ASYMMETRY IN THE CYCLICAL BEHAVIOUR OF THE SOUTH AFRICAN LABOUR MARKET

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ABSTRACT

Economists have long been hypothesising that business cycles are asymmetric. Keynes (1936) argued that recessions are usually short but severe, while expansions are usually longer but milder and characterised by more gradual changes in economic indicators. Recently, several authors have argued that various economic indicators behave asymmetrically over the course of the business cycle (see for example Stern 2001, Acemoglu and Scott 1994, Rothman 1991, and Andolfatto 1997). This article examines the extent to which total and sectoral employment in the South African economy is related to the state of the business cycle. A Markov switching regime model is used to model the state of the business cycle, and this model is included in models of employment in the various economic sectors to capture cyclical asymmetry.

1 INTRODUCTION

Economists have long been hypothesising that business cycles are asymmetric. Keynes (1936) argued that recessions are usually short but severe, while expansions are usually longer but milder and are characterised by more gradual changes in economic indicators. Recently, several authors have argued that various economic indicators behave asymmetrically over the course of the business cycle. For example, recessions are characterised by sharp contractions in employment while employment only increases gradually during expansions. In the literature, employment (Acemoglu & Scott 1994), inventory investment (Stern 2001), wages (Acemoglu & Scott 1994), unemployment (Rothman 1991, Andolfatto 1997) and the unemployment-vacancy ratio (Acemoglu & Scott 1994) among others have been shown to behave asymmetrically over the course of the business cycle.

In this study, the potential asymmetry in the behaviour of employment over the business cycle will be studied. If this behavior is found to be asymmetric, this would have crucial implications for econometric modeling as well as stabilisation policy. Econometrically, an asymmetric relationship would necessitate the conditioning of summary statistics and forecasting rules on the state of the economy or business cycle. In addition, if the behaviour is found to

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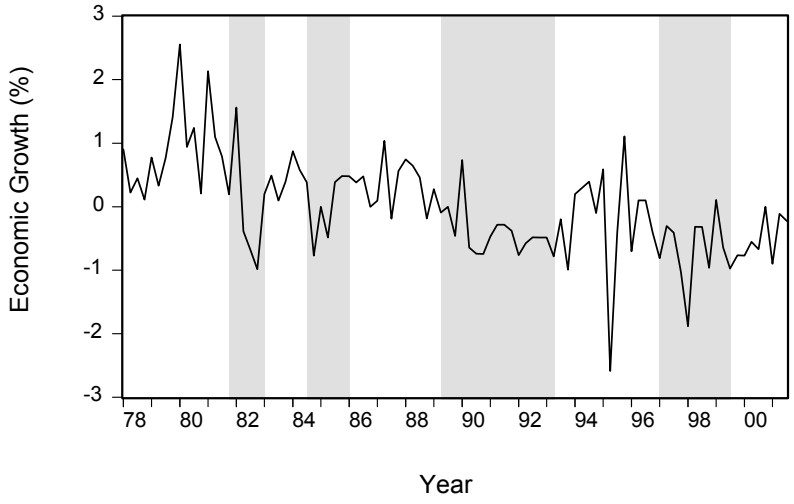
be symmetric, policies such as public works programmes could be used during downturns to counteract the decline in employment due to the fall in economic activity. However, if the behaviour of employment over the business cycle is found to be asymmetric, not only do the jobs that were destroyed by the decline in economic activity need to be replaced, but the slower replacement of jobs during the next economic upswing has also to be addressed.

The growth in employment is represented along with the state of the business cycle in figure 1 (the shaded areas are the periods of economic downswing according to the South African Reserve Bank (SARB)). It would appear from figure 1 that there is a positive relationship between the state of the business cycle and employment, since employment growth seems to be higher during economic upswings than during economic downswings. For example, the average growth in employment was clearly higher during the economic upswing from 1986 to 1989 than during the economic downswing from 1989 to 1993. It also seems as if the creation of employment opportunities during economic expansions is slower than the loss of employment opportunities during recessions. For example, the rate at which employment growth declined during the 1982 recession seems to be higher than the rate at which employment growth increased during the 1983-1984 expansion. In this study, the potential asymmetry in the behavior of the labour market over the business cycle will be evaluated econometrically.

