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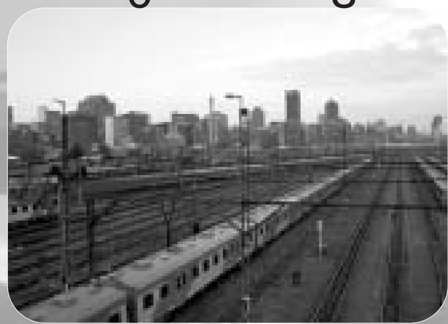

PAPERS

The Productivity -Wage Relationship in South Africa: An Empirical Investigation

Jeremy Wakeford

Development Policy Research Unit
School of Economics, University of Cape Town

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Jeremy Wakeford[*]

School of Economics, University of Cape Town
Private Bag, Rondebosch, 7701
jwakefor@commerce.uct.ac.za

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EXECUTIVE SUMMARY

The aim of this paper is to investigate the empirical relationship between productivity, real wages and unemployment in South Africa using appropriate time series econometric techniques. The value of this approach is that it imposes no *a priori* theoretical assumptions on the relations between the variables, but rather allows the data to 'speak for themselves'. The results may then be used in one of two ways. Either they allow one to interrogate the validity of the data by comparing the results with well-established labour market models, or – assuming the data is deemed reliable – they can be used to provide evidence for or against labour market theories. This seems however to land one in a 'catch 22' situation, and inevitably the economist has to make an informed assumption about which more is reliable: the data, the theoretical models, or neither. In the present case, the real wage and productivity data are regarded as fairly reliable, but the unemployment series is rather makeshift in the absence of accurate annual data over a long period of time. The long run upward trend in unemployment does however seem plausible.

The key findings of the study are as follows. First, there is strong evidence of a structural break in 1990, which seems to have affected the level of employment in the first instance, and fed through into other variables such as per worker wages and productivity. This evidence is substantiated by various economic and policy factors as well as by other empirical work.

Second, real wages, productivity and unemployment have all risen rapidly since 1990. A long-run equilibrium (cointegrating) relationship seems to exist between real wages and productivity for the period 1983 to 2002, but unemployment was apparently not connected to the other two variables. There is also strong evidence that productivity and real wages are cointegrated in the period 1990 to 2002. In the long run, a 1% rise in productivity is associated with an approximately 0.58% rise in real wages. The econometric modelling matches the preliminary analysis of growth rates, in that real wages have not kept pace with productivity gains in the long run.

Third, the unemployment rate behaves in a manner inconsistent with the theory underlying the specification of the wage curve equation. The econometric results show that unemployment is divorced from the long-run equilibrium between real wages and productivity. More specifically, it seems clear that in the South African labour market, the high rate of unemployment has little or no effect in terms of restraining real wage growth. Conversely, real wage increases cannot be blamed for raising the level of unemployment. This carries the implication that the neoclassical view of the labour market has serious shortcomings. On the other hand, this study provides evidence for the insider-outsider model of the labour market, in that it appears as if the unemployed have little effect on wage rates.

Fourth, the econometric evidence suggests the following dynamic (short-run) causal system operates in the labour market: real wages impact on productivity negatively but productivity has no effect on real wages; productivity has a weak autoregressive pattern but real wages lacks this altogether; and adjustment to equilibrium occurs through both wages (negatively) and productivity (positively). Not much can be said about unemployment in the short run owing to the construction of the unemployment data series.

Fifth, given the economy's slow growth performance over the past decade, the rapid rise in productivity (and average real wages) reflects in large part the sharp decline in employment levels. South Africa's productivity performance should not therefore be looked at in isolation of the employment trend, which indicates the job-shedding nature of economic growth in this country over the past 13 years. The decline in employment cannot be fairly blamed on real wages growing in excess of productivity (forcing employers to cut jobs). The reverse is true, i.e. productivity has grown faster than real wages. As a result, labour's share of gross output has been shrinking over the past decade, and has now reached its lowest proportion relative to capital's share in the past 40 years. This trend has been observed in many other developing countries around the world, and reflects an increasing concentration of wealth among owners of capital. This is particularly alarming in the South African case given our high levels of inequality, poverty and unemployment.

An ancillary conclusion of the paper is that in some cases, economists and policy makers can learn just as much from simple graphical representations of key economic data series as they can from the application of sophisticated econometric modelling. The example provided by this paper is that examining a graph of labour's share of value added is roughly equivalent to testing for a cointegrating relationship between productivity and real wages.

This research opens up at least two possible avenues for further investigation. One is to repeat the analysis at a sectoral level, since aggregation to the national level may obscure further complexities in the labour market. Another potentially enlightening way forward would be to unpack the factors that have contributed to the recently declining share of wages in value added, perhaps via econometric modelling of the wage share. This seems particularly important in the light of South Africa's widening inequality and our economy's susceptibility to external shocks.

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey–Fuller
AIC	Akaike Information Criterion
DBSA	Development Bank of Southern Africa
DF	Dickey–Fuller
ECM	Error Correction Model
GDP	Gross Domestic Product
HQC	Hannan–Quinn Criterion
LFS	Labour Force Survey
LM	Lagrange Multiplier
OHS	October Household Survey
OPEC	Organisation of Petroleum Exporting Countries
SARB	South African Reserve Bank
SBC	Schwarz Bayesian Criterion
StatsSA	Statistics South Africa

1 INTRODUCTION

Real wages, productivity and the unemployment rate represent an important nexus within labour markets, which has received a significant amount of attention in the economics literature. Several economic theories have been put forward justifying a relationship among these variables, including efficiency wage, bargaining, search and contract theories. This paper aims to contribute to the body of literature addressing the productivity–wage–unemployment relationship in South Africa by applying modern time series econometric methods. Rather than setting out to test a specific theory, the objective is to 'let the data speak for themselves', i.e. to apply statistical techniques to establish the properties of the time series and their inter-relationships. These results can then be compared to various economic theories.

The following specific questions are addressed in the paper. First, is there a long-run equilibrium (cointegrating) relationship between productivity, real wages and unemployment? Second, what are the short-term or dynamic relationships among these variables? Third, can statistical techniques shed any light on the directions of causality between the three series? A fourth and related issue to be explored is how labour's share of value added has changed over time, relative to the profit share.

The structure of the paper is as follows. Section 2 presents a brief review of some relevant international and South African literature exploring the links between productivity, real wages and unemployment, and thereby provides a backdrop for the empirical analysis. Section 3 outlines the empirical methodology and describes the data used in the study. Section 4 analyses the data and reports the results of cointegration tests, error correction models and causality tests. Section 5 discusses the issue of labour's share of gross value added. Section 6 summarises the main results and presents the conclusions.

2 LITERATURE REVIEW AND THEORETICAL BACKGROUND

This section begins by discussing the definitions of the variables, and then turns to brief reviews of some relevant international and South African studies for comparative purposes. It concludes with a discussion of the various possible causal links between real wages, labour productivity and unemployment.

2.1 Defining Real Wages, Productivity and Unemployment

Real wages are defined in different ways in the literature. They may either be real consumption wages (where nominal wages are deflated by the consumer price index to provide a measure of workers' real purchasing power) or real product wages (where nominal wages are deflated by the producer price index to provide a measure of the labour cost of production). The appropriate choice of wage measure depends on the exact relationship being investigated, but is by no means unambiguous. For example, in a situation of contract bargaining, workers are concerned with their real purchasing power (hence consumption wages), while management are more concerned with their production costs (hence product wages). Resolving this ambiguity may involve a somewhat arbitrary choice of either consumption or production wages. This study chooses a variant of real product wages, where the gross domestic product deflator is used to deflate the nominal wage rate. This may be seen as a compromise, and also makes it fit most closely with the measure of productivity used, which is based on real value added. A final point to note is that we consider *average* (i.e., per worker) real wages. The series is derived by dividing the total wage bill by the number of workers employed, which carries the implication that observed changes in average real wages could emanate from changes in either the wage bill or the level of employment, or both.[1]

Theoretically, the most appropriate concept of productivity in economics is marginal productivity, i.e., the contribution to output of the last worker hired. However, this cannot be readily measured. Next best would be a measure of output per hour of labour input, but again such a measure

[1] More precise details of the data used in this study are provided in section 3.

is not easily obtainable.[2] In practice, therefore, one often has to resort to the use of average labour productivity, which may be calculated in various ways, e.g. total output (either in physical or monetary terms) divided by total employment. Better, though, is value added per worker, which is the measure adopted in this study. In doing so we follow the precedent, in South Africa, of Fallon and Pereira da Silva (1994), for whom the logarithm of non-government GDP expressed as a ratio of non-government employment is taken as an index of productivity. Clearly, the 'productivity' series is affected both by value added (positively) and by employment levels (negatively). This obfuscates the interpretation of changes in measured productivity, since, for example, an observed increase in our measure of productivity may be due to a decline in employment levels with no increase in physical output or value added. This issue is discussed further in section 5.

