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A New Growth Path for South African Industrialisation: An input-output analysis

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A New Growth Path for South African Industrialisation:

An input-output analysis

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"Now is the time to lay the groundwork for stronger growth going forward, and for growth that gives rise to more jobs."

President Jacob Zuma, State of the Nation Address, 11 February 2010

"The negative, unintended consequences of this growth path are manifold they include large and unsustainable imbalances in the economy, continued high levels of unemployment and a large current account deficit. These weaknesses have been exacerbated by the global recession. Taken together these challenges are enormous and make it critical that we upscale our industrial policy efforts."

Rob Davies, Minister of Trade and Industry, National Assembly Statement on IPAP2, 18 February 2010

"And in growing the wider economy, broadening participation, deepening trade and strengthening our revenue base, we have recognised that a new growth path is needed, that industrial policy has to be founded on a well-considered action plan and that we need to do more to promote a dynamic economy, capable of responding both to domestic demand and international opportunities."

Pravin Gordhan, Minister of Finance, Budget Vote Speech, 11 May 2010

"Faced with these realities and the challenges of very high inequality and deep levels of poverty, we are working on ways to improve the employment performance of the economy and create many more decent work opportunities and better social outcomes. We call this the development of a new growth path."

Ebrahim Patel, Minister of Economic Development, on the occasion of the debate on Budget Vote 27: Economic Development, in an extended public committee meeting of the National Assembly, 23 March 2010

1. Introduction

The formation of Zuma's cabinet, has seen a focus in the discourse and policy goals of a number of ministries and departments (namely the newly formed Economic Development Department (EDD), the Department of Trade and Industry (DTI), the National Planning Commission, and the Treasury) over the last year on how policy can shift South Africa onto a "New Growth Path" (NGP). The quotes above, taken from the State of the Nation Address by President Zuma in 2010, and various addresses from the ministers of the three main economic departments show what can be described as a new consensus on what constitutes the NGT and a general commitment to align policies in order to bring the economy to this NGT. The current consensus around the NGT is based on an understanding of the structural legacies of the Apartheid era, the exacerbation of inequalities that have resulted from the policies that defined the character of the post-apartheid growth path, and the need to deepen and diversify the economy and most importantly, to create wide spread decent and sustainable employment.

This paper looks at the way in which the structure of the economy has been built through the economic policies of the Apartheid government and reinforced in the first sixteen years of democracy. It is argued that previous growth paths have resulted in an industrial structure that systematically excludes

the majority in engaging in economic activities, particularly in terms of waged labour. We discuss what is meant by the New Growth Path under the current consensus and relate this to Hirschman's (1958) theory of linkage based economic development, and the need for a change in approach to industrial policy and the need for focussed sector targeting. Having argued that the achievement of the NGP depends upon the restructuring of the economy towards increased labour intensity and greater interconnectedness between industries, we apply Hirschman's linkage theory through input-output analysis in order to identify potential 'key' sectors on the basis of strong forward and backward linkages to other industries. In addition, the potential impact of sector expansion on trade and employment through the calculation of employment and export multipliers. The quantitative analysis presented in this paper constitutes a first step in a deeper study that will further take into account the implications of sectoral expansion on imported inputs. This is an extremely important issue given the size of South Africa's current account deficit.

2. South Africa's Historical Growth Paths

A growth path can be defined as the trajectory of economic growth and development that considers the character of the economic growth beyond the growth rate. Kaplinksy (1991) outlines four types of growth path in the abstract: i) growth through inequality; ii) redistribution with growth; iii) growth with equity; and iv) growth through redistribution. The type of growth path depends upon the prevailing policy framework and strategy of accumulation. The following section discusses historical origins of the current growth path and prevailing industrial structure. We discuss the relationship between policy and the growth path in the Apartheid era and the first 16 years of democracy. It is shown that while the prevailing structure of industry has its roots in the discovery of gold and apartheid policies, the first 16 years of democracy has seen the further entrenchment of the apartheid industrial structure and growing structural unemployment and inequality. The section ends with a discussion of the desired NGP for the future, as articulated by the Economic Development Department and the Department of Trade and Industry.

2.1 The Apartheid Growth Path

Based on Kaplinsky's abstract typology, the apartheid growth path can be described as growth through inequality. Apartheid can be seen as a social structure designed to provide the conditions under which accumulation could occur through inequality based on predominantly racial forms (Kaplinsky 1991, p50).[1]

The strategy of accumulation based on the maintenance of inequalities provided conditions for sustained accumulation during the 1950s and 60s. Thereafter, and particularly throughout the 1980s, the accumulation strategy failed largely as a result of the contradictions inherent in the strategy of growth through inequality (Kaplinsky 1991). The inherent instability in the strategy of growth through inequality is elaborated below in section 2.1.2.

In addition to failure if the apartheid growth path to deliver sustained growth in the 1970s and 1980s, the apartheid era saw the development of South Africa's industrial structure characterised by high capital intensity, with very limited opportunities for the expansion of waged labour - particularly amongst the black population.

[1] We will see in the next section that the nature of the post-apartheid growth path can also be defined as growth through inequality but in a different form. Growth since 1994 has been characterised by neoliberal policies and the types of growth with inequality associated with Thatcherism and Reganism in the 1980s, and globalisation and financialisation in the 1990s and 2000s.

2.1.1 The Historical Development of South African Industry

South Africa's prevailing industrial structure has its roots in the discovery of diamonds and then gold in the 19th Century. Within two decades of the discovery of precious metals and minerals, mining activities dominated the South African economy and proved close to 60% of exports from the region (Feinstein 2005).

The discovery of minerals sparked an enormous inflow of British capital and that quickly established control over the mining industry. Owing to the enormous capital outlays required in mining, groups of British capital consolidated to produce a highly monopolistic structure. By 1932, six mining houses controlled all mineral production in South Africa. (Fine and Rustomjee 1996)

Table 1 Share of sectoral net value of output in total manufacturing 1924-1976

	1924/25	1948/49	1975/76
Food, beverages and tobacco	32.4	19	14.1
Textile, clothing, leather, footwear	10	15.2	10.4
Wood and furniture	6.9	6.4	3.2
Paper, printing and publishing	11.2	7.7	7.7
Other manufacturing	2.7	3.4	3.3
Total light industry	**63.2**	**51.7**	**38.7**
Chemicals and chemical products	12.1	9.5	11.4
Pottery, glass, other non-metallic minerals	7	6	5.3
Basic metals industries	8.9	17.6	13
Metal products and machinery	3.3	5	22.7
Transport equipment	5.3	7.8	7.2
Rubber products	0.2	2.4	1.7
Total heavy industry	**36.8**	**48.4**	**61.3**
Total manufacturing	**100**	**100**	**100**

Source: Feinstein 2005

Table 1 shows the shifting pattern of industrial output in South Africa from the 1920s to the 1970s. The centrality of mining activities in the South African Economy in the turn of the 20th Century shaped the development of the manufacturing sector through diversification and extension of activities by the mining conglomerates. These activities included downstream mineral processing, engineering, the steel and chemicals sector, other manufacturing sectors, and banking. (Schwank 2008) The development of the South African economy and the nature of capital accumulation was thus, and continues to be, highly skewed towards and organised around minerals and energy as core sectors. Fine and Rustomjee coined the term "minerals and energy complex" (MEC) to describe the specific form of capital accumulation and economic development in South Africa. Although the MEC can be defined as a 'core set of industrial sectors which exhibit very strong linkages with each other and relatively weaker linkages with other sectors' (Fine and Rustomjee 1996, p.91), this is not to focus on mining, minerals and energy sectors at the expense of understanding the role of finance, the state, or the political. Instead it is to argue that both the financial system and the state are 'bound together' (Fine and Rustomjee 1996, p.10) by the workings of the MEC. It is understood, then, as an integral partnership between the state and private capital, with state-owned capital playing a major role. (Ashman, Fine & Newman 2010)

The Second World War saw the rapid development of the engineering and capital goods sector in South Africa resulting from the cutting off of imports. Overall, heavy industry developed rapidly increasing its share to almost 50% in 1948/49. Transport equipment also saw rapid expansion during WWII. (Feinstein 2005). The coming into power of the National Government in 1948 saw the promotion of Afrikaner interests by the State. The political goal of creating of jobs for the poor white workers in the manufacturing industry drove the expansion of the textiles and clothing sector.

Industrial diversification continued through the 1950s and 1960s less as a result of industrial policy, where tariff policies were applied piecemeal, without consideration of the industrial structure as a whole, but more as a result of the continuing diversification of the mining conglomerates. This perpetuated and cemented the highly concentrated structure of ownership in the South African Economy.

The integration of English and Afrikanner capital in the 1970s provided the real possibility of further industrial diversification away from the core MEC sectors. But the global situation at the time meant a further intensification of reliance on MEC core sectors as the post-war boom ended, the Bretton Woods system collapsed and the prices of both oil and gold rose sharply. The 1970s saw a huge state-led programme of expansion of both gold and energy production, and other related sectors.

We argue that, as much as addressing the racial inequalities in income, opportunities for education, and political voice, addressing the legacy of South Africa's industrial structure must be at the forefront of policy. The ongoing structural unemployment and continued exclusion of the majority from economic activities can only be addressed through a change in the structure of the South African economy.

2.1.2 Inherent contradictions in the strategy of growth with inequality

Apart from the moral and political implications of increasing social inequalities for the purpose of economic growth, the strategy if growth with inequality contains a number of contradictions that result in inherent instabilities of such an accumulation strategy.

Kaplinsky (1991) outlines a number of reasons for the exhaustion of the growth model and the failure of the apartheid growth path to deliver growth in the 1970s and 1980s after a period of what appeared to be sustained growth in the 1950s and 1960s. First, Kaplinsky notes that the inequality in incomes failed to allow mass consumption to meet with mass production. This undermined the efficiency of the industrial sector by fostering monopoly and sub-optimal scales of production. Second, owing to inequalities on the shop floor, capital was unable to draw forth the creativity of its labour force and overall capital productivity declined. Third, inequality of power relations, employment opportunities and political representation led to costly political opposition; it also led to lost production as a consequence of industrial action; the resulting insecurity and crime dulled capital's incentive to invest in technological development, induced the flight of skills and resulted in international sanctions which limited export growth. Forth, the turnover of the labour force, the commuting system, and, and the general insecurity of living conditions meant that labour costs were increasing by global standards; falling land productivity and rising population in marginalised rural areas also undermined the extent to which the Bantustans were able to subsidise wages in the formal sector. Fifth, inequality in education meant that skills shortages slowed accumulation. (Kaplinsky 1991, p51)

2.2 The Legacy of the Apartheid Growth Path and the post Apartheid Growth Path 1994-2008

The ANC government inherited an economy with an industrial structure in which the majority were excluded from participating in economic activities. Manufacturing sectors were concentrated around highly capital intensive industries with insufficient capacity to soak up the large population of the black unemployed who had been previously excluded from the economy.

Rather than orienting economic policies to the task of the massive structural transformation necessary to address the highly concentrated patterns of ownership in industry, and the structural causes of extremely high unemployment amongst the black population, the ANC government concentrated on macroeconomic stabilisation and liberalisation policies in tune with the fashion of economic policy in the industrial nations of Europe and North America.

On coming into office, the primary goals of the ANC in terms of resurrecting the South African Economy were set out in the Reconstruction and Development Programme (RDP). The policies under RDP consisted of a set of goals rather than a policy strategy proper. It focussed on increasing the growth rate as an end goal with no consideration on industrial structure or its transformation. The route to increased growth rates lay in increasing the rate of investment that would result in a more equal distribution of income and wealth. RDP contained very little in terms of the specific types of policy and government intervention necessary to meet these goals.

Concrete policies were adopted under GEAR in 1996, providing the government's macroeconomic policy framework for economic and industrial development for the next five years. The macroeconomic policy framework under GEAR emphasised fiscal austerity, deficit reduction and pegging taxation and expenditure as fixed proportions of GDP. Through GEAR, the government's stated macroeconomic priorities became the management of inflation, the deregulation of financial markets, tariff reduction and trade liberalisation as well as limiting government expenditure. Despite a policy of high interest rates, the government maintained its belief that the private sector would drive industrial development, with inward foreign direct investment targeted to be a major source of resources. The role of domestic conglomerates in growth and development remained notable for its absence.

The Accelerated and Shared Growth Initiative for South Africa (AsgiSA) was formally launched in February 2006 with the objectives of broadening the base of BEE and to promote the emergence of a black business class; redressing the inequalities between the so-called first and second economies by providing broader access to public goods and services; improving the 'business environment' by reducing the cost of transport and communications, etc.; and reducing unemployment by promoting labour-intensive exports in services (Gelb 2006). But as GEAR mutated into AsgiSA, South Africa's macroeconomic policy remained largely unchanged.

In contrast to GEAR, AsgiSA does contain a number of interventions at the micro level. These are organised into four categories: infrastructure investment programmes, sector investment or industrial strategies, skills and education initiatives, and second economy interventions (ANC 2006). AsgiSA

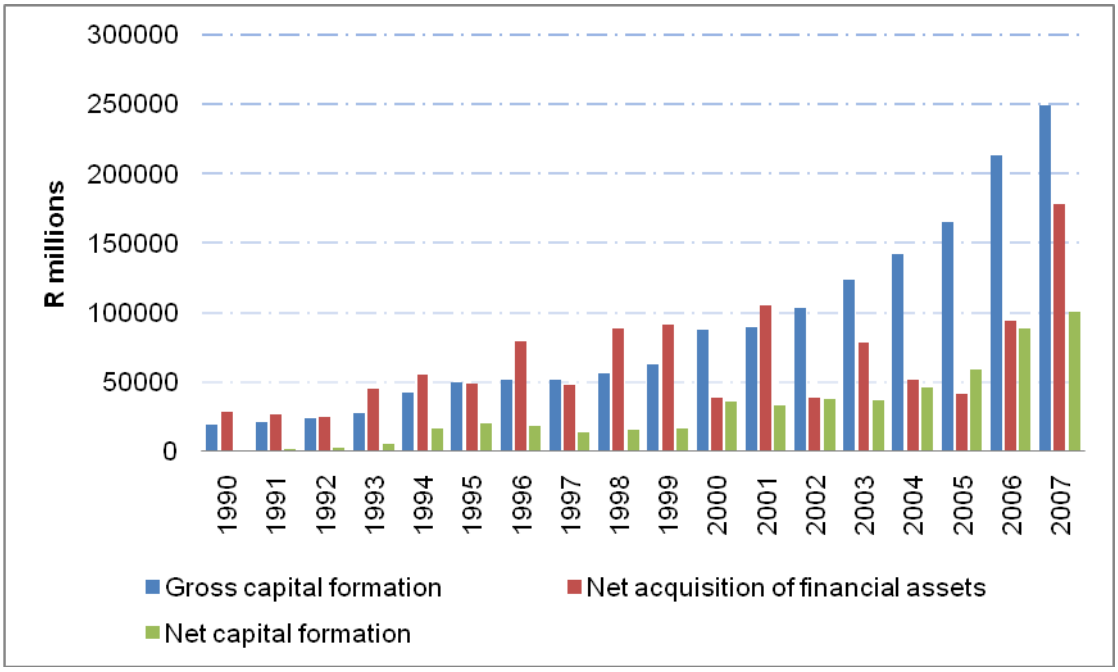
identified business process outsourcing (BPO) and tourism as the two sectors for priority under its industrial strategy.[2]

But there is a conflict between liberal macro policies and these micro interventions with the former supporting short-term capital flows that bolster the private financial sector allowing it systematically to misallocate finance towards speculative and short-term projects and away from longer term investments. Figure 1 shows the distribution of new investment across assets in private corporate enterprises between 1990 and 2007. While gross capital formation has been increasing throughout the period, it has not kept pace with the depreciation of capital. Year on year net capital formation has seen very modest gains while the net acquisition of financial assets has been higher than net capital formation throughout the period (with the exception of 2005). The net acquisition of financial assets exceeded gross capital formation in the years 1990-1994, 1996, 1998, 1999 and 2001.

The pattern of investment by private corporate enterprises has led to very small increased and serious decrease in the capital stock across a large number of productive sectors. (See figure 2) Decreasing capital stock has taken place in light, labour intensive manufactures, further contributing to structural unemployment in South Africa.