FIGURE 1: EMPLOYMENT GROWTH AND BUSINESS CYCLE



There are three economic explanations for cyclical asymmetries in economic aggregates. First, the economy may react asymmetrically to positive and negative shocks (Caballero & Hammour 1992, Beaudry & Koop 1993). Second, different types of shocks may operate during different stages of the cycle, for example, adverse supply shocks may occur during recessions, while beneficial demand shocks occur during expansions. Third, over the course of the cycle, the propagation mechanism may change (Acemoglu & Scott 1994). The model in this paper cannot distinguish between the three alternatives; it merely tests for the presence of the asymmetry.

This article examines the extent to which the behaviour of the South African labor market is related to the state of the business cycle. In particular, the asymmetry of full employment will be evaluated. If full employment displays asymmetric behaviour, this means that the behaviour of employment in the private and/or public sectors must also be asymmetric. Likewise, if private and/or public sector employment behaves asymmetrically, the different subsectors within these sectors will have to be tested for asymmetric behaviour as well. The article is organised as follows: The South African labour market is described in section 2 and section 3 provides an overview of the relevant literature. In section 4 the state of the economy is modelled with the aid of a Markov switching regime model, which is used in section 5 to empirically analyse the cyclical asymmetry of employment. Section 6 provides some conclusions.

2 THE SOUTH AFRICAN LABOUR MARKET

The South African labour market is faced with very high and increasing unemployment, which officially reached a figure of around 29,5% in 2001 (Statistics SA 2002). It is clear from figure 2 that the number of employment opportunities has been declining at an alarming rate since the late 1980s. The unemployment problem is aggravated by the phenomenon of “jobless growth”, which refers to the failure of economic growth to solve the unemployment problem (see figure 3). Unemployment, which is mainly structural in nature, is caused by several factors including the increased use of capital and skill-intensive technology and an inflexible labour market (Du Toit 1999:105).

FIGURE 2: TOTAL EMPLOYMENT, MILLIONS

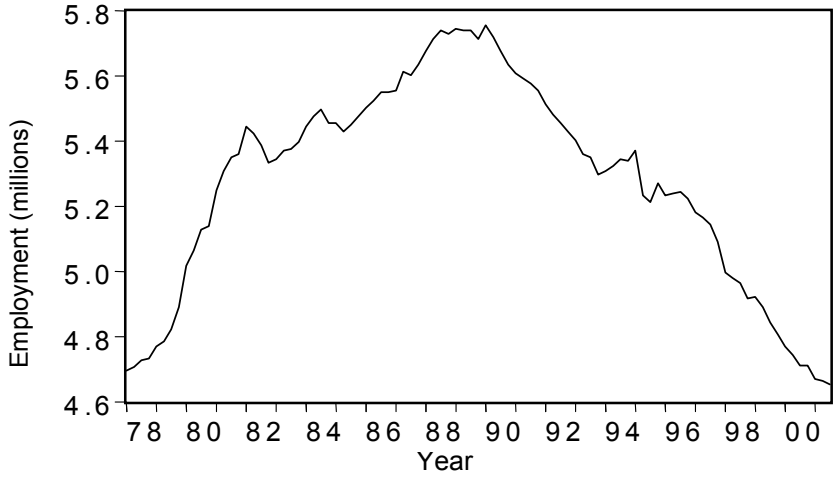
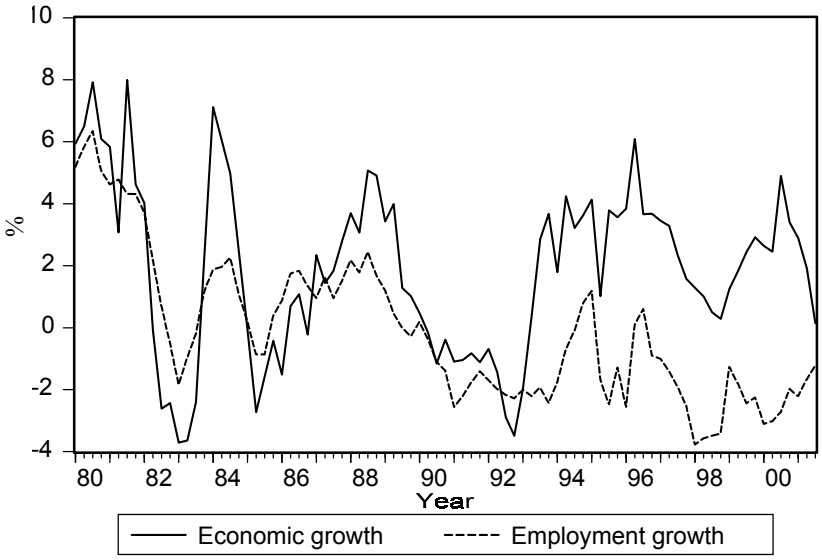


