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**Information technology and producer services
- a source of economic development:
The South African case**

by

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Information technology and producer services – a source of economic development: The South African case

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Abstract

This paper discusses one aspect of the by now somewhat discredited "new economy", namely the impact of information and communication technology on the growth in volume and diversity of producer services. It provides an analysis of data on developments within transport, communication, finance and business services in South Africa and discusses on the background of recent theoretical work the impact of these developments on the economy as a whole. It is argued that so far the very rapid development in the producer services sectors has had little impact on the rest of the economy. It is further argued that outsourcing of producer services combined with access to a broad variety of such services are important factors for reaping the full benefits of the observed developments in the producer services sectors. The paper also provides a discussion of under which conditions extensive outsourcing will take place.

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1 Introduction

Services are in many ways the glue that holds an economy together. Production of goods for the market would not be possible without transport, storage and marketing services. Investment and international trade would be ineffective without financial services, and social and technological conditions would have been static without education and research. Finally, ideas and technology would not spread without information services. Yet, the services sectors have been largely ignored in development research.

While services have traditionally been seen as non-tradable, they now account for more than 20 percent of world trade and the share is increasing. Furthermore, services accounted for 57 percent of the stock of outward foreign direct investment (FDI) in 1997 (UNCTAD 1999), and about 60 percent of world cross-border mergers and acquisitions in 1999 (UNCTAD 2000). Services were brought into the WTO during the Uruguay Round of negotiations, resulting in the GATS in 1994. Trade in services is also incorporated in a number of regional agreements, including the European single market, NAFTA, Mercosur, and the free trade agreement between the EU and South Africa.

This paper focuses on the impact of recent developments in the producer services sectors on productivity in the economy as a whole. We analyze three sources of productivity gains:

1. A decline in the quality-adjusted cost of each individual service;
2. Information technology induced changes in work organization and vertical relations between firms;
3. Access to a broader variety of producer services.

The first source of productivity gain, a decline in the cost of each intermediate input, is particularly relevant for information-intensive services and is driven by the rapid development of information and communication technology (ICT). We therefore include a discussion of price developments in the ICT sector. Developments in ICT have induced a more effective work organization where firms to an increasing extent focus on core activities and outsource non-core activities. In addition they minimize costs through a reduction in stocked and in transit inventories, close to zero defaults in production and closer integration and better management of the supply chain. Finally, access to a broader variety of producer services improves productivity due to gains from specialization. A precondition for firms to benefit from technological developments and liberalization of trade and investment in the services sectors is access to adequate infrastructure in telecommunications, transport and utilities and reasonably cost-effective services provided from these infrastructure networks.

The rest of the paper is organized as follows: Section 2 discusses developments in the cost of individual producer services and ICT. A central concept in this discussion is quality-adjusted prices.[1] A number of countries now provide quality-adjusted price indices for several goods and services. These indices probably give a more accurate picture of economic growth and productivity developments than do traditional price indices. Section 3 discusses outsourcing of services and other changes in work organization that have occurred following advances in ICT. In section 4 we turn to international trade in services, foreign investments in the services sectors and the gains from such trade and investments. We relate the discussion to South African data and conditions throughout the paper, but where such data are not available, we

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[1] Often referred to as hedonic prices in the literature.

also discuss data from the US and Norway. Section 5 discusses the special challenges facing South Africa at some more length before concluding.

2 ICT and quality-adjusted costs of services

ICT has reduced the cost of providing new users with information to almost zero, once the information is produced. This has obviously reduced the cost of producing information-intensive services. In a competitive market this will either lead to lower prices of such services, higher quality, or a combination of both. Quality-adjusted prices aim at adjusting nominal price indices for changes in quality and other features of the product that matters for customers. ICT has also induced the introduction of a number of new products. Both changes in quality and new products pose a challenge for economic analysis that cannot be ignored when the pace of change is as rapid as it has been during the 1990s. We illustrate the problem of new products by an example from the financial services sector. In most countries the price index of financial services has increased more than the overall consumer price index. Table 1 shows the annual average increase in the consumer price index and the corresponding figure for financial services in South Africa, Norway and the US during the period 1995-2000.

Table 1. Annual average price growth

	South Africa	Norway	US
CPI	7.2	1.9	2.3
Financial services	9.0	5.5	4.8

Sources: TIPS (2001), Statistics of Norway (2001) and Bureau of Labor Statistics (2001)[2]

Table 1 leaves the impression that financial services have become increasingly expensive and that the relative price of financial services has increased. Although the price of each and every financial service has indeed increased, new and cheaper services have been introduced over time. Consumers therefore have the opportunity to switch from one "old-fashioned", expensive service to new and cheaper services that serve the same purpose. A simple "back of the envelope" calculation based on Norwegian prices, which are pretty much in line with international prices, is presented in figure 1. It shows the cost per transaction of payment services for three different customers. Customer A pays his bills over the bank teller during the entire period, while customer B pays his bills over the Internet during the entire period. The costs of the two alternatives are $2.16 for the bank teller and $0.16 for the Internet alternative in 2001. A third alternative, tele-giro at a cost of $0.23 per transaction in 2001 is also available. We assume that the average annual inflation for financial services continues at 5.5 percent through 2005. Customer C starts out in 2001 paying his bills over the bank teller, but switches to tele-giro at a cost of $0.23 per transaction in 2002 and then to the Internet in 2005. While both customer A and B experience a cost increase of 5.5 percent per year during the period 2001-05, customer C experiences cost savings of almost 60 percent on average per year!

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[2] http://stats.bls/gov/

Figure 1. Cost of payments services, an example
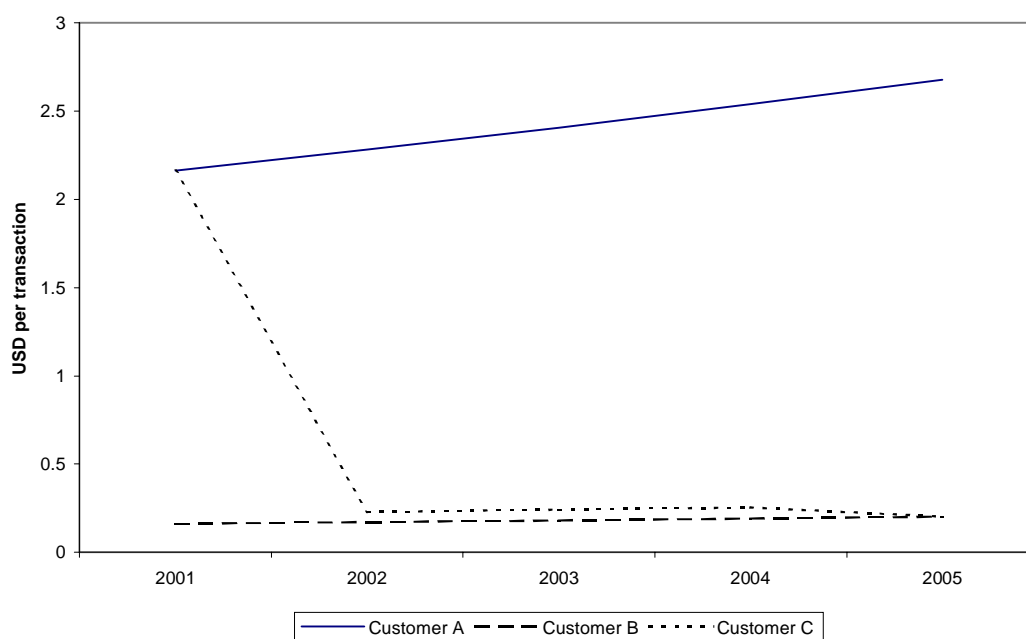
Clearly, if customers switch from bank tellers to the Internet, which indeed they do, the sectoral price index is grossly misleading compared to what customers actually pay for financial services. Furthermore, switching to Internet transactions saves the customer for the time and other costs of physically going to the bank. Businesses are more likely to switch to Internet-based financial services than consumers, indicating that the potential savings as Internet-based financial services become more available are substantial, although financial services do not constitute a large share of firms' total costs. In a developing country access to cheap IT-based financial services is limited by access to telecommunication services and the Internet. Moreover, consumers and businesses that are not being serviced by formal financial institutions at all, face costs in the informal market way above the "old-fashioned" formal sector services. For such consumers and businesses, gains are even more substantial than that of our illustration, if they get access to formal sector financial services during the period in question. They might even be able to leapfrog directly into Internet-based services.

