The cyclicality of mark-ups in South Africa

Prepared by Siobhan Redford[1]

August 2011
Draft

Abstract

The purpose of this paper is to calculate an aggregate mark-up measure and establish the nature of the cyclicality of the aggregate mark-up for South Africa in order to better understand price setting behaviour. The mark-up is calculated more than once, relaxing different assumptions to examine the effect of these assumptions on the cyclicality of the mark-up. The results suggest that the mark-up is quite high with an average above 70 per cent for the period 1960 – 2010, although this is significantly lower once the share of the mark-up allocated to covering intermediate materials is taken into account. The form of the production function does affect the cyclicality of the mark-up, with a Cobb-Douglas specification resulting in a procyclical mark-up and a constant elasticity of scale specification resulting in a countercyclical mark-up. A truncated dataset yields similar results that provide evidence that the South African mark-up has increased in recent years and that the mark-up measure is countercyclical.

JEL classification:E30, E32

Keywords: mark-up, labour share, business cycle

Corresponding author's e-mail address: Siobhan.Redford@resbank.co.za

[1] The views expressed are those of the author and do not necessarily represent those of the South African Reserve Bank or Reserve Bank policy.

1 Introduction

The behaviour of mark-ups over the business cycle could give a good indication as to the nature of pricing along the production line as described in Macallan *et al* (2008). If prices and wages are not completely flexible, observed cyclicality of mark-ups will be due to the relative stickiness of prices and wages. If prices are stickier than wages, it can be expected that the mark-up will decrease during economic upswings. Alternatively, if wages are stickier than prices, then it would be expected that the mark-up would increase during economic upswings. This ambiguity leads to theory being unable to predict what should happen to mark-ups over a business cycle. The nature of the causal relationship is a further topic under debate; Mitchell (1941) suggests that profit margins are squeezed as costs rise faster than prices causing investment to fall resulting in a falling level of output[2]. On the other hand Rotemberg and Woodford (1999) suggest to increase output, mark-ups need to decrease (or the real marginal cost curve needs to shift) if producers want the economic expansion to continue[3].

The purpose of this paper is to construct an aggregate mark-up series for South Africa. To then alter certain assumptions in the formulation of the mark-up series. The paper then goes on to investigate the nature of the cyclicality of the different mark-up measures, to provide some insight on the stickiness of relative prices, as well as to investigate the effect of the assumptions on the cyclicality of the mark-up measure. Two papers that have already considered mark-ups in this manner are a paper by Rotemberg and Woodford (1999) for the US and a paper by Macallan, Millard and Parker (2008). In South Africa, the literature on mark-ups is quite small and limited to looking at the information contained in the mark-up with respect to the competitiveness of different industries. This paper focuses rather on the inferences that can be made about pricing behaviour at an aggregated level and thus contributes to the South African literature by taking a different approach to measuring the mark-up and analysing it.

[2] This would require that prices are stickier than costs.
[3] Basically, by changing the mark-up or shifting the real marginal cost, the equilibrium maximum output for the economy is increased.

This paper will proceed as follows; section two will look at the literature on this topic, focusing on work done for the South African case, section three will focus on the construction of the mark-up variables, data used as well as the analysis of the cyclicality of the mark-up variables. Section four will conclude the analysis.

2 Literature

This paper follows the approach to calculating and analysing the aggregate mark-up as done in Rotemberg and Woodford (1999) and Macallan *et al* (2008). A very broad analysis is done in Rotemberg and Woodford (1999) in considering mark-ups, this chapter provides an extensive review of the literature and applications relating to the topic for US. As part of this chapter the authors demonstrate how the mark-up measure can be split into two parts; the elasticity of output with respect to labour and the labour share of output. Assumptions that are related both to the calculation of the labour share or of the elasticity of output with respect to labour are then relaxed, and the effect of this in terms of the cyclicality of the mark-up analysed. The results support the authors' assertion that the mark-up measure is counter-cyclical. Labour market assumptions that are relaxed include the effects of overhead labour, labour hoarding and labour adjustment costs on the mark-up measure.

Macallan *et al* (2008) apply, in part, the methodology discussed in Rotemberg and Woodford (1999) to construct mark-up measures for the UK and evaluate the cyclicality of these measures. They find, for the aggregate mark-up, that changing the assumed functional form of the production function, assuming that overhead labour has an effect on the mark-up and assuming that there is a fixed cost to changing the labour input tends to cause the mark-up measures to become more cyclical. These results are different to those found by Rotemberg and Woodford (1999), and MMP suggest this may be due to the use of different business cycle measures, or that there may be some fundamental difference in the UK economy from the US economy. They extend their analysis to a more disaggregated level, following Small (1997), and find that the evidence at this level supports their aggregate findings of a procyclical mark-up in the UK.

