# DEVELOPMENT PATHS AND EMPLOYMENT

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# Executive summary

Intensive growth is defined as growth driven by productivity improvements. While this may restrict employment growth, especially when output growth is constrained (for example, by world market conditions), productivity growth is essential for incomes to be raised and for poverty to be tackled.

The paper explores the meaning of intensive and extensive growth paths and considers how to construct an indicator that tracks whether the economy is tending toward one or the other. It suggests that such an index must be based on identifying dynamic sectors, based on their productivity growth and on their linkages with the rest of the economy. A sector may be dynamic in itself, but this is not translated into the systemic dynamism required for economic development if there are not high spillovers into other sectors.

It finds that the measure of productivity problematic. Although past performance in terms of productivity growth may be important, the gap between productivity in the domestic economy and the global productivity of the sector might be a better indicator of sectoral potential.

Despite these problems, the paper illustrates how a monthly indicator of the development path can be constructed. An illustrative estimation suggests that the South African economy has been tending away from intensive growth since the end of 1995.

The paper recommends that further work be undertaken to place the indicator on a firmer footing.

*"… a regular feature of economic growth is the simultaneous movement of a series of economic variables: improved technology, human capital accumulation, investment, savings, and systematic changes in production structures. Yet, these variables are to a large extent results of economic growth. … This means that disentangling cause and effect or, in empirical analysis, leading and lagging variables, is what growth analysis is all about."*

Jose Antonio Ocampo, 2004

# 1. Introduction

In his study of employment and distribution experiences of resource-based countries achieving growth accelerations, Al Berry distinguishes between the high wage/human capital intensive path followed by Chile and the low wage/labour intensive path followed by Indonesia (Berry, 2006). He poses these as different paths towards growth accelerations rather than as successful versus unsuccessful alternatives. Which path "works" depends on a wide range of country specific institutional structures and histories. Berry denotes these alternatives as the "high road" and the "low road", but since these terms may carry unintended connotations of good and bad, in this paper we will refer to them as the "intensive" (Chilean) and the "extensive" (Indonesian) paths.

The distinction is useful for thinking about development strategies for South Africa, which has to deal with many of the same issues that confronted those two countries. There are several reasons why we might want to know which road South Africa is on or rather, since there is a continuum between the two, which road it is tending towards. Even if there is no desire to change paths, it is possible that policies which speed up development along one path may hinder it on the other. There may also be political or social reasons for using policy to influence the road to be travelled.

This paper is not primarily concerned with which road South Africa **should** attempt to travel, but rather with identifying indicators that might tell which of the two it is actually tending towards. However, since this requires some clarity about the characteristics of the two paths, we begin with a discussion of the intensive/extensive dichotomy. We also consider some possible indicators we can consider, although we leave the details of each until later.

It is followed with an account of how movements over the business cycle obfuscate which road the economy might be on. We then discuss some principles involved in constructing indicators and end with an attempt to do so.

# 2. Intensive and extensive paths to development

Al Berry's study cited above focuses primarily on employment and distribution. We can clarify the intensive/extensive dichotomy most easily by beginning with an exclusively employment perspective. We give an intuitive discussion here, leaving the more technical exposition for later.

The distinction between intensive and extensive paths centres on the relationship between output, employment and productivity. "Labour productivity" is defined as output per worker.[1] "Total output" will then, by definition, be productivity times the number of workers. This definitional relationship conveys no information other than how we have decided to define terms. However, it can be given some behavioural content by explaining how each element is determined in the economy. But all three cannot be determined independently of each other. If any two are determined, the third follows automatically from the definition. For example, if productivity is determined by the history of past innovations, and output is constrained by world market conditions, then the number of people employed is determined. Alternatively, say we have a target level of employment, as is often the case when thinking about reducing unemployment. If technology determines productivity, there automatically follows some output level that would be produced by the target employment level. We would have to ask questions about what happens to this output if we want to assess the feasibility and sustainability of our employment target.

The relationship is more usefully formulated in terms of growth rates rather than levels. The growth rate of output will definitionally be equal to the growth rate of employment less the growth rate of labour productivity. If we want to speed up employment growth, either output has to grow faster or productivity growth has to be slowed (or there has to be some combination of the two).

We can use this relationship to explore the intensive/extensive dichotomy.[2] Say the economy has been growing – output has been rising – at some trend rate, with productivity moving at some other trend rate. Employment will have been growing by the difference between the two. We now want to raise employment growth so as to reduce employment.

There are two extreme alternatives between which the growth path is likely to evolve:

- If output growth rate is stimulated without affecting productivity, the employment growth rate will rise by the same amount as the output growth. We would call this ***extensive growth***. We are essentially expanding the economy as it is. This can generate a relatively larger number of jobs in the short run, generally in lower paid sectors. To be successful, demand for these products would either be generated through growing domestic demand in the context of protection, or alternatively that these sectors have a proven global competitive advantage.

- ***Intensive growth*** is found where productivity is an important contributor to output growth. If a development strategy is successful, productivity growth will contribute to a faster pace of output growth. While employment

[1] We might adjust our measure of 'worker' to take into account hours worked, the effort put in, skills etc. That does not alter the substance of what follows, provided we carry through the definitions consistently.

