	3858	563	137607
1988	17799	2884	1126	493	2331	7236	7236	2162	7807	30998	6046	3786	563	136061
1989	18010	2894	1090	484	2235	7794	7794	2222	7394	31393	6200	3616	596	139339
1990	18605	2867	1046	482	2246	7522	7522	2353	7147	32224	6621	3502	609	145685
1991	19018	2627	989	494	2197	6907	6907	2220	6985	32575	6790	3253	726	150268
1992	20306	2601	946	499	2140	6639	6639	2134	6880	32662	7238	3092	798	153757
1993	21258	2376	884	506	2097	6562	6562	2074	6651	35839	7874	2972	756	157718
1994	22308	2299	860	546	2100	7011	7011	2113	6558	39943	7889	3094	693	162327
1995	23705	2425	962	585	2223	8221	8221	2216	6847	42320	8407	3217	661	169211
1996	24934	2564	963	565	2390	8709	8709	2284	7381	46299	8749	3167	637	176189
1997	25264	2577	897	532	2473	9047	9047	2196	7534	51238	8628	3099	659	182652
1998	25832	2500	1017	492	2523	9317	9317	2315	7538	53702	9132	2998	715	187437
1999	27098	2417	974	473	2511	10328	10328	2696	7263	53610	9644	2983	738	190474
2000	27409	2570	886	561	2433	10469	10469	2928	7021	52250	11361	2980	852	193108

Source: http://www.tips.org.za/data

Table 3d

Labour share in value added, South Africa, 1970-2000

	Food Beverages and Tobacco	Textile Mill Products	Wearing Apparel	Leather Products and Footwear	Wood Products, Furniture, Fixtures	Paper and Printing	Chemicals	Rubber and Plastic	Non Metallic Mineral Products	Basic and Fabricated Metal Products	Machinery and Transport	Electrical Machinery and Equipment	Other Manu-facturing	Total Manu-facturing
1970	0.40	0.59	0.77	0.79	0.70	0.72	0.42	0.57	0.66	0.70	0.69	0.78	0.62	0.62
1971	0.43	0.62	0.79	0.81	0.72	0.74	0.45	0.60	0.69	0.71	0.72	0.79	0.62	0.64
1972	0.45	0.65	0.81	0.82	0.73	0.75	0.50	0.62	0.73	0.72	0.73	0.80	0.60	0.67
1973	0.41	0.62	0.78	0.80	0.69	0.71	0.48	0.58	0.70	0.67	0.69	0.76	0.54	0.62
1974	0.42	0.63	0.79	0.80	0.69	0.70	0.52	0.59	0.71	0.68	0.70	0.77	0.52	0.63
1975	0.42	0.63	0.80	0.80	0.71	0.70	0.52	0.59	0.72	0.68	0.71	0.75	0.50	0.63
1976	0.43	0.63	0.81	0.79	0.74	0.71	0.50	0.61	0.71	0.69	0.74	0.76	0.50	0.64
1977	0.46	0.64	0.84	0.80	0.79	0.72	0.50	0.64	0.72	0.72	0.77	0.79	0.50	0.66
1978	0.44	0.62	0.83	0.77	0.75	0.69	0.46	0.61	0.68	0.68	0.74	0.77	0.48	0.63
1979	0.41	0.60	0.80	0.74	0.67	0.66	0.46	0.56	0.65	0.65	0.70	0.76	0.46	0.60
1980	0.36	0.57	0.76	0.70	0.59	0.62	0.43	0.51	0.60	0.61	0.65	0.72	0.43	0.56
1981	0.39	0.61	0.77	0.71	0.61	0.65	0.44	0.53	0.62	0.63	0.67	0.74	0.47	0.58
1982	0.44	0.68	0.82	0.75	0.67	0.70	0.47	0.60	0.66	0.68	0.74	0.77	0.53	0.64
1983	0.41	0.68	0.81	0.72	0.66	0.68	0.42	0.59	0.61	0.65	0.76	0.75	0.49	0.61
1984	0.41	0.70	0.82	0.71	0.67	0.68	0.41	0.62	0.61	0.65	0.78	0.76	0.46	0.60
1985	0.42	0.70	0.82	0.69	0.68	0.66	0.43	0.63	0.62	0.64	0.75	0.76	0.43	0.59
1986	0.41	0.69	0.80	0.68	0.67	0.62	0.44	0.62	0.63	0.63	0.71	0.76	0.41	0.58
1987	0.42	0.68	0.79	0.67	0.66	0.60	0.45	0.62	0.64	0.62	0.67	0.75	0.41	0.57
1988	0.41	0.66	0.77	0.65	0.64	0.57	0.46	0.60	0.64	0.60	0.63	0.74	0.41	0.56
1989	0.41	0.65	0.76	0.64	0.61	0.55	0.47	0.59	0.64	0.58	0.60	0.74	0.41	0.54
1990	0.42	0.64	0.75	0.62	0.60	0.56	0.48	0.59	0.63	0.58	0.59	0.73	0.41	0.54
1991	0.43	0.63	0.75	0.62	0.60	0.56	0.49	0.59	0.63	0.57	0.59	0.74	0.42	0.54
1992	0.43	0.63	0.75	0.61	0.60	0.57	0.48	0.60	0.64	0.56	0.59	0.74	0.42	0.54
1993	0.44	0.63	0.78	0.62	0.64	0.58	0.49	0.61	0.65	0.57	0.59	0.75	0.41	0.55
1994	0.42	0.64	0.78	0.62	0.67	0.59	0.48	0.60	0.62	0.56	0.59	0.76	0.43	0.55
1995	0.40	0.66	0.79	0.62	0.65	0.51	0.47	0.59	0.60	0.52	0.57	0.82	0.44	0.53
1996	0.40	0.76	0.86	0.70	0.67	0.53	0.45	0.58	0.63	0.52	0.59	0.78	0.43	0.53
1997	0.38	0.74	0.84	0.66	0.68	0.53	0.43	0.57	0.61	0.49	0.59	0.76	0.43	0.52
1998	0.42	0.85	0.92	0.78	0.74	0.59	0.49	0.63	0.62	0.50	0.63	0.79	0.44	0.56
1999	0.44	0.86	0.93	0.77	0.74	0.61	0.45	0.62	0.62	0.53	0.63	0.80	0.42	0.56
2000	0.45	0.87	0.93	0.76	0.74	0.61	0.46	0.61	0.53	0.46	0.56	0.83	0.43	0.55