While services sectors have seen increased investment and employment this has not kept pace with output (see figure 3). Figure 4 shows the ratio of employment to output[3] in the primary, secondary and tertiary sectors. The ratio of employment to output has been relatively stagnant in the primary and secondary sectors (with a slight decrease in the secondary sector). By contrast the ratio has been decreasing in the services sector. This suggests that expansion of services might not be the most effective method of generating widespread sustainable employment.[4]

Figure 1 Distribution of new investment across assets in private corporate business enterprises 1990-2007



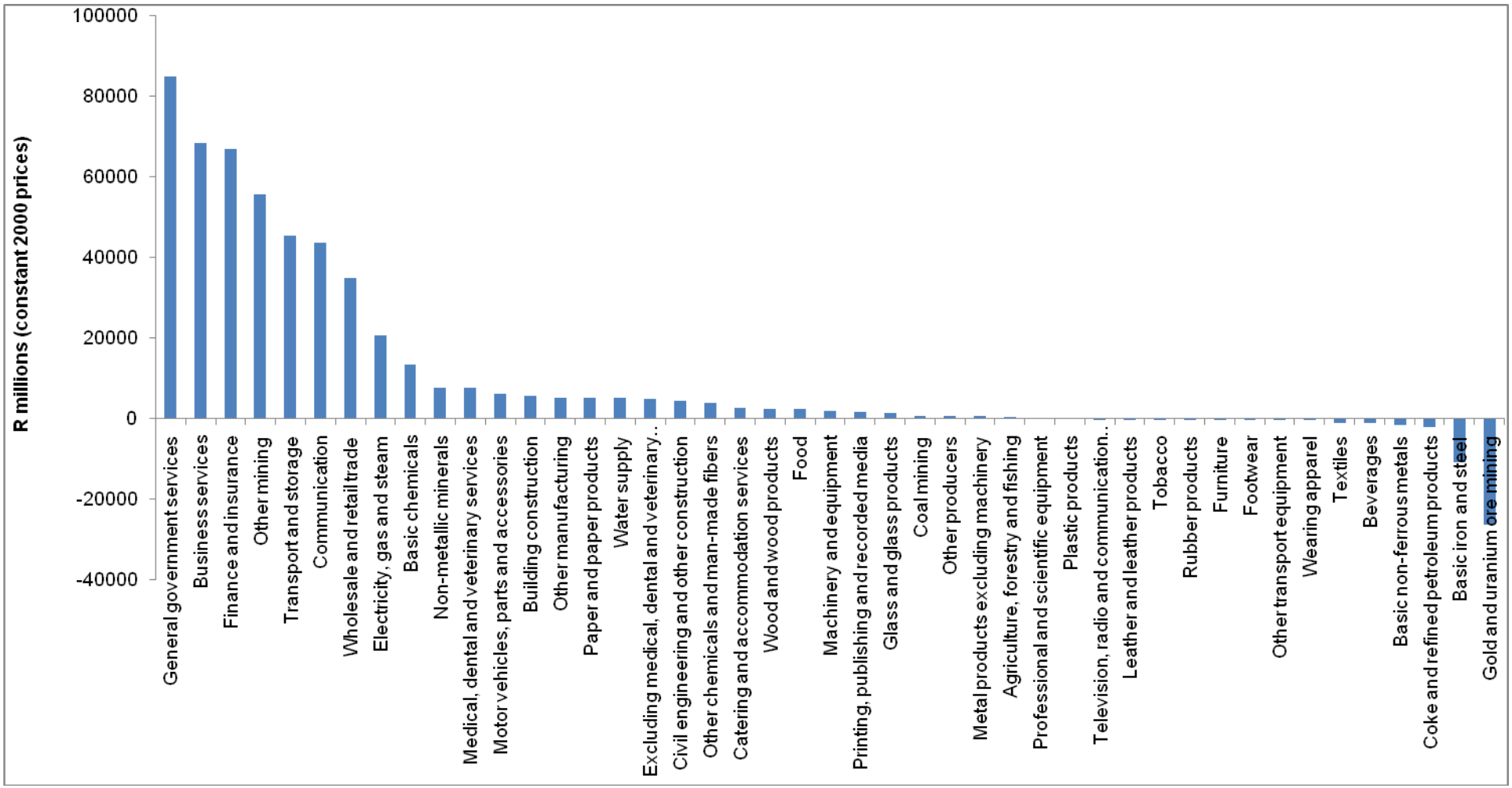
Source: Quantec 2009

[2] The next rank of priority sectors consist of Chemicals; Metals beneficiation, including the capital goods sector; Creative industries (crafts, fils & TV, content and music); Clothing and textiles; Durable consumer goods; Wood, pulp and paper.

[3] The employment to output ratio is calculated as the number of employees divided by annual output at basic prices in R millions (constant 2000 prices).

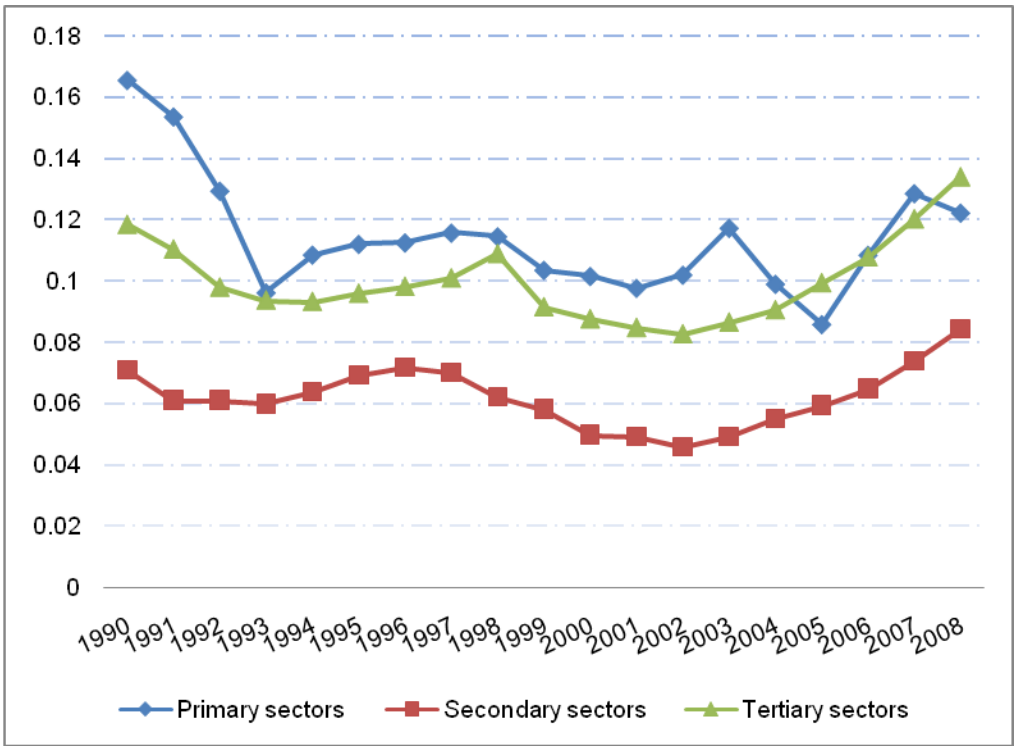
[4] This will be discussed in greater detail in the next section.

Figure 2 Changes in capital stock across all economic sectors in SA between 2000 and 2008



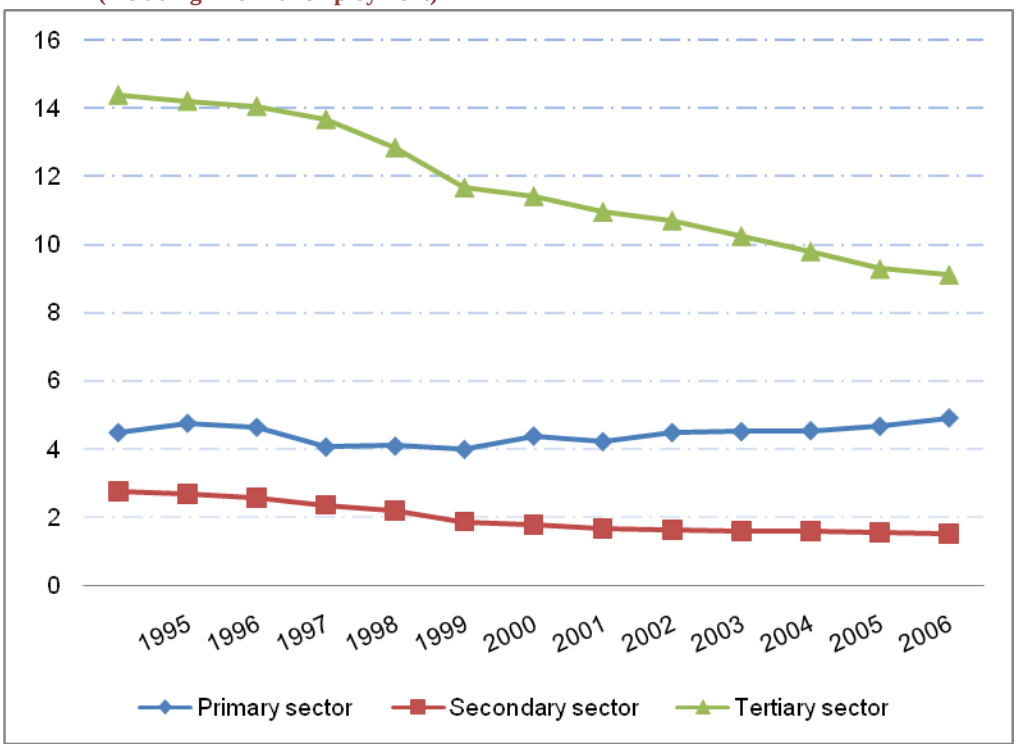
Source: Quantec 2009

Figure 3 Gross domestic fixed investment output ratio in primary, secondary and tertiary sectors in SA 1990-2008



Source: Quantec 2009

Figure 4 Employment output ratio in primary, secondary and tertiary sectors in SA 1990-2008 (including informal employment)



Source: Quantec 2009

The growth path of the South African economy during the first 16 years of democracy can also be described as growth through inequality, albeit in a different sense to the apartheid growth path. Through the macroeconomic policy of GEAR, the ANC government moved the South African economy onto a neoliberal growth path characterised by globalisation, increased internationalisation of South African conglomerates, financialisation and rising inequality. As discussed above, these policies did little to change the structure of the South African economy. Rather, the exclusionary nature of South Africa's industrial structure has been further reinforced during the first 16 years of democracy.

The onset of the global recession in 2008 brought into stark relief, the unsustainable nature of the neoliberal growth path based on growth through inequality. It is within the current context of recovery from recession that the South African Government has formed a new consensus around a well defined new growth path that marks a significant shift from what has come before. This has involved a significant shift in the government's approach to industrial and economic policy.

2.3 A New Growth Path for South Africa

The new consensus within government around the concept of a NGP refers to the need for structural change in the economy in order to address high levels of inequality and poverty, mass structural and persistent unemployment and large unsustainable imbalances in the economy that exists as a result of apartheid economic development. The NGP will thus see the expansion of the wider economy, the broadening of participation, the deepening of trade and the strengthening of South Africa's revenue base. The NGP as articulated by the newly established Economic Development Department emphasises sustainability of the NGP, both in terms of the creation sustainable decent jobs as well as environmental sustainability through the creation of green jobs and the transition to a low carbon economy.

New Growth Path can be defined as one which is employment led. That is, rather than a residual effect of growth policies, the creation of decent work opportunities through the restructuring of the economy is at the centre of economic and industrial policies. This has seen a dramatic shift in the Government's approach to economic and industrial policy away from narrow conceptions of industrial policy based upon the provision of a stable macroeconomic environment and infrastructure for business. This shift is seen in the setting up of new institutions, notably the Economic Development Department and the new National Planning Commission, within the Presidency, to work collectively with the Treasury and the Department of Trade and Industry in the formulation and implementation of economic and industrial policy show a commitment to a coordinated and planned approach to economic and industrial development.

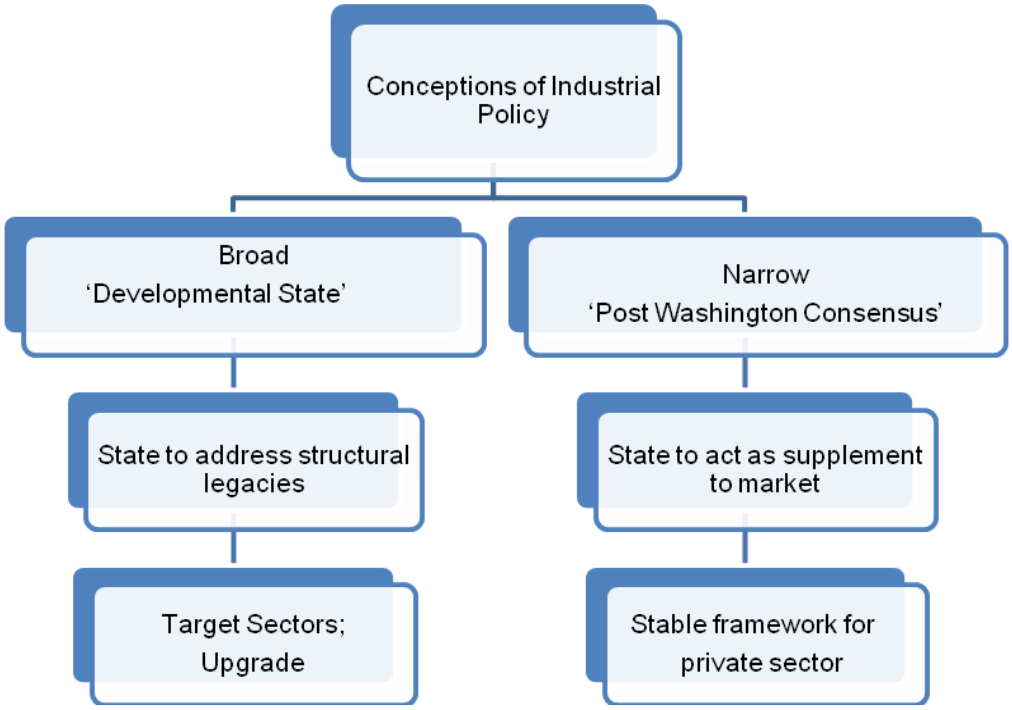
3. Shifting Conceptions of Industrial Policy

There are many ways in which industrial policy (IP) can be defined (extensive overviews can be found in Bianchi and Labory 2006 and Chang 1994). Much of the debate on this subject focuses on whether IP should be defined broadly to include everything which affects the performance of industry or whether it should focus more specifically. A straightforward definition is that industrial policy is the application of selective government intervention to favour certain sectors so that their expansion benefits the productivity of the economy as a whole (Chang 1994; Memis and Montes 2008). However perhaps more important are the shifts which have taken place over time from broad to more narrow conceptions of IP.

Broad conceptions emphasise the general economic and social goals of development, industrialisation and industrial upgrading and the structural transformation of an economy. Particular national or regional policies are set within the context of a far larger vision than simply ensuring competitive survival or support for specific sectors. IP from this perspective must be linked to and co-ordinated with other policies at national level. Within such a broad approach to IP the state is seen as a key agent of structural transformation. Such an approach is prevalent within early debates within Development Economics and is supported by a more recent body of literature emphasising how there are few examples of successful industrialisation without state support and infant industry protection (eg Reinert 2004). This has lead to the emergence of the 'Developmental State' approach which has focussed in particular on the (varying) nature of growth in the East Asian context, with particular reference being made to South Korea and Taiwan but other case studies have followed (Amsden 1989, 2001; Wade 1990; Stiglitz 1996).

Such an approach developed in particular as critique of the assumptions and policy prescriptions of the Washington Consensus and it did much to weaken the arguments of the Washington Consensus. Leading international institutions have since moved away from the Washington Consensus to what has been called the 'Post Washington Consensus'. This however has a narrow conception of IP which emphasises the need for selective state intervention to correct for market 'failure' and 'institutional imperfections'. The state and IP, according to this view, play a compensatory role, providing 'complementary inputs' to the market (Hausmann and Rodrik 2006). The market is therefore favoured but piecemeal intervention is required in addition. This approach places little emphasis on structural transformation and the state – and provincial governments – are limited to providing the best framework for the private sector.

Figure 2.2 Conceptions of Industrial Policy



Justin Lin, currently Chief Economist and Senor Vice-President of the World Bank, for example, argues that industrial upgrading and technological advance are best promoted by 'a state that facilitates the private sector's ability the exploit the country's areas of comparative advantage' (Lin and Chang 2009:2), a facilitating state which provides necessary coordination and removes barriers to firms but does not pursue strategic objectives. Lin's argument is thus an example of an active state making up for the deficiencies of the market within a framework of mainstream economic principles. This is a retreat from the extreme rejection of state intervention embodied in the Washington Consensus. However conceiving IP in this limited fashion rejects the idea that a strategic industrial policy which targets particular sectors can pursue systematic industrialisation and not simply correct for market imperfections. The Post Washington Consensus approach in that sense is little different to the Washington Consensus. It pays little attention to structural factors and specific historical legacies which shape patterns of economic development and which will take active state intervention and vision to change.

This is of great relevance given the inherited legacy of the South African economy: an industrial structure dominated by a 'minerals energy complex' at the expense of secondary industrialisation and with a negative impact on employment levels (Fine and Rustomjee 1996). Overall, our present approach to IP is within the broader conception outlined above and future sections of this report discuss industrial policy in that light.

4. Linkages and Industrial Development

The notion of backward and forward linkages and their importance in the process of economic development was first put forward by Albert Hirschman (1958) in his seminal work, 'The Strategy of Economic Development'. Hirschman argued that sectors with relatively strong forward and backward linkages, namely manufacturing, were of strategic importance in the process of industrial and economic development.

According to Hirschman, a linkage occurs when ongoing economic activities induce other agents to take up new activities. Backward linkage effects are related to derived demand, while forward linkages are related to output utilisation (Hirschamn 1958). An industry creates a backward linkage when its demand enables an upstream industry to establish at least minimum economic scale (Krugman 1994). The strength of industries backward linkages is measured by the probability that it will in fact push other industries beyond the threshold of minimum economies of scale (ibid.).[5] Forward linkages are defined as the ability of an industry to reduce the costs of potential downstream users of its products, pushing them over the threshold of profitability (ibid.). [6]

Hirschman saw successful development as the ability for an economy to enter into a virtous cycle in which the growth of one industry has positive implications on linked industries, producing economy wide positive scale economy effects. Hirschman argued that most developing countries are characterised by market imperfections in factor and product markets and a shortage of entrepreneurial skills. This implies that, if left to the private sector alone, it would be likely that crucial investment opportunities would be missed and rising demand from the expansion of a sector will probably be met with a rise in imports. Economic and industrial policy should, therefore, involve the targeting of specific industries identified as key, in the linkage sense, rather than an economy wide 'Big Push' as argued by Rosenstein-Rodan (1943) or the more recent neo-liberal discourse around providing the 'right' macroeconomic environment for business. In addition, Hirschman argued that economic development should be analysed on a case-by-case basis. In this way, Hirschman's view of industrial policy conforms to the broad conception of IP discussed above.

In the broad view, industrial policy is necessarily context specific and the understanding of the interdependencies within an economy through backward and forward linkages is a central component in the design of a successful industrial policy. If industrial policy, as understood above, is more than providing complementary inputs to the market or a stable macroceconomic environment it should focus on specific industrial sectors and their interconnections with the rest of the economy. New (sub)sectors may need to be created in order to change an existing path of development, but linkages between existing

[5] The probability for backward linkages can be interpreted as the ratio of annual inputs required from an industry over the minimum economic size, in terms of annual productive capacity, of firms that would produce these outputs. (Drejer 2002)

[6] In contrast to backward linkages, the probability for forward is not easily defined since the size of the market for the industries that might be established as the consequence of forward linkages does not depend on their suppliers. The probability is related to the importance of the products of the industry in question as inputs into the production of the output of the 'to-be-linked' industry. If these inputs are a very small fraction of the industry's eventual output, then their domestic availability is not likely to be an important factor in calling forth that industry. (Drejer 2002)

subsectors must be promoted in order to increase the potential employment multipliers and to maximise value addition within a specific geographic region.