FIGURE 3: JOBLESS GROWTH

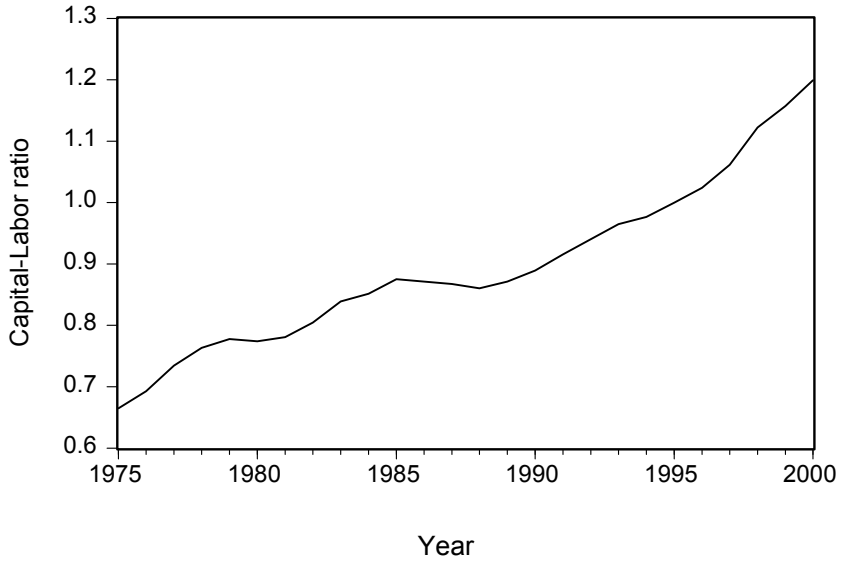


The inflexibility of the labour market, which can mainly be attributed to increased unionisation in the economy, directly and indirectly influences the cost of labour and hence the demand for labour, both in absolute terms and in terms of the labour-intensity of production (ie the ratio in which capital and labour are used). Firstly, unions put direct pressure on the wages of (relatively unskilled) labour (Hofmeyr 1993). With the high unemployment figures and the large oversupply of labour in the South African economy, wages would have been lower without unions (Barker 1999:145). This is evidenced by trends in wages in sectors with different levels of unionisation. In the highly unionised sectors (eg mining and manufacturing) wages have increased despite the decrease in economic activity. In contrast, the less unionised sectors (eg construction) experienced decreases or only small increases in the average wage rate, while wages in the non-unionised sectors (eg domestic services and agriculture) have dropped. Fallon and Lucas (1998) demonstrated that the elevation in wage levels caused by unionisation was responsible for a 6.3% decline in employment during the period 1980 to 1993.

Secondly, in addition to the direct influence on wages, unionisation also raises the cost of labour by causing an increase in strike activity. Since the 1980s, strike activity has increased considerably in South Africa. This is important for voice regulation and collective bargaining for employment conditions, but it has also led to a loss of 0.2% of total working time from 1986 to 1990, which in turn has negatively influenced production output and hence profits.

The trend of increasing capital deepening is a worldwide phenomenon which is especially marked in the South African economy where the capital:labour ratio has increased by 142 percent since 1970 (see figure 4). The economic sectors that experienced the most extensive capital deepening are the mining and agricultural sectors, followed by construction and manufacturing (Bhorat & Hodge 1999). This trend of capital deepening in South African can be attributed mainly to the low relative cost of capital and the inflexibility of the labour market. The low relative cost of capital can mainly be attributed to factors such as the negative or low real interest rates in South Africa as well as the tax concessions given on certain types of investment. The administrative and legislative control of labour in South Africa, which is relatively unskilled, has led to increasingly expensive unskilled labour, and growing unionisation has raised the cost of labour by increasing strikes (with accompanying production and productivity losses) and wages.