Source: http://www.tips.org.za/data

Table 3e

Value added, USA (million 1996 dollars), USA, 1970-1999

	Food Beverages and Tobacco	Textile Mill Products	Wearing Apparel	Leather Products and Footwear	Wood Products, Furniture, Fixtures	Paper and Printing	Chemicals	Rubber and Plastic	Non Metallic Mineral Products	Basic and Fabricated Metal Products	Machinery and Transport	Electrical Machinery and Equipment	Other Manu-facturing	Total Manu-facturing
1970	106540	13099	16359	5954	38006	101340	72252	12235	23429	117689	134517	19340	37195	618214
1971	109849	13572	16557	5957	39377	103407	76582	13232	23821	113677	144245	19374	38190	628819
1972	115000	14521	19384	6145	45565	110573	82281	15106	26158	123579	155596	21546	42712	684645
1973	122440	14273	20917	6650	47739	120649	91458	17464	29050	142167	173537	24681	45556	757875
1974	116073	12783	19743	6398	46119	115904	83437	16195	27280	137344	162260	22996	46266	721683
1975	119452	12007	19565	6120	42349	109848	81633	14646	24695	111037	150937	21140	46777	667892
1976	123446	14666	21049	6839	47565	118333	94185	15232	27535	120550	171733	23329	49902	732662
1977	121344	17818	21793	6511	50014	125456	103558	17705	27994	124945	188681	27854	55073	786879
1978	130178	18250	23571	6520	51409	130788	103121	18792	28748	133128	196487	30549	58373	830124
1979	134690	19126	23905	5924	50687	136633	106588	19595	28542	134634	191352	34361	59955	857524
1980	138282	19029	23446	6336	49514	130078	93552	19178	25690	128364	164885	36365	61853	822478
1981	140399	18827	23104	6363	47109	130503	107599	21450	23859	131398	168500	40334	65578	859564
1982	139211	17795	21451	5934	45045	131183	104188	20474	19753	107266	167627	36167	62494	809449
1983	133775	19827	23738	5678	51879	137206	118892	22302	23078	102131	181521	38797	65228	858827
1984	128572	20187	24927	5446	59038	143664	121790	25206	25376	117311	218837	45924	75495	950477
1985	134102	19833	24935	5136	60514	148260	126135	27270	26144	114899	223228	48839	76069	976219
1986	127031	20855	25655	4518	63077	149457	123355	27271	27107	116409	213218	49640	73436	961755
1987	126713	22077	26330	5105	69790	154944	150557	29646	26606	119826	235362	53952	80346	1046315
1988	134669	21781	27624	5204	68855	160217	153118	31334	27709	127376	254587	60793	95279	1120198
1989	125638	22059	28015	5313	66618	159380	151652	34441	29324	122605	245167	66375	89701	1111559
1990	124009	22804	27289	5200	63209	155316	154082	33957	29416	119791	237850	68636	91778	1102275
1991	123174	22814	26981	5222	58299	151522	149207	35057	26831	113616	218287	72740	89015	1066318
1992	120977	25580	27743	5198	58015	151725	153798	37935	29582	115914	225364	73344	84601	1085023
1993	123847	25930	27571	4860	57042	151144	153628	41170	29092	124301	240252	84988	78609	1122913
1994	126418	26894	28429	5104	59033	153985	167458	44852	31965	136899	258125	103252	76438	1205950
1995	148957	25968	28019	5282	62334	141357	174881	46989	32812	140384	277357	128734	75900	1284741
1996	133491	25335	26958	4184	60635	144128	183846	49660	33157	143986	279977	153181	77514	1316049
1997	131975	24953	26461	4231	61675	144657	189843	53195	36632	148822	310232	182180	74614	1387251
1998	126465	23633	25019	4010	62231	139375	186411	53762	35940	151372	351476	225128	73798	1446439
1999	124101	22938	23568	3974	64393	140298	203556	54436	36858	156626	383212	276828	74761	1529398