The definition and measurement of unemployment is a thorny issue. The main differentiation is between the so-called 'strict' definition, which includes only active work seekers in the labour force, and the 'expanded' or 'broad' definition, in which "all persons are considered as unemployed who did not work in the past week and who either looked for work in a given reference period or were discouraged workers, i.e., they did not look for work in the belief that none was available" (Kingdon and Knight, 1998: 1). The unemployment data used in the present study is based on the broad definition, in recognition of the arguments put forward by Nattrass (2000: 76), for example that "[g]iven the low probability of finding employment, high transport costs… and low incomes, one would expect a labour-surplus economy like South Africa to manifest a high level of discouraged work seekers." This is contrary to the government's stance, i.e. that the 'official rate' of unemployment is defined as the strict measure.

2.2 International Literature

The relationship between labour productivity, real wages and unemployment has received a large amount of attention in the international and (to a lessor extent) South African literatures, although a number of different approaches have been taken. The purpose of this brief review is to provide a flavour of some of these approaches, and thereby establish the theoretical and prior empirical basis for the quantitative analysis conducted in section 4.

Blanchflower and Oswald (1990, 1994, and 1995) pioneered an international wage curve literature, in which a negative relationship between real wages and unemployment is hypothesised and substantiated empirically. This represented a departure from the previous literature on the subject, developed initially by Harris and Todaro (1970), who argued – on the basis of compensating differentials – that the relationship between wages and unemployment is expected to be positive across space. Blanchflower and Oswald (1994: 1026) employ a number of different model specifications, which include controls for personal characteristics, and find a wage-unemployment "elasticity" of approximately –0.10.

The approach taken in this paper differs from that of Blanchflower and Oswald (1994) in two important respects. Firstly, the main emphasis is on the relationship between wages and productivity, as opposed to that between wages and unemployment. Secondly, a time series econometric approach is applied to macroeconomic data, in contrast to these authors' spatial approach using panel data. Nevertheless, their micro evidence provides a testable hypothesis, namely a negative relationship between unemployment and wages.

Wage equations have also been derived and estimated in recent international macroeconomic literature (see Blanchflower and Oswald [1994] for a list of citations). For example, Blanchard and Katz (1999) suggest the following specification:

$$\ln w_t - \ln p_t^e = a + b \ln prod_t + d(\ln w_{t-1} - \ln p_{t-1}) + l U_t + e_t \qquad (1)$$

[2] Certainly not in South Africa.

where w_t is the nominal wage rate, $prod_t$ is the level of productivity, U_t is the unemployment rate, and p_t^e is the expected price level in time t.

Once again, the coefficient on the unemployment term is expected to be negative. The lagged real wage term is included to reflect earnings from participation in activities outside of the labour market, i.e., a proxy for the reservation wage. In the South African context it is implausible that lagged real wages in the formal sector relate to the levels of earnings derived from activities outside of the formal sector or even that these extra-labour market activities exert a direct influence on the level of real wages. On both counts, this lagged term cannot therefore be taken to proxy the reservation wage in a South African version of equation (1) – at least from a theoretical perspective. As will be seen, however, the statistical approach taken in this paper is able to test explicitly whether a lagged real wage term is appropriate empirically (although it need not be seen as a proxy for the reservation wage).

The methodology adopted in the present paper follows that of Alexander (1993), who investigates the relationship between productivity, wages and unemployment in the United Kingdom (at a macroeconomic level) for the period 1955 to 1991. After finding evidence of a structural break in 1979, Alexander (1993) divides her sample into two sub-periods. She then applies the cointegrating vector autoregression (VAR) methodology, developed by Johansen (1988), to test for long-run relationships, and finally applies the concept of Granger causality[3] in an attempt to establish empirically the causal links between the three variables. Alexander's (1993: 88) principal finding is that the relationships differed significantly between the sub-periods: "[b]efore 1979 unemployment is the central variable, being caused by both wages and productivity", while after 1979 she finds "a strong bivariate causality between wages and productivity, unemployment becoming almost divorced from the system." She relates this shift to a change in the policy environment introduced by Margaret Thatcher.

2.3 South African Literature

In the South African literature, the relationship between wages, productivity and unemployment has thus far been addressed mainly in terms of a real wage equation, in which wages are determined by a variety of factors. These determinants include productivity, unemployment, extent of unionisation, number of strikes, intensity of apartheid, and (in pooled time series–cross section regressions) legislated minimum wages and year and industry dummy variables (see Fallon, 1992; Fallon and Pereira da Silva, 1994; Fallon and Lucas, 1998). However, in only one instance is something analogous to a productivity term included on the right hand side of the equation. This single exception is the wage equation for skilled workers, for whom the estimated real wage–'productivity' elasticity is 0.51 in Fallon (1992: 44) and 0.309 in Fallon and Pereira da Silva (1994: 207). Another point to note is that all of this literature deals with the real consumption wage rather than the real product wage, which is the emphasis of the present study.[4] Of all the possible explanatory variables, the two that are focused on in this study are productivity and unemployment.[5]

Unemployment is of great importance in the South Africa context, and consequently it may be expected to be a key determinant of real wages. Kingdon and Knight (1998) apply the wage curve methodology of Blanchflower and Oswald (1994) to South Africa, using household survey data. They find evidence of a negative relationship between wages and unemployment across space, but reconcile this with a positive relationship over time for the macroeconomy as implied by the negative wage elasticity of employment found by Fallon (1992) and Fallon and Lucas (1997).

In a study of 48 South African economic sectors, Fedderke and Mariotti (2002: 853) find that "where the real wage is less closely linked to real labour productivity, the growth in employment also

[3] 'Granger causality' is defined in section 3.1.

[4] An extensive review of the real wage estimations of Fallon (1992), Fallon and Pereira da Silva (1994) and Fallon and Lucas (1998) revealed nothing else of direct relevance for an investigation of the productivity–real wage relationship.

[5] Preliminary analysis of a strike variable revealed no significant statistical relationship with the other variables.

tends to be lower." Furthermore, they find that when wages grow faster than productivity, employment declines (from which may be inferred that unemployment rises). Another result of Fedderke and Mariotti's (2002: 850) analysis is that "for all the sectors with a strong improvement in real labour productivity, there is a strong improvement in the real per labour remuneration," indicating that productivity drives wages. While their work utilises sectoral panel data as against aggregate time series data, and focuses on employment as opposed to unemployment, similar relationships between our three key variables are expected in the present paper for the formal, non-agricultural economy.

2.4 Causality Issues

On the basis of theory and previous empirical evidence, a number of causal relations between real wages, productivity and unemployment may be hypothesized for the South African economy. These are summarised in Table 1, along with the expected signs.

Changes in productivity may cause changes in real wages for at least two reasons: (i) if individuals' pay is performance-based; and (ii) if labour unions bargain for real wage increases on the basis of past improvements in productivity. The effect of an increase in average labour productivity on unemployment is ambiguous. It could reduce the demand for labour, as workers are more efficient, and hence raise the unemployment rate (assuming other factors such as the labour force participation rate remain constant). Alternatively, a rise in productivity could have a positive impact on employment through an 'output effect', thereby reducing the unemployment rate, *ceteris paribus*.

According to efficiency wage theory, a rise in real wages may induce higher worker productivity by raising the costs of job loss. At the macroeconomic level, increasing real wages are expected to raise the cost of labour and therefore cause factor substitution from labour to capital. This could have two effects: it could raise marginal (and hence average) labour productivity, and it could add to the unemployment rate. Therefore real wages are hypothesized to affect positively both productivity and unemployment.

If the unemployment rate were to rise (as a result of factors other than real wage or productivity increases), one may expect this to weaken union bargaining power and therefore dampen real wages. Also, a rise in unemployment may incentivise workers to increase effort and hence productivity to secure their jobs. Furthermore, it is likely that less productive workers are the first to be retrenched, and so increased unemployment may be associated with higher average productivity among the remaining workers.