Quality-adjusted price indices are useful tools for measuring the impact of changes in quality of a product or an aggregate of a fixed number of products, but it does not solve the problem of how to deal with new products. Quality-adjusted price data is available for the US economy for computers (Berndt and Rappaport 2001) and for computers, software and communication equipment (Jorgenson 2001). These are important inputs in the producer services sectors. We report the findings in table 2 below. Figures are given at average annual change.

Table 2. Quality adjusted prices

Item	1990-95	1995-1999
Computers	-15.77	-32.09
Software	-1.62	-2.43
Communications equipment	-1.77	-2.90
Information technology services	-2.95	-11.76
	1989-94	1994-99
Desktop computers	-33.58	-41.11
Mobile computers	-22.74	-31.40

Source: Jorgenson (2001) and Berndt and Rappaport (2001)

Although the two sources of price estimates differ somewhat both regarding the time periods covered and the price estimates, both clearly indicate the sharp decline in quality-adjusted prices for computers. Furthermore, the price decline has accelerated over time for all items included in the table. Since computers, the item with the sharpest decline in quality-adjusted prices, are widely used and for an increasing number of purposes, the cost decline has induced heavy investment in computers and related software and communication equipment. These investments have generated improvement in productivity and they have been the engine of the booming US economy during the 1990s (Oliner and Sichel, 2000).[3] Baily and Lawrence (2001) have studied labor productivity developments in the US economy and show that intense IT-using sectors have had a more rapid productivity growth than less intensive IT-using sectors. Furthermore, they find that services sectors such as retail and wholesale trade, financial services and business services have been among the sectors with the highest increase in productivity growth from 1980-95 to 1995-99. Table 3 below compares the Baily and Lawrence figures for the US economy to South African data.

Table 3. Annual average growth in labor productivity by industry

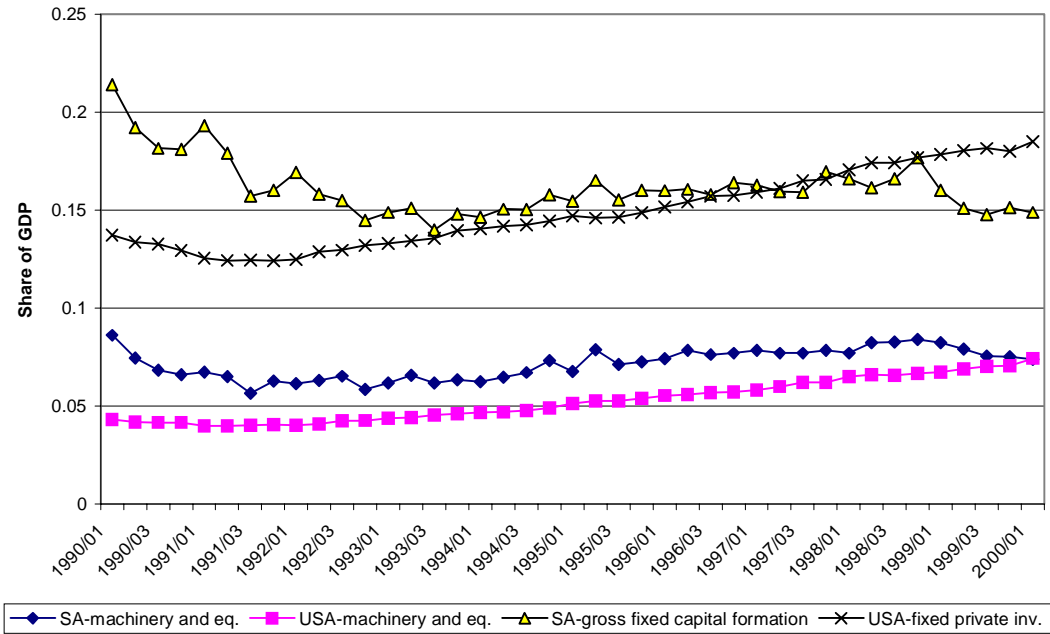|	USA		South Africa	
Industry	1980-95	1995-99	1980-95	1995-99
All industries	0.88	2.31	1.28	3.6
Transport and storage	2.48	1.72	4.2	7.2
Communication	5.07	2.66	6.1	21.6
Finance*	3.18	6.76	-0.3	8.5
Business services	-0.16	1.69	-2.0	0.3

*South African figures include insurance while US figures do not.
Source: Baily and Lawrence (2001) and TIPS (2001)

The producer services included in the table account for about 30 percent of GDP at current prices both in South Africa and the US in the late 1990s. We see that South Africa has experienced the same spurt in productivity growth in IT-intensive services as has the US during the second period, and has even outperformed the US in all the producer services sectors. Furthermore, South Africa has obtained stellar performance in the communications sector during the second half of the 1990s. To what extent these productivity improvements are caused by investment in and adoption of ICT and to what extent they are caused by labor shedding and reforms resulting in more competition is not clear. More research is necessary in order to establish this and data on investments in ICT, including software by sector is needed for such research. Figure 2 below presents quarterly data on investments in machinery and equipment as a share of GDP in South Africa and the US during the 1990s. Although we do not have data on the ICT equipment share of this for South Africa, total investment in machinery and equipment is probably a reasonably good proxy.

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[3] A recent revision of US productivity figures has dampened the new economy hype. Nevertheless, although the productivity figures turn out to be less than miraculous, they are still significant by historical standards.

Figure 2. Investment share of GDP


Sources: TIPS (2001), BEA (2001)

We first notice that South Africa has had a higher investment to GDP ratio than the US during most of the 1990s, but while the investment share has increased in the US, it has declined in South Africa and the ratio is higher in the US at the turn of the century. We also notice that the share of total investment that is spent on machinery and equipment, including ICT equipment has increased in South Africa during the 1990s. Both countries have a low investment to GDP ratio in international comparison, but while the US has achieved an average growth rate of about 3.3 percent during the 1990s, South Africa's growth rate was only about 1.6 percent on average during the same period, indicating a more efficient allocation of investment expenditure and better access to complementary inputs such as skilled workers in the US. Turning to the sectoral break down of investment in South Africa, figures 3 and 4 depict total fixed capital formation and investment in machinery and equipment respectively, both as a share of sectoral value added.