[2] The terms extensive and intensive come from economic historians discussing agricultural output growth. Under extensive growth, there was no change in technology but more land was brought under cultivatiojn: the agricultural frontier was extended. Under intensive growth, the area under cultivation was kept constant, but it was farmed more intensively. Both resulted in output growth, but theycame from different sources and had different implications.

grows more slowly relative to output growth (ie the employment elasticity falls), the faster rate of growth generates a larger number of jobs than previously. This path enables real wage growth, and has more potential for generating employment multipliers. There are two caveats. First, in the short run, the intensive growth path may create relatively fewer jobs as this path takes more time to show results. Second, if there is some limit on the rate of economic growth, output would grow at the same rate as productivity and employment would contract.

Why would we choose intensive over extensive growth, especially in an economy with high unemployment? Essentially, it is because we are not concerned solely with employment. If all we wanted to do was to reduce unemployment, we would try to avoid productivity growth. But there are three prime considerations that make productivity growth desirable.

- First, we want to reduce poverty. Indeed, our concern with employment is primarily because wages from employment are the major way in which people move out of poverty. But productivity growth is a major determinant of wage growth. There is evidence from around the world that in the long run real wage growth tracks productivity growth. (Taylor and Rada, 2004). Furthermore, we want income per head to rise, so it is not only the employed that benefit. Again this is related to productivity growth. Productivity is output divided by the number of employed, while income per head is output divided by total population. As with production we can think of intensive and extensive income growth. If there is no productivity growth (so growth is extensive), then income per head will rise at a rate equal to the difference between the growth rates of employment and population. In most circumstances, intensive growth allows income per head to grow faster than employment growth.
- Second, we want to sustain growth. This requires investment and for this we need productivity to grow. Investment requires there to be savings and that requires some surplus over and above wage costs. Productivity growth can increase the (absolute) surplus available for investment.
- The third reason is that there may be a desire to redistribute income, to use surplus to sustain those out of employment. This means that those in employment have to produce a surplus. Productivity growth is necessary for that.

This simple view of the relationship between employment, productivity and output can be – and generally is – elaborated into sophisticated stories about labour market flexibility, research and development spending and macroeconomic stability. But these should not mask the fact that definitional consistency imposes a constraint on final outcomes.

Once we have moved away from a sole focus on employment, we can broaden the content of intensive and extensive growth further to encompass wider development concerns. Jose Antonio Ocampo's insightful synthesis of development thinking provides a pertinent starting point for thinking about development roads (Ocampo, 2004). He correctly sees "dynamic production structures" as the central determinant of growth. He visualises these as resulting from the interaction between two basic

forces: a) innovations and learning processes; and b) complementarities, linkages or networks among firms and production activities. As he says so concisely:

> "Innovations are the basic engine of change; their diffusion and the creation of production linkages are the mechanisms by which they generate system-wide effects; the learning that accompanies these processes and the development of complementarities generate dynamic economies of scale and specialisation, which are essential to rising productivity; and elastic factor supplies are necessary in order for innovative activities to operate as the driving force of economic growth." (Ocampo, 2004, p14)

Can we measure this multidimensional set of attributes of dynamism for South Africa? What is happening to innovation? How are production linkages evolving? Such a measure (or set of measures) might give us an indication of whether South Africa is tending towards a development road or towards stagnation.

Ocampo's thinking leads him to conclude that the reallocation of capital and labour toward dynamic activities is important. This suggests that an indicator(s) would identify dynamic activities and measure the pace of reallocation. Taylor and Rada, influenced by Ocampo, have developed a decomposition that might help (Taylor and Rada, 2005). They apply their decomposition to a model with two sectors, traded and non-traded activities. However, there is in principle no reason why it cannot be applied to any other decomposition. Rada has constructed a similar flavoured model that looks at the dynamics of a dualistic economy (Rada 2007). For our purposes it is useful to think in terms of dynamic and sluggish sectors.

How might we distinguish these sectors? There are two aspects we need to consider: characteristics that are specific to the sectors themselves and the connectedness of the sectors. The first determines the relative dynamism of sectors taken in isolation. The second determines the extent to which this dynamism spills over into other sectors, providing the systemic dynamism that is central to development.

We discuss each of these in turn.

## 2.1. Sector Specific Characteristics of Dynamic and Sluggish Sectors

For our purposes, the prime distinction between dynamic and sluggish sectors is based on productivity growth. The development process is one of transferring resources from uses with low productivity growth to those with high. Although output growth is important, whether a fast growing sector is dynamic or not depends on whether the growth is being driven mainly by productivity growth or labour growth. The latter is a form of extensive growth; we define sectoral dynamism as related to intensive growth. This is not to say extensive growth does not matter. It is important, but it is not necessarily a sign of sector dynamism.

Productivity growth is tied to the sector's capacity to innovate by implementing labour augmenting technical change, that is, changes that enhance the productivity of

labour. We can think of technical change in its broadest possible meaning: not simply changes in machines, but in labour processes, etc.

We want to be able to distinguish between sectors on the basis of sector specific dynamics. That is, we want to distinguish between sectors that have some engine of growth inside them from those that are growing because they are being pulled along by other sectors. There are a number of initial observations we can make.

- Ideally we want to see which sectors will be more dynamic in the future. It is inherently impossible to predict specific technological developments (if it were, we would know future technology now). We can therefore question whether historical data are what we need to examine for dynamism. Ideally we would like to anticipate whether a sector is going to be dynamic in the future, rather than whether it has been in the past. This would probably require detailed firm and industry level knowledge which is too specialised for our purposes (although it does suggest the possibility of using industry specialists and panels to create the index). However, we may be able to use past performance to identify sectors in which there is a greater probability that technology will develop faster than in others.

