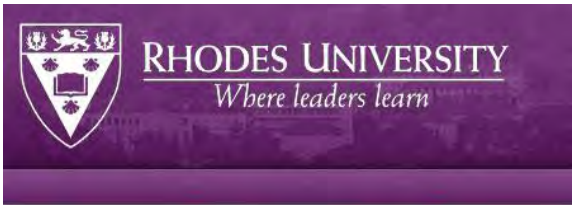

Bank concentration and the interest rate pass-through in Sub-Saharan African countries

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Abstract

This study investigates the link between bank concentration and interest rate pass-through (IRPT) in four sub-Saharan countries. It also analyses whether there is asymmetry in IRPT and whether such asymmetry is related to changes in bank concentration. By applying a number of econometric methods including Asymmetric Error Correction Models, Mean Adjustment Lag (MAL) models and Autoregressive Distributed Lag models on monthly data for the period 1994-2007, the study found some evidence of a relationship between bank concentration and IRPT in all four countries. However, the results reveal that bank concentration has a stronger influence on the magnitude of its adjustment rather than its speed. Of particular note in this investigation is the fact that the findings support both the *Structure-Conduct-Performance* hypothesis and the competing *Efficient-Structure* hypothesis in the banking industries of the four countries. While there is some evidence supporting the view that bank lending and deposit rates adjust asymmetrically to changes in policy rates, there is very limited evidence that these asymmetries are a result of bank concentration. The key implication of the result for African countries is that increased bank concentration through bank consolidation programmes designed to strengthen banking industries should not be viewed with cynicism in so far as monetary policy transmission is concerned because concentration does not necessarily undermine the effectiveness of monetary policy.

Keywords Bank Concentration Monetary Policy Interest Rate Pass-Through Asymmetric Adjustment Sub-Saharan Africa

JEL Classification E52 E58 G28

1 INTRODUCTION

While there generally has been consensus on the importance of effective monetary policy, debate on the most appropriate means to achieve it has created long-standing issues in the literature of monetary economics and central banking (Rasche and Williams, 2005). According to Mishkin (1995), monetary policy is only effective if its tools are able quickly to transmit monetary impulses to interest rates and if the resultant new structure of interest rates affect real expenditure. If market rates are sluggish in their adjustment to policy rate changes, then the desired goals of the monetary policy change may not be achieved despite the size of the change in the policy rates. In this system the banking industry is the gatekeeper, because the monetary policy shifts are enacted through changes in interest rates which banks are expected to reflect in revised lending and deposit rates to the public. Given that the banks, as conduits of monetary policy transmission, determine the strength[1] of the interest rate pass-through (IRPT) by setting lending and deposit rates by banks, research has focused

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[1] A perfect IRPT refers to a pass-through process in which official rates are fully and quickly reflected in bank lending and deposit rates. This makes IRPT analysis synonymous with the measurement of its speed and magnitude.

on identifying elements of the banking industry that could provide incentives or disincentives for banks to adjust their market rates in line with policy rate changes. Amongst the most contentious of these is bank concentration which is particularly interesting because different industrial organisation theories, and the interpretation of those theories, provide ambiguous implications for the relationship between changing bank concentration and the conduct of banks and, ultimately, the IRPT.

There are two opposing views on the impact that a concentrated banking system would have on the setting of bank lending and deposit rates and, by extension, that banking industry's IRPT. The first is the *Structure-Conduct-Performance* (SCP) hypothesis discussed in Hannan and Berger's (1991) analysis of US bank price rigidities and the second is the *Efficient-Structure* (ES) hypothesis investigated by Peltzman's (1969) analysis of monetary transmission in the American banking system. In the SCP the structure of an industry influences the conduct of its members, which in turn influences the performance of that industry. For example, an uncompetitive banking industry (structure) is likely to result in inefficient practices and a reduced incentive to respond quickly to monetary policy stance changes (conduct) resulting in a sluggish and incomplete IRPT (performance). Put simply, the SCP suggests that allowing the banking industry to become more concentrated, through consolidation programmes for example, would weaken the IRPT based on the expected behaviour of market participants in highly concentrated markets. In contrast, the ES suggests that concentration would increase the overall efficiency of the banking industry, resulting in banks pricing their products more competitively and thus becoming more sensitive to monetary policy impulses. This is based on the precept that increased concentration is due to more efficient banks growing more rapidly than less efficient banks, or more efficient banks taking over less efficient ones. If this is the case, at least up to some point, banks would price their services more competitively[2], rather than less competitively.

Effectively, the ESH suggests that the IRPT would strengthen as the market became more concentrated, as all inefficient banks that failed to respond in a timely fashion to policy rate changes were competed out of the market (Allen and Gale, 2003). Empirically, in the work of Hannan and Berger (1991), Neumark and Sharpe (1992) and Scholnick (1996), banking sector concentration influences bank conduct and consequently the nature of the IRPT. Conversely, in the studies conducted by Cottarelli and Kourelis (1994), Berstein and Fuentes (2005) and Abbasoglu *et al.* (2005), banking sector concentration does not influence the IRPT. As evidenced by this, not only are the theories not in agreement but the disparities are confounded by conflicts in the evidence from empirical research. Understanding whether or not bank industry concentration is related to a weak or strong IRPT is important because it will inform banking sector competition regulation. If concentration impedes the IRPT, and consequently the effectiveness of monetary policy, then it is of paramount importance that the banking industry be regulated to increase the number of market participants and reduce concentration. If concentration improves the IRPT then banking regulators may need to consider the possibility of consolidating their banking industries to encourage more concentration to enhance the effectiveness of monetary policy[3]. In addition to informing the regulation of the banking industry, identifying a relationship has implications for the setting of monetary policy when bank concentration is changing. To illustrate, should bank concentration be related to a slower IRPT, then the timing of official rate changes must change to ensure that they are set early enough to have the desired effect at the desired time. If, on the other hand, bank concentration is related to a weakening of the magnitude of the IRPT, then policy changes must be large enough to cater for the diminished reflection of official rates in bank lending and deposit rates.

In addition to the issues highlighted above, an important element of IRPT often overlooked is

[2] Here the word "competitively" is taken to refer to pricing strategies that reflect closely the changes in the official rate. This is the case because the competition would remove the scope for large disparities between the two or for slow adjustments in the bank rates in response to official rate changes.

[3] It is important to note that the results on whether high or low bank concentration is related to a weakening or strengthening IRPT can only partially inform banking sector competition regulation as other implications of a highly/lowly concentrated banking sector must also be considered. For example, questions concerning the impact of concentration on financial stability (see Allen and Gale, 2003) can be considered.

the possibility of asymmetry in the adjustment of both deposit and lending rates by banks following monetary policy changes. Are lending and deposit rates similarly responsive to impulses to adjust upwards and downwards and does bank concentration affect this responsiveness? Two competing hypotheses have been put forward that suggest possible asymmetry in IRPT. On the one hand, the collusive behaviour hypothesis posits that banks in highly concentrated markets may respond more positively to impulses to adjust their lending rates[4] upwards rather than downwards, because of their collective market power, thus resulting in asymmetric lending rate adjustments. In such a case, simply assessing the adjustment under the assumption that the rate would adjust similarly up and down would miss the important fact that bank concentration may be associated with a weakening of the impulse to reduce lending rates and not the impulse to increase them. For this reason ignoring the possibility of asymmetry in adjustment could lead to erroneous conclusions about the presence and nature of a relationship between bank concentration and bank lending and deposit rates. On the other hand, the adverse customer reaction hypothesis suggests that, in an environment where borrowers have bargaining power, rigidities may occur in the downward adjustment of deposit rates following an *expansionary* policy stance and in upward adjustments of lending rates following a *contractionary* monetary policy stance.

The potential issues relating to banking sector concentration have been made pertinent given trends in bank consolidation in Africa and a lack of empirical research on the matter on the continent. Thus the current study attempts to fill this void by investigating this potentially important link between bank concentration and the strength of the IRPT in Botswana, Nigeria, South Africa and Zambia. Furthermore, the study analyses whether there is asymmetry in pass-through and whether this asymmetry is a consequence of bank concentration. The rest of this paper is organised as follows: Section 2 provides a literature review; Section 3 presents an overview of monetary policy in the four countries; Section 4 discusses the analytical framework and data used in the paper; Section 5 presents the results; and Section 6 gives the conclusions and their policy implications.