Table 1: Hypothesized causal relations among real wages, productivity and unemployment

Causal Direction	Expected sign	Rationale
PROD → RW	+	Performance-based pay; bargaining.
PROD → UR	+	Greater efficiency implies reduced labour demand.
	–	Positive output effect on employment.
RW → PROD	+	Efficiency wages.
RW → UR	+	Higher labour costs causes factor substitution.
UR → RW	–	Surplus labour weakens union bargaining power.
UR → PROD	+	Workers increase effort to secure jobs; less productive workers are fired first.

Clearly, this discussion suggests that the inter-relationships between productivity, real wages and unemployment are highly complex, with many feedback effects as well as ambiguous or multiple signs. This paper attempts to shed some light on which of these effects are strongest, on the basis of empirical testing.

The causality between productivity and real wages carries massive policy implications in terms of the distribution of income in South Africa. If real wage increases (e.g. due to strong unions) are driving productivity gains through substitution of capital and technology for labour, then it can be concluded that workers (unions) are (at least partially) responsible for increasing unemployment, inequality and poverty. If, on the other hand, productivity is rising ahead of real wages, then capital (business) is capturing an ever-larger share of the pie at the expense of labour (both the employed and the unemployed).

As a final note, the widespread existence of one-year contracts in the formal labour market lends credence to the view that the variables may influence each other after some time lag rather than contemporaneously. Furthermore, labour market data become available only after a certain lag (usually at least two quarters). Consequently, if workers have one opportunity to bargain for higher real wages per year, they are likely to base their demands on the growth in productivity in the year up to the latest available data, which is likely to be six months old. Hence productivity could influence real wages after a lag of at least two quarters. The plausibility of lags in these relationships underpins the vector autoregression (VAR) econometric specification as well as the use of Granger causality tests, both of which are discussed further in the next section.

3 METHODOLOGY AND DATA

3.1 Empirical Methodology

The methodology used to investigate the productivity–wage–unemployment nexus is as follows. First, the series are presented graphically, as much can be learned from plots about the behaviour of the variables over time. For example, it is important to look for evidence of trends and structural breaks in time series. Following the common practice in macroeconomics, and Alexander (1993) in particular, a natural logarithm transformation is applied to the real wage and productivity series for the remaining analysis.[6] Augmented Dickey–Fuller tests are then applied to the three series to determine their order of integration.

Assuming the variables are found to be nonstationary, the next step is to apply Johansen's (1988) multivariate test for cointegration. This approach is superior to the Engle–Granger (1987) approach for two main reasons: (i) we have a system of three variables which may all be endogenously determined, suggesting that a vector autoregression (VAR) framework is appropriate (i.e. no one variable is clearly *the* dependent variable); (ii) the statistical properties of the Johansen test are superior to those of Engle–Granger. The Johansen procedure begins by selecting an appropriate lag order for the VAR, and then applies maximal eigenvalue and trace tests to establish the number of cointegrating vectors in the system. Should a cointegrating relation be found, the long-run elasticities can be computed. Furthermore, an error correction model (ECM) can then be estimated to account for the short-run dynamics in the system as well as the long-run equilibrating mechanism. This series of tests is performed for the whole period (1983Q1 to 2002Q4) first, and tests are conducted to determine whether a structural break is present in the data. Based on strong evidence for a structural break, the period is split into two sub-periods and the testing procedure repeated for the more recent period.[7]

Finally, Granger causality tests are performed to establish the direction(s) of dynamic (short-run) relationships among the variables. 'Granger causality' is a statistical term, which is interpreted thus: "If X and Y are two jointly covariance stationary processes, then X is said to 'Granger cause' Y if past Y and past X better predicts current Y than past Y alone." (Alexander, 1993: 87). Hence, the issue is technically one of 'predictability' involving lead–lag relationships rather than 'causality' in the strict sense of an endogenous/exogenous relationship. We may find a uni-directional causal relationship between two variables, a bi-directional relationship, or independence. One of the practical issues encountered when applying Granger causality tests is the choice of lag length. The generally accepted wisdom is to err on the side of including more lags rather than fewer, since omitted variable bias is more serious than inefficiency resulting from the inclusion of irrelevant variables. However, testing for appropriate lag length in a VAR using various statistical information criteria assists in selecting an appropriate lag length. The error correction specification is then used for the causality tests as it ensures stationarity of the variables.

[6] The unemployment rate remains untransformed.

[7] Estimations and tests were performed using the Microfit 4.0® and EViews 4.0® econometric packages.

3.2 Data

The study makes use of quarterly data from 1983Q1 to 2002Q4 taken from the South African Reserve Bank (SARB) Quarterly Bulletin, June 2003. The basic source of the SARB's data is Statistics South Africa (StatsSA), which in turn collects its data via quarterly surveys. The principal series used in the investigation are: (i) an index of average real product wages (remuneration per worker at constant prices); and (ii) an index of average labour productivity. Both series pertain to the non-agricultural formal sector of the economy, are seasonally adjusted, and have year 2000 as the base date. The SARB (2003) is not fully transparent about how these two indexes are calculated, but presumably they involve ratios between the wage bill and total employment, and between value added and total employment, respectively. Wages were deflated by the non-agricultural gross domestic product deflator. The third variable is the total, economy-wide unemployment rate, calculated according to the broad definition.[8]

The SARB (2003: S-132) issues the following caveat in respect of these data: "[f]rom the first quarter of 1998 basic data originate from the Survey of Employment and Earnings in industries selected by Statistics South Africa, and are not strictly comparable with earlier data." Both real wages and productivity increased discontinuously between 1997:4 and 1998:1, apparently due mainly to a sharp drop in measured employment (which appears as a denominator in both the wage and productivity terms). This study makes no adjustment to these data (since any modification would be arbitrary), and the results should therefore be treated with circumspection.

An annual unemployment rate series was constructed from various sources. Figures from 1983 to 1993 were provided by the Development Bank of Southern Africa, who calculated the numbers using censuses and interpolation. From 1994 to 1999 the figures come from StatsSA's (1999) annual October Household Survey (OHS), and for the remaining years from StatsSA's (2002) Labour Force Survey (LFS).[9]

The annual data were then interpolated to quarterly figures using a quadratic match average function.[10] While this clearly results in an overly smooth series with loss of short-run information, this is not deemed too serious a problem, as it seems unlikely that the total unemployment rate in the economy would fluctuate greatly from one quarter to the next. Also, when testing for a long-run relationship it is the overall trend in the series that is important. However, this is more of an issue when it comes to estimations of the short-run dynamics. Clearly, many doubts can be cast on the reliability of this unemployment series considering the differences in the surveys used to collect the raw data, as well as the interpolation methods applied. Consequently, the empirical results pertaining to unemployment which are presented in the following section should be viewed with caution.

4 EMPIRICAL RESULTS

Much can be learned from a preliminary analysis of the data before econometric modelling is conducted. The following subsection therefore presents several graphs, correlation coefficients, growth rates and tests for integration. This sets the scene for the cointegration and Granger causality tests which follow.

4.1 Preliminary Data Analysis

The point of departure is a visual examination of time plots of real wages, productivity and the unemployment rate, along with total employment (see Figure 1).[11]