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Figure 3. Gross fixed capital formation by sector
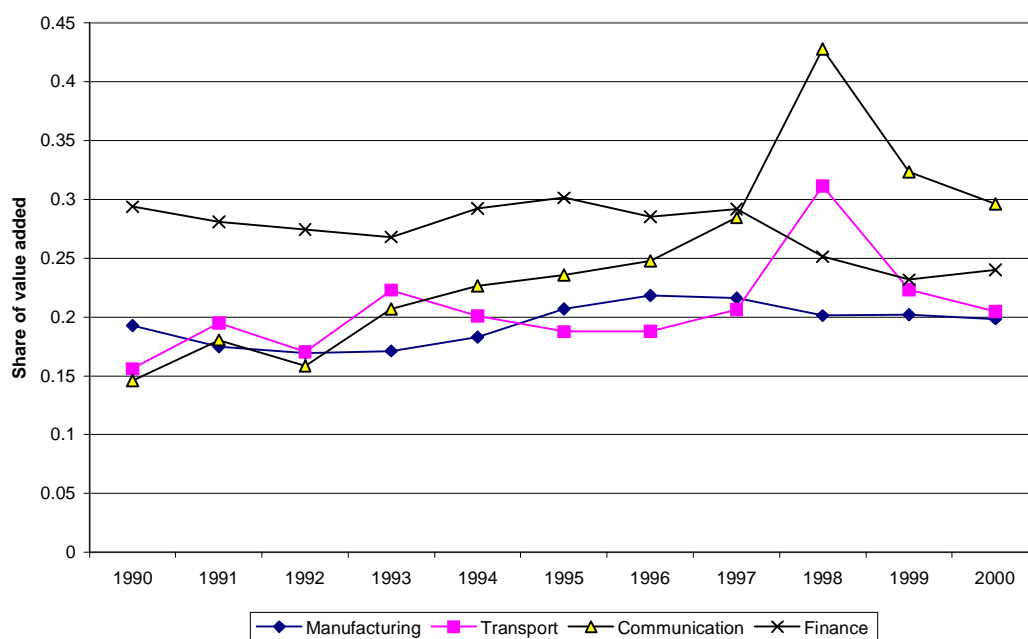
Figure 4. Investment in machinery and equipment by sector
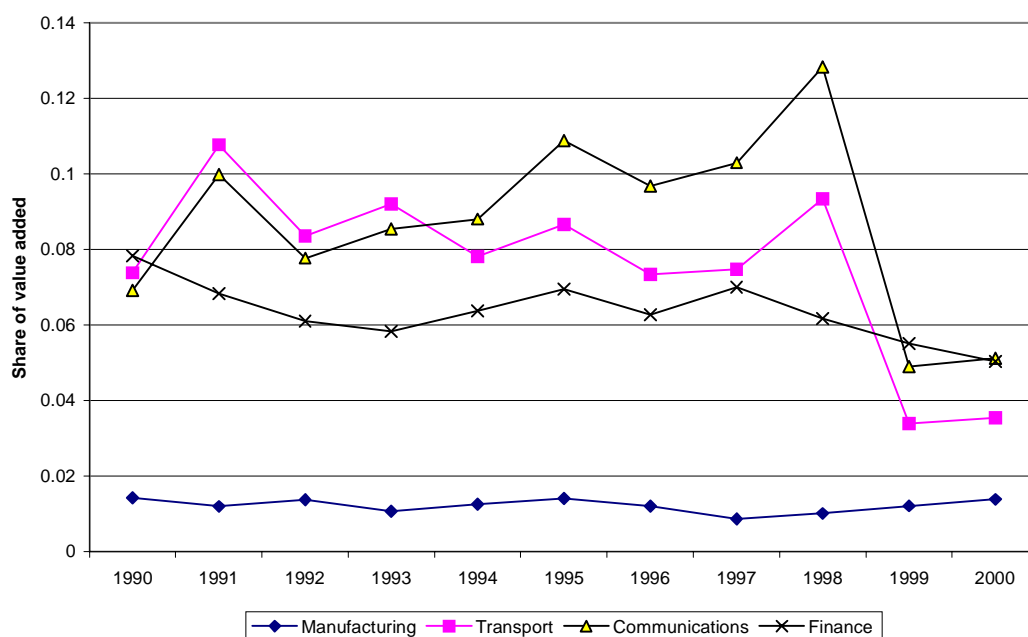
We notice from figure 3 that during the first half of the 1990s, investment in producer services was at approximately the same level as in the manufacturing sector and the economy as a whole (see figure 2), but financial services had an exceptionally high investment ratio compared to other sectors in the economy. During the second half of the 1990s, communications overtook finance as the sector with the highest investment ratio. Business services (not included in the graphs) follow financial services closely, but at a slightly lower investment level.

Investment in machinery and equipment, depicted in figure 4, is much higher in the producer services sectors than in the manufacturing sector throughout the 1990s. The communication sector experienced an investment boom in machinery and equipment starting in 1993 and peaking in 1998. We finally observe that the decline in investment during the period 1998-2000 was largely due to a fall in investment in machinery and equipment. To summarize, the producer services sectors have experienced a higher investment ratio and a higher labor productivity growth rate than the economy average during the 1990s. Machinery and equipment in the producer services sectors are likely to be largely ICT equipment. The data thus suggest that the South African producer services sectors have experienced a similar ICT-driven productivity growth boom as have the producer services sectors in the US economy.

Since producer services are important inputs to all other sectors, one would expect that the trends depicted in figures 3 and 4 and table 3 have had an impact on the economy as a whole over and above the direct impact of higher growth in the producer services sectors. The impact on other sectors works through backward and forward linkages; other sectors get access to better and/or cheaper products.[4] In addition, other sectors get access to new services that may be better suited for their needs and which may allow them to organize production and marketing more effectively. Finally, new producer services may be a vehicle for accessing new markets both for inputs and outputs.

To conclude this section, it appears from table 3 that the South African producer services sectors are rapidly reducing the gap towards the technology frontier and that investment in ICT is an important driving force. However, we do not know how this has affected productivity in the sectors that use producer services extensively and the economy as a whole. Traditional measures of productivity only establish the contribution from labor and capital and a residual that incorporates everything from technological progress, better work organization, higher quality of inputs and gains from specialization. For now we conclude that South Africa has experienced a substantial improvement in labor productivity in the producer services sectors during the second half of the 1990s and that this has improved South Africa's growth potential significantly. Whether this potential is fully exploited, depends on to what extent other sectors are able to take advantage of the progress experienced in the producer services sectors. This will probably require changes in work organization and outsourcing of services, to which we turn in the next section.

3 Producer services, outsourcing and work organization

Although the issue is still somewhat controversial, it has been argued that the rise in productivity in manufacturing, the decline of the relative share of manufacturing in GDP and the simultaneous increase in the services sector share of GDP can to a large extent be explained by outsourcing of services on the part of manufacturing firms. For example a recent study by Fixler and Siegel (1999) analyzing data from the US economy, finds that the cost share of purchased services in total inputs in manufacturing industries increased from 5 percent of total input costs in 1949 to 12.8 percent in 1988, mainly at the expense of materials.

Fixler and Siegel also find that the largest and fastest growing subsector of intermediate services is business services, including accounting, payroll and computer services. This

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[4] The price index for the financial sector suggests that services have not become cheaper, but recall the problems with measuring price indices when new services and products are introduced.

subsector increased its share in total intermediate services from less than a quarter in 1947 to more than half in 1987. The study further finds a positive and statistically significant correlation between wage growth and growth in outsourcing in manufacturing industries, and a positive and statistically significant correlation between growth in manufacturing productivity and the rate of outsourcing. Finally they find that service industries that conduct outsourcing-related work experienced higher growth in real output than other service industries.

Comparing Fixler and Siegel's results to the South African case shows some interesting differences and similarities. Figure 5 depicts 5-year moving average real growth rates of producer services (transport and communication, finance and business services) compared to all other services. The figure shows that the producer services sectors have grown more rapidly than the other services industries, but this trend has only become clear since 1993. We also see that producer services are much more volatile than other services.