FIGURE 4: THE CAPITAL:LABOUR RATIO



In addition to the serious problems mentioned above, the South African economy is also characterised by the so-called "jobless growth" phenomenon, which refers to the inability of economic growth to create sufficient employment opportunities (see figure 3). Theoretically there is a positive relationship between economic growth and employment, since more employment opportunities are created when there is an upswing in economic activity. This relationship will be modelled empirically for the South African economy in order to improve the understanding of this (potentially asymmetric) relationship and hence the potential use of policy to smooth employment.

3 LITERATURE REVIEW

Acemoglu and Scott (1994) use inferred states from the Markov switching model with constant transition probabilities of the UK business cycle as the explanatory variable in single equations of labour market variables. They model employment, unemployment, the unemployment:vacancy ratio, and real wages. The inferred state variable is included in an additive and multiplicative way to autoregressive models. When the state of the economy is added additively, it captures the effect of shocks that affect

the state of the economy but not the dependent variable. When the state of the economy is added multiplicatively, in other words an interaction term between the autoregressive term and the state of the economy, it measures the difference in persistence between recessions and expansions. In most cases he found evidence of cyclical asymmetry.

In a similar study, Bodman (1998) examined the extent to which the properties of the unemployment growth rate in Australia are related to the state of the business cycle. He modelled the state of the economy by means of a Markov switching regime model, and included the variable generated by this model representing the state of the economy additively and multiplicatively in an autoregressive model. He found significant asymmetries and non-linearities in the unemployment rate that are related to the state of the business cycle.

Andolfatto (1997) found that cyclical movements in labour productivity cause symmetric fluctuations in the rate of job creation but asymmetric fluctuations in the rate of job losses. Specifically, the additional flow of job losses induced by a negative productivity shock is unmatched by additional job creation during expansions.

Rothman (1991) went beyond testing total aggregates for cyclical asymmetry. He showed that the total rate of unemployment of the US displays asymmetric behaviour, but then argues that this implies that some or all of the sectors should also be behaving asymmetrically. Therefore he also tested the unemployment rates disaggregated by sector, and found that the asymmetry stems mainly from the asymmetry in the unemployment rate of the manufacturing sector.

4 MODELLING THE STATE OF THE ECONOMY

Following Acemoglu and Scott (1994) and Bodman (1998), an estimate of the inferred state of the business cycle, s_t, is incorporated into autoregressive models of employment. The estimate of the inferred state of the business cycle is obtained from a Markov switching regime model. It will be shown that this state indicator accurately reflects the true state of the business cycle in each period, and that it outperforms several other indicators of the state of the business cycle.

Hamilton (1989) first introduced the Markov switching regime model, a stochastic regime model, to business cycle modelling. He applied it to economic growth, and his model has been increasingly used to assist in the dating and forecasting of turning points in the business cycle. The

model is conceptually appealing in that over time the variable of interest, such as some appropriate measure of the business cycle, is regarded as having a certain probability of switching abruptly among a number of regimes. In the case of the business cycle, expansions and contractions might be considered as the two regimes, each with unique characteristics such as a unique mean and variance. In other words, the business cycle switches between a high-growth and a low-growth regime.

These discrete shifts have their own dynamics, specified as a Markov switching regime process. An attractive feature of the model is that no prior information regarding the dates when the economy was in each regime, or the size of the two growth rates, is required. This is in contrast with models such as probit and logit models that require and depend heavily upon the exact dates of all the regimes in the history of the series. Instead, the probability of being in a particular regime is inferred from the data.

In this section, the South African business cycle will be modelled with the aid of a Markov switching regime model. The purpose of the Markov switching regime (MS) model is two-fold. First, it estimates the data generating process (DGP) of the variable under consideration. Second, it can be used to classify each observation into one of two regimes, which can in turn be used to predict turning points in the cycles when a number of observations in one regime are followed by a number of observations in the other regime.