The application of Hirschman's theory of economic development has been closely associated with the use of input-output tables to measure economic interdependencies and linkages for development planning and policy. Input-output based development models have been applied to the issues of: allocation of investment; import substitution; foreign exchange constraints; inflation; optimal growth; income distribution; as well as education planning and human capital formation in the context of developing countries. (Rose and Miernyk 1989) In the case of linkage based development strategies, analyses based on input-output tables have been used to identify key sectors for policy targeting. Key sectors are defined as those with strong direct and indirect backward and forward linkages.

A number of extensions to the basic input-output model have been made and applied to questions of economic development. These include the calculation of output, income, employment and foreign trade multipliers occurring through direct and indirect linkages. This will be elaborated further in the next section.[7]

More weight has tended to be placed on backward linkages compared with forward linkages. With respect to backward linkages, key sectors generate above-average input requirements from other sectors, and therefore there is a greater probability of induced investment in the supplying sectors – to expand existing plant and/or to replace imports. The mechanism with respect to forward linkages is less direct and hinges on the probability of investment in sectors where the product of the key sector is an important input. (McGilvray1977)

While the use of input-output analysis serves as a very useful tool in economic planning, particularly for the identification of key sectors and the measurement of changes in the extent of interdependencies in the economy and the 'depth' of the industrial structure, there are a number of considerations that must be taken into account when comparing the use of quantitative measures of linkages based on input-output data and Hirschman's own conception of linkages and interdependencies. Due to the causal effect that creates the set-up of an economic system, linkages and interdependence cannot be used interchangeably in a Hirschman setting (Drejer 2002). The use of input-output tables assumes that the industry for which backward and forward linkages have been calculated is the first to be established, causing knock-on effects upstream through increased demand for inputs and downstream through an increased domestic supply of intermediate inputs for downstream industries. Jones (1976) gives the example of the electricity sector which has relatively high forward linkages, but these are not causal, since expansion is better viewed as the result of demand generated by users' backward linkages. Nonetheless, the forward linkages remain important in a 'permissive' sense because, in the absence of response, there would be a constraint on the development of users. The role of the development economist must not stop at the identification of key sectors based on the strength of linkages alone. Industries with strong linkages must be looked at on a case by case basis to establish the direction of causality between itself and up- and down-stream industries. Input-output analyses can tell us nothing of the causal relationships between linked sectors as required by a linkage based development strategy.

There are a number of other issues that need to be taken into account when using the input-output frame work to measure direct and indirect linkages. These are: i) difference between the domestic and the world

[7] For an overview of widely used techniques in input about analysis see United Nations 1999.

linkage; ii) comparative advantage and differences in technology across countries; iii) the problem of aggregation.

Whether or not the effect of expanding an industry will have a positive impact on domestic industry through by stimulating production along linked sectors depends upon domestic resource endowments and the productive capacity of domestic industry (related to the stage of industrial development and level of technology). For this reason, 'world' and 'domestic' linkages can differ greatly. If the difference occurs as a result of difference in resource endowments then the linkage effect has no relevance to the Hirschman hypothesis. If however, the difference relates to differences in the level of development then the gap represents the potential for import substitution and the development of domestic industry. (Jones 1976) In the context of large current account deficits - as in the case of South Africa – the decomposition of inputs into key sectors by imports and domestic production is of particular importance as the expansion of a sector identified as 'key' on the basis of its total backward linkages may induce the perverse effect of stimulating imports at the expense of the current account.

Owing to data constraints, input-output tables tend to be constructed on the basis of aggregate classifications of industries. The calculation of linkage effects on the basis of aggregate sectors may overshadow the true nature of the performance of the economic activities of which they are comprised

In this way, while useful, input-output analysis for the purpose of identifying key sectors represents a broad brush stroke method. The identification of key sectors would need to be further refined through supplementary methods such as value-chain analyses. In terms of ex-post analyses of structural change in the economy, and changes in the depth and interdependencies of the industrial structure, the input-output framework is particularly useful.

5. Input-output analysis

5.1 Input-output analysis and its applications

Linkages, as a concept, has attracted considerable interest as a means of identifying 'key sectors' in a strategy of industrial development. Input-output analysis is has been widely applied in the analysis and assessment of the structure of an economy and the interconnections between industries in order to identify sectors which can act as potential key sources of growth and employment.

Sectors with stronger linkages with the rest of the economy suggest a higher possible multiplier effect on employment and output if those sectors are targeted. Backward linkages in particular refer to the links an industry makes with those sectors from where it gains its inputs. If an industry successfully promoted by industrial policy has high backward linkages, the growth of this industry will have strong impact on the region through the effect of this growth on all the **domestic** sectors which supply it

As discussed above, there are two types of linkages; namely backward and forward linkages. Backward linkages describe inter-industry linkages between a sector and those sectors from which it demands inputs, i.e. its upstream customers. Forward linkages describe an inter-industry linkage between a sector and those to which it supplies its output, i.e. its downstream customers. These linkages are calculated in an input output flow table.

Measurement of backward linkages

The upstream dependency of sector j on i is measured by the direct backward linkage coefficient. The ***direct*** backward linkage coefficient measures the percentage share of sector j's total inputs purchased from sector i. These relationships are captured by the A matrix operator calculated from the input output table and are represented in the equation 1:

$$X_{(nx1)} = A_{(nxn)} X_{(nx1)} + f_{(nx1)} \qquad (1)$$

where $X_{(nx1)}$ is a vector of total inputs; $f_{(nx1)}$ is a vector of final output and A is the technical input coefficient matrix and is calculated in equation 2 :

$$a_{ij} = \frac{F_{ij}}{Xj} \qquad (2)$$

where F_{ij} is an element from the input output flow table which describes the value of inputs arising from sector i flowing to sector j. X_j is a vector of total input purchased by sector j. The column sum of a_{ij}, i.e. $\sum_{j=1}^{n} a_{ij}$ measures the share of total intermediate output purchased by sector j.

One more measure of backward integration is the total linkage coefficient. Total backward linkages measure the economy-wide (direct and indirect) stimulatory effects on output emanating from a one unit increase in a sectors demand for inputs. The Leontief inverse is commonly used to measure total backward linkages. Total backward linkage are calculated in equation 3

$$Z_{(nxn)} \equiv (I_{(nxn)} - A_{(nxn)})^{-1} \qquad (3)$$

The Leontief inverse $Z_{(nxn)}$ comprises of elements z_{ij} which measure the total backward linkage of sector i on account of a unit increase in sector j. $I_{(nxn)}$ is an identity matrix. $A_{(nxn)}$ is the input technical coefficient matrix. $A_{(nxn)}$ comprises of elements a_{ij} which measure the share of sector j's total input requirement that sector j sources or purchases from sector i. These elements are calculated in equation 2.

Measurement of forward linkages

The downstream dependency of sector j on i is measured by the direct forward linkage coefficient. The ***direct*** forward linkage coefficient measures the percentage share of sector i's total output used as inputs by sector j. These relationships are captured by the B matrix operator calculated from the input output table and are represented in the equation 4:

$$X_{(n\times 1)} = B_{(nxn)} X_{(nx1)} + f_{(nx1)} \qquad (4)$$

where $X_{(nx1)}$ is a vector of total output; $f_{(nx1)}$ is a vector of final output and B is the technical output coefficient matrix and is calculated in equation 5 :

$$b_{ij} = \frac{F_{ij}}{X_i} \qquad (5)$$

where F_{ij} is an element from the input output flow table which describes the value of inputs arising from sector i flowing to sector j. X_i is a vector of total output produced by sector i. The row sum of b_{ij} i.e. $\sum_{j=1}^{n} b_{ij}$ measures the share of total intermediate output used by sector i's downstream sectors to its total output.

One more measure of forward integration is the total linkage coefficient. Total forward linkages measure the economy-wide (direct and indirect) stimulatory effects on output emanating from a one unit increase in the purchasing sectors usage (or demand for) of the selling sectors output. Total forward linkage are calculated in equation 6.

$$W_{(nxn)} \equiv (I_{(nxn)} - B_{nxn})^{-1} \qquad (6)$$

Where $W_{(nxn)}$ is the output inverse matrix and I is an identity matrix. The output inverse matrix comprises of elements w_{ij}. These elements reflect the total forward linkage of sector i to sector j. The row sum of w_{ij} i.e. $\sum_{j=1}^{n} w_{ij}$ measures the impact on economy wide output arising from a unit increase in the use of sector i's output.

5.2 Employment and Export Multipliers

Employment Multipliers

Employment multipliers can be calculated to measure the direct and indirect employment generation potential of a sector. An employment multiplier measures the number of jobs that may potentially be created in each sector and throughout the economy to satisfy a "…R 1 million increase in each sector j's final demand" (Tregenna, 2008:13). Equation 7 gives the employment multiplier matrix.

$$M_{(nxn)} = N_{(nxn)} Z_{(nxn)} \qquad (7)$$

Where $M_{(nxn)}$ is the employment multiplier matrix which comprises of elements m_{ij}. These elements measure the number of jobs created in sector i by a unit increase in sector j's final demand. The column sum of m_{ij} i.e. $\sum_{i=1}^{n} m_{ij}$ is the total employment multiplier which measures the economy wide jobs created by sector j on account of a unit increase in its final demand. $N_{(nxn)}$ measures the labour intensity of output and $Z_{(nxn)}$ is the input or Leontief inverse which measures the total backward linkages. Both $N_{(nxn)}$ and $Z_{(nxn)}$ are calculated in equation 8 and equation 1 respectively:

$$N_{(nxn)} = Diagonal(P_{(nxn)}) Diagonal(X_{(nxn)})^{-1} \qquad (8)$$

Where $P_{(nxn)}$ is the number of people employed in each sector and $X_{(nxn)}$ is each sector's total output.

Export multiplier

Export multipliers are used to measure export potential. An export multiplier measures the unit value of exports that may potentially be generated in each sector and through the economy to satisfy a unit increase in each sector i's final demand. This is captured in equation 9.

$$Q_{(nxn)} = R_{(nxn)} Z_{(nxn)} \qquad (9)$$

Where $Q_{(nxn)}$ is the export multiplier matrix which comprises of elements q_{ij}. These elements measure the unit value of exports generated in sector i by a unit increase in sector j's final demand. The column sum of q_{ij} i.e. $\sum_{i=1}^{n} q_{ij}$ is the total export multiplier which measures the economy wide exports generated by sector j

on account of a unit increase in its final demand. $R_{(nxn)}$ measures the export intensity of output and $Z_{(nxn)}$. Both $N_{(nxn)}$ and $Z_{(nxn)}$ are calculated in equation 10 and equation 1 respectively:

$$R_{(nxn)} = Diagonal(S_{(nxn)})\,Diagonal(X_{(nxn)})^{-1} \qquad (10)$$

Where $S_{(nxn)}$ is the value of exports in each sector and $X_{(nxn)}$ is each sector's total output.

5.3 Data

The first set of input-output tables for the South African Economy were constructed in 1967 and published by Statistics South Africa (StatSA), these included data that went back as far as 1956. I-O tables were expressed in basic values. These tables were constructed with 95 industries and 6 categories of final demand. From 1981 onwards, the I-O tables showed imports separately, that is, they were shown as an input to each economic activity as well as private consumption, consumption, general government expenditure, gross fixed capital formation and changes in inventories. (Bouwer 2002)

In 1993, the System of National Accounts (SNA) was implemented by the United Nations. Focus shifted from I-O tables to supply and use (S-U) tables. The S-U table published in 1999 had 94 industries and 153 commodities on the supply side and 94 industries and 95 commodities on the use side S-U tables have been constructed annually since then, although the last full table was published in 2002.

The current S-U tables are compiled annually within StatSA and small versions are published in the annual GDP publications. The most recent GDP publication, May 2010, has a 27x27 S-U table in it (Stats SA, 2010:17). The data used for the compilation of S-U tables is obtained from the Annual Financial Survey and Large Sample Survey which is conducted every 2-3 years.

S-U tables can be used to construct I-O tables, Social Accounting Matrices (SAMs) and for the calculation of GDP. StatSA constructs S-U tables for the calculation of GDP. Bouwer (2010) indicated that GDP per industry was previously used to compile I-O tables. Stats SA stopped constructing I-O tables due to a lack of resources. Converting S-U tables to I-O tables requires a lot of assumptions and adjustments to be made. Firstly, the supply part of the tables is calculated based on basic prices and the use side is based on purchasers' prices. I-O tables require basic prices. So to convert the purchasers' prices to basic prices one would need to take imports, taxes & subsidies, trade margins and transport costs into account. In addition, imported inputs cannot be included in the I-O table that has been constructed on the bases of the S-U table.

StatSA is due to publish a more extensive S-U table in September 2010. The September publication will see a change in the product classification from the International Standard Industrial Classification (ISIC). The new table will have 200 industries and 100 products.

Given the infrequency of large S-U published by StatSA and the high level of aggregation of the S-U tables that are published annually, we have used I-O tables available from Quantec Research in our input-output analysis of the South Africa economy .

The I-O tables that we used in this study were obtained from Quantec Research who would have had to make these and other assumptions in their construction of I-O tables as these are no longer being

calculated by Stats SA. This explains, among other things, why we were not able to obtain data on intermediate imports for each industry.

The present study uses data from Quantec research. Quantec publishes annual input-output tables that contain 43 observed sectors and subsectors. Quantec, however, do not make available their methods for constructing their I-O tables, nor do we know the primary sources of data from which the tables are constructed, or the assumptions made. Given these data problems, one needs to be cautious in interpreting results from our input-output analysis, particularly in terms of analysing changes in the structure of the South African Economy over time.

5.4 Input-output analysis of the South African Economy

The following section reports the results for our input output analysis of South Africa at different levels of sectoral aggregation. The first part of the analysis looks at the relative role of manufacturing and services in driving long-term linkage-based economic development. The second part of the study identifies potential key sectors based upon the strength of their linkages and employment and export multipliers.

5.4.1 Situating manufacturing's stimulatory power on Output and Employment vis-à-vis Services: on Aggregate

In classical economic development theory and heterodox literature the manufacturing sector is viewed as the engine of growth. However, increasing deindustrialization and tertiarisation of the economy has led many to believe that the service sector is equal to the task or better yet, is viewed as more capable than manufacturing to drive both economic and employment growth.

Input output analysis is one way of assessing each sector's potential to contribute to growth. Backward and forward linkages are used as a measure to test the possible stimulatory effects a sector has on its upstream and downstream sectors respectively.

A sector's backward linkages could contribute to economic growth through its upstream sectors as it creates demand for these upstream sector's outputs. Tregenna (2008) points out three mechanisms through which demand for upstream sector output contributes to economic growth: it may raise upstream sector investment, capacity utilization or technological upgrading. The extent to which a stimulus may contribute to economic growth depends on the strength of a sector's backward linkages with its upstream sectors and the strength of these upstream sectors backward linkages with their upstream sectors and so on (Tregenna 2008, p.14).

A sector's forward linkages to its downstream sectors can contribute to economic growth through lower intermediate input costs. Lower input costs have the effect of increasing downstream sector investment, capacity utilization, technological upgrading and productivity growth (Tregenna, 2008, p17).

Tables 2 and 3 below depict the manufacturing sector and the services sector's direct backward linkages and total backward linkages respectively in selected years. An analysis of the results shown in the tables reveals that the manufacturing sector has more backward linkages than the services sector.

Firstly, the manufacturing sector's backward dependence on the services sector is larger than that of the service sector on manufacturing in all of the selected years. Manufacturing sourced 20.59 percent of its total inputs from the services sector; whereas the services sector sourced 8.78 percent of its total inputs from the manufacturing sector in 2009.

Table 2 Backward linkages; 2009, 2008, 2006, 2000

	2009		2008		2006		2000	
	Manu	Services	Manu	Services	Manu	Services	Manu	Services
Agriculture	7,917	0,105	6,867	0,100	5,900	0,088	6,035	0,098
Mining	12,354	0,315	16,020	0,384	13,398	0,300	10,114	0,227
Manufacturing	30,201	8,775	34,300	10,555	36,014	10,773	38,150	10,970
EGW	1,486	1,058	1,194	0,923	1,196	0,903	1,501	0,982
Construction	0,002	1,162	0,001	1,015	0,001	0,975	0,001	1,266
Services	20,591	33,519	16,934	32,080	17,672	32,100	18,010	28,396
Total	**72,551**	**44,934**	**75,316**	**45,057**	**74,181**	**45,140**	**73,812**	**41,940**

Secondly, the manufacturing sector's backward linkages are not only larger but have greater strength than the service sectors. Total backward linkages, which account for direct and indirect linkages, measure the strength of the linkages. To satisfy a unit increase in manufacturing demand, 0.58 units of service inputs are required; whereas a similar increase in service demand is satisfied by a 0.22 units of manufacturing inputs. Once more the analysis reveals that manufacturing has more backward linkages with services than vice versa.

Lastly, manufacturing sector demand has larger stimulatory effects on economy wide output than the service sector's demand in each of the selected years. A unit increase in manufacturing demand may potentially require the production of 2.7 units of inputs (using the year 2009 as an indicator); an equivalent increase in service demand may potentially require 1.9 units of manufacturing inputs (using the year 2009 as an indicator).

