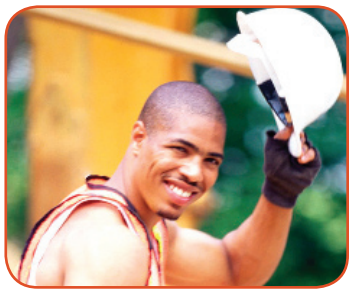


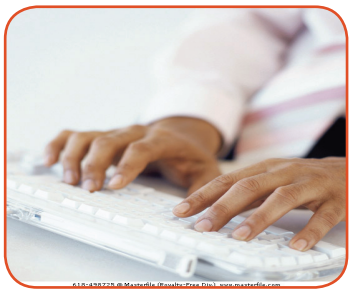

WHICH SECTORS CAN BE ENGINES OF GROWTH AND EMPLOYMENT IN SOUTH AFRICA?

An Analysis of Manufacturing and Services

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Which sectors can be engines of growth and employment in South Africa? An analysis of manufacturing and services

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ABSTRACT

This paper investigates the relationship between the manufacturing and services sectors in South Africa and between each of them and the rest of the economy, in terms of capacity to drive and support economic growth and employment retention and creation. A key question in this regard is whether manufacturing (still) has the potential to be the key engine of economic growth, or whether services or services subsectors can play this role in future. This has critical implications for whether the relative decline in manufacturing and rise in services in the South African economy will affect the prospects for sustainable growth and for addressing the crisis of unemployment. International comparisons reveal that while the share of manufacturing value added in South Africa is high for our level of income, the share of manufacturing employment is less than would be expected. Meanwhile, the shares of both services in GDP and services employment are both higher in South Africa than would be expected based on international patterns. The paper develops theoretical perspectives around the implications of sectoral structure for growth and development processes, drawing in particular on Kaldorian, Hirschmanian, and Marxian ideas. Critical points emerging from these discussions include the special characteristics of manufacturing in the growth process; the relevance of the distinction between commodity-producing sectors (which generate value, and which may be either in manufacturing and services) and those activities that do not generate value but which may be supportive of ongoing or accelerated production; and the various channels through which sectoral growth can raise overall economic growth, with the relative importance of these channels depending in part on the 'binding' constraints on growth in a particular economy at a particular time. Investigating some of these channels further, various backward and forward linkages in the economy are calculated and discussed, with a focus on the manufacturing and services sectors. These reveal the centrality of manufacturing as a source of demand in the South African economy, both directly and indirectly. The demand from manufacturing for the output of the service sector implies that a decline in manufacturing could negatively affect the future growth of services, as for the rest of the economy. This is not to undermine the importance of services – which account for over half of GDP, are also a significant source of demand, and the price and quality of services inputs into manufacturing will affect the competitiveness of the latter. Nevertheless, the findings of this research suggest that manufacturing remains more important in terms of 'growth-pulling' than is services. On the other hand, services are absolutely central in employment creation, both directly and indirectly. This is notwithstanding the underemployment of 'low-skilled' workers in services. Further, services are highly heterogeneous and subsectors such as ICT share similar characteristics as manufacturing. To some extent these differing qualities of sectors present a tension in prioritising growth and employment. However, this trade-off is mitigated to the extent that the current level of unemployment in South Africa itself constitutes a constraint on growth.

Keywords: manufacturing, services, employment, growth, multipliers, input-output, South Africa
JEL Codes: D57, J21, L52, L60, L80, O14, R15

1 Introduction

The basic object of this paper is to investigate the relationship between manufacturing and services in South Africa, and the relationship of each of these sectors to growth and employment in the overall economy.

Some of the questions with which this paper attempts to engage are as follows:

- Does manufacturing 'pull along' services, or the other way around?
- Does manufacturing act as an engine of the economy?
- Does manufacturing in South Africa – or sectors of manufacturing – have the 'special qualities' that are typically associated with it and that accord it a special place in the growth process? Are there service sectors that share in some of these properties?
- In what ways can growth in a particular sector induce or support net growth in the overall economy, over and above the actual growth in the sector?
- Is South Africa experiencing premature deindustrialisation?
- In sectoral terms, where should we look to for sustainable future growth and employment creation?

This paper contains preliminary research, and does not claim to answer any of these questions conclusively. However, it does shed some light on them, in some cases coming up with surprising results, and where relevant points to future research directions.

Section 2 of this paper looks at some of the relevant issues from a theoretical perspective. This includes a discussion of the various dimensions of the changing sectoral composition of an economy over time; and different theoretical approaches regarding how sectoral structure matters for growth and development – in particular, what are regarded as the special properties of manufacturing; as well as the relationship between manufacturing and services in particular. This section also sets out a conceptual template for thinking through the various ways in which sectoral growth can contribute to higher overall economic growth.

Section 3 provides an overview of relevant empirical trends in the South African economy, with an emphasis on a comparison of the manufacturing and services sectors. It also investigates trends in the sectoral composition of the economy in an international context. Section 4 then empirically investigates some of the conceptual questions discussed in section 2, in particular the relationship between the manufacturing and services sections in South Africa and the contributions of each to overall growth and employment. Section 5 concludes.

2 Sectoral composition and growth and development

2.1 The changing sectoral composition of an economy in the development process

Kuznets analysed the structure of and changes in the economy in terms of the agricultural, manufacturing, and services sectors. The somewhat less 'neutral' conceptualisation of the economy in 'primary', 'secondary' and 'tertiary' sectors is traced back to Fisher (1939), and was restated by Clark (1940), albeit with a slightly different meaning of the 'tertiary' sector. This developed into the Fisher-Clark 'three-stages' theory of growth.

The shift from agricultural to manufacturing is explained by three main factors, encompassing both the supply and demand sides. First, changes in comparative costs and differences in their respective rates of growth of productivity (the rate of growth of productivity in manufacturing being significantly higher, owing to factors such as economies of scale). Second, changes in preferences (towards manufactured goods) and income-elasticities of demand (those of manufactured commodities being higher than those of agricultural goods). Third, the impact of a changing international division of labour. Fourth, the increasing division of labour within an economy. Initially, an increase in agricultural productivity led on the demand side to higher income in agriculture, which increased the demand for manufactured goods, while on the supply side to an increase in the division of labour, towards manufacturing. Similar, but not identical, dynamics would subsequently be at work in economies' shift towards services.

I would argue that caution should be applied to extrapolating or generalising the primary-secondary-tertiary transition. The transitions in developed countries may have been facilitated, at least in part, to the earlier existence of colonies and later to developing countries to which earlier stages of manufacturing could be shifted as developed countries moved towards services. The demand for manufactured goods does rise with income, and this growing demand for goods does need to be satisfied by goods being produced somewhere. This may suggest a limit to the manufacturing-services transition at an international level.[1] Developing countries may not undergo the same type of manufacturing-services transition as has been underway in developed countries, insofar as this has resulted from an international shifting around of production.

[1] However, it should be noted that a 'limit' on a manufacturing-services shift applies more to output in terms of 'quantity' than in terms of 'value'. If trends towards declining prices of manufactures continue, then even if people are consuming the same amount of manufactures as previously, apparent 'limits' to the manufacturing-services transition would not necessarily apply as might otherwise be expected.

2.2 Classical developmentalist and heterodox approaches

There has traditionally been a strong argument in (at least parts of) the heterodox economics literature that there is a sector-specificity in the economic growth process. This implies that a unit of value added is not necessarily equivalent across sectors, notably in terms of in terms of its growth-inducing effects. Such an approach can be distinguished from those parts of the growth literature that tend to see growth as sector-neutral (as well as activity-neutral in the traditional Solow-type growth models and some endogenous growth theories, or activity-specific such as in the new endogenous growth theories that emphasise the importance of R&D and human capital).[2]

The classical development economics literature posits a strong relationship between changes in the sectoral composition of an economy and its rate of growth. The intersectoral reallocation of labour from low- to high-productivity activities is seen as central to increases in overall productivity in developing countries. Specifically, industrialisation and the growth of manufacturing is the engine of technical change and economic growth. This differs from developed countries where technological innovation, rather than changes in the sectoral composition of the economy, is most important for raising aggregate productivity.[3] Further, in the absence of sufficient dynamism, neither technological progress nor productivity-enhancing structural changes in the economy are likely to reduce employment.

In some sense Kaldor's contribution might be regarded as formalising and rationalising the empirical regularities and stylised facts discussed by Kuznets and developed and tested by Chenery and Syrquin. To this Kaldor added an analysis of why manufacturing has such special qualities relevant for growth. The Kaldorian approach does not assume the efficient utilisation of all resources – unlike neo-classical theories. This means that an intersectoral shift of employment (or similarly of other resources) can increase aggregate productivity.

The heterodox literature – notably that in the broad Kaldorian tradition[4] – has seen the manufacturing sector as being imbued with 'special characteristics' that are not shared by the other sectors[5]. This leads to the manufacturing sector being accorded a special place in understanding the causal relationships of the growth process, as well as suggesting that from a policy perspective there needs to be a particular focus on the manufacturing sector.

The special characteristics typically attributed to the manufacturing sector include:

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[2] See Palma (2005).

[3] Note also that developing countries may gain some of the benefits of technological innovation in a form embodies in imported machinery.

[4] Others associated with this type of approach include Verdoorn, Kalecki, Hirschman, Prebisch, Pasinetti, and Thirlwall.

[5] Note that these arguments are not necessarily mutually exclusive from the approach outlined below with respect to a Marxian approach.

- The idea that manufacturing growth 'pulls along' economic growth in ways that growth in other sectors of the economy does not.

- Dynamic economies of scale[6] in manufacturing, such that the growth of productivity in manufacturing is higher the higher the growth in manufacturing output[7]. This is related to the notion that 'learning by doing' is more important in industry than in agriculture or services. Learning by doing, innovation, and intersectoral linkages thus render overall productivity growth endogenous to growth in dynamic manufacturing sectors. This of course means that expanding the manufacturing sector would raise manufacturing (and non-manufacturing) productivity.

- The argument that most technological change occurs in the manufacturing sector. Further, that technological change that does occur in the rest of the economy actually tends to be diffused out from the manufacturing sector (see cumulative causation), in part through the use of higher productivity manufacturing inputs in the 'production' process of the rest of the economy. These kinds of technological-change externalities are one form of Hirschman-type intersectoral linkages.

- That manufacturing is critical to alleviating balance of payments constraints that can impose a 'stop-go' pattern on developing countries' growth and hence to supporting sustained high growth rates, particularly in the absence of a strong primary commodity export sector with stable and favourable terms of trade.

Concerns have arisen in this type of literature in recent years, although more broadly as well, concerning deindustrialisation and premature deindustrialisation in particular. By way of stylised facts, not only have levels of manufacturing employment corresponding to particular levels of GDP fallen, but the turning point of GDP per capita at which manufacturing employment as a percentage of total employment has tended to decline as well. Further, trade liberalisation appears to have accelerated deindustrialisation in a number of emerging economies. This has raised concerns that such economies may not be able to take advantage of the apparent broader benefits of manufacturing growth as much as they could have.

2.3 Marxian approaches to surplus-producing and non-surplus-producing activities

In Marxian approaches, the key distinction would be between those activities that produce surplus and those that do not. Surplus is generated in the production of commodities. The distinguishing feature of commodities is that they are produced for exchange rather than for own use, that is, they have not

[6] Note that this refers to economies of scale at the sectoral level, not necessarily in terms of the enterprise level.

[7] However, note also that in an open economy, economies of scale may be associated with falling prices, depending in part on demand conditions.

only use-value but also exchange-value. Commodities are not limited to physical objects, but may also include certain types of services. Thinking in terms of the circuit of capital $M - C\begin{Bmatrix} LP \\ MP \end{Bmatrix}...P...C' - M'$, value is expanded in the commodity production process *P* through the contribution of labour power *LP*, hence the produced commodity C' has greater value than the commodities *C* used in the production process. Value is thus added specifically in the *production* process. (Production does not, however, necessarily refer to the physical production of a tangible object.)

Applying this paradigm to the questions at hand around the respective roles of the manufacturing and service sectors, a critical consideration is whether or not the activity produces commodities. While all manufacturing activities[8] produce commodities, some service activities (such as restaurants) do produce commodities, others (such as retail trade or financial intermediation, in general) do not. This corresponds with the distinction between productive and unproductive labour, where productive labour is engaged in the production of surplus while unproductive labour is not.[9] Manufacturing work would be regarded as productive, as would services jobs in which surplus is directly produced. Also note that some service activities – for example transport – would have differential surplus-producing properties according to the specific context and end use: leisure transport, transport of workers to their place of employment, transport of final commodities, and transport of inputs into the production process would each have different roles in the circuit of capital.

It is also relevant to distinguish between the productivity/unproductivity of labour at the levels of the individual capitalist versus the social level. Some costs of circulation may be completely unproductive from a social point of view, but may be 'productive' of value for an individual capitalist by increasing the selling price of his commodity. These activities increase the surplus of a capitalist merely by transferring surplus from elsewhere without increasing the overall sum of value or amount of surplus.

A component of surplus labour in the circulation process can be considered as surplus, in the sense that the labour can result in additional surplus for the capitalist in excess of the wages paid. However, this surplus labour is 'sterile' in the sense that it does not produce surplus value, unlike surplus labour engaged in the production of commodities. The surplus that the capitalist is able to appropriate through the employment of surplus labour is actually simply transferred from surplus that was generated in the production of commodities in the productive circuit of capital.

Marx distinguishes between three types of circulation costs: pure circulation costs, costs of storage, and transport costs. Pure circulation costs facilitate the transformation of value into or between its money and commodity forms. Storage services preserve value that has already been created. Transport services of commodities (not of people) can be productive of value for both

[8] Save those where the product is used by the producer rather than sold.

[9] Note that the concepts of productive and unproductive labour in the Marxian sense have no relationship with the conventional economic meaning of labour productivity, nor do they carry any connotations as to the effort or worth of different types of labour.

the individual capitalist and socially. In fact, although nominally part of the circulatory phase, transport of commodities prior to their sale can actually be considered part of the production phase. Other circulation activities do not generate surplus value but perform particular functions in return for a portion of the surplus appropriated in the production process. Overall, the functions performed in the circulatory phase allow for the realization of the value created in production.

Service activities in the circulatory sphere may raise the price of a commodity above its underlying value, hence creating a façade of value-creation, but without actually creating any new value. For instance, marketing activities that associate a particular brand name with a line of clothing may allow a higher price to be realized in the sale of these commodities than would otherwise be the case, but do not themselves transform the commodities in a value-creating process.

Service activities that produce commodities in the production phase are however a different matter. As mentioned earlier, commodities may be goods or services. A haircut performed for a customer at a fee is a commodity, and in the 'production' of the haircut value is generated through the productive labour of the hairdresser. This is very different from services in the circulatory phase of the circuit of capital.

From this perspective the key distinction is thus not between manufacturing and services per se, but between those activities that produce surplus and those that do not. This is not to imply that non-surplus producing activities are not important for the economy. However, their role is different from surplus-producing activities. Non-surplus-producing activities are essential in the sphere of circulation (that is $P...C' - M'$), without which the surplus extracted in the production process cannot be realized and hence reinvested in further production. Non-surplus-producing activities, particularly in the financial sector, are also critical in the initial $\mathrm{M} - \mathrm{C}$ stage. Further, non-surplus-producing activities are important for accelerating the velocity of circulation, thereby increasing the *rate* of accumulation. The financial circuit of capital is also critical to accumulation as it allows for the scale of production to be expanded through the credit system.

Of course, not all commodity-producing activities are equally important for accumulation, growth, and employment. One relevant distinction in this regard is between activities that produce Department I commodities (the means of production) and Department II commodities (wage goods). The former will have stronger forward linkages and are in general more likely to contribute to economic growth. A Department I service may thus be potentially more relevant for growth than a Department II manufacturing activity (although most commodity services – i.e. those that are not part of the circulatory phase – are likely to fall within Department II). However, this dimension of commodities is of course not the only feature relevant for accumulation, growth, and employment.

Non-surplus-producing activities may be essential for the realization of surplus, or for the realization of surplus at higher rates than would otherwise

be the case. In turn, a portion of the surplus generated through the commodity production process must be diverted to other fractions of capital in order to support these functions. The profits from, for example, sales or bank lending or typical business services are actually transfers of the portions of the surplus appropriated in the commodity-production process. However, insofar as such transfers of portions of the surplus to complementary service activities increase the rate of surplus on an ongoing basis, the mass of surplus available to surplus-producing activities may actually increase despite the transfers.

One interpretation of a Marxian approach nevertheless privileges surplus-producing activities. Intuitively, this emanates in part from the centrality of the production of surplus for accumulation and economic growth. Given that non-surplus-producing activities divert a portion of the surplus generated in surplus-producing activities (although the former may in fact be a condition for the realization of surplus or may raise the net surplus accruing to surplus-producing activities), in a closed economy it would be the surplus-producing activities that in some sense would be central to economic growth.

Significantly, in an open economy this does not necessarily hold, insofar as portions of surplus produced in other countries may be received domestically as payment for even non-surplus producing services. For instance, the expansion of service activities such as finance to other African countries may divert a portion of the surplus produced in those countries to South African financial institutions. Although these financial activities have not themselves produced any surplus, they can in such a case increase the net amount of surplus available domestically (of course at the expense of the economy from which the surplus has been transferred).

Ceteris paribus, the higher the rate of surplus value, the greater the amount of surplus potentially available for accumulation. However, the rate of surplus can also proxy (or, depending on how it is measured, is related monotonically to) the rate of exploitation. Aside from the principled and distributional concerns associated with a higher rate of surplus value, this can also be associated with problems of realization, as wages are the source of demand (for Department II goods). An excessively high rate of surplus value that confronts the circuit of capital with problems of realization can thus be counterproductive for sustainable growth.[10]

Marxian tools of analysis can also be applied to understanding deindustrialisation. One form of deindustrialisation – 'backward' or 'downward' deindustrialisation – could be a shift from manufacturing towards primary production that only produces the raw material components of the means of production for the production stage ('P') in other countries.

[10] These problems of realization may be mitigated through foreign demand, but this can only really alleviate problems at the sectoral level rather than at the aggregate level, as there must be a matching domestic demand for imports (unless there is tolerance for accumulating an ever-increasing stock of reserves). The gap can also be mitigated in the short- to medium-term by the granting of credit (diverted from surplus value) to the working class in order to finance consumption in excess of wages.

This would be one form of a changing international division of labour in which the production of surplus is shifted between countries. The loss of manufacturing activities to the deindustrialising country would deprive it of direct surplus production (or reduce the proportion of surplus value per unit of output). Instead it would receive a portion of the surplus produced elsewhere in a simple exchange for primary products sold.

The net payments flow associated with such a shift would depend on the terms of trade. Both primary products and manufactured commodities could be exchanged at prices above or below their values. Of course, the trend has been towards deterioration in the terms of trade associated with primary products, and hence backward/downward deindustrialisation would typically be associated with both a worsening of both the balance of payments and the net amount of surplus available domestically for accumulation (or for other uses). On the other hand, if terms of trade favour services (for instance owing to differential income elasticities of demand between manufacturing and export-services), upward/forward deindustrialisation could improve not only the balance of payments but also the amount of surplus available domestically, despite a fall in the domestic generation of surplus.

Deindustrialisation could also take the form of the weakening or subordination of the circuit of productive capital vis-à-vis the circuit of money capital or of commodity capital. An example of this is the trend towards financialisation – both in terms of the rising importance of financial activities in non-financial corporations, and the increasing dominance of financial over non-financial corporations – particularly in developed countries.

To understand why such trends might occur, a starting point could be a comparison of the rates of surplus value obtaining from industrial production, relative to the rate of profit on merchant capital, the rate of interest on money capital, etc. These relative rates of return could be influenced by various natural, social, political, and other factors. Policy interventions may also deliberately raise (lower) the rates of return on particular sectors or activities in order to incentivise (discourage) these. In addition to influencing relative rates of return, policy could also influence the distribution of capital between industrial and non-industrial activities more directly – by the state directly engaging in production, limiting the number of enterprises licensed to engage in certain activities, and so on.

The actual rate of return in a given activity at a point in time thus need not (and in practice is unlikely to) equal the *potential* rate of return. Effective industrial policy interventions could increase rates of return (just as various factors could lower them).

Although there would be a general tendency towards the equalisation of the rates of return on different types of capital, differential rates of return could in fact persist for some time. This could derive from factors such as the differential political power of different fractions of capital (for example the financial vs. industrial fractions of capital) as well as blockages to full (domestic) capital mobility. For instance, the subordination of the productive circuit to the money circuit could take the form of financialisation and result in a blockage in converting M' back into the next C for further industrial

production. Or on the other hand the subordination of the productive circuit to the commodity circuit, with 'excessive' surplus being diverted into the $C' - M'$ stage (manifest for example in capital being invested in shopping malls rather than factories, powerful oligopolist retailers being able to set the terms of commodity production as well as exchange, etc).

Thus, at a domestic level, a lower rate of surplus extraction on commodity production in manufacturing than the rate of interest on financial capital or the profits on commodity exchange, deindustrialisation would be likely to occur and the circuit of productive capital to be subordinated or decentred relative to the circuits of money or commodity capital.

When the international mobility of capital is factored in, the rate of return on manufacturing need not be lower than that on other sectors in a country for deindustrialisation to occur. When the rate of return on a manufacturing activity is perceived to be potentially higher elsewhere in the world, production might relocate resulting in a process of deindustrialisation, despite a positive rate of return (which may be even higher than for other sectors in the country).[11]

At an international level, deindustrialisation can thus be associated with the breaking up of the productive circuit of capital between countries. Deindustrialisation could occur in a developed country where the P stage shifts to another country (for example if wages are lower there and so the rate of surplus value is higher), but the $M - C$ and/or the $C' - M'$ stages remain behind. Or deindustrialisation could occur in a developing country where the P stage shifts elsewhere, and the country's economy becomes (re)centred around the export of raw materials as part of the C for that manufacturing production elsewhere. In 'neo-colonial' patterns of surplus transfer between countries, these raw materials are exported at a price below their value with the difference accruing as a superprofit to the country importing these raw materials (or the country in which the multinational importing the raw materials ultimately pays its dividends).

Given that it is through industrial production that surplus value is extracted and that surplus forms the basis for accumulation, any country's accumulation drive would need access to surplus, which ultimately derives from the circuit of production. Of course a country can still deindustrialise while accumulating and growing – but it would need to access surplus that ultimately originates in the production of commodities somewhere. Very high profits could obviously be made on commodity exchange or financial lending (especially where unequal exchange is sustained, through political or other means), but these can only be a transfer between capitalists and cannot create any new value themselves. If there were deindustrialisation on a global scale, this would limit the basis for the overall extraction of surplus value. This could be countered by the extraction of a higher rate of surplus on production that does take place,

[11] This could occur in the absence of the equalisation of the rate of return globally, which is highly unlikely in practice as the barriers to equalisation at the domestic level as discussed would be considerably magnified at the international level.

notably by squeezing wages; and/or by a capitalist class attempting to appropriate a greater share of the 'global' surplus.

The above discussion develops (at a superficial level) a broad Marxian approach (although it should be noted that there would be different perspectives within different Marxian schools of thought on some of these questions). Marxian analysis has not (to the author's knowledge) been comprehensively applied to the types of questions that this project is interested in investigating, but the perspective set out above may provide one analytical way of thinking through the relevant questions, as well as resonating with what is commonly intuitively believed.

3 Conceptualising the services sector

3.1 Approaches to the services sector

The classical or traditional conceptualisation of services was as products of labour that are consumed *as* they are produced. This would mean that a stock of services cannot be accumulated (either by the producer or consumer). However, this conceptualisation is rather restrictive, and pertains specifically to services whose production and consumption are inseparable in time and space. Technological progress has however expanded the range of services which *can* be separated in time and/or space (although this separation may come with a loss in efficiency). Nevertheless, services in general are characterised by non-transferability and non-storability; and by the fact that they do not produce or modify physical goods.

In mainstream economic theory, there has emerged a new understanding of the role of services in economic growth. In the new growth theory framework, for example, services (especially those classified as 'complementary' capital, such as transport, utilities, and communications) play a key role in growth. The two key interrelated questions asked by this approach regarding growth is why there is such little 'convergence' of income per capita across the world, and why capital moves out of developing countries. The answer given is because of a lack of 'complementary capital' and market friendly governance in developing countries (in particular, lack of security in property rights). Capital may theoretically have a much higher productivity in a developing country (due to its relative scarcity there). However, that potentially high productivity cannot be realized unless there is at least a critical mass of 'complementary' capital providing the type of services without which productive capital cannot operate properly. So, in this mainstream new growth theory approach, economic growth depends crucially on the supply of two 'services' (and it is further acknowledged that in both, governments should play a crucial role in their supply). One, is the availability of a critical mass of the type of services provided by 'complementary' capital; the other, the proper provision by governments of the 'property rights service'. If these two types of services are missing, there would be little 'convergence', as financial capital would continue to fly out of developing countries and productive capital would not be able to realize its potentially high productivity.

The HSRC undertook an earlier, empirically focused study on the services sector and related policy, titled 'Leveraging Services for Growth, Education, and Equity'. Services have typically not received the same attention as manufacturing in economic policy: perhaps this is because services were historically mostly non-tradable. As local service firms did not compete internationally, there was not substantial concern over the level of efficiency, product range, product quality and rates of innovation of domestic service sectors. The study argued that four factors that have challenged this approach to the services sector. First, the imminent reduction of barriers to trade in services will expand opportunities to export services, while exposing the domestic services sector to global competition. Second, that services appear to increasingly have their own markets dynamics, with increasing diversity of market segments, technology change, and so on. Third, many of the costs that undermine the competitiveness of the South African economy emanate from the services sector: communications, transport and utilities. Fourth, in a context of high and growing unemployment, the domestic-oriented services sector provides a potential avenue for employment creation.

3.2 Classification of different types of services

Various alternative classifications of services have been proposed in the literature. Some of these are briefly reviewed here, not out of an interest in the taxonomy of services per se, but as this is relevant to conceptualising different types of services and how they may relate to manufacturing and the rest of the economy. There are three broad ways of classifying services: according to whether they are for intermediate or final demand (using IO tables, etc.); a related classification is based on the end user – producer, consumer, and (sometimes included) government services; and between market and non-market services. These classification approaches are not necessarily mutually exclusive, and the merits might depend on what one is interested in.

Katouzian (1970) proposed the classification of services into three categories: 'new services', 'complementary services' and 'old services'. 'Old services' are those whose importance declined since industrialisation, owing to changes in the mode of production and its impact on social relations. He suggests domestic service as the pre-eminent example of this category of services, foreseeing a decline in the share of domestic services in total services over time. 'New services' (the conceptualisation of which roughly approximates Fisher's definition of the tertiary sector) are those whose consumption took off since the Rostovian stage of high mass consumption of manufactured products, notably consumer durables. Before the age of mass consumption, demand for these services was limited to a minority and there were no huge shifts in demand for them. The 'new services' include medical services, education, entertainment and tourism. Demand for such services tends to be highly income-elastic, and is an increasing function of both income and leisure time. One could also suggest several types of 'new' services in the domestic services sphere, not included by Katouzian at the time that he wrote, which are highly income elastic: examples include personal security, professional home-based nursing care for the elderly, and so on. Thirdly, 'complementary services' are those complementary to industrialisation, and whose production normally

takes a 'sharp turn' with the rise of the growth of output in general and manufacturing production in particular. These services would include financial services, trade, transport, and certain government services. Katouzian argues that these services are complementary to manufacturing in two ways: firstly, as complementary factors to urbanisation, and secondly, as necessary links to round-about or capitalist production. Sabolo (1975) also distinguishes between 'new' and 'old' sectors, where the former tend to have positive income elasticity of demand while the latter are traditional types of services and often have negative elasticities of demand, such as domestic services or small trading.[12]

In their influential classification, Gershuny and Miles (1983) classify sectors according to the nature of activities and the factors involved in the supply and demand of the activities. They distinguish between marketed and non-marketed services, further subdividing the former into producer, distributive and personal services.

Hirsh (1989) argues that services should be classified according to the *primary reason why the service is demanded*. He distinguishes three categories in this regard. Firstly, services that are demanded in order to obtain immediate benefits (for example, services such as tourism or entertainment). Secondly, services demanded for their capacity to enhance a user's consumption benefit capacity by reducing the cost-benefit ratio per product transaction (for example, transport or communications). Thirdly, services demanded for their capacity to enhance the user's productive capacity by reducing the cost-benefit ratio per unit of output (for example, business services or some forms of transport).

These various alternative distinctions between different types of services can be relevant for thinking through the heterogeneity of the services sector. The levels and rates of growth of productivity are generally regarded as being lower in services than in manufacturing[13]. Reasons for this include that the generally labour-intensive nature of services makes it difficult to extract increasing returns from them, and they are actually likely to have diminishing returns; and that it is difficult to increase the efficiency of services through economies of scale, investment, or innovation.

However, certain service subsectors may exhibit some of the positive growth-inducing qualities traditionally identified in the heterodox and developmentalist literature with manufacturing, as discussed above. This would tend to hold more strongly for service sectors with relatively standardised output, and sectors that do not necessarily involve direct ongoing personal contact between the producer and consumer. The potential positive growth-inducing characteristics of services are especially relevant for those services with strong 'complementarities' in the process of production.

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[12] A key issue in the income elasticity of some of these 'old' services, such as domestic services, is real wages. It is only when real wages begin to increase that the income elasticity of demand for domestic services begins to fall significantly. For instance, in economies with high rates of (legal or illegal) immigration, the fall in the income elasticity of domestic services is delayed by the use of a significant proportion of (cheaper) migrant workers in this activity.

[13] Note the South African trends as shown in figures 17-22

There is greater potential for economies of scale within service sectors which have automated processes requiring standardised inputs and generating standardised outputs. These types of sectors – for instance telecommunications – are more likely to be 'internally dynamic' in similar ways as are associated with manufacturing. Other types of service sectors may have 'manufacturing-type' qualities in terms of their potential for raising productivity or growth in other sectors. The IT and finance sectors may be examples here, sometimes thought of (for instance in new growth theory) as 'complementary investment'. We will return to some of these issues in the section below on conceptualising the ways in which sectoral growth can enhance or support additional overall economic growth.

3.3 Linkages between manufacturing and services

Park and Chan (1989) discuss the changes in the linkages between manufacturing and services at different stages of economic growth. In the early stages of industrialisation, the types of services that are most important tend to be small-scale and informal in nature, with the consumers being predominantly low-income. As industrialisation progresses, the importance of these types of activities diminishes. The manufacturing sector increasingly stimulates demand for service inputs. Further, rising incomes generate increased demand for social and personal services. In late industrialisation and in 'post-industrial' economies, services account for an increasing share of employment, often in fact the bulk of employment. This owes both to the growth of the services sector (absolute), as well as to the decline of manufacturing employment (relative).

Bhagwati argues in his seminal paper (1984) that services that splinter off from manufacturing are technically progressive (and relatively likely to be capital intensive), as services arising from specialisation are technically progressive, reflecting economies of scale, as well as being part of a dynamic process of the division of labour and economic change. On the other hand, services that are left behind after the splintering off of goods from services tend to be technically unprogressive (and more likely to be labour intensive).

However, Bhagwati's arguments do not necessarily hold, or at least not any more. With a shift of businesses to focus increasingly on 'core' activities, some of the services that 'splinter off' from manufacturing are not necessarily technologically progressive. Businesses may be motivated not only by narrow costs, but also by a desire to be rid of 'distracting problems', as well as wanting to be free from issues of labour legislation (particularly in relatively labour-intensive activities).

The growth and increasing sophistication and specialisation of manufacturing may generate increased demand for service inputs into manufacturing. To the extent that services grow as a result of this, such a shift in the composition of the economy should not be interpreted as services *replacing* manufacturing as it is associated with an increased demand arising from manufacturing itself. On the other hand, a rise in services associated with increasing per capita income is less directly connected with manufacturing (depending in part on the source of the rising incomes).

There are dual spillover effects between manufacturing and services. On the one hand, the growth in manufacturing leads to structural changes that render contracting out and outsourcing less costly and more efficient, creating additional demand for services and growth in the services sector. One component of this is simply a reallocation of output and employment from being measured in the manufacturing sector to being measured in the services sector. Another component may be more 'real' shifts associated with an increasing demand for service activities. Insofar as there are economies of scale in some services, both such reallocation and shifts may have important effects in increasing productivity.

On the other hand, the higher use of specialised services in manufacturing can raise manufacturing productivity, as well as growth in (and induced by) the services sector, creating additional demand for manufactured commodities. There is potential for a virtuous circle in which greater demand for services increases their profitability as well as facilitating a greater degree of specialisation.

Park and Chan argue that, "the capability of the services sector to generate and sustain a high level of employment critically hinges upon its vital linkages with the manufacturing sector". They contend that the employment absorptive capacity of manufacturing is underestimated, once not only the direct employment of manufacturing is taken into account but also the intersectoral demand of manufacturing for service inputs and the income-induced demand for services.

These issues of the relationship between the manufacturing and services sectors are explored empirically in sections 6 and 7 of this paper. This analysis includes an investigation of linkages between manufacturing and services (and subsectors of each of them) in order to shed light on the demand between the sectors; a comparison of various multipliers; and exploratory econometrical analysis of the 'causal' links between the sectors.

3.4 Outsourcing

There have been several key changes in the relationship between manufacturing and services in recent years. One of these is the tendency towards the outsourcing of service functions previously performed in-house within manufacturing. The business-type literature identifies various motivations and explanations for this trend. One of these is a move in favour of firms concentrating on their 'core competencies', which would suggest the hiving off of service activities considered to be non-core. Outsourcing is also purported to be cost-saving insofar as specialised external companies can provide the services at lower costs than would be the case in-house, for instance due to specialisation and economies of scale.

Service companies may develop expertise in solving similar types of problems across firms, in a way that an in-house services department may be less able. Outsourcing is also considered to increase firms' flexibility, in particular as it allows services to be brought in according to actual needs, hence minimising costly idle in-house capacity. Operating in an increasingly complex and

competitive environment, with changing market opportunities, and in some cases working according to 'just-in-time'-type processes, can increase the demand for service firms specialised in information, research, marketing, and so on. The trend towards outsourcing is also traced to changes in the manufacturing process itself, and the resultant need for increasingly sophisticated specialised service inputs; and similarly an increase in the demand for highly technology- and skills-intensive service inputs. These types of inputs tend to be more costly to maintain in-house than service inputs might have been previously, which may also increase the likelihood of their being outsourced.

On the other hand, outsourcing may also be an attempt to increase profits at the expense of workers. This could be achieved through lower wages, higher productivity through uncompensated higher effort levels, or the circumventing of labour legislation.

A related paper (Tregenna 2007) explores outsourcing in South Africa in recent years. The focus in on attempting to estimate the extent to which employment has shifted between the manufacturing and services sectors, associated with outsourcing. The study finds that a significant part of the relative decline in manufacturing employment and increase in services employment can be explained by this intersectoral outsourcing, although there does appear to be a real structural shift in the structure of the economy away from manufacturing and towards services.