Another branch of the literature investigates the mark-up in relation to the formulation of the Solow residual (Hall, 1988). Hall considers the conditions under which the sum of the

factor inputs (weighted by their relative factor costs) could sum to less than one in a competitive environment, whilst also considering the formulation of a mark-up that would explain such differences in the absence of perfect competition. His formulation relies heavily on the use of instruments that are correlated with output and employment whilst having no correlation with the Solow residual as a way to deal with endogeneity issues. He finds that there is little evidence to support the assumption of perfect competition, given the existence of a mark-up measure in the industries in which he did his study. Roeger (1995) raises concerns regarding the Hall methodology. He notes that the formulation of the mark-up based on the Solow residual is likely to lead to the use of positively correlated independent variables for which instrumentation is tricky. He proposes introducing the dual Solow residual[4] and subtracting this from the Solow residual[5] to eliminate this correlation[6]. He also noted the issue of measurement error of the variables. Showing though, that the central projection should not be affected by the measurement error and that higher volatility of the mark-up variable will be the only effect. His results produce a significantly lower mark-up than Hall, using the same data set.

Fedderke and Schaling (2005) estimate a vector error correction model (VECM) that is structured around the dynamics of a Phillips curve relationship over 1960 - 99. Part of the estimation includes modelling the price in the long run as a function of the unit labour cost. They suggest that the coefficient on the unit labour cost variable in their long-run price relationship provides an estimate of the mark-up over unit labour cost. They find that this coefficient is 1,31 suggesting that prices in South Africa using aggregated data are set approximately 30 per cent above the unit labour cost[7]. They further conclude that the inflation process in South Africa is largely a cost-push process.

Much of the rest of the analysis of the mark-up in South Africa has focused on the estimation of an average mark-up at industry level to analyse the competitiveness of different industries. Fedderke *et al* (2007) set out to apply the Roeger (1995) methodology to the

[4] A cost-based approach that estimates the dual of the Solow residual.
[5] Subtracting the the dual Solow residual from the Solow residual produces a variable that is also referred to as the nominal Solow residual (NSR) in the literature.
[6] As both measures are subjected to the same productivity shocks, the effects of which are eliminated through subtraction.

South African case over the period 1970 - 97. The paper establishes that mark-ups in the South African manufacturing industry are significantly higher than those in the US[8] and that they tend to be counter-cyclical. Further results from this paper find that import and export penetration will lead to a lower mark-up (through increased competition), as will increased within industry competitiveness, but increased industry concentration and between-industry competitiveness will lead to higher mark-ups.

The effect of tariffs on mark-ups is investigated by Edwards and van de Winkel (2005). They consider the theoretical motivation for such a study and use sectoral data from 1970 - 2002 to estimate mark-ups and study the effect of tariff liberalisation on these mark-ups. They find that the average mark-up in the manufacturing sector is 42 per cent, but that this is sensitive to the inclusion of intermediate inputs, which causes the mark-up to fall to 12,5 per cent. Furthermore they find that the mark-up in the mining and services sectors are high, with and without intermediate inputs included. The effect of tariff liberalisation and import penetration on mark-ups is investigated over the period 1988 – 2002, with the finding suggest that both tariff liberalisation and increased import penetration post 1994 have resulted in mark-ups falling.

Fedderke and Hill (2011) consider the effects of the labour market on the mark-up in the manufacturing sector. The mark-up is both calculated and estimated based on a specification of the NSR. The study finds that the aggregate mark-up in the manufacturing sector from 1970 until 2004 was about 50 per cent, and that the proportion of labour that contributes to fixed costs is about two-thirds. The analysis also considers the trend of the mark-up and of the proportion of fixed labour over time finding that there was an initial drop in the mark-up which then reversed during the 1990's. Similarly, the labour market seems to have become more flexible, followed by a decrease in flexibility during the 1990's.

Aghion *et al* (2008) set out to investigate the nature of competition and productivity growth in South Africa, using three data sets from the mid-1960s, the early 1980's and between

[7] Fedderke and Schaling note that this is significantly higher than the 10 per cent found by Ghali (1999) for the USA.

1970 and 2004. Measures of the mark-up, calculated as proxies of the Lerner index and estimated using the Hall (1990) and Roeger (1995) NSR methodology are used to assess competitiveness. They find that there is evidence to suggest that the mark-up in South Africa is generally higher than in the rest of the world[9]. They also find that a higher level of mark-up, and hence lower implied level of competitiveness, leads to a lower level of productivity in the South African manufacturing sector at both sub-sector and firm levels. They do not find evidence of a decline in the level of the mark-up followed by an increase in the 1990's as suggested in Edwards and van de Winkel (2005), but rather that mark-ups remain high over the entire period.