Table 3 Backward linkages; 2009, 2008, 2006, 2000

	2009		2008		2006		2000	
	Manu	Services	Manu	Services	Manu	Services	Manu	Services
Agriculture	0.141	0.008	0.134	0.009	0.123	0.128	0.124	0.008
Mining	0.224	0.041	0.314	0.050	0.281	0.046	0.210	0.038
Manufacturing	1.686	0.223	1.855	0.287	1.976	0.299	1.948	0.302
EGW	0.057	0.025	0.053	0.028	0.055	0.010	0.060	0.024
Construction	0.026	0.024	0.020	0.029	0.023	0.020	0.027	0.027
Services	0.577	1.595	0.566	1.668	0.593	1.063	0.563	1.496
Total	**2.713**	**1.916**	**2.943**	**2.071**	**3.052**	**1.566**	**2.932**	**1.893**

The second interpretation of table 1 concerns the potential for each of the sectors demand to stimulate the growth in economy wide production of total inputs. The total backward linkage for the manufacturing sector and services sector is interpreted as follows: a unit increase in manufacturing's demand may potentially generate 2.7 units of economy wide inputs; whereas an equivalent increase in services demand may potentially generate 1.9 units of economy wide input in 2009.

Tables 4 and 5 depict the manufacturing and service sector's direct and total forward linkages in selected years. The measures reveal that the manufacturing sector has more forward dependence on the rest of the economy than the service sector. In other words, manufacturing depends on other sectors as a source of demand than the service sector. 60.5 percent of manufacturing output was used as inputs in other economic activities; of this figure, 19 percent was used by the services sector in 2009. In contrast, 47.4 percent of service output was used as inputs in other economic activities; of this figure, the manufacturing sector used 9.5 units of output produced by services.

Table 4 Forward Linkages; 2009, 2008, 2006, 2000

		Agriculture	Mining	Manufacturing	EGW	Construction	Services	Total
2009	Manufacturing	3,059	1,393	30,201	0,517	6,379	18,979	**60,527**
	Services	1,236	1,164	9,520	0,400	1,597	33,519	**47,435**
2008	Manufacturing	3,126	3,323	34,300	0,490	5,509	18,306	**65,052**
	Services	1,057	3,026	9,764	0,354	1,280	32,080	**47,561**
2006	Manufacturing	2,514	3,089	36,014	0,496	4,737	18,894	**65,745**
	Services	0,944	3,107	10,076	0,368	1,094	32,100	**47,690**
	Manufacturing	1,063	2,952	11,906	0,352	1,009	28,396	**45,678**
	2000	1,063	2,952	11,906	0,352	1,009	28,396	**45,679**

Total forward linkages measure the strength to which a sector is integrated with its downstream industries. The measure reveals that the manufacturing sector has more forward dependence on the service sector than vice versa. A unit increase in primary inputs into manufacturing would require 0.49 units of services in order to fully utilize it; whereas a similar increase in primary inputs into services would require 0.37 units of service to fully utilise it.

Table 5 Forward Linkages; 2009, 2008, 2006, 2000

		Agriculture	Mining	Manufacturing	EGW	Construction	Services	Total
2009	Manufacturing	0.069	0.039	1.686	0.027	0.185	0.223	**2.228**
	Services	0.029	0.023	0.577	0.012	0.054	1.595	**2.290**
2008	Manufacturing	0.072	0.099	1.855	0.027	0.163	0.498	**2.714**
	Services	0.031	0.026	0.326	0.013	0.061	1.668	**2.124**

2006	Manufacturing	0.096	0.274	2.271	0.039	0.164	0.524	**3.366**
	Services	0.023	0.020	0.338	0.006	0.030	1.063	**1.479**
2000	Manufacturing	0.088	0.211	2.215	0.034	0.128	0.456	**3.133**
	Services	0.027	0.059	0.372	0.013	0.040	1.496	**2.006**

In a similar vein, the total forward linkages for the manufacturing sector and the services sector can be interpreted as follows: a unit increase in the manufacturing sector's primary inputs would require 2.2 units of total economy wide production to satisfy it; whereas an equivalent increase in services primary inputs requires 2.3 units in 2009. An inference from these results is that in 2009, the manufacturing sector and the services sector were similarly integrated with downstream sectors. In other words, downstream sectors made similar usage of the manufacturing and services sectors output into their production. Indications from other years are that the manufacturing sector is more forwardly integrated to downstream sectors than the services sector i.e. downstream sectors make more use of manufacturing output than service output.

Backward linkages are more relevant for policy purposes as the stimulated sectors have a domestic downstream market to support their development. Such a market (of downstream sectors) may not exist if sectors are targeted according to their forward linkages because they will have to be supported by a foreign market. Therefore targeting sectors according to their forward linkages would defeat the purpose of maximizing linkages to stimulate output growth.

Table 6 shows the employment multipliers of the manufacturing and services sectors in selected years. A R1 increase in the manufacturing final demand has a potential of creating eight jobs whereas a similar increase in services final demand may generate 9 jobs in 2009. The services sector has a larger employment absorption potential than manufacturing. However, according to these results, the services sector's edge over the manufacturing sector is ever so slight.

Table 6 Employment Multipliers, 2000, 2006, 2008, 2009

	2009		2008		2006		2000	
	Manufacturing	Services	Manufacturing	Services	Manufacturing	Services	Manufacturing	Services
Agriculture	1.179	0.068	1.270	0.081	2.165	2.249	5.322	0.332
Mining	1.980	0.359	1.202	0.193	1.254	0.204	1.584	0.285
Manufacturing	2.257	0.404	2.226	0.344	3.182	0.481	5.574	0.863
EGW	0.060	0.026	0.062	0.033	0.075	0.014	0.145	0.058
Construction	0.055	0.051	0.054	0.077	0.092	0.080	0.221	0.218
Services	2.864	8.119	3.170	9.342	4.060	7.281	7.724	20.531

Total	**8.395**	**9.027**	**7.985**	**10.071**	**10.828**	**10.308**	**20.570**	**22.286**

The above analysis confirms that further industrialization, i.e. stimulating manufacturing output, may be of greater benefit to economic growth relative to further tertiarisation. However this does not mean that the services sector does not have a role to play in the economy. An important advantage to the service sector is that it has greater labour absorption potential than the manufacturing sector. Second to that is that the service sector is for manufacturing, a key source of input supply as measured by manufacturing's backward linkages.

5.4.2 Situating manufacturing's stimulatory power on Output and Employment vis-à-vis Services: Disaggregated

This section of the report analyses the linkages and employment multipliers at the lowest disaggregated subsector level possible using 2009 input output tables and employment data from Quantec. Not only is it shown that manufacturing subsectors generally have the strongest linkages, but the types of manufacturing subsectors that have the strongest linkages are identified. Moreover, not only are the services that are responsible for the sectors total employment generating potential identified; but employment multipliers by skills category are also analysed to ascertain the types of employment either sector – manufacturing and services – are likely to generate should they benefit from a government stimulus.

Figure 5 shows the total backward linkages expressed in current prices for each of the 43 observed sectors and subsectors in 2009. Manufacturing subsectors tend to have the strongest backward linkages with the rest of the economy while services backward linkages tend to be weak. Amongst the manufacturing subsectors, the strength of the backward linkages is greatest amongst consumer goods (such as leather; footwear; textiles; furniture and food) and weakest amongst intermediate goods (such as non-metallic minerals; basic non-ferrous metals; coke & petroleum; glass & products of; basic iron & steel etc). Services subsectors that had the strongest backward linkages are: communications and catering & accommodation. Government services and finance services are amongst service subsectors and subsectors at large that had the weakest backward linkages.

That consumer goods have the strongest backward linkages than intermediate goods is to be expected. Sectors that tend to have the strongest backward linkages will tend to be those that satisfy final demand and thus require a whole host of inputs (which maybe in themselves the product of a manufacturing process and thus at some stage required inputs) in order to do so (Kelegama, 1999). Whereas sectors that tend to have weak backward linkages are those that satisfy intermediate consumption and are thus located upstream as their input requirements tend to be lower than their downstream counterparts. Upstream sectors thus generally have higher forward integration with the rest of the economy.

Figure 6 depicts total forward linkages of the 43 subsectors and sectors. Indeed, intermediate goods are shown to have the strongest total forward linkages while consumer goods are shown to have the weakest total forward linkages with the exception of T.V and communications equipment.

While these tendencies may appear obvious for the manufacturing sector and its subsectors; it is less obvious for the services sector and subsectors. In other words, the mere fact that services have weak

backward linkages is insufficient grounds to suppose that they are located upstream i.e. they have strong forward integration with downstream sectors. Service subsector's total forward integration with the rest of the economy ranges from low to medium. This is a revealing result. If service subsectors have relatively weak linkages it can be inferred that rather than fueling production they feed consumption. It further suggests that services productive role in the economy cannot be understood in isolation to production; particularly manufacturing. Therefore services should feature in industrial policy in as far as they support industry. However not all services subsectors should be subordinated to manufacturing. One ought to be mindful of the fact that certain services such as health services are in and of themselves important to wellbeing and ought to be supported in spite of their relationship with industry.

At this point, we can delve into the employment generation potential of the 43 subsectors and sectors as depicted in figures 7 to 10. Service subsectors had the highest employment generation potential in 2009 as evidenced by their total employment multipliers (fig 3). Included amongst the highest employment generating service subsectors are: community, personal and social services (excl government), government, business services and trade. Sandwiched between these services are consumer goods manufactures which include: clothing, textiles, furniture, leather & products thereof, food and footwear. Intermediate goods manufactures follow and at the top of the employment generation range is wood and products thereof and basic iron & steel; while at the bottom is plastics and products thereof and basic non-ferrous metals. Capital goods manufactures, with the exception of machinery & equipment, are the bottom of the potential employment generation range.

Service subsectors are shown to have a skills bias as they are at the top of the range of sectors that could potentially generate employment for highly skilled and skilled individuals (see figures 8 and 9). Given the high levels of employment concentrated around semi-skilled workers, the expansion of these service sectors can do little to mitigate current high levels of employment. Moreover the highly skilled and skilled employment categories tend to be less labour intensive. This is shown in lower employment multipliers for skilled labour compared with semi-skilled employment multipliers. In contrast, employment multipliers for consumers good manufactures do not differ much across skills. Manufacturers of intermediate goods tends to absorb relatively more semi-skilled labour.