3.5 Measurement issues

There are various problems with measuring productivity in services, and in particular with comparing productivity in services to that in other sectors of the economy. These are particularly germane to a study such as this one, which seeks to compare various aspects of the manufacturing and services sectors. Problems of measurement that are particularly applicable to the services sector include the following:

- The general unavailability of *market prices* for services provided by government.
- Difficulties in accurately measuring *output*. This is particularly pronounced in services such as health and education, as well as for services that are an ongoing process.
- A high degree of *heterogeneity* amongst services that are classified together.
- Difficulty in measuring *quality* and factoring in changes in quality.
- Generally *poor quality of official data* on services.[14]

[14] See, for example, Altman et al (2005), which discusses the serious problems with South African data on trade in services.

There do not appear to be satisfactory ways of overcoming these difficulties. Alternative measures proposed appear to be even more problematic. For instance, it has been proposed to use wage costs as a measure of labour productivity, given the difficulties in measuring productivity directly[15]. However, this is based on strong (and highly dubious) neo-classical assumptions concerning the equation of marginal costs and marginal productivity. Further, even within such an approach, wages would only impart information about marginal productivity, and nothing about average productivity, which is the more relevant concept for measuring productivity trends. In any event, there is no reason to think that available sectoral wage data is at all superior to employment and output data, if anything it is likely to be inferior (at least to employment data).

The problems would tend to be more pronounced for some subsectors of services than others. Government services are subject to particular measurement problems.[16] Sectors such as telecommunications or transport are arguably likely to suffer from less severe measurement problems than sectors such as personal services.

Further research could be undertaken specifically on the subject of measurement of particular variables (notably value added, employment, and productivity) in the service sectors. A literature review of any alternative measures or methodologies may be useful in this regard. However, given that some of the measurement problems discussed above relate in part to the inherent characteristics of the services sector, it is unlikely that completely satisfactory measures can be found. Further, proxy measures would need to be treated with caution in terms of how closely they measure the actual variable of interest. A helpful approach may also include primary research to verify the levels and (where feasible) the trends of key variables, through direct contact with industry bodies and major companies and stakeholders by sector.

4 Channels of sectoral contribution to overall growth

This section aims to provide a conceptual framework for thinking through the various ways in which growth in a sector of the economy can contribute to broader economic growth, over and above the sector's direct contribution to total output through its own value added (or its own direct contribution to economic growth through growth in its own value added). If an increase in the value added by a sector increases GDP by a factor exceeding that direct increase in value added, this would indicate additional indirect growth-inducing processes at work. It is these processes that are further discussed below. The object of this discussion is not to suggest ways in which growth can be enhanced; it is to discuss the channels through which growth in a sector can induce or support higher aggregate growth.

[15] It has been suggested that this should be measured in terms of average daily earnings, measured as the ratio of yearly payments to the number of working days.

[16] Note that the empirical trends discussed in this paper are shown (where appropriate) both including and excluding general government services.

Sectoral growth can bring about economic growth (over and above the actual sectoral growth itself) by feeding into any of four basic sources of growth: *net investment*, *technological change*, *the reallocation of resources to achieve higher output,* and *an increased level of resource utilisation*. The first two of these sources of growth relate to shifting the production frontier outwards, whilst the latter two deal with obtaining higher levels of output for any given production frontier.

Certain characteristics of a sector and the way in which it articulates with the rest of the economy affect the extent to which growth in that sector contributes to overall growth. Below I outline ten mechanisms through which sectoral growth can lead to net overall growth over and above that sectoral growth. These channels are: backward linkages; forward linkages; compositional effects; specialisation; trade; employment; innovation, technological progress and productivity growth; savings; fiscal; and institutional. For each mechanism, where helpful, I also discuss the characteristics of a sector that might determine the strength of that mechanism for that particular sector. Further, where relevant, the empirical investigation of relevance to that mechanism is mentioned.

First, a sector's *backward linkages* to the rest of the domestic economy create additional demand for the output of those upstream sectors. This additional demand may induce increased upstream investment and/or an increased level of capacity utilisation (including employment creation) upstream, as well as possibly promoting upstream technological upgrading.

The strength of a particular sector's contribution to growth through this mechanism would be determined by its degree of upstream vertical integration with the rest of the domestic economy. The lower a sector's value added as a share of its output, the higher the proportion of intermediate inputs. The higher the proportion of these intermediate inputs that are domestically sourced, the higher is the sector's degree of backward integration. Further, the overall effects on the economy would also depend on the nature of the sectors to which a sector is backwardly linked – their own backward linkages, and so on. The strengths of these direct and indirect backward linkages are measured and compared across the economy in section 6 of this paper.

Secondly, a sector's *forward linkages* to the rest of the economy can contribute to growth through impact on downstream sectors. If a sector's growth lowers the cost of its output which goes into intermediate inputs for downstream sectors, and to the extent that this lowers the cost faced by those downstream sectors below what it paid previously (whether for domestically sourced or imported inputs), this can result in growth-inducing downstream effects. These could include downstream investment, technological upgrading, or increased productivity and resource utilisation (again including employment).

The strength of this mechanism for a given sector depends on its degree of downstream vertical integration with the domestic economy. This would obviously be higher for sectors the lower the proportion of final output in their total output. Total forward linkages of a sector would also depend on the nature of its downstream sectors and their own forward linkages. The strength of direct and indirect forward linkages are evaluated in section 6 of this paper. Both of these first two mechanisms through which sectoral growth may

contribute to economic growth – the effects of backward and forward linkages – are Hirschman-type production linkages.

The *third* mechanism, of a *change in the sectoral composition of the economy*, is relevant when the existing sectoral composition of the economy is not 'optimal' for growth. This optimality could of course have different meanings, but would typically be thought of in terms of productivity. Growth in a sector with higher (marginal) productivity than the economy-wide average would, ceteris paribus, raise aggregate productivity, even if the expansion in that sector came at the expense of other sectors with lower average productivity. This mechanism can thus contribute to growth in terms of reallocating resources to achieve a higher output.

Empirically investigating a sector's (potential) contribution to growth through this mechanism could entail a comparison of productivity across sectors (although this would actually show average productivity, whereas marginal productivity is the more relevant concept). The productivity of up- and down-stream sectors would also be relevant to analysing the effect of the change in sectoral composition on overall growth.

Fourthly, sectoral growth can lead to increased *division of labour and specialisation* in the economy. As a sector grows and develops, 'non-core' activities are more likely to be outsourced (either within the sector or to other sectors). The tendency towards such increased division of labour and specialisation – which is found throughout economic history – tends to be associated with higher level of productivity and higher rates of growth. Growth-induced division of labour and specialisation increases the possibilities for benefiting from economies of scale and increasing returns, which can raise overall growth. For example, the hiving off of activities such as data processing, transport, or recruitment to specialised firms can allow these activities to be undertaken at higher rates of productivity than when undertaken within the original firm. Specialisation can thus feed into higher aggregate growth through a reallocation of activities as well as through progressive technological change.

Fifthly, a sector may contribute to growth through *trade*. The first issue in this regard is whether exports of the sector exceed import penetration in that sector, putting the sector in a net balance of payments surplus position. The second factor is the import dependence of the sector. Even a sector that is a net exporter (in the sense of more final output of the sector being exported than imported) may be a net user of foreign exchange if it is highly dependent on imported intermediate inputs.

Considering these two aspects jointly, if a sector is a *net generator of foreign exchange*, it may contribute to growth, as the foreign exchange surplus can increase investment in the economy as well as providing the foreign exchange needed for imported inputs into other productive activities in the economy. By mitigating balance of payments constraints on other sectors of the economy, sectoral growth that generates net foreign exchange can facilitate a reallocation of resources across the economy in a manner that supports higher growth.

Many growth theories also emphasise the 'supply-side' role of international trade in economic growth. According to these theories, the crucial 'incentives'

for technological change and productive efficiency (not just in the traded sectors but in the overall economy) arise from competitive trade pressures. This is both for exports having to compete in international markets, and for domestic activities having to deal with the competitive pressure of imported substitutes. Augmented Solow-type models have gone as far as introducing exports as a 'factor of production' in their production functions (alongside capital and labour).

To empirically investigate a sector's growth-inducing contribution through the trade channel, firstly the balance of payments position of a sector can be readily ascertained in order to establish the contribution of the sector's final demand to the balance of payments. Secondly, data estimates on the amount of the sector's intermediate inputs that are imported also need to be factored in order to ascertain its net position as a generator or user of foreign exchange.

The *sixth* channel through which a sector can contribute to economic growth is through growth-inducing or growth-complementing externalities of *employment* in the sector. There are a number of ways through which such effects can be realized. First, and perhaps most important here, wages paid are a component of domestic demand. Growth in a sector can increase the wage bill through an increase in average remuneration per worker in that sector and/or through an increase in employment in the sector. A higher wage bill in the sector can have growth-inducing effects by increasing domestic demand and thereby raising the level of resource utilisation. This may also induce increased investment. This is an important instance of a 'Keynesian-type' demand multiplier.

Secondly, the engagement of people of work as opposed to them being unemployed can preserve developed skills (both through on-the-job training as well as learning-by-doing) which can be positive for the current and future productivity of the economy. This can be considered a form of technological change, which can contribute to higher levels of aggregate growth.

Thirdly, higher employment can contribute to the fiscus through taxes on wages and incomes, as well as (to a limited extent given our non-comprehensive social security system) reducing the burden of social security and health and education co-payments on the state. This can potentially contribute to growth through a more productive reallocation of resources to achieve higher output.

Fourthly, in a less tangible way, higher employment can generate broader positive externalities through contributions to social stability and cohesion, lower crime, etc. This could potentially contribute to growth through an improved environment for investment, increases in total factor productivity, a reallocation of resources to achieve higher output, and an increased level of resource allocation. These are four channels through which additional employment generated through sectoral growth can have broader growth-inducing effects. These mechanisms are particularly important given the depth of our unemployment crisis.

In empirically investigating the strength of these employment-related growth-inducing or growth-complementing effects, both the direct and indirect

employment intensities of a sector are relevant. This means that an evaluation of a sector's (actual or potential) growth contribution through employment channels needs to take into account measures of the sector's direct employment-creating potential – notably the labour-intensity of output and output-employment elasticities – as well as measures of the sector's indirect employment-creating potential – best quantified through employment elasticities. These direct and indirect measures allow for a comparison of the employment-generating potential of growth in any particular sector.

The nature of marginal employment in a sector is also relevant in assessing the growth-inducing potential of the employment channel. One specific consideration here, which relates to the first of the employment-associated growth channels discussed above, is the composition of a sector's wage bill and specifically of the increase in the wage bill associated with sectoral growth. For instance, for a given wage bill, employment of a greater number of low-paid jobs is likely to have a higher positive effect on domestic demand given the higher propensity to consume domestically produced goods and services among low-income earners. Examining the wage levels and distribution by sector would be relevant to comparing this channel across sectors.

Lastly, the skills composition and degree of training and learning-by-doing is relevant to the extent to which employment in a sector contributes to skills preservation and acquisition. The degree of transferability of those skills is pertinent to the extent to which there is a contribution to the overall skills base and future productivity of the workforce.

The *seventh* mechanism through which sectoral growth can contribute to higher overall growth is through *innovation, technological progress, and productivity growth.* This is in fact one of the four basic sources of growth discussed above. First, innovation and technological progress 'internal' to the sector can raise overall productivity and competitiveness. Secondly, to the extent to which this innovation is transferable, it can raise productivity and competitiveness in other sectors. Thirdly, especially for the ICT sectors (as well as others sharing similar characteristics or roles), they are a direct input into the productivity and competitiveness of those downstream sectors. Fourthly, to the extent that productivity is endogenous to output, growth in a sector can raise overall productivity through economies of scale. In addition to acting as a direct source of growth, technological progress in a sector may also be favourable for investment – either within the sector or in other sectors.

This mechanism is particularly difficult to quantify or even compare across sectors in an empirical investigation. Single-factor productivity can be relatively easily compared across sectors and across time (although, as discussed elsewhere, productivity measures are not necessarily strictly comparable between, for instance, services and other sectors). Multi- or total factor productivity can be estimated using a production function approach, although there are various problems associated with this. Innovation and technological progress are not easy to measure directly. Where data exists on R&D spending, this is an indicator at least on the input side. Otherwise, measurement would tend to be based on the output side of technological progress, in particular in productivity trends.

The *eighth* channel is through *savings*. Surplus in a sector – if retained domestically – can contribute to aggregate savings which can feed into investment elsewhere in the economy, providing the basis for accumulation and growth. However, in evaluating whether or not a sector is a net saver, it is necessary to consider both its direct and indirect contributions to saving.

First, a sector can save directly, which can be used for investment in the economy as a whole. Secondly, the sector can give rise to incomes that go to agents that have high savings rates. In this regard, comparing two sectors that have the same direct savings rate, if one pays out incomes to agents that result in higher savings by those agents – either due to a higher payout or that the agents have a higher rate of savings than those paid out by a different sector – then that sector will have a higher indirect savings rate.

This is not to suggest that it is necessarily a negative characteristic of a sector to be a net dissaver, i.e. a net investor. A dynamic sector with high growth and profit prospects would be likely to attract investment from elsewhere in the economy and to be a net dissaver. It simply means that such a sector would not be contributing to additional overall growth through this particular mechanism. One can also note the possible trade-off between a sector's contribution to savings and its role in stimulating demand for intermediate goods from other sectors, in the sense that savings is a form of 'leakage'.

Quantifying a sector's direct contribution to savings is not difficult, except for the fact that as large corporations are usually engaged in more than one sector, it is difficult to allocate their overall financial surplus to their different activities. However, a sector's indirect contribution is much more difficult to measure, is contingent on what assumptions are used and would need a detailed analysis through a SAM.

The *ninth* mechanism through which sectoral growth can contribute to additional growth is through the net increase in its *fiscal contribution* associated with the sectoral growth, that is, a sector's tax payments, net of subsidies to the sector. This can contribute to growth through a reallocation of resources insofar as the marginal public expenditure has higher growth-inducing qualities than the marginal private expenditure. A sector's potential growth contribution through this channel would depend on its net fiscal contribution, which would be determined by the effective tax paid minus any subsidies received from the state.

Finally, the *tenth* set of mechanisms through which sectoral growth can lead to or support aggregate growth over and above that sectoral growth, is *institutional* channels. Broadly speaking, growth in particular sectors can be conducive to particular institutional structures, which could have differential effects in inducing or supporting overall growth. For example, minerals-exporters tend to generate specific types of institutions, as distinct from agricultural exporters, as distinct from light-manufacturing exporters (sectoral structure is of course merely one of the many determinants of institutional structure). These different institutional structures would tend to have varying growth-inducing and growth-complementing capacities. If growth in a sector leads or supports the development of 'progressive' institutions, this can contribute to overall

growth above the sectoral growth as these institutions can support growth elsewhere in the economy.

A further aspect of this 'institutional' channel relates to firm size. Barriers to entry, particularly in internationalised markets, mean that a large firm size is often required to competitively break into particular sectors, which also tend to be the higher-productivity sectors. If growth in a sector, combined with appropriate policy interventions, facilitates the growth of large competitive firms with the resources to break into international competition, and compete not only in the original sector but in other sectors as well, this has the potential for contributing to higher net growth. (Of course, there are also problems associated with large firms, particularly in the context of a monopolistic industrial structure, and hence the overall effects are ambiguous and context-specific).

Empirically, this institutional set of mechanisms is inherently difficult to quantify or compare across sectors. Conclusions could only be drawn from detailed sector-specific studies. This is however outside of the scope of this particular paper.

Summing up this discussion, growth in any sector could potentially have growth-inducing or growth-supporting effects through any or all of the nine channels discussed above. However, the strength and relative importance of these mechanisms would differ between sectors. And of course, the overall growth-inducing effects of sectoral growth would vary across sectors. One of the primary objectives of this paper is to investigate empirically the strengths of the various effects, and the overall growth-inducing effects of sectoral growth, across sectors of the economy and in particular comparing between the manufacturing and service sectors.

A final comment is that such an approach to the analysis of the ways in which sectors can contribute to growth perhaps highlights some of the limitations of the usual manufacturing versus services classification (alongside the other major divisions of the economy). Certainly, there are common denominators to both the manufacturing and service sector groups, which mean that these categories are by no means meaningless. Depending on the issue of interest, however, other classifications may be more useful. Certain mixed groupings of manufacturing and services sectors may have common characteristics in terms of one or more of the channels discussed above.

5 Empirical trends

5.1 International context

Sectoral structure and economic development: Cross-sectional analysis

This section contextualises the sectoral structure of South Africa's economy and changes in terms of international patterns of sectoral structure for countries at different levels of economic development. The shares of agriculture, manufacturing, and services respectively in each of value added and

employment are regressing in each instance on the level of per capita income (six specifications in total). The purpose of course is to explain sectoral shares in terms of level of economic development, to understand the nature of the relationship, and to consider South Africa's sectoral shares relative to what would be expected for our level of income per capita.

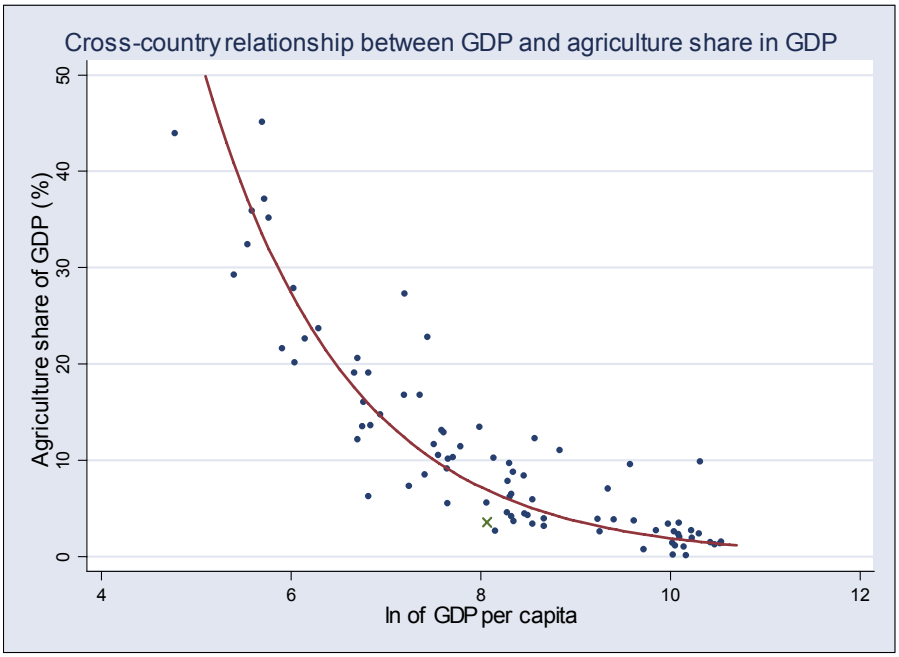
All regressions are based on a uniform sample of 84 countries.[17] Data is from 2003. In each case various linear and non-linear specifications were tested, and those presented here had the best fit in the case of each explanatory variable. All parameters are statistically significant at the 1% level (except for the squared term in the manufacturing value added regression which is significant at the 2% level). The regressions are of course underspecified, but the purpose is to understand the basic relationships between economic development and sector shares, rather than to fully explain the determination of sectoral shares. Finally, note that these regressions are static takes on the relationship between economic development and sector shares, as they are cross-sectional in nature. These relationships have of course shifted over time – for instance the share of manufacturing at any given level of economic development has fallen over the past few decades (see Palma 2005).

Overall, a negative relationship is found between agricultural share of GDP and employment, an inverted-U shaped relationship in the case of manufacturing, and a positive relationship between services share and GDP. These findings are consistent with what would be expected. Of particular interest is South Africa's position relative to what would be expected given our level of income per capita. In summary, South Africa's shares of agriculture GDP and employment are both lower than would be expected; the share of manufacturing in GDP is higher than would be expected whereas the share of manufacturing employment is lower than would be expected; and for services both the share of GDP and of employment are higher than would be expected.

Figure 1 shows the negative relationship between GDP per capita and the share of agriculture in a country's GDP. South Africa's share of agriculture in GDP is lower than would be expected given its level of income per capita – it is actually 3.58% as compared to 6.95% that could be expected on the basis of the regression.

[17] This is in order to avoid non-comparability arising from selection bias associated with different types of countries having data for different sectors. However, it should be noted that the sample is nevertheless somewhat biased owing to uneven data availability. Less developed countries – and hence Sub-Saharan African countries in particular – are underrepresented.

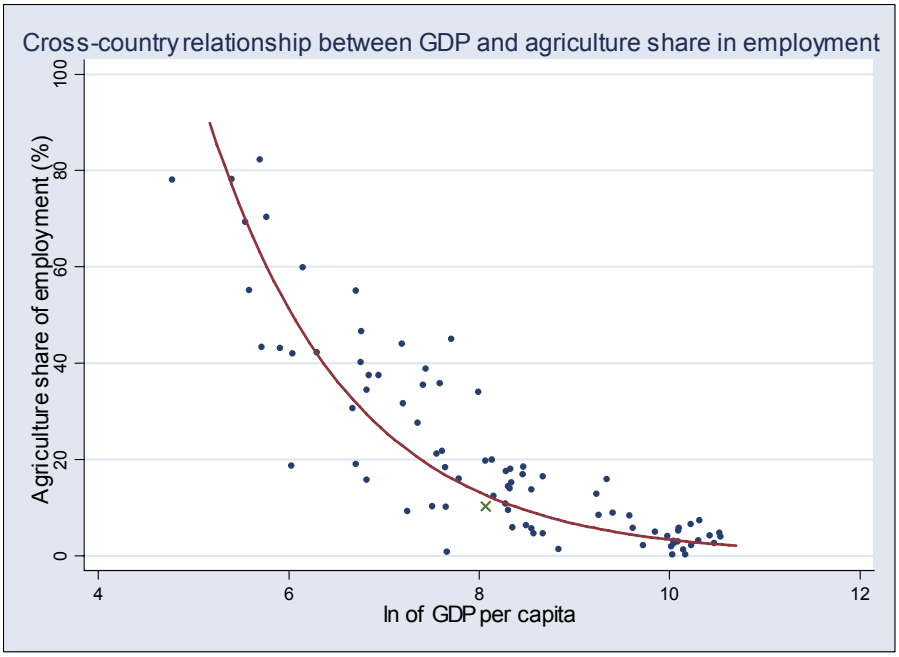
Figure 1: Cross-country relationship between GDP and agriculture share in GDP



Specification: lny = 7.296 - 0.664(lnGDP)
R^2 = 0.69

A similar relationship is found for the share of agricultural employment in total employment, as seen in Figure 2. Both of the regressions concerning agriculture have very good fits. South Africa is again below the line, but not by as much as when compared to its level of income per capita. South Africa's actual share of agricultural employment in total employment is 10.3% compared to an expected share of 12.67%.

Figure 2: Cross-country relationship between GDP and agriculture share in employment

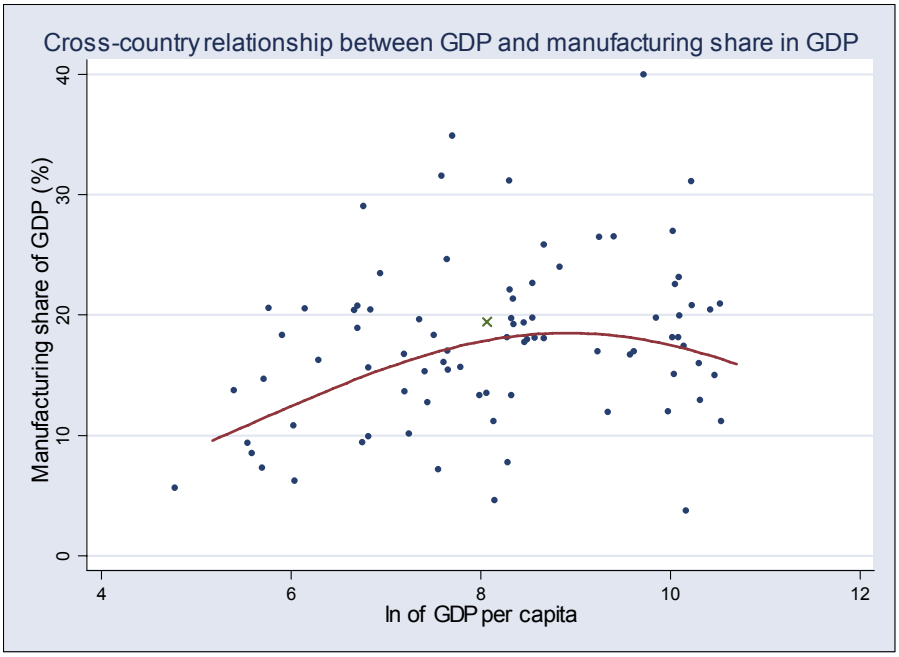


Specification: lny = 8.000 - 0.677(lnGDP)
R^2 = 0.64

Both manufacturing value added and manufacturing employment show the typical inverted-U as discussed in the literature, as shown in Figures 3 and 4. However, the fit is very weak in the case of the share of manufacturing share in GDP, where there is a high degree of heterogeneity for any given level of GDP (particularly at middle-upper levels of income per capita).[18] The estimated coefficients are nevertheless highly significant.

It is very interesting to note that South Africa performs differently in terms of value added and employment in the case of manufacturing. This is distinct from both other sectors modelled – in agriculture South Africa is below the norm for both value added and employment, whereas for services South Africa is above the norm for both. In manufacturing, however, South Africa has a higher share of manufacturing value added than would be expected (19.44% as compared to an expected 17.90%) but a lower share of manufacturing employment than would be expected (14.1% as compared to an expected 16.11%). This suggests that the 'problem' is specifically with *manufacturing employment* in South Africa.

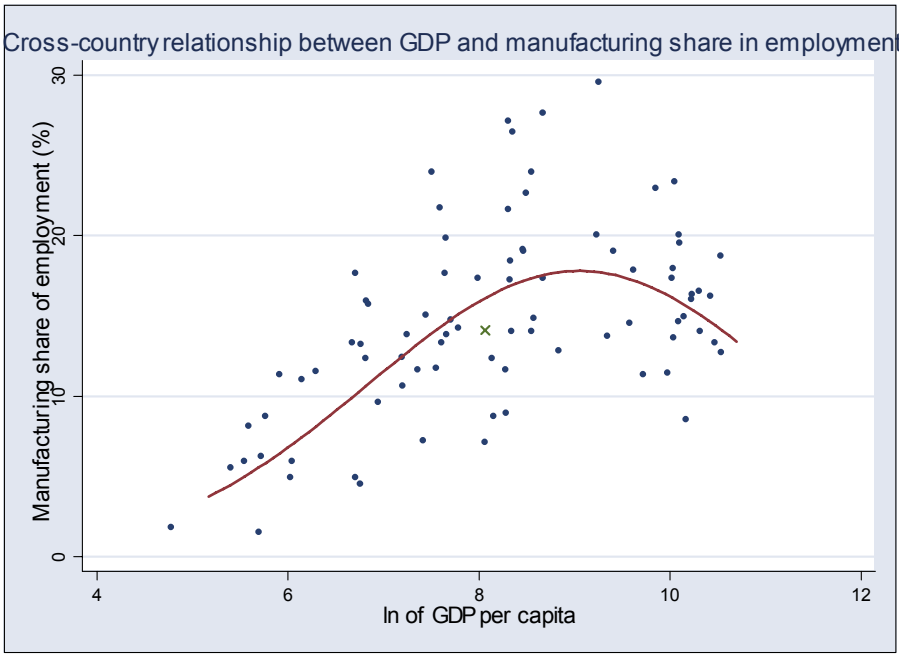
Figure 3: Cross-country relationship between GDP and manufacturing share in GDP



Specification: lny = -0.816 + 0.838(lnGDP) - 0.047(lnGDP)^2
R^2 = 0.14

[18] Note that the low R^2 of 0.14 increases considerably (with the parameters remaining highly significant) if outliers are excluded, if more countries are included in the sample (i.e. including countries which do not have available data for the full set of regressions), and if a dummy is included for commodity-producing countries.

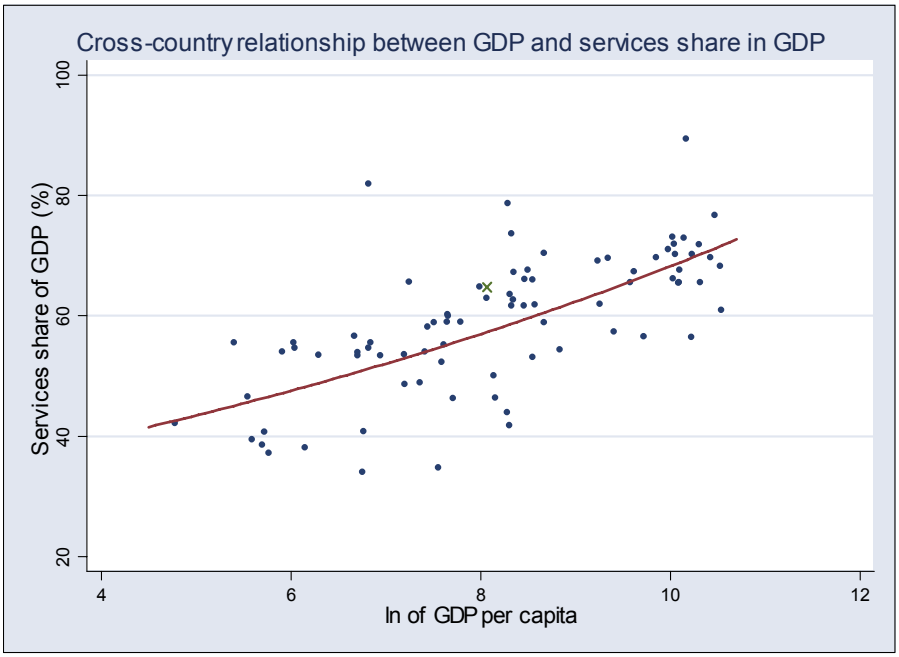
Figure 4: Cross-country relationship between GDP and manufacturing share in employment



Specification: lny = -5.603 + 1.875(lnGDP) - 0.104(lnGDP)^2
$R^2 = 0.54$

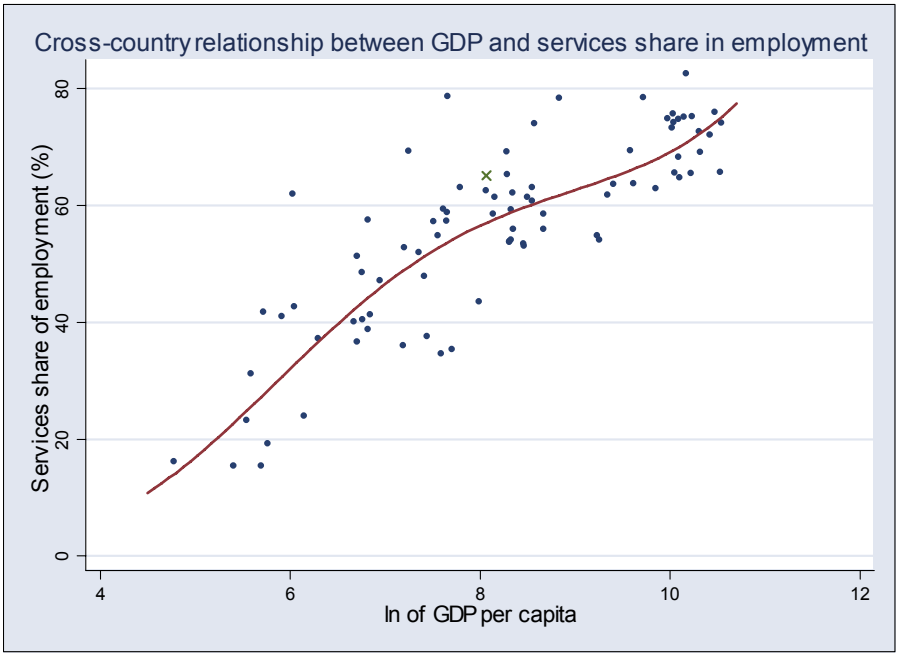
In services, a positive relationship is found between income per capita and both services share of GDP and services share of employment – see Figures 5 and 6. For both value added and employment, the share of services in South Africa is significantly above the level that would be expected for its level of income per capita. South Africa's actual share of services in GDP is 64.75%, well above the expected level of 57.30%. A very similar picture emerges in terms of employment: the actual share of services in total employment in South Africa is 65.1%, relative to an expected level of 57.02%.

Figure 5: Cross-country relationship between GDP and services share in GDP



Specification: lny = 3.321 + 0.090(lnGDP)
$R^2 = 0.45$

Figure 6: Cross-country relationship between GDP and services share in employment



Specification: lny = -7.448 + 3.671(lnGDP) - 0.396$(lnGDP)^2$ + 0.015$(lnGDP)^3$
$R^2 = 0.73$

It is striking that South Africa lies above the linear trendline for both GDP versus services share of GDP and for GDP versus services share of total employment.

This is particularly noteworthy given that South Africa comes from a background of minerals and heavy industry. On the one hand, from a simple compositional approach, South Africa's position above the trendline is surprising given that a share of value added and of employment would be accounted for my minerals and mineral-linked activities, which would not be the case for countries without such a background. On this basis it might have been expected that South Africa would have a relatively low share of services (especially in value added) for its level of economic development, and its actual position in the scatterplots might be surprising.

On the other hand, from a dynamic perspective of the economy's developmental trajectory, South Africa's apparently 'disproportionately large' services sector might be a symptom of a distorted development path and underdevelopment of a manufacturing sector, notably of light manufacturing. South Africa could be considered to have earlier 'leapfrogged' from a minerals and resource-based economy to capital-intensive heavy industry, without going through a period of development of labour-intensive light industry. Now, South Africa may be 'leapfrogging' to a services-oriented economy, as a form of premature deindustrialisation – without ever having industrialised fully or derived full benefits from that.

This would be consistent with the result discussed above that South Africa has a larger share of value added and of employment accounted for by services than is typical for economies at our stage of development. Further, the finding that South Africa's manufacturing value added as a share of GDP is higher than would be expected whereas the opposite result emerges for manufacturing employment could be consistent with the underdevelopment of light manufacturing in particular (although it is also likely to be related to political economy and labour market factors specific to South Africa). South Africa's manufacturing employment also appears to have peaked at both a lower share of employment and at a lower level of per capita income (i.e. earlier) than was the international norm of the turning point for country's manufacturing share of employment[19]. This again points to evidence of premature deindustrialisation.

It is also worth noting that, according to theories of comparative advantage, countries with relatively high endowments of skilled labour, and to a lesser extent of capital, and relatively poor natural resource endowments, would (and even should) export more services than those relatively abundant in land and natural resources or lacking in skills. This would suggest that South Africa would not necessarily be a 'natural' net services-exporter. However, such comparative advantages are of course not cast in stone, but are partially endogenous and subject to policy interventions.

[19] This is not shown in the charts, but is based on the fact that the highest shares that South African manufacturing reached both as in terms of GDP and in terms of employment are lower than had been the case for many comparable countries.

Recent international experiences of employment creation in manufacturing

The potential of the manufacturing sector to create significant numbers of jobs in the twenty first century is often viewed with scepticism. This is associated with a view in South Africa that the manufacturing sector has limited job creation potential for the future, and that the services sector will be the engine of future employment creation. It is indeed true that manufacturing employment has declined – both in absolute numbers and as a share of total employment – in many countries, and not only in upper-middle- and upper-income countries.