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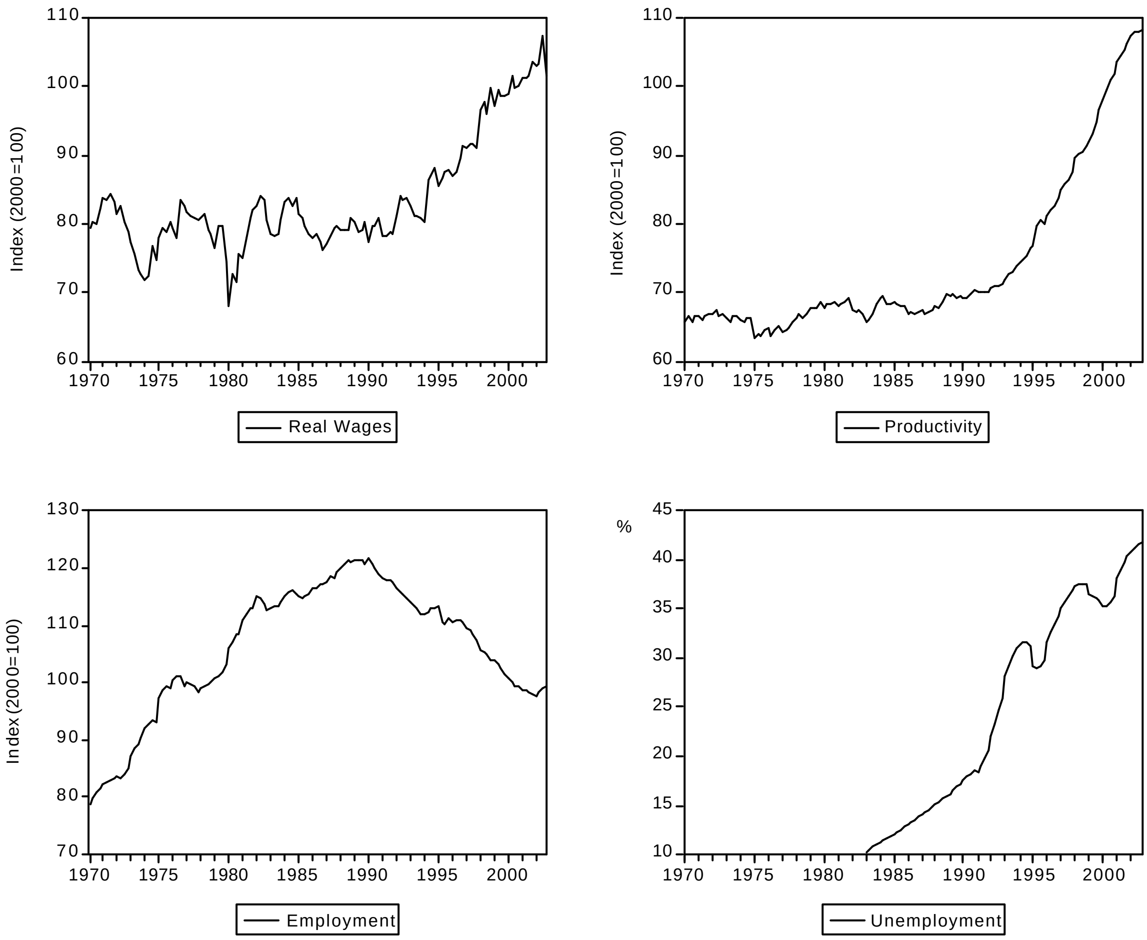
[8] The following notation is used for the three variables: LRW = log(real wage index); LPROD = log(productivity index); UR = total unemployment rate (percentage).

[9] The LFS is conducted twice annually, in February and September; averages were calculated to obtain annual figures.

[10] See EViews (1997) *User's Guide* for more details on this method.

[11] This employment series is the SARB's (2003) index of total, non-agricultural, formal sector employment (2000=100).

Figure 1: Real wages, productivity, employment and unemployment, 1970-2002



[Sources: SARB (2003), DBSA and StatsSA.]

Real wages fluctuated considerably around a horizontal trend throughout the 1970s and 1980s. These large swings in real wages coincided with periods of general economic instability, such as the Organisation of Petroleum Exporting Countries (OPEC) induced recessions of 1974 and 1979, the gold price boom of 1981, and the political events in 1985. In other words, for the period 1970-1989, real wages appear to have followed the business cycle quite closely. Since about 1990, however, the real wage index has risen considerably, with much more muted variations around a roughly linear trend.

The productivity series displays a broadly similar pattern, although it is much smoother. Over the 1970s and 1980s there is a slight positive trend, interrupted by a couple of shocks. From 1990 to 1994 the productivity curve appears to be exponential, while it seems to follow an almost linear trend for the remainder of the sample, rising somewhat more steeply than real wages.

The employment series is very striking, in that it rises fairly consistently from 1970 till 1990 (other than a dip from 1976, possibly following the Soweto riots), where after it declines almost monotonically (with a brief hiccup after the democratic election in 1994). Except for dips in 1995 and 2000, the unemployment rate has grown consistently.[12] The upward trend in unemployment was most pronounced between 1992 and 1994, during a deep recession. This continual job shedding, in the context of a growing population, goes a long way in explaining South Africa's high levels of inequality and poverty (see, for example, Leibbrandt, Woolard and Bhorat, 2000).

[12] The dips in unemployment cannot easily be reconciled with the smoothly declining employment series during the same period, as one expects labour force growth to be relatively consistent over time.

4.1.1 Evidence of a structural break

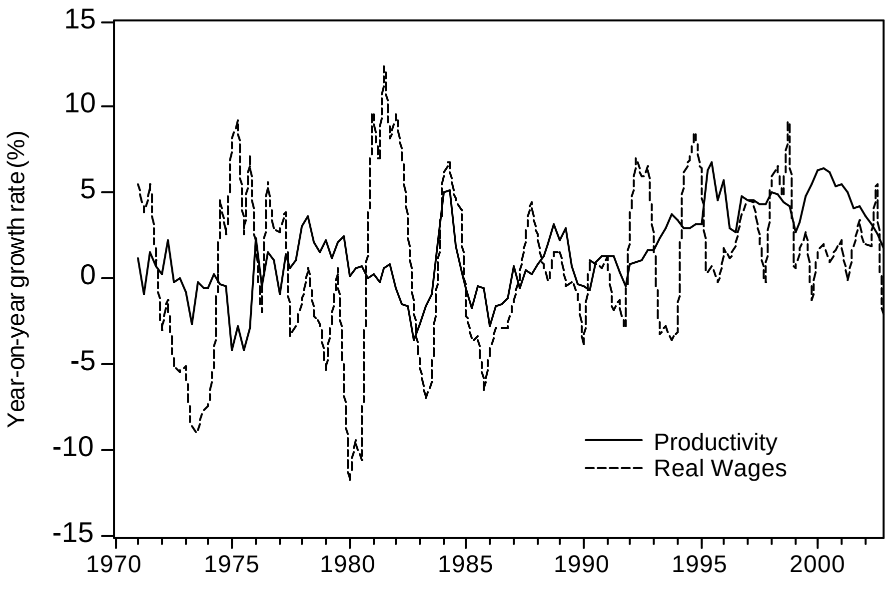
The key features identified in the real wage, productivity and employment series all indicate that a structural change may have occurred in the labour market around 1990. The structural break is most clearly evident in the employment series, the break occurring in 1990Q1.[13] Fedderke and Mariotti (2002) also find clear evidence of a structural break in 1990 in their sectoral analysis. This break manifested in changing employment growth rates and an increasing skills intensity of production.

Several factors may explain a structural break in or around 1990. Firstly, by 1990 the South African economy had entered a severe, sustained recession lasting until 1994 when the democratic election turned the tide of confidence. This recession was the result of several factors, including a severe drought, the impact of economic sanctions against South Africa, a global economic downturn, and not least of all the uncertainty leading up to the political transition. It seems plausible that this recession would have had a major impact on the labour market and on employment levels in particular. Secondly, in 1989 the SARB came under the governorship of Dr Chris Stals, who made it his primary mission to reduce inflation through the use of high real interest rates. This policy arguably slowed the rate of output growth and consequently stifled job creation. Thirdly, the 1990s was a period in which many firms increasingly began to substitute capital machinery and (relatively scarce) high-skilled labour for (relatively abundant) unskilled labour (see Fedderke and Mariotti, 2002). From 1994 onwards, it can be argued that increasing competition resulting from South Africa's reintroduction to the world economy stimulated this factor substitution. Fedderke and Mariotti (2002: 843) state that "technological change has effectively been capital- rather than labour-augmenting over time, thus decreasing the capacity of SA industry to expand employment." Finally, the break may also have been driven by increasing labour market intervention by the government, which raised the wage and non-wage costs of labour (Barker, 1999).[14]

The existence of a structural break will be tested more formally in the econometric modelling in section 4.2. For now, let us examine other features of the data.

4.1.2 Growth rates

Figure 2: Growth in productivity and real wages, 1970-2002



[Source: SARB Quarterly Bulletin, June 2003.]

[13] I call this the "Devil's Peak" effect, since the shape of the employment graph resembles the mountain overlooking the University of Cape Town.

[14] Fedderke and Mariotti (2002) point out that the structural shift as a result of policy changes was not limited to the labour market.

The relationship between real wages and productivity is further demonstrated in Figure 2, which plots the year-on-year growth rates of these series. Clearly, real wage growth has been far more volatile than productivity growth throughout the sample. The period 1980 to 1983 was evidently one during which real wages rose rapidly, possibly due to the 'catch-up' of black wages to white wages as the black trade union movement gathered momentum. For the remainder of the 1980s, productivity and real wage growth moved in similar directions, although wages were still more volatile. During the 1990s, both series have grown more rapidly. The large swings in real wage growth during the latter period may be explained at least in part by the volatility of inflation, which has been influenced by several currency crises.