Figure 5. Real growth rates, services
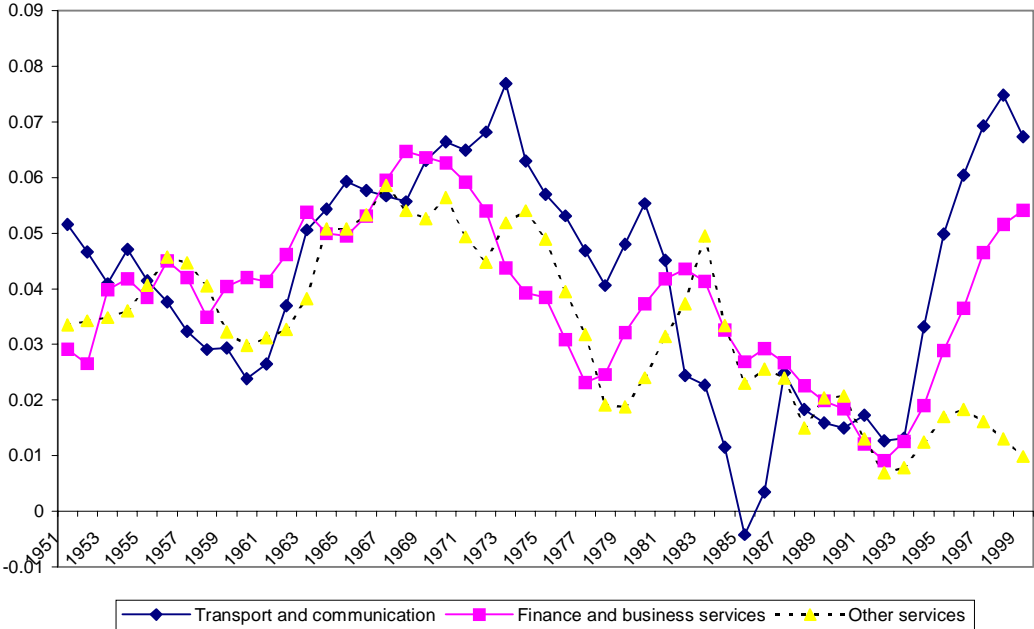
Source: South African Reserve Bank

Producer services accounted for much less of input costs in the South African manufacturing industries than in the US in 1988. Figure 6 shows developments in the producer service cost share of total inputs in the primary, secondary and tertiary sectors during the period 1970-2000.[5] The cost shares are calculated at current prices. As the figure indicates, outsourcing of producer services is not limited to manufacturing industries. Currently, leading service sector industries such as finance, outsource services on a much higher scale than manufacturing industry companies.

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[5] The share is significantly higher than that reported in Hodge (2001), which is based on the 1997 input-output table.

Figure 6. Producer services' cost share of total inputs
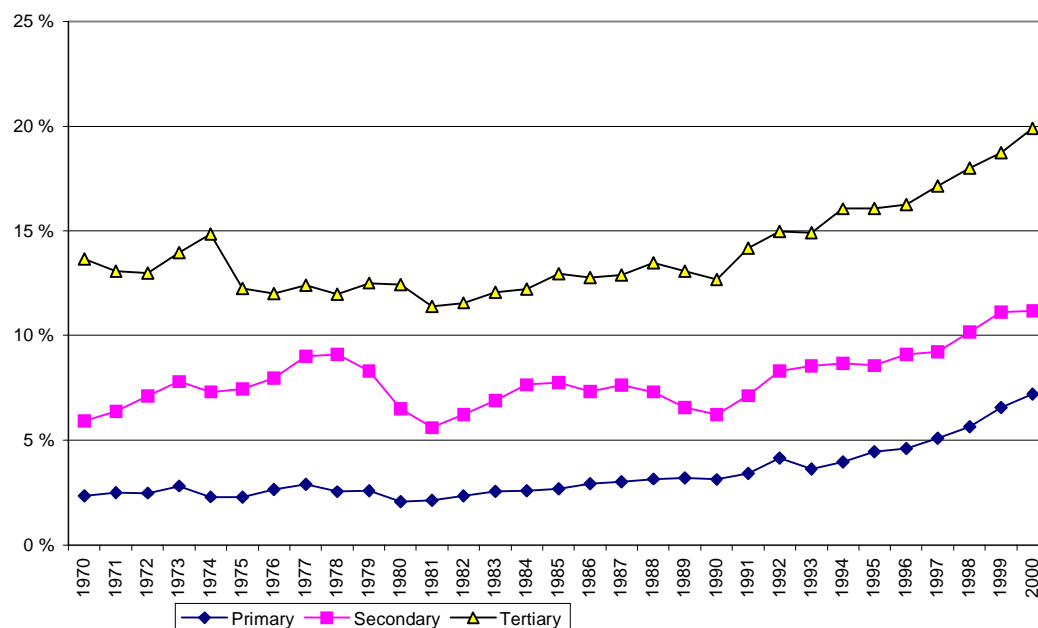
The figure further shows that while the cost share of producer services fluctuated around a flat trend during the 1970s and 1980s, there was a sharp increase in the cost share during the 1990s, corresponding to the growth rates of the producer services sectors depicted in figure 5 above. We also notice that the cost share has increased less in the manufacturing sector than in services and the primary sector. This is even clearer if we look at the cost shares at constant 1995 prices. Then the cost share of producer services in the manufacturing sector reached a peak of 11 percent in 1978, while it was only 9.9 percent in the year 2000. Nevertheless, the cost share increased in real terms in the secondary sector during the 1990s, from 7.8 percent in 1990. To what extent this is due to increased outsourcing of services or changes in industrial structure and growing exports needs further investigation at a more disaggregated level. We note that the share of total industrial output exported increased from about 9 percent in 1990 to about 22.5 percent in 2000. It is likely that exports require inputs of more producer services such as transport, insurance, other financial services and business services than do local sales.

Table 4. Manufacturing and producer services

	1990	2000
Export share of total output	9.1	22.6
Cost share of inputs		
Transport	2.8	3.6
Communication	0.4	0.9
Finance	2.0	3.1
Business services	1.1	3.5
Real growth rates 1990-2000		
Total output, manufacturing		0.9
Purchases of producer services		
Transport		1.5
Communication		9.3
Finance		2.5
Business services		5.4

Table 4 summarizes the findings regarding the linkages between the manufacturing sector and producer services. Real growth rates are given as annual average growth rates during the period 1990-2000. We notice that the cost share (at current prices) has increased the most for business services, while real purchases have increased the most for communication services, indicating that the market price of business services has increased relative to communication services.

We finally observe that South Africa is a net exporter of producer services. Net exports actually increased from about R 1.2 billion in 1970 to about R 7.1 billion in 2000, both figures are at constant 1995 prices (TIPS 2001).[6] Export performance thus indicates that South African producer services are internationally competitive, at least in the SADC region. See section 4 for further discussions on trade in services.

We have now seen that producer services have experienced a relatively high rate of growth in output and labor productivity during the past decade, and that productivity growth has most likely been driven by investments in machinery and equipment, probably largely ICT equipment. On the demand side, it appears that intermediate demand, particularly from the services sectors, together with exports have been the most important driving forces. We have not been able to establish the extent of outsourcing on the basis of macro and sectoral data. We therefore continue the discussion of gains from outsourcing on a general basis, building on insights from previous research.

3.1 The make-or-buy decision

Consider a manufacturing firm that faces the decision whether to produce a service in-house or purchase it from the market. In the end of the day the decision depends on the relative cost of the two choices. However, the relative cost depends on much more than the in-house production cost of the service relative to the price of the service when purchased in the market. Unless the service is completely standardized, or the outside supplier can be persuaded to design the service exactly according to the manufacturer's specification, the service produced internally is different from the service purchased from the market. Furthermore, different suppliers may offer different packages of content and timing of delivery, and finding the best match to the manufacturer's needs therefore becomes important. The internally produced service is typically better integrated with the manufacturer's production process both in terms content and timing than any externally purchased service can be. Thus, although the cost of producing the service internally may be high relative to purchasing it from the market, it may still contribute more to the manufacturer's cost effectiveness. Outside service providers on the other hand may have lower costs because of superior technology and/or economies of scale.