- In principle, indicators can be differentiated according to whether they are input- or outcome-based. In an anticipatory sense, we would want to say that we can tell which sector will be dynamic based on inputs into it – knowledge about the determinants of dynamism. It might be possible to get some insight into such factors from very detailed sectoral studies, which are beyond the scope of this study. In the absence of such knowledge, we have to rely on indirect or outcome-based measures: a sector is classified as dynamic because its performance has been what we would expect from a dynamic industry. This runs into the problem that sector performance is determined by a multitude of factors, some of which we would not want to regard as showing dynamism. For example, there might be a surge in the output of a sluggish sector because world demand has grown. We would not want to regard this as indicating sector dynamism.

- Whichever measure we adopt, there will be the problem that the characteristics on which we focus may not be present at all times. Dynamic growth is not a smooth process. There has to be some smoothing of performance of the indicator over time.

- Whichever measure we adopt, we run into the problem that the data we have – based on the Standard Industrial Classification (SIC) – are probably not what we would ideally want. There is too much heterogeneity at this level. This means that it is likely that there are dynamic and sluggish sub-sectors within sectors, or even dynamic and sluggish firms within sub-sectors. We would like to be able to see which of these firms are expanding and which not. Just because a firm is identified as dynamic, does not mean that it will grow faster than its sluggish competitors at all times. It may be that the sluggish firm has well-established ties with a market that has a growth spurt that stimulates output. Indeed, the persistence of sales to an established market might be a sign of sluggishness.

Although we are looking into the future, we necessarily have to draw on past performances to base our judgements on. Broadly speaking there are two alternative approaches.

First we can concentrate on past performance of South African industries. We can make some judgement that those sectors that have seen faster productivity growth in the past will continue to do so in the future. The measure of dynamism will then be relative: some industries are held to be more dynamic than others, based on their past productivity growth relative to other industries in South Africa. We will call these *domestically oriented measure*s.

Second, we can judge sectors based on their performance relative to some global norm. Sectors are judged to be dynamic according to how they have performed relative to a global benchmark performance. We will call these *globally oriented measures*.

Both types of measures have been used in work on productivity in South Africa.

### 2.1.1. Domestically oriented measures

Although we will use outcome based measures, it is worth making a few remarks about input-based measures in passing. These would focus on characteristics of sectors that are the determinants of dynamism. [3] We will see that many of the potential indicators are ambiguous. While they can indicate dynamism, they can also be indicators of problems. They are mostly neither necessary nor sufficient to indicate dynamism. This makes interpretation of empirical evidence difficult. This problem also applies to outcome based measures.

As Ocampo observes, dynamic sectors are characterised by innovation, investment and learning (Ocampo, 2004). The process of innovation involves creation and destruction. New firms (products, strategies. processes, sectors) appear while old ones disappear. This suggests that the net creations turnover of the number of firms might be used as an indicator of dynamism. While a high number of company closures and liquidations in a sector would sensibly be taken as a sign of a sector in trouble, it might be a sign of vibrancy if it were coupled simultaneously with high start-ups and new entries. However, although net creation must prevail for there to be growth, there is no reason why this should be the actual outcome over any period at any particular location. Therefore, such a measure would not unambiguously indicator either the presence or the absence of dynamism.

In developing countries innovations are "primarily associated with the spread of new products, technologies and organizational or commercial strategies previously developed in the industrial centers." (Ocampo, 2004 p15) This suggests that R&D expenditures, typically used as indicators of innovation in developed countries may not be a relevant measure in developing. As against this, learning is also necessary for innovation. The fact that technology seldom has detailed blueprints – its tacit nature – implies that it is imperfectly tradable. Even firms that purchase technology require some form of learning by doing to master it. There is need for absorption of

[3] The following draws directly from Ocampo 2004.

technology. This applies particularly to adoption of new technologies. It could well be that R&D expenditure in the third world is related to learning and adaptation, rather than to creation. As with creative destruction, however, it would not be an unambiguous measure. If learning and adaptation is done on the job, the absence of explicit R&D expenditure does not imply absence of technological innovation.

Innovation typically requires investment, both in physical capital and in intangibles such as new technology and strategies. This implies, together with the falling investment needs of established activities, that high investment is associated with innovation and structural change. We might therefore try to identify dynamic sectors by examining investment patterns: dynamic sectors should have higher investment levels than sluggish. Again there is ambiguity: while investment might be a necessary condition for dynamism, it is not a sufficient one. One cannot infer that a sector is dynamic simply because it has a high investment rate.

Outcome-based domestically oriented measures are the most common measures used in examining productivity growth. Standard growth accounting is intended to allow us to decompose output growth into its various sources: growth of inputs and growth in the productivity of those inputs. What kind of productivity growth are we talking about? Typically economists identify two types of productivity measures: factor specific productivity growth and total (or multi-) factor productivity growth.