Table 2 displays the average, year-on-year growth rates of productivity and real wages for each of the last three decades. In the 1970s the growth rate of productivity was slightly positive, while that of real wages was small and negative. In the 1980s, real wages grew marginally faster than productivity, possibly reflecting the rise of black trade unions during this period. The figures from 1990 to the present are strikingly different on two counts: (i) the (positive) growth rates are much larger; and (ii) the average growth of real wages has been greater than the average growth of productivity by a factor of two-thirds. This is clear evidence that labour has been receiving a diminishing share of the output 'pie' in recent years. This, together with increasing unemployment, may explain to a significant degree why inequality in South Africa is continually worsening.

Table 2: Average year-on-year growth rates of productivity and real wages

Variable	*1971-1979*	*1980-1989*	*1990-2002*
Productivity	0.30%	0.22%	3.38%
Real Wages	-0.40%	0.26%	2.04%

[Source: SARB Quarterly Bulletin, June 2003.]

4.1.3 Correlations

The correlation coefficients presented in Table 3 below afford a more precise summary of the relationships between real wages, productivity and unemployment. The figures corroborate the earlier discussion based on the graphs, in that they show no significant relationship between real wages and productivity in the 1970s and 1980s, but an extremely high correlation in the 1990s. Real wages are negatively associated with unemployment in the 1980s – although this coefficient is insignificant at the 10% level – but strongly positively related in the 1990s. The correlation between unemployment and productivity was positive and moderate in the 1980s but strongly positive in the 1990s. The overall picture is that the three variables were weakly related in the 1980s but very strongly (positively) related in the 1990s.

Table 3: Pairwise correlation coefficients

Variables	*1971-1979*	*1980-1989*	*1990-2002*	*1983-2002*
RW-PROD	-0.09[1]	0.21[1]	0.97	0.98
RW-UR	–	-0.25[1,2]	0.90	0.88
UR-PROD	–	0.46[2]	0.88	0.89

Notes: (1) Insignificant at the 10% level. All other coefficients are significant at 1%. (2) 1983-1989.

[Source: SARB (2003), DBSA and StatsSA; own calculations.]

In the longest period for which data are available on all variables, 1983-2002, the pairwise correlations are all very strongly positive.[15] One possible rationalisation of this result is that real wages have not been able to grow quite as fast as productivity because labour's bargaining power has been undermined by rising unemployment. This hypothesis is further investigated through cointegration

[15] The structural break in 1990 appears to have affected all three variables in a similar manner, i.e. they all grew more rapidly since 1990.

analysis in section 4. It does beg the question though, of what is driving this dynamic; some possible answers are provided in the concluding section.

4.1.4 Orders of integration

Having gathered some very useful information from graphs and growth rates, we turn to an analysis of the time series properties of the series. *A priori*, the visible evidence of upward trends (see Figure 1) suggests that all three series are nonstationary. This is tested formally by way of Dickey–Fuller (DF) and augmented Dickey–Fuller (ADF) tests for stationarity.[16] The results, shown in Table 4, indicate that LPROD, LRW and UR are all I(1) variables, i.e. integrated of order one (nonstationary in levels but stationary in first differences). This result is robust to the inclusion of a deterministic trend in the test regressions (column four), and in all but one case is also robust to the inclusion of one or four lagged difference terms (which account for possible autocorrelation).[17]

Table 4: Testing for order of integration, 1983-2002

Variable	*Test*	*I(1) vs I(0)*	*I(1) vs I(0) + trend*	*I(2) vs I(1)*
LPROD	DF	3.51*	**-0.99**	**-6.54***
	ADF(1)	**2.40**	-1.01	-4.79*
	ADF(4)	1.57	-0.98	-2.94*
LRW	DF	**-0.29**	**-2.41**	**-9.78***
	ADF(1)	0.01	-2.22	-6.71*
	ADF(4)	0.53	-1.90	-5.49*
UR	DF	0.02	-1.36	**-3.89***
	ADF(1)	-0.52	**-2.79**	-3.18*
	ADF(4)	**-0.28**	-2.37	-3.48*
5% critical value		*-2.90*	*-3.47*	*-2.90*

**Significant at 5% level.*

Note: Bold case test statistics correspond to the 'best' regression specification chosen by the Akaike Information Criterion (AIC), Schwarz Bayesian Criterion (SBC), and Hannan-Quinn Criterion (HQC).

The properties of any particular series may change over time, particularly after a structural break. Also, the DF and ADF tests are sensitive to the presence of structural breaks, in that they tend to find unit roots more often when breaks are not taken into account (see Maddala and Kim, 1998). Hence, based on the evidence presented in section 4.1.1 for a structural break in 1990, the testing procedure is repeated for the sample 1990Q1 to 2002Q4. The results are presented in Table 5. When no trend term is included, the DF and ADF tests all indicate that the three variables are nonstationary in levels (third column). The same applies for LPROD and UR when a deterministic trend is included, but the results indicate that LRW is trend stationary in this period. According to Alexander (1993: 89), this justifies the inclusion of a general constant term in the cointegration tests (to be performed later). None of the variables is I(2) since all of the test statistics in the final column are significant at the 5% level (meaning the variables are stationary in first differences).

For both periods (1983-2002 and 1990-2002), therefore, we have established that the variables are I(1) and therefore that cointegration tests are necessary before regression results can be considered reliable (nonspurious).

[16]The ADF test allows one to distinguish between difference stationary and trend stationary time series processes; the former contain unit roots, while the latter are stationary once a linear trend has been removed. However, DF and ADF tests have low power in small samples, and are not good at distinguishing borderline cases.

[17] The exception is the DF test statistic for LPROD. However, the ADF(1) specification is selected by the three model selection criteria.

Table 5: Testing for order of integration, 1990-2002

Variable	*Test*	*I(1) vs I(0)*	*I(1) vs I(0) + trend*	*I(2) vs I(1)*
LPROD	DF	**1.92**	**-3.20**	**-5.53***
	ADF(1)	1.40	-3.07	-4.09*
	ADF(4)	0.24	-2.93	-2.16
LRW	DF	-0.76	**-4.44***	**-9.03***
	ADF(1)	**-0.37**	-3.70*	-6.02*
	ADF(4)	0.06	-3.38	-4.78*
UR	DF	-1.59	-1.23	**-3.29***
	ADF(1)	**-1.43**	**-2.45**	-2.68
	ADF(4)	-1.34	-2.00	-2.95*
5% critical value		*-2.92*	*-3.50*	*-2.92*

**Significant at 5% level.*

Note: Bold case test statistics correspond to the 'best' regression specification chosen by the Akaike Information Criterion (AIC), Schwarz Bayesian Criterion (SBC), and Hannan-Quinn Criterion (HQC).

4.2 Cointegration Tests

4.2.1 Testing for cointegration with a structural break in 1990

We turn now to test for the existence of a long-run (cointegrating) relationship between LNPROD, LNRW and UR over the period for which data are available, *viz*. 1983Q1 to 2002Q4. Following the graphical indications that a structural break occurred in 1990, and the supporting discussion, allowance is made in the testing procedure for such a break. Maddala and Kim (1998: 417) recommend a general to specific methodology which allows for structural breaks in the first instance. The methodology involves estimating a VAR and testing for lag order, determining the number of cointegrating vectors using the Johansen procedure, and then estimating error correction models should a cointegrating relation be found. Throughout this process, a dummy variable (D90) is used to test for the presence of a structural break in 1990Q1.[18]

The first step is to test for the appropriate lag order (p) in the VAR. A starting point of four lags is chosen since the data series are of quarterly frequency.[19] The results, displayed in Table 6, unambiguously indicate that a VAR(2) is appropriate: the AIC, SBC, Likelihood Ratio (LR) test and adjusted LR test all select p equal to two.[20] Lagrange Multiplier (LM) tests applied to the residuals of each equation yield no evidence of autocorrelation,[21] so we can safely say that two lags are sufficient for the VAR. A LR test of restrictions was applied to test the significance of the D90 variable. The chi-square statistic with three degrees of freedom is 6.59 (p-value = 0.086), which is insignificant at the 5% level (implying the dummy variable is not significant), but significant at the 10% level. The reason for this weak evidence for a structural change could be that the break primarily affected the level of employment, which affects the per worker real wage, productivity and unemployment series in a similar manner. As a result, it was decided to continue from this point without the dummy variable.[22] Re-estimating the VAR excluding D90 yields very similar results, and again the lag order is unambiguously two.