A crucial factor affecting the make-or-buy decision is as already mentioned the extent to which the producer service is standardized, and if it is not standardized, to what extent the supplier can be persuaded to design the service according to the manufacturer's needs. The literature addressing this issue uses the term asset specificity about the extent to which an input is specially designed for the intended customer. One feature of asset specificity is that the input, once produced has little value to other potential customers. Therefore, service providers will not be willing to incur the extra cost of designing an input for a particular customer unless they are sure that they will be able to recoup their costs. Asset specificity therefore requires contracts between the two parties, and such contracts are usually imperfect

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[6] This implies an annual average growth rate of about 6 percent in real terms.

and there are costs related both to entering the contract and enforcing it. We have now identified the following factors that determine the make-or-by decision for producer services (or other inputs):

1. The internal production cost of the service;
2. The market price of the service;
3. The degree of asset specificity of the service;
4. The importance of asset specificity for total production costs in manufacturing;
5. The search cost of finding a suitable supplier/customer;
6. The cost of entering a contract and monitoring the relationship with the outside supplier;
7. The bargaining power of the two contracting parties.

The final decision thus involves weighing the perceived values of each of these factors against each other. This is a complex task and it is probably the case that few firms have exact estimates of these factors underlying their decisions. It is therefore useful to develop theoretical models that capture all these variables and analyze the relative importance of each factor and how they interact based on as realistic assumptions and parameter values as possible. In the following we will briefly discuss the insight from such research.

Riordan and Williams (1985) find that internal production (i.e., vertical integration) is more common in companies where asset specificity is great and important, where economies of scale in the production of the service input is small and large firms will be more integrated than small firms. Whether firms are large because they are integrated or integrated because they are large, is however not clear. Intermediate services such as managerial services, engineering and product design have traditionally been produced inside the manufacturing firm, while financial services, transport and some business services such as accounting and marketing are typically provided from outside. It is also the case that engineering, design and management are less standardized than financial services and transport, so the theory appears, perhaps unsurprisingly, to fit empirical evidence well. Although the results of this early research may seem trivial today, the study was nevertheless important because it identified some key factors affecting the make-or-buy decision and provided an analytical framework for analyzing their impact.

A more recent and far richer study by Grossman and Helpman (2001) takes all the 7 factors listed above into account. It explores the determinants of the make-or-buy decision in industries consisting of many firms both on the supply and the demand side of the market for inputs. We stick to our example of manufacturers and producer service providers on the demand and supply side of the market respectively. Both manufacturers and service providers incur search costs related to finding a contract partner. The manufacturers search for a service supplier willing to adopt the service to the manufacturer's specifications, while the service firms search for a customer that match their technology and capacity. The probability that a particular manufacturer will find a suitable supplier depends positively on the number of producer service firms established in the market and negatively on the number of other manufacturers also looking for a suitable provider of producer services, while the opposite is true for the service supplier. An implication of this is that outsourcing is more likely if the barriers to entry in the producer service sector are low and/or market concentration in manufacturing is low. Further, the extent of outsourcing depends on the relative bargaining power of the supplier and purchaser of services. If either party has a disproportionately strong bargaining position, outsourcing is less likely than if the two parties have more equal

bargaining power. Pervasive outsourcing is also more likely when the market for final output is competitive, but not perfectly competitive.

The two studies discussed so far consider cases where each manufacturer uses only one producer service. They do thus not capture the cost advantages of specialization fully. A vast theoretical and empirical literature argues that a manufacturer is more productive the more extensive is the degree of specialization within the firm. The assembly plants in which production is split into as small operations as possible are based on this principle. By the same token an economy is more productive the larger the extent of specialization between firms. If there are any fixed costs, and thus economies of scale related to the production of each input, the extent of specialization is limited by the size of the firm or the market. Only a limited number of producers of inputs can break even in a small market and assembly plants used to be very large in the heyday of Taylorism.

However, in the "old economy" assembly plants both operations and inputs are highly standardized and asset specificity is unimportant. In fact, standardization of components and processes was a precondition for mass-production in the first place. In the early days most of the standardized components were produced in-house in large plants, but increasingly production of parts were outsourced to outside suppliers while services that could not be standardized were produced in-house. The car industry has been the subject of numerous studies of this process. Little research has been done on how to reap the benefits of specialization in industries where asset specificity is important, however. Nordås (2000a) argues that in such industries it is possible to obtain asset specificity through specialization, provided that the market is sufficiently large. We illustrate the point by a stylized example. Assume that figure 7a represents a complex customized final output, while figure 7b represents the standardized components available in the market.
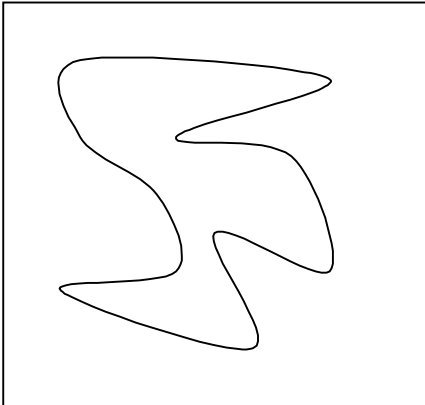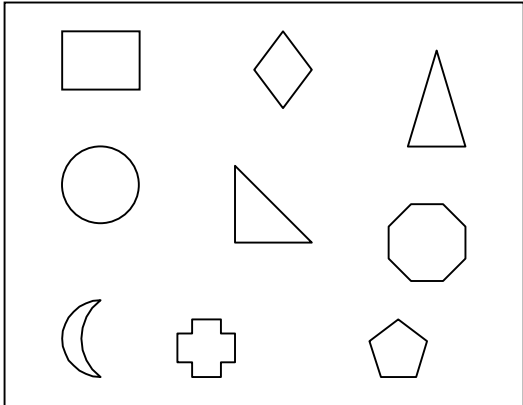
Figure 7a

Figure 7b

The final output can be produced by combining inputs such that they fit into figure 7a. The better they fit without overlapping or extending beyond the borders of the figure, the higher the productivity and the lower the cost of producing the final output. Clearly, the greater the variety of inputs, the easier it is to find a combination that fills the complex figure 7a exactly. The figure also illustrates the idea behind so-called mass customization where the final product is customized to the tastes and preferences of individual customers or market segments, while the inputs are standardized. If the market is small and accommodates only a

few suppliers of inputs, the manufacturer will ask the suppliers to bend and shape the inputs in order to get a better fit, or he will produce the inputs in-house such that they fit exactly. If the market is large and accommodates a big number of producers of differentiated inputs on the other hand, the manufacturer will purchase the standardized inputs. The ranking of alternative technologies according to cost are shown to be as follows (Nordås 2000a):

1. Large market, standardized inputs (lowest cost);
2. Small market, specific inputs;
3. Small market, standardized inputs.[7]

Notice that in a small market in-house production or outsourcing to a supplier willing to design the input according to the manufacturer's specification is more cost-effective than purchasing the standardized inputs from the market. Yet, the manufacturer operating in the small market producing inputs in-house has significantly higher costs than a manufacturer operating in a large market using standard inputs. The manufacturer operating in the small market will therefore have difficulties competing in the world market.

Recent developments in ICT and trade liberalization in services have strongly affected both sides of the make-or-buy decision concerning producer services. Returning to the 7 factors determining the make-or-buy decision listed above, we saw in section 2 that ICT has probably significantly improved productivity in the producer services sectors. Although there are few signs that this has resulted in lower market prices for each individual service, it has indeed resulted in new and lower-cost alternatives to existing services.