2 THEORETICAL AND EMPIRICAL LITERATURE

While bank concentration and the IRPT can be described and identified separately, there is no explicitly stated theoretical representation of the interaction between them (Hoffman and Mizen, 2001)[5]. Consequently, the study of their relationship is focused on a merger of an understanding of market concentration and its potential influences on the behaviour of banks when making pricing decisions on deposits and loans. To this end De Bondt (2002) puts forward a simple marginal cost view of bank pricing decisions. The method suggests that a bank's interest rate (lending and deposit) "IB" is equal to a markup "X" plus a fraction "β" of the policy interest rate "IM". Algebraically this is represented as follows:

$$IB = X + \beta(IM) \tag{1}$$

Under perfectly competitive conditions the pass-through parameter "β" is 1, which means that shocks in the official rates are fully reflected in the individual bank's interest rates. Should it be below one, because of a lack of perfect information or bankers' resistance to monetary policy impulses, the changes in official rates are not fully reflected in the individual bank's interest rates. Equation 1 provides a primary model of bank pricing decisions from which to assess the sensitivity of bank lending and deposit rates to changes in monetary policy rates and in so doing the strength and magnitude of the IRPT. Where concentration can be found to influence "β,"concentration ccan be seen to influence the IRPT. The other element in this study, bank concentration, can be described as the degree to which a relatively small number of banks account for a relatively large

[4] Note that lending rates represent returns on assets, namely, loans.

[5] There are theories (explored here) regarding why it may be made smoother/stronger or more rigid/weak, however, these are not actually IRPT theories but theories surrounding IRPT changes; for example, theories on bank behaviour.

percentage of the banking market (Alegria and Schaeck, 2007: 4)[6]. In the empirical work, Cottarelli and Kourelis (1994) measured the speed of the adjustment of bank lending rates in 31 industrial and developing countries by regressing the lending rate on a distributed lag of money market rates. After determining the effects on lending rates of shocks in money market rates and tracking these effects over three months, six months and the long run they sought to explain cross-country differences by banking industry characteristics. One of the factors they investigated was bank concentration, which they observed as having no pronounced effect on the pass-through. Cottarelli *et al.* (1995) studied 63 banks in Italy from June 1986 to December 1993. Using an error correction model on monthly data over the period they established that bank concentration did have a significant impact on the IRPT. The authors argued the five firm concentration ratio (CR5) used in Cottarelli and Kourelis (1994) was a weak measure of market concentration and so they used the Herfindahl Hirschman Index (HHI). Their findings supported the existence of a negative relationship between bank concentration and the speed of the pass-through and were in line with Hannan and Berger's (1991) findings for US banks. Consistent with the *Structure-Conduct-Performance* hypothesis, banks in the most concentrated local markets were found to pay money market deposit account rates that ranged from 25 to 100 basis points less than those paid in the least concentrated markets. In contrast to this finding, Berstein and Fuentes (2005) found results that were similar to Cottarelli and Kourelis (1994). They found that the speed of adjustment was affected by banking sector expectations and interest rate volatility, but not concentration. Taking monthly data on deposit interest rates of different maturities in Chile, from May 1995 to December 2002, and concentration ratios of the three largest (CR3) banks, the five largest banks (CR5) and the HHI, their study showed that bank interest rates responded by between 75% and 88% to changes in the interbank interest rate. However, the authors conceded that their results were not in line with their expectations and so sought an explanation. In their research they found that concentration affected the coefficient of the lagged variables in their model and thus it had a long-run influence that could be missed in a short-run analysis. From this they concluded that market concentration negatively affected the interest rate pass-through, the only issue being when this effect would be felt in the pass-through. Importantly here, was the observation that the influence of market concentration could be missed if the analysis of the relationship was confined to the short run. In addition, the study also identified the potential for an asymmetric relationship in which bank concentration only influences one type of change in the bank lending and deposit rates[7]. Abbasoglu *et al.* (2005) presented another study that refuted the link between interest rate pass-through rigidity and the level of concentration in the banking sector. Taking CR3, CR5 and the HHI for Turkish banks from 2001 to 2005, they saw no evidence suggesting that there was a relationship between bank concentration and the IRPT. Of importance in their work was the identification that the IRPT was influenced by the level of banking sector *competition*. This observation was important because Van Leuvensteijn *et al.*'s (2008) work would suggest that contention existed in the study of bank concentration and the IRPT because researchers had been studying the effect of competition on the IRPT and not that of bank concentration. As a result, the expected relationship between bank competition and the IRPT was sometimes mistakenly represented as the relationship between bank concentration and the IRPT[8]. In Pakistan, Central

[6] It is important to note that concentration is a *relative* measure and while absolute measures of what constitutes a lowly concentrated or highly concentrated market can be suggested, these would be highly contentious and subjective in the very least. For the purposes of this investigation concentration is compared between countries and over rolling windows (as shown in section on the methods used for analysis).

[7] To illustrate, we follow Tomasz (2003) who observes that bank concentration need not exert a symmetric effect on the pass-through: it may speed up the pass-through in times of declining interest rates, while slowing it down in periods of increasing interest rates. In such a case, failure to consider the asymmetric response would yield confusing results.

[8] Such a mistake can be understood when concentration can be seen sometimes to be closely related to competition, for example, where the performance of an industry (competitiveness) is greatly influenced by the structure of the firms in the industry (concentration). Where concentration is high, for example, competitive pressures may be abated by tacit collusion on the part of the participating firm. In such a situation concentration and competition are closely and negatively related.

and Eastern Europe Quayyum *et al.* (2005) and Egert *et al.* (2007) found evidence supporting a relationship between bank concentration and the IRPT. While Quayyum *et al.* (2005) used Box *et al.'s* "Intervention Approach" and Egert *et al.* (2007) used a bivariate error correction system, their results both revealed that developing countries had discernable relationships between the concentration of their banking sector and their IRPT. From the foregoing, it is evident that the theoretical literature is ambiguous on the relationship between bank concentration and IRPT, with the big question being whether concentration promotes collusive and uncompetitive behaviour by banks, as the SCP suggests, or whether it enhances efficiency by flushing out uncompetitive banks, as the ESH suggests. In addition, that concentration may have an asymmetric response on bank rates, may suggest that symmetric tests ignoring this possibility will struggle to arrive at a consensus on its expected influence. With this in mind, the current study is particularly important as it is the first attempt, to the authors' knowledge, to address this issue for African countries.

3 OVERVIEW OF MONETARY POLICY AND BANKING INDUSTRY IN THE COUNTRIES

3.1 Monetary Policy

The principal objectives of monetary policy in all four countries were the maintenance of stable price levels, the preservation of an environment conducive to economic growth and the maintenance of the balance of payments. However, despite similar objectives, the targets of monetary policy differed, with South Africa and Botswana using inflation targets while Zambia and Nigeria used monetary aggregates (South African Reserve Bank, 2009; Bank of Botswana, 2009, Central Bank of Nigeria, 2009; Bank of Zambia, 2009). In each of the four countries, interest rates are a critical tool for the conduct of monetary policy. Consequently, the behaviour of private banks in setting lending and deposit rates potentially could have a profound effect on the effectiveness of monetary policy. In Figure 1, plots showing how well the movements in policy rates are mirrored by movement in lending and deposit rates are given for each country.

There is a clear positive trend for the policy, lending and deposit rates in South Africa suggesting a close relationship between these interest rates. Zambia also has similar trends in the movement of its interest rates. For Botswana, the trend is clearest between the policy rate and the lending rate, while the trend with deposit rates is weak. Of the four countries, Nigeria presents the weakest trend amongst the interest rates. While the general pattern of rates shows a positive relationship, like in the other countries, the movement is not as closely related.

To complement this preliminary graphical analysis, correlation coefficients for each country's deposit and lending rate with the central bank rate were computed and the results are reported in Table 1.

In line with the graphical plots, South Africa has the highest correlation coefficients, followed by Zambia, whose correlation coefficients are marginally below those of South Africa. Botswana and Nigeria have nearly similar correlation coefficients for both the official rate and the lending rate, while Botswana has by far the lowest correlation coefficients between official and deposit rates. Despite the observations made above, it should be noted that the graphical plots and the correlation coefficients are not meant to draw conclusions about the speed and magnitude of the IRPT. They do, however, give a picture of how well the retail rates seem to respond to the official rate and thus help stimulate questions about the effectiveness of monetary policy in the four countries. For instance, South Africa and Zambia exhibit the closest trends and strongest correlation in the policy, lending and deposit rates, while Botswana exhibits the weakest correlation between the official rate and the deposit rate. Does this imply that pass-through is strongest in South Africa and Zambia, and that pass-through to the deposit rate is quite rigid in Botswana? More analysis is needed to answer these questions.

3.2 Banking concentration

Generally, with the exception of South Africa, bank concentration declined over the sample period. The decreases seem to be more apparent in Nigeria and Zambia. The major influences in the declining concentration were the adoption of more liberal financial regulation, the encouragement of banking sector growth to cater to growing markets, and the desire to improve financial service delivery and capacity.

These trends in bank concentration can be explained as follows; in Botswana, the threat of market power abuse necessitated the encouragement of increased industry participation (Kayawe and Amusa, 2003: 5). In an effort to develop the financial services sector, the requirements for starting up a Nigerian bank were relaxed, with drastic reductions in statutory reserve requirements. The resultant rapid increase in the number of banks led to the existence of many banks without sound financial foundations – and the failure of many. This failure of banks necessitated the introduction of a bank consolidation exercise in 2004, to restore financial stability which was threatened by the fragile banking industry (Soludo, 2004: 2).