The basics of measurement are easy: we track the growth of output and the growth of inputs. In a purely accounting sense, we should find that the growth of output is a weighted sum of the growth of all inputs, where the weights are some measure of the relative contribution of each input to output. The relative contribution is often measured assuming that inputs are paid according to the marginal contribution to output, that is, according to their marginal products. If this is so, we can take shares in value added as measures of relative contributions. In practice there are many reasons why it is not so, so the sum of growth rates of factors weighted by their share in the value of output typically does not add up to the total output. The residual is generally interpreted as "total factor productivity". There has been a long debate on this and it is recognised that the residual encompasses all errors made in the application. Edward Dennison, one of the pioneers of growth accounting, called it "the measure of our ignorance". There are thus strong grounds for avoiding the technique, even though these are typically ignored.

Taylor and Rada focus purely on the specific factor productivity, avoiding the problem of separating growth emanating from different sources of productivity growth (Taylor and Rada, 2007). We can choose to focus either on labour and labour productivity growth or on capital and capital productivity growth. Here we choose labour, since it is more closely related to our overall concern of employment growth.

Starting with the identity $X \equiv X$ (where $X$ is output), and multiplying and dividing the right hand side by labour used, we derive the truism that output is equal to output per worker (i.e. productivity) multiplied by the number of workers employed:

$$X \equiv \frac{X}{L} \cdot L \equiv \lambda_L \cdot L$$

Turning this into growth rates, we get

$$\hat{X} \equiv \hat{L} + \hat{\lambda}_L$$

where a 'hat' (^) over a variable denotes its growth rate. The rate of output growth is thus equal to the sum of the labour growth rate plus the labour productivity growth rate.

We can use this to estimate labour productivity growth in each sector:

$$\hat{\lambda}_L \equiv \hat{X} - \hat{L}$$

In principle, sectors with faster labour productivity growth are more dynamic.

There are some practical difficulties applying this method.

First, as with all such decompositions, the 'productivity' measure empirically ascribes all differences between output and labour growth rates to labour productivity growth. In one sense this is fine: if workers produce more they have become more productive, regardless of the reason. But we might feel uncomfortable with this for a number of reasons. For example, it is possible that although the number of people employed remains the same, they put in more hours. We might accept that this means that productivity per worker has risen, but would we want to take such an increase as showing the sector has become more dynamic? Output has risen because of greater intensity of work, not because workers have "really" become more productive. This problem is related to changes in capacity utilisation.

In part this problem arises because we are not precise about what we mean by productivity. For the purposes of this study, we have some notion of that productivity growth is a 'structural' variable – showing something about the sector's dynamism. Ideally we would like to avoid ascribing to productivity growth any growth in output that is due to greater capacity utilisation.

We could reduce this problem if we had good data on hours worked, rather than number of people employed. However, although there are some such data available from the Labour Force Survey, they cannot be used for time series analysis. In the absence of such data, some economists have used proxy measures for capacity utilization, such as material inputs or electricity inputs. For the moment we use numbers of employed.

A second practical problem is that measured output can in practice fluctuate significantly over the short run. We therefore need to smooth output growth to extract the underlying 'structural' output growth, since productivity growth intuitively should be relatively stable in the short run. There are several ways this can be done. We experiment with fitting a linear trend to the logarithm of the deseasonalised output data. We also try smoothing the deseasonalised data using a Hodrick-Prescott filter.[4] Although this method is somewhat arbitrary, we use it, in part because it has been widely used in business cycle analysis. Since we deal with annual data, we chose a

[4] This is explained in the Appendix to the paper on Employment cycles.

smoothing parameter value of equal to 12, a fairly standard value for annual data. We also smooth employment data in the same two ways.

Once we have extracted 'productivity growth' in this way for all sectors, we compare each sector with the average across the economy. This allows us to identify sectors whose productivity growth has historically been higher than average (dynamic sectors) and those where it has been lower (sluggish sectors). We present the results in Section 2.3.

This approach has several shortcomings. Apart from the data deficiencies that we have discussed above, there is the problem, arising from the use of historical data, that sectors that have had high productivity growth in the recent path may have reached the limits to productivity growth. Far from being an indication of potential future dynamism, it could be a sign that the sector is about to slow down, having exhausted the potential for growth. It would be better if we were able to identify sectors that have the potential for dynamism.

In addition, there is no reason why only a sub-set of sectors within a country can be dynamic. Although some maybe more dynamic than others, there could be across-the-board dynamism. Yet *domestically oriented measures* necessarily rank sectors relative to each other. At one level, we are concerned sectors in South Africa that are more dynamic than other sectors in South Africa. But for many purposes, our concern should be the identification of sectors in South Africa that are dynamic with reference to the same sectors elsewhere in the world. This is likely to be a major determinant of global competitiveness and a better indicator of future growth possibilities.

For both these reasons, we turn to consider what we have labelled globally oriented measures of dynamism.

### 2.1.2. Globally oriented measures

Using an external benchmark makes more sense when we reflect on the analysis by Ocampo cited above. We can think of technical change as coming from two sources: innovation and adaptation. Ability to innovate is, as Ocampo has suggested, rather limited for third world countries. Technological change is more likely to be driven by adaptation of international technology, rather than by domestic invention. This adaptation is determined by a number of factors. First, the gap between the domestic and world technology will be significant. If there is no gap, then the sector's productivity is likely to track global trends. The bigger the gap, the greater the possibility of catch up and thus of sector productivity growing faster than global. Secondly, the capacity to adapt – which is probably determined by factors similar to the capacity to innovate. Thirdly, there may be barriers to adaptation – trade, patents, domestic regulation etc.