Figure 5 Total Backward linkages, 2009

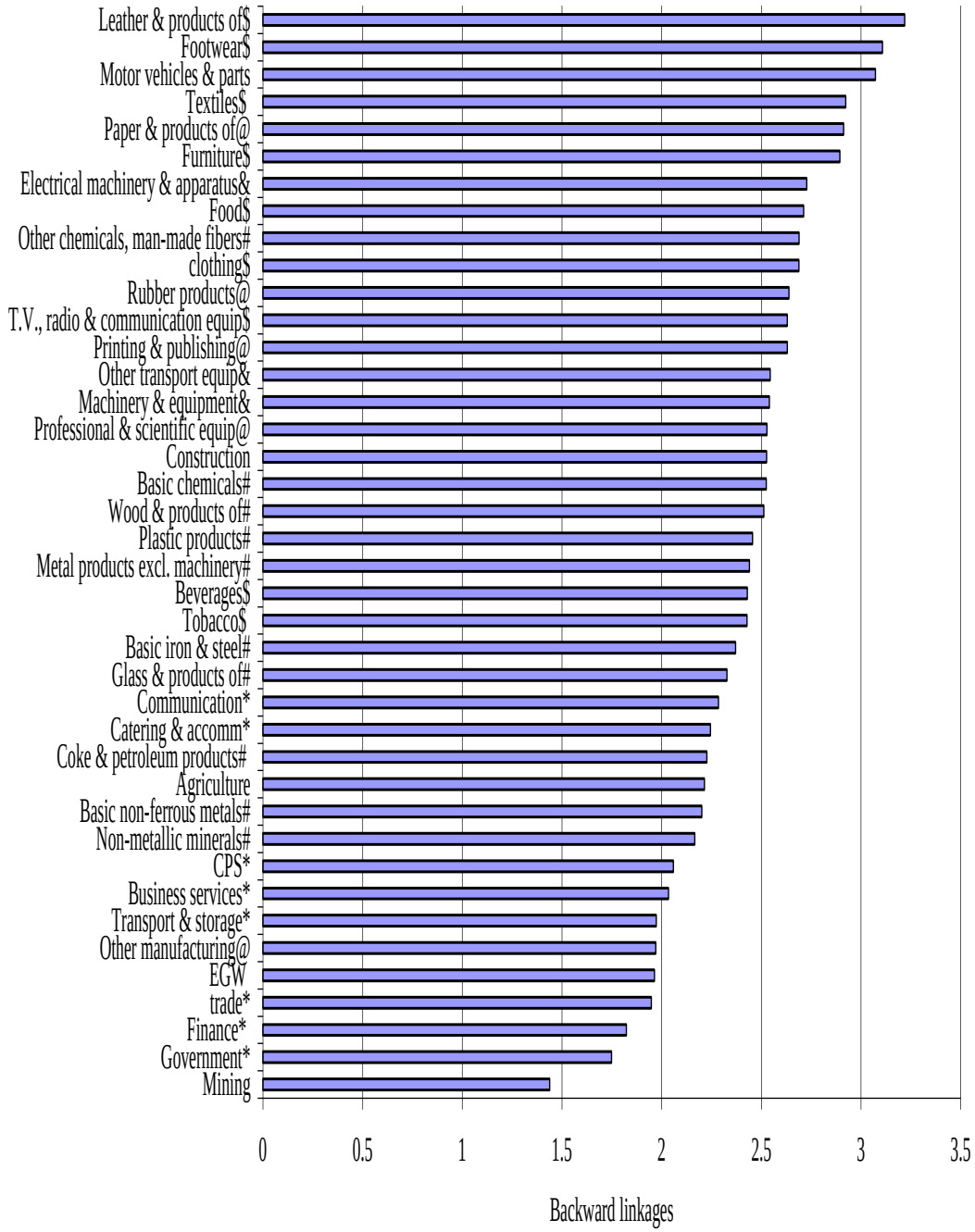


Figure 6 Total Forward linkages, 2009

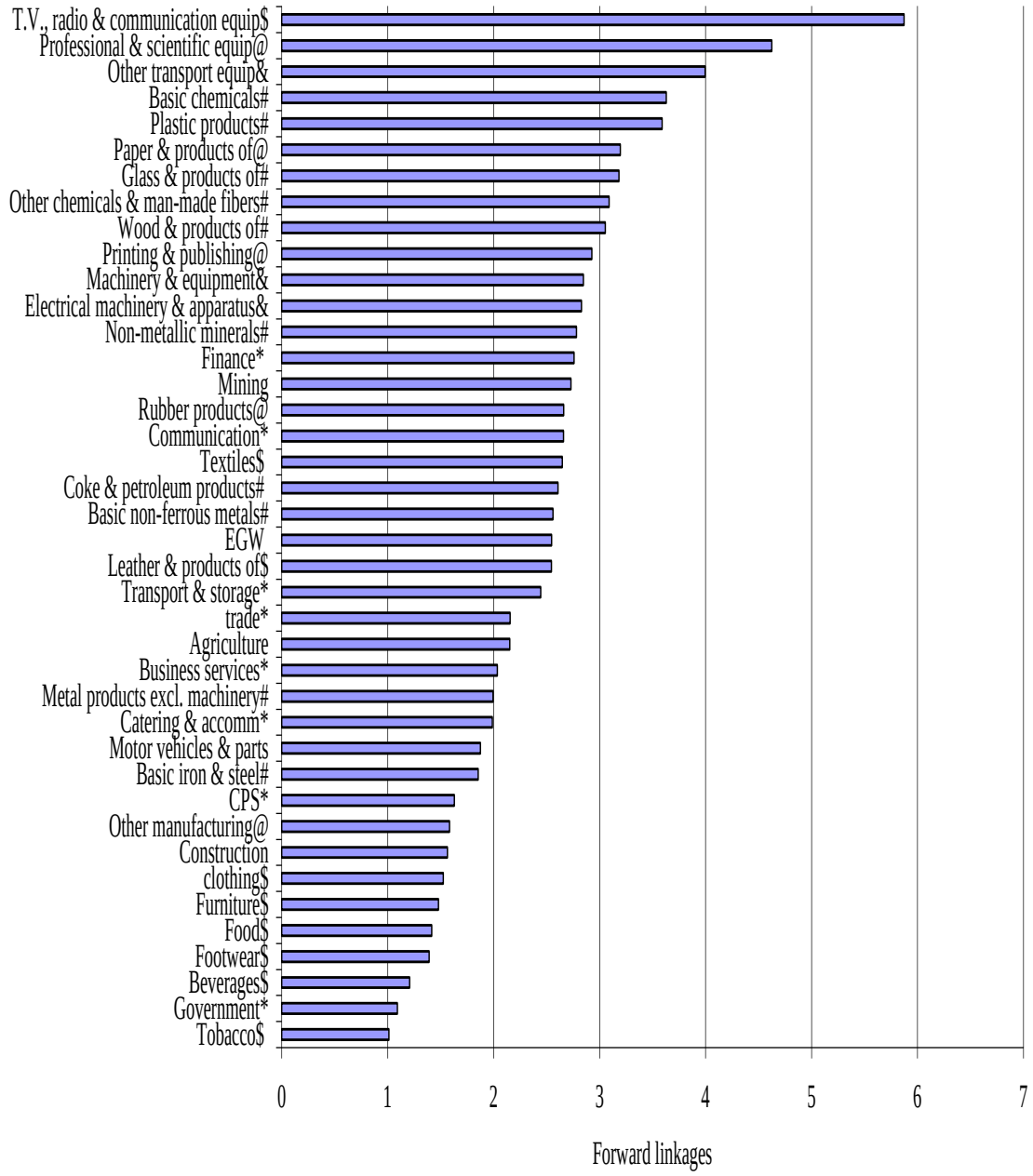


Figure 7 Total employment multiplier, 2009

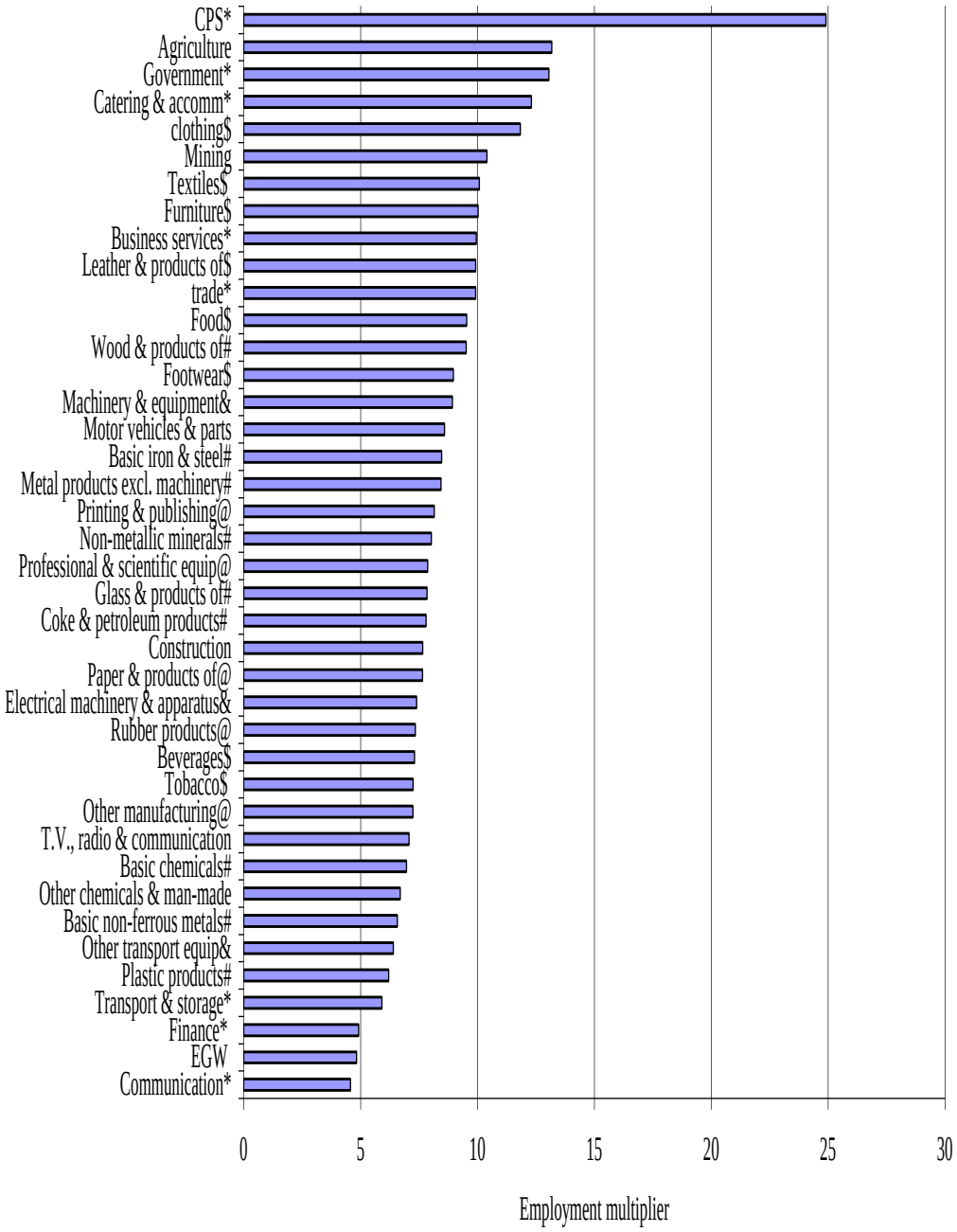


Figure 8 High skilled employment multiplier, 2009

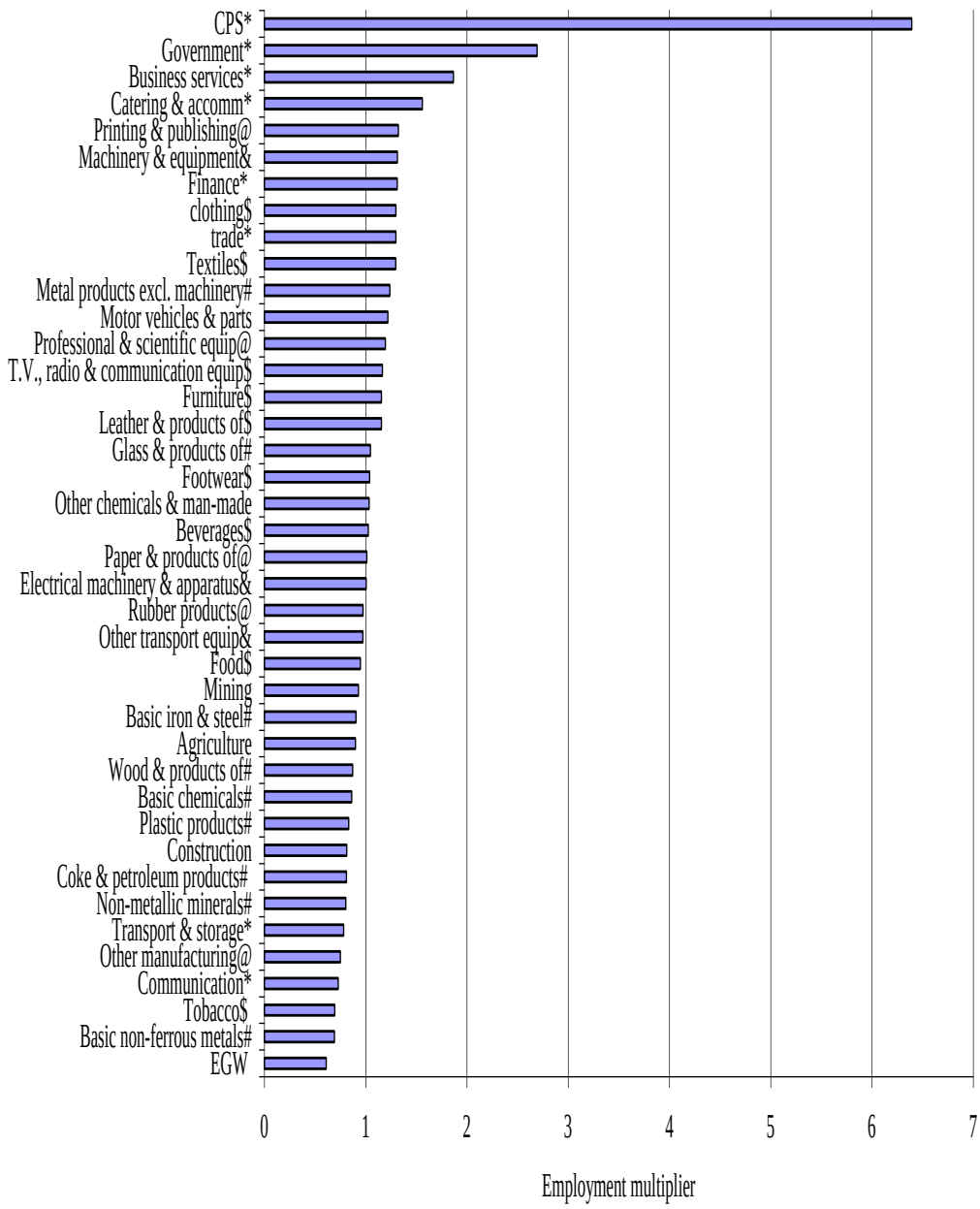


Figure 9 Skilled employment multiplier, 2009

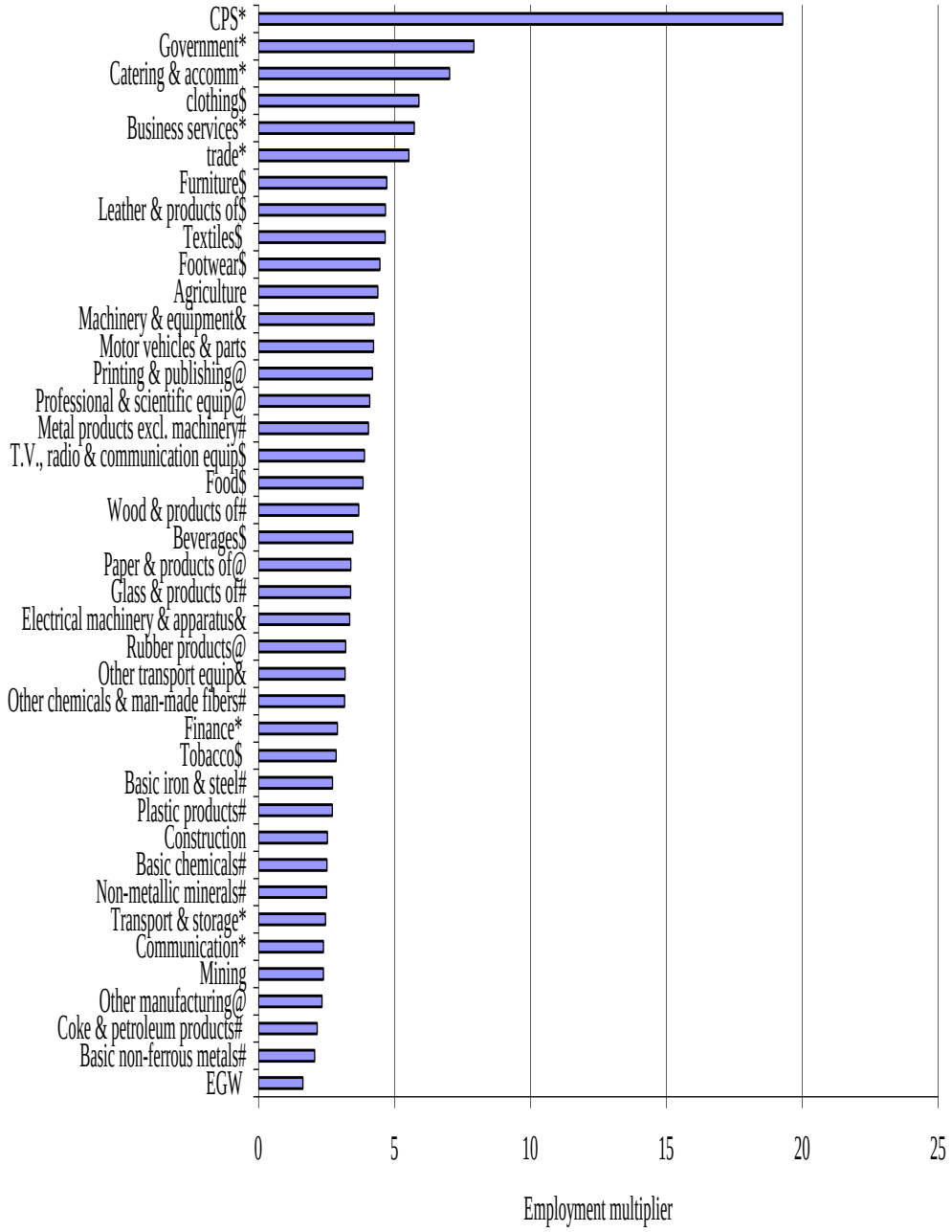
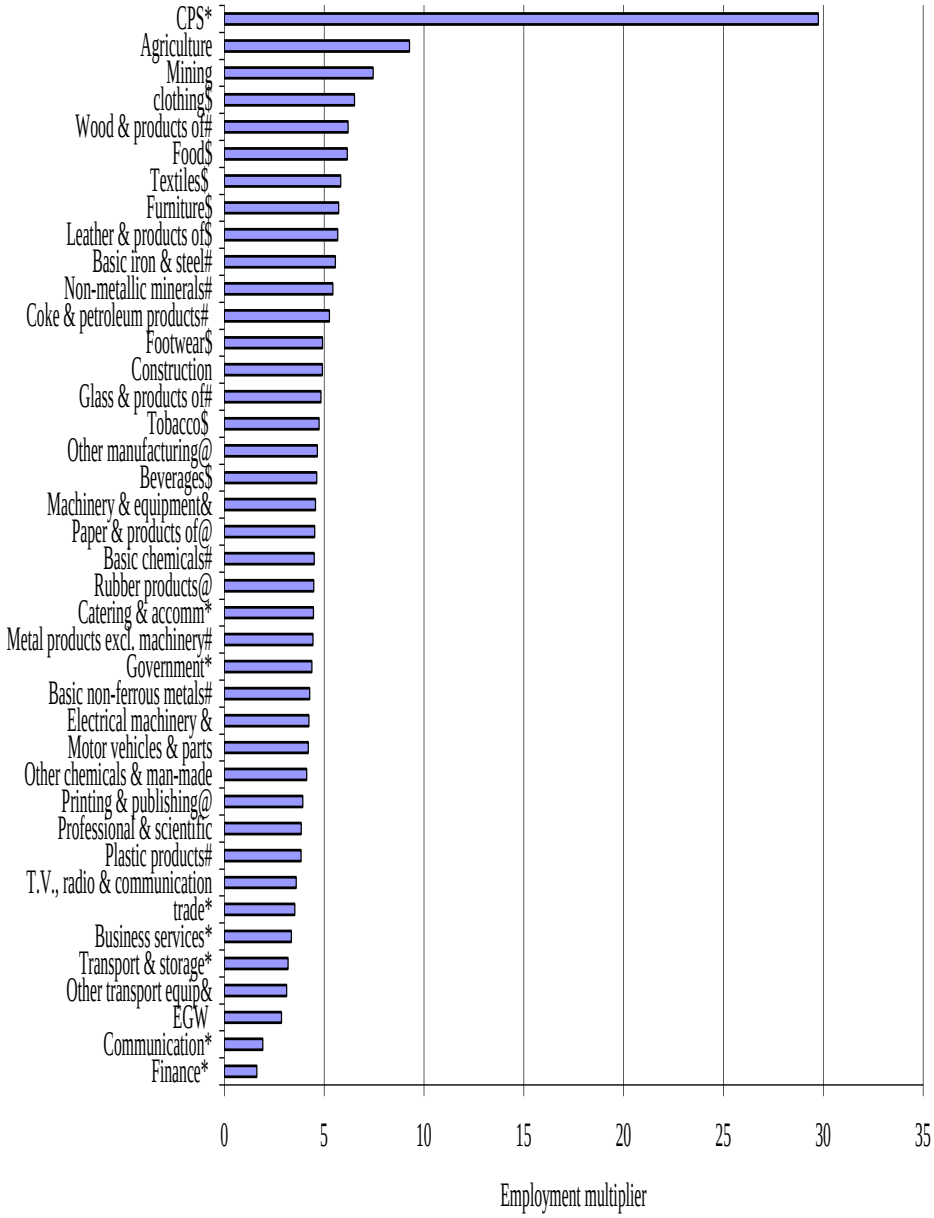


Figure 10 Semi-skilled employment multiplier, 2009



5.4.3 Potential Drivers of Growth and Employment in South Africa

Combining the output dimension and employment dimension will enable us to propose a few subsectors which may possibly warrant policy attention due to their ability to maximize backward as well as employment multipliers. The section will propose subsectors that may possibly maximize backward linkages and employment multipliers by combining the output and employment dimensions. Subsectors that maximise both dimensions may help to foster sustainable growth and employment creation.

The discussion on linkages is limited to backward linkages as they are the most suitable in identifying potential sectors that can be used to drive economic growth. A stimulus on sectors with strong backward linkages has greater potential to maximize linkages more than sectors with strong forward linkages. Sectors with strong upstream integration (i.e. backward linkages) have an already established upstream market that may be used to support their development. Sectors with stronger downstream integration are not likely to have downstream market support as it is highly likely that downstream sectors are not as yet established. In which case, the sectors would have to be supported by the foreign market which defeats the purpose of maximizing linkages to stimulate economic growth.

Figures 11-18 plot backward linkages against employment multipliers for each subsector in 2000 and 2009. Employment multipliers have further been broken down by skills category. Each scatter plot has been divided into four quadrants with the axis cutting through the median value for backward linkages and employment multipliers respectively. Sectors located in the top right quadrant have both relatively strong backward linkages and high employment multipliers. Those in the bottom left quadrant have both relatively weak backward linkages and low employment multipliers.

Service subsectors appear to have a relatively weak economic growth generating potential as their backward linkages are weak i.e. most are located below the horizontal line across all years. Services do however have a bias towards employment generation in lieu of their high employment multipliers. Consequently, most services are located in the top left quadrant. Moreover, services appear to have the potential to generate more skill intensive jobs as their employment multipliers for the skilled and highly skilled categories are high while those for the semi-skilled categories are low.

Manufacturing subsectors have strong economic growth generating potential as their backward linkages are relatively strong (i.e. they are located above the horizontal line) across all years. Added to which, the number of subsectors that have high employment generating potential is roughly equivalent to the number that has low employment generating potential in all skills classifications. Putting all of this together (i.e. the services output and employment dynamics and the manufacturing dynamics) it is not surprising that most subsectors found in the ‘growth generating region’ (quadrant four) are manufacturing subsectors.

The growth generating region requires further analysis. Key questions to be considered are: a) what types of manufacturing subsectors are situated in this region? And b) what type of skills do they mostly generate? Figures 19-22 help us answer these questions. Depicted in each diagram are the subsectors situated in the growth generating region. The diagram is drawn to show the type of skills category towards which the manufacturing subsectors bias. The centre circle represents the subsectors from the growth region that has high total employment multipliers. The surrounding circles cut across two regions: the region that overlaps with the centre circle and the outer region of the centre circle. The overlap depicts the makeup of the total employment multipliers by skills type. The outer region depicts the subsectors which, while not having the potential to generate total employment, have the potential to generate employment in a particular skills type.

Manufacturing subsectors dominate the growth generating region across all skills categories. In particular, consumer goods feature prominently in this region as they have high total employment multiplier which implies that they generate employment in each of the skills types in each of the selected years. The most prominent are: leather, footwear, furniture, textiles and food. Machinery and equipment – capital goods – is another that generates employment in each skills category across all the selected years. There are a few subsectors which have a particular skills bias in spite of the fact that they have high total employment multipliers. The construction sector has a bias towards creating semi-skilled employment.