Most recently, Gilbert and Du Plessis (2008) suggest that an inherent fault in Aghion *et al* is that their firm level data included only firms that have existed over the entire period of the study[10], hence introducing survivorship bias into the analysis. The focus of their paper is a comparison of survivorship-adjusted firm level data for South Africa and the US in terms of a select number of profit margins as used by Aghion *et al* in their firm level analysis. Their findings that the various profit margin measures return far more similar levels across South Africa and the US suggests that the survivorship bias present in the Aghion *et al* paper, may be one of the reasons for the large difference in calculated profits between firms in South Africa and firms in the rest of the world.

3 The mark-up measure: composition and cyclicality

The focus of this paper is somewhat different from previous work done for South Africa, as it is the implied nature of price and wage setting that is investigated rather than the inferred level of competition in various sectors of the economy and the comparison with other countries. To consider the dynamic correlation of the mark-up series, to investigate whether the evidence supports stickier wages or stickier prices, a mark-up series needs to be formulated.

[8] Between 77 and 79 per cent in South Africa where the US sees a 45 per cent average mark-up, this result reverses when the mark-up over gross output is considered, in which case South Africa seems to exhibit mark-ups of between 6 and 9 per cent and the US 13 per cent.
[9] Note that this is with intermediate inputs excluded from the calculation of the mark-up measures.

Formulation of an expression for the mark-up relies on a production function as well as information on prices, wages, the level of production and the amount of labour employed. Given the expression for the mark-up[11] (μ):

$$\mu = \frac{P}{MC_L} \tag{1}$$

where MC_L is the marginal cost of production with respect to labour[12] and P the price. A generalised, linearly homogenous production function:

$$Y = F(K, zL) \tag{2}$$

where Y is output, K is the capital input into production, L the labour input and z some form of labour augmenting technology. The production function can be differentiated with respect to labour to obtain part of the marginal cost formulation where the marginal cost with respect to labour is given by:

$$MC_L = \frac{W}{F_L(K, zL)} \tag{3}$$

where $F_L(K,zL)$ represents the marginal product of labour and W the wage bill. Substituting (3) into (1) yields the expression for the mark-up:

$$\mu = \frac{PF_L(K, zL)}{W} \tag{4}$$

Manipulation of this expression shows the mark-up to be a function of the elasticity of output with respect to labour (ε_{YL}) and the inverse of the labour share of income (s_L) as given in RW.

$$\mu = \frac{PY}{WL}\frac{LF_L(K, zL)}{Y} = s_L^{-1}\varepsilon_{YL} \tag{5}$$

This specification can be practically applied once a particular form of production function is assumed and estimates of the parameters have been obtained.

The above specification suggests that when a production function that produces a constant elasticity of output with respect to labour is assumed, then movements in the mark-up will be the result of movements in the labour share. If a non-constant elasticity of output with

[10] They point out that details about the number of SA firms (or any other firms) and whether the data set has been adjusted for survivorship bias has not been given in any form in the paper.

[11] The economic definition of the mark-up is used in this paper, that is that the mark-up is the price over the marginal cost of production. This is expected to differ markedly from the accounting definition of the mark-up.

respect to labour specification is assumed though, movement in the elasticity of output with respect to labour can also drive movements in the mark-up as will be seen in section 3.2.

3.1 The labour share

The labour share measure for this paper is loosely based on the formulation presented in Appendix A of Macallan *et al* (2008) with deviations due to data availability issues. Data for this paper is sourced from the South African Reserve Bank (SARB), and is of a quarterly frequency between in 1960 Q1 until 2010 Q3[13]. Two labour share measures are calculated – for the whole economy and for the private sector. The total economy labour share is not viewed to be the best measure of the mark-up or progression of the mark-up for the economy as it includes government services, whose values are not market determined. For this reason, the literature focuses on the private sector labour share. Gross value added at basic prices less the rental component[14] is used as the total value of output (PY) in the labour share calculation[15] with the total compensation of employees used for the value of labour (WL) in the calculation. Final consumption expenditure by general government is then subtracted from the value of output and compensation to government employees is subtracted from total compensation to produce the private sector labour share.

The labour share measures for South Africa are reproduced in Figure 1, where it can be seen that the labour share declined over the period 1960 - 2010[16]. The measures remained, on average, high and appear mean stationary through the mid to late eighties, although volatile. The labour share then followed a period of steady decline until the early 2000's after which it began to exhibit signs of stabilising on average below 0,55.