As Harding and Rattso observe, the "dominant understanding of productivity growth in middle income countries such as South Africa is 'catching up'." (Harding and Rattso 2007). They explore the application of barrier models to South Africa, and find that they perform well. Barrier models essentially suggest that we would expect labour productivity growth in a domestic sector to track global productivity growth in the same sector. Any differences are thus explained by the existence of barriers to adoption.

This suggests that sectors with higher gaps between global and domestic labour productivity have the most potential for intensive growth. This would provide a different measure of dynamism from the domestically oriented measures. As with those measures, there are practical problems implementing this approach.

The main problem is establishing the appropriate global benchmark. In principle, we would like to measure a productivity frontier, representing the 'best practice' for a sector. In practice, this requires too much data. We therefore have taken US productivity data as the benchmark. Since there are differences in the way sectors are defined, we created a concordance between SA and US classifications. We then measure average US value added per worker over a five year period and use this as the benchmark. For comparability the South African data had to be converted from rands to US dollars, so exchange rate variations influenced the outcome. We used average exchange rates but also experimented with purchasing power parity rates.

### 2.1.3. Domestically oriented versus globally oriented measures

The two measures we explore are fundamentally different. Sectors that have been experiencing relatively fast productivity growth in recent years, and are thus identified as dynamic by the domestically oriented measure, are likely to have closed the gap with international productivity frontier, and thus be identified as sluggish by the globally oriented measure. This contradiction could be circumvented to some extent by developing a measure that combines the two. Due to lack of time, we have taken a static measure of the technology gap. With more time to collect and refine global data, one could compare global and domestic productivity growth rates over time, attempting to measure dynamism by the success with which sectors have closed the gap over a period of time.

Even with such a measure, however, there would remain the problem of using historical performance data to infer potential future performance. From this point of view, the global gap measure is preferable. It can be viewed as an input measure, since it focuses on what is probably a major determinant of productivity growth. It has the additional merit of alerting policy makers to sectors in which there may be substantial barriers to productivity growth.

We will report on outcomes based on both measures. However, the measure of internal sector dynamism is only one aspect of the dynamism we wish to identify. Regardless of the way in which we define and measure internal dynamism, it is important that sectors have connections to other sectors in the economy. It is only in this way that sectoral dynamism spills over into systemic dynamism. We therefore now turn to consider this second aspect.

## 2.2. Connectedness

Some aspects of connectedness are easier to measure than dynamism. The extent and nature of forward and backward linkages can be measured through standard input-output tables. Backward linkages determine whether the dynamic sector will pull along

other sectors through its demand for their products as inputs. This can also create a bottleneck, where sluggishness in a supplying sector inhibits the release of dynamism in another. Forward linkages determine the extent to which the dynamic sector stimulates other sectors, primarily through the provision of cheaper or qualitatively better inputs. Again we can see how such linkages might inhibit the expansion of the dynamic sector, if its potential markets cannot absorb the expanded output its dynamism can create.

These linkages show why it is connectedness matters. Linkages not only determine the spill-over of the benefits of the dynamic sector, but also potential constraints on the growth of the dynamic sector. It is no good identifying dynamic sectors in isolation, as we explored in the previous section. We have to see them in their economy-wide context.

Input-output tables and their modern variants, Supply-Use Tables (SUTs) and Social Accounting Matrices (SAMs) are not the only method for examining connectedness. Value-chain analysis can also provide important insights. In this report we restrict ourselves to using input-output (IO) data, but in taking this project further we would want to incorporate evidence from value chain analysis. Structural Path Analysis (SPA) is also a useful technique for exploring connectedness. This is being undertaken as a separate part of this overall project.

Using IO analysis, the simplest approach to measuring connectedness is to measure the sectoral output multipliers. These show the direct and indirect effects that a rise in the final demand for a particular good will have on total output in the economy. Other things equal, the more linkages a sector has the greater will be its multiplier.

Using input output tables supplied by QUANTEC, we constructed a time series of sectoral multipliers from 1970 to 2007. We removed imported inputs from the standard IO tables, so as to focus purely on linkages through flows of domestically produced goods. As well as the full sectoral multipliers we also consider forward linkages on their own, since these capture the channels through which sectoral productivity increases feed through the economy.

## 2.3. Development path indicators

In the foregoing sections we have discussed alternative measures of sectoral dynamism and connectedness. We need to combine these two measures to derive a combined index that will give us the measures we want to use for assessing whether South Africa is moving towards an intensive or an extensive development path.

As with all indices that are combinations of other measures one needs to decide on the weights for each component and the functional form of the aggregation. It is clear that we want our combined index to be positively related to each of the components, since increases in our measures of dynamism and of connectedness are both desirable. The trade off between them (the relative weights attached to each) is less clear. It might be possible to derive the relative weights 'objectively' by exploring the contribution that a one per cent rise in each makes (say) to overall economic growth. Given the preliminary nature of this work, we have not done this. We have simply taken the product of the two measures. This gives each component equal weight, and

implies that a one percent rise in either will lead to a one percent rise in the overall index.

Given the alternative ways we have explored to measure dynamism and connectedness, a number of different combined indicators are possible. For convenience, Table 1 summarises the alternatives.