In Zambia financial reforms in 1991 led to a more liberalised financial sector, which drew more banking sector participants. However, this liberalisation also resulted in increased bank failures and the stunted growth of existing banks (Musonda, 2008). In South Africa, it is surprising that, despite post-democratisation policies meant to ensure that a large number of the previously unbanked black population got access to financial intermediaries (SARB, 2010), concentration has not decreased significantly. This was mainly due to bank consolidation that began in the late 1980s when profit margins were falling due to non-performing loans and the high cost of modern technology (Gidlow, 2003). Gidlow (2003) also suggests that despite the inception of the Banks Act of 1995, that encouraged entry of foreign banks to enhance competition, concentration has continued to rise as foreign banks limited their activities to niche markets due to their failure to compete with the big four South African banks in the core areas of retail banking[9].

4 ANALYTICAL FRAMEWORK

4.1 Methodology, Modelling Framework and Econometric Procedure

In order to address the question of whether bank concentration is relevant in IRPT this study uses two approaches. The first approach uses the overall average bank concentration for the entire period in each of the four countries. The average bank concentration is then compared with the IRPTs corresponding to the same time period, to evaluate whether countries with the highest (lowest) bank concentration have the weakest (strongest) IRPT. The second approach involves tracing the dynamics of IRPT and bank concentration over time using an 8-year rolling window[10]. The idea here is to examine whether the time-to-time dynamics in bank concentration are related to time-to-time dynamics in IRPT in each of the countries.

The starting point in analysing IRPT is the specification of a primary model which shows how rational commercial banks make pricing decisions on their loans and deposits, cognisant of the cost of obtaining accommodation from the central bank (Scholnick, 1996 and Aziakpono *et al.*, 2007). This model is a simple specification De Bondt's model (Equation 1) representing the long-run relationship between policy rates and bank lending/deposit rates as follows:

$$RR_t = \alpha_0 + \beta_1 CBR_t + u_t \tag{2}$$

where RR_t is the endogenously determined retail rate (in this study deposit and lending interest rates), CBR is the policy dictated rate, α_0 is an intercept which denotes a mark up/mark down

[9] For a comprehensive discussion of the South African banking industry see Aziakpono and Wilson (2010).

[10] The 8-year period was chosen to ensure that each period had approximately 100 observations to prevent small sample bias.

on the retail rates to reflect market conditions, e.g. credit risk premium on the lending rate (see Marotta, 2009), β_1 is the slope parameter that shows the fraction of the change in official rates that is reflected in changes in the retail rates in the long-run. A β_1 close to 0 would imply that the long-run IRPT is slow and weak. While a β_1 of 1 would be desirable as it implies that the policy rate is fully reflected in bank retail rates, it would be unlikely because of a number of factors such as asymmetric information, market imperfections, menu cost, switching costs and adverse customer reactions (Aziakpono and Wilson, 2010: 19). Consequently, β_1 is likely to be between 0 and 1, with a value close to 1 implying high and near complete pass-through, and *vice versa* In rare circumstances, overpass-through might occur when commercial banks respond to higher risks posed by asymmetric information by charging very high interest rates resulting in β_1 >1 (De Bondt, 2005; Aziakpono and Wilson, 2010). Variations in the magnitude of IRPT are reflected in the variation in the size of β_1, while variations in the speed of IRPT adjustment are reflected by the variation in the time taken for β_1 to be fully reflected in the bank lending and deposit rates. Finally u_t is a stochastic error term.

The simplest way to estimate the long run parameters $\alpha_0$and $\beta_1$would be by using the Ordinary Least Squares (OLS) technique. However it is well documented that time series can be non-stationary resulting in spurious regressions when they are used (Guajarati, 2002). In this study we test for stationarity using the Augmented Dickey Fuller (ADF) approach and the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) tests for stationarity[11] to ensure we have robust results.

For series that are stationary, OLS was used to estimate the long-run parameters in equation (2). Otherwise the series were differenced to make them stationary before estimating (provided that the series were stationary at first difference), in which case the long-run properties of the series were lost and the resulting parameter was interpreted as the short-run relationship between the official rate and the retail rates. Based on equation (2) the model for estimating the short-run parameter is the following autoregressive distributed lag (ADL) model:

$$\Delta RR_t = \delta_0 + \delta_1 \Delta CBR_t + \sum_{i=1}^{n} \delta_i \Delta CBR_{t-i} + \sum_{j=1}^{m} \lambda_j \Delta RR_{t-j} + \varepsilon_t \tag{3}$$

where Δ is a first difference operator, n and m denote the maximum number of lags chosen based on the Akaike Information Criterion (AIC), ε_t is a white noise error term, and δ_0 and $\delta_1$are short-run parameters which in this context can be interpreted as the short run/immediate pass-through and due to various impediments as mentioned earlier it is likely to be lower than the long-run pass-through (β_1). Following Kwapil and Scharler (2009), the symmetric LR impact of a policy rate change can then be computed from equation (2) as follows:

$$LR\ impact = \beta_1 = (\sum_{i=0}^{m} \delta_i)/(\sum_{j=1}^{m} \lambda_j) \tag{4}$$

To determine a symmetric adjustment for the non-stationary and non-cointegrated series of equation 3 is re-estimated by distinguishing between episodes of increasing and decreasing policy rate as follows:

$$\Delta RR_t = \delta_0 + \sum_{i=0}^{n} \gamma_i \Delta CBR^{+}_{t-i} + \sum_{q=0}^{p} \phi_q \Delta CBR^{-}_{t-q} + \sum_{j=1}^{m} \lambda_j \Delta RR_{t-j} + \varepsilon_{kt} \tag{5}$$

where n, p and m are the lag order based on the AIC, and the CBR^{+} and CBR^{-} are positive and negative shocks in the policy rates respectively. The long-run asymmetric multipliers are computed as follows:

$$LR^{+}(LR\ adjustment\ for\ increase\ in\ Central\ Bank\ rates) = \left(\sum_{i=0}^{n} \gamma_i\right) / \left(\sum_{j=1}^{m} \lambda_j\right) \tag{6}$$

[11] Since the two techniques for testing for stationarity are widely explored in several empirical studies, the theoretical underpinning behind them will not be discussed here. See Brooks (2008: 318-322).

$$LR^{-}(LR\ adjustment\ for\ increase\ in\ Central\ Bank\ rates) = \left(\sum_{q=0}^{p} \phi_q\right) / \left(\sum_{j=1}^{m} \lambda_j\right) \quad (7)$$

However, it is possible that a combination of two or more non-stationary series may be stationary. In this case the series are said to be conitegrated and results obtained from estimating equation 2 using OLS will no longer be spurious. Thus before estimating equation 3, series are first tested for cointegration. If cointegration exists then the analysis of interest rate pass-through will be based on the Error Correction Model.

This study used the Engle and Granger (EG) approach. Since each model has only two variables (the policy rate and the bank rate), there is at most one cointegrating vector, thus invalidating the strenth of the likelihood approach in identifying multiple vectors. Secondly, since IRPT is concerned with analysing the transmission of exogenously and discretionarily determined policy rates to endogenous retail rates, simultaneity/reverse causality is strongly ruled out. A potential criticism of the EG approach is the potential *lack of power* in the unit root tests, but in the current case, complementary tests using the cointegration regression Durbin-Watson and error correlation based tests are used to ensure robustness of the EG results.

The EG technique involves estimating the long-run equation (2), then testing whether the estimated residuals obtained are stationary. Where the residuals are stationary the variables are cointegrated. The CRDW technique compares the Durbin-Watson (d) values computed from estimating the potentially cointegrating regression equation (2) to some critical values under the hypotheses that $d = 0$ or $d = 2$. If the computed d statistic is greater than the critical values, then the series in the potentially cointegrating regression are cointegrated. The critical values are: 1% (0.511), 5% (0.386), 10% (0.322) (Gujarati, 1995: 726). Lastly, error-correction-based cointegration tests whether potentially cointegrating series have a statistically significant error correction term (see Kremers, 1989; Hendry and Ericson, 1991; Artis and Zhang, 1998). Since the LR pass-through and the asymmetry in pass-through are determined based on the error correlation model, it is important to give more attention to the error-correction-based test.

Assuming that cointegration exists between the central bank rate and the retail rates, a dynamic model that ties any short-run disequilibria to the long-run equilibrium can be represented as follows:

$$\Delta RR_t = \delta_0 + \delta_1 \Delta CBR_t + \sum_{i=1}^{n} \delta_i \Delta CBR_{t-i} + \sum_{j=1}^{m} \lambda_j \Delta RR_{t-j} + \varphi(RR_{t-1} - CBR_{t-1}) + \varepsilon_t \quad (8)$$

where is the error correction term [i.e. residual from OLS estimation equation (2)], whose coefficient, ϕ is a measure of degree of monthly adjustment towards long run equilibrium. The error correction cointegration test involves testing whether ϕ is statistically different from zero, in which case cointegration is said to exist between the official rate and the retail rate. As Aziakpono *et al.* (2007) note, a negative and statistically significant ϕ would imply that any short-run deviation of the official and retail rate from their long-run equilibrium is corrected in the adjustment of bank rates.