Figure 1 about here

[12] RW point out that under the assumption of profit maximisation, the marginal cost for every input to the production function will be equal; as a result if the marginal cost of labour was replaced by the marginal cost of capital, the mark-up should not change.

[13] This is a higher frequency than the papers that have done previous work on this topic.

[14] Including imputed rentals for owner-occupied housing.

[15] The use of GVA rather than GDP ensures that the value of subsidies is included in the value of production and that taxes are excluded and hence the price component more accurately reflect the price received by producers for their goods and services and hence the actual mark-up.

[16] Depending on the sample considered by RW, the labour share has either increased somewhat (full sample) or remained stable (truncated sample), and for MMP the labour share has remained relatively stable, possible increasing toward the end of the period (private labour share).

Correlations of the two labour share measures, calculated for this study against a dummy that equals one during economic downturns as identified in the Quarterly Bulletin[17] and zero otherwise, produces a much stronger positive relationship than found in Rotemberg and Woodford (1999) and Macallan *et al* (2008). For the period 1961 Q3 – 2009 Q1, the correlation of the business cycle dummy with the private labour share is 0.35 and for lags of the dummy variable up to 6 quarters this correlation remains positive and relatively strong, similar results are found for a truncated sample starting in 1972 Q3. This suggests a negative relationship between the business cycle and the labour share for South Africa[18], and by extension a positive relationship between the mark-up and the business cycle (assuming a constant elasticity of production with respect to labour, movements of the labour share are the inverse of the movements of the mark-up measure). These results are reported in the first column of Table 1.

Table 1 about here

Moving onto a more formal analysis of the correlation of the business cycle and labour share, South African HP detrended log GDP, the coincident business cycle indicator, new vehicle sales, manufacturing capacity utilisation and retails sales are used as cyclical indicators. These correlations are also done for lags and leads of the cyclical indicators. The results are reported in Table 1, where two time periods are considered; firstly the period 1961 Q3 – 2009 Q1 and then 1972 Q3 – 2009 Q1[19]. These truncations are a result of the leading and lagging of the business cycle measures as well as data availability. The contemporaneous correlations of the labour share variables are all negative and range from -0,17 to -0,55 for the longer period, and from -0,16 to -0,60 for the shorter period. The dynamic correlations of the private labour share with the business cycle indicators for the period 1972 Q3 – 2009 Q1 yield some interesting results. The correlation with detrended

[17] These periods of economic downturn differ in definition to periods identified for the US by the NBER dating committee as downturns for South Africa, as published in the Quarterly Bulletin, are defined as periods when aggregate economic activity is below the long-term growth trend (Venter 2009).

[18] This is due to the formulation of the dummy which increases (from zero to one) for economic down turns and reverses for economic upswings. This formulation is used to keep the results comparable.

GDP and with manufacturing capacity utilisation, produces the strongest negative relationship when the cyclical indicators are lead by three and five quarters respectively, suggesting that the private labour share leads the GDP cycle by three to five quarters. Stronger correlations are obtained when using the coincident business cycle indicator, new vehicle sales and retail sales with the largest negative correlations at a lead of six quarters. Similar results are obtained for the extended sample. The findings for the papers on the US and UK mark-ups are that the labour share is weakly countercyclical, with evidence that suggests that the labour share may peak before the cyclical indicators when doing a similar analysis.

3.2 The mark-up measure

An extension to this analysis is to replace the assumption that the production function exhibits a constant elasticity of output with respect to labour, with an assumption that the production function exhibits a constant elasticity of substitution between labour and capital (a constant elasticity of substitution (CES) production function with constant returns to scale), which results in a non-constant elasticity of output with respect to input. The CES production function specification is given as:

$$Y = A_t[\delta L_t^{1-\frac{1}{\sigma}} + (1-\delta)K_t^{1-\frac{1}{\sigma}}]^{\frac{\sigma}{\sigma-1}} \quad (6)$$

where A_t is the efficiency parameter that represents technological progress[20], δ the distribution parameter that represents the relative factor share contribution to output and σ represents the elasticity of substitution of capital and labour. The resulting formulation for the mark-up is then (given in terms of log deviations from mean):

$$\hat{\mu} = \left(\frac{1-\varepsilon_{YL}}{\varepsilon_{YL}}\right)\left(\frac{\sigma-1}{\sigma}\right)(\hat{y}-\hat{k}) - \hat{s} = \left(\frac{1-\mu.s}{\mu.s}\right)\left(\frac{\sigma-1}{\sigma}\right)(\hat{y}-\hat{k}) - \hat{s} \quad (7)$$

where the average ε_{YL} is replaced by the product of the average mark-up[21] and average labour share[22].