The case of China is frequently cited, where manufacturing employment has been declining as both a level and share for some time despite its place as the 'workshop of the world', leading to the question: "If China cannot create manufacturing jobs, how can we?" It should be noted that there are particular explanations specific to the Chinese case, such as the job losses associated with the privatisation of previously state-owned manufacturing enterprises. Changing data definitions also limit the comparability of manufacturing employment data for China over time. Further, the anomalously low share of services in the Chinese economy which may be associated with 'sectoral rebalancing'. Nevertheless, the question remains as to the feasibility of manufacturing employment creation.

Below we briefly review some recent international experiences of employment creation in manufacturing. The focus is on employment creation in the decade up to the latest available data (which does not extend beyond 2003). A decade is used for consistency (unless there is a specific reason to use a different period) and in order to look at sustainable manufacturing employment creation rather than short spurts of employment growth. All data is derived from the ILO's Key Indicators of the Labour Market. The figures cited should be treated as indicative. Further, it should be noted that most low- and lower-middle income countries are excluded from the data, although it is in these categories of countries that most manufacturing growth (particularly in terms of the share of total employment) would be expected.

Unusually for a developed country, Canada has seen increases in both the level and share of manufacturing employment from the early to the late 1990s (the latest available data is for 1998), although the share is not as high as it had been in the 1980s. In Ireland the level of manufacturing employment has growth steadily – a rate of 2.2% p.a. between 1993 and 2003[20] – although it has declined as a share of total employment. In Italy the share of total employment in manufacturing has remained roughly steady since the mid-1980's, and although the level of manufacturing employment had earlier declined it has since been increasing from the mid 1990s onwards (data up to 2003).

There have been steady increases in the level of manufacturing employment but falls in the share of total employment in the decade up to 2003, in Ecuador (data up to 2002), Honduras (2.3% manufacturing employment growth p.a. from 1995-2002), and El Salvador (3.8% growth p.a. from 1992-2001). In

[20] Although there is a break in the series in 1998 and the effects of this are unclear.

Guatemala (up to 2002), both the level and share of manufacturing employment have been increasing. The Bahamas has experienced an almost continuous growth of manufacturing employment over the period for which data is available (2.8% p.a. for 1991-1999), although it has remained low and stable as a percentage of total employment.

Brazil (surprisingly given the poor performance of its manufacturing sector) shows increases in both the level and share of manufacturing employment in the decade up to 2002 (although the share is not as high as it was in the 1980s), with an annual increase of 2.2% in the period 1992-2002. There is however a break in the series in 2002 which may have artificially inflated this increase; if the year 2002 is excluded, the annual increase from 1992-2001 is 1.2% p.a.. In Trinidad and Tobago the level of manufacturing employment has been increasing at a rate of 2.8% p.a. in the decade up to 2002, while the share has been fluctuating around a fairly constant level. In Nicaragua both the level and share of employment have been increasing (at a rate of 9.4% p.a. from 1993-2003, but excluding the years 2002 and 2003 where there are breaks in the series, just 2.8% p.a.). One consideration to be borne in mind regarding the figures from Latin America and the Caribbean is that some or all of the manufacturing jobs created (notably in countries such as Nicaragua, Mexico, Guatemala, and Honduras) is due to 'maquila' production, which has less of the positive effects associated with manufacturing than would be the case in most non-maquila manufacturing.

In Egypt, data is only available up to 1995, but up to that point the level of manufacturing employment is increasing but the share is fluctuating around a fairly constant level. The level of manufacturing employment in Mauritius has been increasing (2% p.a. in the 5 years up to 1999, the latest available date) but roughly steady as a share. Data for Hungary is available only up to 1998, but the couple of preceding years saw small increases in both the level and share.

Indonesia has seen significant and steady increases in both the share and level (4.4% p.a. from 1992-2002). The level of manufacturing employment in Malaysia has been on a general upward trend (2.4% annual increases from 1992 to 2002) although declining a bit as a share since the mid-1990s. In Myanmar (Burma), data is available only up to 1998, but until that point both the level and share of manufacturing employment have been increasing (the former at 2% p.a.). In Pakistan the level of manufacturing employment has been increasing at 4% p.a. (1992-2002); the share had earlier fallen but has since increased back to the high shares of the 1980s.

In the Philippines the level of manufacturing employment has been increasing (by 2.1% p.a. during 1991-2001) while the share has been fluctuating around a fairly constant level for some time. In Sri Lanka the level of manufacturing employment has been increasing though in a volatile fashion (data up to 1998) but the share falling. In Thailand both the level and share of manufacturing employment have been rising, with the number of manufacturing jobs increasing at 2.5% p.a. from 1993-2003. There is however a break in the series in 2002; if measured only up to 2001 the annual increases are 2.3%.Both the level and share of manufacturing employment have also been increasing in

Turkey: the level by 3.3% p.a. from 1990 to 2000 (the latest available), and the share from 14.2% to 16.9%.

There are thus a number of countries, especially in Asia, that have been experiencing increases in manufacturing employment – particularly in the level, less commonly in the share – in recent years. The annual rates of increase cited are (generally) for the most recent decade for which data is available, and faster rates of increase are of course evident for shorter periods, as well as in earlier periods. Of course, there are bound to be many more countries whose employment in services has grown than for manufacturing. As would be expected, these are particularly but not exclusively upper-middle- and upper-income countries.

Nevertheless, employment creation from manufacturing is not a completely lost cause. The inverted-U relationship between income per capita and share of manufacturing employment indicates that the share of manufacturing employment is expected be lower beyond a certain level of income – but it is crucial to note that this point is at a very high level of income. Recent evidence (Palma, 2007) indicates that for the year 2000 all countries are actually to the left of that peak – in other words there is actually a positive (albeit declining) relationship between income per capita and share of manufacturing employment. At the least, countries with a moderately higher level of income per capita than South Africa tend to have higher shares of manufacturing employment than does South Africa.

This brief review of recent international experiences of employment creation in manufacturing, including countries at a comparable level of development as South Africa, might be interpreted as suggesting that South Africa should not give up on employment creation in manufacturing. The performance of manufacturing employment is not completely predetermined; although it is subject to various tendencies and international influences, there is nevertheless a degree of variance and endogeneity. However, as discussed elsewhere, employment creation in manufacturing in South Africa may not happen without the appropriate policy environment and interventions.

5.2 South Africa: Empirical Trends

This section examines various trends in the economy of relevance to this paper. These include trends in output, value added, employment, skills composition, capital stock, capital intensity, labour productivity, exports, and the trade balance, as well as an international comparison of the share of services in the economy. Sectors are generally grouped as follows: all industries (i.e. the total economy); manufacturing; services sectors (referring to SIC codes 6-9); and services sectors excluding government (i.e. private services). All trend charts are shown in a three-year moving average for clarity (unless otherwise indicated).

Data is derived from the South African Standardised Industry Database (SASID) unless otherwise indicated. For employment trends, or trends derived using employment data (that is, capital intensity and labour productivity), results are presented using both SASID and LFS employment data. As

discussed below, the use of these two different sources of employment data lead to very different trends and conclusions, as discussed in Box 1.

Box 1: A note on employment data

Any empirical work relating to employment in South Africa confronts the problem of reliable employment data. Two sources of employment data are used in this paper: the South African Standardised Industry Database (SASID) and combined data from the October Household Surveys (OHS) and Labour Force Surveys (LFS). This box briefly reviews the advantages and disadvantages of each, and in particular limitations that need to be borne in mind in any use of South African employment data, and is relevant to the interpretation of any employment-related trends and results presented in this paper.

The OHS was carried out between 1993 and 1999 (although the first survey excluded the TBVC areas and hence is not at all comparable with later years). Changes in methodology in subsequent years plague the construction of a series (in particular, the 1995 and 1996 surveys are not really comparable either with each other or with later surveys). The LFS was introduced in 2000 and is conducted biannually. However, methodological and questionnaire changes, especially in the early years of the LFS, affect the reliability of an employment time series constructed from LFS data. Constructing a combined 'series' from the OHS and LFS is highly problematic especially in terms of employment totals (probably less so in terms of sectoral composition). While it is the only way of getting a 'series' slightly longer than five years using person-based survey data, the totals cannot really be compared using the two sources and should only be cautiously compared even for certain years within the OHS or LFS data.

The main advantage of OHS/LFS data is that, by virtue of being based on interviews with people which are intended to be representative, no sector or occupation is excluded. One important drawback is that data is based on people's own perceptions of the company in which they are employed, in terms of the sector that it is in, whether it is formal or informal, and so on. Needless to say, an employee may not be aware of which sector most of the enterprise's economic activity falls within, which may distort the reported sectoral composition of employment; similarly for the formal/informal proportions. A further consideration regarding the OHS/LFS data is that it is likely to overestimate employment given the rather 'expansive' definition of employment used (an extreme example being the inclusion of someone who begs for food as "employed") and also to overestimate employment creation/underestimate employment loss, especially in services. This is due to trends towards atypical employment such as casualisation, such that for example a retail job previously performed by one person and counted as a single job may now be done by several part-time workers in shifts, with each of these counted as a retail job.

The SASID database is provided by private company Quantec, and hence is not an official database although it is constructed from official data. The SASID

Box 1 continued

employment data are based on several sources (the Statistics South Africa Survey of Total Employment and Earnings, Survey of Employment and Earnings (SEE), OHS and Population Censuses; as well as the Manpower Surveys of the Department of Labour and the Standardised Employment Series of the Development Bank of South Africa), but primarily the SEE. The SEE is based on data provided by employers (unlike the LFS that is based on questioning people about their own employment status). Enterprises included in the SEE are drawn from a register of companies, which was revised in 2003 (as well as being updated periodically).

One of the advantages of the SASID data is that it provides the only reasonably long-run employment series for South Africa, which is essential for analysing long-run trends as well as for any time series econometric analysis. The sectoral classification of employment data is also consistent with the national accounting framework, which enables calculations involving both employment data and other series such as value added. Further, the way that employment is allocated between sectors is more likely to be accurate as they are based on actual information about the main economic activities of the enterprise. The main drawback is that the enterprise register on which the SEE data is based is not representative of the entire economy. In particular, it excludes the informal sector, small enterprises with a turnover below R300 000 per annum, new enterprises not yet included in the register, and agricultural and domestic work. While these problems have been partly addressed in the SASID database (for example the inclusion of the agricultural sector), it is not clear exactly what modifications have been made. Of particular relevance to this paper, the SASID data appears to underestimate employment in the services sector. This is probably because services firms fall disproportionately into the categories which are unsampled or undersampled in the SEE, notably small and new firms. A further drawback of the SASID data is that firms may understate their employment, for example if they are not adhering to labour legislation or tax regulations and are concerned that information which they provide in response to the survey may be provided to other state institutions.

In any context, one would expect discrepancies between employment data based on household surveys and on surveys of businesses. These differences are compounded for various reasons in the data available in South Africa, as discussed above. Unfortunately there is no reliable and comprehensive time series employment data. In order to do empirical work relating to employment, one must use the existing data, but obviously with an appropriate degree of caution. While the SASID data must be used to look at long-term trends, the downward bias of this data should be borne in mind, especially for the services sector. Where feasible, this paper presents trends using both the SASID and OHS/LFS data. Insofar as these produce divergent results, we can only use judgement and of course caution in interpretation.

Firstly, as can be seen from figures 7 and 8, services account for a large and increasing share of both total output and value added. The services sector excluding general government accounts for 44% of total output and 53% of value added in 2005, up from 33% and 38% respectively in 1970. Manufacturing's share of total output and of value added has been fairly

stagnant, although the share peaked in the early 1980s, with value added in particular showing a slight but steady downward trend since then.

Figure 7: Total output 1970-2005

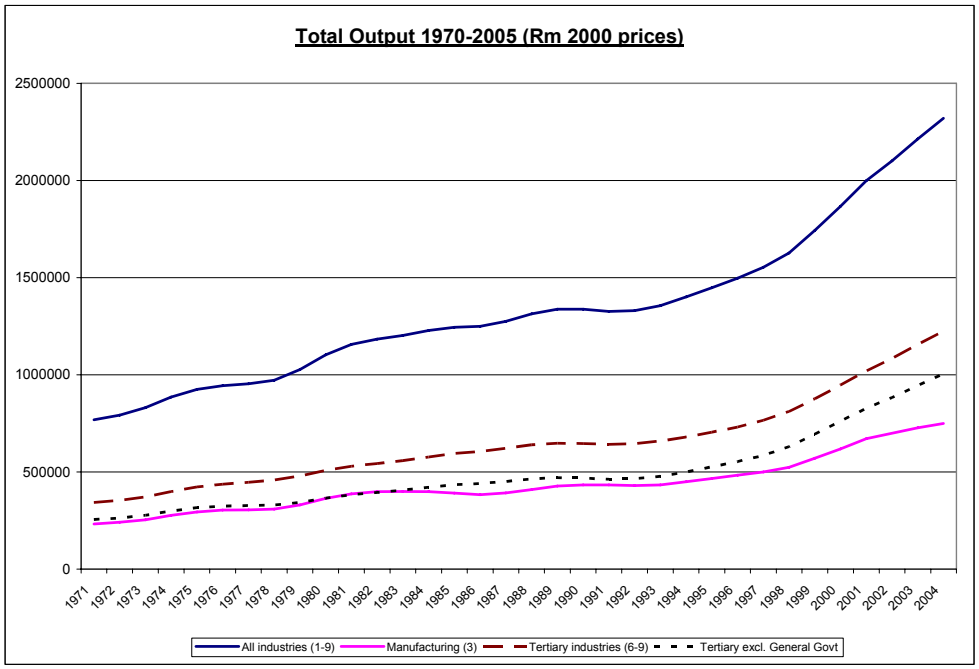
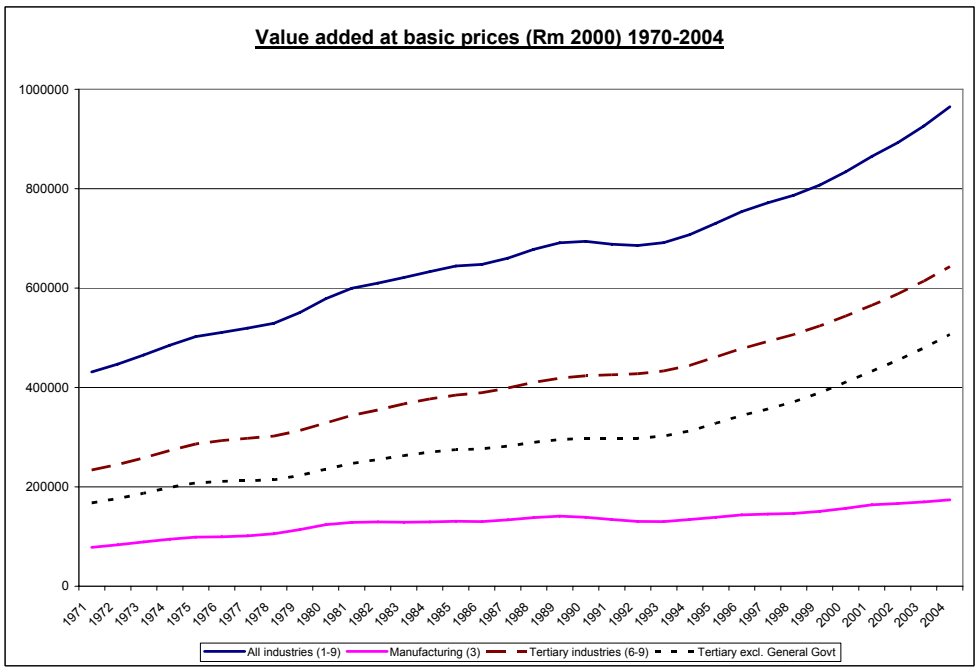
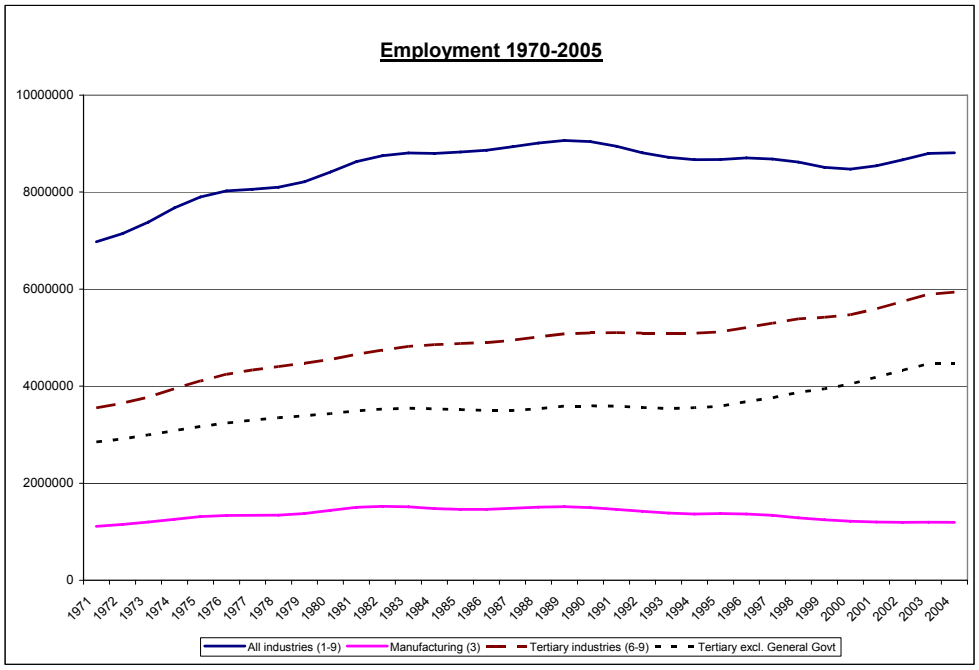


Figure 8: Value added at basic prices 1970-2004



In terms of employment (see figure 9), services have shown significant and steady growth throughout, both in absolute terms and as a percentage of total employment. Manufacturing employment varies between about 1.08 million and 1.55 million over the period; as a share of total employment declining from a peak of almost 18% in the early 1980s and a share of over 16% up until 1992, to just 13.5% at present.

Figure 9: Employment 1970-2005



We also show employment trends for 1997-2005 based on LFS data, as shown in figures 10 and 11[21]. Figure 10 shows both formal and informal employment, while figure 11 shows formal employment only. Apart from an upward jump in 2000, the LFS data is surprisingly smooth (particularly as it has not been smoothed out, unlike in figure 9).

Several differences can be noted between the trends apparent from the SASID data used in figure 9 and the LFS data used in figures 10 and 11. Essentially, the LFS data provides a more positive picture of employment growth over the past eight years, particularly if informal sector employment is included. The LFS data shows employment growth in all sectoral groupings shown, and at significantly higher rates of growth than does the SASID data.

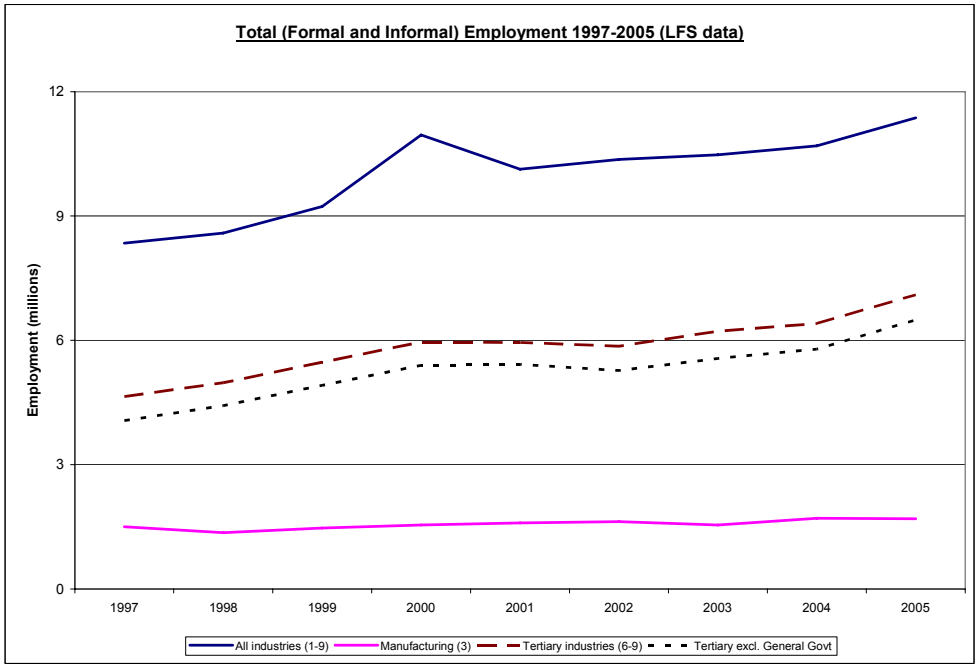
According to LFS data, total employment grew by an annual rate of 3.77% and total formal sector employment by 2.4% over this period, compared to barely positive growth of 0.04% using the SASID data. Total manufacturing employment grew by 1.52% and formal manufacturing employment by 0.56% per annum according to the LFS, whereas it shrunk by 1.47% per annum according to SASID data.

LFS data shows a rise of 4.98% per annum in total services employment and 3.96% in formal services employment, compared to a rise of 1.35% according to SASID data. Looking at private services employment, LFS shows annual growth of 5.43% for total private services employment and 4.43% for formal private services employment, while SASID data shows a smaller rise of 2% per annum.

[21] Thanks to Debbie Lee for processing the LFS data.

Note that some of the apparent growth in the LFS data (apart from the growth in total employment) derives from the problem of unspecified workers, which fell from 4.8% of total employment in 1997 to 1.8% in 2005, i.e. they were increasingly allocated to particular sectors, boosting reported sectoral growth. Further, the early years of LFS data (actually derived from the OHS) are not really comparable to later years. Even focusing only on the period 2001-2005, however, the levels and trends are still very different between the LFS and SASID data. Both sources have their advantages and limitations; a discussion of these is beyond the scope of this paper. Nevertheless, the dramatic discrepancy between them in both levels and trends presents a serious dilemma for empirical work using employment data.

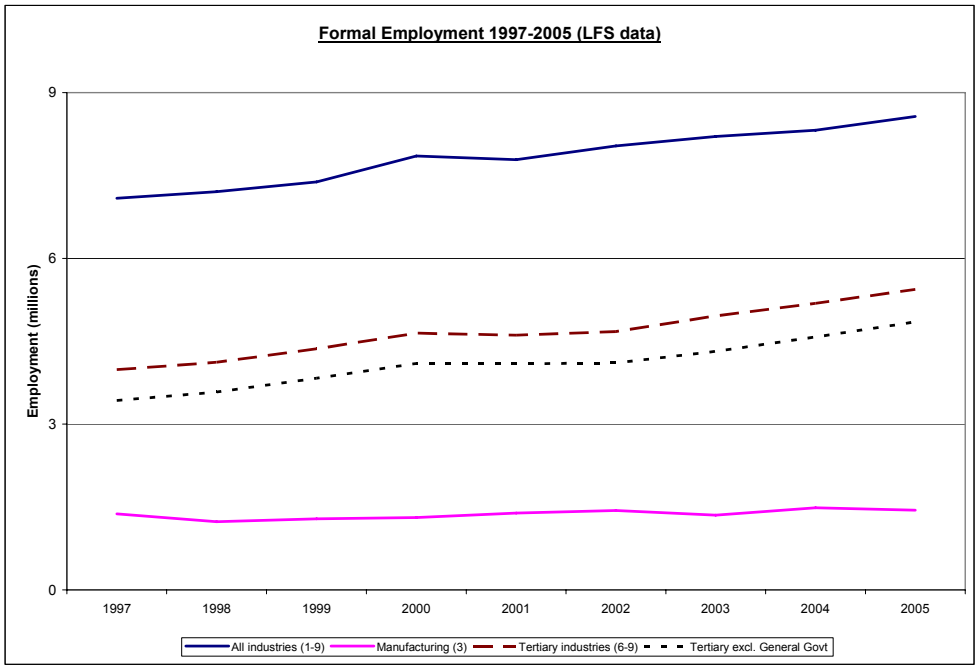
Figure 10: Total (Formal and Informal) Employment (LFS data)



Source: Labour Force Surveys 1997-2005

Note that the time scale for this chart only begins at 1997 unlike the others. Further, in this chart actual data is used (instead of 3-year moving averages as in the other charts), because of the shorter period of available data.

Figure 11: Formal employment (LFS data)



Source: Labour Force Surveys 1997-2005

Note that the time scale for this chart only begins at 1997 unlike the others. Further, in this chart actual data is used (instead of 3-year moving averages as in the other charts), because of the shorter period of available data.

Next we look at the skills composition of employment across different sectors. Note that skills categories are not actually based on workers' skill or education levels, but on their occupational grouping, on the grounds of the skills level typically required to perform certain types of jobs.[22] Although consistent with international practice, this is potentially misleading and this classification framework needs to be borne in mind in any analysis regarding skills. The classification tends to result in the skills level of services appearing to be high and that of manufacturing low. This is partly because service-type occupations fall disproportionately within the 'skilled' category and manufacturing-type occupations within the unskilled category. Further, services firms tend to be smaller and management is classified as 'highly skilled', no matter how limited their responsibilities might be.

Figure 12 shows the share of high skilled employment in the total employment of each sector, while figure 13 shows the share of semi- and unskilled employment. The third skills category, skilled employment, is not shown but is simply the residual of these two shares.

[22] *Highly skilled* occupations consist of the following occupation groups: Professional, semi-professional and technical occupations; Managerial, executive and administrative occupations; and certain transport occupations, e.g. pilot navigator. *Skilled* occupations consist of the following occupation groups: Clerical occupations; Sales occupations; Transport, delivery and communications occupations; Service occupations; Farmer or farm manager; Artisan, apprentice and related occupations; and Production foreman or production supervisor. *Semi- and unskilled* occupations consist of all the occupations that are neither highly skilled nor skilled occupations.

Looking at the trends in the proportion of high-skilled labour, this is rising in both manufacturing and private services. However, over time it has risen significantly faster in private services than in manufacturing, and private services has a higher proportion of high-skilled employment in its total employment than is the case in manufacturing. In 2005 over half (51.5%) of all high-skilled jobs in the economy were in private services, while just 11.3% were in manufacturing.

A different picture emerges in terms of semi- and unskilled employment, as shown in figure 13. There is a general decline in the share of semi- and unskilled employment in total employment by sector and in the economy as a whole, yet this decline was much more pronounced in private services than in manufacturing. These trends are of concern from an employment perspective, as it is these workers who are most in need of employment creation opportunities. It appears that manufacturing has performed relatively well in absorbing these skills categories. Nevertheless, private services account for 47.5% of the overall employment of semi- and unskilled workers in the economy, as opposed to 15.0% employed in manufacturing.

Figure 12: High-skilled employment as % total employment by sector, 1970-2004

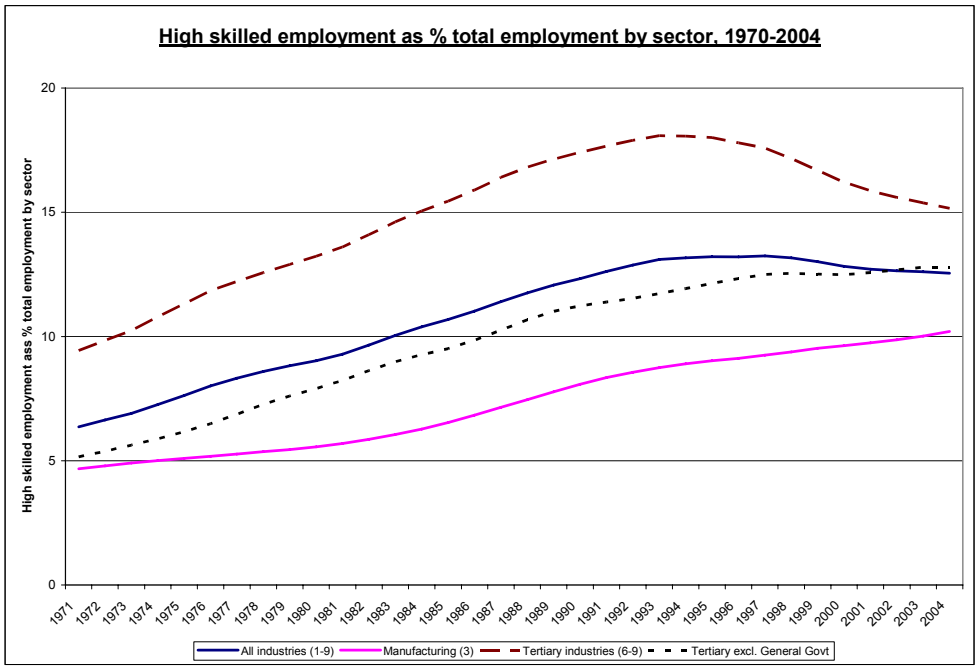
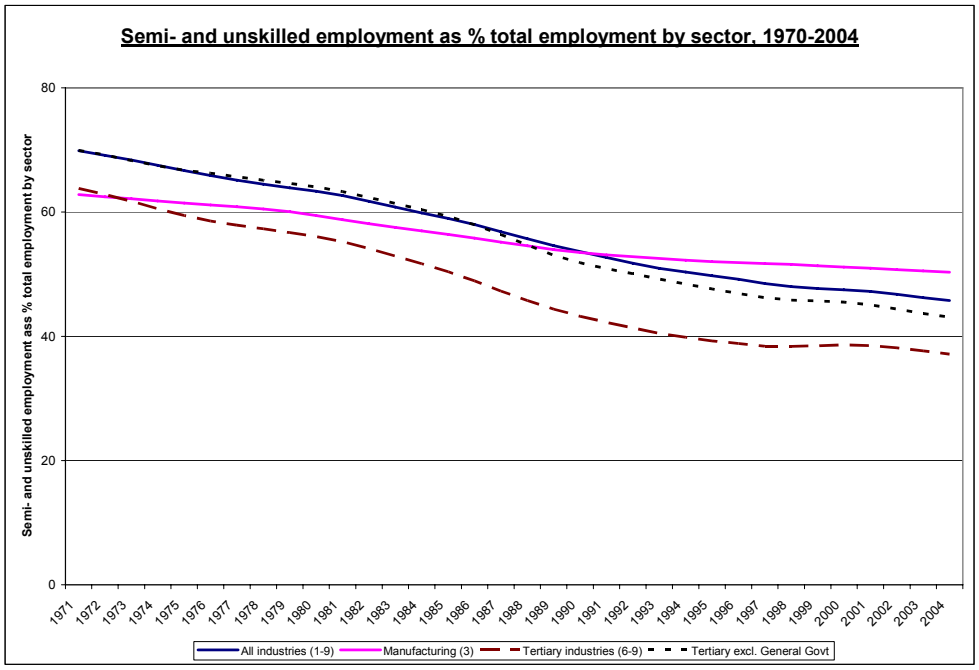


Figure 13: Semi- and unskilled employment as % total employment by sector, 1970-2004



Changes in employment can also be analysed in terms of which occupations experienced the greatest changes in recent years. Unfortunately the period of analysis is limited to 1997 onwards as this analysis relies on the OHS and LFS data[23]. The following table shows the ten occupations that gained or lost the most in employment during the periods 1997-1999, 2000-2005, and 1997-2005 respectively, and in each the number of jobs that were gained or lost.[24] Note that these results are partly a function of the way in which occupations are classified, in terms of how aggregated various categories are. Further, these are not the occupations that have experienced the greatest proportional changes – the focus here is on contributions to overall changes in employment.

[23] Although there is OHS data for earlier years, these are generally considered incomparable with each other or with subsequent surveys.

[24] the period is separated into two as the 1997-1999 and 2000-2005 periods are not strictly comparable as they are based on the OHS and LFS data respectively

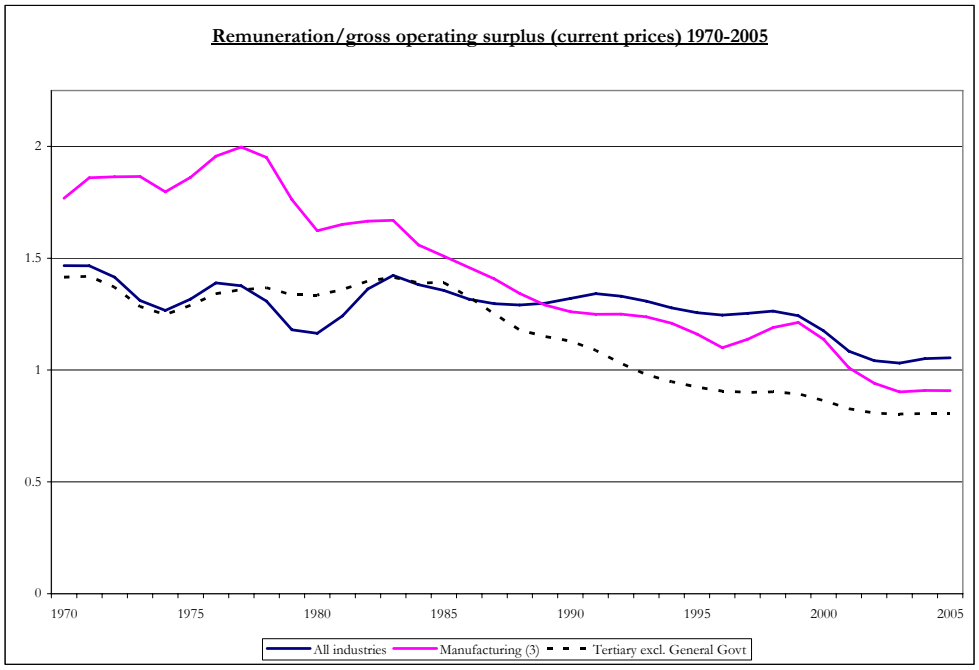
Table 1: Changes in occupational employment 1997-2005

	1997-1999		2000-2005		1997-2005	
Occupations that increased the most	Farm hands and labourers	185 821	Other office clerks	280 217	Other office clerks	198 123
	Helpers and cleaners in offices, hotels etc.	155 072	Prodn & ops managers/dept managers in business services	97 242	Helpers and cleaners in offices, hotels etc.	177 923
	Accounting and bookkeeping clerks	122 884	Construction and maintenance labourers	83 640	Security Guards	169 275
	Library and filing clerks	109 084	General managers of business services	66 519	Farm hands and labourers	155 981
	Primary education teaching associate professionals	91 113	Security Guards	66 326	Primary education teaching associate professionals	129 782
	Preprimary education teaching assoc. prof'als	78 623	Hand packers and other manufacturing labourers	57 346	Prodn & ops managers/dept managers in business services	100 443
	Crane, hoist and related plant operators	66 861	Shop salespersons and demonstrators	50 455	General managers of business services	95 459
	Security Guards	66 698	Prodn & ops managers/dept managers in W&R trade	48 812	Shop salespersons and demonstrators	88 516
	Cashiers and ticket clerks	51 181	Bricklayers and stonemasons	44 985	Hand packers and other manufacturing labourers	80 810
	Miners and quarry workers	48 788	Cashiers and ticket clerks	44 876	Construction and maintenance labourers	79 264
Occupations that decreased the most	Primary education teaching professionals	-38 490	Computer assistants	-24 051	Transport clerks	-16 334
	Other machine operators and assemblers n.e.c.	-44 544	Subsistence agricultural and fishery workers	-30 648	Builders, traditional methods	-21 665
	Construction and maintenance labourers	-47 133	Motorised farm and forestry plant operators	-36 631	Business service agents and trade brokers n.e.c.	-24 368
	unclassified	-76 992	Miners and quarry workers	-41 347	Civil engineering technicians	-31 947
	Other office clerks and clerks n.e.c.	-92 987	Directors and Chief executives	-44 998	Gardeners, horticultural and nursery growers	-38 791
	Drivers and mobile plant operators n.e.c.	-109 769	Farm hands and labourers	-55 590	Nursing and midwifery professionals	-38 798
	Teaching n.e.c.	-121 722	Accounting and bookkeeping clerks	-60 336	Directors and Chief executives	-44 332
	Domestic helpers and cleaners	-129 379	General manager in wholesale and retail trade	-61 471	Other machine operators and assemblers n.e.c.	-50 395
	Labourers in mining, construction, transport, & manufacturing n.e.c.	-140 932	Gardeners, horticultural and nursery growers	-78 510	College, university and higher education teaching professionals	-66 027
	General manager in wholesale and retail trade	-227 809	Library and filing clerks	-147 844	General manager in wholesale and retail trade	-254 089

Figure 14 shows the ratio of total remuneration to gross operating surplus as a measure of profits.[25] The overall trend in the economy is falling remuneration relative to operating surplus over time. Comparing sectors, it is somewhat surprising that a higher share of value added is accounted for by remuneration is higher in services than in manufacturing. Further, the share of remuneration in manufacturing has fallen less than in the economy as a whole. To the extent that this data is accurate, it suggests that there could be negative distributional implications of a shift from manufacturing to services.