Source: 1970-1976, BEA, *National Income and Product Accounts of the United States.1929-82*, Washington D.C., 1986; 1977-1987 from BEA, *Survey of Current Business*, various issues; 1988-1999 from BEA website, Http://www.bea.doc.gov/bea/dn2/gpo.htm.

Table 3f

Persons Engaged (000 persons), USA, 1970-1999

	Food Beverages and Tobacco	Textile Mill Products	Wearing Apparel	Leather Products and Footwear	Wood Products, Furniture, Fixtures	Paper and Printing	Chemicals	Rubber and Plastic	Non Metallic Mineral Products	Basic and Fabricated Metal Products	Machinery and Transport	Electrical Machinery and Equipment	Other Manu-facturing	Total Manu-facturing
1970	1868	984	1370	320	1152	1805	1213	632	613	2821	3835	1597	1186	19442
1971	1832	962	1347	301	1167	1751	1173	629	603	2644	3561	1477	1125	18611
1972	1808	1000	1377	300	1226	1765	1162	680	623	2702	3704	1522	1176	19080
1973	1797	1033	1416	298	1290	1808	1191	736	660	2903	4024	1682	1259	20139
1974	1795	987	1357	281	1229	1812	1217	732	656	2920	4107	1696	1302	20121
1975	1737	869	1250	251	1058	1730	1213	625	598	2606	3772	1459	1198	18379
1976	1761	917	1333	270	1150	1781	1244	675	614	2670	3873	1526	1258	19082
1977	1785	912	1329	263	1220	1846	1281	745	635	2767	4077	1609	1330	19801
1978	1803	909	1349	265	1285	1907	1303	786	668	2894	4361	1731	1397	20667
1979	1809	891	1312	254	1295	1959	1320	816	679	2972	4602	1822	1441	21181
1980	1784	853	1276	243	1187	1962	1314	756	635	2771	4406	1806	1440	20432
1981	1757	827	1259	249	1159	1979	1321	768	611	2727	4419	1808	1454	20327
1982	1720	754	1174	227	1052	1964	1279	721	549	2367	4009	1734	1410	18943
1983	1685	749	1171	213	1128	1990	1239	741	545	2207	3789	1735	1375	18556
1984	1680	751	1202	195	1220	2076	1232	816	570	2330	4109	1901	1417	19509
1985	1670	705	1131	170	1222	2123	1219	819	561	2287	4180	1886	1400	19378
1986	1673	710	1108	153	1236	2154	1189	823	557	2184	4078	1820	1379	19064
1987	1681	731	1104	148	1287	2199	1187	856	558	2148	4070	1781	1362	19112
1988	1693	732	1099	147	1320	2264	1220	867	572	2205	4152	1773	1431	19475
1989	1696	725	1091	144	1304	2285	1230	890	572	2219	4178	1754	1429	19517
1990	1717	700	1047	137	1266	2294	1245	892	560	2180	4100	1688	1380	19206
1991	1721	673	1017	128	1174	2254	1241	866	524	2082	3904	1603	1348	18535
1992	1706	675	1012	122	1179	2220	1237	879	514	2027	3768	1536	1304	18179
1993	1723	680	997	121	1222	2231	1224	912	520	2025	3698	1537	1285	18175
1994	1725	681	982	116	1281	2259	1203	954	534	2092	3752	1582	1264	18425
1995	1729	664	945	108	1302	2264	1182	979	541	2151	3857	1626	1246	18594
1996	1738	630	874	99	1307	2247	1172	981	546	2161	3906	1660	1258	18579
1997	1735	617	830	92	1335	2265	1174	1000	555	2195	4010	1695	1269	18772
1998	1734	597	770	87	1373	2273	1179	1017	566	2230	4109	1709	1278	18922
1999	1731	559	697	79	1408	2244	1169	1010	570	2228	4040	1669	1261	18665

Source: 1970-1976, BEA, *National Income and Product Accounts of the United States.1929-82*, Washington D.C., 1986; 1977-1987 from BEA, *Survey of Current Business*, various issues; 1988-1999 from BEA website, Http://www.bea.doc.gov/bea/dn2/gpo.htm.