A first-order, two-regime Markov switching regime model was estimated for the South African business cycle. The model was specified as follows:

$$Y_t = \mu_2(1-S_t)+\mu_1 S_t +\phi_1(Y_{t-1}-(\mu_2(1-S_{t-1})+\mu_1 S_{t-1}))+\phi_2(Y_{t-2}-(\mu_2(1-S_{t-2})+\mu_1 S_{t-2}))$$
$$+\phi_3(Y_{t-3}-(\mu_2(1-S_{t-3})+\mu_1 S_{t-3}))+\phi_4(Y_{t-4}-(\mu_2(1-S_{t-4})+\mu_1 S_{t-4}))+\varepsilon_t$$

where $\varepsilon_t \sim N(0,\sigma^2)$

S_t = 1 if low-growth regime, 0 otherwise

$P(s_t=j|s_{t-1}=i) = p_{ij,t}$ i, j = 0,1

Notice that, since $p_{12,t} = 1 - p_{11,t}$ and $p_{21,t} = 1 - p_{22,t}$, the transition probabilities are completely defined by $p_{11,t}$ and $p_{22,t}$.

Following Filardo (1994), Durland and McCurday (1994), among others,

the transition probabilities were modelled with the aid of a logit function:

$P_{11,t} = p(S_t = 1 \mid S_{t-1} = 1) = \exp(\alpha_1+\beta_1 z_{t-k})/(1+\exp(\alpha_1+\beta_1 z_{t-k}))$
$P_{00,t} = p(S_t = 0 \mid S_{t-1} = 0) = \exp(\alpha_0+\beta_0 z_{t-k})/(1+\exp(\alpha_0+\beta_0 z_{t-k}))$

where z_t are the information variables that can include a leading indicator, and α and β the coefficients estimated with maximum likelihood.

Table 1 presents significant evidence to support the assumption that two distinct growth-rate phases characterise the business cycle. The point estimates of the regime-dependent means, μ_o and μ_1 are statistically different. More important, their magnitudes differ significantly in economic terms. The mean growth rate in the high-growth regime, μ_1 is significantly positive, while the mean growth rate in the low-growth regime, μ_0, is significantly positive. Because the sample dichotomises into phases that exhibit declining aggregate output and growing aggregate output, each can be labelled as low-growth and high-growth regimes of the economy.

TABLE 1 PARAMETERS OF GROWTH EQUATION IN MARKOV MODEL

$$Y_t = \mu_2(1-S_t)+\mu_1 S_t +\phi_1(Y_{t-1}-(\mu_2(1-S_{t-1})+\mu_1 S_{t-1}))+\phi_2(Y_{t-2}-(\mu_2(1-S_{t-2})+\mu_1 S_{t-2}))$$
$$+\phi_3(Y_{t-3}-(\mu_2(1-S_{t-3})+\mu_1 S_{t-3}))+\phi_4(Y_{t-4}-(\mu_2(1-S_{t-4})+\mu_1 S_{t-4}))+\varepsilon_t$$

Parameter	Coefficient	Std error
μ_0	-1.061275	0.287213
μ_1	3.741749	0.313490
φ_1	0.332210	0.064285
φ_2	0.035363	0.067236
φ_3	-0.032597	0.068706
φ_4	0.001868	0.067109
σ^2	2.693322	0.293941

TABLE 2 PARAMETERS OF TRANSITION PROBABILITY EQUATION IN MARKOV MODEL

TVTPmodel:

$$p_{ii,t} = p(S_t = i \mid S_{t-1} = i) = \exp(\alpha_i + \beta_i z_{t-k}) / (1 + \exp(\alpha_i + \beta_i z_{t-k}))$$

Parameter	Coefficient	Std error
α_0	-0.880836	0.567530
β_o	-0.784035	0.418566
α_1	1.250595	0.555241
β_1	0.388441	0.184527

According to the results in table 2, all the estimated coefficients in the generation process of the transition probabilities are significant. The parameters that govern the time-variation of the transition probabilities, β_1 and β_0, have opposite signs. This is consistent with the intuition that an increase in the value of the leading indicator increases the probability of remaining in a period of expansion and decreases the probability of remaining in a recession. The parameters α_0 and α_1 determine the unconditional mean duration of recessions and expansions. The estimates capture the potential asymmetry in duration across expansions and recessions.