Once an error correction is calculated it is possible to ascertain the speed at which the bank rates adjust back to equilibrium after a change in official rates. This is done by computing mean adjustment lags which, in the context of the study, can be interpreted as indicating the speed of the IRPT. Whereas the error correction term shows the adjustment towards equilibrium within a month, the MALs show the total time taken (speed) to return to equilibrium. Following Doornik and Hendry (1994), the MAL is calculated from equation (8) as follows:

$$MAL = (1 - \delta_1)/\varphi \quad (9)$$

In the case of monthly data the MAL presents how many months it takes for the change in central bank rates to be fully[12] reflected in bank lending and deposit rates. If the mean adjustment

[12] The word "fully" refers to the complete LR impact rather than a full reflection of the change in the central bank rate, i.e. if LR adjustment is only 80% then the MAL shows how long after the initial response in the bank rate it takes for the full 80% response to be reflected.

lag is high, then there is a high rigidity/slow adjustment in the response of bank rates to policy rate changes. The opposite would be true with a low mean adjustment lag, suggesting low rigidity/fast adjustment of bank rates to policy rate changes.

These MALs are more correctly described as symmetric MALs as they reflect the response of bank rates whether they are above or below their equilibrium level. Computing asymmetric lags would show how long it takes bank rates to adjust up to equilibrium and down to equilibrium. These asymmetric MALs would effectively show how fast bank rates adjust upwards and downwards. To determine the asymmetric effects Scholnik (1996) suggests the separation of the residuals (here marked as) from the cointegrating equation into two series and, where:

$$\begin{aligned} EC^{+} &= EC, \qquad if \quad EC > \mu \\ EC^{+} &= 0 \qquad\quad if \quad EC < \mu \end{aligned}$$

and

$$\begin{aligned} EC^{-} &= EC, \qquad if \quad EC < \mu \\ EC^{-} &= 0 \qquad\quad if \quad EC > \mu \end{aligned} \tag{10}$$

where μ is the mean of the error correction which is equal to zero, since it is the residual series of the cointegrating equation. When a residual is above its mean it can be interpreted as the bank lending/deposit rates being above their equilibrium level with the policy rates and consequently expected to move *down* to equilibrium. Conversely, when the residual is below its mean it can be interpreted as the bank lending/deposit rates being below their equilibrium level with policy rates and consequently expected to move back *up* to equilibrium. By splitting the residuals it is now possible to observe the speed of adjustment up or down for lending and deposit rates after central bank rate changes. Once the residuals are split into two series an asymmetric error correction system is calculated from which the asymmetric MALs can be calculated. The asymmetric error correction equation is presented as follows:

$$\Delta RR_t = \delta_0 + \delta_1 \Delta CBR_t + \sum_{i=1}^{n} \gamma CBR_{t-i} + \sum_{j=1}^{m} \lambda \Delta RR_{t-i} + \varphi_1 EC^{+} + \varphi_2 EC^{-} + \varepsilon_{kt} \tag{11}$$

The relevant asymmetric mean adjustment lags become:

$$MAL^{+} = (1 - \delta_1)/\varphi_1 \tag{12}$$

and

$$MAL^{-} = (1 - \delta_1)/\varphi_2 \tag{13}$$

The mean adjustment lags in equations 12 and 13 show the asymmetric adjustment in bank lending and deposit rates when they are above and below equilibrium respectively. If the mean lags are different then the adjustments of the bank rates can be seen to be different. However, whether or not true asymmetry exists requires the use of the Wald test with a distribution on the restriction that equations 7 and 8 are in fact equal[13]. If the Wald test reveals asymmetric responses when residuals are above equilibrium (and bank rates are pushed to move down) and when residuals are below equilibrium (and bank rates are pushed to move up) then it can be concluded that bank rates will adjust differently during periods of expansionary monetary policy, when bank rates are expected to rise, and during contractionary monetary policy when bank rates are expected to fall, as indicated in the theory discussed earlier.

[13] The Wald test works on the null hypothesis that the coefficients of the asymmetric error correction terms (R^{+} and R^{-} in equation 6) are not statistically different from zero. Rejecting this null suggests that the responses of bank rates to impulses to move *down* to equilibrium and *up* to equilibrium are in fact asymmetric.

5 RESULTS

5.1 Data and data sources

The measure of bank concentration utilised in this study is the three-firm banking concentration ratio (CR3)[14]. While data choice in Africa is subject to the major constraint of data availability, the CR3 measure was used not only for its availability but also for its common use in empirical analysis (cf. Berstein and Fuentes, 2005 and Abbasoglu *et al.*, 2005)[15]. The data is for the period 1994-2007 for Botswana (BOTS), Nigeria (NIG), South Africa (RSA) and Zambia (ZAM). The countries and sample periods were selected primarily according to data availability. The data is sourced largely from the IMF International Financial Statistics (IFS) CD ROM 2009, Central Bank Reports and the New Database on Financial Development and Structure 2007 (Beck *et al.*, 2007 and World Bank, 2009).

5.2 Stationarity and Cointegration Test Results

The results are reported in Table A1 (in Appendix). Most the series were $I(1)$, although in rare circumstances some series were $I(0)$(a fact that did not materially change the analysis). The cointegration analysis was done for the entire period and in 8-year rolling windows. Results for both the entire period and the rolling windows, along with corresponding average concentration ratios (and their rankings[16]), are reported in Table A2. Given that three tests of cointegration are used, the procedure in deciding if series are cointegrated follows Kremers *et al.* (1992), who suggests that cointegration exists when one of the tests confirm cointegration at least at a 5% level of significance or at least two of the tests confirm cointegration at 10% level of significance.

Starting with the entire period, the cointegration results show strong evidence of cointegration in South Africa and Zambia, where all the tests identify cointegration at least at the 5% level of significance for both lending and deposit rates. In the case of Nigeria, deposit and lending rate cointegration is confirmed by only two of the tests. Botswana has the weakest evidence of cointegration for both lending and deposit rates and the cointegration is only identified by the ECM coefficient test. Particularly noticeable in the results is that the coefficient of the ECM strongly confirms the presence of cointegration in all the countries, for both lending and deposit rates, at a 1% level of significance. This is important given Artis and Zhang's (1998: 5) assertion that the ECM statistic for testing cointegration can generate more powerful tests than those based on the ADF and CRDW statistics. For this reason the results still demonstrate strong evidence of cointegration even where the ECM test is the only one to confirm its presence. Noteworthy is that the pattern of concentration does not seem to be related to the existence of cointegration in the series. For instance, South Africa, whose bank concentration level is marginally lower than that of Botswana (with the highest bank concentration), has the strongest and Botswana has the weakest cointegration results, while Nigeria, with the lowest bank concentration level, also has stronger cointegration results than Botswana. Moreover, changes in average bank concentration across the rolling periods also do not seem to be systematically related to the cointegration results in any of the countries or across countries.

[14] The 3-firm concentration ratio (CR3) is calculated as follows: $CR3 = (\sum_{i=1}^{3} Z_i)/Z_t$, where Z_i is the value of the assets held by an individual bank and Z_t is the total number of assets in the industry. Appendix Table A0 shows the concentration levels in the four countries for the entire period and for 8-year rolling windows. Here the choice of concentration measure was dictated by the data that was available.

[15] Furthermore, the commonality of its use allows the comparability of the analysis across industries, countries and time periods. With a myriad of concentration measures capturing varying elements of market structure it is essential that measures used must be sufficiently common to allow comparison of results to other studies (Jordán, 2003).

[16] The rolling windows are ranked according to their average level of bank concentration so that for each country there is an 8 year period demarcated as the most concentrated, that is "1", all through to one demarcated the least concentrated, that is "7".

One explanation for these results is that IRPT hinges on more than just the level of bank concentration: other factors, such as the ownership of the banks, legislation and bank supervision, may determine whether there is a long-run relationship between policy rates and bank lending and deposit rates (cf. Allen and Gale, 2003).

What the analysis on the two levels suggests is that bank concentration may not be a determining influence in the relationship between bank and central bank rates. Put differently, whether or not bank lending/deposit rates and central bank rates move together appears to be independent of the level of banking sector concentration. However, more scrutiny is necessary before a comprehensive conclusion can be drawn.

5.3 Symmetric and Asymmetric Adjustments

For the periods where cointegration was found, symmetric error correction models were estimated. Corresponding asymmetric error correction models were also estimated to separate the error correction mechanism between periods when bank rates are above and below equilibrium. The results for both the entire period and the rolling windows, together with the corresponding bank concentration ratios for each period, are reported in Table A3.

In all four countries symmetric error correction for both lending and deposit rates is significant, as shown by the fact that all EC_{t-1} values are significant at the 1% level. In addition lending rates adjust faster than deposit rates, suggesting a greater reluctance for banks to adjust deposit rates than lending rates. However, since this is true in all cases, regardless of the level of bank concentration, we can see that whether or not the lending rate adjustments are faster than deposit rate adjustments is not related to the level of concentration. This result is in line with the intuition, that since lending rates represent returns on assets (loans) and deposit rates represent expenditure on liabilities (deposits), banks would adjust lending rates faster than they would deposit rates, regardless of the level of concentration. In addition, it can be seen that the speed of adjustment is not related to the level of concentration. For example, Botswana, with the greatest concentration, has the slowest adjustment of lending rates, while Nigeria has the least concentrated banking industry and the third slowest adjustment of lending rates.