The degree and importance of asset specificity are also affected by ICT. As figure 7 illustrates, customizing a product may be achieved by mixing and matching a large number of standardized, but different inputs. A large number of different standardized inputs are, however usually found only in large markets. A number of producer services can be digitized and standardized and therefore traded internationally at relatively low costs. ICT has in other words made more services tradable and therefore increased the number of varieties available to the local manufacturer. ICT has also contributed to services being more easily separated from production of goods and forming businesses of their own, thus increasing the outside supply of producer services.

Turning to search costs and the cost of enforcing contracts, ICT has clearly reduced both. The Internet has made it easier to find a suitable supplier/customer and ICT makes it possible to maintain constant communication with outside suppliers, reducing the monitoring and transaction costs related to external purchases. This is why it has been argued that the reduction in transaction costs due to the proliferation of ICT has affected vertical specialization and trade in intermediate products, including services, more than horizontal specialization and trade in final products (Hummels et. al. 1998). The total cost of external purchases has consequently been reduced relative to in-house production. Empirical evidence also suggests that ICT is associated with a decline in average firm size.[8] This is due to a reduction of the minimum efficient scale in many manufacturing industries as more flexible production equipment has been introduced, while the emergence of a number of specialized niche service firms has allowed manufacturing firms to focus on their core activities. This may have reduced market concentration in the manufacturing sector and thus increased the

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[7] The fourth alternative; large market - specific inputs is less cost-effective than large market -standardized inputs and would not be chosen.
[8] See Brynjolfsson and Hitt (2000) for a review.

probability of outsourcing. We therefore conclude that ICT contributes to more extensive outsourcing of producer services.

As we saw in section 2, the ICT sector has experienced exceptional growth in South Africa during the 1990s. For example, cellular phones were introduced in South Africa in 1994 and had obtained about 5.2 million subscribers by the end of year 2000.[9] The same year there were about 1.82 million Internet users in South Africa (Hodge, 2001). This development should significantly increase the number of potential outside suppliers of producer services. However, as the Grossman and Helpman study shows, market concentration and loop-sided bargaining power are not conducive for pervasive outsourcing. The South African business sector is characterized by highly concentrated ownership structures and huge conglomerates. During the period 1983-2000, the top five groups controlled between 55 (1998) and 85 (1987 and 1991) percent of the total Johannesburg Stock Exchange (JSE) capitalization.[10] The figure stood at 61.4 percent in 2000 (McGregor 2001). This ownership structure is partly a result of the long history of foreign exchange control and South Africa's isolation. The mining houses have earned substantial resource rents, which have been locked into the South African economy and forced the mining houses to invest in local non-mining activities. The import substitution policy also induced the mining houses to integrate backwards in order to secure reasonably inexpensive inputs. Since 1994, unbundling of pyramid and conglomerate structures has been a strategy for the dominant groups in order to disclose value, as shares in such conglomerates typically trade at a discount to net asset value. The conglomerate discount constitutes further evidence of the gains from outsourcing or unbundling non-core activities. To the extent that the conglomerate structure of the South African economy still constitutes a barrier to entry for independent producer services firms, it is an impediment to obtaining the gains from outsourcing and specialization.

3.2 Producer services, ICT and work organization
An intermediate solution between outsourcing and internal production is close vertical relations between upstream suppliers of inputs and a downstream producer of final goods or services. Modern supply chain management (SCM) involves the optimization, integration and synchronization of all enterprise functions throughout the supply chain from raw materials to marketing and after sales services. The objective of supply chain management is to minimize total costs through accelerating delivery times, reducing stocked and in transit inventories while providing the customer with the low-cost quality products she demands. SCM is about integrating material procurement, product design, the production process and market distribution without necessarily integrating the organizations involved. SCM, then, is about coordination of firms working together in more or less formal partnerships or alliances. This has successfully been achieved through the automation of procurement, logistics and production, assisted by ICT which links and synchronize these processes within and between firms. In markets characterized by short product life cycles, effective supply chains are crucial for competitiveness.

The SCM literature argues that it is entire supply chains that compete in the market, not individual firms. However, the supply chain often consists of a very large number of suppliers. For example, one of the largest retailers in the US, Wal-Mart, has its own private communications satellite system, which enables the company to send point-of-sale data to its 4000 suppliers daily (Ross 1998). In the automotive industry and in the oil industry some of

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[9] This compares to 3.7 million subscribers in India, a country with more than a billion inhabitants! (the Economist 2001).
[10] The JSE has changed name to the Johannesburg Securities Exchange.

the leading multinational firms have set up common electronic markets, the oil companies in cooperation with financial service companies. They increasingly conduct their procurement over these electronic networks. From these examples it is difficult to envisage competing, unified vertical supply chains. The mere number of participants suggests that coordination, not to speak of synchronization, is difficult even when assisted by the most sophisticated ICT. Furthermore, the fact that competing companies set up common electronic markets for inputs questions the notion of a unified supply chain at least in the industries where this is common.

SCM and outsourcing are closely related issues. Since customers to an increasing extent demand customized products, SCM aims at cost effective "mass customization". The empirical literature suggests that final products are increasingly customized, but intermediate inputs may be increasingly "commoditized", i.e., standardized as illustrated by figure 7 above.

In addition to being part and parcel of the supply chain, producer services are also the glue that holds the supply chain together. The quality, cost and availability of producer services such as transport, communication and finance determine to what extent a producer in a location can enter and benefit from participating in an international supply chain. Being part of Wal-Mart or the leading oil companies' supply chains, for example, requires access to sophisticated telecommunications services and the Internet. When such supply chains operate just-in-time supply, timely delivery of fault-free components is a precondition to participate. Logistics becomes a crucial factor, but also a market opportunity for specialized companies like DHL, TNT, and some major airlines. These companies provide shipping as well as warehousing, packaging and customer support and may constitute a vehicle for firms located in remote areas to participate in time-sensitive international supply chains even if they are not able to enter such supply chains directly. The additional cost of these intermediaries between remotely located suppliers and centrally located customers will, however, probably be reflected in lower producer prices in remote locations.

We will discuss producer services and international trade in the next section. We conclude this section by observing that South Africa has a relatively well-developed producer services sector and hosts a number of multinational firms that manage and participate in international production networks.[11] Unbundling of non-core businesses by these multinationals should generate business opportunities for independent suppliers to service the local multinationals in their international operations as well as participating in other international supply chains.

4 Producer services and international trade

In this section we extend the discussion in section 3 to international outsourcing and supply chains. A crucial factor in the discussion is the relevance of the size of the market. A large country such as the US have internal markets big enough to host a broad variety of industries and companies, while small countries to some extent can extend their markets by being open to trade and investments and integrate their markets more closely with other countries. We start our discussion with a recent study by McLaren (2000), which brings together the issues of outsourcing, asset specificity and international trade. Recall from the Grossman and Helpman (2001) study discussed in section 3 that outsourcing is more likely when the barriers to entry for input suppliers are low and they have sufficient bargaining power relative to the manufacturer customer. McLaren focuses on the effect that international trade has on the outside options of input suppliers and thereby their bargaining power. Let us consider three

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[11] See Nordås (2001) for a discussion.

types of firms – independent producers of producer services (A), independent producers of final products (B) and vertically integrated firms that produce inputs in-house (AB). Assume that firm A1 decides whether or not to enter a contract with firm B1 where it commits to design a service to B1's need. The expected value of making this investment in design depends on B1's willingness to pay for it, ex post, and the price A1 can get for the input if B1 refuses to buy it ex post. McLaren argues that type B firms (i.e., firms that do not have internal production of the service in question) are more likely outside customers for the service provider than type AB firms. Therefore, the more type B firms there are, the better are the opportunities of A1 to find another customer willing to pay a price close to the one agreed with B1. If the outside market is thin and the value of the investment to B1 is high, however, they are likely to be integrated into a type AB firm (i.e., in-house production). Trade is a means of thickening the outside market, improving the outside options for the input suppliers and thereby their bargaining power. Extending the market through trade thus increases the pervasiveness of outsourcing.