[25] This trend was calculated using data in current prices. Similar trends were found when using data in constant prices, as well as using net rather than gross operating surplus.

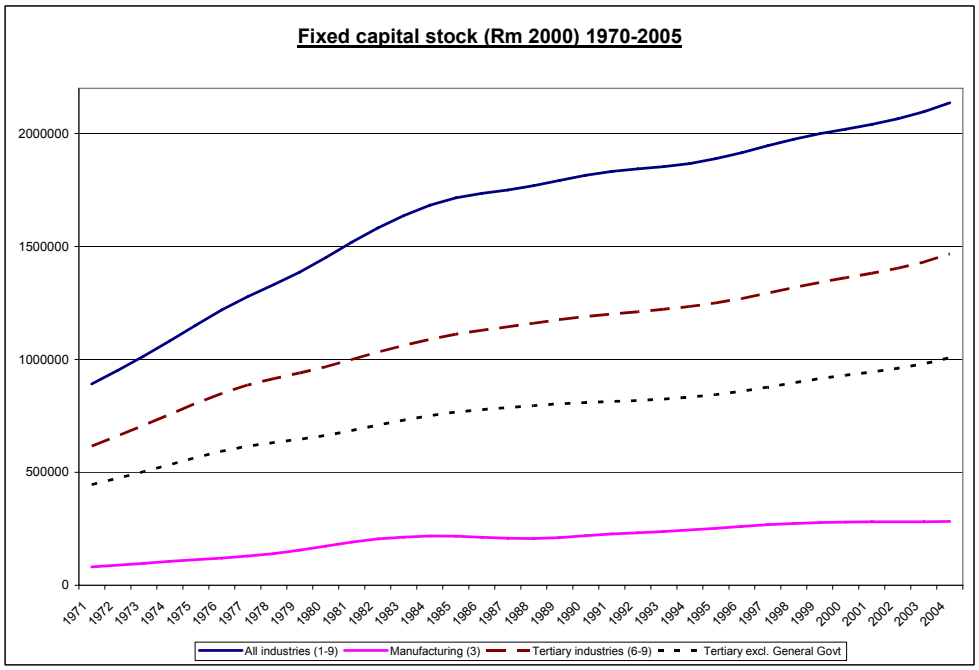
Figure 14: Remuneration/gross operating surplus 1970-2005



Total tertiary is not shown as the measure of operating surplus is not very meaningful for the government sector.

Figure 15 shows trends in fixed capital stock. The share of manufacturing has actually been rising, with the capital intensification of this sector. The share of capital stock in services has dropped slightly, although it is still close to half of total fixed capital stock. Half of the capital stock of services is in finance and business services, and another 30% in transport and storage.

Figure 15: Fixed capital stock 1970-2005



Disaggregating capital stock into its components – buildings and construction, machinery and other equipment, transport equipment, and transfer costs –

53% of the capital stock of manufacturing is comprised of buildings and construction and 45% of machinery, and the latter share has been increasing significantly since 1990. 63% of the capital stock of services is in buildings and construction.

Figures 16 and 17 show trends capital intensity, measured as (real) capital per worker. The trends are dramatically different depending on whether the employment data used in derived from SASID (as in figure 16) or the LFS (as in figure 17).

Using the SASID data, the first obvious observation is the general capital intensification of the economy as a whole, as well as each of the sectors shown. The greatest increase in capital intensity occurred in manufacturing, while the increase was much lower in the services sectors. Nevertheless, by 2005 the capital per worker in manufacturing was just below that of the economy as a whole; and below that of the whole services sector but above that of the private services sector. This is somewhat surprising, as services might have been expected to be significantly more labour-intensive than manufacturing.[26] In fact, excluding the highly capital-intensive manufacturing subsector of coke and refined petroleum products, private services are more capital-intensive than manufacturing. In the economy as a whole, after coke and refined petroleum products the next most capital intensive subsectors are from a mix of sectors: basic chemicals, electricity gas and water, transport storage and communication, and finance and insurance.

Using the LFS data (see figure 16), and of course for a much shorter time period, we actually see falling capital intensity. Both the manufacturing and services sectors show rising labour intensification. Further, contrary to the SASID data, here services (both overall and private services) are more capital-intensive than is manufacturing.

It is thus difficult to draw strong conclusions about either capital intensity trends or the relative levels in different sectors, given the very different results emerging depending on which data source is used. Nevertheless, one surprising finding, with both datasets apart from the last few years in the SASID data, is that services are more capital intensive than manufacturing.

[26] However, the complications discussed earlier around the comparability of such series between manufacturing and non-manufacturing series need to be borne in mind here. In particular, an underestimation of services employment in SASID data which result in services appearing to be more capital-intensive than is actually the case.

Figure 16: Capital intensity, 1970-2005 (SASID employment data)

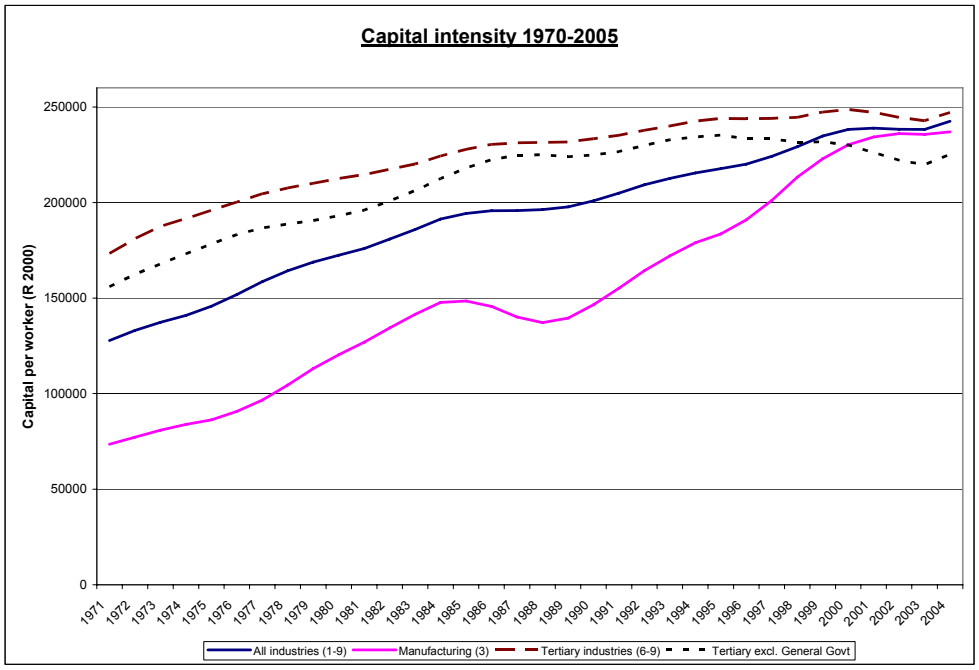
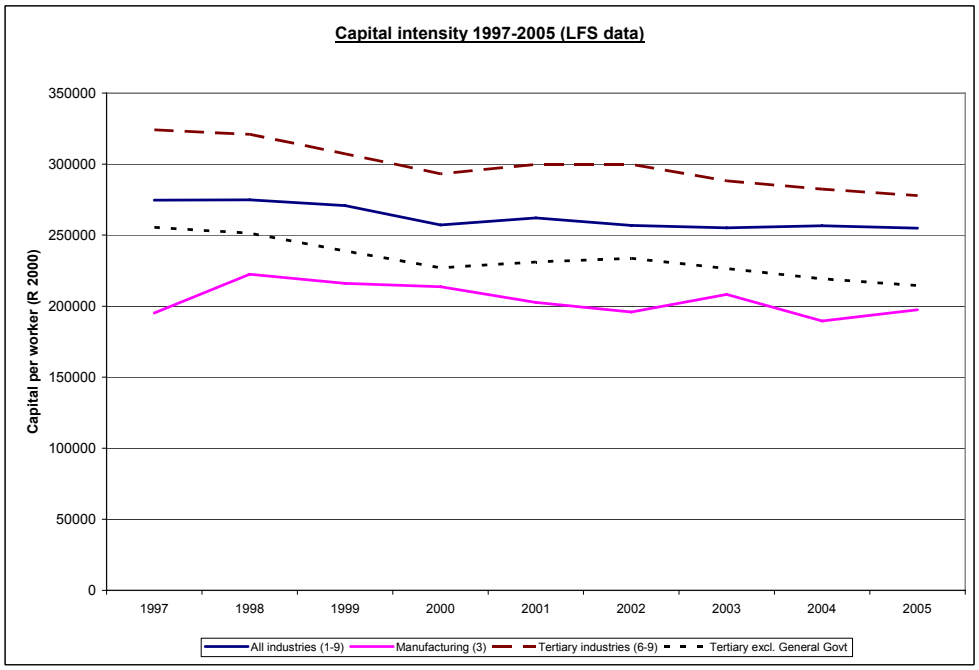


Figure 17: Capital intensity, 1997-2005 (LFS employment data)



Figures 18-21 show trends in labour productivity. Productivity in figures 18 and 19 is measured in terms of total output, using employment data from SASID and the LFS respectively. Productivity in figures 20 and 21 is measured in terms of value added, again using employment data from SASID and the LFS respectively.

The key notable feature from the charts using LFS employment data is the high and rising labour productivity in manufacturing (with both measures of productivity). This is consistent with the idea (discussed in section 2) that the manufacturing sector is the high-productivity sector of the economy and has

distinct dynamic characteristics. It is however surprising in the context of the relative skills composition and capital intensity of the manufacturing and service sectors, as discussed above. The private services sector has a significantly higher share of high skilled labour and a lower share of semi- and unskilled labour in its total employment than does manufacturing. Although manufacturing is more capital intensive than private services, the difference is not very large – R239 624 of capital per worker in manufacturing compared to R234 590 of capital per worker in private services (2005 figures, expressed in R2000).

With these characteristics in mind, it is significant that manufacturing productivity outstrips that in services. Of course, these results do need to be interpreted with considerable caution, given the data problems as well as general problems with interpreting productivity in services in particular. Nevertheless, a finding of higher productivity in manufacturing – especially taking into account the relative capital intensity and skills composition as discussed above – would be consistent with ideas discussed in section 2 about the special qualities of manufacturing (economies of scale, learning by doing, and so on). Even considering the fact that some of the rise in manufacturing productivity may also in part reflect the fact that many low-productivity manufacturing activities have simply shut down, raising the average productivity of the rest of the sector, the consistently higher level of manufacturing productivity is significant.

However, once again, different conclusions would be drawn when using LFS data, as in figures 18 and 20 (although note of course that the periods are different from the charts using SASID data). In terms of labour productivity measured with total output (figure 18), manufacturing productivity is still the highest of all sectors shown and is and rising, although not quite a steeply as when SASID data is used. Services productivity is also rising, again not as steeply as with the SASID data (these differences are of course owing to the more positive employment picture in the LFS data).

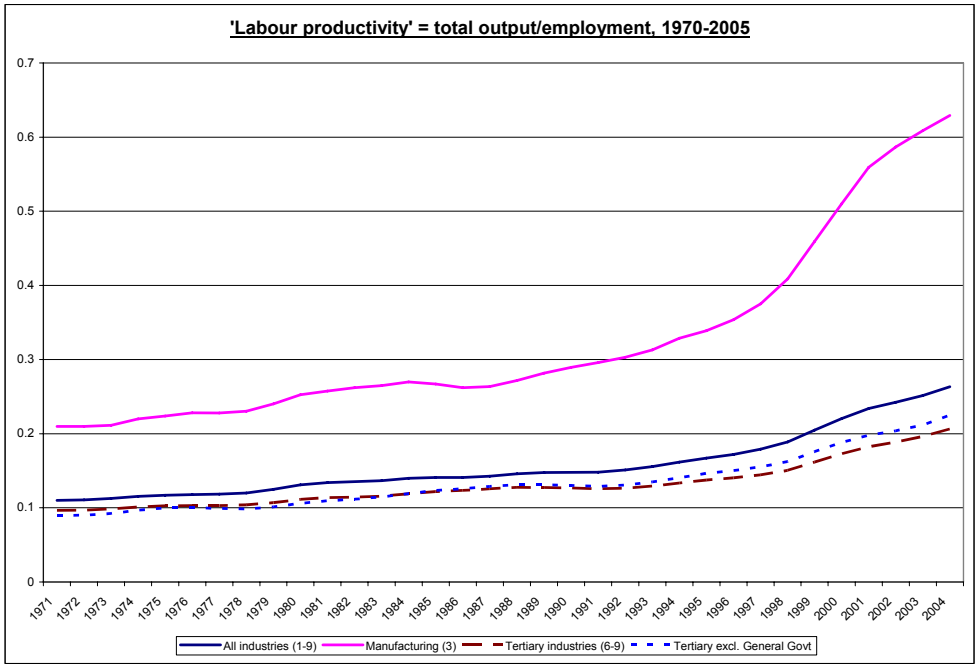
Considering the trends in labour productivity based on value added and using the LFS data (see figure 20), most series are fairly stable. This contrasts to the rising labour productivity trends obtained when using the SASID data. Further, when the LFS data is used the level of manufacturing productivity is actually below that of the entire services sector (including government), whereas with the SASID data labour productivity is by far the highest in manufacturing.

Further, when comparing productivity trends in manufacturing and services, the role of services as a 'residual employer' needs to be factored in. As discussed elsewhere, certain subsectors of services play a role as 'employers of last resort', in a similar way as agriculture may have previously or continues to do in some developing countries. The relatively low barriers to entry in services such as retail result in an absorption of 'excess' labour supply into these sectors, and hence employment trends in these sectors are likely to some extent to be a reflection of aggregate labour supply conditions. An increase in services employment under such conditions would be associated with falling labour productivity (or labour productivity not rising as fast as it would

otherwise have done), which may thus not be an indicator of the type of productivity changes that are of interest from a causal growth perspective.

It is thus difficult to draw conclusions about labour productivity, as both the trends and relative sectoral levels differ radically depending on which source of employment data is used. In all measures and data sources, labour productivity is higher in manufacturing than in private services. Although both the SASID and LFS data have shortcomings, the LFS data should however be treated with particular scepticism in the analysis of productivity and capital intensity, as the employment data and the capital stock and output data are based on different sources. In my own view the data pointing to the capital intensification of the economy is more credible.

Figure 18: 'Labour productivity' = total output/employment, 1970-2005 (SASID employment data)



All productivity measures are in Rmillion per worker.

Figure 19: 'Labour productivity' = total output/employment, 1997-2005 (LFS employment data)

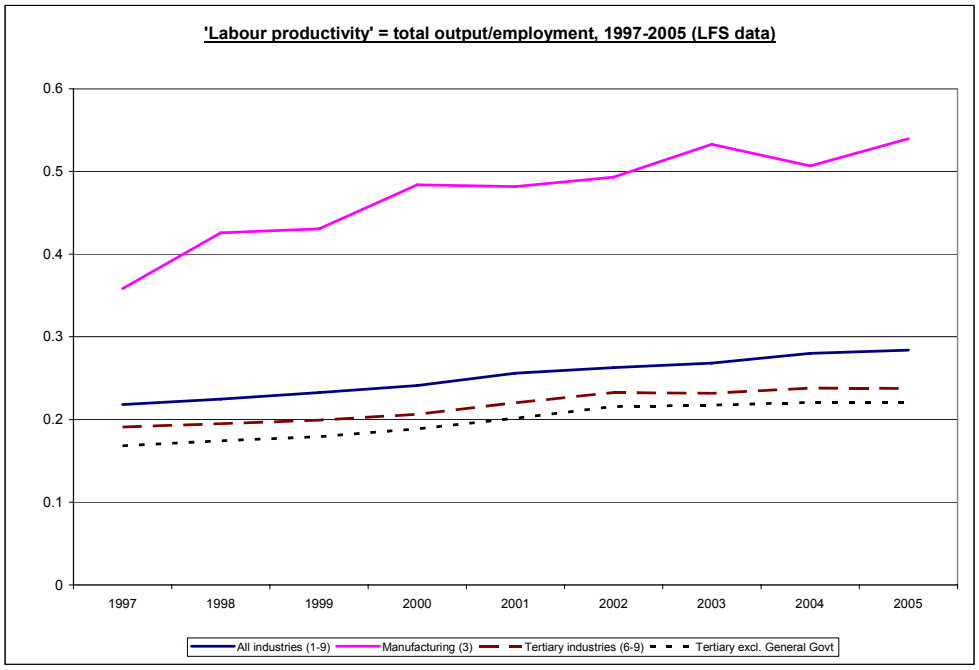
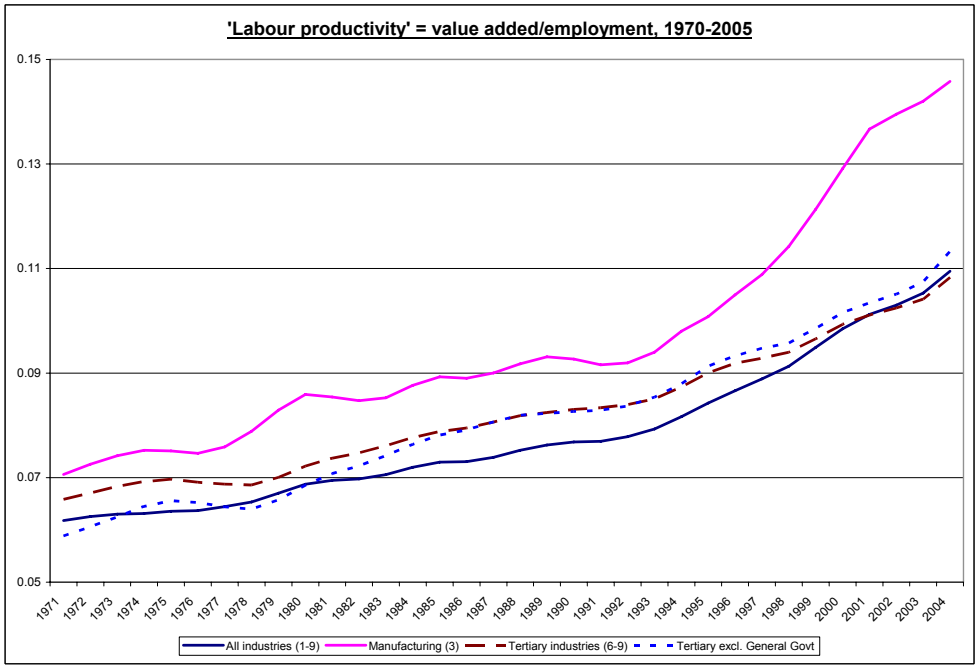
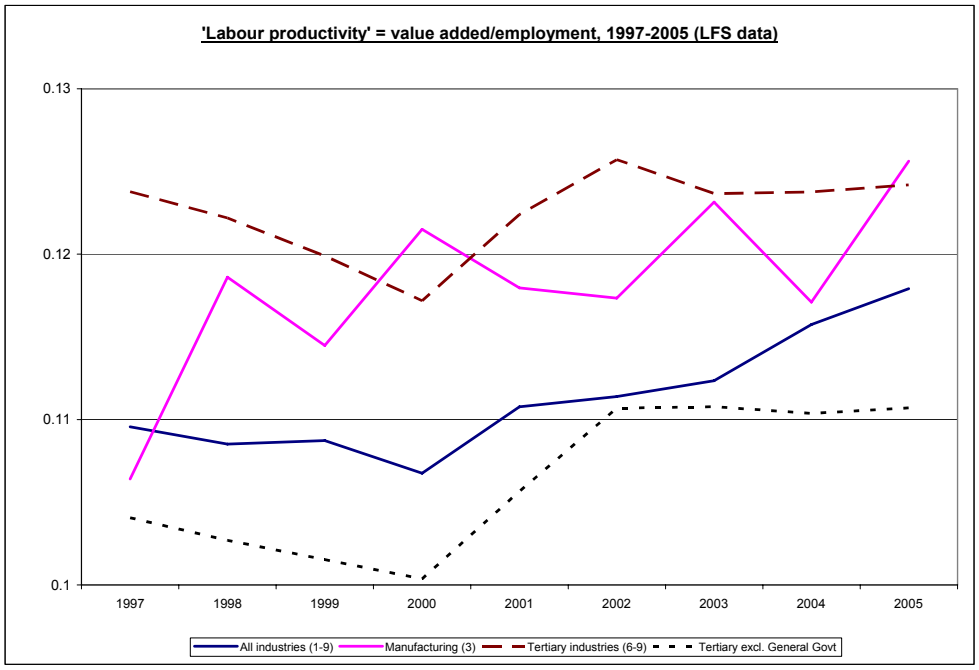


Figure 20: 'Labour productivity' = value added/employment, 1970-2005 (SASID employment data)



Note that for both of the labour productivity graphs in terms of value added, the y-axis does not start at 0 for visual clarity.

Figure 21: 'Labour productivity' = value added/employment, 1997-2005 (LFS employment data)



Figures 22 and 23 below summarise trends in value added, labour productivity and employment, for the manufacturing and (private) services sectors, over the period 1970-2005. Figure 22 uses SASID data and shows the trends from 1970-2005, while figure 23 uses LFS data and is limited to the period 1997-2005.

In addition to the earlier discussion of trends in these variables separately, the examination of these together can yield additional insights concerning changes in employment. Of course, given that growth in employment is simply the difference between growth in value added and growth in productivity, conclusions cannot necessarily be drawn about causal relationships.

Looking at the entire period from 1970 onwards (using SASID data), services show fairly steady growth throughout, without clear changes in patterns over the entire period. The growth is services employment is 'explained' (in a narrow mathematical sense) by the much faster rate of growth of value added over the rate of growth in productivity. If this data undermeasures employment and services employment in particular, this would mean that productivity and the rise in productivity is understated, especially for services. In the manufacturing sector, on the other hand, since about 1990 value added has risen but employment fallen, associated with rising productivity (at a faster rate than in services). Over the last decade the rate of growth in manufacturing value added has actually picked up, yet has been outstripped by productivity growth.

OHS/LFS data (figure 23, shown for 1997 onwards) show increasing employment in both the manufacturing and services sectors (although much higher in services than in manufacturing). The increases in employment however lag behind increases in value added, especially for manufacturing, hence labour productivity is still seen to rise particularly for manufacturing.

The higher employment figures compared to the SASID data result in lower increases in productivity.

Figure 22: Value added, labour productivity and employment in manufacturing and services, 1970-2005 (SASID employment data)

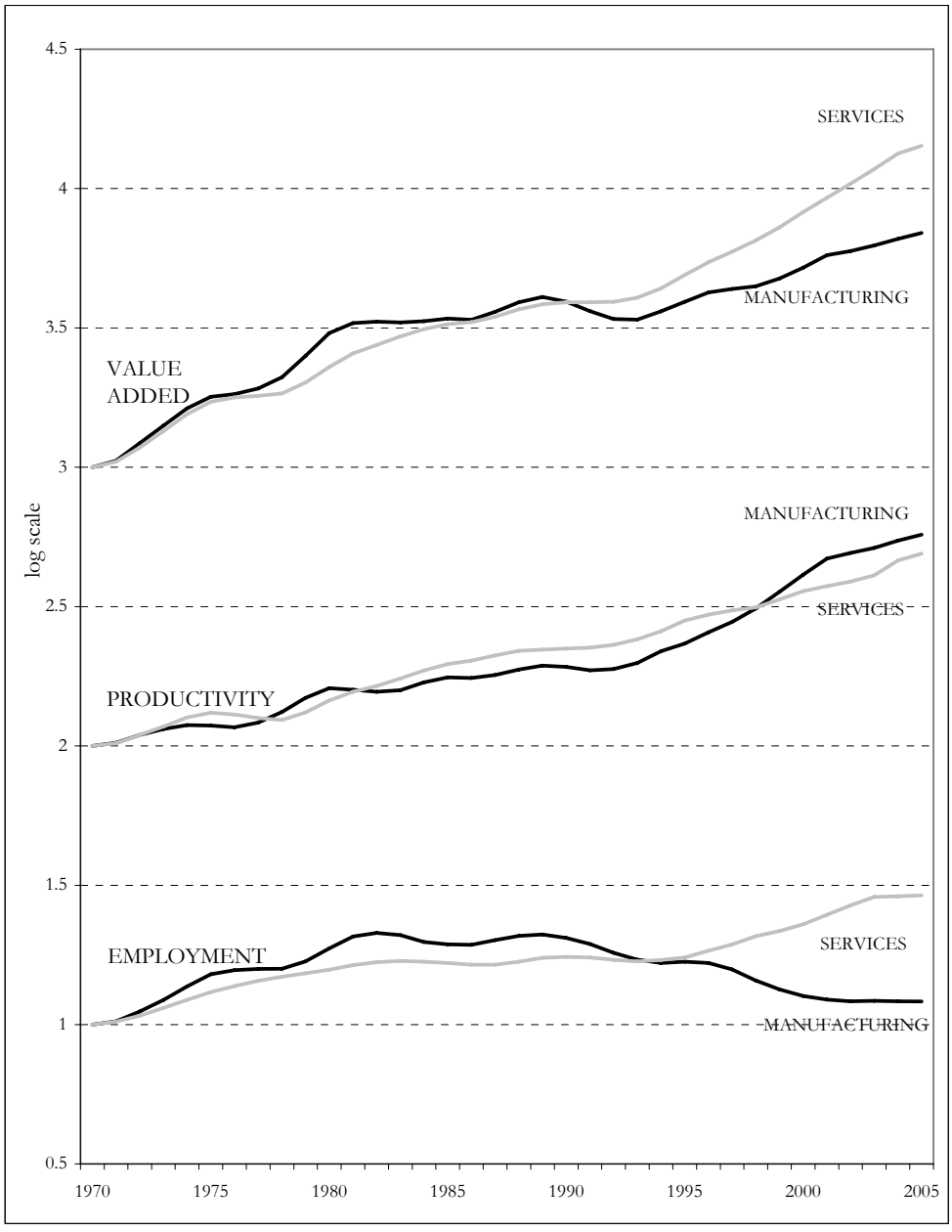
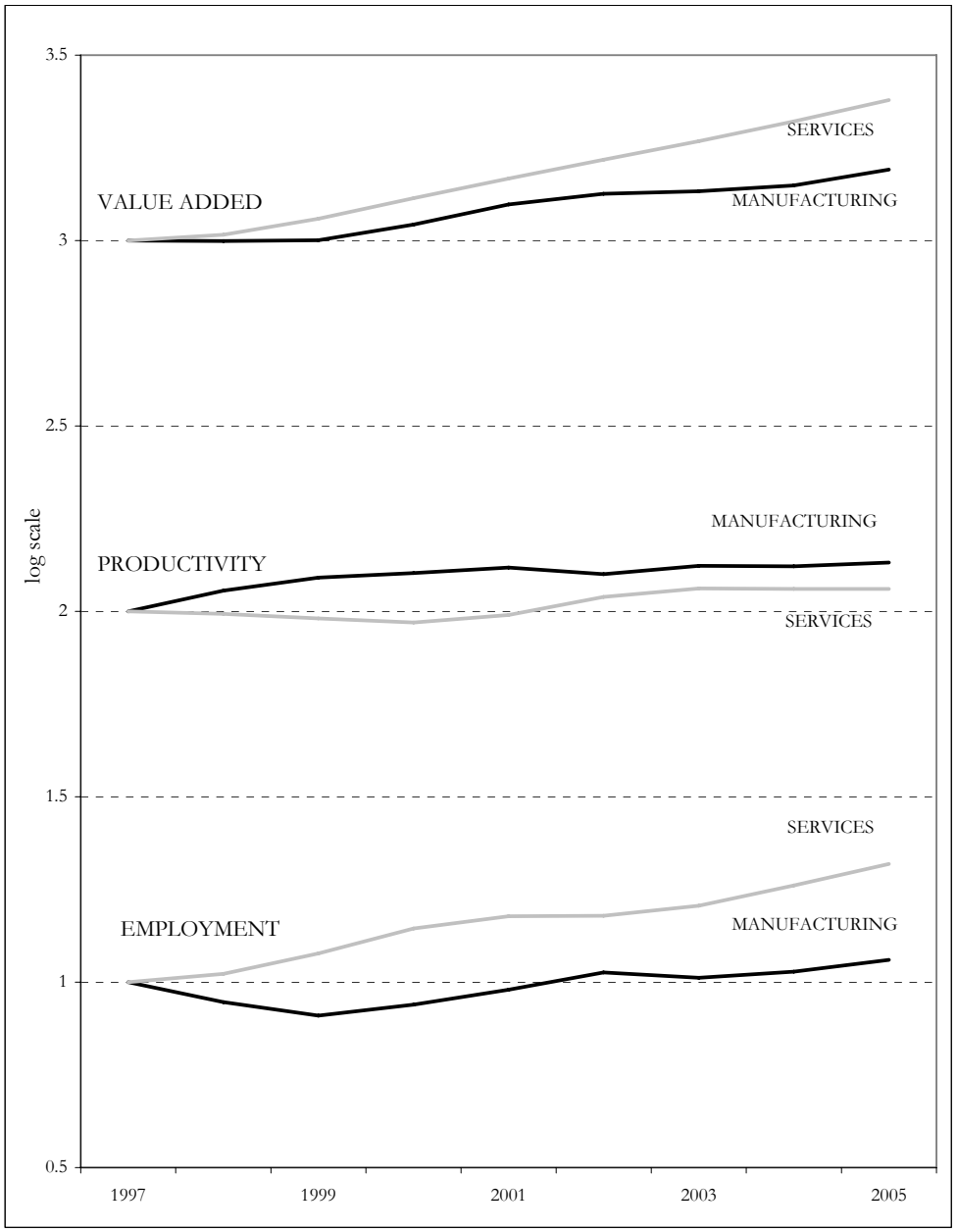


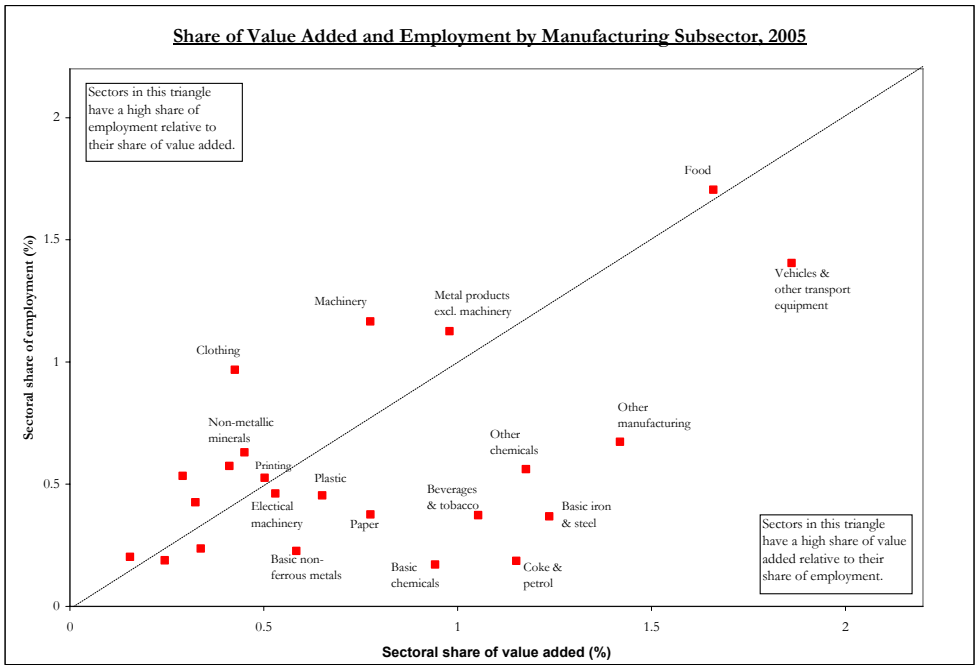
Figure 23: Value added, labour productivity and employment in manufacturing and services, 1997-2005 (LFS employment data)



Figures 24 and 25 show subsectors' contribution to value added and employment, in manufacturing and services respectively. A sector falling on the diagonal dotted line would be making an equal contribution to output and employment in the economy; a sector falling above the line would be contributing relatively more to employment than to output; while a sector falling below the line would be contributing relatively more to output than to employment. The relative size of sectors is of course evident from their positions.[27] The object of this exercise is to examine sectors' differential importance in terms of value added and employment, and further to investigate whether there different patterns are evident for the manufacturing and services sectors.

Although the picture is mixed, but on balance it appears that services sectors tend to be relatively more important from an employment perspective, while manufacturing sectors tend to be relatively more important from a value added perspective.[28]

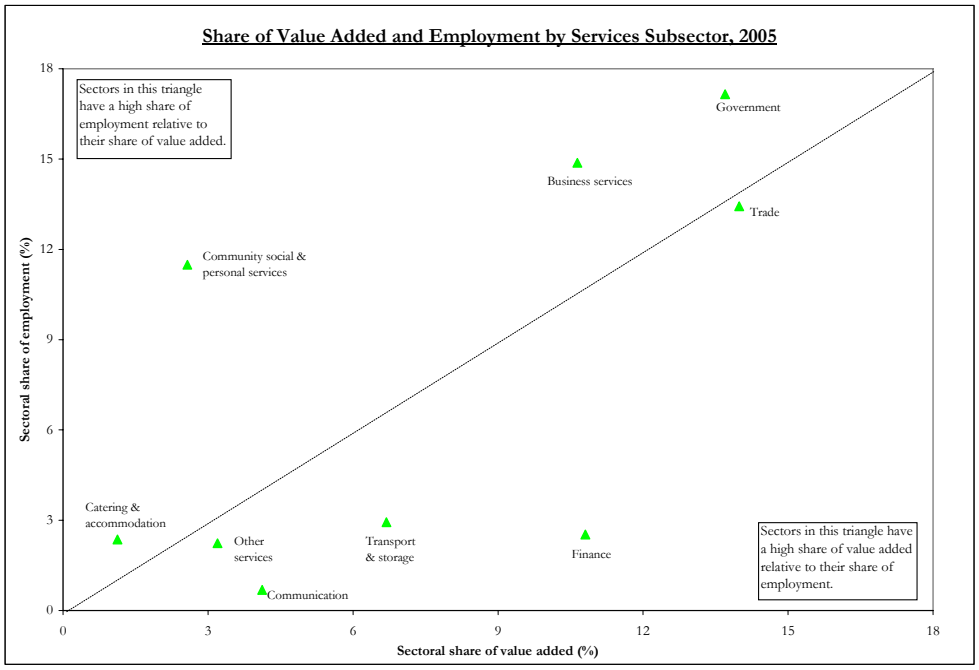
Figure 24: Share of value added and employment by manufacturing sector, 2005



[27] As appropriate and where their shares are very small, some sectors are clustered for heuristic purposes.