In the case of rolling windows, as expected, the results in all periods in which no cointegration is identified, and the error correction is computed to perform the ECM coefficient test, show that there is no statistically significant error correction both symmetrically and asymmetrically. For example, in Botswana for the periods 1999-2006 and 2000-2007, there is no evidence of cointegration and the corresponding ECM values are not significant. However, in so far as the symmetric adjustment is concerned there are some intuitively unappealing results in which cointegration is identified and yet the corresponding error correction is not significant. In the symmetric error correction this is the case for South Africa 1999-2006(1), Botswana's deposit rate 1998-2005(7) and lending rates 1995-2002(4) and 1997-2004(6), and Zambia's deposit rate 1998-2005(7). According to Gonzalo and Lee (2000), it is possible to observe such a conflicting outcome in cases where the underlying series are fractionally integrated. In such cases the series are not actually $I(1)$, as identified by the stationarity/unit root tests. Consequently, the cointegration results on such series are in fact spurious. In all cases, however, there is no pattern between the changes in the bank concentration and the size or significance of the symmetric error correction.

In terms of the asymmetric error correction, there are fewer periods in which both the asymmetric error correction terms are significant than periods in which at least one of them is not significant. Neither in the size nor significance of the positive (EC^{+}_{t-1}) and negative error correction (EC^{-}_{t-1}) is there a clear relationship between bank concentration and the error correction mechanism of the cointegrated series.

5.4 Speed of Adjustment: Mean Adjustment Lags

While the error correction coefficients show by how much bank rates adjust back to equilibrium in each month, they do not show how long the complete adjustment will take. To determine the speed of the adjustment of the bank rates to central bank rate changes the study computes the mean adjustment lags as described in the analytical framework. Both the symmetric and asymmetric mean adjustments are computed. The average levels of concentration for each of the periods in each of the four countries are then compared to the mean adjustment to evaluate if there is any systematic relationship between the two. The results for both the entire sample period and the rolling windows period are reported in Table A4.

Starting with the results for the entire period, Botswana has the highest level of concentration and the largest symmetric MAL/slowest adjustment for both deposit and lending rates. After a shock to the equilibrium relationship it takes on average 2.6 months (approximately 78 days) and 1.7 months (approximately 50 days) for deposit rates and lending rates respectively to return to equilibrium. It follows that for a discernable relationship to be seen between bank concentration and the speed of adjustment, the country with the lowest concentration must have the fastest symmetric adjustment/lowest MAL. However, despite having the lowest level of concentration Nigeria does not have the smallest MALs. The fastest adjustment for both deposit and lending rates occurs in South Africa where, despite having the second highest level of concentration, it takes 0.7 months (approximately 19 days) and 0.5 months (approximately 13 days) for deposit rates and lending rates respectively to return to equilibrium. This analysis does not show a relationship between the level of concentration and the symmetric adjustment of bank lending/deposit rates to central bank rate changes.

In the case of the asymmetric adjustment, high bank concentration seems to be associated with slow adjustment down to equilibrium in lending rates. Botswana, with the most concentrated banking sector, has the slowest adjustment of lending rates, followed by Zambia and then Nigeria, which has the least concentrated banking sector. This suggests that that the more concentrated the banking industry the slower the speed in the reduction of lending rates back to equilibrium, This is evidence in support of the *Structure-Conduct-Performance* hypothesis which suggests that concentrated markets are susceptible to collusion which would slow down profit-reducing reductions in lending rates. This evidence supports the findings of Corvoisier and Gropp (2002) which also identify evidence in support of SCP in the banking industries of EU countries. However, some caution is necessary in drawing conclusions on thes results as this relationship exists in the absence of a significant MAL^{+} for South Africa, which had the fastest symmetric adjustment. In contrast to the speed of downward adjustment in lending rates, the speedds of downward adjustment of deposits (MAL^{+}) and the upward adjustment of both lending and deposit rates (MAL^{-}) do not seem to be related to bank concentration across the countries.

As for the rolling windows results, South Africa does not present evidence of a clear relationship between changing bank concentration and either a slower or faster symmetric speed of adjustment. For the same reason as the analysis of the entire period, no relationship is observable as increasing bank concentration is not clearly associated with increases or decreases in the mean adjustment lags[17]. The result is the same for adjustments up to equilibrium (MAL^{+}) and adjustments down to equilibrium (MAL^{-}). However, as may be expected, the impulses for profit-boosting increases in lending rates are faster than the impulses to reduce them. Of interest in the case of South Africa is that deposit rates adjust faster to impulses to increase than decrease, providing support for the adverse consumer reaction hypothesis. However, again, while some support for this theory may exist, there is still no evidence of a relationship between both the symmetric and asymmetric speed of adjustment and the level of bank concentration.

In Botswana the symmetric adjustments are larger than in South Africa, suggesting that both

[17] If increasing bank concentration was associated with either larger or smaller MALs then it would be clear that a pattern/relationship is present between bank concentration and the speed of the IRPT, as represented by the MALs.

lending and deposit rates adjusted more slowly in Botswana than in South Africa (with the lower concentration of the two). However, Nigeria, with the lowest concentration, has slower adjustments than more concentrated South Africa and Zambia, which quashes the possibility of a relationship. Nevertheless, within Botswana there is an indication that bank concentration is negatively related to the speed of adjustment of deposit rates symmetrically and when they are above equilibrium (and the impulse is for them to fall). This relationship is identifiable in the three most concentrated periods where the reduction in concentration is associated with slower symmetric and negative adjustments of deposit rates. The relationship between the asymmetric response and the level of bank concentration is not observable as the asymmetric mean adjustment lags are not significant in the same periods for MAL^{+} and MAL^{-} , for both lending and deposit rates, except in one period.

The results for Nigeria also show some signs of a relationship. As with Botswana there is a relationship, but in this case it is a positive relationship in the deposit rate between decreasing bank concentration and a slower speed of adjustment in the least concentrated periods for symmetric deposit rates, while there is a negative relationship over the same period for falling concentration and the faster adjustment of increasing deposit rates. The symmetric and asymmetric response of lending rates in Nigeria is not related to the level of bank concentration.

In Zambia bank concentration is negatively related to the symmetric and asymmetric mean adjustment lags for deposit rates in the most concentrated periods. As concentration fell the time taken for deposit rates to return to equilibrium increased, i.e. the speed of adjustment fell. This is a similar relationship to the one identified in Botswana. However, as with Botswana, the relationship does not hold for all the periods and so cannot be described as a distinct relationship. In terms of the lending rates, as with the other countries in the study a clear relationship could not be identified.

The analysis of results identified traces of a relationship between bank concentration and the symmetric and negative adjustment of deposit rates and falling lending rates, and moves on to an investigation of the relationship between bank concentration and the magnitude of the adjustment of bank rates in the short and long run, symmetrically and asymmetrically, in response to official rate changes.

5.5 Magnitude of Adjustment

As presented in Appendix A5, the short-run symmetric adjustment in deposit rates following a change in official rates is smallest in Nigeria, where concentration is smallest, and is at its largest in South Africa, where concentration is highest[18]. Based on this, the size of the short-run adjustment of deposit rates is positively related to bank concentration. This is to say that the greater the concentration, the larger the size of the adjustment. However, the symmetric adjustment of lending rates does not show a similar pattern, as the inclusion of Botswana (with the smallest adjustment) means that no clear relationship can be seen between concentration and the size of lending rate adjustments.

Appendix A5 also presents the long-run symmetric and asymmetric magnitudes of adjustment. As can be seen, there is no clear pattern between concentration and the symmetric magnitude of adjustment of lending and deposit rates. In the case of lending rates, while Nigeria has the smallest long-run adjustment and the lowest level of concentration, the largest adjustment is not associated with the most concentrated country (Botswana).

The symmetric long-run adjustment results are in line with the findings of the short-run results where no clear pattern can be seen between bank concentration and either a rising or falling size of adjustment following a positive or negative change in official rates. However, unlike the case of the short-run adjustments, the Wald test shows that the response is only asymmetric for lending rates in Zambia and Nigeria, and deposit rates in Zambia (countries with the lowest level of concentration).

[18] Botswana is eliminated from the analysis as it does not have a statistically significant value for the short-run adjustment. This leaves South Africa as the most concentrated country in so far as the symmetric short-run adjustment is concerned.

This indicates that asymmetry in the long-run adjustment of bank rates may be related to the level of banking sector concentration.

In South Africa the symmetric adjustment of long-run lending and deposit rates is negatively related to the level of banking sector concentration in the rolling windows from 1994-2001 to 1999-2006 (lending rates) and 1995-2002 to 1999-2006 (deposit rates). Increasing concentration is associated with lower long-run adjustments in bank rates following changes in official rates. This is in keeping with the SCP that suggests collusive behaviour will hinder the full reflection of changes in official rates in bank rates.