---

[19] The manufacturing capacity utilisation series runs from the first quarter of 1971 onward only and the retail sales series from the first quarter of 1970. Thus, analysis with these two variables is run from the third quarter of 1972 to account for the six quarter lag structure that is used later on.

[20] This can be assumed to be time-varying or constant.

[21] There is evidence that the mark-up is constant until the 1990's, during which it tends to increase and then stabilises from about 2000 onward. This is likely driven by movements in the labour share discussed earlier in the paper.

[22] From equation (1).

Bonga-Bonga (2009) produces both a Cobb-Douglas (CD) production function and CES production function for South Africa over the period 1970 to 2006 for the purposes of comparing forecasting accuracy. The CES production function is linearised following Nerlove's two-step procedure, with the elasticity of substitution between capital and labour, estimated in the first step, to be 0,125. As a result, this paper sets σ equal to 0.125[23], the average value of the labour share equal to 0.56[24] and the average value of the mark-up equal to 1,7 (this is the average of the mark-up implied by the parameters used). A log deviation of the mark-up series is calculated (according to equation 7) and the resulting correlations with selected business cycle variables are given in Table 2 for the period 1972 Q3 to 2009 Q1. Results for a CD specification (inverse of the labour share) are also included for the sake of comparison.

Table 2 shows that the correlations of the mark-up measures based on a CD specification are effectively the inverse of the correlations with the labour share (given in Table 1), as would be expected. If this is then assumed to reflect the nature of production in South Africa, the mark-up would appear to be pro-cyclical, with the mark-up tending to lead the business cycle. Once a different production function specification is assumed, such as the CES production function in this case, the contemporaneous correlation of the log deviation of the mark-up measure turns negative and relatively strong, with the mark-up measure peaking one to two quarters before the business cycle bottoms out or coinciding with the business cycle depending on the business cycle indicator considered. These patterns are similar to those reported in Rotemberg and Woodford (1999) whereas Macallan *et al* (2008) find that their CES based mark-up measure exhibits procyclicality.

Table 2 about here

Next the assumption of constant returns to scale can be relaxed to allow for overhead labour. The concept of overhead labour refers to the level of labour that is required to be hired regardless of the level of production (e.g. the finance/accounting departments of a

[23] This differs from RW and MMP. A difference in the elasticity of substitution between SA and the UK and US would not be surprising given the different levels of development and areas of relative advantage in the labour and capital markets.

firm). Theoretically this alteration should lead to a more countercyclical mark-up measure as the adjustment to the mark-up ($\frac{L}{L-\bar{L}}$) is monotonically decreasing in *L*, where $\bar{L}$ is overhead labour. The effect of this on the deviation of the mark-up from its average is therefore:

$$\hat{\mu} = \left(\frac{1-\mu s}{\mu s}\right)\left(\frac{\sigma-1}{\sigma}\right)(\hat{y}-\hat{k}) - \frac{\frac{\bar{L}}{L}}{1-\frac{\bar{L}}{L}} - \hat{s} \tag{8}$$

Work in this area by Fedderke and Hill (2011) for South Africa finds that the average level of the labour force that is fixed is approximately two thirds. This is high relative to the $\frac{2}{7}$ used for the US and UK, but as it is the only available evidence for South Africa, the steady state ratio is set at two thirds[25]. Table 3 reports the results obtained by adjusting both the CD production function and the CES production function specifications for overhead labour. It is worth noting that the elasticity of output with respect to labour is now with respect to the variable labour component. The results suggest that including a term for overhead labour would cause the correlation of the deviation of the mark-up measure from average to become more countercyclical. Interestingly, the CD production function specification yields dynamic correlations that suggest that the mark-up lags the business cycle rather than leads it as has been found previously. The results for the dynamic correlations with manufacturing capacity utilisation do not support this conclusion, finding little change in the patterns from the correlation of the mark-up with the fixed labour costs to the correlation of the mark-up with no fixed labour costs.