[18] D90 takes on values of zero up to and including 1989Q4, and values of one thereafter.
[19] In general one could allow for more lags, but Table 6 shows this is clearly unnecessary in the present example.
[20] The LR tests indicate we should reject the restriction that lags two to four should be excluded, but accept the restriction that lags three and four should be dropped. The adjusted LR test is considered more reliable in small samples (Pesaran and Pesaran, 1997).
[21] The chi-square test statistics with four degrees of freedom for the LRW, LPROD and UR equations are 3.27 (p = 0.51), 1.60 (p = 0.81), and 7.28 (p = 0.12), respectively. The null hypothesis is no serial correlation.
[22] The Johansen procedure was also applied with D90 included, and there was no solid evidence of a cointegrating relationship in that case.

Table 6: Testing for lag order in the VAR

Test Statistics and Choice Criteria for Selecting the Order of the VAR Model
Based on 76 observations from 1984Q1 to 2002Q4. Order of VAR = 4
List of variables included in the unrestricted VAR: LRW, LPROD, UR
List of deterministic and/or exogenous variables: C, D90

Order	LL	AIC	SBC	LR test	Adjusted LR test
4	795.6347	753.6347	704.6893	…	…
3	788.3159	755.3159	716.8588	CHSQ(9)= 14.6376[.101]	11.9412[.217]
2	784.7229	760.7229	732.7541	CHSQ(18)= 21.8237[.240]	17.8035[.469]
1	754.1743	739.1743	721.6938	CHSQ(27)= 82.9208[.000]	67.6459[.000]
0	397.8210	391.8210	384.8288	CHSQ(36)= 795.6275[.000]	649.0646[.000]

AIC=Akaike Information Criterion SBC=Schwarz Bayesian Criterion

Now that the VAR order has been established, Johansen's (1988) maximum likelihood test for cointegration can be applied. However, first one has to make an assumption about whether intercept and/or trend terms are appropriate in the VAR model. For the sake of transparency, the test results are shown in Table 7 for four combinations of intercept/trend specification. The results show just how sensitive the cointegration tests are to the way in which intercept and trend terms are included in the VAR. They also demonstrate that the various tests for the number of cointegrating vectors are often inconsistent (for a given specification). The preferred tests, developed by Johansen (1988), are the 'maximal eigenvalue' and 'trace' tests, while the three model selection criteria (AIC, SBC and HQC) may be used as additional evidence.

Table 7: Cointegration tests for LRW, LPROD and UR, 1983-2002

Specification of the cointegrating VAR	*Eigenvalue*	*Trace*	*AIC*	*SBC*	*HQC*
Restricted intercepts, no trends	1	1	3	1	2
Unrestricted intercepts, no trends	0	1	2	0	2
Unrestricted intercepts, restricted trends	0	2	3	0	3
Unrestricted intercepts, unrestricted trends	0	0	2	0	2

Note: figures refer to the number of cointegrating vectors (r) indicated by each test.

Because of the possibility that LRW has a deterministic trend, and the graphical evidence that the three series are trending together, the 'unrestricted intercepts, no trends' option is selected as being most appropriate in this instance.[23] The detailed results of this cointegration test are reported in Table 8. There is clearly a lot of variation among the criteria: the maximal eigenvalue test suggests that the number of cointegrating vectors (r) is zero; the trace test indicates r = 1; the AIC and HQC suggest r = 2; and the SBC as usual favours parsimony (r = 0). Weighing up this evidence is not easy, but by applying the law of averages – and with the support of theory – it may be justifiable to assume that there is a single cointegrating vector. This allows one to estimate the long-run relationship and ECMs.

The long-run equilibrium vector is estimated to be Z = LRW – 0.74LPROD + 0.40UR. The coefficient of LPROD has a standard error of 0.15 and is therefore significant, while the coefficient of UR has a standard error of 0.37 and is clearly insignificant. The latter result is tested further via an over-identifying restriction (that the coefficient of UR = 0), which produces a chi-square statistic of

[23] See chapter 16 of Pesaran and Pesaran (1997), and Alexander (1993).

1.43, which is not significant (p-value = 0.103). Hence, the evidence suggests that UR is not part of the long-run relationship.[24]

Table 8: Cointegration test using 'unrestricted intercepts, no trends', 1983-2002

Eigenvalue test:			*Critical values*	
Null	*Alternative*	*Eigenvalue*	*5%*	*10%*
r = 0	r = 1	18.81	21.12	19.02
r <=1	r = 2	13.49	14.88	12.98
r <=2	r = 3	1.05	8.07	6.50
Trace test:			*Critical values*	
Null	*Alternative*	*Trace*	*5%*	*10%*
r = 0	r ≥ 1	33.35	31.54	28.78
r <=1	r ≥ 2	14.53	17.86	15.75
r <=2	r = 3	1.05	8.07	6.50

4.2.2 Testing for multivariate cointegration, 1990 to 2002

Although the foregoing evidence for a structural break is rather weak at best, the economic and empirical reasons discussed earlier would seem to justify splitting the data sample into two sub-periods: 1983Q1 to 1989Q4, and 1990Q1 to 2002Q4. Unfortunately, these relatively short time periods may undermine the robustness of the econometric results, but this is traded off against the possible effect of the break. Since the recent past is of more interest, and the sample is larger, the tests are repeated for the latter period only. This allows us to check whether the result obtained above (in particular that there is a cointegrating relation between LRW and LPROD but not with UR) is robust to the sample period.

Table 9: Cointegration test using 'unrestricted intercepts, no trends', 1990-2002

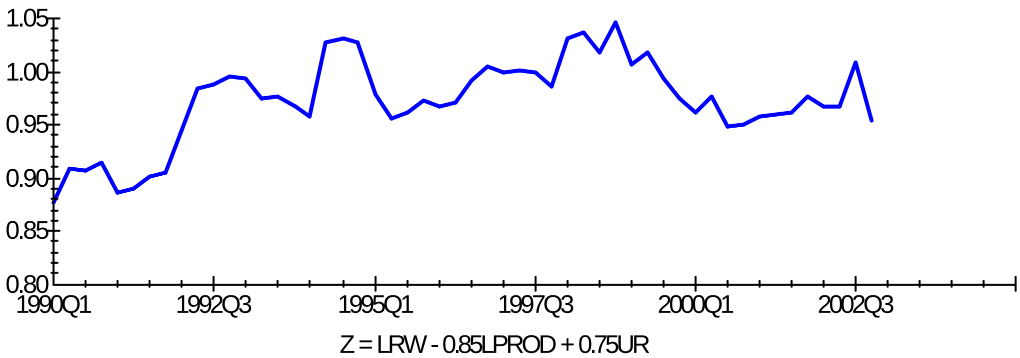
Eigenvalue test:			*Critical values*	
Null	*Alternative*	*Eigenvalue*	*5%*	*10%*
r = 0	r = 1	17.35	21.12	19.02
r <=1	r = 2	13.70	14.88	12.98
r <=2	r = 3	0.63	8.07	6.50
Trace test:			*Critical values*	
Null	*Alternative*	*Trace*	*5%*	*10%*
r = 0	r ≥ 1	31.67	31.54	28.78
r <=1	r ≥ 2	14.32	17.86	15.75
r <=2	r = 3	0.63	8.07	6.50

[24] The coefficient of LPROD under the over-identifying restriction changes to –0.57, which is almost identical to the elasticity found in section 4.2.3 for the period 1990-2002 (where UR is omitted from the start).

As before, the 'unrestricted intercepts, no trends' option is chosen as most appropriate in this instance, and the test results are mixed once again (interestingly, they are identical to those obtained for the expanded sample). The full results are reported in Table 9 above.

Following the same logic as earlier, it is assumed that there is one cointegrating vector. The long-run equilibrium vector is estimated to be Z = LRW – 0.85LPROD + 0.75UR (see Figure 3). The coefficient of LPROD has a standard error of 0.42 and is therefore significant, while the coefficient of UR has a standard error of 1.15 and is clearly insignificant. The latter result is tested further via an over-identifying restriction (that the coefficient of UR = 0), which produces a chi-square statistic of 1.43, which is not significant (p-value = 0.23). Hence, we can again safely conclude that UR is not part of the long-run relationship and should be omitted. This has interesting implications for theory and policy, which are discussed in the concluding section.