Table 3g

Capital Stock (million 1985 dollars), USA, 1970-1997

	Food Beverages and Tobacco	Textile Mill Products	Wearing Apparel	Leather Products and Footwear	Wood Products, Furniture, Fixtures	Paper and Printing	Chemicals	Rubber and Plastic	Non Metallic Mineral Products	Basic and Fabricated Metal Products	Machinery and Transport	Electrical Machinery and Equipment	Other Manu-facturing	Total Manu-facturing
1970	106813	39134	10614	3632	36872	115120	183043	28508	48465	173746	172255	50535	25991	994726
1971	108636	39694	11223	3653	38197	118728	190054	30033	49508	178217	176916	53335	27128	1025323
1972	110603	40537	11966	3646	39716	121241	195925	31709	50361	181694	180732	56052	28215	1052397
1973	112581	41592	12713	3639	41433	123324	200911	33941	51200	184909	184859	59436	29546	1080084
1974	114254	42354	13288	3649	43607	126266	207622	36374	52012	188805	190293	63585	31224	1113332
1975	116660	43116	13788	3646	45757	131298	217027	38410	53097	194787	196917	67175	32764	1154441
1976	119883	43980	14308	3647	47338	137456	228491	40090	54243	202225	203619	70020	34209	1199509
1977	123834	44970	15002	3681	49332	144008	240909	41784	55342	209697	211628	73125	35786	1249097
1978	128299	46085	15774	3751	51972	151241	252204	43803	57011	217670	222724	77106	37403	1305042
1979	132602	46987	16335	3832	54685	159294	263108	46139	59007	226402	236491	82382	39260	1366524
1980	136695	47758	16600	3910	57138	167825	274421	48232	61167	234694	250676	88933	41416	1429467
1981	140606	48295	16776	4004	58861	174699	285519	49876	62731	241773	264883	95907	43524	1487455
1982	144199	48190	16924	4043	59508	179092	295811	50869	62997	245001	276139	102555	45429	1530758
1983	147161	47606	16983	4017	59589	181912	303064	51182	62421	243988	281596	108624	47103	1555244
1984	149860	47267	17028	3985	60046	184646	307740	51660	62265	241882	286401	115259	48716	1576755
1985	152949	47210	17033	3925	60788	189468	311487	52841	62663	240216	295063	123309	50619	1607571
1986	155432	46670	16921	3844	61210	194474	313108	53794	62478	237919	304394	130496	52390	1633130
1987	157762	46023	16792	3791	61749	198772	313564	54213	62253	235706	312521	137012	54017	1654175
1988	161164	45713	16717	3757	62561	205523	315703	54775	62461	236040	320839	145033	56097	1686383
1989	165174	45238	16498	3725	63302	216822	320045	55507	62714	238269	330023	153799	58614	1729730
1990	169578	44406	16158	3689	64060	230055	324291	55735	62300	239841	338856	162167	60953	1772090
1991	174477	43314	15712	3637	64011	239411	326705	55368	60956	238204	344624	169098	62882	1798398
1992	179591	42454	15276	3585	63436	244899	327785	55342	59670	234634	349400	175228	64873	1816172
1993	185245	42049	14940	3542	64068	251036	328991	55706	59723	232187	358321	183488	67058	1846353
1994	192746	41686	14444	3498	65481	260058	331281	56544	60858	231624	372736	193199	69204	1893359
1995	202603	41183	13859	3443	67041	270778	335834	57782	61997	232203	390952	203573	71721	1952970
1996	213822	40590	13319	3389	69117	282572	342613	59055	63562	233027	412663	215628	74767	2024125
1997	225348	40049	12797	3322	71619	294699	349831	60751	66583	233734	438337	229065	78341	2104474

Source: PIM with rectangular scrapping after service life. Real investment from data underlying capital stock estimates by Van Ark and Pilat (1993) (see text for details).