A further extension of the analysis suggested by Rotemberg and Woodford (1999) is to include material costs in the mark-up estimation (these have not been taken into account as yet as they are not included in the production function). Results for a similar analysis are found in Fedderke *et al* (2007) who suggest that, in South Africa, the proportion of intermediate inputs into gross output is between 0.8 and 0.9, resulting in a fall in the mark-up from 77-79 per cent to 6-9 per cent[26]. Applying Fedderke *et al* (2007) findings to the CES mark-up measure results in the average mark-up falling to 4-9 per cent when taking account

[24] Under the assumption of perfect competition, the distribution parameter is expected to be equal to the share of labour to GDP at factor income (Klump and Preissler, 2000:Bonga-Bonga, 2009).
[25] As the composition of this is not investigated it may include overhead labour and labour-hoarding and any other kind of behaviour that may exhibit "fixed" labour characteristics.

of the share of material in the calculation of the mark-up measure (a substantially bigger fall than the results reported for the US, although the share of intermediate inputs is quite a bit lower at 0.6).

Table 3 about here

A number of other extensions to the analysis are considered in both the papers followed her for the US and the UK. These include looking at the cost of adjusting the labour input (costs of training etc), the effect of overhead labour and estimating the mark-up by including intermediate inputs in the production function, and considering the resulting mark-up measure with a focus on intermediate inputs rather than labour. In all cases, the results for the US find that the mark-up measure remains negatively related to the business cycle, and in most cases seems to lead the business cycle. By contrast, the results for the UK find that the mark-up measure is positively related to the business cycle for their full sample (except for a weak negative correlation when looking at overhead labour and labour adjustment costs). Such research in the South African context is restricted by the lack of available research in the regarding the nature of employment as well as data availability issues.

3.3 Mark-up behaviour during inflation-targeting

Table 4 presents the correlation results for various mark-up measures for South Africa with manufacturing capacity utilisation for Q3 2000 onward. This period starts shortly after South Africa adopted inflation targeting and also coincides with the start of the apparent stabilisation of the calculated labour share (see figure 1). The results show that the mark-up for South Africa since Q3 2000 seems to be negatively correlated with manufacturing capacity utilisation. Including fixed labour causes the mark-up calculated using a CD production function to become more negative, however the CES mark-up seems to experience little effect by taking into account fixed labour although the correlation is significantly stronger for this measure than for the whole period. The average implied mark-up as a result of using the truncated dataset increases to about 92 per cent, which is very high. Mark-ups at this level have been recorded for individual sub-sectors in the

[26] In this paper, the authors also control for industry concentration. Once this is done, the mark-up measure over gross output increases substantially above the 6-9 per cent. This cannot be done in the context of this

manufacturing industry by Fedderke and Hill (2011), but not for their entire sample, although the entire sample for this paper covers a wider section of the economy than in Fedderke and Hill (2011). The gross mark-up for this period is also higher at between 5 and 10 per cent.

Table 4 about here

4 Conclusion

This paper set out to calculate an aggregate mark-up measure and establish the nature of the cyclicality of the aggregate mark-up for South Africa in order to better understand price setting behaviour. The labour share, a significant component of the mark-up, was found to be countercyclical with some evidence that it leads the business cycle. The movements of a typical CD based mark-up measure, which is the inverse of the labour share imply a pro-cyclical mark-up measure. The mark-up measure, calculated using a CES production function, is shown to be quite volatile over 1960-2010, with evidence that the aggregate mark-up has risen over the period. The average mark-up over the entire period is found be 70 per cent, this is quite high, although not beyond the bounds of previous estimates for South Africa. Taking into account the proportion of the mark-up that covers intermediate materials (80-90 per cent), the gross mark-up is shown, provisionally, to be much lower (4-9 per cent). When fixed costs are introduced, the cyclicality of the mark-up measures for both production function specifications turns negative, except in the case of manufacturing capacity utilisation, where the CD measure still exhibits procyclicality and the CES remains negatively related to the business cycle. In two cases, under this specification, the mark-up was found to lag the business cycle rather than leading it.

Analysis of a truncated dataset, provides further support to the conclusion that the mark-up has increased as the average mark-up for the period from 2001 to 2010 was about 92 per cent. Further analysis of this data continues to support the conclusion that the mark-up is countercyclical.

paper as it is done at an aggregated level.

The evidence as to relative price setting is somewhat mixed, with the evidence mostly finding that the labour share leads or is contemporaneously correlated with the business cycle. This would support the notion that wages are stickier than prices in South Africa.

This paper manages to produce a series, albeit volatile, for the aggregate mark-up for South Africa, further work on this could consider the relationship of the mark-up with inflation and exchange rate pass-through to better understand the role of the mark-up in price setting. It also contributes to looking at the effect of the assumptions commonly made in economic analysis on the outcome that is observed. Specifically, as described above, changing the assumed production function, or considering overhead costs can had the effect of changing the nature of the correlation between the mark-up measure considered and the cyclical indicator suggesting that care must be taken when making assumptions in formulating models – assumptions are useful to help isolate certain relationships, but can also have the effect of distorting the results. It is perhaps not to say that we must do away with assumptions, but perhaps consideration of the effect of alternatives could provide more information (although not necessarily leading to greater clarity). Finally, there is very little reseach on models with endogenously determined and time varying mark-ups in South Africa as per the final section of Rotemberg and Woodford (1999). This is an area of research that is rich in information, but fraught with measurement, data and estimation issues.