Figure 3: Cointegrating vector Z = LRW – 0.85LPROD + 0.75UR



4.2.3 Cointegration between LRW and LPROD, 1990-2002

The last result suggests that a cointegration test for the bivariate relationship between LRW and LPROD should be conducted.[25] Applying the same methodology as before, a VAR(1) was selected. The two equations were tested for residual serial correlation, and none was found, which further validates the lag order selection.[26] However, using only one lag in the VAR for quarterly data is very restrictive, and subsequent ECM modelling showed that using a VAR(2) is more informative, without

Table 10: Cointegration test for LRW and LPROD, 1990-2002

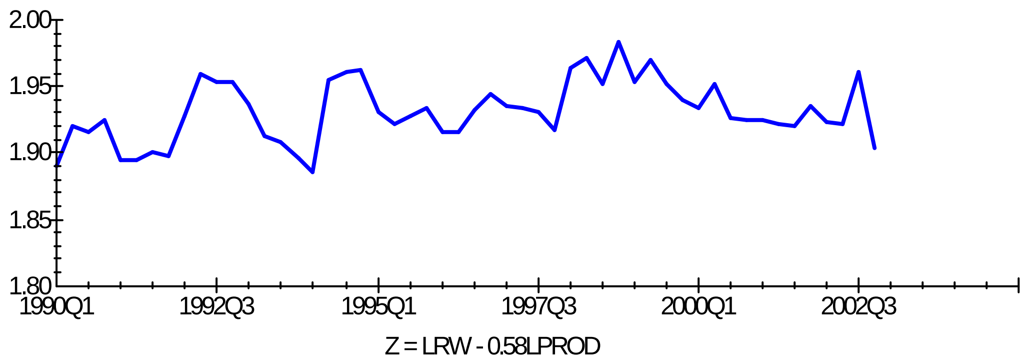
Eigenvalue test:			*Critical values*	
Null	*Alternative*	*Eigenvalue*	*5%*	*10%*
r = 0	r = 1	15.53	14.88	12.98
r <=1	r = 2	2.76	8.07	6.50
Trace test:			*Critical values*	
Null	*Alternative*	*Trace*	*5%*	*10%*
r = 0	r ≥ 1	16.64	17.86	15.75
r <=1	r = 2	1.11	8.07	6.50

[25] Cointegration tests were also conducted for the period 1970 to 2002 with a dummy variable for the years 1990 onwards. The results were qualitatively similar, in that a single cointegrating vector was found with a wage-productivity elasticity of 0.53.
[26] Chi-square values (d.f. = 4) for the LM serial correlation test of 2.14 (p=0.71) and 3.76 (p=0.44) were obtained for the LRW and LPROD equations, respectively.

changing any of the substantive results. Therefore, the Johansen cointegration test was applied in a VAR(2), again with unrestricted intercepts and no trends. The evidence in Table 10 is consistent with the existence of a single cointegrating vector and is far more robust than earlier estimations. The maximal eigenvalue test clearly indicates a single cointegrating vector at the 5% level, although the trace test suggests r = 1 at the 10% level only. However, the AIC, SBC and HQC all select r = 1, and therefore it seems safe to assume there is one cointegrating vector.

The long-run equilibrium vector is estimated as Z = LRW – 0.58LPROD, which is depicted in Figure 4. The standard error on the coefficient of LPROD is 0.04, implying a high degree of significance. This implies that for every one percent rise in productivity, real wages rise by 0.58 percent in the long run. This elasticity is statistically significantly different from zero and from unity.[27]

Figure 4: Cointegrating vector Z = LRW – 0.58LPROD



4.3 Error Correction Models and Granger Causality

Since a cointegrating relation was found between LRW and LPROD, it may be concluded that there is a long-run causal relationship between the variables. It also means that ECMs may be estimated, which allow us to test for short-run or dynamic causality. The results of the ECM estimations are reported in Table 11. The DLRW model has low explanatory power, but the F statistic is significant and the model passes all of the conventional tests for serial correlation, functional form, residual normality and heteroscedasticity at the 10% level. It can be seen that only the constant and error correction terms are significant (which is consistent with the evidence mentioned earlier that a single lag in the VAR may be appropriate). On the other hand, in the DLPROD model the lagged real wage term is significant at 5%, and the lagged productivity term is significant at 10%. Overall, this model is significant at 1%, although the residuals fail the normality test, which casts doubt on the reliability of t and F tests.

Granger causality may be inferred from the ECMs by testing restrictions on the lagged difference terms. For the DLPROD equation, the Wald statistic for testing the restriction that DLRW(-1) has a zero coefficient is 7.01 (p = 0.008), which implies that real wages Granger cause productivity. It is interesting to note, however, that the coefficient is negative.[28] This runs counter to efficiency wage theory. The ECM term is significant but positive, which is contrary to expectations.

Conversely, for the DLRW equation, the Wald statistic for testing the restriction that DLPROD(-1) has a zero coefficient is 0.71 (p = 0.401), which implies that productivity *does not* Granger cause real wages. This result is evidence against the supposition that employers use performance-related pay schemes, and is contrary to the wage bargaining hypothesis presented earlier.

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[27] An over-identifying restriction for the long-run coefficient of LPROD equal to unity yields a chi-square statistic of 14.42, which is significant at the 1% level, implying rejection of the restriction.
[28] Interestingly, Alexander (1993: 99) finds the same result for the UK in the period 1979 to 1991.

Table 11: Error correction models for LRW and LPROD, 1990-2002

1990Q1–2002Q4; n=52	*Dependent variable*	
Regressor	DLRW	DLPROD
CONSTANT	0.72*	-0.21*
	(2.52)	(-2.22)
DLRW(-1)	-0.14	-0.14*
	(-0.85)	(-2.65)
DLPROD(-1)	0.34	0.24
	(0.84)	(1.77)
ECM(-1)	-0.37*	0.11*
	(-2.50)	(2.30)
R-squared	0.19	0.20
Adjusted R-squared	0.14	0.15
F(3, 48)	3.87	3.92
p-value of F	0.02	0.01
Standard Error	0.0208	0.0068

**Significant at 5%; t-statistics in parentheses.*

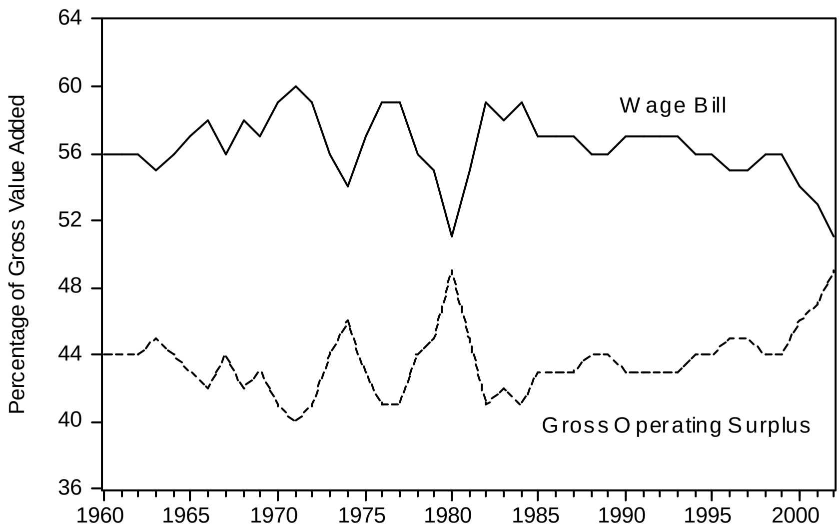
However, the lack of a short-run effect could be related to fixed wage contracts, which in South Africa tend to be a year long in most cases (i.e. four quarters). Similarly, the DLRW(-1) term is insignificant, which tells us that there is no short-run feedback in the dynamics of real wages. This supports the argument put forward in section 2 about the proxy for a reservation wage being inappropriate in a wage curve equation in the South African context. On the other hand, the negative error correction term is significant with a Wald statistic of 6.2702 (p = 0.012), so real wages adjust back towards long-run equilibrium (with productivity) following a shock, which conforms to expectations. The coefficient is also quite large, indicating a fairly rapid adjustment to equilibrium.

In sum, the econometric evidence suggests we have the following dynamic causal system: real wages impact on productivity negatively but productivity has no effect on real wages; productivity has a weak autoregressive pattern but real wages lack this altogether; and adjustment to equilibrium occurs through both wages (negatively) and productivity (positively). Not much of substance can be said about unemployment in the short run, mainly due to the way in which the data series was constructed.

5 LABOUR'S SHARE OF VALUE ADDED

The implication to be drawn from the main result of the previous section, *viz*. that the relationship between real wages and productivity has not been one-to-one (since productivity has grown more rapidly than real wages), is that labour's share of value added has declined since 1990. This is made clearer by emphasising the components of the two series. The (average) real wage is the wage bill divided by total employment, while productivity is value added divided by (the exact same) total employment. Hence, a simplified way of looking at this issue is examining the ratio of the wage bill to value added directly (so that the employment denominators cancel out). This is done in Figure 3 below, which plots the shares of value added accruing to labour (in the form of the wage bill) and employers (in the form of gross operating surplus), respectively.