As discussed in section 3, one of the most important productivity gains from outsourcing relates to specialization and having access to a large variety of inputs. While intermediate *goods* are traded at low cost such that producers can access a broad variety of physical inputs through imports if the local market is small, producer services are less readily traded. ICT has changed this by making services that can be digitized tradable. South Africa has a relatively small market compared to the major exporters of producer services such as the US. Intra-industry trade in producer services between South Africa and the rest of the world can therefore be modeled as intra-industry trade between a large and a small trading partner. Nordås (2000b) developed a model to investigate the gains from intra-industry trade in producer services among unequal trading partners as a function of the transaction costs incurred by traders. These transaction costs decline with the penetration of telecommunications networks and the cost and quality of transmitting information over such networks. The key properties of the model are the following:

- The economy has three sectors, one "old economy" sector which uses producer services to a very little extent,[12] one modern sector that uses producer services extensively and one producer services sector;
- Production of producer services is subject to economies of scale;
- The old economy sector employs both skilled and unskilled workers, producer services employ skilled workers only, while the modern sector assembles intermediate products;
- Old economy goods are freely traded, producer services are traded, but subject to transaction costs, while the modern sector does not engage in trade in final output – only in intermediate inputs;
- Changes in skilled and unskilled labor productivity are reflected in changes in wages.

The assumption that final output from the modern sector is not traded needs some further explanation. It is of course a simplification of reality, but as discussed in section 3, modern production often involves mass customization where products are customized to individual consumers or market segments. In order to keep up with changes in tastes and preferences, and respond quickly to such changes, the final assembling is often located as close to the customer as possible, while the standardized inputs are sourced from farther afield. We think of the old economy sector as an aggregate of manufacturing industries, agriculture, mining

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[12] In order to simplify the model the sector does not purchase producer services from external producers at all.

and some services. These use purchased intermediate inputs from each other, but in the aggregate this is netted out.

Figure 8. Relative wages, large/small country
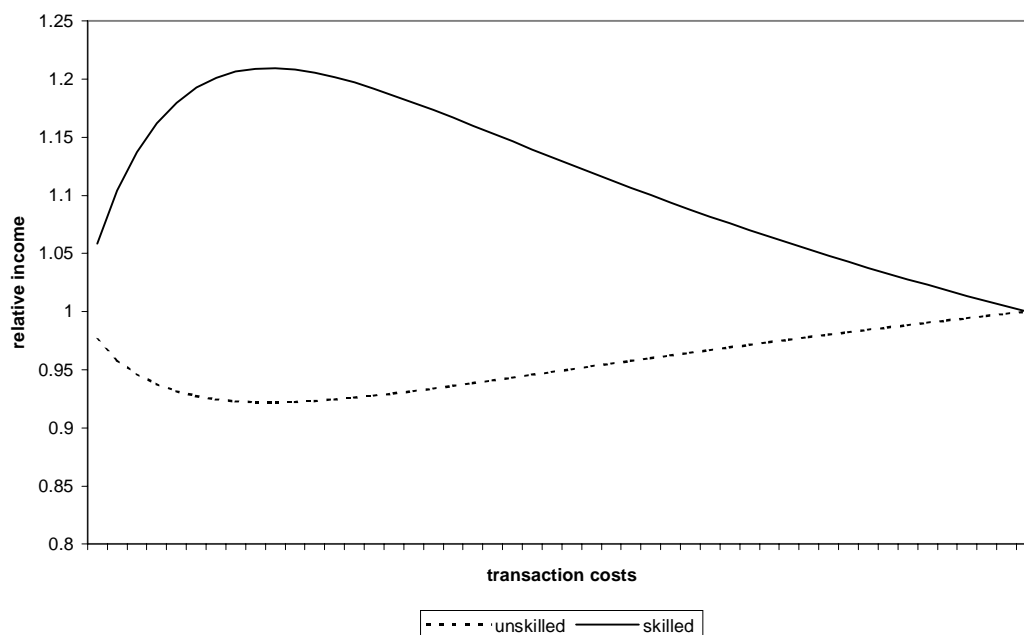
The results of a model simulation with a stylized example of two countries where the larger country has a 13 times as large total labor force as the smaller country, but a 20 times larger skilled labor force are presented in figure 8. Transaction costs of trading in producer services are shown on the horizontal axis, declining from the left to the right on the axis. The curves depict the wage rate in the large country relative to the wage rate in the small country for skilled and unskilled labor respectively. We first notice that both skilled and unskilled wages converge as transaction costs are eliminated and that the impact of reduced transaction costs, and thereby increased trade in producer services, is largest for skilled labor. We also notice that the wage differences between the large and the small country first increase, and after reaching a peak, start to narrow and are totally eliminated if transaction costs are also totally eliminated. Thus, at an early stage of trade in producer services, when transaction costs are still high, the large country gains more than the small country from trade, and the income gap between the two trading parties increases, *although both countries gain in absolute terms.* At a later stage, when transaction costs have come down to a critical level, the smaller country gains the most from further lowering trade barriers. Eliminating transaction costs totally and obtaining income equality between the two countries is probably not possible, however.

Turning to the internal income distribution, the model simulation yields a dramatic drop in the skills premium, i.e., the wages of skilled workers relative to unskilled workers in the smaller country.   At an early stage of trade in producer services, therefore, internal income distribution would become more equal in the small country. This is because producer service firms will move to the larger economy as trade opens up. In the process demand for skilled labor declines and some skilled workers has to move to the traditional sector, which increases its output.[13]   The simulations in other words predict further de-industrialization in the larger and richer country and industrialization in the smaller and poorer country. This development is reversed as transaction costs come further down and the skill premium starts to increase

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[13] There is of course also the possibility that they will leave the country.

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again in the small country, while the two countries become more similar in terms of industrial structure.

The model captures the gains from getting access to a larger variety of inputs though trade, and it also captures the impact on income distribution between and within trading partners where the smaller country is relatively scarce in skills. Given the unequal income distribution in South Africa at present, the political feasibility of opening the market to trade in producer services probably depends on whether transaction costs are to the left or to the right of the peak on the curve in figure 8. The transaction costs consist of politically determined as well as technological barriers to trade, and are difficult to estimate. The transaction costs in South Africa are, however, at present sufficiently low for extensive intra-industry trade in services to take place. Figure 9 below shows import and exports of four producer services sectors.

Positive numbers represent exports while negative numbers represent imports. We see that while imports of services have been relatively stable in real terms during the 1990s, exports of services have increased. The transport sector accounts for the largest share of total producer services exports, which is probably related to increased trade in goods during the same period. While imports of producer services as a share of total imports of goods and services have declined during the 1990s, (from 8.7 to 5.6 percent), exports of producer services share of total exports of goods and services have been stable at about 9.5 percent.