Table 3h

Labour share in value added, USA, 1970-1997

	Food Beverages and Tobacco	Textile Mill Products	Wearing Apparel	Leather Products and Footwear	Wood Products, Furniture, Fixtures	Paper and Printing	Chemicals	Rubber and Plastic	Non Metallic Mineral Products	Basic and Fabricated Metal Products	Machinery and Transport	Electrical Machinery and Equipment	Other Manu-facturing	Total Manu-facturing
1970	0.58	0.81	0.81	0.81	0.77	0.77	0.66	0.66	0.77	0.82	0.78	0.78	0.77	0.78
1971	0.58	0.82	0.82	0.82	0.75	0.75	0.64	0.64	0.75	0.81	0.74	0.74	0.75	0.75
1972	0.60	0.82	0.82	0.82	0.73	0.73	0.64	0.64	0.73	0.79	0.75	0.75	0.73	0.75
1973	0.62	0.83	0.83	0.83	0.73	0.73	0.62	0.62	0.73	0.79	0.78	0.78	0.73	0.76
1974	0.64	0.83	0.83	0.83	0.76	0.76	0.68	0.68	0.76	0.76	0.86	0.86	0.76	0.80
1975	0.55	0.81	0.81	0.81	0.73	0.73	0.65	0.65	0.73	0.77	0.82	0.82	0.73	0.76
1976	0.60	0.81	0.81	0.81	0.72	0.72	0.63	0.63	0.72	0.78	0.79	0.79	0.72	0.76
1977	0.62	0.77	0.77	0.77	0.72	0.72	0.64	0.64	0.72	0.80	0.76	0.76	0.72	0.75
1978	0.64	0.80	0.80	0.80	0.71	0.71	0.67	0.67	0.71	0.77	0.78	0.78	0.71	0.76
1979	0.65	0.82	0.82	0.82	0.72	0.72	0.69	0.69	0.72	0.77	0.82	0.82	0.72	0.79
1980	0.65	0.81	0.81	0.81	0.74	0.74	0.73	0.73	0.74	0.79	0.86	0.86	0.74	0.81
1981	0.64	0.81	0.81	0.81	0.75	0.75	0.69	0.69	0.75	0.77	0.85	0.85	0.75	0.80
1982	0.63	0.80	0.80	0.80	0.76	0.76	0.68	0.68	0.76	0.86	0.86	0.86	0.76	0.81
1983	0.59	0.79	0.79	0.79	0.75	0.75	0.64	0.64	0.75	0.87	0.81	0.81	0.75	0.78
1984	0.59	0.82	0.82	0.82	0.72	0.72	0.62	0.62	0.72	0.81	0.79	0.79	0.72	0.76
1985	0.60	0.81	0.81	0.81	0.72	0.72	0.63	0.63	0.72	0.81	0.83	0.83	0.72	0.77
1986	0.59	0.78	0.78	0.78	0.71	0.71	0.59	0.59	0.71	0.76	0.82	0.82	0.71	0.75
1987	0.59	0.79	0.79	0.79	0.70	0.70	0.59	0.59	0.70	0.77	0.78	0.78	0.70	0.74
1988	0.59	0.80	0.80	0.80	0.70	0.70	0.52	0.52	0.70	0.75	0.79	0.79	0.70	0.72
1989	0.58	0.78	0.78	0.78	0.68	0.68	0.53	0.53	0.68	0.73	0.79	0.79	0.68	0.72
1990	0.56	0.78	0.78	0.78	0.70	0.70	0.56	0.56	0.70	0.76	0.81	0.81	0.70	0.73
1991	0.56	0.78	0.78	0.78	0.70	0.70	0.56	0.56	0.70	0.76	0.81	0.81	0.70	0.73
1992	0.56	0.78	0.78	0.78	0.70	0.70	0.56	0.56	0.70	0.76	0.81	0.81	0.70	0.73
1993	0.56	0.78	0.78	0.78	0.70	0.70	0.56	0.56	0.70	0.76	0.81	0.81	0.70	0.73
1994	0.56	0.78	0.78	0.78	0.70	0.70	0.56	0.56	0.70	0.76	0.81	0.81	0.70	0.73
1995	0.56	0.78	0.78	0.78	0.70	0.70	0.56	0.56	0.70	0.76	0.81	0.81	0.70	0.73
1996	0.56	0.78	0.78	0.78	0.70	0.70	0.56	0.56	0.70	0.76	0.81	0.81	0.70	0.73
1997	0.56	0.78	0.78	0.78	0.70	0.70	0.56	0.56	0.70	0.76	0.81	0.81	0.70	0.73

Source: Data underlying van Ark and Pilat (1993), extrapolated by Marcel Timmer up to 1997.