[28] This only shows sectors' direct contribution to value added and employment. The discussion of sectoral multipliers in section 6 will also factor in indirect contributions.

Figure 25: Share of value added and employment by services sector, 2005

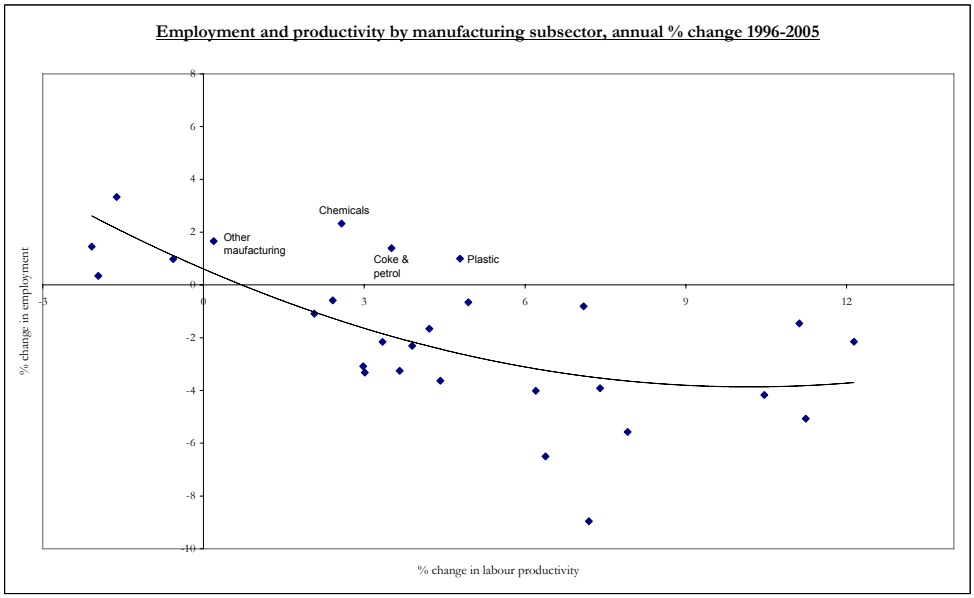


The scatterplots in figure 26 and 27 shows the relationship between changes in employment and labour productivity[29] by sector over the last 10 years, for manufacturing and services respectively. Apparent changes in labour productivity per se do not necessarily indicate any dynamism in a sector, but may simply be a function of a sector having shed employment without having reduced production (or at least not proportionately). It is thus perhaps more revealing to look at both changes in productivity and employment. In fact, there appears to a negative correlation between sectors' changes in labour productivity and in employment, for both manufacturing and services

Subsectors with both rising labour productivity and rising employment (those in the North-East quadrants, which are labelled) could be considered particularly employment-dynamic. Yet few subsectors fall within this category, especially in manufacturing. Most manufacturing subsectors fall in the South-East quadrants (rising labour productivity and falling employment).

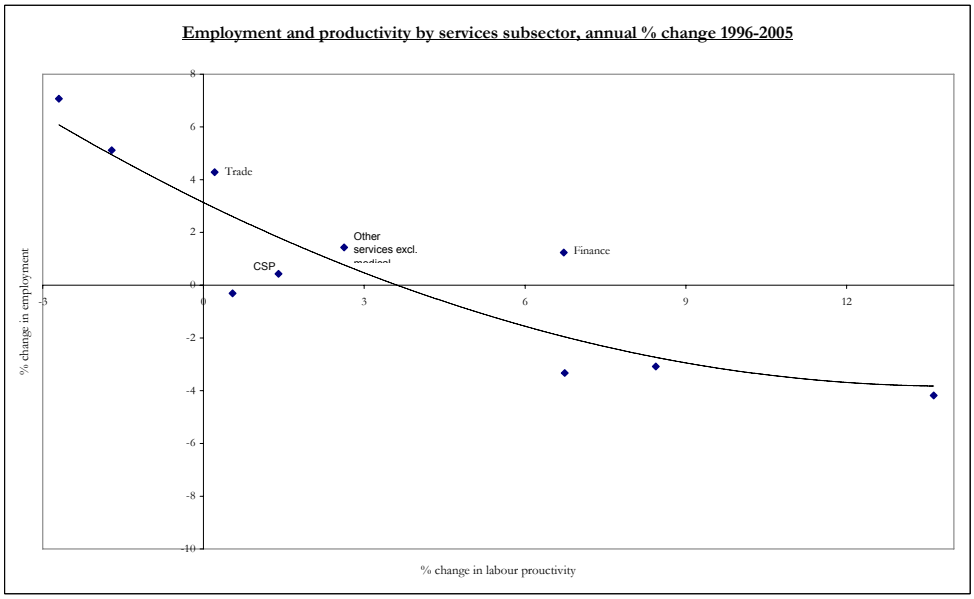
[29] Note that productivity should actually be measured in terms of labour hours rather than total employment; although it is not clear a priori in which direction this would change the relative trends given the preponderance of casualisation in services in particular.

Figure 26: Employment and productivity by manufacturing subsector, annual % change 1996-2005



Trendline: $y = 0.6 - 0.88x + 0.04x^2$, $R^2 = 0.46$

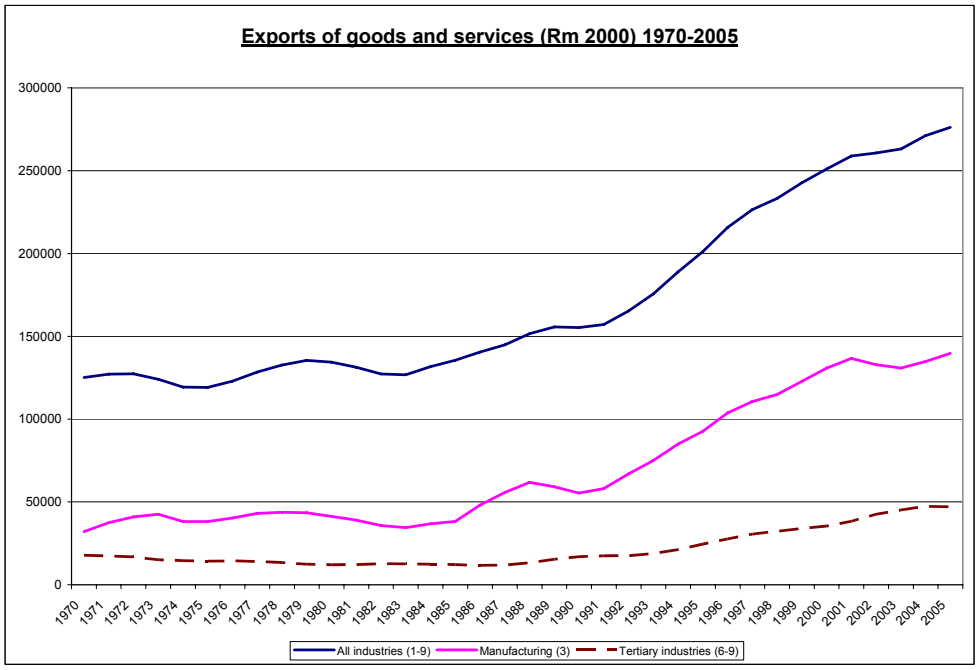
Figure 27: Employment and productivity by services subsector, annual % change 1996-2005



Trendline: $y = 3.14 - x + 0.04x^2$, $R^2 = 0.80$

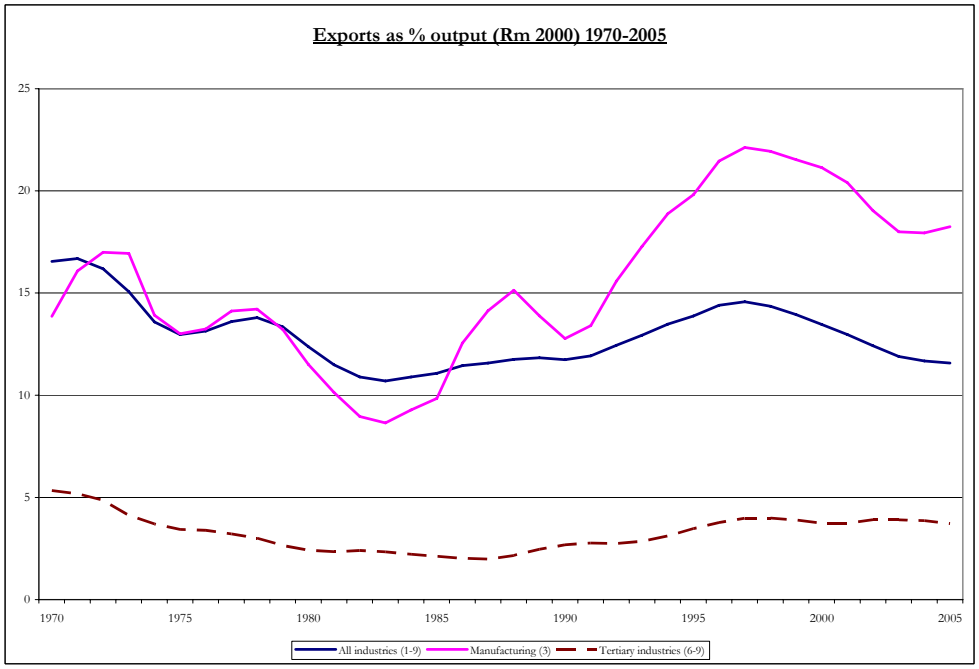
Figure 28 shows the trends in real exports by sector. 55% of exports are accounted for by manufacturing, up from a quarter in 1970 (when gold was far more important). The share of services has risen gradually, up to 17% in 2005 – far below services' share of output or value added (as would be expected). Note that there is some evidence that the share of services trade may be underestimated.

Figure 28: Exports of goods and services 1970-2005



Note that no series is shown for 'tertiary excluding general government' in this chart as the value of exports in the general government sector is 0.

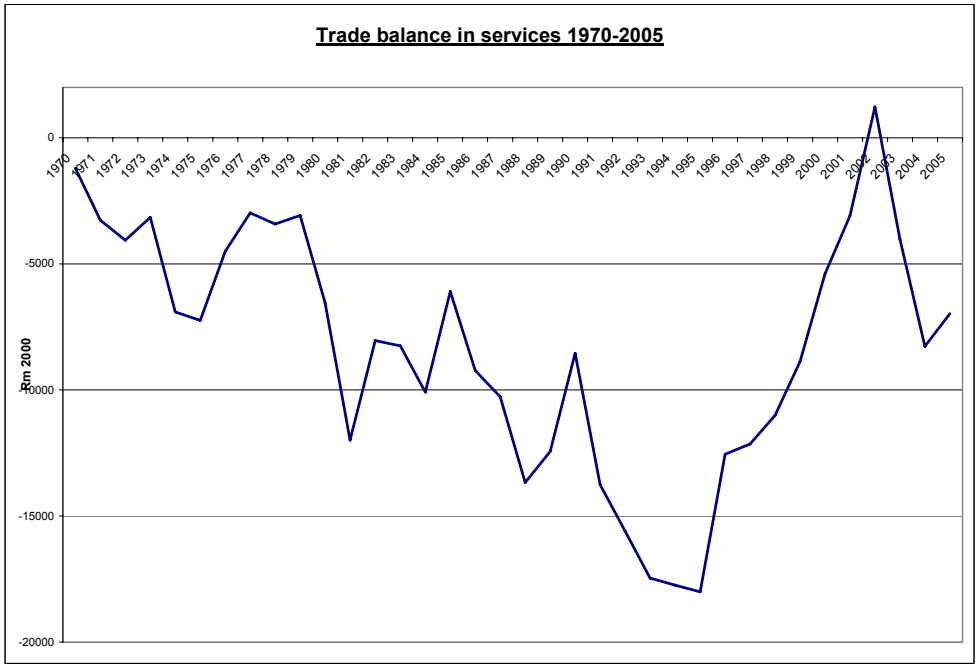
Figure 29: Exports as % of total output 1970-2005



In terms of the trade balance in services, as can be seen in figure 30, there is a deficit throughout, with the exception of a small surplus in 2002. The ongoing failure of the services sector to generate a trade surplus also needs to be taken in to consideration in assessing its dynamic and growth-supporting or growth-inducing capacity. Note, however, that as discussed in Altman at al (2005), there are serious problems with South Africa's data on trade in services, which call into question the veracity of these apparent trends. Nevertheless, it would be highly unusual for a country at South Africa's level of development to have

a trade surplus in services, apart from countries that have a particularly strong specialisation in activities such as tourism or finance. The dramatic rise in the trade balance in services from about the mid-1990s is striking. To the extent that the data is accurate, this might be related to the increase in services exports, especially to the rest of Africa, associated with the advent of democracy. However, if this is the case it is not clear why the trade balance would deteriorate again from about 2003 onwards. The changes in the trade balance may also be related to movements in the value of the Rand.

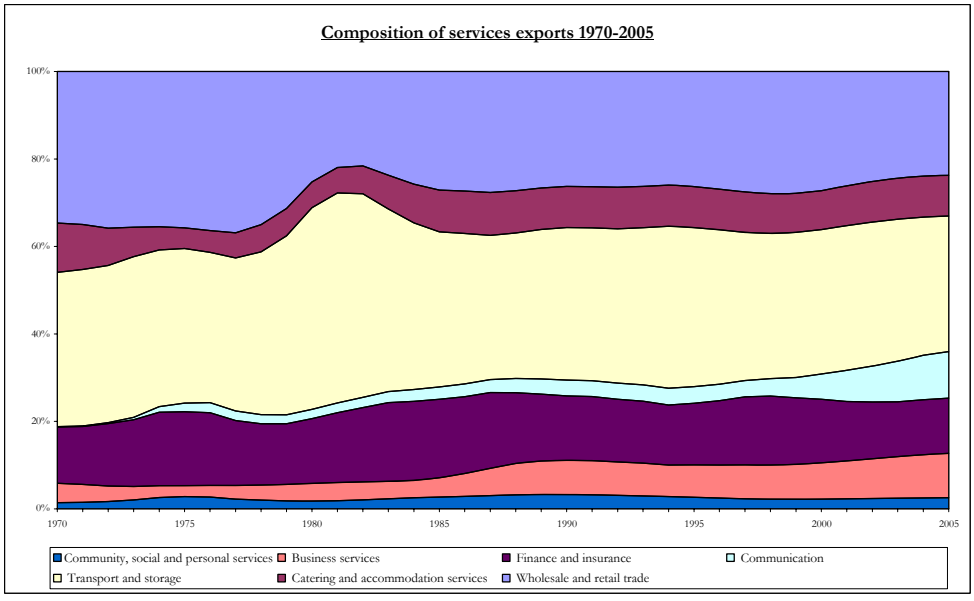
Figure 30: Trade balance in services 1970-2005



Source: SARB National Accounts

Figure 31 shows the composition of exports in services: the largest categories are transport and storage, and wholesale and retail trade.

Figure 31: Composition of services exports 1970-2005



6 Sectoral linkages and multipliers

6.1 Relevance of backward and forward linkages

This section builds on the empirical review in section 5 above, by investigating certain issues in more detail. The basic objective is to 'populate' some aspects of the conceptual template discussed in section 4, which set out various channels through which sectoral growth can contribute to overall economic growth over and above the direct contribution of the sectoral growth.

Forward and backward linkages between a sector and the rest of the domestic economy were identified as two of the channels through which growth in a sector can contribute to higher levels of overall economic growth, over and above the direct contribution of the sector. This is investigated primarily through the analysis of input-output tables, and also through the input-output parts of the Social Accounting Matrix (SAM). This analysis quantifies various direct and indirect backward and forward linkages and multipliers (including employment multipliers) of each sector and tracks the changes over time. This yields interesting results in terms of the relative strength of these linkages, particularly comparing the manufacturing and services sectors.

Backward linkages create additional demand for the output of upstream sectors. This additional demand can contribute to growth through increased upstream investment and/or capacity utilisation, as well as possibly contributing to upstream technological upgrading. How much a given sector contributes to growth through this channel depends on the strength of its upstream vertical integration with the domestic economy, as well as indirectly through the degree of integration of those upstream sectors to which it is linked.

Note that the share of a sector's total output that is (own) value added and that is sourced from upstream sectors are negatively related, as these sum to one. So-called 'high value-added' sectors are often regarded in South African policy discourse as positive and warranting prioritisation and active promotion. However, such sectors are necessarily more weakly integrated with upstream sectors. These two considerations thus need to be weighed depending on the particular challenges faced and policy priorities.

Forward linkages with downstream sectors of the domestic economy can also be a channel through which sectoral growth can raise overall growth. The primary mechanisms through which this can be realized are lower costs of intermediate inputs into downstream sectors, which can induce higher investment and/or capacity utilisation, technological upgrading, and increased productivity in those downstream sectors (as well as potentially indirectly into other sectors with which those downstream sectors are integrated). Hirschman also argues that a sector whose output can be used as intermediate inputs in other sectors will result in attempts to employ these products in new activities.

The strength of this forward-linkages growth channel for a given sector depends on the strength of its downstream vertical integration with the

domestic economy as well as of those downstream sectors with which it is integrated. The lower the proportion of final output in a sector's output, the higher the degree of its downstream vertical integration.

Differential forward and backward linkages between sectors, and the potential of these linkages to contribute to higher economic growth, suggest that an unbalanced growth path in which sectors with high linkages are prioritised – not that this is the only relevant criterion of course – could potentially reach higher growth than a balanced growth path.

Of course, not all linkages of similar size are equivalent, either analytically or in terms of policy implications. A high linkage coefficient does not necessarily indicate causality. Jones (1976) makes a useful distinction in this regard between *permissive* linkages and *causal* linkages. For instance, high forward linkages from sectors such as communications or electricity do not necessarily suggest that an expansion of these sectors would lead to the growth of downstream industries. On the contrary, these high linkages may actually reflect causality from the demand generated by downstream industries. Even so, high linkages in such a situation do indicate the importance of the upstream sector, as any failure on its part to meet downstream demand (assuming that this could not be substituted by imported inputs) would constrain downstream growth.

Hirschmanian-type production linkages, both backward and forward, are part of the 'sectoral specificity' of growth discussed earlier in this paper. They are often more strongly associated with the manufacturing sector, being considered part of the 'special properties' of manufacturing that accord it a privileged role in the growth process.

6.2 Some methodological issues

The methodology used to calculate the various linkages and multipliers is shown in Appendix 1. Here we simply highlight a particular issue around imported intermediates – which this study takes account of, unlike most similar work in the literature – as well as pointing out some caveats relevant to this type of analysis.

Using the total flow matrix to calculate linkages means that no distinction is made between inputs sourced domestically or abroad, and hence no distinction between the potential stimulation of upstream industries in South Africa or in other countries from which inputs are imported. Failure to distinguish these – as is often the case in analysis of intersectoral linkages – is thus very problematic. For instance, a backward linkage between two sectors that appears to show significant 'pulling power' from the downstream to the upstream sector may be misleading if a large proportion of the upstream inputs are in fact imported, with little stimulatory effect on the domestic economy.

When the difference between 'domestic' and 'worldwide' backward linkages arises because of differential resource endowments or because of differential capacities that are unlikely to converge in the short- to medium-term (or at least over the period of interest for the analysis), then 'worldwide' linkages

over and above the domestic ones are irrelevant to Hirschmanian growth processes. On the other hand, insofar as the gap between domestic and worldwide backward linkages is due to differences in the stage of development or to differential capacities which are subject to 'catch-up', then the gap actually points to the potential for import substitution.

Thus, use of the domestic flow matrix is relevant to ex post analysis of what has actually happened, as well as the relevance of this for what is likely to happen in the future period of interest. The total flow matrix is relevant to the 'upper bound' of backward linkages (if all imports could be substituted by domestically produced goods, and in the absence of changes in the degree of intersectoral integration).[30]

In order to take into account this issue of imported intermediate inputs, for each of the sets of linkages discussed below (and shown in Appendix 2), the results are analysed using both the total flow matrix (which includes imported intermediates) as well as the adjusted matrix (excluding these imported intermediates).

A caveat to be noted is that all multipliers discussed here are actually based on average and not marginal analysis. Any interpretation regarding what might happen if, for example, final demand for a certain sector rose, should be treated with caution. Such projections are most likely to be accurate for relatively small increases in the short- to medium- term. For example, a huge increase (decrease) in demand for the output of a given sector would not necessarily be associated with the same linkages and employment patterns as currently characterise the sector. This is especially pertinent in a relatively open economy, as expanded demand can be met through imports in greater proportion than is the case initially. To the extent that this is the case, it implies that the analysis might overstate the stimulatory effects on the domestic economy of an increase in demand. Further, this is likely to be stronger for manufacturing than for services, as tradables can generally be more easily substituted with imports. A final caveat at this point is that, given that these calculations are not integrated in an economy-wide model, no consideration is given to supply constraints or to macroeconomic considerations.

6.3 Output linkages

This section quantifies and discusses the relative strength of both backward and forward linkages between sectors, with a focus on the manufacturing and services sectors. This empirically investigates the issues discussed earlier at a theoretical level concerning the relative interdependence of sectors, with particular attention to the manufacturing and services sectors.

[30] A further exercise (not undertaken here) would be to identify, by sector, imported intermediates that can potentially and within the timeframe of interest be substituted by domestically produced goods, and on that basis to estimate a 'domestic potential' flow matrix from which technical coefficients could be derived.

The methodology used to calculate the various linkages and multipliers is shown in Appendix 1, and the tables of results are shown in Appendix 2. In this section the meaning of each of the measures is explained, and the key results concerning the linkages between the manufacturing and services sectors are highlighted.

First, we look at backward linkages in order to evaluate how 'dependent' one sector is on upstream sectors (suppliers) for its inputs. The upstream linkages coefficient of sector j with respect to sector i measures the percentage of sector i's intermediate inputs purchased from sector j.

25.3% of the intermediate inputs into manufacturing come from services (of which the bulk comes from trade and from finance). *24.7% of the intermediate inputs into services come from manufacturing*. The transport and community social and personal services subsectors of services are particularly dependent on manufacturing for their intermediate inputs. In this first measure, manufacturing and services are thus roughly equally dependent on each other for their intermediate inputs as a share of their total intermediate inputs.

These linkages can be re-examined excluding imported intermediates. As discussed earlier, this is important as backward linkages through imported intermediates would not have much stimulatory effect on the domestic economy (at least through the Hirschmanian-type channels under discussion here). *31.4% of all domestically produced intermediates into manufacturing are purchased from the services sector* (especially the trade and finance subsectors of services). On the other hand, *18.6% of all domestically sourced intermediate inputs into services come from manufacturing*. When imported intermediates are excluded, manufacturing is thus seen to be more 'dependent' on services inputs than the other way around (whereas they appeared roughly equal when looking at *all* intermediate inputs). Of course, the converse dimension of this 'dependence' of manufacturing for inputs from services is the demand generated by manufacturing for the output of the services sector.

The above calculations of backward linkages measured intermediate inputs from upstream sectors as a share of total intermediate inputs into each downstream sector. Next, we measure intermediate inputs from sector i into sector j as a share of the total inputs into sector j (that is, not only intermediate inputs from the same and other sectors but also remuneration, net operating surplus, consumption of fixed capital, and taxes and subsidies).*18.7% of the total inputs into manufacturing come from services*, while conversely *11.8% of the total inputs into services come from manufacturing*. In this respect, manufacturing has greater 'backward dependence' on services for its inputs than the other way around. When these figures are adjusted to exclude imported intermediates, the *backward link from manufacturing to services is slightly brought down to 18.2%* whereas the *backward link from services to manufacturing is brought down more to 8%.* (The greater drop in the latter is case is due to the higher share of imports in the intermediate inputs used in manufacturing than in services.) Excluding imported inputs, the greater 'backward dependence' of manufacturing on service inputs is thus underlined. This means that manufacturing uses relatively more inputs from services than the other way around.

Next, backward linkages are weighted according to the size of each sector (the relative size of each input sector i). The *weighted backward dependence of manufacturing on services is 0.65 (0.69 excluding intermediate inputs)*, while the *weighted backward dependence of services on manufacturing is 0.54 (0.40 excluding intermediate inputs)*. Relative to the sizes of the two sectors, while manufacturing is still disproportionately 'dependent' on services for its inputs, the difference is not as great as in the unweighted figures.

In the final part of the analysis of backward linkages, we factor in both direct and indirect linkages through the input inverse (sometimes referred to as the Leontief inverse). This is the key measure of the strength of total backward linkages. The input inverse shows the inputs from sector i that would be required (both directly and indirectly) for sector j to meet one additional unit of final demand. *An additional unit of final demand for manufacturing output would require an additional 0.65 units of services*. On the other hand, *an additional unit of final demand for services output would require an additional 0.35 units of manufacturing.* This asymmetry is somewhat closed when imported intermediate inputs are excluded, although manufacturing is still more 'dependent' on services in terms of backward linkages than the other way around: a *unit of final demand for manufacturing output would require 0.46 units of inputs from services* while a *unit of final demand for services output would require a 0.19 units of inputs from manufacturing.*

For the economy as a whole, an additional unit of final demand for manufacturing would require an additional 2.9 units of output (2.1 when import adjusted). An additional unit of final demand for services would have a weaker stimulatory effect on the economy as a whole: 2.1 units of additional output (or 1.8 when import adjusted). This is a central result, which suggests that a stimulus to manufacturing would have greater multiplier effects on the economy than an equal stimulus to services. Within services, the highest total multiplier is for transport, followed by community social and personal services, with the lowest multiplier for finance. However, the multiplier for manufacturing is higher than for any of the service subsectors analysed individually.

Having analysed backward linkages, we now turn to forward linkages. The object is to assess the relationship between each sector and its downstream (user) industries.

As can be seen from table A9, these coefficients sum to 100% across rows (unlike the backward linkage measures, which down columns). Initial analysis suggests approximate symmetry between manufacturing and services although services is slightly more dependent on manufacturing as a source of demand than the other way around. *23.2% of the output of manufacturing that goes as intermediate inputs into other sectors, goes into services* (i.e. services accounts for 23.2% of the demand for intermediate outputs from manufacturing). The main component of this demand from services is from the transport, storage, and communication subsector of services. On the other hand, *24.2% of the output from services that goes as intermediate inputs into other sectors, goes into manufacturing.* As would be expected, these figures are only slightly affected by the exclusion of imported intermediates.

However, since the proportion of output that goes to intermediate inputs varies significantly across sectors, this part of the analysis does not necessarily give a full picture of the importance of demand from each sector in the total demand for a sector's output. We thus consider forward linkages in terms of total output, which is probably a more relevant measure. Tables A11 and A12 thus show the demand from each sector i for a sector j's output, as a share of the total output of that sector j. (Of course the rows in this table no longer sum to 100%, as not all the output of each sector goes into intermediate inputs – some is consumed, exported, and so on). *15.7% of total manufacturing output goes into services* (as intermediate input); whereas *14.1% of total services output goes into manufacturing* (as intermediate input) Excluding imported intermediates, *10.7% of total manufacturing output goes into services* and *13.6% of total services output goes into manufacturing*. In this sense services is more dependent on manufacturing as a source of demand than the other way around.

One consideration to be borne in mind in comparing these coefficients between the manufacturing and services sectors is that by virtue of the fact that manufacturing is a secondary sector while services are tertiary, one might expect a greater proportion of manufacturing output to go into services than vice versa. This makes the greater dependence of services on manufacturing as a source of demand more noteworthy than would otherwise be the case.

The relative size of sectors is also relevant to interpreting these results. For instance, were the manufacturing and services sector to have equally 'strong' forward linkages with the rest of the domestic economy, the downstream dependency ratios of services would still show up as much higher than those of manufacturing, simply by virtue of the fact that services' share of the economy is several times as large as the share of manufacturing. We thus also calculate the weighted downstream dependency coefficients.

When weighted according to sector size, the importance of *manufacturing as a source of demand for the output of the services sector is 0.65*, whereas the importance of *services as a source of demand for manufacturing is 0.54*. This indicates that, even more when adjusted for relative sector size, manufacturing is more important as a source of demand for services than the other way around. This asymmetry is heightened when imported intermediates are excluded: the weighted downstream dependence of manufacturing on services is 0.69 compared to 0.4 for services on manufacturing.

Finally, we consider not only direct but also indirect linkages through the output inverse and total forward linkage vector. A one unit increase in primary input into manufacturing would need an additional 0.46 (0.25 when import adjusted) units of services in order to fully utilise it, including both direct and indirect intersectoral linkages. An additional unit of primary input into services would need an additional 0.49 (0.34 when import adjusted) units of manufacturing production in order to fully utilise this initial increase. This suggests stronger forward linkages from services to manufacturing than the other way around.

In terms of economy-wide total forward linkages, an additional unit of primary input into manufacturing would need an additional 2.7 units of total production in order to fully utilise it (1.9 when import-adjusted) while an

additional unit of primary input into services would need an additional 2.4 units of total production in order to fully utilise it (2.1 when import-adjusted). These figures are of a roughly similar order of magnitude when comparing manufacturing and services. However, the policy implications of these figures are not as strong as in the case of the total backward linkages, which show the multiplier potential of the different sectors.

6.4 Trends over time

All of the measures discussed here of various forward and backward linkages were also calculated on a historical basis from 1970 onwards (in current terms) and from 1980 onwards (in constant terms). Figures 32-35 below show the trends in direct and total backward and forward linkages over time (in constant terms). Both the direct and total backward linkages of manufacturing are significantly stronger than those of services for the entire period (although in the case of the direct linkages, services appears to be slightly converging towards manufacturing over time). The stronger backward linkages of manufacturing indicate the importance of manufacturing as a source of demand in the economy and in terms of 'growth-pulling'.

Looking at forward linkages over time, a similar pattern is evident between direct and indirect linkages. Interestingly, services overtakes manufacturing in the strength of forward linkages in the mid-1990s. There is also greater volatility in the trends for manufacturing than for services, which may be related to the relative tradability of the two sectors. It is not clear at this point as to why the backward linkages of manufacturing and services track each other fairly evenly over the entire period, whereas in the case of forward linkages there is a distinct shift in the mid-1990s where the linkages of services rise significantly. This may be indicative of the increasing 'maturity' of the services sector, and could also be related to composition changes within services.

The total forward linkages and total backward linkages of the economy (which are of course equal) and coefficient of interdependence of the economy have also risen significantly since the late 1990's. This is especially surprising in the context of the increasing openness of the economy during this period. These trends might be positive in terms of the degree of internal integration and 'depth' of the economy. Further research could investigate these issues in greater detail.

Figure 32: Direct backward linkage vectors 1980-2005, Manufacturing and Services (constant prices)

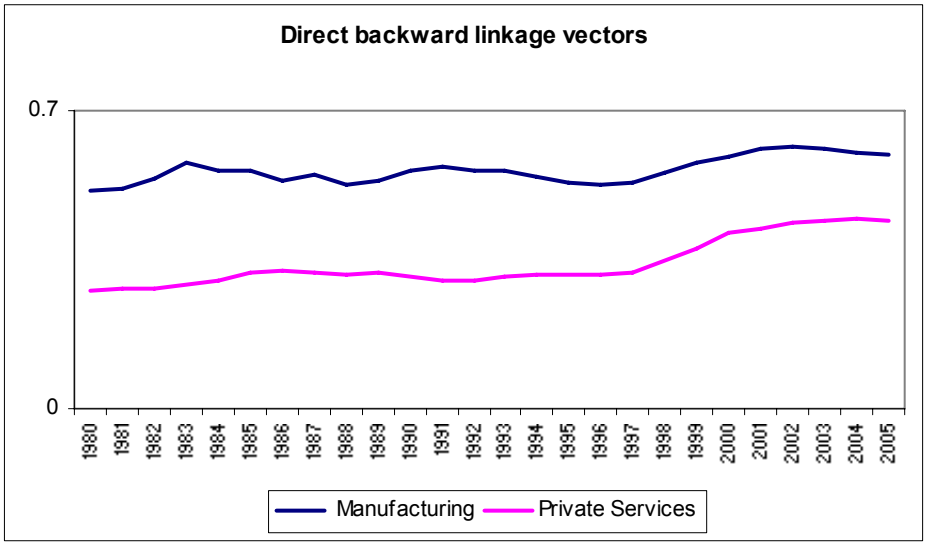


Figure 33: Total backward linkage vectors 1980-2005, Manufacturing and Services (constant prices)

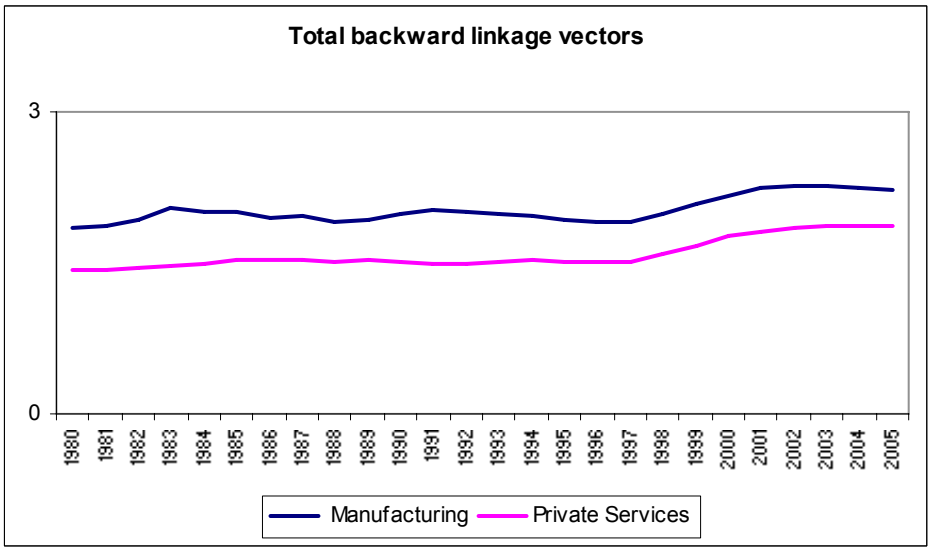
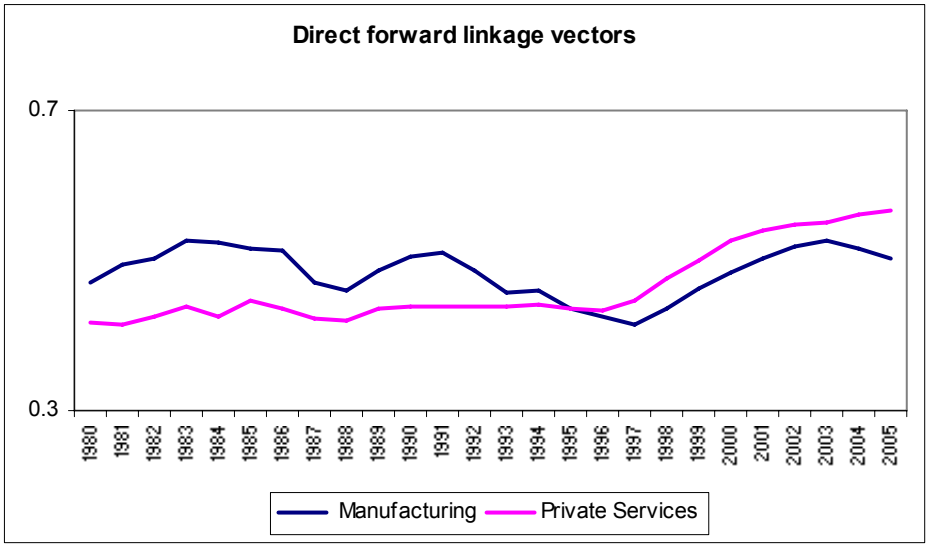
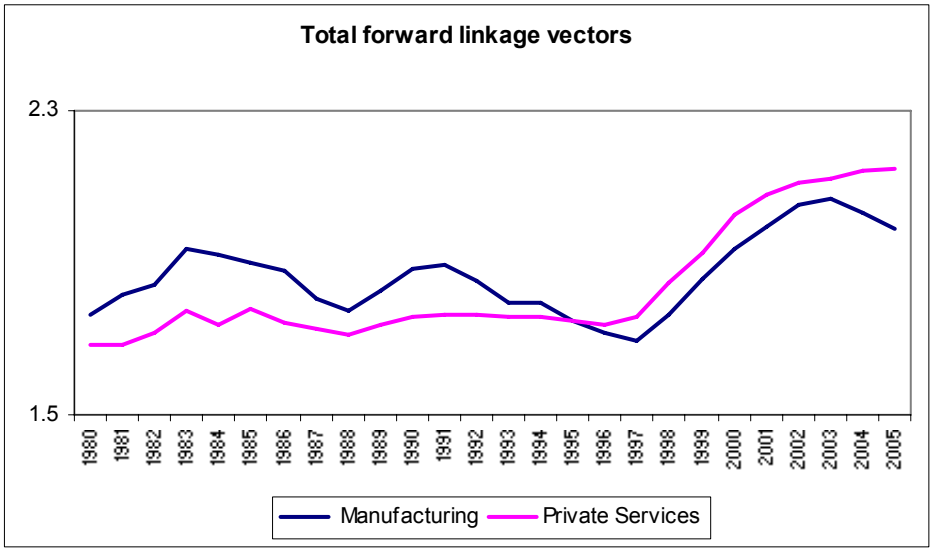


Figure 34: Direct forward linkage vectors 1980-2005, Manufacturing and Services (constant prices)



Note that the y-axis does not start from zero.