**Table 1: Alternative Combinations for Indicators of Development Paths**

| | | | Connectedness | |
|---|---|---|---|---|
| | | | Full sectoral multiplier | Forward linkages |
| Dynamism | Domestically oriented measures | Past productivity growth using log-linear trend | I | II |
| | | Past productivity growth using Hodrick Prescott Filter | III | IV |
| | Globally oriented measures | Productivity Gap using Exchange rate | V | VI |
| | | Productivity Gap Using PPP | VII | VIII |

Although we explored most of these possible combinations, we do not present all the results here. Our main use of the combined index is to classify sectors as dynamic or sluggish. In Table 2 we present the results from three alternative indices (those referred to as III, V and VIII in Table 1).

For each of the alternatives we present the index constructed as the product of the two component measures. We then take the ratio of this index for each sector to the median for the whole economy. On the basis of these ratios, we then classify into three groups – "dynamic" (more than 50% above the median), "sluggish" (more than 50% below the median) and "neither" (within 50% of the median). These boundaries are arbitrary.

It can be seen from the final column in the table that there are only four sectors that are classified as dynamic by all three measures (Leather and leather products [316], Footwear [317], Glass and glass products [341] and Electrical machinery and apparatus [361-366]). We have indicated earlier that the domestically oriented measures are likely to be the obverse of the globally oriented ones, so it is surprising that there are any sectors which are classified the same way by the different measures. It is more common that the different measures lead, as expected, to contradictory classifications. We need to re-emphasise that this is the result of different interpretations of the term 'dynamic'.

The above procedure enables us to identify sluggish and dynamic sectors. However it does not provide an index which tracks where the economy is going. To do this we use high frequency data showing the performance of each sector over time to track how the composition of the economy is changing, in terms of how dynamic sectors are performing relative to sluggish. Unfortunately monthly output data is not available for all sectors in the economy. We therefore focus on the manufacturing sector, for which Statistics South Africa publishes monthly output indices. Using these we

construct a monthly index based on the share of total manufacturing output produced by the top ten manufacturing sectors ranked by the appropriate combined index.

Figure 22 presents the trend since January 1998, based on the globally oriented measure denoted as V in Table 1. To reiterate, this combines the full sectoral multipliers with the gap between South African and US productivity using the rand-$ exchange rate. The output of the top ten manufacturing sectors according to this index is then estimated as a share of total manufacturing output for each month. Finally, this series is converted into an index, with the average share for 2000 as a base.

The index fell by about 19% between November 2005 and January 2009, with approximately half that fall being concentrated between April and August 2008. Given the measure of productivity used in this index, this suggests that output of sectors whose productivity lagged furthest behind that of their global counterparts but which had relatively high multipliers shrunk relative to other manufacturing sectors. In this sense, the economy has moved away from the intensive growth path over the past three years.

# 3. Development Roads and the Business Cycle

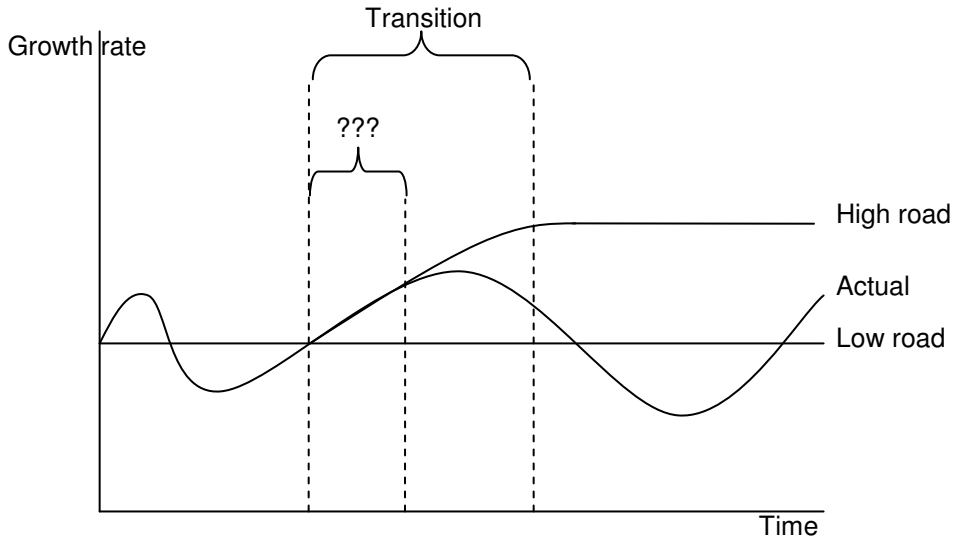
One of the problems with indicators such as we have been attempting to construct is that their movement may be masked by 'normal' business cycle trends. When an indicator shows a down turn, how can we tell whether this indicates a shift to a lower path as opposed to a 'normal' business cycle down turn?

The diagram below illustrates the broad problem with which we are concerned. There are two trend growth rates – a high road and a low road. The actual growth rate fluctuates around each of these (the high road cycle is not shown in order to keep the diagram simple). We assume we are on the low road and want to make a transition to the high. The problem is that there may be a period of ambiguity (marked "???") in which we are not sure whether what we are observing is the up-swing of the low road cycle or the transitional trend towards the high road. (We could complicate the diagram further in two ways by posing the possibilities that: 1) there will also be ambiguity as to whether we are on a high road down swing or a failed transition; 2) the transition entail an initial downturn – some short run cost – so that we do not know whether we are on the transitional downturn or a low road down swing.)

Although the diagram is in terms of growth rates, we are thinking more generally. We could put any appropriate index on the vertical axis. Also, we should note that although the diagram presents the issue as if there are two clear cut alternatives, this is purely for expositional purposes. In reality it is a question of balance and tendencies

Can the development path indicator we have suggested here help policy makers know where the economy is?