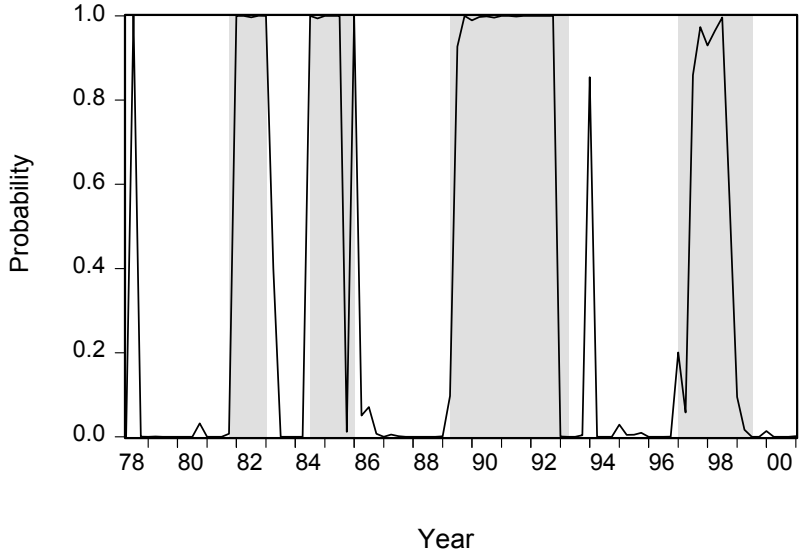
Figure 5 plots the inferred probability of a low-growth-rate regime given the available data. When above (below) 0.5, the economy is more likely to be in a recession (expansion). The inferred regimes of the FTP model correspond to the official cycles of the SARB. The shaded areas represent the official recessions/expansions (see table 3).

TABLE 3: BUSINESS CYCLE PHASES ACCORDING TO THE SARB SINCE 1978

Upward phase		Downward phase	
January 1978	August 1981	September 1981	March 1983
April 1983	June 1984	July 1984	March 1986
April 1986	February 1989	March 1989	May 1993
June 1993	November 1996	December 1996	August 1999

The turning points predicted by the Markov model are highly correlated with the dates of the official turning points, and the regime probabilities are generally very close to 0 or 1, so the model always specifically indicates one of the regimes. The Markov model gave "false" signals of an expansion in 1985 and a recession in 1994, but both these signals only lasted for one quarter, and can therefore be eliminated by applying the common dating rule that a cycle should last for at least two quarters. However, instead of regarding these signals as "false" simply because they don't correspond to the official dates, a careful analysis of the periods during which they occurred might show that they were not truly false in the sense of incorrectly indicating the general state of the economy.

FIGURE 5: MARKOV MODEL: TIME-VARYING TRANSITION PROBABILITIES



The business cycle definition used by the SARB classifies a recession as at least two consecutive quarters of negative economic growth. In other words, if only a single quarter of negative growth is experienced it will not be reflected by the official recessions. For example, during the first quarter of 1994, the economy was contracting by 0.6% but since the

previous and following quarters both showed positive economic growth this was not defined as a recession. The high recession probability in the first quarter of 1994 can therefore be seen as reflecting this drop in economic growth rather than giving a false signal. Likewise, the low recession probability in the last quarter of 1985 corresponds to a positive economic growth rate, but since growth was negative during the following quarter the economy was officially still in a recession. This was also the case with the third quarter of 1978.

This means that the differences between the Markov model and the official classification should not be viewed as "false" signals, but should rather be viewed as additional information yielded by the Markov model regarding the true state of the economy which are not influenced by the asymmetric classification definition used by the SARB. The Markov switching model's recession indicator is also superior to that of the SARB in that it is more timeously, in fact contemporaneously, available and hence more useful for forecasting purposes as well as for policy makers and other economic agents who need to know the current state of the economy without having to wait around five months for the SARB indicators.

5 THE CYCLICAL ASYMMETRIC BEHAVIOUR OF EMPLOYMENT

In this section, the potential cyclical asymmetry in total employment in the South African economy will be analysed empirically. All the data were obtained from the Quarterly Bulletin of the South African Reserve Bank (www.reservebank.co.za). Following Acemoglu and Scott (1994) and Bodman (1998), an estimate of the inferred state of the business cycle, s_t, is incorporated into autoregressive models of employment. The estimate of the inferred state of the business cycle is obtained from the Markov switching regime model presented in the previous section. If total employment is found to exhibit asymmetric behaviour, total employment will be divided into public and private sector employment, which will be analysed to see where the asymmetry stems from. Likewise, if public and/or private sector employment behaves asymmetrically, they will be divided into subsectors that will be analysed as well.