Figure 35: Total forward linkage vectors 1980-2005, Manufacturing and Services (constant prices)



Note that the y-axis does not start from zero.

6.5 Employment multipliers

Employment multipliers across sectors (for 2005), in total and for each skills category separately, are shown in tables A17-A20. These project how many additional jobs (actually full-time, full-year equivalents) in each sector and hence overall would be required to meet a R1m increase in final demand for each sector j. The total employment multiplier exceeds that of services: 5.46 for services compared to 4 for manufacturing. Manufacturing is associated with more indirect jobs in services that the other way around (R1 million increase in final demand for manufacturing would be associated with 1.37 jobs

in services, whereas R1 million increase in final demand for services would be associated with only 0.22 jobs in manufacturing).

For subsectors of services, the total employment multipliers are highest for community social and personal services, followed by trade, finance, and finally transport. The high-skilled employment multiplier is highest for finance and lowest for transport. The skilled employment multiplier is highest for trade and again lowest for transport. Finally, the multiplier for semi- and unskilled labour is highest for community social and personal services – making it potentially a key sector for generating employment for unskilled labour – and lowest for transport and for finance.

Figures 36-39 below show the employment multipliers over time[31]. Overall, the employment multipliers of both manufacturing and services have been falling over time. This is consistent with the generally acknowledged declining employment elasticity of output in South Africa. Reasons for this could include capital-augmenting labour-displacing technological change, trade liberalisation, changes in relative factor costs, political economy factors leading to capital intensification, and compositional changes in the economy.

Data limitations need to be pointed out again at this stage. The employment multipliers are calculated using the SASID data, which may underestimate employment – particularly in small firms, in new firms, and in unregistered firms; and as mentioned earlier is likely to especially under-represent services employment. This analysis may thus underestimate employment multipliers as well as overstating the decline, especially in services. However, even if the decline is overestimated, the finding that employment multipliers have been falling is consistent with other evidence (even, for example, with the fact that net employment creation has lagged well behind economic growth).

This decline in employment multipliers is obviously of concern in terms of the employment-absorbing capacity of economic growth. Of the various employment multipliers shown, the only one to increase over time is the skilled employment multiplier of services. The total employment multiplier of services is higher than that of manufacturing throughout the period, and further that of manufacturing has declined at a faster rate than that of services.

Looking at the multipliers for high-skilled labour (figure 37), this is where the multiplier of services most exceeds that of manufacturing. This is somewhat surprising, given that manufacturing is typically thought of as using more skilled labour and services as being a prime absorber of unskilled labour. However, it is consistent with the fact that the services sector in South Africa employs more skilled labour than does manufacturing, in both proportionate and absolute terms (see figures 12 and 13). The high-skilled employment multipliers are smaller than either the skilled or semi- and unskilled employment multipliers. The only category of employment multipliers in which manufacturing exceeds services is for semi- and unskilled labour. However, the semi- and unskilled employment multiplier has been declining

[31] Note that the 2005 data in the tables and charts do not correspond as the former are calculated in current prices and the latter in constant prices in order to evaluate trends over time.

more rapidly for manufacturing than for services. In interpreting the multipliers for the different skills categories it should again be borne in mind that these are based purely on occupational groups.

Figure 36: Total employment multipliers 1980-2005

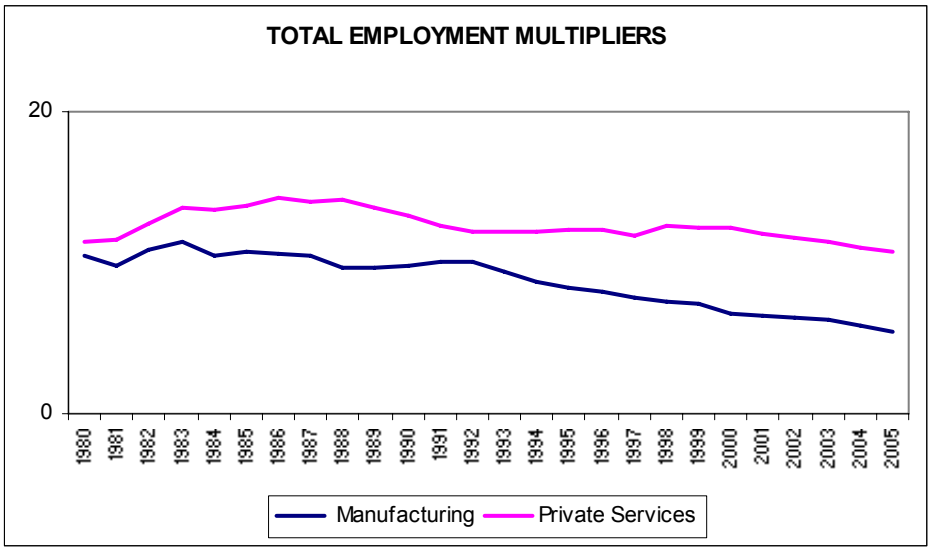


Figure 37: High skilled employment multipliers 1980-2005

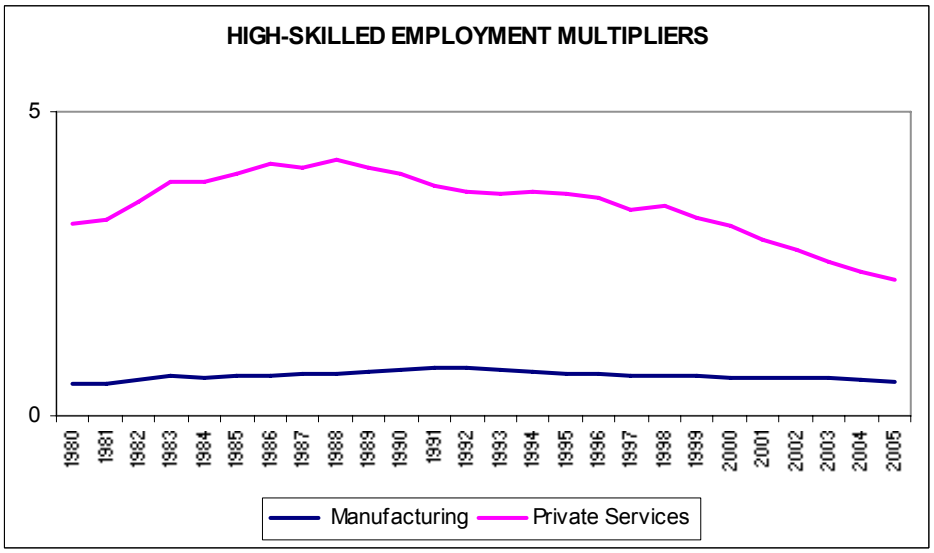


Figure 38: Skilled employment multipliers 1980-2005

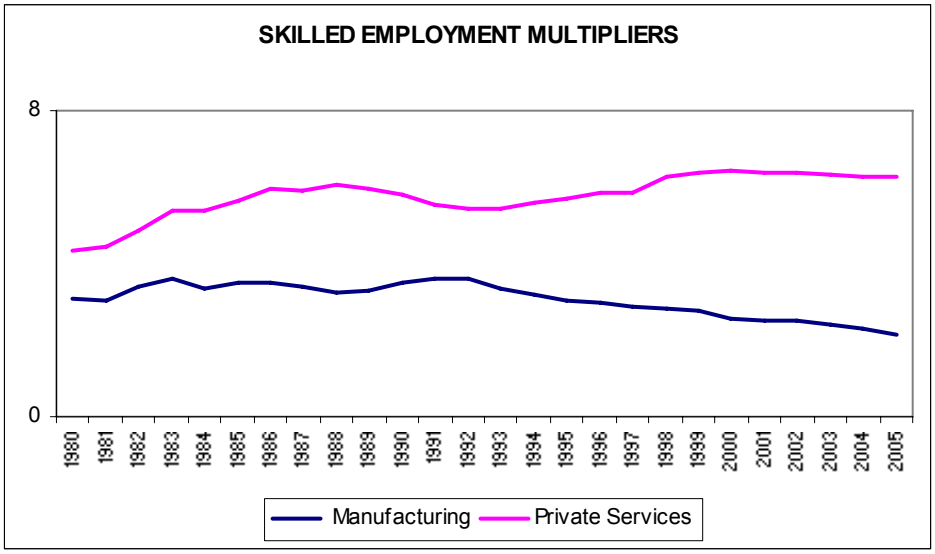
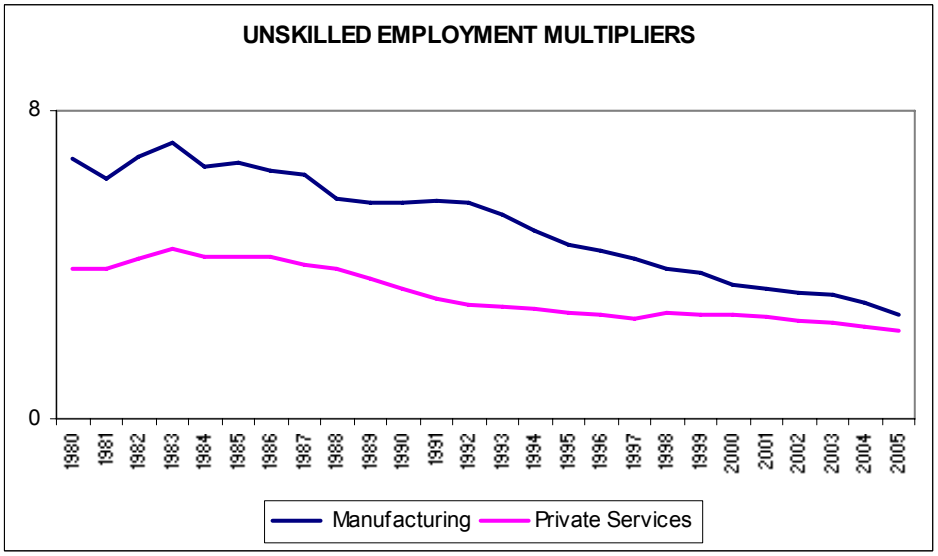


Figure 39: Semi- and unskilled employment multipliers 1980-2005



6.6 Summary of results based on input-output tables

The key empirical results emerging from this analysis of linkages and multipliers in the South African economy can be summarised as follows. Manufacturing uses more inputs from services (as intermediate inputs in manufacturing production), than the other way around. This holds whether or not imported intermediate inputs are excluded. Even when weighted for the relative size of the two sectors, the backward linkages from manufacturing to upstream services are stronger than from services to upstream manufacturing. This points to the importance of manufacturing as a source of demand for services. It also suggests that the costs and quality of services (that form intermediate inputs into manufacturing) are important for the competitiveness of manufacturing.

Factoring in both direct and indirect backward linkages, an additional unit of final demand for manufacturing would require significantly more additional input from services than the other way around. Similarly for the economy as a whole, an additional unit of final demand for manufacturing would require more inputs than would an additional unit of services.

These results are consistent with those from the analysis of forward linkages. In particular, manufacturing is more important as a source of demand for the output of the services sector than is services as a source of demand for the manufacturing sector. This holds whether or not imported intermediates are excluded. This is a striking result, particularly in the light of the greater size of the services sector relative to manufacturing.

These findings could suggest that manufacturing could have greater 'pulling power' on services than the other way around. In terms of economy-wide multipliers, an additional unit of final demand for manufacturing would require greater inputs from other sectors than is the case for services, suggesting that growth (decline) in manufacturing would have a greater stimulatory (contractionary) effect on the economy as a whole than an equal increase in final demand for services.[32]

In terms of economy-wide total forward linkages, and factoring in both direct and indirect effects, the increase in total production that would be required to fully utilise an additional unit of primary input are roughly similar for manufacturing and services.

The strength of the backward linkages from manufacturing to services (or the forward linkages from services to manufacturing) indicates that the cost and quality of service inputs into manufacturing are crucial for the competitiveness of manufacturing. Further, there is an asymmetry between manufacturing and services in terms of the possibilities of substituting imported inputs for domestically produced inputs – given that manufacturing is (in general) more tradable than services, it is easier for services to switch to imported manufacturing inputs than for manufacturing to switch to imported services inputs. This further underscores the importance of the cost and quality of (domestic) service inputs into manufacturing.

It is also worth noting that the amount that the manufacturing sector spends on service inputs far exceeds the total wage bill of the manufacturing sector. In 2005 (current prices), manufacturing spent R186 billion on intermediate inputs from domestically produced services and R118 billion in remuneration. This puts in perspective arguments around the importance of manufacturing wages for competitiveness – while the level of manufacturing wages is of course important for the competitiveness of the sector, the cost and quality of inputs sourced from services are likely to be at least as important.[33]

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[32] Of course, this focuses only on growth-enhancing effects through intersectoral linkages; in assessing the overall potential of a sector for stimulatory/contractionary effects of the economy other channels would also need to be factored in, for example through the balance of payments.

[33] Wages in the services sector would also be germane to the cost of inputs from services into manufacturing, yet wages do not account for the bulk of costs in services.

Considering the trends in backward and forward linkages from 1980 onwards, both the direct and total backward linkages of manufacturing are significantly stronger than those of services for the entire period. Services does appear to be beginning to catch up with manufacturing in terms of direct linkages.

A different picture emerges regarding employment multipliers. Ominously for the potential for employment creation – particularly with respect to the employment-creating potential of economic growth – the employment multipliers of both manufacturing and services have been falling over time. The total employment multiplier of services is higher than that of manufacturing throughout the period, and further that of manufacturing has declined more rapidly than has the total employment multiplier of services. The high-skilled employment multipliers of services far exceed those of manufacturing, whereas the low-skilled employment multipliers of manufacturing exceed those of services. To the extent that the skills multipliers to convey useful information (given that they are based purely on occupational categories), this does point to the potential importance of manufacturing in (both directly and indirectly) absorbing low-skilled labour.

6.7 SAM-based linkages and multipliers

Next, we continue with the analysis of intersectoral linkages and multipliers by using as a source the Social Accounting Matrices (SAMs). These are built up not only from supply and use tables but also from institutional sector accounts (such as of households). Although including more information than the input-output tables, there are also more assumptions in the construction of a SAM, and hence the results derived from a SAM are not necessarily more accurate. It should also be noted that SAM multipliers tend to be higher than Input-Output multipliers, as the latter do not include some of the indirect multiplier effects through wages and so on

Table 2 shows the output, income, and employment multipliers by sector, as derived from the 2003 SAM. These figures show the impact of a R1 million increase in final demand for the commodity of a given sector[34], with sectors as shown in the first column on output[35], on factor incomes, on household incomes, and employment, of the economy as a whole. The object of this analysis is, by also factoring in indirect effects, to investigate the degree to which various sectors are connected to/integrated with the rest of the economy in terms of output, incomes, and employment.

Note that the employment multiplier does not refer to the number of new jobs created, but to the number of full-time full-year person year equivalents. Each person year is equivalent to 1,725 hours per year, which is based on 7.5 hours per day for a 5-day week and 46 weeks of work per year. This means, for example, that part-time casual jobs are measured here as less than one person-year equivalent.

[34] Which could come from government expenditure, investment demand, changes in stocks, or changes in exports (not household expenditure).
[35] This is the activities multiplier.

For example, reading along the first row, a R1 million increase in final demand for agricultural commodities is expected to result in a R3.04 million increase in economy-wide output, a R1.31 million increase in factor incomes, and a R0.88 million increase in household incomes. Comparing the manufacturing and services multipliers (in bold), each of the three multipliers is higher for services than for manufacturing.

Note that the factor income multipliers exceed the household income multipliers, as not all of the wages and returns to capital (included in factor income) is distributed to households.

Looking at the multipliers across sectors, several interesting findings emerge. First, in terms of the output multipliers, the sectors with the highest multipliers are construction, water and gas, and wearing apparel, followed by government services, and wood and wood products. At the other end, the sectors with the very lowest output multipliers are communications equipment, transport equipment, and machinery, followed by scientific and professional equipment and finance. Figure 40 shows the output multipliers by sector from highest to lowest.

For both the factor income and household income multipliers, the sectors with the highest multipliers are government services, gold mining, other service producers, wholesale and retail trade, and electricity; while those with the lowest are communication equipment, transport equipment, machinery, and vehicles.

Table 3 shows three employment multipliers derived from the SAM for each sector. These are broken down into employment into the three skills categories (high-skilled, skilled, and semi- and unskilled), with the total employment multiplier being the sum of these three multipliers. For example, a R1 million increase in final demand for agricultural commodities is expected to result in an increase of 1 high-skilled, 3.1 skilled, 10.92 semi- or unskilled, and a total of 15.02, full-time person year equivalents.

The sectors with the highest employment multipliers are other service producers, agriculture, government services, gold mining, medical and other producers, and wood and wood products. The sectors with the lowest employment multipliers are communication equipment, transport equipment, coke and petroleum, machinery, and vehicles. The sectors with the highest multipliers for high-skilled labour are government services, medical and other services, and business services; and those with the lowest are communication equipment, transport equipment, and other mining. For skilled labour, the sectors with the highest multipliers are government services, other producers, and trade services, and those with the lowest are the same as for high-skilled labour. Finally, the sectors with the highest multipliers for semi- or unskilled labour are agriculture, other producers of community social and personal services, and gold, while those with the lowest are again similar as for the other skills categories – communication equipment, transport equipment, and financial and related services.

Figure 36 compares employment multipliers across sectors.

Table 2: SAM Sectoral multipliers (2003)

	Output multipliers	Factor income multipliers	Household income multipliers
Agriculture	3.04	1.31	0.88
Coal	3.30	1.41	0.99
Gold	3.43	1.59	1.16
Other mining	2.37	1.03	0.71
Food processing	3.40	1.27	0.88
Beverages and tobacco	2.80	1.12	0.77
Textiles	3.07	1.13	0.80
Wearing apparel	3.24	1.29	0.93
Leather products	3.52	1.16	0.81
Footwear	2.63	1.00	0.71
Wood products	3.56	1.36	0.99
Paper products	3.69	1.33	0.93
Printing and publishing	3.20	1.24	0.93
Petroleum products	2.41	0.92	0.62
Chemical products	2.84	1.01	0.70
Other chemical products	3.14	1.15	0.82
Rubber products	2.92	1.08	0.78
Plastic products	3.39	1.24	0.90
Glass products	3.01	1.16	0.82
Non-metallic metal products	2.99	1.15	0.79
Basic iron and steel	3.51	1.25	0.86
Non-ferrous metals	3.11	1.18	0.78
Metal products	3.41	1.21	0.87
Machinery	2.10	0.79	0.56
Electrical machinery	2.94	1.06	0.76
Communication equipment	1.23	0.48	0.34
Scientific equipment	2.18	0.90	0.63
Vehicles	2.64	0.86	0.61
Transport equipment	1.56	0.58	0.43
Furniture	3.44	1.32	0.95
Other industries	2.87	1.20	0.82
Total manufacturing	**2.79**	**1.03**	**0.72**
Electricity and gas	3.33	1.47	1.02
Water	3.78	1.44	0.97
Construction	3.85	1.34	0.96
Trade services	3.38	1.47	1.04
Hotels and catering	2.39	0.95	0.65
Transport services	2.96	1.18	0.83
Communication services	3.10	1.27	0.86
Financial and real estate services	2.35	1.11	0.77
Business services	3.16	1.41	0.96
Medical and other services	3.30	1.34	0.96
Other producers	3.52	1.52	1.13
Total private services	**3.15**	**1.34**	**0.94**
Government services	3.65	1.71	1.35

Figure 40: SAM Sectoral activities multipliers (2003)

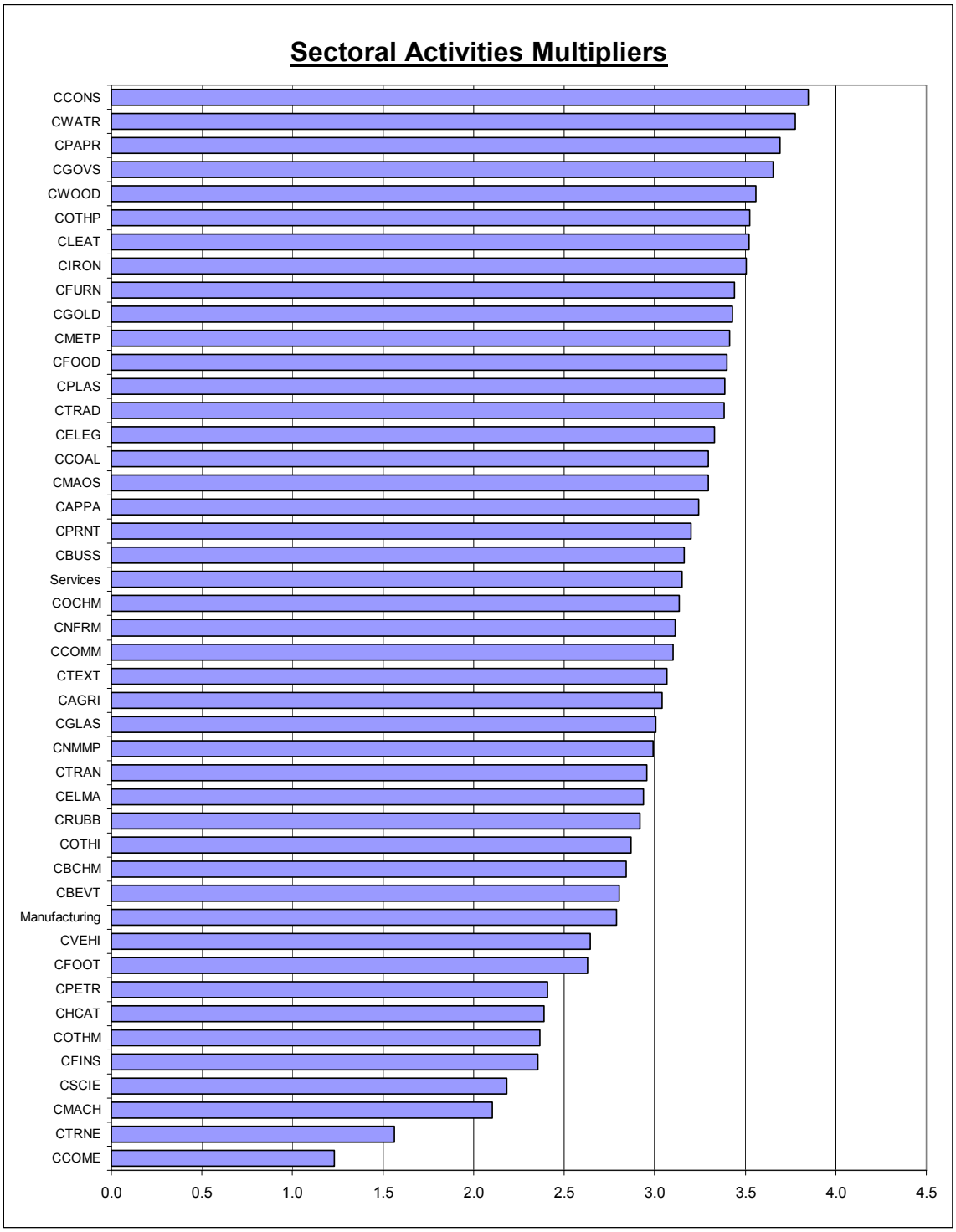
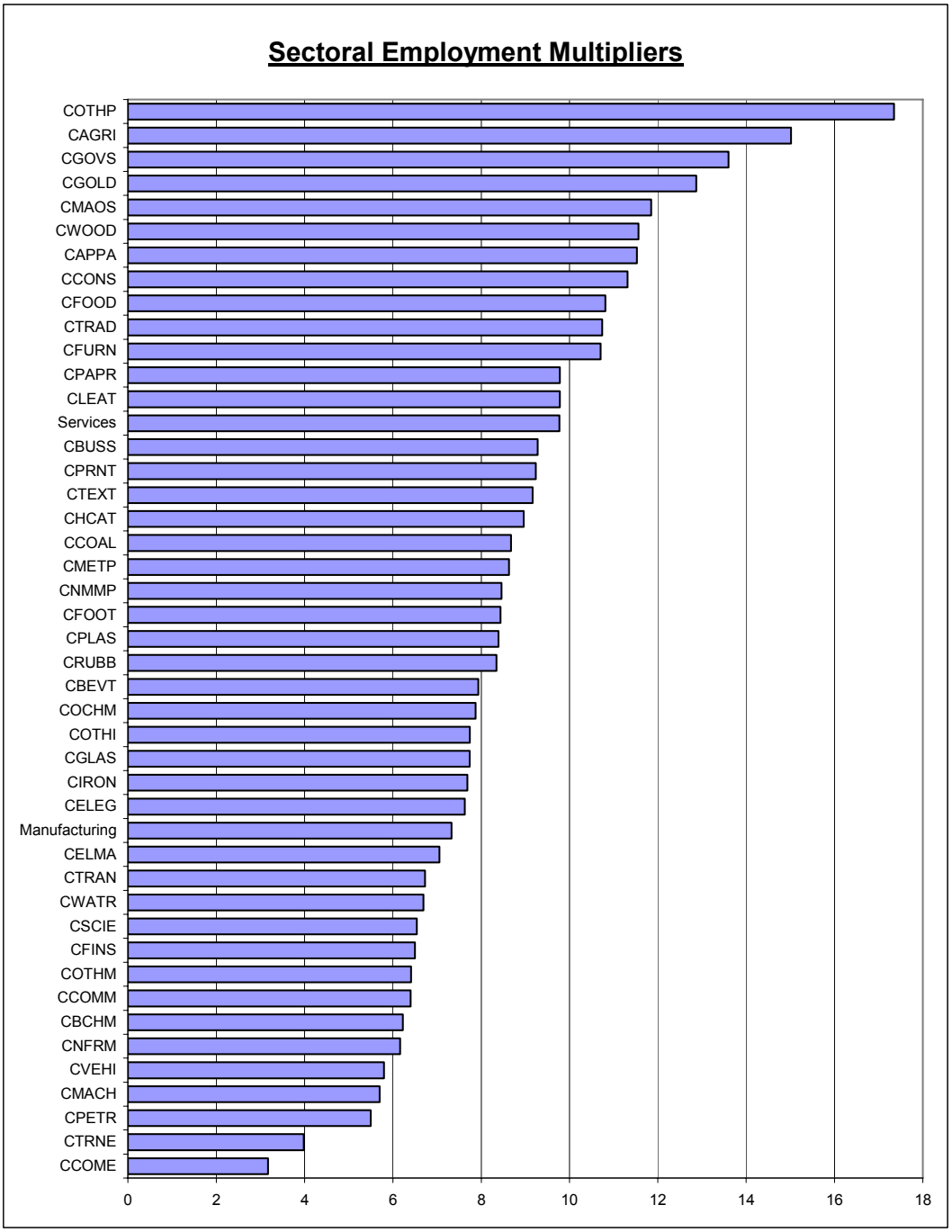


Table 3: SAM Sectoral employment multipliers (2003)

	High-skilled employment multiplier	Skilled employment multiplier	Semi/unskilled employment multiplier	Total employment multiplier
Agriculture	1.00	3.10	10.92	15.02
Coal	0.94	3.35	4.39	8.68
Gold	1.04	3.49	8.34	12.87
Other mining	0.67	2.37	3.37	6.41
Food processing	1.05	3.83	5.93	10.81
Beverages and tobacco	0.87	3.07	4.00	7.93
Textiles	0.98	3.49	4.69	9.16
Wearing apparel	1.20	4.39	5.94	11.53
Leather products	0.94	3.45	5.39	9.78
Footwear	0.87	3.18	4.39	8.44
Wood products	1.00	4.02	6.55	11.56
Paper products	1.08	3.78	4.92	9.78
Printing and publishing	1.25	4.21	3.77	9.23
Petroleum products	0.67	2.41	2.42	5.50
Chemical products	0.77	2.59	2.87	6.22
Other chemical products	1.00	3.49	3.38	7.87
Rubber products	0.95	3.14	4.25	8.34
Plastic products	0.99	3.21	4.19	8.39
Glass products	0.89	3.06	3.79	7.74
Non-metallic metal products	0.92	3.03	4.51	8.46
Basic iron and steel	0.92	3.18	3.59	7.69
Non-ferrous metals	0.76	2.49	2.92	6.16
Metal products	0.99	3.39	4.25	8.63
Machinery	0.73	2.54	2.43	5.70
Electrical machinery	0.93	2.93	3.20	7.06
Communication equipment	0.42	1.38	1.36	3.17
Scientific equipment	0.88	3.06	2.61	6.54
Vehicles	0.75	2.48	2.57	5.80
Transport equipment	0.54	1.69	1.75	3.98
Furniture	1.14	4.37	5.19	10.70
Other industries	0.94	3.55	3.26	7.75
Total manufacturing	0.89	2.93	3.52	7.33
Electricity and gas	1.09	3.03	3.51	7.63
Water	0.96	2.80	2.93	6.69
Construction	1.13	3.75	6.44	11.32
Trade services	1.40	5.55	3.78	10.74
Hotels and catering	0.98	4.55	3.44	8.96
Transport services	0.85	3.04	2.84	6.73
Communication services	0.82	2.85	2.73	6.40
Financial and real estate services	1.15	3.27	2.09	6.50
Business services	1.49	4.60	3.18	9.28
Medical and other services	3.32	5.53	3.01	11.85
Other producers	1.25	5.66	10.44	17.35
Total private services	1.35	4.56	3.86	9.77
Government services	3.52	6.01	4.07	13.60

Figure 41: SAM Sectoral employment multipliers (2003)



Comparing the ranking of sectors in terms of the different types of multipliers, we find a correlation coefficient between the output and employment multipliers of 0.66[36]. This indicates that while there is (as one would expect) a fairly strong positive relationship between the output and employment multipliers, there is also considerable variation across sectors. The factor incomes and household incomes are very closely related, with a correlation coefficient of 0.98. The factor incomes and household income multipliers have correlation coefficients with the employment multipliers of 0.74 and 0.77 respectively.

Tables 4 shows the changes in the employment multipliers between 1998 and 2003. All sectors bar one experienced a fall in their employment multipliers. Even the changes in multipliers by skill categories are almost all negative (the only exceptions being small increases in the high-skilled employment multipliers for business services and for scientific equipment, in the skilled employment multiplier for scientific equipment, and in the semi- and unskilled multiplier for scientific equipment as well as for other producers of community social and personal services).[37] This means that a greater increase in final demand would be required in 2003 in order to obtain a given increase in employment as would have been required in 1998. This development is of obvious concern from an employment perspective, as the potential employment-generating effects of any increase in final demand are falling (although the caveats around the employment data discussed earlier are also relevant here).

[36] This coefficient indicates the degree to which sectors' ranking according to the output and employment multipliers respectively are correlated. A correlation coefficient of 1 would indicate that sectors were ranked identically in terms of the output and employment multipliers, that is, that there is perfect correlation in sectors' ordering in terms of the output and employment multipliers. On the other hand, a correlation coefficient of 0 would indicate no correlation whatsoever between sectors' ranking in terms of the output and employment multipliers. A negative coefficient would indicate an inverse relationship. The correlation coefficients thus give some sense of the closeness of the relationship between sectors' ordering in terms of different types of multipliers.