In Botswana the only sign of a relationship between the symmetric long-run adjustment and bank rate adjustment can be seen in lending rates in the rolling windows 1994-2001 to 1996-2003, where falling concentration is associated with larger long-run adjustments. This is a similar relationship to the one found in South Africa and it provides additional support for the influence of the SCP in so far as symmetric lending rate adjustments are concerned (see Appendix). The results for Nigeria do not give any evidence of a relationship between concentration and the symmetric adjustment of both lending and deposit rates. In contrast the evidence from Zambia is similar to the findings for Botswana and South Africa, where a relationship can be seen between falling concentration and larger symmetric magnitude of adjustments for lending rates.

In so far as the relationship between the level of concentration and the asymmetric response of the long-run magnitude of adjustment is concerned, there is some evidence of a relationship with the positive long-run adjustment and none with the negative long-run adjustment. Falling concentration is associated with larger long-run adjustments in deposit rates following both increases (LR+) and decreases (LR-) in the official rate. The results for lending rates do not depict any relationship.

In Botswana the only evidence of a relationship between the asymmetric adjustments and the level of concentration is in the lending rates. Over the sample period a falling level of bank concentration is associated with a larger long-run positive adjustment in lending rates following a positive change in the official rate. In Nigeria there is evidence that the positive long-run adjustments of both lending and deposit rates are related to the level of banking sector concentration. In the rolling windows 1996-2003 to 1999-2006, decreases in the level of concentration were associated with increases in the size of the positive long-run adjustment of deposit rates, while in the rolling windows 1994-2001 and 1995-2002 falling concentration is associated with a decreasing size in the positive long-run adjustment of lending rates. In Zambia the positive long-run adjustment of lending rates is positively related to the level of concentration. As the concentration level falls the size of the positive long-run adjustment also falls. Of particular importance is that in all four countries, whether the size of the negative adjustment is smaller or bigger than the corresponding positive adjustment for deposit and lending rates, it is not related to the level of banking sector concentration.

6 CONCLUSION AND POLICY IMPLICATIONS

The paper analysed the relationship between bank concentration and interest rate pass-through in four sub-Saharan countries. It also analysed whether bank retail rates responded asymmetrically to changes in the official rate and whether this asymmetry was associated with the levels or changes in bank concentration. The analysis was done both for the entire period (to see whether a country with the highest concentration has the most effective monetary policy transmission or otherwise) and eight year rolling windows (to trace whether the dynamic responses in pass-through are linked to changes in average bank concentration). The findings of the study are as follows:

Regarding the speed of adjustment, there is evidence that, in some cases, bank concentration is related to the speed of the IRPT. In the analysis of the entire period there is evidence of a negative relationship between bank concentration and speed of lending rate adjustments down to equilibrium, suggesting that the greater the concentration, the slower the reduction in lending rates by banks following a change in official rates. Put differently, bank concentration can be seen to

impede expansionary monetary policy when lending rates are expected to fall. However, once the analysis is moved to the rolling windows, the trend over time suggests a relationship only in the adjustment of deposit rates. In addition, where the trend over time shows a relationship between bank concentration and the symmetric and negative adjustment of deposit rates, the nature of the relationship is not consistent. In Botswana and Zambia the relationship is a negative one, suggesting that greater bank concentration results in slower adjustments of deposit rates, while in Nigeria it is a positive one, suggesting that greater bank concentration is associated with faster adjustments in deposit rates. In addition, the evidence from the Wald tests shows that bank concentration is not related to the presence of asymmetry in the speed of adjustment of both lending and deposit rates. This result is the same for the analysis of the entire period and the analysis through the rolling windows.

In so far as the magnitude of the adjustment is concerned; there is more evidence to suggest a relationship with bank concentration than there is to suggest a relationship between bank concentration and the speed of the IRPT. There is a positive relationship between the symmetric adjustment of deposit rates and the level of bank concentration in the analysis of the entire period. This analysis also shows a relationship between falling concentration and larger long-run negative adjustments in lending rates, which suggests that the responsiveness of banks to monetary policy impulses to reduce lending rates is negatively affected by bank concentration. In other words, bank concentration stifles the magnitude of the IRPT and by implication the effectiveness of monetary policy. In the rolling window analysis the evidence suggests a relationship with deposit rates as well. However, in some cases the relationships are positive while in others they are negative, suggesting that there is no consistent relationship between bank concentration and the magnitude of the IRPT in both the short run and the long run, symmetrically or asymmetrically. In some cases there is evidence that supports the Structure Conduct Performance hypothesis while in others there is evidence supporting the Efficient Structure Hypothesis.

It is important to note that the relationships were not consistent between the countries and across the two levels of analysis. This suggests that the relationships were either not the natural outcome of bank concentration changes and IRPT (supporting researchers such as Van Leuvensteijn *et al.*, 2008) or that there are some mitigating factors that are preventing the observation of the relationship. While the true explanation may still be debated, what is clear in the evidence is that bank concentration is not consistently related to the speed and magnitude of the IRPT. As a result, while the results show that bank concentration can be negatively and positively related to the speed and magnitude of the IRPT it should not be expected that greater concentration will either automatically retard or accelerate the IRPT and make monetary policy transmission any more or any less effective. Additionally, the fact that the relationships observed between bank concentration and the IRPT cannot be captured neatly by one hypothesis suggests that the influence of bank concentration will not be universal, but will capture the trend within a country at a specific time. Consequently, trying to identify a single relationship will continue to provide inconclusive results where the reality is that bank concentration can be related to the IRPT in different ways in different countries at different times.

The most important implication of these results is that the African trend towards bank consolidation (in line with the global trend noted earlier) is not to be regarded with alarm in so far as effective monetary policy is concerned. Simply because concentration is likely to increase is not to say that the IRPT will weaken or monetary policy will be less effective. However, this is not a vindication of proponents of increased bank consolidation and concentration. Such a conclusion can only be informed in part by this study because there are still other concerns around the operation of highly concentrated markets, for example, the potential abuse of market power access to financial capital.

As competition commissions consider legislation relating to policy on acceptable mergers, acquisitions and consolidation exercises in the banking industry they may now do so informed of the fact that the evidence in the selected African countries in this study is that the level of banking

concentration can be, but is not always, related to the either the strength or weakness of the IRPT of policy changes to bank deposit and lending rates.

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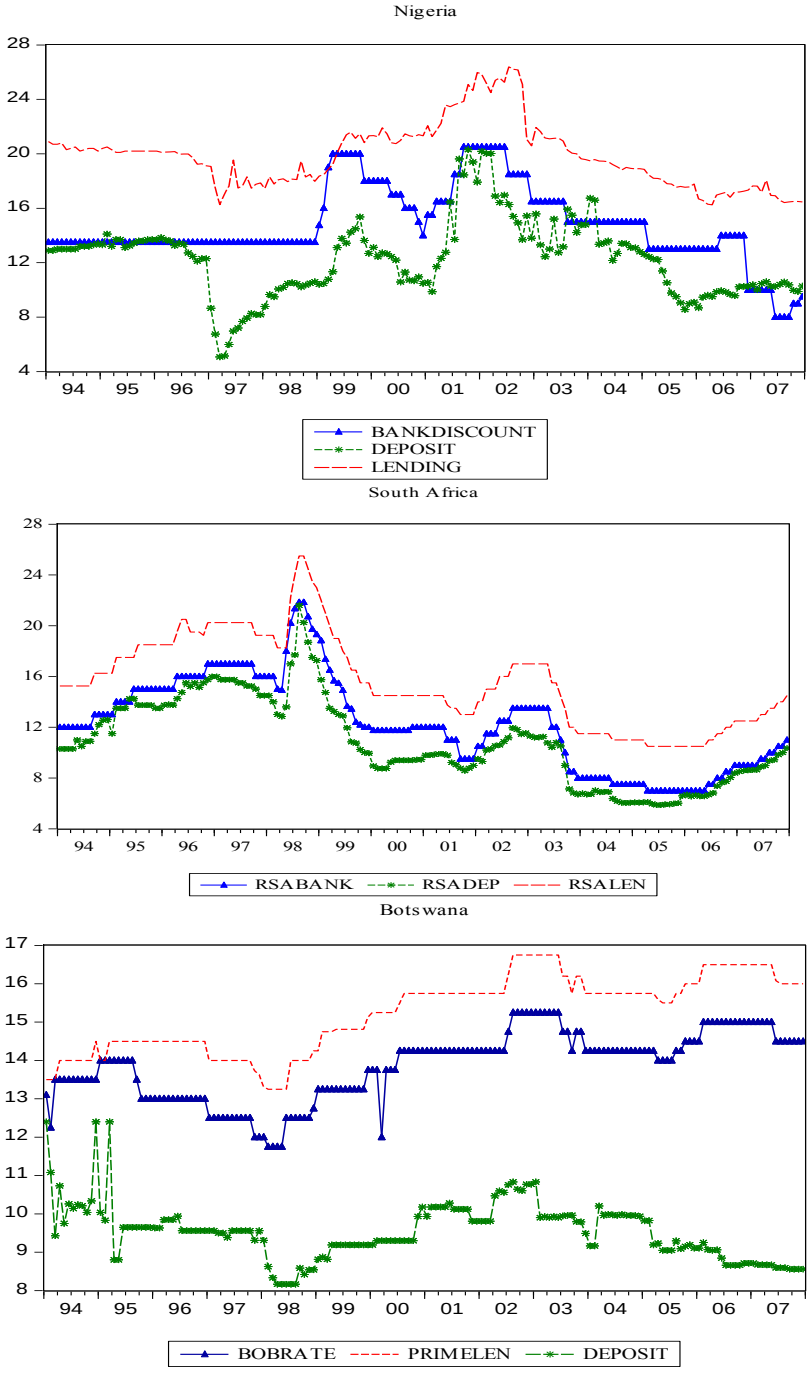
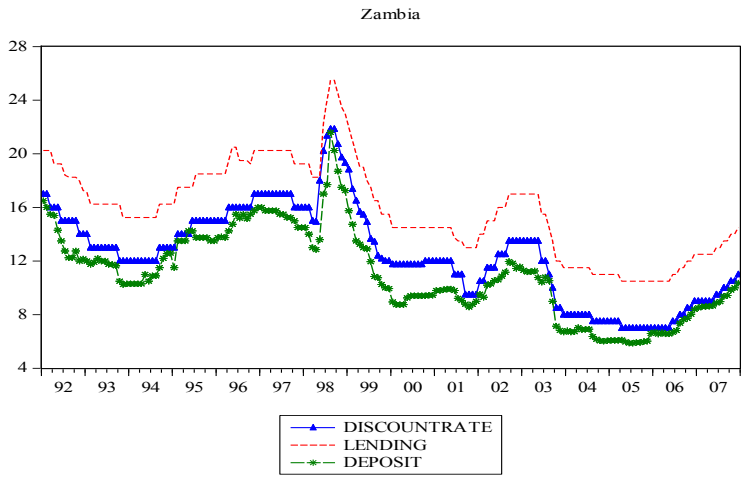
Table 1: Correlation of the Central Bank Rate with Deposit Rate and Lending Rate