Table 3I

Labour Productivity, South Africa as % of USA, 1970-1999

	Food Beverages and Tobacco	Textile Mill Products	Wearing Apparel	Leather Products and Footwear	Wood Products, Furniture, Fixtures	Paper and Printing	Chemicals	Rubber and Plastic	Non Metallic Mineral Products	Basic and Fabricated Metal Products	Machinery and Transport	Electrical Machinery and Equipment	Other Manu-facturing	Total Manu-facturing
1970	0.22	0.44	0.47	0.77	0.31	0.35	0.24	0.45	0.29	0.32	0.25	0.58	0.29	0.32
1971	0.21	0.42	0.46	0.78	0.31	0.34	0.22	0.44	0.29	0.34	0.23	0.56	0.28	0.31
1972	0.19	0.37	0.39	0.70	0.31	0.33	0.19	0.44	0.27	0.34	0.24	0.58	0.28	0.30
1973	0.19	0.38	0.37	0.66	0.34	0.31	0.18	0.44	0.27	0.32	0.23	0.60	0.30	0.29
1974	0.20	0.40	0.36	0.73	0.33	0.31	0.19	0.43	0.29	0.34	0.26	0.69	0.31	0.31
1975	0.20	0.42	0.34	0.72	0.31	0.30	0.20	0.39	0.29	0.37	0.24	0.68	0.30	0.31
1976	0.20	0.40	0.36	0.64	0.31	0.30	0.18	0.39	0.26	0.35	0.19	0.66	0.30	0.29
1977	0.19	0.31	0.34	0.67	0.31	0.29	0.17	0.38	0.26	0.33	0.20	0.62	0.30	0.28
1978	0.19	0.34	0.34	0.71	0.34	0.32	0.19	0.44	0.27	0.34	0.22	0.66	0.31	0.30
1979	0.20	0.35	0.35	0.68	0.36	0.34	0.18	0.43	0.30	0.36	0.26	0.66	0.32	0.31
1980	0.19	0.35	0.35	0.61	0.33	0.35	0.22	0.42	0.32	0.39	0.30	0.63	0.31	0.32
1981	0.19	0.36	0.37	0.64	0.35	0.36	0.21	0.40	0.35	0.36	0.30	0.59	0.29	0.31
1982	0.18	0.34	0.38	0.62	0.30	0.33	0.21	0.35	0.36	0.35	0.24	0.64	0.27	0.29
1983	0.19	0.29	0.34	0.64	0.26	0.32	0.21	0.33	0.29	0.33	0.20	0.59	0.27	0.27
1984	0.21	0.30	0.34	0.63	0.26	0.35	0.23	0.35	0.28	0.32	0.18	0.56	0.26	0.27
1985	0.20	0.28	0.31	0.57	0.25	0.35	0.20	0.30	0.26	0.33	0.18	0.51	0.27	0.26
1986	0.22	0.27	0.30	0.57	0.26	0.35	0.21	0.31	0.26	0.31	0.17	0.44	0.28	0.26
1987	0.22	0.26	0.28	0.45	0.23	0.34	0.18	0.32	0.26	0.29	0.16	0.43	0.25	0.24
1988	0.20	0.25	0.27	0.43	0.24	0.33	0.19	0.31	0.30	0.30	0.17	0.38	0.22	0.24
1989	0.23	0.24	0.30	0.44	0.23	0.33	0.20	0.26	0.29	0.32	0.19	0.33	0.23	0.24
1990	0.23	0.21	0.28	0.41	0.24	0.32	0.19	0.27	0.27	0.32	0.18	0.29	0.21	0.24
1991	0.23	0.21	0.27	0.41	0.23	0.30	0.19	0.23	0.26	0.31	0.19	0.26	0.20	0.23
1992	0.24	0.19	0.27	0.40	0.23	0.30	0.18	0.23	0.24	0.31	0.17	0.24	0.20	0.22
1993	0.24	0.21	0.27	0.41	0.25	0.31	0.18	0.23	0.25	0.30	0.16	0.20	0.21	0.22
1994	0.24	0.21	0.26	0.36	0.25	0.32	0.17	0.23	0.26	0.29	0.15	0.18	0.21	0.21
1995	0.22	0.22	0.26	0.33	0.25	0.35	0.18	0.23	0.28	0.32	0.15	0.16	0.20	0.21
1996	0.24	0.17	0.22	0.35	0.24	0.34	0.18	0.22	0.28	0.34	0.15	0.14	0.21	0.21
1997	0.26	0.19	0.22	0.34	0.25	0.36	0.19	0.21	0.26	0.36	0.14	0.14	0.22	0.21
1998	0.28	0.23	0.25	0.27	0.27	0.35	0.18	0.21	0.33	0.37	0.13	0.12	0.24	0.21
1999	0.27	0.21	0.24	0.26	0.25	0.33	0.18	0.24	0.35	0.37	0.13	0.10	0.25	0.20

Source: Extrapolation of 1993 benchmark from table 5 with time series from table 3a, 3b, 3e and 3f.