The inferred state variable (s_t) is included both additively and multiplicatively in each autoregressive model. If the state variable (s_t) is significant when included additively, this means that two types of shocks need to be accounted for in persistence and impulse response analysis, shocks that shift the business cycle from one state to another, and shocks that impact on the labour market variable but not on the state of the

business cycle. If the interaction term is significant, this means that the persistence of all shocks varies between booms and recessions. The following model is fitted to employment:

$$X_t = \beta_0 + \beta_1 X_{t-1} + \beta_2 S_{t-1} + \beta_3 S_{t-1} X_{t-1}$$

where X_t is the percentage change in employment in period t, S_t is the state of the economy in period t as estimated by the Markov switching regime model, and β_i for i= 0,1,2,3 the coefficients.

FIGURE 6: EMPLOYMENT: TOTAL, PRIVATE SECTOR AND PUBLIC SECTOR

The results of the regression analyses are presented in table 4. Standard errors are provided below the coefficients in parentheses, and coefficients that are significant at a 10% level of significance are indicated in bold print.

The results in table 4 show that total employment displays asymmetric behaviour since the term representing the state of the economy is

significant. This means that employment behaves different during expansions and recessions. The asymmetry in total employment means that the public and/or private sectors behave asymmetrically as well. According to the results in table 4, employment in the private sector behaves asymmetrically but there is no evidence of asymmetry in the public sector. This implies that some or all of the different private sectors should also behave asymmetrically.

The results given in table 4 show that all the sectors except the trade sector display asymmetric behaviour over the business cycle. For all four sectors displaying asymmetry, the additive term (S_{t-1}) is significant. This means that measures of persistence and impulse response analysis have to accommodate two types of shocks, namely those that affect only the state of the economy but that do not directly affect unemployment, and those that affect unemployment and not the state of the economy.

TABLE 4 RESULTS OF REGRESSION ANALYSES

Sector	β_0	β_1	β_2	β_3
Total	**0.000713**	0.410560	**-0.002638**	-0.097254
	0.000920	(0.113084)	(0.001693)	(0.233495)
Public	0.0005	0.169889	0.001057	0.249698
	-0.0016	(0.110591)	(0.002846)	-0.327967
Private	0.0007	**0.520988**	**-0.004308**	-0.202109
	-0.001	(0.112520)	(0.001882)	(0.210871)
Construction	0.00144	**0.347493**	**-0.010384**	-0.009820
	-0.0027	(0.117200)	(0.005227)	(0.218788)
Mining	-0.0018	-0.009655	**-0.008648**	0.26306
	-0.0026	(0.152444)	(0.005042)	(0.211795)
Financial	**0.00437**	0.464550	**-0.001421**	-0.319349
	-0.0017	-0.11812	(0.002949)	-0.223854
Manufacturing	0.0003	**0.650445**	**-0.003478**	**-0.369767**
	(0.000981)	-0.0975	-0.0019	(0.212917)
Trade	0.002088	**0.274206**	-0.0015	0.09223
	(0.001338)	-0.12729	-0.0022	-0.212767

Table 5 presents the employment growth rates for the sectors in which the growth rates differ between recessions and expansions. Employment growth is lower for all sectors during recessions than during expansions, which implies that recessions are characterised by sharp contractions in employment while employment only increases gradually during expansions. This is consistent with the commonly held view that economic recessions seem to be characterised by sharp but short-lived declines in employment, output and other economic aggregates, whereas expansions seems to be characterised by more gradual increases (Davis 1984; Neftci 1984; Brunner 1992; Hussey 1992).