[37] The fact that even the high-skilled multiplier falls goes against the ***

Table 4: Change in SAM sectoral employment multipliers 1998 – 2003

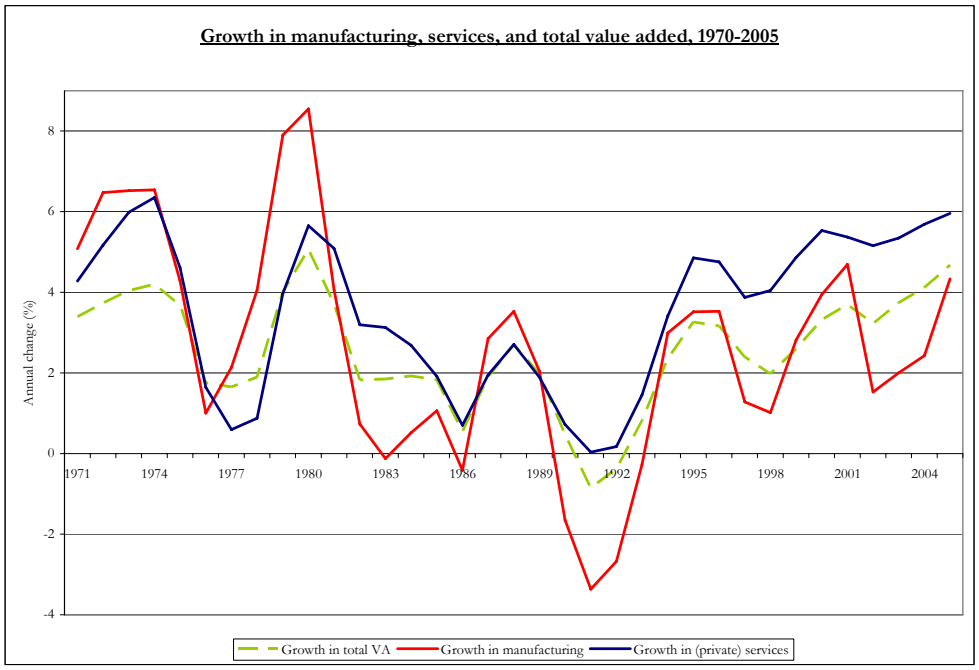
	High-skilled employment multiplier	Skilled employment multiplier	Semi/unskilled employment multiplier	Total employment multiplier
Agriculture	-0.18	-1.05	-5.78	-7.01
Coal	-0.25	-1.35	-1.21	-2.81
Gold	-0.37	-1.70	-3.58	-5.64
Other mining	-0.25	-1.16	-1.68	-3.09
Food processing	-0.19	-1.25	-2.40	-3.84
Beverages and tobacco	-0.17	-0.93	-0.15	-1.25
Textiles	-0.22	-1.03	-1.53	-2.77
Wearing apparel	-0.36	-1.81	-3.16	-5.33
Leather products	-0.27	-1.02	-2.34	-3.63
Footwear	-0.23	-1.11	-1.70	-3.04
Wood products	-0.39	-2.89	-4.96	-8.25
Paper products	-0.16	-0.92	-0.63	-1.71
Printing and publishing	-0.29	-1.39	-0.48	-2.17
Petroleum products	-0.08	-0.53	-0.19	-0.79
Chemical products	-0.19	-0.80	-0.63	-1.62
Other chemical products	-0.29	-1.17	-0.65	-2.11
Rubber products	-0.13	-0.73	-0.50	-1.37
Plastic products	-0.47	-1.57	-2.27	-4.31
Glass products	-0.29	-1.21	-1.34	-2.84
Non-metallic metal products	-0.38	-1.53	-2.05	-3.97
Basic iron and steel	-0.37	-1.60	-1.35	-3.33
Non-ferrous metals	-0.27	-1.13	-1.07	-2.48
Metal products	-0.40	-1.83	-1.87	-4.10
Machinery	-0.07	-0.49	-0.22	-0.78
Electrical machinery	-0.61	-1.40	-2.02	-4.03
Communication equipment	-0.23	-0.69	-0.75	-1.67
Scientific equipment	0.04	-0.24	0.07	-0.13
Vehicles	-0.26	-1.04	-0.67	-1.97
Transport equipment	-0.17	-0.71	-0.57	-1.45
Furniture	-0.34	-1.92	-2.26	-4.52
Other industries	-0.35	-2.20	-1.88	-4.43
Total manufacturing	-0.24	-1.06	-1.09	-2.39
Electricity and gas	-0.43	-1.08	-1.14	-2.65
Water	-0.29	-0.78	-0.75	-1.82
Construction	-0.24	-1.24	-1.80	-3.28
Trade services	-0.37	-2.14	-1.11	-3.62
Hotels and catering	-0.50	-3.32	-2.07	-5.89
Transport services	-0.23	-1.68	-0.93	-2.83
Communication services	-0.28	-1.72	-1.09	-3.09
Financial and real estate services	-0.44	-1.84	-1.06	-3.34
Business services	0.00	-0.43	-0.47	-0.90
Medical and other services	-0.71	-1.53	-0.50	-2.75
Other producers	-0.79	-3.15	5.48	1.55
Total private services	-0.33	-1.77	-0.12	-2.21
Government services	-0.81	-1.37	-1.12	-3.30

7 Econometric analysis of 'growth-inducing' properties of manufacturing and services sectors

We are interested in the issue of causality between the manufacturing and services sectors and with the broader economy, in the sense of how growth impulses are carried forward between sectors: to what extent do the manufacturing and services sectors respectively pull along growth in each other, as well as in the rest of the economy?

Although by no means answering this question, figure 42 is of interest in this regard. It shows annual growth rates in the manufacturing and services sectors, as well as for the aggregate economy, over the period 1970-2005 (in 3-year moving averages). What is remarkable is the apparent close correlation between the growth rates of the manufacturing and services sectors[38]. Although the growth rate of services exceeds that of manufacturing from around 1990 onwards, the two series seem to move fairly closely together throughout. This might point to a close relationship between the fortunes of the two sectors. Another noteworthy observation from the chart below is that manufacturing value added appears to be more volatile than services value added. This is probably related to manufacturing being (more) tradable.

Figure 42: Growth in manufacturing, services and total value added, 1970-2005



Interestingly, the relationship between changes in employment between the sectors – shown in figure 43 – is much less clearly correlated than the value-added series shown above.[39] The manufacturing and services employment

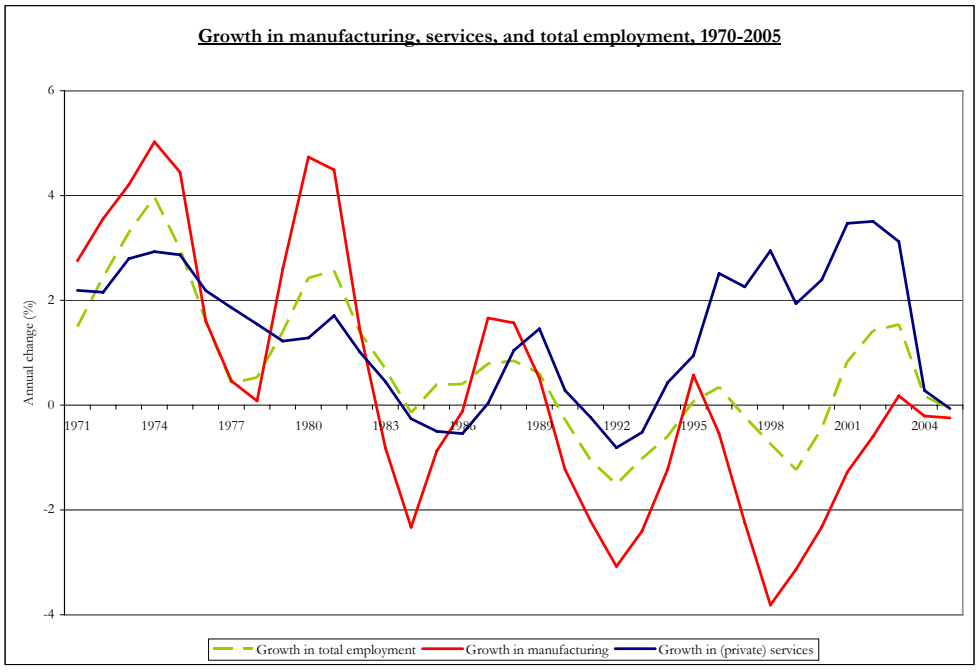
[38] The correlation coefficient between the two original growth series is 0.74.

[39] The correlation coefficient between the two original employment growth series is 0.29, whereas that for the value added series was 0.74.

series appear to sometimes move together up to about the mid-1990's, although even during this time they appear to be less tightly related than is the case for the value added series as shown above. During this period visual inspection suggests that changes in manufacturing employment may 'lead' (at least in a temporal sense) changes in services employment. But particularly over the last decade or so, the two series diverge considerably.

It might be hypothesised that some of the movement of growth in manufacturing and services employment in opposite directions in the second half of the 1990's could reflect firstly a shift of employment from manufacturing to services associated with outsourcing, and secondly the absorption of displaced manufacturing workers in the services sector. Services sector employment has both pro- and counter-cyclical characteristics. On the one hand some elements of services employment would be complementary to manufacturing employment, both due to direct demand for services into manufacturing and also through broader income effects. On the other hand, some elements of services employment would be functional as 'sponge' employment, mopping up labour shed from manufacturing or otherwise unable to obtain employment. Finally, it can be seen that, as with the value added trends shown above, manufacturing employment appears to be more volatile than services employment.

Figure 43: Growth in manufacturing, services and total employment, 1970-2005



The question of the relationship between growth in the manufacturing and service sectors can be more formally investigated using time series econometric analysis, and specifically Granger causality tests. Testing the extent to which past values of one variable help in explaining current values of another, can

shed some light on the extent to which variables Granger cause each other.[40] If past changes in the value added of one sector have no significant explanatory power over current change in value added of a second sector series, that is no evidence of Granger causality from the first to the second series is found, then it is unlikely based on such a result that changes in the value added in the first sector have a significant effect on the second.[41]

This analysis is intended to supplement the discussion of linkages and multipliers above, as well as other methods of investigation. The econometric analysis does not of course elucidate the causal mechanisms at work (if any) in the relationships.

Granger causality tests were run between the following pairs of variables, in time series form from 1970-2005:

- First differences of manufacturing and services value added;
- Changes in manufacturing and services value added;
- First differences of manufacturing value added and value added of the rest of the economy;
- Changes in manufacturing value added and value added of the rest of the economy;
- First differences of services value added and value added of the rest of the economy;
- Changes in services value added and value added of the rest of the economy.

Taken together, the results point to Granger causation from services to manufacturing as well as to the rest of the economy (i.e. the non-services economy). Testing the services and manufacturing pair, services were found to Granger cause manufacturing, but not the other way around, both in first differences and in percentage changes.

No Granger causation was found between manufacturing and non-manufacturing, either in first differences or in percentage changes. On the contrary, mutual Granger causation was found between services and the non-services economy. In first differences this was stronger from non-services to

[40] Note that a positive finding of Granger causality cannot conclusively establish a direct causal relationship between two series.

[41] The methodology used in running these tests was as follows. First all series were checked for a unit root, but all were found to be stationary (in the forms used, that is, first differences or percentage changes), hence there was no need to check for cointegration or to use a Vector Error Correction method. Tests were run in a VAR framework. The optimal number of lags was decided using the sequential modified LR test statistic (LR), the final predictive error (FPE), the Akaike Information Criterion (AIC), the Schwarz Information Criterion (SC), and the Hannon-Quinn Information Criterion (HQ). All residuals were confirmed to be white noise.

services, while in percentage change it was stronger from services to non-services.

One possible explanation of these results is that changes in the manufacturing and services sectors as well as in the rest of the economy are simply responses to common underlying factors, and that the services sector may simply respond to these factors faster than does manufacturing or other sectors. This would show up as changes in services 'leading' changes in manufacturing or the rest of the economy, without any causal relationships whatsoever between these changes.

The relative size of the manufacturing and services sectors is also relevant to understanding these results. The fact that services account for over half of GDP suggests that – irrespective of the innate 'growth-pulling' properties of the sector – changes in the services sector will tend to have a significant impact on the rest of the economy.

Additional Granger causality tests were run for subsectors of both manufacturing and services. The intention here is to investigate differential 'growth-pulling' capacities for different parts of manufacturing and services. These tests were only run using series of the annual percentage change, given the generally large differences between the size of these sectors and the rest of the economy. The categorisation of sectors is shown in Appendix 3. The pairs tested were as follows:

For manufacturing:

- Changes in labour intensive intermediate goods and in the rest of the economy;
- Changes in labour intensive consumer goods and in the rest of the economy;
- Changes in labour intensive capital goods and in the rest of the economy;
- Changes in capital intensive intermediate goods and in the rest of the economy;
- Changes in capital-intensive consumer goods and in the rest of the economy.

And for services:

- Changes in low skill intensive intermediate services and in the rest of the economy;
- Changes in low skill intensive consumer services and in the rest of the economy;
- Changes in skill intensive intermediate services and in the rest of the economy;
- Changes in skill intensive consumer services and in the rest of the economy.

The results of these tests were surprising, as very little evidence of Granger causality was found, either from the subsectors to the rest of the economy or

vice versa. The only sector for which growth in the rest of the economy (that is, the percentage annual change in the total economy minus that sector) was found to Granger cause sectoral growth was labour intensive capital goods (this includes machinery and equipment, and communication and scientific equipment). One would have expected overall economic growth to Granger cause growth in many more sectors than this.

In the other direction, the only sector whose growth was found to Granger cause growth in the rest of the economy was skills intensive intermediate services (which includes finance and insurance, and business services). This apparent relationship was investigated further by testing Granger causality between finance and insurance and the rest of the economy, and similarly for business services. Granger causality was found running from each of these sectors to the rest of the economy, with a stronger effect for finance and insurance than for business services. To the extent that these results are valid, they would be consistent with the important role of both the finance and business services sectors as producer services, including as inputs into manufacturing.

These results should be treated with caution. As mentioned earlier, the Granger causality test embodies a narrow meaning of causality, and it should not be interpreted as signifying causation in a broader sense. In addition, more econometric analysis may be required to further clarify the results. It is surprising that growth in almost no sector groupings of the economy were found to Granger cause or to be Granger caused by growth in the rest of the economy. This may indicate limitations of the classification of sectors into the 14 groupings. In the next stage of this research further tests are to be carried out for each subsector separately.

To the extent that these preliminary results are meaningful, the lack of evidence for Granger causality from manufacturing to the rest of the economy also needs to be understood in the context of the poor performance of manufacturing during this period. Manufacturing grew by only 2.6% p.a. (in real terms) over the period of analysis. The special properties associated with manufacturing that are thought to give it a central role as an engine of growth are closely connected to its own dynamism. That is, it is only really when manufacturing is growing at a reasonable rate – which has not been the case I South Africa – that it can be expected to pull along growth in the rest of the economy.

Initial exploratory econometric analysis was also undertaken concerning the relative explanatory power of changes in the manufacturing sector over changes in the non-manufacturing sectors, and of changes in the services sector over changes in the non-services sectors, between 1970 and 2005. Preliminary results point to a stronger explanatory relationship between growth in manufacturing and non-manufacturing, than between growth in services and non-services. However, much more analysis is required to verify these results, to repeat the exercise for different subsectors of manufacturing and of services respectively, and to reconcile such findings with the results of the Granger causality tests discussed above.

8 Conclusions

Growth per capita in South Africa has been stagnant for a long time (notwithstanding a recent pick up). Employment creation (net) has lagged far behind growth, such that unemployment remains at crisis proportions[42]. This paper has investigated the manufacturing and services sectors in South Africa, with a focus on the relationship between these two sectors and between each of them and the rest of the economy.

The (private) services sector accounts for over half of South African GDP and this share continues to rise, while the share of manufacturing has slowly declined over the past two and a half decades from a peak of 22% to about 18% at present[43]. Services has also accounted for an increasing share of total employment, and manufacturing a declining share.[44] Rather surprisingly, high-skilled workers are disproportionately employed in the services sector and low-skilled workers in manufacturing[45]. The level of labour productivity in manufacturing outstrips that in services and continues to rise, a development that is probably at least in part related to the capital intensification of manufacturing (although services is also surprisingly capital-intensive). One way of understanding the differing employment performances of the manufacturing and services sectors is that in services the growth of value added has significantly outstripped that of productivity, whereas in manufacturing productivity growth has exceeded growth in value added, particularly over the past decade.

These changes in the sectoral composition of the South African economy and differing characteristics are relevant for growth and employment. Heterodox and 'classical' development economics approaches have typically focused on the 'special characteristics' of manufacturing for a country's growth and development, suggesting that it has a particular role to play as an engine of sustainable growth. Growth-generating properties attributed to manufacturing include learning by doing and increasing returns to scale, strong linkages with the rest of the economy, technological progressiveness, and mitigating balance of payments constraints.

This would imply that a unit of value added is not equivalent across sectors in terms of potential to drive and sustain growth. A decline in manufacturing – even if replaced by services – could have negative effects on South Africa's

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[42] Currently at 25.5% using the narrow (official) definition, and 37.3% using the broad definition.

[43] Real annual growth in manufacturing over the period 1970-2005 was 2.6%, and 3.5% for (private) services.

[44] The significant discrepancies between the employment data in SASID and in the LFS – in terms of both levels and trends – pose a serious problem for analysis of trends in employment, as well as in capital intensity and in labour productivity. This is a serious problem for this research, as these trends are central to the overall analysis. The issues around employment data in South Africa are discussed in Box 1. Where relevant, analysis is presented using both SASID and LFS/OHS data. However, this does make it difficult to reach conclusions around some key issues.

[45] Although this may in part be due to the way that skills categories are defined, which is based on occupation and also tends to overemphasise 'white-collar' skills.

medium- to long-term growth and employment prospects, the former directly and the latter primarily indirectly. To the extent that there has been deindustrialisation in South Africa – specifically in terms of a relative decline in manufacturing employment – a key question is whether this process can be regarded as premature (given our level of income per capita), in the sense of foregoing potential benefits of further manufacturing growth.

Rather than taking for granted that manufacturing (still) has the 'special properties' attributed to it, this paper begins an empirical investigation of this issue in the South African context. The heterogeneity of sectors also raises questions around whether *all subsectors* of manufacturing share in these properties, and whether certain subsectors of services might also do so at the current stage of South Africa's development process. It should also be borne in mind that the special characteristics of manufacturing that give it the potential to act as an engine of growth are likely to only come into effect in a significant way when manufacturing is growing at a decent rate, as these characteristics are dynamic in nature.

A distinction can be drawn between those sectors that produce surplus (in the circuit of productive capital) and those sectors that receive transferred portions of the surplus in exchange for facilitating or accelerating reproduction in the circuit of capital. A sector that does not directly produce surplus cannot in itself drive growth on an ongoing basis. It may accelerate growth up to a certain point, given sufficient dynamism from growth driving sectors. Further, failure of a non-surplus-producing sector to function effectively can certainly act as a blockage to growth. But such a sector cannot act as a *source* of growth on a *sustainable* basis. The only partial exception to this could be if the sector functions as a conduit to the transfer of surplus produced in other countries and appropriated and invested domestically.

Non-surplus producing sectors can also contribute to growth by redistributing surplus to productive uses. For instance, the finance sector facilitating the transfer of surplus from a sector that is not particularly productive and dynamic to one that is more so, or from surplus appropriated by individuals (for example through dividends paid out) to productive investment and working capital. Nevertheless, the actual generation of surplus remains central. It is not only manufacturing that produces commodities (and surplus value): certain services also directly generate surplus. However, service activities that contribute through the phase of circulation do not themselves generate surplus value.

Going deeper into the sector 'non-neutrality' of growth, the paper proposes a conceptual template for thinking through the various ways in which sectoral growth can bring about additional overall economic growth. These channels are as follows: a sector's backward linkages to domestic upstream sectors; a sector's forward linkages to domestic downstream sectors; sectoral growth that brings about a growth-inducing change in the sectoral composition of the economy; increased division of labour and specialisation; trade, notably if a sector is a *net* generator of foreign exchange; the growth-inducing or growth-complementing effects of sectoral employment; innovation, technological progress, and productivity growth (both internally to the sector and through its

contributions to the broader economy); savings of a sector, which can finance productive investment elsewhere in the economy; the net fiscal contribution associated with sectoral growth; and institutional effects of sectoral growth, which may be more broadly growth-inducing or supporting.

The purpose of theoretically mapping out these channels of sectoral contributions to overall growth is to provide a basis for analysing the differential contributions of different sectors of the South African economy (with a particular interest in manufacturing and services). Based on this approach, an identification of what the primary constraints on growth are at any particular conjuncture can allow for the prioritisation of sectors that are especially relevant to inducing or supporting growth in relation to that constraint. This paper does not comprehensively investigate each of the channels or test each of the special characteristics associated with manufacturing – which would be a mammoth task – but does hone in on some key areas.

The differential 'growth-pulling' capacities of manufacturing and services were empirically investigated. This is an attempt to empirically investigate the types of issues discussed earlier at a theoretical and conceptual level, testing the extent to which ideas developed theoretically and in the existing literature actually hold in the South African case. The growth-pulling power of manufacturing and services (as well as various subsectors) were tested econometrically. Initial findings point to services growth 'leading' (in a temporal and econometric sense) growth in manufacturing and the rest of the economy. However, the results are mixed and inconclusive, and need much more clarification. Manufacturing growth appears to have strong explanatory power over non-manufacturing growth, but this requires further investigation. It should also be borne in mind that the special characteristics of manufacturing that give it the potential to act as an engine of growth are likely to only come into effect in a significant way when manufacturing is growing at a decent rate, as these characteristics are dynamic in nature. The stagnant performance of manufacturing in South Africa in recent decades may thus be relevant to understanding the lack of econometric evidence for pulling along growth in the rest of the economy.

Analysis of the backward and forward linkages between sectors revealed fascinating results in terms of the way different sectors depend on each other for inputs as well as a market for their intermediate outputs. An important methodological step undertaken in this analysis is the exclusion of imported intermediate inputs, which is often overlooked in empirical work of this nature leading to misleading results. Manufacturing is found to be more important as a source of demand for services, than the other way around. This significant result might suggest that manufacturing has greater 'pulling power' on services than the other way around. In terms of economy-wide multipliers, an additional unit of final demand for manufacturing would require more inputs from other sectors than is the case for services, suggesting that growth in manufacturing would have a greater stimulatory effect on the economy as a whole than an equal increase in final demand for services. Conversely, decline in the manufacturing sector would deprive the services sector of an important source of demand, both direct and indirect. The costs and quality of service

inputs into manufacturing would be important for the productivity and competitiveness of manufacturing, but less important as a source of demand or driver of growth.

In terms of employment, however, services has a significantly higher employment multiplier than does manufacturing, and although both have declined over time the employment multiplier of manufacturing has fallen more. It is only for low-skilled labour that the employment multiplier of manufacturing is higher than that of services. Notwithstanding the caveat that skills categories are based solely on occupation, this result does suggest that manufacturing might be important in absorbing low-skilled labour in South Africa. That is, unless the nature of the services sector (and the linkages between services and the rest of the economy) changes to favour the absorption of more low-skilled workers. Employment generation for these segments of the labour force is critical, both in the light of the high unemployment rates amongst unskilled workers and the intersection between race and skills (occupation) in the South African labour market.

Manufacturing remains critically important for growth in South Africa. In particular, as a source of demand for other sectors, which is important for pulling along growth in the rest of the economy. However, manufacturing is currently failing to absorb sufficient labour to seriously dent unemployment in South Africa. Even factoring in its indirect contributions (as measured in the employment multipliers) the employment-creating potential of manufacturing growth is lower than that of services per unit of final demand, based on current patterns.

Manufacturing would not typically be expected to be central in employment creation, at least not directly. However, its lack of dynamism appears to be inhibiting its potential to drive growth in the economy as much as it could. The potential growth-driving properties of manufacturing – such as increasing returns to scale – are likely to only be fully operative when manufacturing grows at a faster rate than has been the case in South Africa. In other words, the role of manufacturing as a growth engine may only really kick in in a meaningful way above a certain level of manufacturing growth, and thereafter at an increasing rate (up to a certain point). Although this is difficult to assess empirically, it would be consistent with both theoretical perspectives and international empirical evidence. This would suggest that the acceleration of growth in the manufacturing sector could enhance its growth-pulling effects on the rest of the economy.

Services are unlikely to be central in driving growth in South Africa, but are critical for labour absorption. The relatively low share of unskilled labour in services is however surprising, and it would be important for services to play a much more significant role in 'mopping up' unemployed unskilled workers. Services in many developing countries are far more important as an 'employer of last resort' than is the case in South Africa. This may be related in part to political economy considerations and the racialised character of the South African labour market, which may lead to underemployment (in the sense of lower employment than would otherwise be 'optimal' from the perspective of employers) in interpersonal services in particular.

International comparisons of sectoral composition (discussed in section 5.1) show South Africa to have a share of manufacturing in GDP higher than would be (econometrically) expected for our level of economic development, but a share of manufacturing in total employment lower than would be expected. The shares of services in both GDP and employment are higher than would be expected. These findings suggest that there is a particular problem around *manufacturing employment*.

This may be indicative of a distorted development path in which South Africa 'leapfrogged' from a minerals and resource-based economy to capital-intensive heavy industry, without going through a period of development of labour-intensive light industry. Now, South Africa may be 'leapfrogging' to a services-oriented economy, as a form of premature deindustrialisation – without ever having industrialised fully or derived 'full benefits' from that. However, because of global production and trade trends and the context of South Africa's trade liberalisation, it would be challenging at this point to move into sectors of light manufacturing production which have been 'underdeveloped' up to this point and in which we are not currently competitive, apart from developing the capacity to at least meet domestic demand.

The capital intensification of manufacturing over a long period of time is also part of the explanation for the low and falling share of manufacturing in total employment. This capital intensification has two dimensions: the composition of the manufacturing sector (in terms of the relative capital intensity of different manufacturing subsectors), and more importantly, the shift towards capital over labour across manufacturing. Although there is underemployment in services as well, there is arguably less scope for capital-labour substitution in services than in manufacturing.

A fuller analysis of accumulation in South Africa is central to understanding the growth path that we have been on, as well as what interventions might be needed to shift to a path that is not only higher growth but, of central importance, creates employment adequate to deal with the unemployment crisis facing the country. Not only has accumulation been on an inadequate scale, but the nature of accumulation has been skewed (relative to what would be optimal for growth and in particular for employment). For instance, capital investment that is labour-displacing rather than labour-absorbing (see Tregenna 2007a).

There is a potential trade-off between sectors that are highly productive, technologically progressive, etc.; and those which are more labour absorbing, less productive, with a limited range of factor substitution possibilities towards capital, and so on. To some extent this is an inherent trade-off, as certain of the 'progressive' characteristics – such as technological progressivity and factor substitution potential – render them less likely to be prime employment creators, at least directly. Of course, this is not a simple dichotomy. Especially when indirect effects are factored in, a 'progressive' yet not particularly labour-absorbing sector can make an important contribution to employment creation through 'growth-pulling' effects on high-employment sectors.

The manufacturing sector is generally regarded in the literature as relatively dynamic, highly productive, with the greatest potential for benefits from

economies of scale, the most rapid technological progress on balance, and with the most potential for capital-intensifying factor substitution. To the extent that there is empirical confirmation in this regard, while these qualities may be conducive to high growth, they are not necessarily conducive to employment creation, or at least to *direct* employment creation.

On the other hand, the service sectors are generally more labour-intensive, with relatively lower scope for capital-intensifying factor substitution and technological progress. Even if sectors with these types of characteristics are not particularly growth-dynamic, they may be extremely important from an employment perspective.

Such trade-offs are not only at the intersectoral level, but also within sectors given the heterogeneity of subsectors. Although it may sound trite, an important point that emerges from this research is the importance of subsectoral analysis. Great heterogeneity is relevant in both the manufacturing and services sectors. Both manufacturing and services include subsectors that are capital-intensive and labour-intensive, technologically progressive and less so, those that are primarily growth-generating and those that are primarily labour-absorbing, and so on. Nevertheless, there are important commonalities within the manufacturing and services groupings respectively.

Service subsectors such as ICT are highly technologically progressive, both internally and for other sectors, and have significant growth-inducing or at least growth-supporting potential, yet are highly capital-intensive. Other service sectors such as domestic work are highly labour-absorbing (in a direct sense), yet would have extremely limited growth-inducing potential.

Such trade-offs are only partly associated with the intrinsic characteristics of different sectors, and are subject at least in part to policy interventions – for example around the relative factor intensity of a sector, the nature of technological progress, and so on.

The potential 'growth-employment' trade-off identified is at least in part mitigated in the South African case to the extent that the current level of unemployment is itself a constraint on growth. As discussed in section 4, employment creation is one of the channels through which sectoral growth can actually contribute to overall growth over and above that sectoral growth. Higher domestic demand derived from employment creation, as well as the mitigation of the destabilising effects and other negative externalities associated with high levels of unemployment, means that employment creation can in itself raise growth. Nevertheless, as shown in this paper the manufacturing and services sectors in South Africa do contribute differentially to growth and to employment, suggesting that some difficult choices are called for in industrial and other policies.

Sectoral characteristics as discussed in this paper are partly intrinsic to the nature of the sectors but are also partly reflective of past policies as well as subject to future policies. Clarification of these issues is not only analytically interesting but is also highly relevant from a policy perspective, in terms of where we should look to for future economic growth and employment creation, and what policy interventions might be required in this regard.

Appendix 1: Derivation of linkage coefficients and multipliers

The following methodology was used to calculate the various linkage measures and multipliers.

Let $F_{(n\times n)} \equiv$ the intermediate input flow matrix, which shows the inputs from and to each of the sectors (inputs from the factors of production and excluding final outputs). f_{ij} is the value of the intermediate inputs flowing from sector *i* to sector *j*, i.e. the payment for intermediate inputs that flows from sector *j* to sector *i*.

$X_{(n\times 1)} \equiv$ the total output flow vector, where x_i is the total output of sector i (the sum of intermediate and final output).

$\text{DIAG}(X)_{(nxn)} \equiv$ a diagonal matrix where $\text{DIAG}(x)_{ij} = x_{ij}$ for all i=j, $\text{DIAG}(x)_{ij} = 0$ otherwise.

$Y_{(n\times 1)} \equiv$ the intermediate output flow vector, where y_i is the intermediate output of sector i (that is, output which goes as intermediate inputs into other sectors).

$\text{DIAG}(Y)_{(nxn)} \equiv$ a diagonal matrix where $\text{DIAG}(y)_{ij} = y_{ij}$ for all i=j, $\text{DIAG}(y)_{ij} = 0$ otherwise.

$I_{(n\times n)}$ = identity matrix.

$1_{(n\times 1)}$ = unity column vector

then

$D_{(n\times n)} \equiv F\text{DIAG}(Y)^{-1}$. This is the upstream linkages coefficient matrix, where $d_{ij} = \frac{f_{ij}}{\sum_{i=1}^{n} f_{ij}} * 100$.

$E_{(n\times n)} \equiv \text{DIAG}(Y)^{-1}F$. This is the downstream linkages coefficient matrix, where $e_{ij} = \frac{f_{ij}}{\sum_{j=1}^{n} f_{ij}} * 100$

$A_{(n\times n)} \equiv F\text{DIAG}(X)^{-1}$ is the input coefficient matrix or the technical coefficient matrix in the Leontief system. The elements of the matrix are $a_{ij} = \frac{f_{ij}}{Q_i} * 100$.

(The difference between this and the upstream linkages coefficient matrix is that the latter is based on the intermediate output flow vector and measures intermediate inputs as a share of total intermediate inputs, whereas the input coefficient matrix is based on the total output flow vector and measures as a share of total inputs.)

$\tilde{A}_{(nxn)}$ is the weighted input coefficient matrix, weighted by the relative size of the input sectors (i). That is, $\tilde{a}_{ji} = \frac{f_{ij}}{\sum_{i=1}^{n} f_{ij}} * \frac{\sum_{i=1}^{n} Q_i}{100 Q_i}$. This shows the strength of forward linkages for the relative size of the upstream sector.

$B_{(nxn)} \equiv \text{DIAG}(X)^{-1}F$. This is the output coefficient matrix, where $b_{ij} = \frac{f_{ij}}{Q_j} * 100$.

$\tilde{B}_{(nxn)}$ is the weighted output coefficient matrix, weighted by the relative size of the output sectors (j). That is, $\tilde{b}_{ij} = \frac{f_{ij}}{Q_j} * \frac{\sum_{j=1}^{n} Q_j}{100 Q_j}$. This shows the strength of forward linkages for the relative size of the downstream sector.

$Z \equiv (I - A)^{-1}$, the input inverse or Leontief inverse, is a matrix of technical input coefficients that show intermediate inputs as a share of all inputs (including the value added components). z_{ij} is the value of the additional output that would be required from the i^{th} sector to produce the necessary inputs for one unit of final demand of the j^{th} sector. The j^{th} column sum $\sum_{i=1}^{n} z_{ij}$ is the total increase in output that would be required to supply the necessary inputs for an initial unit in increase in sector *j*.[46] *Z* thus represents the effects of expansion on suppliers. It is a measure of *backward linkages*.

$W \equiv (I - B)^{-1}$, the output inverse, is a matrix of technical output coefficients, which each measure output which is sold as intermediate inputs into other sectors as a share of total sales (including final demand of consumers). w_{ij} is the increase in output of the j^{th} sector that would fully utilise the increased output from an initial unit of primary input into sector *i*. The i^{th} row sum $\sum_{j=1}^{n} w_{ij}$ is the total increase in output that would fully utilise the increased output from an initial unit of primary input into sector *i*.[47] *W* represents the effect of an expansion on users, and is a measure of *forward linkages*.

$L^{DF}_{(1xn)} \equiv B1$ is the direct forward linkage vector. (This of course equals the row sums of the output coefficient matrix *B*.) For each sector *i*, this vector

[46] The i^{th} row sum of *Z* represents the increase in output of sector *i* that would be required to supply the inputs necessary for a one unit increase in final demand from all n sectors. This is not a relevant figure as the size of sectors varies considerably and hence an equal increase in final demand across the board is unrealistic.

[47] The j^{th} column sum of *W* shows the effect of a one unit expansion of primary inputs into all n sectors. As with the row sums of *Z*, this is not particularly relevant as an equal expansion across all sectors is unrealistic.

shows the direct forward linkages with downstream sectors. The direct forward linkage vector of each sector *i* is a weighted sum of direct forward linkages to downstream industries (with the weighting of course based on the proportion of sector *i*'s output going to each of the downstream sectors.)

$L^{DB}_{(nx1)} \equiv 1'A$ is the direct backward linkage vector. (This of course equals the column sums of the output coefficient matrix A.) For each sector *j*, this vector shows the direct backward linkages with upstream sectors. As above, the direct forward linkage vector of each sector *j* is a weighted sum of its backward linkages.

$L^{TF}_{(1xn)} \equiv W1$ is the total (direct and indirect) forward linkage vector. (This of course equals the row sums of the output inverse W.) For each sector *i*, this vector shows the direct and indirect forward linkages with downstream sectors.

$L^{TB}_{(nx1)} \equiv 1'Z$ is the total (direct and indirect) backward linkage vector. (This of course equals the column sums of the Leontief inverse W.) For each sector *j*, this vector shows the direct and indirect backward linkages with upstream sectors.

Given that the forward linkage vector of each sector is a weighted sum of that sectors backward linkages (and *vice versa*), aggregate weighted forward linkages equal aggregate weighted backward linkages (with weighting being the value of each sector's output). That is, $X'L^{TF} = L^{TB}X$.

The economy-wide coefficient of interdependence can then be obtained as an output-weighted average of either of these measures, that is,
$C \equiv X'L^{TF} \div X'1 = L^{TB}X \div X'1$. This measures the degree of 'internal integration' or 'industrial depth' at any point in time.