Table 3j

Capital intensity, SA as % of USA, 1970-1997

	Food Beverages and Tobacco	Textile Mill Products	Wearing Apparel	Leather Products and Footwear	Wood Products, Furniture, Fixtures	Paper and Printing	Chemicals	Rubber and Plastic	Non Metallic Mineral Products	Basic and Fabricated Metal Products	Machinery and Transport	Electrical Machinery and Equipment	Other Manu-facturing	Total Manu-facturing
1970	0.18	0.14	0.28	0.16	0.15	0.19	0.82	0.19	0.13	0.27	0.12	0.37	0.30	0.21
1971	0.17	0.13	0.26	0.15	0.15	0.19	0.82	0.19	0.13	0.26	0.13	0.32	0.28	0.20
1972	0.18	0.14	0.25	0.15	0.16	0.20	0.80	0.21	0.14	0.30	0.14	0.35	0.30	0.21
1973	0.18	0.13	0.23	0.16	0.16	0.20	0.79	0.22	0.15	0.37	0.15	0.40	0.23	0.23
1974	0.18	0.12	0.21	0.16	0.14	0.20	0.79	0.21	0.15	0.40	0.14	0.39	0.24	0.23
1975	0.17	0.10	0.18	0.14	0.12	0.19	0.74	0.17	0.14	0.36	0.13	0.33	0.23	0.21
1976	0.17	0.10	0.18	0.15	0.13	0.18	0.67	0.18	0.16	0.36	0.12	0.32	0.26	0.22
1977	0.17	0.10	0.17	0.15	0.14	0.17	0.63	0.19	0.16	0.38	0.12	0.35	0.31	0.23
1978	0.18	0.10	0.15	0.14	0.14	0.16	0.55	0.17	0.17	0.38	0.12	0.36	0.29	0.25
1979	0.17	0.09	0.14	0.13	0.13	0.15	0.51	0.16	0.17	0.36	0.12	0.36	0.27	0.26
1980	0.17	0.09	0.13	0.12	0.11	0.15	0.50	0.13	0.17	0.34	0.11	0.32	0.25	0.26
1981	0.17	0.09	0.12	0.12	0.12	0.15	0.50	0.12	0.17	0.29	0.11	0.30	0.23	0.26
1982	0.17	0.08	0.11	0.11	0.11	0.18	0.52	0.11	0.16	0.26	0.10	0.29	0.24	0.24
1983	0.19	0.09	0.12	0.11	0.12	0.24	0.68	0.13	0.19	0.27	0.11	0.29	0.20	0.26
1984	0.19	0.09	0.12	0.10	0.13	0.30	0.81	0.14	0.20	0.28	0.12	0.30	0.20	0.27
1985	0.18	0.09	0.12	0.09	0.13	0.27	0.73	0.15	0.22	0.29	0.13	0.30	0.18	0.27
1986	0.18	0.08	0.11	0.08	0.12	0.23	0.63	0.14	0.21	0.28	0.12	0.26	0.16	0.25
1987	0.17	0.08	0.10	0.07	0.11	0.20	0.55	0.13	0.19	0.26	0.11	0.23	0.15	0.23
1988	0.16	0.09	0.10	0.07	0.11	0.19	0.54	0.13	0.18	0.27	0.10	0.20	0.14	0.22
1989	0.16	0.09	0.10	0.06	0.10	0.19	0.57	0.13	0.17	0.28	0.10	0.16	0.13	0.22
1990	0.16	0.09	0.10	0.07	0.10	0.17	0.55	0.13	0.17	0.27	0.11	0.13	0.11	0.22
1991	0.16	0.09	0.10	0.07	0.09	0.14	0.50	0.12	0.16	0.28	0.11	0.11	0.13	0.22
1992	0.17	0.09	0.10	0.07	0.09	0.13	0.49	0.12	0.16	0.29	0.12	0.09	0.13	0.23
1993	0.18	0.11	0.09	0.08	0.09	0.13	0.47	0.12	0.16	0.34	0.14	0.08	0.11	0.24
1994	0.19	0.10	0.09	0.08	0.08	0.13	0.52	0.13	0.17	0.40	0.13	0.08	0.09	0.24
1995	0.20	0.11	0.09	0.08	0.09	0.15	0.60	0.12	0.18	0.44	0.13	0.09	0.09	0.24
1996	0.20	0.10	0.08	0.08	0.09	0.15	0.63	0.13	0.19	0.48	0.12	0.09	0.08	0.24
1997	0.20	0.10	0.08	0.08	0.10	0.16	0.68	0.12	0.20	0.55	0.12	0.09	0.08	0.25

Source: Extrapolation of 1993 benchmark from table 6 with time series from table 3c and 3g.