Figure 5: Decomposition of gross value added into wage bill and gross operating surplus



[Source: SARB Quarterly Bulletin, June 2003.]

As can be seen in Figure 5, labour's share of value added fluctuated considerably over much of the 1960s, 1970s and 1980s, although the long-run trend appears to be stable. However, the wage share has been declining steadily since the late-1980s, and by 2002 had reached its lowest level in 43 years (51%). The maximum value during this period (1960-2002) was 60%, while the long-run average wage share was 56.4%.[29] The only previous year in which the wage share dropped to the level of 51% was 1980, in the wake of the second OPEC oil price shock and consequent global recession. Clearly, workers in South Africa are feeling the pinch in a very significant way. This, together with the extremely high unemployment rate, is further evidence of the increasing inequality in our society.

What might be the reasons for the declining wage share? In the first place, it seems to be clear that some major restructuring has taken place in the South African economy over the past two decades. In particular, there appears to have been a substitution of capital for labour in the production function (evidenced by the rapid decline in employment levels but growth – albeit slow – in both capital stock and output during the 1990s). This has been particularly evident in the mining and manufacturing sectors.

The cause of this restructuring is by no means certain, but one possible scenario is that rising real wage demands induced firms to substitute other factors of production in place of labour. This is consistent with the findings of a negative wage–employment elasticity in South Africa.[30] However, an unambiguous causality between wages and employment has not been established either empirically or theoretically. Nevertheless, wage increases seem likely to be at least part of the story.

An alternative scenario can also be hypothesised. Instead of (or as well as) rising average real wages driving the restructuring, the underlying cause could have been other incentives facing producers, such as labour market inflexibility, technological advances embodied in capital, and so on. The immediate result was the same, i.e. slow growth in value added in the face of falling employment, resulting in growth in measured average productivity. This may have served as a basis for higher real wage bargains by labour unions, although from the results in the previous section it appears that this bargaining power was rather weak, so that labour enjoyed a relatively meagre slice of the productivity gains.

Diwan (1999) offers another possible explanation for the recent sharp decline in the share of value added accruing to labour. His panel data analysis of a group of developing countries yields the

[29] A long-run average is meaningful since the wage share series is stationary according to Augmented Dickey-Fuller tests (the test statistics are significant at the 5% level whether or not a trend term is included).
[30] See, for example, Bhorat and Leibbrandt (1998), Fallon (1992), Fallon and Lucas (1998).

conclusion that labour's share of GDP is adversely affected by financial shocks, such as the Asian Crisis of 1997-8. Diwan (1999: 19) concludes that "[financial] crises are resolved when workers end up bearing large costs that resemble bail-outs of (financial) capital," which amount to 20 per cent of GDP on average. He notes that the labour share recovers only partially after such crises. His work also shows that there has been a general trend toward declining labour shares in most regions of the world in the past two decades, which "may be connected to a race to the bottom, generated by increased globalisation" (1999: 19).

South Africa has experienced no less than three financial shocks (transmitted principally through the exchange rate) since the democratic transition in 1994, and their effect on the economy has been clearly visible in many indicators (e.g. upward pressure on inflation and interest rates, slow economic growth and continued job shedding). In the light of Diwan's evidence, it seems plausible that these crises could be at least partially responsible for the recent decline in the labour share of GDP. The biggest drop in labour's share has occurred since 1999, while the main impact of the Asian Crises was felt in the second half of 1998. There may plausibly be a time lag between the early indications of a crisis (e.g. plunging currency and rising interest rates) and its restructuring effect on the economy – particularly in the context of fixed wage contracts. The massive depression in the rand in 2001 may be partly responsible for the sharp decline in labour's share in the past two years, and it will be interesting to see whether (and to what extent) this recovers following the rand's recent appreciation.

Whether the effects of financial crises are permanent or transitory, considering South Africa's vulnerability to financial shocks given the free-floating exchange rate regime operated by the SARB, the foregoing findings beg the question of what the authorities could or should do to limit the distributional impact of such shocks. Clearly, further research is required to investigate empirically the factors that are associated with variations in labour's share, for example business cycle fluctuations, financial crises, and labour market policy interventions.

6 CONCLUSIONS

The aim of this paper was to investigate the empirical relationship between productivity, real wages and unemployment in South Africa using appropriate time series econometric techniques. The value of this approach is that it imposes no *a priori* theoretical assumptions on the relations between the variables, but rather allows the data to 'speak for themselves'. The results may then be used in one of two ways. Either they allow one to interrogate the validity of the data by comparing the results with well-established labour market models, or – assuming the data is deemed reliable – they can be used to provide evidence for or against labour market theories (Alexander, 1993: 101). This seems however to land one in a 'catch 22' situation, and inevitably the economist has to make an informed assumption about which is more reliable: the data, the theoretical models, or neither. In the present case, the real wage and productivity data are regarded as fairly reliable, but the unemployment series is rather makeshift in the absence of accurate annual (let alone quarterly) data over a long period of time. The long run upward trend in unemployment does however seem plausible.

Having said all this, the key findings of this study are as follows. First, there is strong evidence of a structural break in 1990, which seems to have affected the level of employment in the first instance, and fed through into other variables such as per worker wages and productivity. This evidence is substantiated by various economic and policy factors as well as by other empirical work.

Second, real wages, productivity and unemployment have all risen rapidly since 1990. A long-run equilibrium (cointegrating) relationship seems to exist between real wages and productivity for the period 1983 to 2002, but unemployment was apparently not connected to the other two variables. There is also strong evidence that productivity and real wages are cointegrated in the period 1990 to 2002. In the long run, a 1% rise in productivity is associated with an approximately 0.58% rise in real wages. The econometric modelling matches the preliminary analysis of growth rates, in that real wages have not kept pace with productivity gains in the long run.

Third, the unemployment rate behaves in a manner inconsistent with the theory underlying the specification of the wage curve equation. The econometric results show that unemployment is divorced from the long-run equilibrium between real wages and productivity. More specifically, it seems clear that in the South African labour market, the high rate of unemployment has little or no effect in terms of restraining real wage growth. Conversely, real wage increases cannot be blamed for raising the level of unemployment. This carries the implication that the neoclassical view of the labour market has serious shortcomings. On the other hand, this study provides evidence for the insider-outsider model of the labour market, in that it appears as if the unemployed have little effect on wage rates.

Fourth, the econometric evidence suggests the following dynamic (short-run) causal system operates in the labour market: real wages impact on productivity negatively but productivity has no effect on real wages; productivity has a weak autoregressive pattern but real wages lacks this altogether; and adjustment to equilibrium occurs through both wages (negatively) and productivity (positively). Not much can be said about unemployment in the short run owing to the construction of the unemployment data series.

Fifth, given the economy's slow growth performance over the past decade, the rapid rise in productivity (and average real wages) reflects in large part the sharp decline in employment levels. South Africa's productivity performance should not therefore be looked at in isolation of the employment trend, which indicates the job-shedding nature of economic growth in this country over the past 13 years. The decline in employment cannot be fairly blamed on real wages growing in excess of productivity (forcing employers to cut jobs). The reverse is true, i.e. productivity has grown faster than real wages. As a result, labour's share of gross output has been shrinking over the past decade, and has now reached its lowest proportion relative to capital's share in the past 40 years. This trend has been observed in many other developing countries around the world, and reflects an increasing concentration of wealth among owners of capital. This is particularly alarming in the South African case given our high levels of inequality, unemployment and poverty.

An ancillary conclusion of the paper is that in some cases, economists and policy makers can learn just as much from simple graphical representations of key economic data series as they can from the application of sophisticated econometric modelling. The example provided by this paper is that examining a graph of labour's share of value added is roughly equivalent to testing for a cointegrating relationship between productivity and real wages.

In wrapping up, at least two possible avenues for further research stemming from this paper may be identified. One is to repeat the analysis at a sectoral level. Previous work by the author on one-digit sectors revealed a high degree of variability in the productivity–wage relationship, which suggests that aggregation to the national level may obscure further complexities in the labour market. Another potentially enlightening way forward would be to unpack the factors which have contributed to the recently declining share of wages in value added. This seems particularly important in the light of South Africa's widening inequality and our economy's susceptibility to external shocks.

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