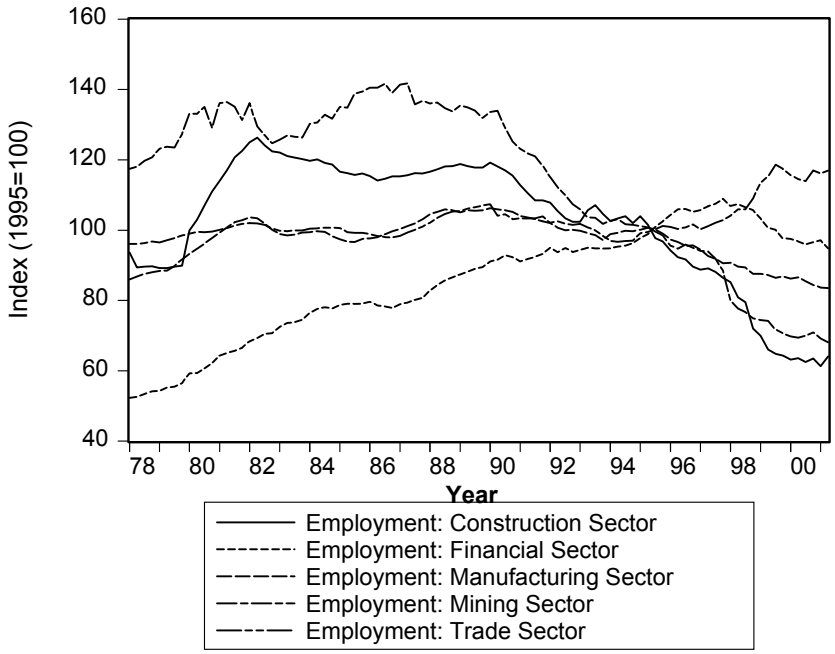
Total employment grows by approximately 0.07% per quarter during expansions while it contracts by approximately 0.19% per quarter during recessions. Private sector employment also grows by approximately 0.07% per quarter during expansions, while it contracts by 0.36% during recessions. In the construction and manufacturing sectors, employment contracts faster during recessions than what it increases during expansions. In contrast, the employment growth rate in the financial sector is lower in recessionary periods than in expansions, but it is always positive. In other words, jobs are always being created in the financial sector, albeit at a slower rate during recessions. The opposite is true for the mining sector. In this sector, employment growth is negative during recessions as well as expansions, although it is lower during recessions. This means that jobs are constantly being shed in the mining sector, although this happens at a slower rate during expansions.

The interaction term ($S_{t-1}X_{t-1}$) was insignificant in all the sectors, except for manufacturing. This means that the persistence of shocks to employment in the manufacturing sector varies between recessions and expansions. The autoregressive term during expansions is 0.65045, compared to 0.2807 during recessions. In other words, shocks are more persistent during expansions than during recessions. This is consistent with the results of Acemoglu and Scott (1994) for the UK labour market and Stock (1989) for the US labour market.

TABLE 5: EMPLOYMENT GROWTH RATES IN RECESSIONS AND EXPANSIONS

Sector	Total	Private	Con-struction	Mining	Finan-cial	Manu-facturing
Recession	-0.0019	-0.0036	-0.0089	-0.0104	0.0029	-0.0031
Expansion	0.0007	0.0007	0.0014	-0.0018	0.0044	0.0003

FIGURE 7: SECTORAL EMPLOYMENT



6 CONCLUSION

This article examined the extent to which the behaviour of the South African labour market is related to the state of the business cycle. A Markov-switching regime model was used to generate a variable representing the state of the economy. It was shown that this variable is superior to the official business cycle classification of the SARB in that it more accurately reflects the state of the economy. In addition, it is immediately available, whereas the SARB indicator is only available after a considerable time lag. Timeous availability is crucial for forecasting as well as policy purposes.

This Markov switching regime variable has been included multiplicatively and additively in autoregressive models of employment in different sectors of the South African economy to capture two types of cyclical

asymmetry. The results showed that total employment displays cyclical asymmetry, which stems from private rather than public sector employment. The cyclical asymmetry of private sector employment stems from asymmetry in the construction, mining, financial and manufacturing sectors while employment in the trade sector behaves symmetrically.

For all the sectors showing cyclical asymmetry, employment growth is lower during recessions than during expansions, which implies that recessions are characterised by sharp contractions in employment while employment only increases gradually during expansions. This is consistent with the commonly held view that economic recessions seem to be characterised by sharp but short-lived declines in employment, output and other economic aggregates, whereas expansions seem to be characterised by more gradual increases (Davis 1984; Neftci 1984; Brunner 1992; Hussey 1992).

In the construction and manufacturing sectors, employment contracts faster during recessions than it increases during expansions. Employment growth is always negative in the mining sector while it is always positive in the financial sector. However, jobs in the mining sector are shed more slowly during recessions than during expansions, while jobs in the financial sector are created faster during expansions than during recessions.

These results have crucial implications both for econometric modeling and for economic policy. Forecasts and estimations of employment should be tailored to the state of the business cycle. Policy makers need to take the implications of these cyclical asymmetries into account when creating stabilisation policies.

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