Figure 11 Total Employment multiplier and Backward Linkages, 2009

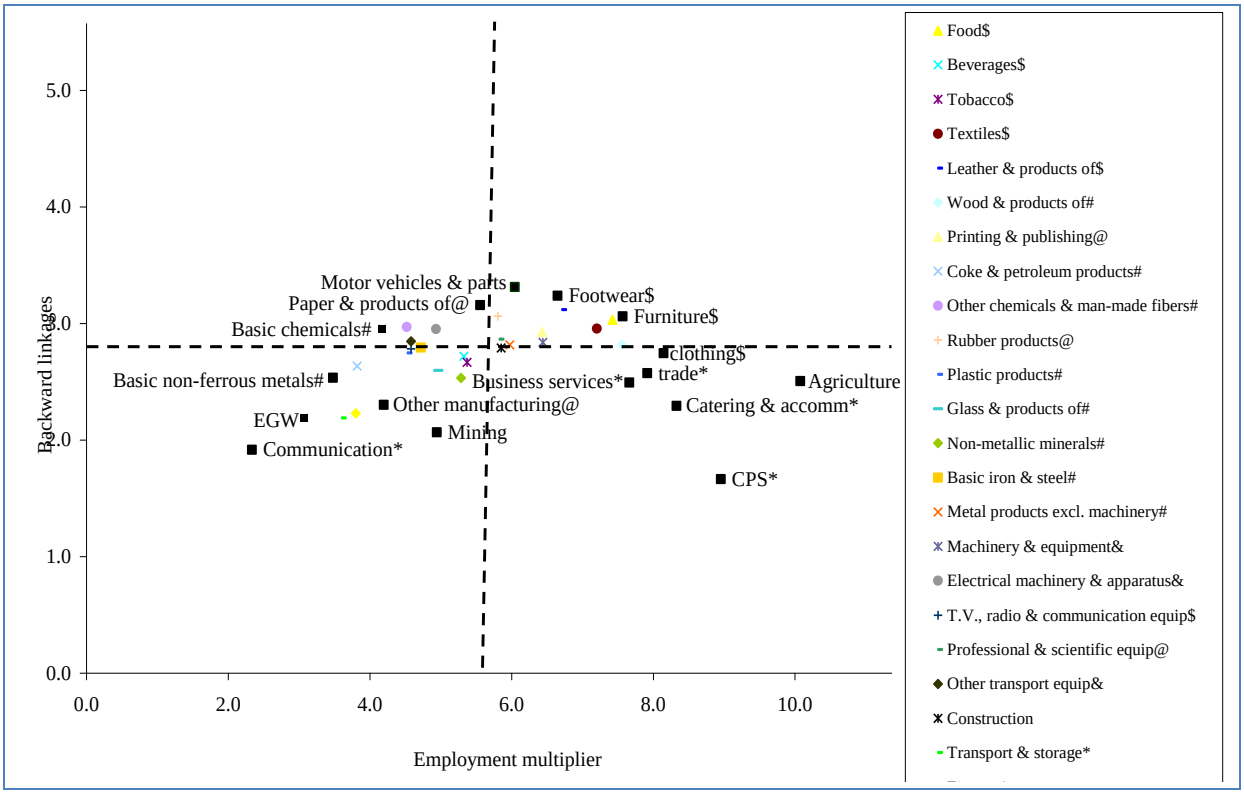


Figure 12 High skilled employment multiplier and Backward Linkages, 2009

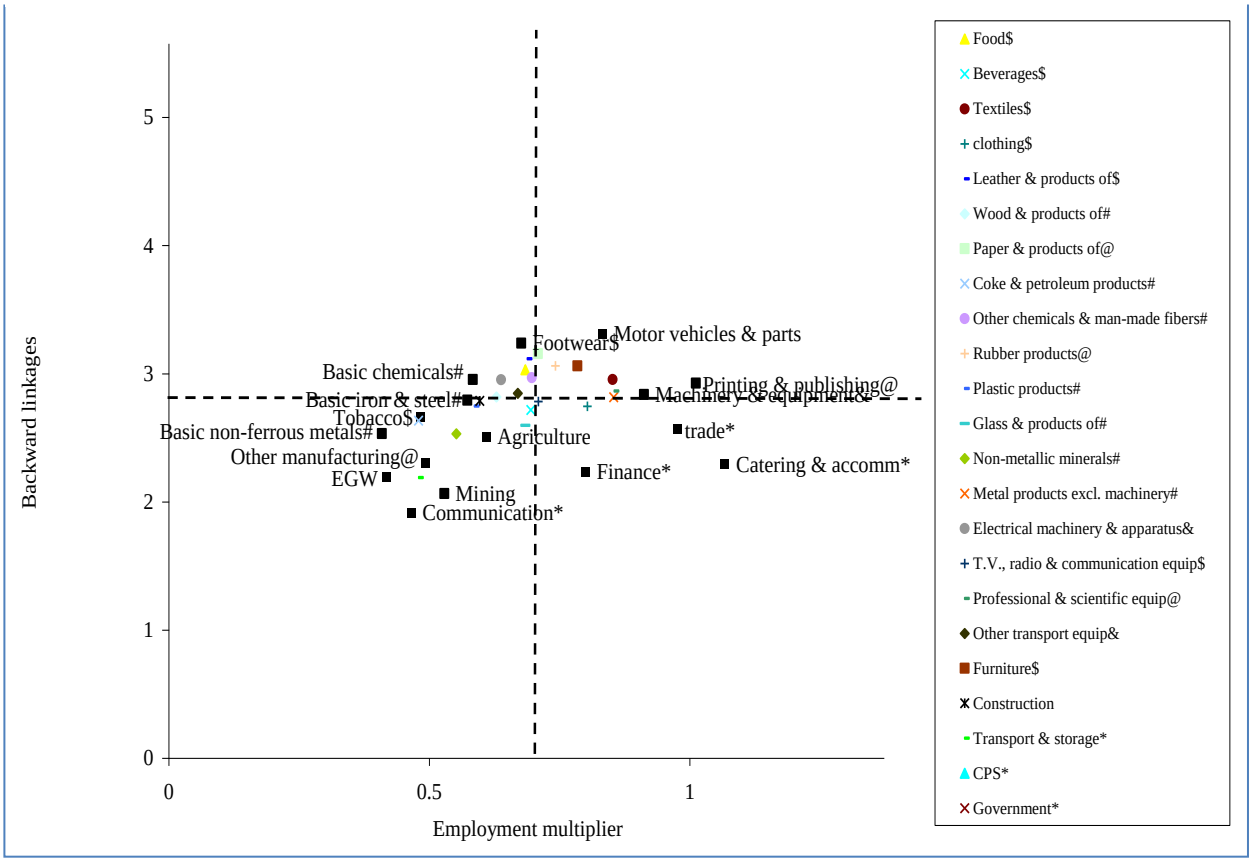


Figure 13 Skilled employment multiplier and Backward linkages, 2009

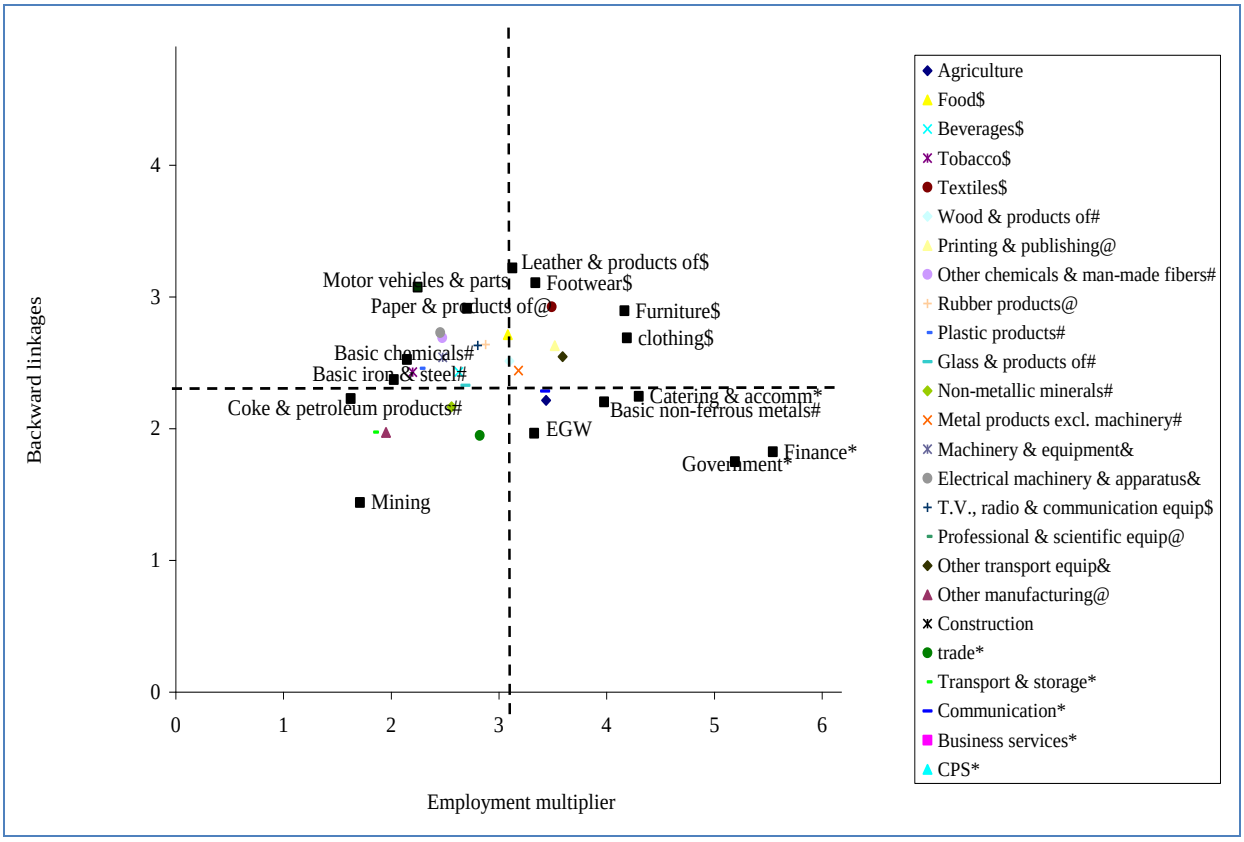


Figure 14 Semi-skilled employment multiplier and Backward linkages, 2009

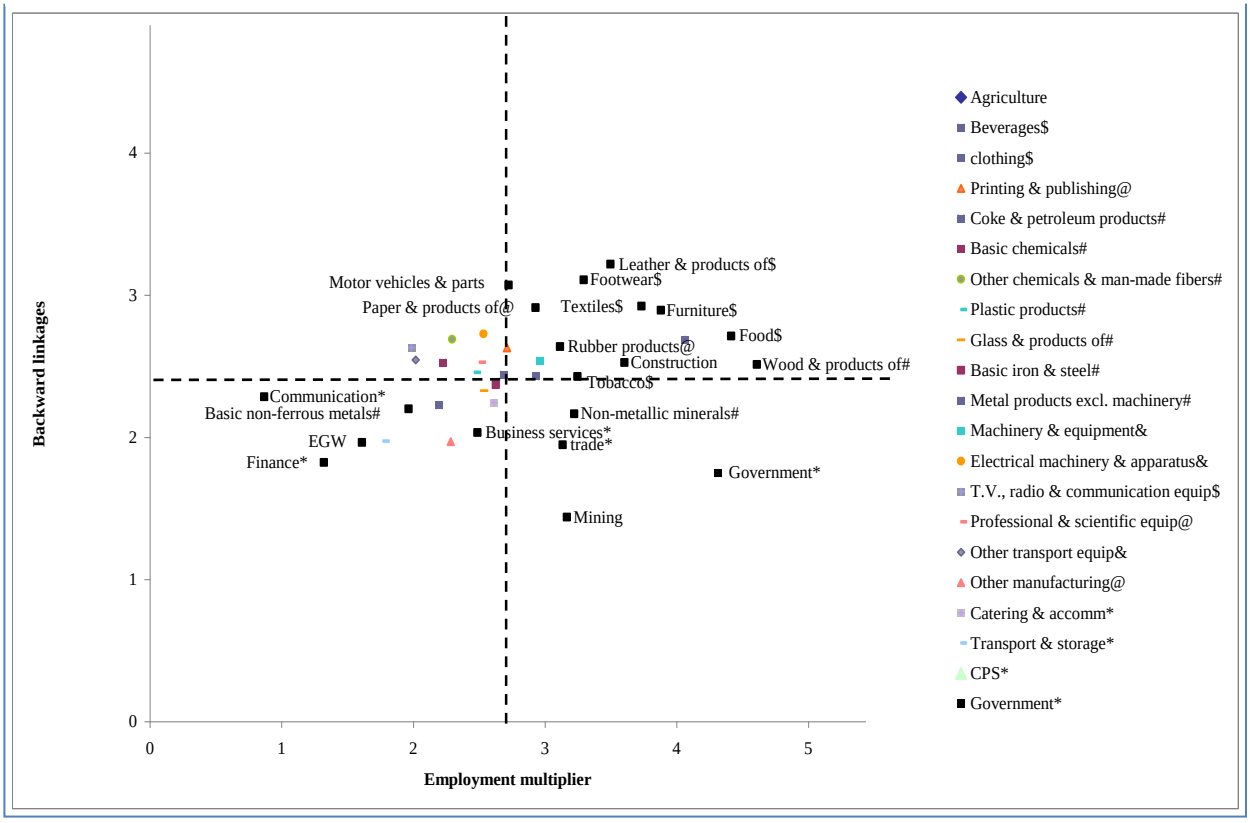


Figure 15 Total employment multiplier and Backward linkages, 2000

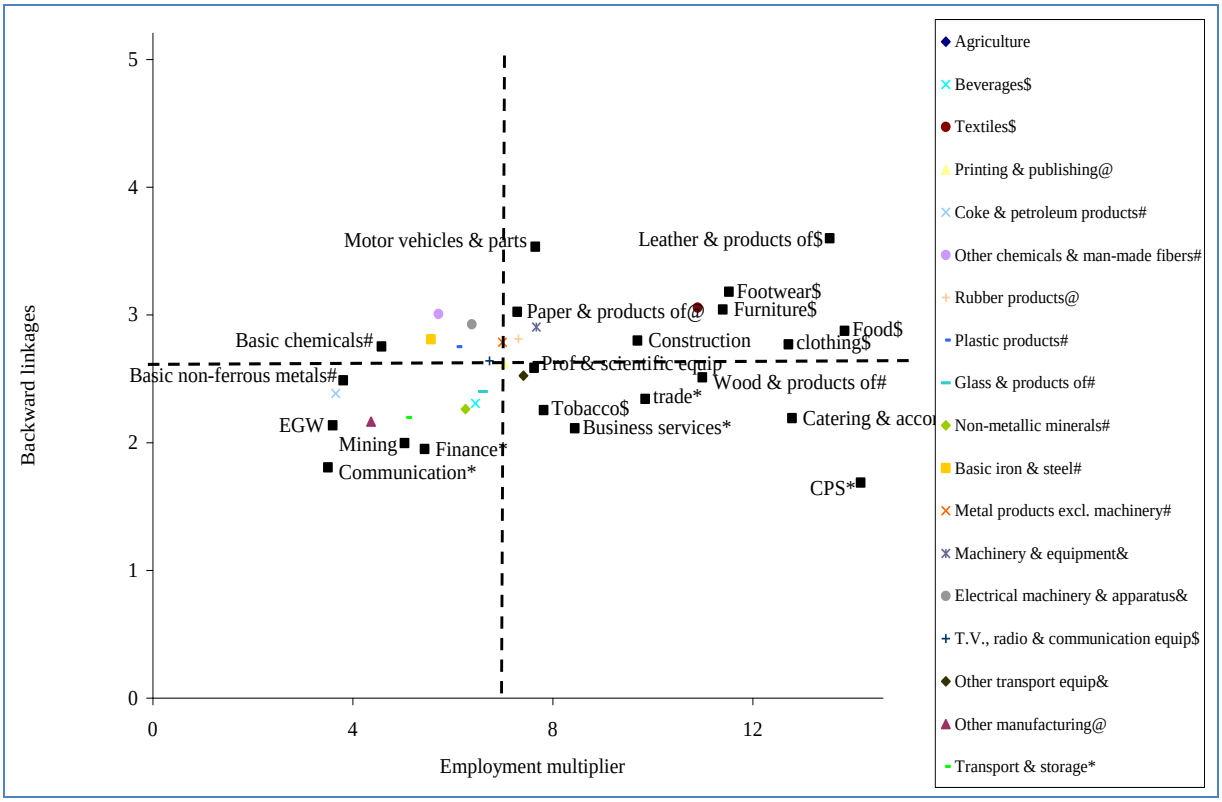


Figure 16 High skilled employment multiplier and Backward Linkages, 2000

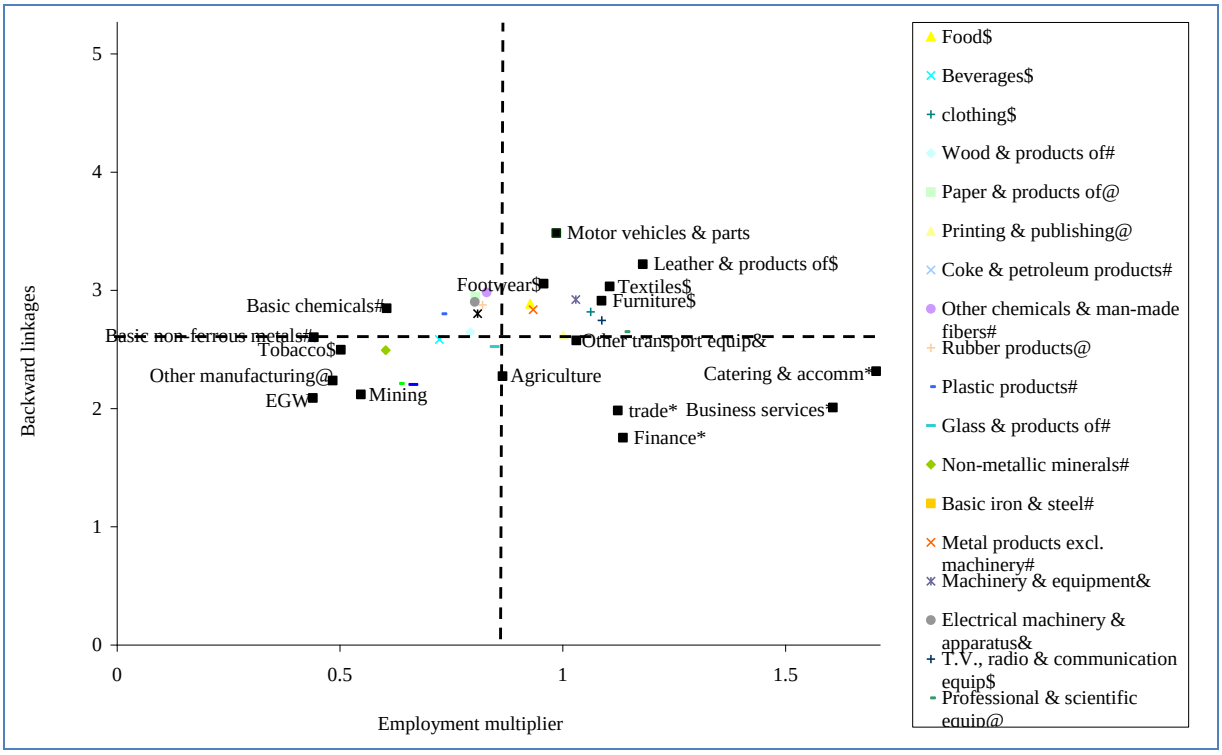


Figure 17 Skilled employment multiplier and backward linkages, 2000

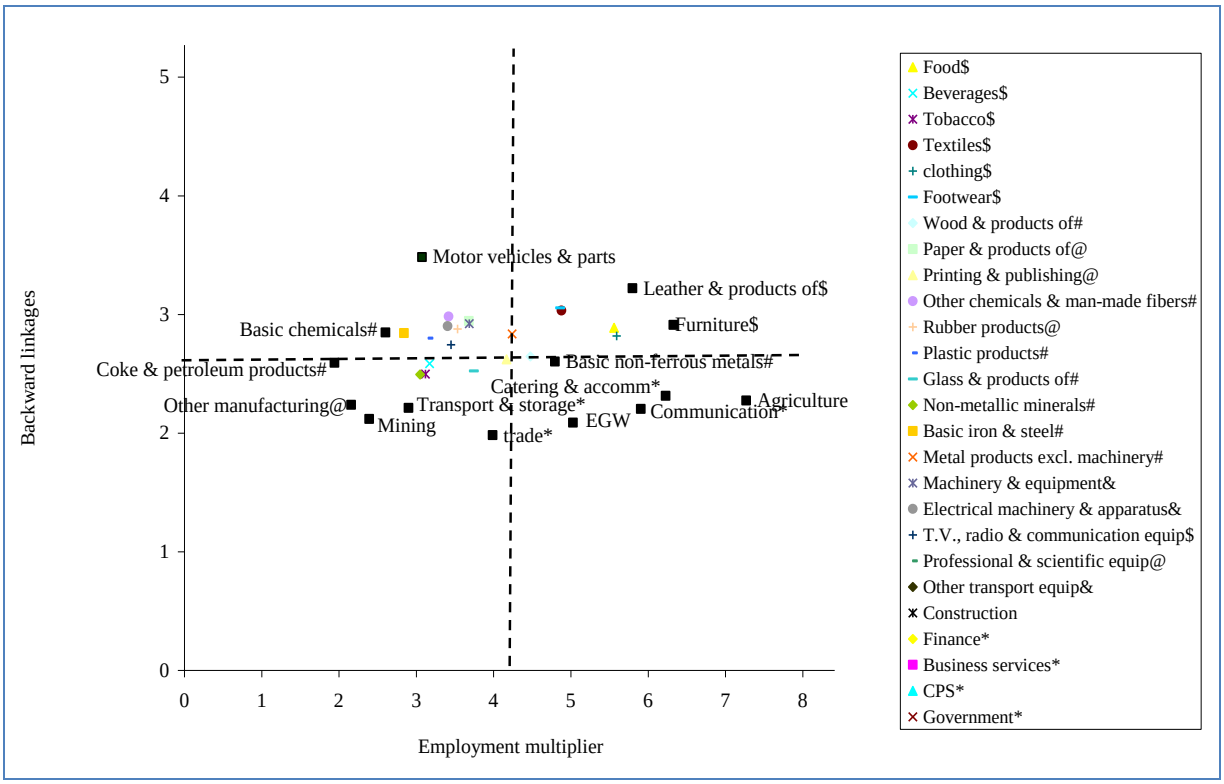


Figure 18 Semi-skilled employment multiplier and backward linkages, 2000

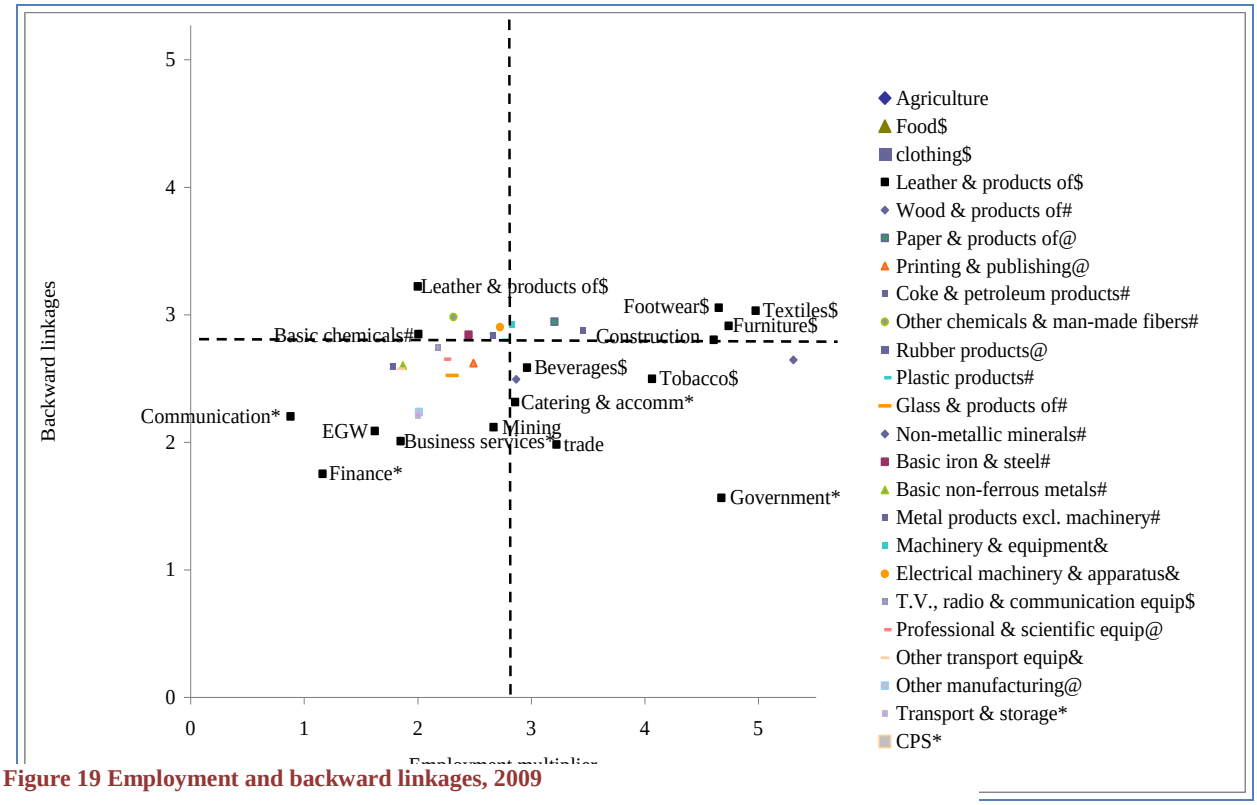


Figure 19 Employment and backward linkages, 2009

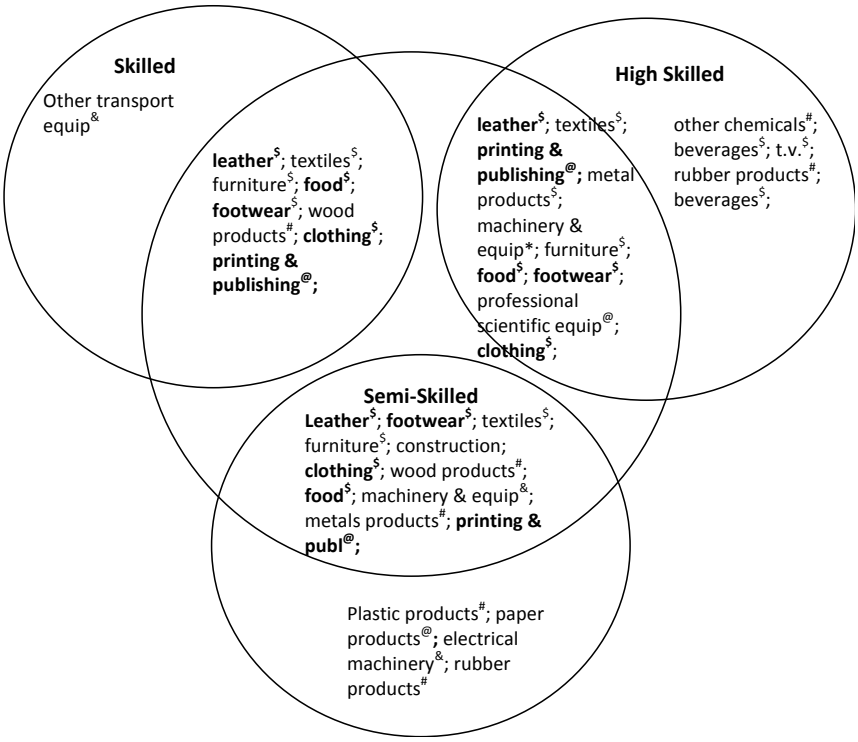


Figure 20 Employment and backward linkages, 2008

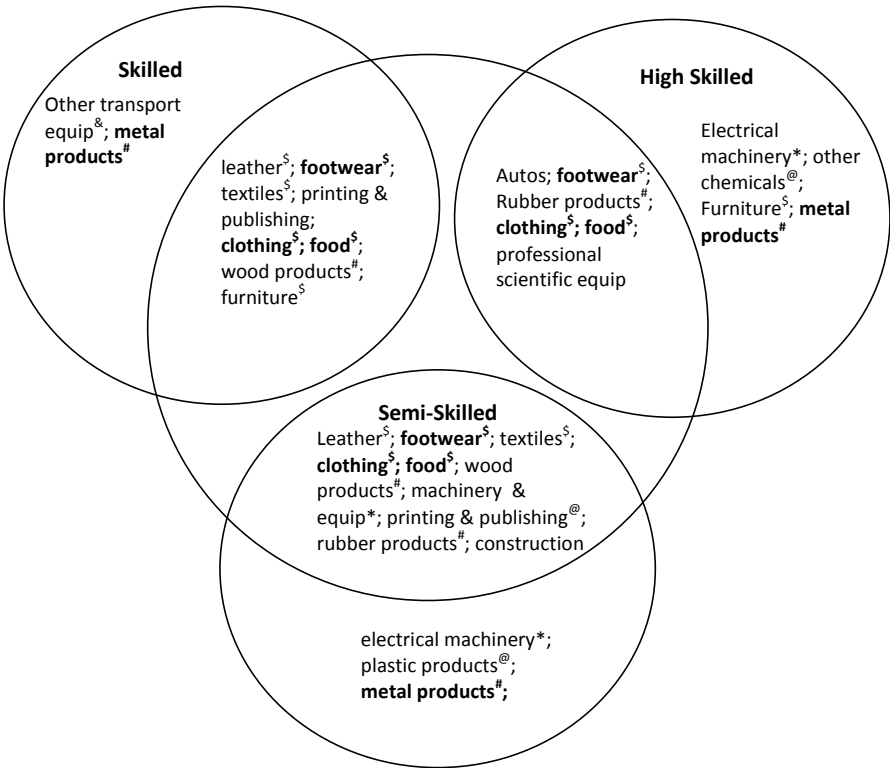


Figure 21 Employment and Backward linkages

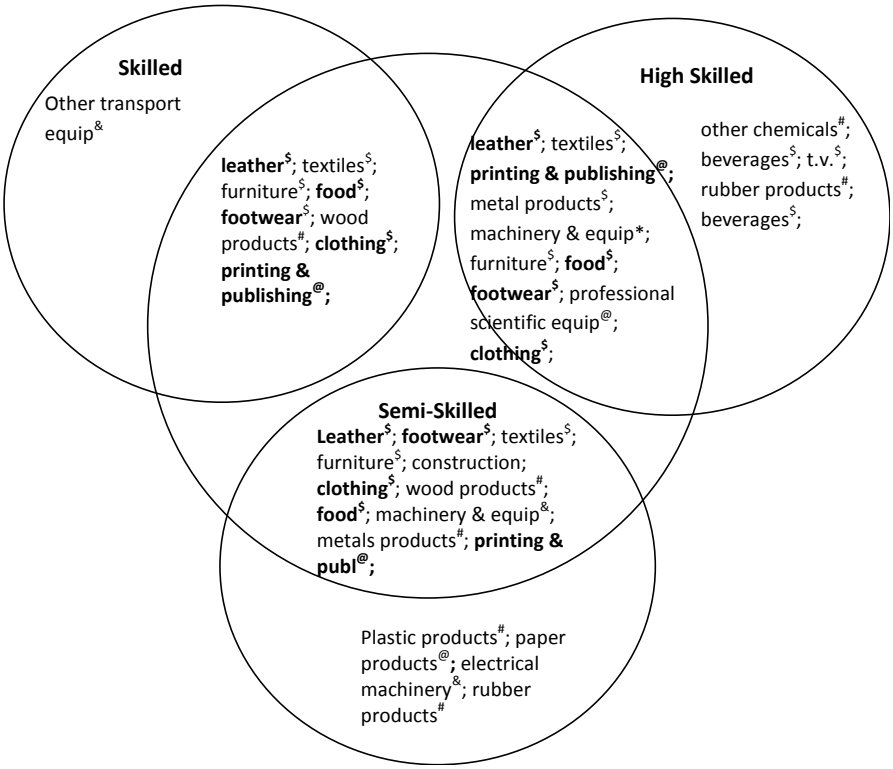
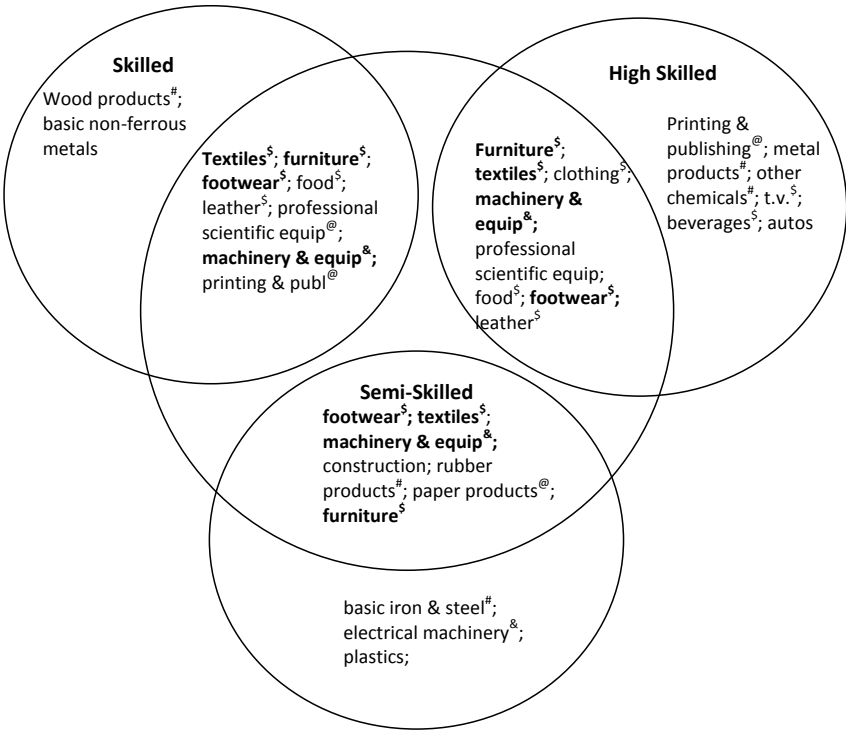


Figure 22 Employment and backward linkages, 2000



5.4.4 Export Multipliers

Exports are an important factor to consider in the process of identifying sectors that could potentially drive economic growth. In a small market economy, exports not only add to sales growth; but linked to that, they are an important means of increasing a sector's profitability through the lower costs generated by increased economies of scale. In a similar fashion demonstrated in the above analysis, a sector's export multiplier is considered in conjunction to the strength of its backward linkage.

The vertical lines in figures 23-26 distinguish those subsectors with high export multipliers from those with low export multipliers. Those with low export multipliers are to the left of the vertical line while those with high export multipliers are to the right of the vertical line. The horizontal lines in figures 23-26 distinguish those subsectors with strong backward linkages from those with weak backward linkages. Subsectors with strong backward linkages are located above the horizontal line and those with weak backward linkages are located below the horizontal line.

Subsectors situated in the top left quadrant are those that have strong backward linkages and low export multipliers. Subsectors located in the bottom left quadrant have weak backward linkages and low export multipliers. Subsectors situated in the bottom right quadrant have high export multipliers and weak backward linkages. Lastly, subsectors situated in the top right quadrant are those with high export multipliers and strong backward linkages.

The top right quadrant is dominated by manufacturing subsectors. Leather products, paper products, electrical machinery & equipment and furniture are featured in all the selected years. The following subsectors feature in three of the four analysed years: Other transport equipment, metal products, professional scientific equipment, autos, t.v. & communication equipment, rubber products and basic chemicals. Wood and footwear feature in at least one year.