**Figure 1: Illustration of alternative development paths**




Unfortunately, the data limitations we face do not allow us to answer this question as yet. The illustrative indicator we have constructed runs from 1998. Essentially this period has until recently seen a continuous upswing in the business cycle. There is insufficient variation to allow us to test the relationship between the two. We would need to construct a longer series for the development path indicator to be able to explore its relationship with the business cycle.

# 4. Conclusions

This paper set out to construct an indictor of whether the economy is tending towards a high productivity or a low productivity growth path. It suggests that such a measure should be based on identifying dynamic sectors and then measuring whether the share of output of those sectors is expanding or contracting.

It suggests that 'dynamic' sectors should be identified on the basis of two primary characteristics: the internal dynamism of the sector, as measured by some index of productivity, and the connectedness of the sector, as measured by its linkages to the rest of the economy. The former would indicate how powerful the engine off growth of the sector is, when taken in isolation. The later would measure how such an internal engine creates systemic dynamism.

The paper measures connectedness though standard input out multipliers. However, it faces difficulties measuring productivity, suggesting that there are two plausible measures that give contradictory results.

Despite this problem, an attempt is made to construct the requisite indices. A monthly development path indicator is constructed for illustrative purposes. It suggests that the economy has been moving away from intensive growth, as defined, since the end of 2005. However, the available data do not allow the index to be constructed over sufficiently long a period to be able to test it properly. In particular, the lack of a long series makes it difficult to explore the relationship between the proposed indicator and the business cycle.

It is recommended that, if there is found to merit in the ideas explored in this paper, further work should be undertaken to develop a more secure methodology and data set for the construction and testing of a longer series.

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**Table 2: Classification of Sectors according to Path Indicators**