Reference List

Aghion, P., M. Braun and J.W. Fedderke, 2008, Competition and Productivity Growth in South Africa, *Economics of Transition,* 16(4) p 741-768

Arrow, K. J., H. B. Chenery, B. S. Minhas and R. M. Solow, 1961, Capital-Labour Substitution and Economic Efficiency, *The Review of Economics and Statistics*, 43(3) p 225-250

Balakrishnana, R. and J. D. Lopez-Salido, 2002, Understanding UK inflation: the role of openness, *Bank of England Working Paper no. 164*

Bonga-Bonga, L., 2009, The South African Aggregate Production Function: Estimation of the Constant Elasticity of Substitution Function, *South African Journal of Economics,* 77(2) p 332-349

Campa, J.M. and L. S. Goldberg, 2005, Exchange Rate Pass-through into Import Prices, *The Review of Economics and Statistics,* 87(4) p 679-690

Edwards, L. and T. van de Winkel, 2005, The Market Disciplining Effects of Trade Liberalisation and Regional Import Penetration on Manufacturing in South Africa, *TIPS Working Paper WP1-2005*

Fedderke, Johannes W. & Hill, Andrew J., 2011, Industry structure and labour market flexibility in the South African manufacturing sector: A time series and panel data approach, *Economic Modelling*, 28(3) p 1291-1302

Fedderke, J. W., C. Kularatne and M. Mariotti, 2007, Mark-up Pricing in South African Industry, *Journal of African Economies,* 16(1) p 28-69

Fedderke, J. W. and E. Schaling, 2005, Modelling Inflation in South Africa: A Multivariate Cointegration Analysis, *South African Journal of Economics,* 73(1) p 79-92

Gilbert, E. S. and S. A. Du Plessis, 2008, Mark-ups and competition – a comparison of the profitability of listed South African and American industrial companies, *presented at an ERSA Institutions and Growth Workshop,*
http://www.econrsa.org/wkshops/institutions/Stan.pdf, accessed 12 July 2010

Macallan, C., S. Millard and M. Parker, 2008, The cyclicality of mark-ups and profit margins for the United Kingdom: some new evidence, *Bank of England Working Paper No. 351*

Mitchell, W. C., 1941, Business Cycles and their Causes Ch 5, *University of California Press, Berkeley*

Parsley, D., 2010, Exchange Rate Pass-through in South Africa: Panel Evidence from Individual Goods and Services, *South African Reserve Bank Working Paper WP/10/03*

Roeger, W., 1995, Can Imperfect Competition Explain the Difference between Primal and Dual Productivity Measures? Estimates for U.S. Manufacturing, *The Journal of Political Economy*, 103(2) p316-330

Rotemberg, J and M. Woodford, 1999, The cyclical behaviour of prices and costs, in Taylor, J. B. and Wordford, M. (eds), *Handbook of macroeconomics*, Vol. 1B, Amsterdam: Elsevier.

Venter, J. C., 2009, Business cycles in South Africa during the period 1999 to 2007, *South African Reserve Bank Quarterly Bulletin*, September 2009.

Table 1 Correlations of the labour share measures with business cycle indicators

		Business cycle dummy	HP filtered GDP	Coincident BC indicator	New vehicle sales	Manufacturing capacity utilisation	Retail sales
Total economy labour share	1	0.37	-0.21	-0.57	-0.51	-	-
	2	0.46	-0.22	-0.58	-0.55	-0.32	-0.59
Private sector labour share	1	0.35	-0.18	-0.55	-0.41	-	-
	2	0.40	-0.19	-0.62	-0.45	-0.15	-0.56
Correlation of private labour share with leads and lags of cyclical indicators 1972 Q3 - 2009 Q1							
Lead 6		0.07	-0.21	-0.69	-0.56	-0.20	-0.66
Lead 5		0.10	-0.24	-0.69	-0.55	-0.21	-0.64
Lead 4		0.15	-0.25	-0.68	-0.52	-0.20	-0.62
Lead 3		0.22	-0.25	-0.67	-0.51	-0.19	-0.61
Lead 2		0.29	-0.25	-0.65	-0.49	-0.18	-0.59
Lead 1		0.34	-0.23	-0.64	-0.47	-0.17	-0.58
Lag 1		0.45	-0.12	-0.59	-0.42	-0.10	-0.54
Lag 2		0.46	-0.03	-0.57	-0.38	-0.04	-0.52
Lag 3		0.45	0.05	-0.54	-0.36	0.02	-0.51
Lag 4		0.44	0.13	-0.52	-0.33	0.09	-0.50
Lag 5		0.43	0.20	-0.50	-0.29	0.16	-0.49
Lag 6		0.39	0.25	-0.49	-0.26	0.22	-0.48