Figure 23 Export multiplier and backward linkages, 2009

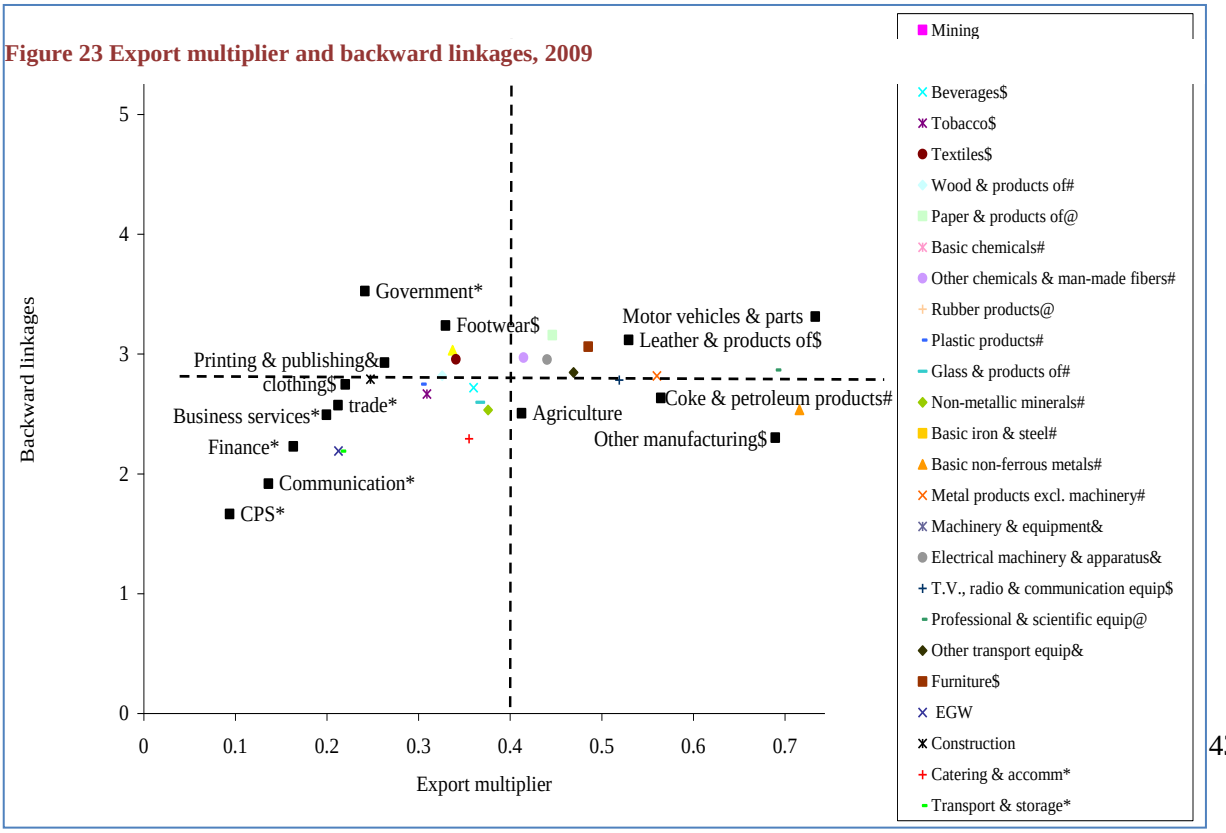


Figure 24 Export multiplier and backward linkages, 2008

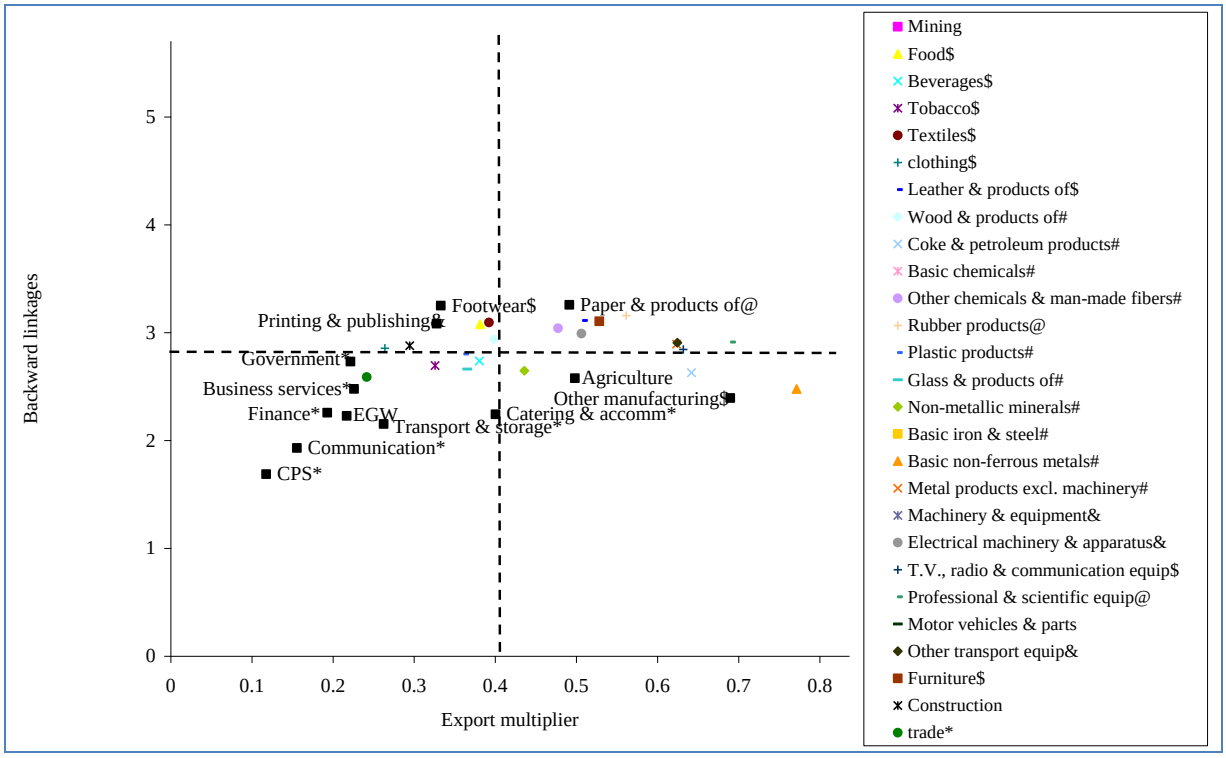


Figure 25 Export multiplier and backward linkages, 2006

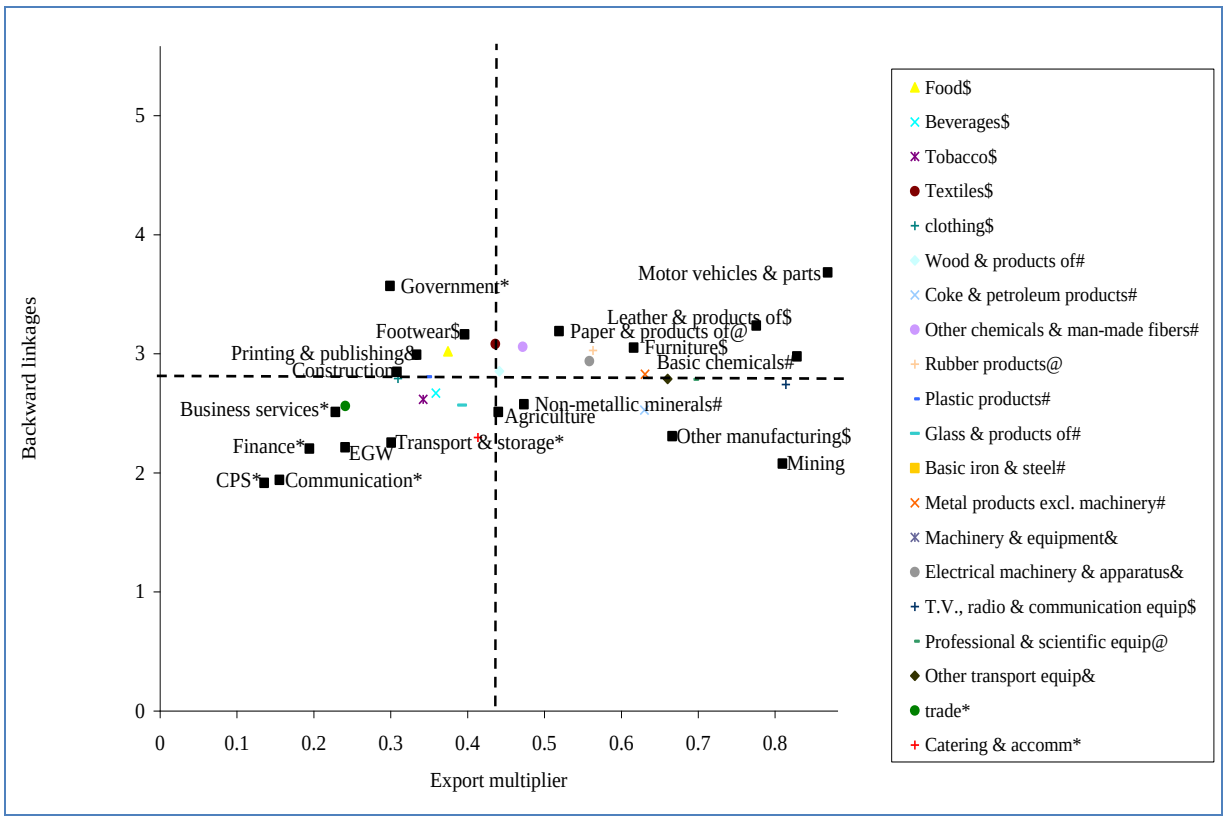
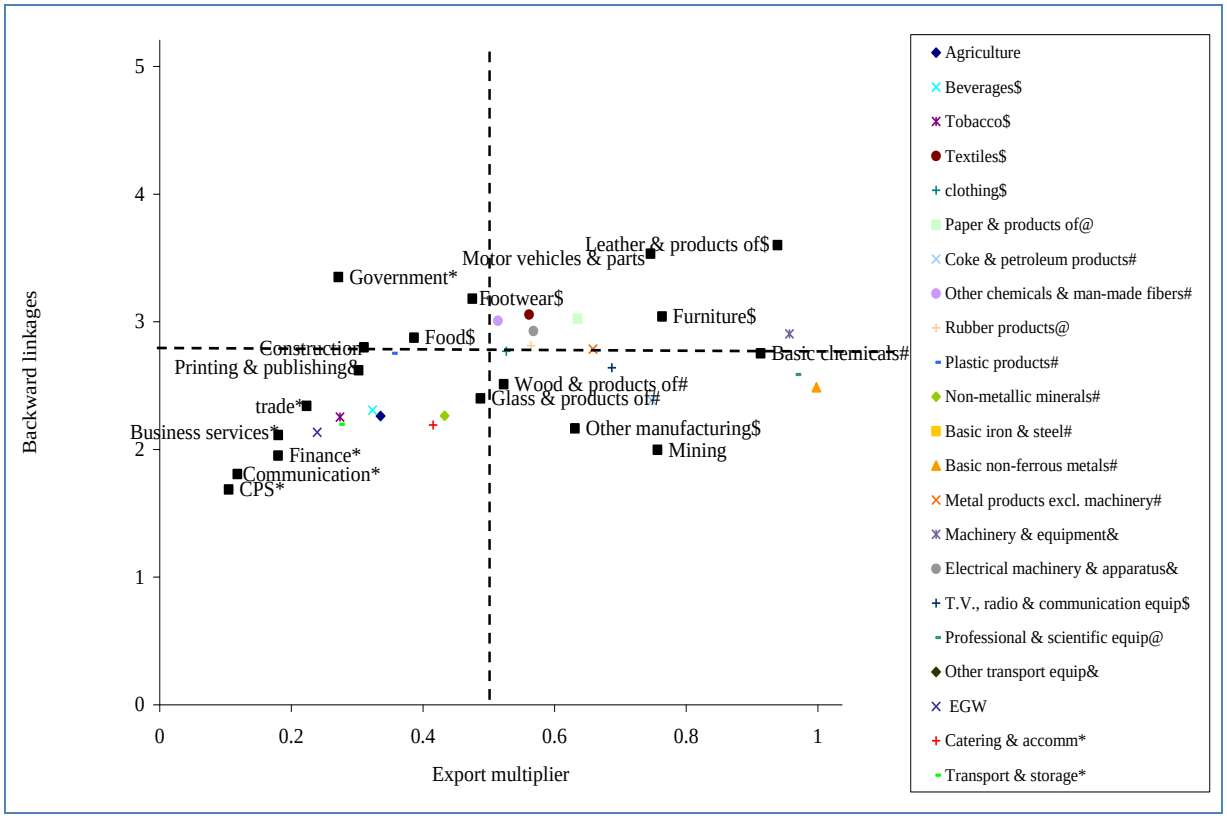


Figure 26 Export multiplier and backward linkages, 2000



5.4.5 Indentifying key sectors

As discussed above, input-output analysis has been utilised as a method to identify key sectors in linkage based development strategies of planned economies. On the basis of our analysis, we are able to identify a number of potential key sectors that can act as drivers for integrated industrial development through strong backward and forward linkages. In addition to strong linkages, input output analysis allows us to identify key sectors that can be identified as 'key' on the basis of several criteria. Here we have considered the potential impact of expanding a sector on employment generation in that sector, as well as sectors that are linked in the production process. In addition, we have looked at the impact of expanding a sector on exports both directly, as well as through its backward linkages.

Our finding that manufactures have far stronger linkages to other sectors of the economy compared with services and primary production confirms the arguments of heterodox and classical development economists that manufacturing is the 'engine of growth' in the early stages of capitalist development. While services tend to be relatively more labour intensive, the expansion of manufacturing is more likely to generate sustainable employment by facilitating the deepening and integration of the economy. Moreover, it is shown that the employment that is created through an expansion in service sectors tend to be biased towards highly-skilled and skilled employment. Given that high unemployment is concentrated in skilled and semi-skilled workers, the expansion of services may have the perverse effect of opening a skills gap in the context of persistent unemployment.

When the strength of linkages and employment multipliers are considered together, we find that light manufactures and capital goods sectors are identified to have the greatest development potential in terms. Interestingly, we come up with a similar list of sectors, concentrated around light manufactures

and consumer goods, when we consider backward linkages together with export multipliers. Table 7 lists the sectors that have been identified as potential key sectors. These subsectors have been identified not only on the strength of linkages, employment and export multipliers, but also on their potential to generate employment opportunities for semi-skilled workers.

Table 7 Potential priority sectors identified

First tier subsectors	Second tier subsectors
Leather products; footwear; textiles; food; wood; furniture; machinery & equipment; rubber; clothing; autos; construction; paper products; metal; printing; electrical machinery; plastic products.	Electrical machinery; plastic products.

The identification key sectors based on an analysis of input-output tables constitutes a first step in identifying sectors that should be targeted by industrial policy. As discussed above, it is the task of the development economist to identify the direction of causality between sectors ex-post.

Input-output analysis measures the potential for particular sectors with strong linkages to positively impact on the domestic economy through their stimulatory effect on upstream or downstream industries. The extent to which this potential is realised depends on a number of factors that are not captured in our input-output analysis. First, our input-output analysis takes no account of the political economy and institutional environment that can seriously influence the extent to which potential domestic linkages are realised. For example, the conduct of larger conglomerates in the input-pricing of raw materials can seriously limit the expansion of upstream sectors. Second, input-output analysis can play down the importance of physical and social infrastructure that, while having relatively weak linkages in terms of input-output tables, are crucial in terms of the functioning of the economy and the realisation of linkage potentials. Third, there is no guarantee that the expansion of a sector with strong backward linkages will stimulate domestic production of intermediate inputs. Domestic capacity must be built up in-order that linkage effects are maximised. Fourth, we have utilised input output tables published by Quantec which include 43 observed sectors. These sectors remain highly aggregated and hide the nuances and interdependencies between sectors within these categories.

In order to be fully informed in terms of identifying key sectors, input-output analysis must be seen as a first step to be complemented with a study of the institutional structures of production along value chains in order to identify bottlenecks.

6. Conclusions

This paper has taken its starting point in the current discussions within Government on the need for South Africa to charter a "New Growth Path" characterised by sustainable and widespread creation of decent jobs by addressing the structural legacies of the past. The vision of the NGP calls for a dramatic shift in the Governments approach to industrial policy from a narrow conception – creating an environment conducive to private business – to a broad conception based on direct intervention of selected key sectors.

The broad conception of industrial policy and sector targeting is closely related to Albert Hirschman's theory of linkage based growth. On the basis of Hirschman's theory of linkage based development, we

have conducted and input-output analysis of the South African economy in order to identify sectors that have the potential to stimulated other sectors through physical interdependencies in terms of output, employment and exports as an analytical tool closely related to Hirschman's theory. On the basis of our analysis, we have identified light manufacturing, consumer goods sectors and capital equipment as potential key sectors. This is not to say that targeted policies towards these sectors alone will lead to stimulatory effects across linked industries. There is a need to consider the institutional structure of production as well as domestic capacity to realise the potential stimulatory effects.

Our input-output analysis has been limited by the availability of data. Before 1993, StatSA compiled input-output tables annually that included 95 industries. Since then there has been a shift to the compilation of Supply-Use tables. While I-O tables can be derived from S-U tables, this process requires a large number of assumptions that compromise the validity of the resulting I-O table. In addition, large S-U tables have not been published annually, precluding analyses of structural change over time based on I-O tables. While Quantec do publish annual I-O tables, these do not allow the level of disaggregation necessary for accurate sector identification. The method by which Quantec compile their I-O table, and the data sources used, are not well known. This compromises our analysis.

Prior to 1993, I-O tables published by StatSA included imported intermediate inputs by supply sector. This data allows the researcher to measure the potential impact of sector expansion on the import of intermediate goods. In the absence of this data, we have not investigated the import multiplier effect. Given South Africa's current account deficit, accounting for imports should be an important part of any analysis of industrial development and policy. This will considered as we build upon the work that has been presented in this paper.

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