	Botswana (BOTS)	Nigeria (NIG)	South Africa (SA)	Zambia (ZAM)
	Central Bank Rate	Central Bank Rate	Central Bank Rate	Central Bank Rate
Central Bank Rate	1.0000	1.0000	1.0000	1.0000
Deposit Rate	0.1930	0.7847	0.9780	0.9769
Lending Rate	0.8717	0.8623	0.9931	0.9928

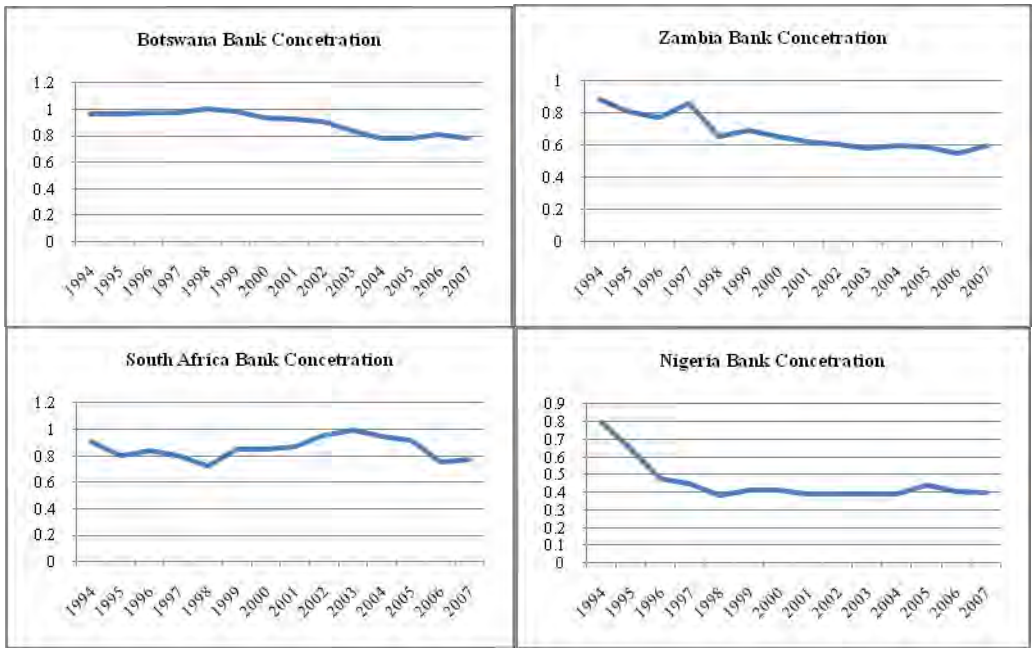
Figure 1: Trends in official and retail rates





All the graphs in Figure 1 are constructed from the IMF International Financial Statistics (2009 CD Rom). The y-axis marks the interest rates while the x-axis marks the year

Figure 2: Bank Concentration



Adapted from a New Database on Financial Development Structure 2007 (World Bank, 2009)

APPENDIX

TABLE A0: ROLLING WINDOW CONCENTRATION LEVELS

		SOUTH AFRICA		BOTSWANA		NIGERIA		ZAMBIA	
ppendix Tabl	CR3								
	Period	Conc. Level	Conc. Rank	Conc. Level	Conc. Rank	Conc. Level	Conc. Rank	Conc. Level	Conc. Rank
	1994-2001	0.82997	**7**	0.96702	**1**	0.49582	**1**	0.74408	**1**
	1995-2002	0.83617	**6**	0.95926	**2**	0.44532	**2**	0.70881	**2**
	1996-2003	0.86107	**5**	0.94289	**3**	0.41283	**3**	0.68047	**3**
	1997-	0.87434	**4**	0.91888	**4**	0.40161	**4**	0.65875	**4**
		0.88949	**2**	0.89482	**5**	0.40032	**5**	0.62463	**5**
		0.89341	**1**	0.87105	**6**	0.40248	**6**	0.61076	**6**

Key:
Significant at 1% (*), 5% (**), 10% (***)

A1: STATIONARITY and UNIT ROOT TESTS

ADF (H: 0 ~ Unit Root) Critical Values: 1% (-3.464643), 5% (-2.876515), 10% (-2.574831)
KPSS (H: 0 ~ Stationarity) Critical Values: 1% (0.739), 5% (0.463), 10% (0.347)

TABLE A-1: RSA (Stationarity/Unit Root Test)

	DEPOSIT RATE				LENDING RATE				BANK RATE			
	ADF		KPSS		ADF		KPSS		ADF		KPSS	
	Level	1st Diff	Level	1st Diff	Level	1st Diff	Level	1st Diff	Level	1st Diff	Level	1st Diff
1994-2001	-1.944	-4.724*	0.442*	0.212*	-1.405	-6.349*	0.374*	0.260*	-1.388	-5.951*	0.343*	0.278*
1995-2002	-2.011	-4.924*	0.738	0.117*	-1.623	-6.671*	0.640*	0.126*	-1.64	-6.299*	0.621*	0.621*
1996-2003	-1.676	-7.017*	0.875	0.095*	-1.595	-4.361*	0.812	0.108*	-1.048	-6.123*	0.834	0.118*
1997-2004	-1.392	-7.037*	0.913	0.050*	-1.745	-4.156*	0.882	0.056*	-1.235	-6.072*	0.939	0.055*
1998-2005	-1.557	-6.972*	0.848	0.053*	-1.368	-4.437*	0.859	0.053*	-1.458	-3.848*	0.927	0.051*
1999-2006	-2.541	-6.011*	0.851	0.323*	-1.974	-3.231*	0.887	0.285*	-1.965	-3.236**	0.982	0.266*
2000-2007	-1.304	-6.014*	0.463*	0.221*	-2.206	-2.644*	0.582*	0.164*	-2.177	-2.733***	0.699*	0.170*
1994-2007	**-1.883**	**-6.360***	**1.047**	**0.110***	**-1.849**	**-5.862***	**1.029**	**0.108***	**-1.421**	**-2.921****	**1.058**	**0.107***

TABLE A-2 BOTSWANA (Stationarity/Unit Root Test)