All of the above vectors and matrices were also calculated using an adjusted intermediate input flow matrix $\hat{F}$ that excludes *imported* intermediate inputs. Following all the above steps, all vectors and matrices can be derived adjusting such that the intermediate inputs on which they are based are only domestically produced. We thus derived the imported adjusted upstream linkages coefficient matrix ($\hat{D}$), upstream linkages coefficient matrix ($\hat{E}$), input coefficient matrix ($\hat{A}$), weighted input coefficient matrix ($\hat{\tilde{A}}$), output coefficient matrix ($\hat{B}$), weighted input coefficient matrix ($\hat{\tilde{B}}$), input inverse ($\hat{Z}$), output inverse ($\hat{W}$), direct forward linkage vector ($\hat{\mathrm{L}}^{\mathrm{DF}}$), direct backward linkage vector ($\hat{\mathrm{L}}^{\mathrm{DB}}$), total forward linkage vector ($\hat{L}^{TF}$), total backward linkage vector ($\hat{L}^{TB}$), and coefficient of integration $\hat{C}$.

The employment multipliers were then calculated as follows (shown here for the import-adjusted figures, as in the results presented in the paper).

$P_{(nx1)}$ is the employment vector, where p_i is the number of people employed in sector i (actually the number of full-time full-year equivalents). Similarly P^H, P^S

and P^U for the numbers of highly-skilled, skilled, and semi- and unskilled people respectively.

DIAG$(P)_{(nxn)}$ ≡ a diagonal matrix where DIAG$(p)_{ij} = p_{ij}$ for all i=j, DIAG$(p)_{ij}$ = 0 otherwise.

$\hat{N}_{(nxn)} = \text{DIAG}(P)(\text{DIAG}(\hat{X})^{-1})$, a diagonal matrix in which the diagonal elements are the employment/value added ratios of each sector i.

Then $\hat{M}_{(nxn)} = \hat{N}\hat{Z}$ where $\hat{m}_{ij}$ is the number of additional jobs (full-time full-year equivalents) in sector i that would be associated with one additional unit of final demand in sector j. The column totals $\sum_{i=1}^{n} \hat{m}_{ij}$ show the total number of additional jobs associated with an additional unit of final demand in sector j. Similarly for $\hat{M}^H$, $\hat{M}^S$, and $\hat{M}^U$.

Appendix 2: Linkages and multipliers – tables of results

The following sets of tables show the results for all sectors of the various calculations of forward and backward linkages and multipliers, according to the methods set out in Appendix 1 and as discussed in section 6. The calculations have also been undertaken for the more disaggregated 43-sector structure, but are shown here at the 9-sector level for the sake of brevity.

TableA1: Backward linkages in terms of intermediate output

	Agriculture	Mining	Manufacturing	Electricity gas and water	Construction	Trade	Transport	Finance	CSP	Government	Services total
Agriculture	4.4	0	6.6	0	0	0.5	0	0	0.2	0.2	0.2
Mining	1.3	10	14.6	30.7	5.9	0	0.3	0.5	0.5	0.9	0.3
Manufacturing	57.1	32.3	51.8	15.2	47.0	19.5	38.8	16.1	29.7	32.3	24.7
EGW	1.9	4.9	1.7	30.3	0.4	2.4	2.6	1.5	2.2	1.2	2.1
Construction	0.6	1.4	0	6.5	26.4	2.0	0.6	2.8	1.1	2.5	1.8
Trade	11.0	5.5	9.7	3.9	5.7	13.5	16.0	9.2	12.6	9.0	12.6
Transport	13.9	46.5	5.1	3.2	2.9	22.6	26.1	12.4	8.6	10.7	18.3
Finance	5.1	5.6	8.6	10.2	11.3	38.9	14.8	54.1	39.0	16.8	37.7
CSP	4.7	2.9	1.9	0.1	0.4	0.6	0.8	3.3	4.2	11.3	2.0
Government	0	0	0	0	0	0	0.1	0.1	1.8	15.0	0.3
Services total	34.7	60.5	25.3	17.3	20.3	75.7	57.6	79.0	64.4	47.8	70.6
SUM	100	100	100	100	100	100	100	100	100	100	100

This is the upstream linkages coefficient matrix, *D* (with the addition of a row showing the columns summing to 100%).

Table A2: Backward linkages in terms of intermediate output, import adjusted

	Agriculture	Mining	Manufacturing	Electricity gas and water	Construction	Trade	Transport	Finance	CSP	Government	Services total
Agriculture	5.0	0	7.8	0	0	0.5	0	0	0.2	0.2	0.2
Mining	0.8	0.9	10.6	30.8	3.3	0.0	0.2	0.4	0.4	0.6	0.3
Manufacturing	50.4	24.0	48.1	10.7	40.6	16.8	28.4	12.3	21.7	21.9	18.6
EGW	2.3	5.9	2.2	32.4	0.4	2.5	3.1	1.6	2.6	1.3	2.3
Construction	0.9	1.7	0.0	8.3	34.8	3.0	1.0	4.0	1.8	2.8	2.7
Trade	13.4	6.6	12.4	4.0	6.0	14.2	18.9	9.5	14.1	9.4	13.7
Transport	15.5	50.9	6.1	3.1	2.9	22.8	30.1	12.5	9.4	10.6	19.2
Finance	6.1	6.3	10.4	10.5	11.5	39.6	17.2	55.9	42.6	16.6	40.3
CSP	5.6	3.5	2.5	0.1	0.4	0.7	1.0	3.7	5.4	11.8	2.4
Government	0	0	0	0	0	0	0.1	0.1	1.9	24.9	0.3
Services total	40.6	67.4	31.4	17.7	20.8	77.2	67.2	81.6	71.4	48.4	75.6
SUM	100	100	100	100	100	100	100	100	100	100	100

This is the import-adjusted upstream linkages coefficient matrix, $\hat{D}$ (with the addition of a row showing the columns summing to 100%).

Table A3: Backward linkages in terms of total output

	Agriculture	Mining	Manufacturing	Electricity gas and water	Construction	Trade	Transport	Finance	CSP	Government	Services total
Agriculture	2.4	0.0	4.9	0.0	0.0	0.2	0.0	0.0	0.1	0.1	0.1
Mining	0.7	0.5	10.8	16.0	4.3	0.0	0.2	0.2	0.3	0.3	0.2
Manufacturing	31.1	15.2	38.4	7.9	33.9	9.0	21.2	7.1	14.5	10.2	11.8
EGW	1.0	2.3	1.2	15.7	0.3	1.1	1.4	0.6	1.1	0.4	1.0
Construction	0.3	0.6	0.0	3.4	19.0	0.9	0.4	1.2	0.6	0.8	0.9
Trade	6.0	2.6	7.2	2.0	4.1	6.2	8.7	4.0	6.1	2.9	6.0
Transport	7.6	21.9	3.8	1.7	2.1	10.4	14.3	5.4	4.2	3.4	8.7
Finance	2.8	2.6	6.3	5.3	8.2	17.9	8.1	23.7	19.1	5.3	18.0
CSP	2.6	1.3	1.4	0.0	0.3	0.3	0.4	1.5	2.1	3.6	1.0
Government	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.9	4.7	0.1
Services total	18.9	28.4	18.7	9.0	14.6	34.9	31.5	34.7	31.5	15.1	33.6
SUM	54.5	47.0	74.1	52.0	72.1	46.1	54.6	43.9	48.8	31.6	47.6

This is the input coefficient matrix A. The last row is the direct backward linkage vector L^{DB}.

Table A4: Backward linkages in terms of total output, import adjusted

	Agriculture	Mining	Manufacturing	Electricity gas and water	Construction	Trade	Transport	Finance	CSP	Government	Services total
Agriculture	2.2	0.0	4.5	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.1
Mining	0.4	0.4	6.1	14.9	2.1	0.0	0.1	0.2	0.2	0.2	0.1
Manufacturing	22.5	9.4	27.8	5.2	25.7	7.3	12.9	5.1	9.2	6.5	8.0
EGW	1.0	2.3	1.2	15.6	0.3	1.1	1.4	0.6	1.1	0.4	1.0
Construction	0.4	0.7	0.0	4.0	22.1	1.3	0.5	1.6	0.8	0.8	1.2
Trade	6.0	2.6	7.2	1.9	3.8	6.1	8.6	3.9	6.0	2.8	5.9
Transport	6.9	19.9	3.5	1.5	1.8	9.9	13.6	5.1	4.0	3.1	8.2
Finance	2.7	2.5	6.0	5.1	7.3	17.2	7.8	23.0	18.1	4.9	17.3
CSP	2.5	1.4	1.5	0.0	0.3	0.3	0.4	1.5	2.3	3.5	1.0
Government	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	7.4	0.1
Services total	18.2	26.4	18.2	8.5	13.2	33.5	30.4	33.5	30.5	14.3	32.4
SUM	44.7	39.2	57.8	48.3	63.4	43.4	45.3	41.1	42.6	29.7	42.9

This is the import-adjusted input coefficient matrix $\hat{A}$, and the last row is the import-adjusted direct backward linkage vector $\hat{\mathrm{L}}^{\mathrm{DB}}$.

Table A5: Backward linkages (in terms of total output), weighted

	Agriculture	Mining	Manufacturing	Electricity gas and water	Construction	Trade	Transport	Finance	CSP	Government	Services total
Agriculture	1.43	0.01	2.90	0.01	0.00	0.13	0.00	0.00	0.06	0.03	0.04
Mining	0.18	0.12	2.83	4.17	1.11	0.00	0.05	0.06	0.07	0.08	0.04
Manufacturing	1.43	0.70	1.76	0.36	1.55	0.41	0.97	0.32	0.66	0.47	0.54
EGW	0.75	1.66	0.89	11.27	0.20	0.78	1.00	0.46	0.78	0.27	0.71
Construction	0.11	0.21	0.00	1.09	6.17	0.30	0.11	0.40	0.18	0.26	0.28
Trade	0.77	0.33	0.92	0.26	0.53	0.79	1.11	0.52	0.79	0.37	0.76
Transport	1.12	3.23	0.56	0.24	0.31	1.54	2.11	0.80	0.62	0.50	1.28
Finance	0.26	0.24	0.58	0.49	0.75	1.65	0.74	2.18	1.75	0.49	1.65
CSP	0.72	0.38	0.39	0.01	0.07	0.08	0.12	0.41	0.58	1.01	0.27
Government	0	0	0	0	0	0	0	0.01	0.13	0.69	0.02
Services total	0.65	0.98	0.65	0.31	0.50	1.20	1.08	1.19	1.08	0.52	1.16

This is the weighted input coefficient matrix $\tilde{A}$.

Table A6: Backward linkages (in terms of total output), weighted and import adjusted

	Agriculture	Mining	Manufacturing	Electricity gas and water	Construction	Trade	Transport	Finance	CSP	Government	Services total
Agriculture	1.45	0.01	2.93	0.01	0.00	0.13	0.00	0.00	0.06	0.03	0.04
Mining	0.10	0.10	1.75	4.25	0.60	0.00	0.03	0.05	0.05	0.05	0.03
Manufacturing	1.13	0.47	1.40	0.26	1.29	0.37	0.65	0.25	0.46	0.33	0.40
EGW	0.82	1.81	0.98	12.26	0.21	0.86	1.10	0.51	0.86	0.30	0.78
Construction	0.14	0.24	0.00	1.43	7.84	0.46	0.17	0.58	0.27	0.29	0.41
Trade	0.84	0.36	1.01	0.27	0.53	0.86	1.20	0.55	0.84	0.39	0.82
Transport	1.12	3.23	0.57	0.24	0.30	1.60	2.21	0.83	0.65	0.51	1.34
Finance	0.28	0.25	0.61	0.51	0.73	1.73	0.78	2.31	1.83	0.49	1.74
CSP	0.77	0.42	0.45	0.01	0.08	0.09	0.13	0.46	0.71	1.08	0.32
Government	0	0	0	0	0	0	0	0.01	0.12	1.14	0.02
Services total	0.69	1.00	0.69	0.32	0.50	1.26	1.15	1.26	1.15	0.54	1.22

This is the import-adjusted weighted input coefficient matrix $\hat{\tilde{A}}$.

Table A7: Input inverse (Leontief inverse) and total backward linkage vector

	Agriculture	Mining	Manufacturing	Electricity gas and water	Construction	Trade	Transport	Finance	CSP	Government	Services total
Agriculture	1.06	0.02	0.09	0.02	0.04	0.02	0.03	0.01	0.02	0.01	0.02
Mining	0.09	1.06	0.21	0.23	0.15	0.04	0.07	0.03	0.05	0.04	0.05
Manufacturing	0.68	0.43	1.86	0.32	0.86	0.30	0.53	0.25	0.38	0.27	0.35
EGW	0.03	0.04	0.04	1.20	0.03	0.03	0.03	0.02	0.03	0.01	0.03
Construction	0.01	0.02	0.01	0.06	1.24	0.02	0.01	0.02	0.02	0.01	0.02
Trade	0.15	0.10	0.19	0.08	0.16	1.12	0.17	0.09	0.13	0.07	
Transport	0.18	0.32	0.19	0.12	0.15	0.18	1.25	0.12	0.12	0.08	
Finance	0.17	0.14	0.24	0.16	0.27	0.32	0.23	1.38	0.34	0.14	
CSP	0.04	0.03	0.04	0.01	0.02	0.01	0.02	0.03	1.03	0.05	
Government	0	0	0	0	0	0	0	0	0.01	1.05	
Services total	0.54	0.58	0.65	0.37	0.60	1.64	1.67	1.62	1.62	0.34	1.64
SUM	2.41	2.16	2.87	2.20	2.93	2.04	2.33	1.97	2.12	1.73	2.10

The last row is the total backward linkage vector.

Note that for some calculations, it was necessary to recalculate the matrices with services as an aggregate category, where summing across the services subsectors would have been incorrect. In these cases there are no values for the interaction between services and the service subsectors, as in the above table.

Table A8: Import-adjusted input inverse and total backward linkage vector

	Agriculture	Mining	Manufacturing	Electricity gas and water	Construction	Trade	Transport	Finance	CSP	Government	Services total
Agriculture	1.04	0.01	0.07	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01
Mining	0.03	1.02	0.10	0.19	0.06	0.02	0.02	0.01	0.02	0.01	0.02
Manufacturing	0.38	0.21	1.48	0.17	0.52	0.18	0.26	0.14	0.19	0.14	0.19
EGW	0.02	0.04	0.03	1.20	0.02	0.02	0.03	0.02	0.02	0.01	0.02
Construction	0.01	0.02	0.01	0.07	1.29	0.03	0.02	0.03	0.02	0.02	0.02
Trade	0.12	0.08	0.14	0.06	0.11	1.11	0.14	0.08	0.10	0.06	
Transport	0.13	0.26	0.12	0.09	0.09	0.16	1.20	0.10	0.09	0.06	
Finance	0.12	0.10	0.17	0.13	0.21	0.28	0.18	1.35	0.30	0.11	
CSP	0.04	0.02	0.03	0.01	0.02	0.01	0.01	0.02	1.03	0.04	
Government	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	1.08	0.00
Services total	0.40	0.46	0.46	0.29	0.43	1.56	1.54	1.55	1.52	0.28	1.55
SUM	1.89	1.76	2.14	1.92	2.35	1.82	1.87	1.76	1.80	1.54	1.81

The last row is the import-adjusted total backward linkage vector.

Table A9: Forward linkages in terms of intermediate output

	Agriculture	Mining	Manufacturing	Electricity gas and water	Construction	Trade	Transport	Finance	CSP	Government	Services total	SUM
Agriculture	3.58	0.05	94.14	0.02	0.01	1.46	0.01	0.07	0.32	0.35	1.86	100
Mining	0.41	0.61	84.02	7.94	4.68	0.04	0.42	0.83	0.33	0.72	1.61	100
Manufacturing	3.54	3.94	56.77	0.75	7.08	4.76	9.72	5.21	3.49	4.75	23.18	100
EGW	1.91	9.64	29.43	23.86	0.95	9.28	10.28	7.65	4.18	2.82	31.39	100
Construction	0.57	2.54	0.02	4.85	60.63	7.43	2.46	13.81	2.04	5.65	25.74	100
Trade	2.61	2.58	40.69	0.74	3.30	12.62	15.32	11.40	5.66	5.09	45.00	100
Transport	2.75	18.07	17.92	0.50	1.39	17.61	20.81	12.78	3.21	4.98	54.41	100
Finance	0.63	1.35	18.59	1.00	3.38	18.89	7.36	34.79	9.11	4.89	70.16	100
CSP	4.59	5.52	32.41	0.05	0.86	2.24	3.09	17.04	7.83	26.37	30.21	100
Government	0	0	0	0.05	0	0	0.60	1.64	8.76	88.95	11.00	100
Services total	1.88	6.46	24.22	0.75	2.67	16.19	12.64	22.41	6.63	6.15	57.86	100

This is the import-adjusted downstream linkages coefficient matrix E, with the addition of the last column showing each row summing to 100%.

Table A10: Forward linkages in terms of intermediate output, import adjusted

	Agriculture	Mining	Manufacturing	Electricity gas and water	Construction	Trade	Transport	Finance	CSP	Government	Services total	SUM
Agriculture	3.57	0.05	94.13	0.02	0.01	1.48	0.01	0.07	0.32	0.34	1.87	100
Mining	0.36	0.83	79.68	12.44	3.88	0.06	0.39	1.19	0.39	0.78	2.03	100
Manufacturing	3.61	3.45	58.02	0.69	7.60	5.46	8.34	5.27	3.14	4.41	22.21	100
EGW	1.91	9.62	29.41	23.72	0.89	9.35	10.32	7.63	4.23	2.92	31.53	100
Construction	0.57	2.21	0.03	4.82	58.48	8.62	2.71	15.20	2.31	5.05	28.84	100
Trade	2.63	2.60	41.13	0.71	3.09	12.62	15.25	11.16	5.62	5.18	44.66	100
Transport	2.68	17.60	17.60	0.49	1.30	17.80	21.25	12.87	3.27	5.14	55.19	100
Finance	0.64	1.34	18.45	0.99	3.15	18.87	7.41	35.16	9.06	4.92	70.51	100
CSP	4.32	5.46	32.74	0.05	0.80	2.44	3.06	16.90	8.42	25.82	30.82	100
Government	0.00	0.00	0.00	0.03	0.00	0.00	0.34	0.93	5.08	93.62	6.36	100
Services total	1.88	6.23	24.39	0.74	2.50	16.14	12.69	22.48	6.67	6.28	57.98	100

This is the downstream linkages coefficient matrix $\hat{E}$, with the addition of the last column showing each row summing to 100%.

Table A11: Forward linkages in terms of total output

	Agriculture	Mining	Manufacturing	Electricity gas and water	Construction	Trade	Transport	Finance	CSP	Government	Services total	SUM
Agriculture	2.40	0.04	63.12	0.01	0.01	0.98	0.00	0.05	0.21	0.23	1.24	67.06
Mining	0.30	0.45	61.66	5.83	3.44	0.03	0.31	0.61	0.24	0.53	1.18	73.40
Manufacturing	2.39	2.67	38.43	0.51	4.79	3.22	6.58	3.53	2.36	3.21	15.69	67.70
EGW	1.26	6.37	19.43	15.75	0.63	6.13	6.79	5.05	2.76	1.86	20.73	66.02
Construction	0.18	0.80	0.01	1.52	19.04	2.33	0.77	4.34	0.64	1.77	8.08	31.40
Trade	1.28	1.27	20.04	0.36	1.62	6.22	7.55	5.61	2.79	2.51	22.17	49.26
Transport	1.88	12.38	12.27	0.34	0.95	12.07	14.25	8.76	2.20	3.41	37.27	68.51
Finance	0.43	0.92	12.69	0.68	2.31	12.89	5.02	23.75	6.22	3.34	47.88	68.25
CSP	1.20	1.45	8.50	0.01	0.22	0.59	0.81	4.47	2.05	6.92	7.92	26.23
Government	0	0	0	0	0	0	0.03	0.09	0.47	4.75	0.59	5.34
Services total	1.09	3.75	14.06	0.43	1.55	9.40	7.34	13.01	3.85	3.57	33.59	58.05

This is the output coefficient matrix *B*. The final column is the direct forward linkage vector L^{DF}.

Table A12: Forward linkages in terms of total output, import adjusted

	Agriculture	Mining	Manufacturing	Electricity gas and water	Construction	Trade	Transport	Finance	CSP	Government	Services total	SUM
Agriculture	2.21	0.03	58.25	0.01	0.01	0.91	0.00	0.04	0.20	0.21	1.16	61.89
Mining	0.16	0.36	34.72	5.42	1.69	0.02	0.17	0.52	0.17	0.34	0.88	43.58
Manufacturing	1.73	1.65	27.82	0.33	3.64	2.62	4.00	2.53	1.51	2.12	10.65	47.95
EGW	1.26	6.34	19.39	15.65	0.59	6.16	6.80	5.03	2.79	1.93	20.79	65.95
Construction	0.22	0.83	0.01	1.82	22.07	3.25	1.02	5.74	0.87	1.91	10.88	37.74
Trade	1.28	1.27	20.02	0.35	1.50	6.14	7.42	5.43	2.74	2.52	21.73	48.67
Transport	1.72	11.29	11.29	0.31	0.83	11.42	13.63	8.25	2.09	3.29	35.39	64.13
Finance	0.42	0.87	12.05	0.65	2.06	12.33	4.84	22.97	5.92	3.21	46.06	65.33
CSP	1.18	1.49	8.91	0.01	0.22	0.67	0.83	4.60	2.29	7.03	8.39	27.23
Government	0	0	0	0	0	0	0.03	0.07	0.40	7.39	0.50	7.90
Services total	1.05	3.48	13.64	0.41	1.40	9.02	7.10	12.57	3.73	3.51	32.41	55.90

This is the import-adjusted output coefficient matrix $\hat{B}$. The final column is the import-adjusted direct forward linkage vector $\hat{L}^{DF}$.

Table A13: Forward linkages (in terms of total output), weighted

	Agriculture	Mining	Manufacturing	Electricity gas and water	Construction	Trade	Transport	Finance	CSP	Government	Services total
Agriculture	1.43	0.01	2.90	0.01	0.00	0.13	0.00	0.00	0.06	0.03	0.04
Mining	0.18	0.12	2.83	4.17	1.11	0.00	0.05	0.06	0.07	0.08	0.04
Manufacturing	1.43	0.70	1.76	0.36	1.55	0.41	0.97	0.32	0.66	0.47	0.54
EGW	0.75	1.66	0.89	11.27	0.20	0.78	1.00	0.46	0.78	0.27	0.71
Construction	0.11	0.21	0.00	1.09	6.17	0.30	0.11	0.40	0.18	0.26	0.28
Trade	0.77	0.33	0.92	0.26	0.53	0.79	1.11	0.52	0.79	0.37	0.76
Transport	1.12	3.23	0.56	0.24	0.31	1.54	2.11	0.80	0.62	0.50	1.28
Finance	0.26	0.24	0.58	0.49	0.75	1.65	0.74	2.18	1.75	0.49	1.65
CSP	0.72	0.38	0.39	0.01	0.07	0.08	0.12	0.41	0.58	1.01	0.27
Government	0	0	0	0	0	0	0	0.01	0.13	0.69	0.02
Services total	0.65	0.98	0.65	0.31	0.50	1.20	1.08	1.19	1.08	0.52	1.16

This is the weighted output coefficient matrix $\tilde{B}$.

Table A14: Forward linkages (in terms of total output), weighted and import adjusted

	Agriculture	Mining	Manufacturing	Electricity gas and water	Construction	Trade	Transport	Finance	CSP	Government	Services total
Agriculture	1.45	0.01	2.93	0.01	0	0.13	0	0	0.06	0.04	0.04
Mining	0.10	0.10	1.75	4.25	0.60	0	0.03	0.05	0.05	0.03	0.03
Manufacturing	1.13	0.47	1.40	0.26	1.29	0.37	0.65	0.25	0.46	0.40	0.40
EGW	0.82	1.81	0.98	12.26	0.21	0.86	1.10	0.51	0.86	0.78	0.78
Construction	0.14	0.24	0	1.43	7.84	0.46	0.17	0.58	0.27	0.41	0.41
Trade	0.84	0.36	1.01	0.27	0.53	0.86	1.20	0.55	0.84	0.82	0.82
Transport	1.12	3.23	0.57	0.24	0.30	1.60	2.21	0.83	0.65	1.34	1.34
Finance	0.28	0.25	0.61	0.51	0.73	1.73	0.78	2.31	1.83	1.74	1.74
CSP	0.77	0.42	0.45	0.01	0.08	0.09	0.13	0.46	0.71	0.32	0.32
Government	0	0	0	0	0	0	0	0.01	0.12	0.02	0.02
Services total	0.69	1.00	0.69	0.32	0.50	1.26	1.15	1.26	1.15	1.22	1.22

This is the import-adjusted weighted output coefficient matrix $\hat{\tilde{B}}$.

Table A15: Output inverse (*W*) and total forward linkage vector (L^{TF})

	Agriculture	Mining	Manufacturing	Electricity gas and water	Construction	Trade	Transport	Finance	CSP	Government	Services total	SUM
Agriculture	1.06	0.05	1.21	0.01	0.08	0.08	0.11	0.08	0.04	0.06	0.31	2.79
Mining	0.04	1.06	1.20	0.08	0.12	0.08	0.12	0.10	0.05	0.06	0.34	2.92
Manufacturing	0.05	0.08	1.86	0.02	0.12	0.11	0.16	0.13	0.06	0.08	0.46	2.67
EGW	0.04	0.12	0.66	1.20	0.06	0.15	0.17	0.15	0.07	0.07	0.53	2.69
Construction	0.01	0.02	0.08	0.03	1.24	0.05	0.03	0.08	0.02	0.03	0.18	1.59
Trade	0.03	0.05	0.52	0.01	0.06	1.12	0.15	0.13	0.06	0.06	1.46	2.20
Transport	0.04	0.18	0.60	0.02	0.07	0.21	1.25	0.20	0.06	0.08	1.72	2.72
Finance	0.03	0.05	0.49	0.02	0.08	0.23	0.14	1.38	0.11	0.09	1.86	2.60
CSP	0.02	0.03	0.22	0.00	0.02	0.03	0.04	0.08	1.03	0.09	1.18	1.56
Government	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	1.05	0.01	1.06
Services total	0.03	0.08	0.49	0.02	0.06					0.08	1.64	2.39

The last column is the total forward linkage vector.

Table A16: Import-adjusted output inverse ($\hat{W}$) and total forward linkage vector ($\hat{L}^{TF}$)

	Agriculture	Mining	Manufacturing	Electricity gas and water	Construction	Trade	Transport	Finance	CSP	Government	Services total	SUM
Agriculture	1.04	0.02	0.88	0.01	0.04	0.05	0.05	0.04	0.02	0.03	0.16	2.19
Mining	0.01	1.02	0.55	0.07	0.05	0.03	0.04	0.04	0.02	0.02	0.13	1.85
Manufacturing	0.03	0.04	1.48	0.01	0.07	0.06	0.08	0.07	0.03	0.05	0.25	1.92
EGW	0.03	0.10	0.48	1.20	0.04	0.13	0.14	0.12	0.06	0.05	0.44	2.35
Construction	0.01	0.02	0.07	0.03	1.29	0.07	0.03	0.11	0.02	0.04	0.23	1.69
Trade	0.02	0.04	0.39	0.01	0.04	1.11	0.12	0.11	0.05	0.05	1.39	1.95
Transport	0.03	0.15	0.37	0.02	0.04	0.18	1.20	0.16	0.05	0.07	1.59	2.27
Finance	0.02	0.04	0.35	0.02	0.06	0.20	0.11	1.35	0.10	0.07	1.76	2.31
CSP	0.02	0.02	0.18	0.00	0.01	0.03	0.02	0.07	1.03	0.09	1.16	1.48
Government	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.08	0.01	1.09
Services total	0.02	0.06	0.34	0.01	0.05					0.07	1.55	2.10

The last column is the import-adjusted total forward linkage vector.

Table A17: Total employment multipliers

	Agriculture	Mining	Manufacturing	Electricity gas and water	Construction	Trade	Transport	Finance	CSP	Government	Services total
Agriculture	9.78	0.09	0.64	0.08	0.23	0.10	0.11	0.06	0.10	0.07	0.09
Mining	0.08	2.49	0.23	0.46	0.15	0.04	0.05	0.03	0.04	0.03	0.04
Manufacturing	0.44	0.24	1.71	0.20	0.60	0.21	0.30	0.16	0.23	0.16	0.22
EGW	0.02	0.03	0.03	1.01	0.02	0.02	0.02	0.01	0.02	0.01	0.02
Construction	0.03	0.04	0.03	0.19	3.61	0.07	0.04	0.09	0.06	0.05	0.07
Trade	0.44	0.28	0.53	0.23	0.43	4.17	0.53	0.30	0.39	0.22	
Transport	0.13	0.26	0.12	0.09	0.09	0.16	1.20	0.10	0.09	0.06	
Finance	0.35	0.30	0.52	0.38	0.61	0.85	0.54	4.01	0.88	0.33	
CSP	0.26	0.15	0.21	0.06	0.12	0.08	0.09	0.17	7.43	0.31	
Government	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	4.85	0.01
Services total	1.17	1.00	1.37	0.76	1.25	5.26	2.36	4.58	8.79	0.93	5.01
SUM	11.53	3.91	4.00	2.70	5.86	5.69	2.89	4.95	9.27	6.09	5.46

The last row is the aggregate total employment multiplier for each sector j.

Table A18: High-skilled employment multipliers

	Agriculture	Mining	Manufacturing	Electricity gas and water	Construction	Trade	Transport	Finance	CSP	Government	Services total
Agriculture	0.24	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Mining	0.01	0.20	0.02	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Manufacturing	0.05	0.03	0.18	0.02	0.06	0.02	0.03	0.02	0.02	0.02	0.02
EGW	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Construction	0.00	0.00	0.00	0.01	0.21	0.00	0.00	0.01	0.00	0.00	0.00
Trade	0.05	0.03	0.06	0.03	0.05	0.47	0.06	0.03	0.04	0.02	
Transport	0.02	0.03	0.01	0.01	0.01	0.02	0.14	0.01	0.01	0.01	
Finance	0.08	0.06	0.11	0.08	0.13	0.18	0.11	0.86	0.19	0.07	
CSP	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.27	0.01	
Government	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	1.04	0.00
Services total	0.15	0.13	0.19	0.12	0.19	0.68	0.32	0.91	0.51	0.11	0.64
SUM	0.45	0.36	0.41	0.34	0.49	0.71	0.37	0.94	0.55	1.18	0.68

The last row is the aggregate high-skilled employment multiplier for each sector j.

Table A19: Skilled employment multipliers

	Agriculture	Mining	Manufacturing	Electricity gas and water	Construction	Trade	Transport	Finance	CSP	Government	Services total
Agriculture	2.50	0.02	0.16	0.02	0.06	0.02	0.03	0.02	0.02	0.02	0.02
Mining	0.01	0.46	0.04	0.09	0.03	0.01	0.01	0.01	0.01	0.01	0.01
Manufacturing	0.17	0.10	0.67	0.08	0.24	0.08	0.12	0.06	0.09	0.06	0.09
EGW	0.01	0.01	0.01	0.33	0.01	0.01	0.01	0.00	0.01	0.00	0.01
Construction	0.01	0.01	0.00	0.03	0.60	0.01	0.01	0.01	0.01	0.01	0.01
Trade	0.26	0.17	0.31	0.13	0.25	2.43	0.31	0.18	0.23	0.13	
Transport	0.05	0.09	0.04	0.03	0.03	0.05	0.42	0.04	0.03	0.02	
Finance	0.21	0.18	0.31	0.23	0.36	0.50	0.32	2.39	0.52	0.20	
CSP	0.03	0.02	0.03	0.01	0.02	0.01	0.01	0.02	0.95	0.04	
Government	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.90	0.01
Services total	0.54	0.46	0.68	0.40	0.66	3.00	1.06	2.62	1.73	0.39	2.24
SUM	3.24	1.06	1.58	0.95	1.59	3.13	1.23	2.73	1.90	3.38	2.38

The last row is the aggregate skilled employment multiplier for each sector j.

Table A20: Semi- and unskilled employment multipliers

	Agriculture	Mining	Manufacturing	Electricity gas and water	Construction	Trade	Transport	Finance	CSP	Government	Services total
Agriculture	7.05	0.07	0.46	0.06	0.16	0.07	0.08	0.05	0.07	0.05	0.07
Mining	0.06	1.83	0.17	0.34	0.11	0.03	0.04	0.03	0.03	0.02	0.03
Manufacturing	0.22	0.12	0.86	0.10	0.30	0.10	0.15	0.08	0.11	0.08	0.11
EGW	0.01	0.02	0.01	0.53	0.01	0.01	0.01	0.01	0.01	0.00	0.01
Construction	0.03	0.03	0.02	0.15	2.80	0.06	0.03	0.07	0.04	0.04	0.05
Trade	0.13	0.09	0.16	0.07	0.13	1.26	0.16	0.09	0.12	0.07	
Transport	0.07	0.14	0.06	0.05	0.05	0.08	0.64	0.05	0.05	0.03	
Finance	0.07	0.06	0.10	0.07	0.12	0.16	0.10	0.77	0.17	0.06	
CSP	0.21	0.13	0.17	0.05	0.10	0.07	0.08	0.14	6.21	0.26	
Government	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.91	0.00
Services total	0.48	0.41	0.49	0.24	0.39	1.58	0.98	1.05	6.55	0.42	2.13
SUM	7.85	2.48	2.02	1.41	3.79	1.85	1.29	1.28	6.83	1.53	2.40

The last row is the aggregate semi- and unskilled employment multiplier for each sector j.

Appendix 3: List of sector and group codes

Table A21 summarises the codes of the sector groups as used in the econometric analysis at the subsectoral level, discussed in section 7 of this paper. It also shows which sectors are included in each of the 14 groups.

Table A21: Sector group description and codes

Code	Description	Sectors included	SIC codes
Agric	Agriculture	agriculture	1
Mining	Mining	coal	21
		gold	23
		other mining	22/24/25/29
LIIG	Labour intensive intermediate goods	textiles	311-312
		leather products	316
		wood products	321-322
		paper products	323
		printing and publishing	324-326
		other chemical products	335-336
		rubber products	337
		plastic products	338
		glass products	341
		non-metallic metal products	342
		metal products	353-355
		electrical machinery	361-366
		scientific equipment	374-376
		vehicles	381-383
		transport equipment	384-387
LICG	Labour intensive consumer goods	food processing	301-304
		wearing apparel	313-315
		footwear	317
		furniture	391
		other industries	392-393
LIKG	Labour intensive capital goods	machinery	356-359
		communication equipment	371-373
KIIG	Capital intensive intermediate goods	petroleum products	331-333
		chemical products	334
		basic iron and steel	351
		non-ferrous metals	352
KICG	Capital intensive consumer goods	beverages and tobacco	305-306
EW	Electricity and water	electricity and gas	41
		water	42
Const	Construction	construction	5
LSIIS	Low skill intensive intermediate services	trade services	61-63
		transport services	71-74
		communication services	75
LSICS	Low skill intensive consumer services	hotels and catering	64
		other producers	92, 95-96, 99
SIIS	Skill intensive intermediate services	financial and real estate services	81-82
		business services	83-88
SICS	Skill intensive consumer services	medical and other services	93
GS	Government services	government services	91, 94

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