Figure 9. Trade in producer services, South Africa
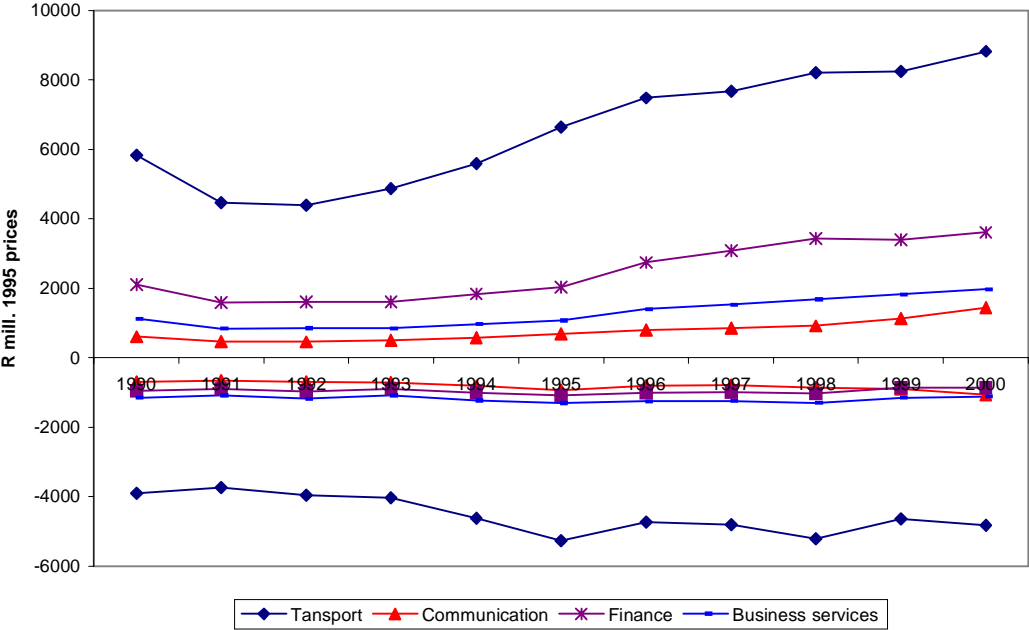
Source: TIPS (2001)

The model discussed above only relates to arms-length trade in services. Many services can, however, not be stored and transmitted, but has to be produced and consumed at the same time and in the same space. It is still possible to access foreign suppliers of such services through foreign direct investment (FDI) and allowing the movement of persons providing the

service.[14]   According to figures from Business Map, the services sectors have been leading recipients of FDI since 1994 as figure 11 shows.

Figure 11. FDI by sector
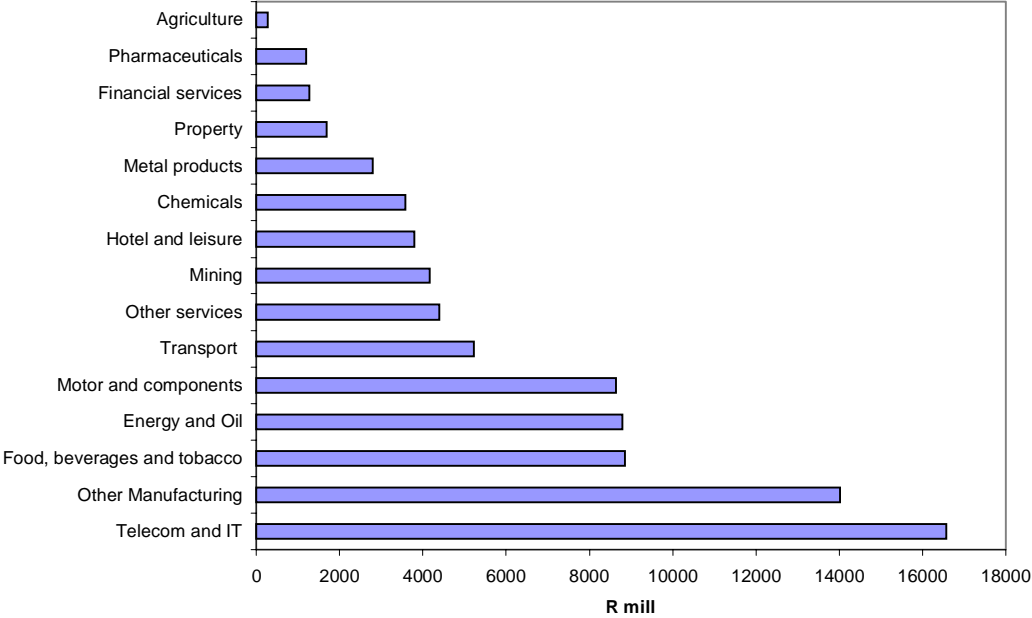
Source: BusinessMap

Notice that the telecommunication sector has been the largest recipient of foreign direct investment. Having access to high-quality services at reasonable costs is probably crucial for attracting FDI in other sectors as well. This is because the major multinational companies have already outsourced many producer services and depend on external supply of such services wherever they chose to locate production. Services that cannot easily be traded over geographical distances thus have to be provided locally, and multinational firms may be reluctant to reintroduce such services in their own organization and therefore chose locations where such services are readily available.

5 Challenges for South Africa

In this study we have seen that producer services have experienced unprecedented growth both in terms of output and labor productivity during the 1990s in South Africa. It is suggested, but not documented, that these improvements largely stem from extensive investments in ICT. Yet, economic growth for the economy as a whole has been dismal during the 1990s. Looking at experience from the OECD countries, a discrepancy between growth in ICT-intensive industries and the economy as a whole is not surprising. Solow's remark that computers are found everywhere except in the productivity figures of the economy is well-known and indicates that it takes time before the diffusion of ICT has been accompanied with the complementary skills requirement and organizational change that are necessary to reap the full benefits from ICT.[15] Only recently have computers made a mark on productivity figures in the OECD countries.

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[14] GATS entails regulation of all these modes of servicing foreign markets.
[15] See Brynjolfsson and Hitt (2000) for a discussion.

We have further discussed the potential gains to the economy as a whole from having access to more, better quality and a broader range of producer services. While some of these gains are incremental, others represent a switch to a fundamentally new and more efficient business practice. We illustrated this point by the example of switching to Internet-based financial services, and the example of switching from tailor-made to standardized inputs. The latter technology switching not only improves productivity, it shifts the entire cost curve downwards, and in many cases significantly so. There is, however, a possibility that shifting from tailor-made to standardized inputs may shift the cost-function upwards to a higher level if the number of standardized, but different inputs are small. When this is the case, firms will obviously not change technology. Increased tradability of producer services may be the deciding factor for whether the cost curve will shift up or down for firms operating in smaller markets such as the South African market.

Finally, we have seen that producer services constitute the glue that holds supply chains together. The cost and quality of such services may thus determine whether or not a South African producer can participate in international supply chains directly, whether the company is limited to the local market, or eventually whether it can enter international supply chains indirectly through a mediator, which will capture some of the gains from doing so. Participating in international supply chains may improve productivity through better capacity utilization and exploitation of economies of scale, if any. It may also improve productivity through technology transfers from the customers although it is often the firms managing the supply chain that reap the benefits from such productivity improvements (Lucking-Reiley and Spulber, 2001).

Both the production and the use of ICT are relatively skills-incentive. The scarcity of skills in the South African economy is well documented and may pose the major obstacle for modernizing the economy and fully utilizing the relatively well-developed producer services already available in the economy. Producer services can to an increasing extent be imported through arms-length trade and FDI, and thus alleviating the constraint imposed by skills scarcity on further developments in the producer services sector itself. However, imports can probably not induce the organizational changes in manufacturing necessary to fully benefit from the introduction of ICT. More research is however needed before the extent of outsourcing and organizational changes in the manufacturing sector can be established.

To conclude the paper, South African producer services and related infrastructure appear to be well developed, at least in the industrial centers, and do not appear to be a bottleneck for the South African economy to benefit from the ICT revolution and participate in international production networks. However, substantial growth in the producer services sectors appears to have had little effect on growth rates in other sectors using these services as inputs. A first condition for producer service sector developments to benefit other sectors is obviously that they use these services. It is suggested that reducing the concentration in South African industries, lowering the barriers to trade and investment in all sectors, skills upgrading and organizational modernization, particularly in the manufacturing sector, are crucial factors for increasing the prevalence of outsourcing, and thus the purchasing of services from the market. We use the phrase "suggest" because a more thorough analysis using firm-level data on investment in ICT, including software, sources of inputs and organizational features are necessary to draw firm conclusions.

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