| | III Full sectoral multiplier with past productivity smoothed using HP Filter | | | V Full sectoral multiplier with global productivity gap using SA-US exchange rate | | | VIII Forward multiplier with global productivity gap using SA-US PPP | | | Count of dynamic |
|---|---|---|---|---|---|---|---|---|---|---|
| | Index | Ratio | Status | Index | Ratio | Status | Index | Ratio | Status | |
| Agriculture, forestry and fishing [1] | 0.050 | 0.677 | neither | 17.776 | 1.546 | dynamic | 8.692 | 1.395 | dynamic | 2 |
| Coal mining [21] | 0.044 | 0.598 | neither | 17.217 | 1.497 | dynamic | 8.529 | 1.369 | dynamic | 2 |
| Gold and uranium ore mining [23] | 0.033 | 0.446 | sluggish | 12.335 | 1.073 | dynamic | 7.794 | 1.251 | dynamic | 2 |
| Other mining [22/24/25/29] | -0.044 | -0.599 | sluggish | 15.816 | 1.375 | dynamic | 8.380 | 1.345 | dynamic | 2 |
| Food [301-304] | 0.069 | 0.923 | neither | 9.323 | 0.811 | sluggish | 6.309 | 1.013 | dynamic | 1 |
| Beverages [305] | 0.055 | 0.735 | neither | 8.386 | 0.729 | sluggish | 5.650 | 0.907 | sluggish | 0 |
| Tobacco [306] | 0.015 | 0.198 | sluggish | 7.691 | 0.669 | sluggish | 5.422 | 0.870 | sluggish | 0 |
| Textiles [311-312] | 0.088 | 1.179 | neither | 15.599 | 1.356 | dynamic | 8.743 | 1.404 | dynamic | 2 |
| Wearing apparel [313-315] | 0.072 | 0.975 | neither | 12.110 | 1.053 | dynamic | 8.199 | 1.316 | dynamic | 2 |
| Leather and leather products [316] | 0.305 | 4.103 | dynamic | 14.905 | 1.296 | dynamic | 9.421 | 1.512 | dynamic | 3 |
| Footwear [317] | 0.147 | 1.980 | dynamic | 12.267 | 1.067 | dynamic | 8.521 | 1.368 | dynamic | 3 |
| Wood and wood products [321-322] | 0.051 | 0.688 | neither | 13.897 | 1.208 | dynamic | 6.767 | 1.086 | dynamic | 2 |
| Paper and paper products [323] | 0.153 | 2.056 | dynamic | 8.360 | 0.727 | sluggish | 4.195 | 0.673 | sluggish | 1 |
| Printing, publishing and recorded media [324-326] | -0.088 | -1.179 | sluggish | 18.623 | 1.619 | dynamic | 8.180 | 1.313 | dynamic | 2 |
| Coke and refined petroleum products [331-333] | 0.085 | 1.150 | neither | 4.490 | 0.390 | sluggish | 2.147 | 0.345 | sluggish | 0 |
| Basic chemicals [334] | 0.138 | 1.852 | dynamic | 11.284 | 0.981 | sluggish | 4.901 | 0.787 | sluggish | 1 |
| Other chemicals and man-made fibers [335-336] | 0.076 | 1.025 | neither | 11.228 | 0.976 | sluggish | 5.286 | 0.849 | sluggish | 0 |
| Rubber products [337] | 0.095 | 1.286 | neither | 8.767 | 0.762 | sluggish | 4.630 | 0.743 | sluggish | 0 |
| Plastic products [338] | 0.113 | 1.523 | dynamic | 10.029 | 0.872 | sluggish | 4.514 | 0.725 | sluggish | 1 |
| Glass and glass products [341] | 0.172 | 2.321 | dynamic | 16.775 | 1.459 | dynamic | 7.498 | 1.204 | dynamic | 3 |
| Non-metallic minerals [342] | 0.088 | 1.184 | neither | 16.553 | 1.439 | dynamic | 7.449 | 1.196 | dynamic | 2 |
| Basic iron and steel [351] | 0.204 | 2.741 | dynamic | 5.164 | 0.449 | sluggish | 2.751 | 0.442 | sluggish | 1 |
| Basic non-ferrous metals [352] | 0.066 | 0.883 | neither | 4.833 | 0.420 | sluggish | 2.453 | 0.394 | sluggish | 0 |
| Metal products excluding machinery [353-355] | 0.045 | 0.600 | neither | 14.095 | 1.226 | dynamic | 7.050 | 1.132 | dynamic | 2 |
| Machinery and equipment [356-359] | -0.024 | -0.319 | sluggish | 24.044 | 2.091 | dynamic | 12.443 | 1.997 | dynamic | 2 |
| Electrical machinery and apparatus [361-366] | 0.136 | 1.833 | dynamic | 21.201 | 1.844 | dynamic | 9.954 | 1.598 | dynamic | 3 |
| Television, radio and communication equipment [371-373] | 0.094 | 1.263 | neither | 17.825 | 1.550 | dynamic | 7.988 | 1.282 | dynamic | 2 |
| Professional and scientific equipment [374-376] | 0.008 | 0.112 | sluggish | 19.554 | 1.700 | dynamic | 9.592 | 1.540 | dynamic | 2 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Motor vehicles, parts and accessories [381-383] | 0.086 | 1.163 | neither | 15.687 | 1.364 | dynamic | 8.502 | 1.365 | dynamic | 2 |
| Other transport equipment [384-387] | 0.000 | 0.000 | sluggish | 10.011 | 0.871 | sluggish | 4.833 | 0.776 | sluggish | 0 |
| Furniture [391] | 0.165 | 2.224 | dynamic | 5.670 | 0.493 | sluggish | 3.644 | 0.585 | sluggish | 1 |
| Other manufacturing [392-393] | -0.035 | -0.471 | sluggish | 5.003 | 0.435 | sluggish | 2.670 | 0.429 | sluggish | 0 |
| Electricity, gas and steam [41] | 0.071 | 0.955 | neither | 10.916 | 0.949 | sluggish | 4.815 | 0.773 | sluggish | 0 |
| Water supply [42] | -0.033 | -0.441 | sluggish | 14.418 | 1.254 | dynamic | 6.637 | 1.065 | dynamic | 2 |
| Building construction [51] | 0.138 | 1.855 | dynamic | 9.180 | 0.798 | sluggish | 6.150 | 0.987 | sluggish | 1 |
| Civil engineering and other construction [52-53] | 0.106 | 1.432 | neither | 8.133 | 0.707 | sluggish | 5.646 | 0.906 | sluggish | 0 |
| Wholesale and retail trade [61-63] | 0.014 | 0.192 | sluggish | 8.732 | 0.759 | sluggish | 4.394 | 0.705 | sluggish | 0 |
| Catering and accommodation services [64] | 0.087 | 1.175 | neither | 7.229 | 0.629 | sluggish | 4.546 | 0.730 | sluggish | 0 |
| Transport and storage [71-74] | 0.117 | 1.574 | dynamic | 4.450 | 0.387 | sluggish | 2.080 | 0.334 | sluggish | 1 |
| Communication [75] | 0.244 | 3.289 | dynamic | 4.326 | 0.376 | sluggish | 1.953 | 0.313 | sluggish | 1 |
| Finance and insurance [81-82] | 0.133 | 1.791 | dynamic | 9.192 | 0.799 | sluggish | 4.119 | 0.661 | sluggish | 1 |
| Business services [83-88] | -0.064 | -0.864 | sluggish | 21.866 | 1.901 | dynamic | 10.105 | 1.622 | dynamic | 2 |
| Medical, dental and veterinary services [93] | -0.020 | -0.276 | sluggish | 12.803 | 1.113 | dynamic | 8.135 | 1.306 | dynamic | 2 |
| Excluding medical, dental and veterinary services [94-96] | 0.088 | 1.191 | neither | 12.496 | 1.087 | dynamic | 8.095 | 1.300 | dynamic | 2 |
| Other producers [98] | 0.012 | 0.162 | sluggish | 11.716 | 1.019 | dynamic | 5.569 | 0.894 | sluggish | 1 |
| General government services [99] | 0.014 | 0.186 | sluggish | 9.965 | 0.867 | sluggish | 6.091 | 0.978 | sluggish | 0 |
| Total / Median | 0.074 | 1.000 | neither | 11.500 | 1.000 | neither | 6.229 | 1.000 | neither | |

Source: authors's calculations

Notes: 1) the columns headed "Index" show the product of the measures of connectedness and of dynamism given in the appropriate heading. 2) "Ratio" in each case refers to the ratio of the sector's index to the economy-wide median. 3) "Status" classifies sectors according to the ratio. Those that are more than 50% above the median are classified as dynamic, those that are more the 50% below are sluggish, while the remainder are neither. The final column is simply a count of the number of times a sector is classified as dynamic.

**Figure 2: Monthly development path indicator**