Table 3k

Total factor productivity, SA as % of USA, 1970-1997

	Food Beverages and Tobacco	Textile Mill Products	Wearing Apparel	Leather Products and Footwear	Wood Products, Furniture, Fixtures	Paper and Printing	Chemicals	Rubber and Plastic	Non Metallic Mineral Products	Basic and Fabricated Metal Products	Machinery and Transport	Electrical Machinery and Equipment	Other Manu-facturing	Total Manu-facturing
1970	0.57	0.84	0.62	1.46	0.61	0.67	0.28	0.89	0.58	0.56	0.53	0.74	0.58	0.63
1971	0.54	0.80	0.63	1.49	0.60	0.64	0.25	0.88	0.56	0.57	0.46	0.72	0.57	0.60
1972	0.49	0.71	0.54	1.32	0.58	0.61	0.22	0.85	0.52	0.55	0.46	0.73	0.53	0.56
1973	0.48	0.75	0.52	1.25	0.64	0.57	0.20	0.82	0.51	0.48	0.46	0.73	0.65	0.55
1974	0.53	0.80	0.52	1.38	0.66	0.58	0.22	0.83	0.55	0.50	0.53	0.90	0.68	0.59
1975	0.51	0.87	0.51	1.38	0.64	0.56	0.24	0.81	0.55	0.55	0.49	0.88	0.62	0.58
1976	0.52	0.81	0.53	1.23	0.62	0.58	0.23	0.82	0.48	0.51	0.40	0.85	0.59	0.54
1977	0.50	0.64	0.51	1.25	0.61	0.57	0.22	0.78	0.48	0.49	0.40	0.78	0.53	0.50
1978	0.50	0.72	0.52	1.36	0.67	0.62	0.26	0.92	0.50	0.50	0.45	0.83	0.58	0.52
1979	0.53	0.74	0.55	1.35	0.72	0.68	0.26	0.94	0.55	0.54	0.54	0.85	0.61	0.54
1980	0.51	0.74	0.56	1.23	0.67	0.71	0.31	0.97	0.59	0.59	0.66	0.83	0.61	0.56
1981	0.49	0.76	0.60	1.29	0.70	0.71	0.30	0.96	0.64	0.57	0.64	0.80	0.60	0.54
1982	0.45	0.71	0.62	1.26	0.62	0.62	0.29	0.86	0.65	0.56	0.51	0.87	0.54	0.50
1983	0.46	0.61	0.55	1.29	0.54	0.54	0.25	0.79	0.51	0.53	0.41	0.78	0.58	0.45
1984	0.49	0.61	0.55	1.31	0.50	0.54	0.25	0.79	0.47	0.51	0.36	0.73	0.57	0.45
1985	0.49	0.58	0.50	1.20	0.50	0.56	0.23	0.66	0.43	0.52	0.35	0.66	0.59	0.43
1986	0.53	0.58	0.50	1.25	0.52	0.60	0.26	0.71	0.44	0.48	0.33	0.59	0.65	0.44
1987	0.54	0.57	0.48	1.05	0.48	0.59	0.23	0.76	0.44	0.47	0.33	0.59	0.62	0.42
1988	0.52	0.53	0.45	1.00	0.50	0.60	0.26	0.72	0.52	0.48	0.37	0.53	0.57	0.42
1989	0.59	0.50	0.49	1.05	0.48	0.59	0.26	0.62	0.51	0.51	0.40	0.48	0.59	0.43
1990	0.58	0.44	0.46	0.96	0.51	0.61	0.25	0.62	0.49	0.51	0.38	0.45	0.58	0.41
1991	0.58	0.44	0.46	0.94	0.51	0.60	0.26	0.57	0.48	0.49	0.38	0.43	0.50	0.40
1992	0.58	0.39	0.45	0.87	0.50	0.62	0.25	0.56	0.42	0.47	0.33	0.41	0.48	0.38
1993	0.56	0.40	0.47	0.89	0.57	0.65	0.25	0.56	0.46	0.43	0.28	0.35	0.56	0.36
1994	0.55	0.41	0.44	0.77	0.57	0.65	0.24	0.54	0.46	0.39	0.27	0.31	0.60	0.35
1995	0.48	0.42	0.45	0.70	0.56	0.68	0.23	0.54	0.49	0.41	0.28	0.28	0.61	0.34
1996	0.54	0.35	0.39	0.73	0.54	0.65	0.22	0.52	0.47	0.42	0.28	0.24	0.64	0.34
1997	0.58	0.39	0.40	0.72	0.54	0.67	0.22	0.50	0.44	0.41	0.27	0.23	0.69	0.33

Source: Extrapolation of 1993 benchmark from table 6 with time series from table 3a, 3b, 3c, 3d, 3e, 3f, 3g and 3h.

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