* 1: 1961 Q3 - 2009 Q1

** 2: 1972 Q3 - 2009 Q1

Table 2 Dynamic correlation of the mark-up with selected business cycle indicators for 1972 Q3 – 2008 Q3

	HP filtered GDP		Coincident BC indicator		Manufacturing capacity utilisation	
	a	b	a	b	a	b
Lead 6	0.20	-0.09	0.69	-0.24	0.20	-0.35
Lead 5	0.23	-0.14	0.69	-0.25	0.21	-0.40
Lead 4	0.24	-0.19	0.68	-0.26	0.19	-0.45
Lead 3	0.25	-0.22	0.67	-0.26	0.19	-0.51
Lead 2	0.24	-0.26	0.66	-0.26	0.18	-0.56
Lead 1	0.23	-0.30	0.64	-0.26	0.17	-0.61
Contemporaneous	0.19	-0.31	0.62	-0.25	0.15	-0.64
Lag 1	0.12	-0.27	0.60	-0.24	0.11	-0.66
Lag 2	0.04	-0.20	0.57	-0.21	0.05	-0.64
Lag 3	-0.05	-0.14	0.55	-0.18	-0.01	-0.60
Lag 4	-0.12	-0.08	0.53	-0.15	-0.08	-0.56
Lag 5	-0.19	-0.02	0.51	-0.12	-0.15	-0.52
Lag 6	-0.24	0.02	0.49	-0.09	-0.22	-0.47

* a: Cobb-Douglas specification

** b: CES specification

Table 3 Dynamic correlation of mark-up adjusted for fixed labour with selected business cycle indicators for 1972 Q3 – 2008 Q3

	HP filtered GDP		Coincident BC indicator		Manufacturing capacity utilisation	
	a	b	a	b	a	b
Lead 6	0.14	-0.06	-0.63	-0.58	0.41	-0.22
Lead 5	0.12	-0.12	-0.64	-0.59	0.40	-0.28
Lead 4	0.08	-0.19	-0.66	-0.60	0.39	-0.34
Lead 3	0.02	-0.25	-0.68	-0.62	0.36	-0.40
Lead 2	-0.03	-0.31	-0.70	-0.62	0.33	-0.46
Lead 1	-0.09	-0.37	-0.71	-0.63	0.30	-0.53
Contemporaneous	-0.14	-0.39	-0.73	-0.62	0.26	-0.57
Lag 1	-0.18	-0.36	-0.75	-0.61	0.23	-0.59
Lag 2	-0.21	-0.29	-0.76	-0.59	0.20	-0.58
Lag 3	-0.20	-0.22	-0.77	-0.56	0.19	-0.54
Lag 4	-0.19	-0.14	-0.78	-0.53	0.19	-0.49
Lag 5	-0.17	-0.06	-0.79	-0.50	0.19	-0.44
Lag 6	-0.13	0.00	-0.80	-0.47	0.20	-0.38

* a: Cobb-Douglas specification

** b: CES specification

Table 4 Correlation of various measures of the mark-up with manufacturing capacity utilisation from 2000

	Cobb-Douglas mark-up	CES mark-up	Cobb-Douglas mark-up with fixed labour	CES mark-up with fixed labour
Lead 6	-0.26	0.00	0.37	0.06
Lead 5	-0.37	-0.12	0.24	-0.06
Lead 4	-0.48	-0.28	0.09	-0.21
Lead 3	-0.51	-0.41	-0.04	-0.35
Lead 2	-0.48	-0.55	-0.21	-0.50
Lead 1	-0.39	-0.70	-0.41	-0.66
Contemporaneous	-0.37	-0.83	-0.62	-0.81
Lag 1	-0.39	-0.94	-0.78	-0.93
Lag 2	-0.36	-0.96	-0.84	-0.96
Lag 3	-0.30	-0.95	-0.84	-0.95
Lag 4	-0.25	-0.94	-0.84	-0.95
Lag 5	-0.26	-0.94	-0.88	-0.95
Lag 6	-0.27	-0.93	-0.92	-0.94

Figure 1 Aggregate labour share for South Africa