	DEPOSIT RATE				LENDING RATE				BANK RATE			
	ADF		KPSS		ADF		KPSS		ADF		KPSS	
	Level	1st Diff	Level	1st Diff	Level	1st Diff	Level	1st Diff	Level	1st Diff	Level	1st Diff
1994-2001	-2.078	-7.294*	0.423*	0.252*	-0.941	-10.079*	0.759	0.130*	-1.474	-14.232*	0.366*	0.149*
1995-2002	-3.511*	-14.929*	0.390*	0.219*	0.287	-8.187*	0.955	0.218*	-0.552	-12.669*	0.711*	0.403*
1996-2003	-1.517	-9.124*	0.571*	0.103*	-0.823	-8.563*	1.073	0.151*	-1.041	-13.142*	1.083	0.115*
1997-2004	-1.649	-9.592*	0.719	0.077*	-1.218	-8.919*	1.051	0.170*	-1.397	-13.365*	1.066	0.127*
1998-2005	-1.659	-10.316*	0.549*	0.120*	-2.547	-9.295*	0.846	0.407*	-2.53	-13.544*	0.863	0.236*
1999-2006	-1.778	-10.258*	0.330*	0.275*	-2.547	-9.585*	0.640*	0.212*	-1.984	-14.028*	0.641*	0.086*
2000-2007	-1.28	-10.240*	0.774	0.214*	-2.177	-8.924*	0.319*	0.129*	-3.289**	-13.960*	0.349*	0.060*
1994-2007	**-1.924**	**-8.013***	**0.713**	**0.313***	**-2.59*****	**-14.135***	**1.417**	**0.129***	**-2.80*****	**-16.164***	**0.807**	**0.083***

TABLE A-3 NIGERIA (Stationarity/Unit Root Test)

	DEPOSIT RATE				LENDING RATE				BANK RATE			
	ADF		KPSS		ADF		KPSS		ADF		KPSS	
	Level	1st Diff	Level	1st Diff	Level	1st Diff	Level	1st Diff	Level	1st Diff	Level	1st Diff
1994-2001	-2.116	-4.860*	0.211*	0.179*	0.114	-11.464*	0.499*	0.593*	-0.602	-4.081*	0.856	0.115*
1995-2002	-2.667	-5.464*	0.428*	0.089*	-1.464	-9.591*	0.815	0.115*	-1.317	-7.305*	0.911	0.078*
1996-2003	-1.882	-12.294*	0.631*	0.103*	-1.466	-9.708*	0.739	0.165*	-1.438	-7.972*	0.643*	0.133*
1997-2004	-1.924	-13.056*	0.753	0.099*	-1.458	-9.977*	0.484*	0.211*	-1.549	-7.972*	0.304*	0.145*
1998-2005	-1.601	-13.335*	0.256*	0.236*	-1.36	-9.188*	0.299*	0.376*	-1.292	-8.099*	0.295*	0.212*
1999-2006	-1.592	-13.312*	0.350*	0.100*	-0.979	-8.469*	0.666*	0.324*	-0.625	-7.316*	0.857	0.252*
2000-2007	-1.313	-13.805*	0.568*	0.086*	-0.698	-9.015*	0.983	0.149*	-0.627	-9.811*	0.999	0.104*
1994-2007	**-2.403**	**-17.491***	**0.424***	**0.045***	**-2.113**	**-16.950***	**0.547***	**0.079***	**-1.96**	**-13.322***	**0.379***	**0.056***

TABLE A-4 ZAMBIA (Stationarity/Unit Root Test)

	DEPOSIT RATE				LENDING RATE				BANK RATE			
	ADF		KPSS		ADF		KPSS		ADF		KPSS	
	Level	1st Diff	Level	1st Diff	Level	1st Diff	Level	1st Diff	Level	1st Diff	Level	1st Diff
1994-2001	-1.098	-7.764*	0.365*	0.130*	-2.036	-6.468*	0.457*	0.130*	-1.942	-6.118*	0.469*	0.143*
1995-2002	-2.029	-4.782*	0.244*	0.155*	-1.712	-6.511*	0.266*	0.161*	-1.852	-5.932*	0.287*	0.147*
1996-2003	1.454	-5.014*	0.624*	0.221*	-2.206	-2.944*	0.499*	0.376*	-2.177	-2.933***	0.699*	0.133*
1997-2004	-2.515	-11.202*	0.843	0.232*	-1.362	-10.410*	0.277*	0.190*	-2.482	-12.024*	0.427*	0.296
1998-2005	-1.814	-4.342*	0.775	0.081*	-2.263	-12.165*	0.700*	0.071*	-1.818	-9.224*	0.342*	0.087*
1999-2006	-2.968	-11.610*	0.629*	0.096*	-2.541	-12.369*	0.537*	0.078*	-2.148	-9.137*	0.254*	0.128*
2000-2007	-0.97	-10.842*	1.006	0.085*	-3.507*	-10.200*	0.189*	0.149*	-2.239	-9.186*	0.696*	0.167*
1994-2007	**-2.633**	**-8.235***	**0.753**	**0.214***	**-2.315**	**-9.356***	**0.450***	**0.156***	**-2.147**	**-11.326***	**0.452***	**0.112***

A2: COINTEGRATION TEST RESULTS

ADF McKinnon Critical values 2 variables ~ 100 observations: 1% (-4.008), 5% (-3.398), 10% (-0.3087) (Enders, 2004: 441)
ADF McKinnon Critical values 2 variables ~ 200 observations: 1% (-3.954), 5% (-3.368), 10% (-3.067) (Enders, 2004: 441)
CRDW critical values: 1% (0.511), 5% (0.386), 10% (0.322) (Gujarati, 1995: 726)
Conc. Rank is the 3 firm concentration ratio ranking of rolling windows with 1 being the most concentrated and 7 the least concentrated.

			Engle and Granger Model			
			ADF	CRDW	ECM coefficient	*ECM (prob).*
Conc. Rank		**Dep. Variable**				
	SOUTH AFRICA					
7	1994-2001	Deposit Rate	-2.594	0.586*	-0.407	0.000
6	1995-2002	Deposit Rate	-2.936	0.594*	-0.497	0.000
5	1996-2003	Deposit Rate	-4.339*	0.658*	-0.379	0.000
4	1997-2004	Deposit Rate	-4.883*	0.755*	-0.399	0.000
2	1998-2005	Deposit Rate	-5.187*	0.880*	-0.392	0.000
1	1999-2006	Deposit Rate	-3.309***	0.444**	-0.113	0.330
3	2000-2007	Deposit Rate	-2.548	0.239	-0.055	0.569
	1994-2007	**Deposit Rate**	**-3.443****	**0.498****	**-0.361**	**0.000**
7	1994-2001	Lending Rate	-5.389*	0.952*	-0.496	0.000
6	1995-2002	Lending Rate	-5.198*	0.897*	-0.581	0.000
5	1996-2003	Lending Rate	-4.890*	0.811*	-0.446	0.000
4	1997-2004	Lending Rate	-4.891*	0.813*	-0.505	0.000
2	1998-2005	Lending Rate	-3.487**	0.802*	-0.500	0.000
1	1999-2006	Lending Rate	-2.061	0.402**	0.607	0.000
3	2000-2007	Lending Rate	-1.745	0.101	-0.034	0.512
	1994-2007	**Lending Rate**	**-4.744***	**0.793***	**-0.435**	**0.000**

			Engle and Granger Model			
			ADF	CRDW	ECM coefficient	*ECM (prob).*
Conc. Rank		**Dep. Variable**				
	BOTSWANA					
1	1994-2001	Deposit Rate	-2.739	0.905*	-0.408	0.000
2	1995-2002	Deposit Rate	-5.48*	0.969*	-0.351	0.000
3	1996-2003	Deposit Rate	-2.647	0.281	-0.013	0.907
4	1997-2004	Deposit Rate	-3.250	0.367***	-0.050	0.642
5	1998-2005	Deposit Rate	-3.945**	0.503**	-0.039	0.717
6	1999-2006	Deposit Rate	-1.674	0.172	-0.082	0.432
7	2000-2007	Deposit Rate	-1.284	0.106	-0.100	0.347
	1994-2007	**Deposit Rate**	**-1.819**	**0.137**	**-0.347**	**0.000**
1	1994-2001	Lending Rate	-2.154	0.431**	-0.239	0.004
2	1995-2002	Lending Rate	-4.543*	0.558*	-0.152	0.110
3	1996-2003	Lending Rate	-9.353*	1.927*	-0.257	0.026
4	1997-2004	Lending Rate	-9.343*	1.925*	0.011	0.887
5	1998-2005	Lending Rate	-9.415*	1.908*	-0.267	0.014
6	1999-2006	Lending Rate	-9.915*	1.768*	-0.234	0.038
7	2000-2007	Lending Rate	-8.965*	1.824*	-0.505	0.000
	1994-2007	**Lending Rate**	**-2.484**	**0.302**	**-0.353**	**0.000**

			Engle and Granger Model			
			ADF	CRDW	ECM coefficient	*ECM (prob).*
Conc. Rank		**Dep. Variable**				
	NIGERIA					
1	1994-2001	Deposit Rate	-2.132	0.214	-0.241	0.020
2	1995-2002	Deposit Rate	-2.065	0.267	-0.308	0.005
3	1996-2003	Deposit Rate	-2.402	0.376***	-0.330	0.002
4	1997-2004	Deposit Rate	-2.471	0.427**	-0.313	0.003
5	1998-2005	Deposit Rate	-2.504	0.494**	-0.443	0.000
6	1999-2006	Deposit Rate	-2.589	0.501**	-0.447	0.000
7	2000-2007	Deposit Rate	-2.528	0.489**	-0.428	0.000
	1994-2007	**Deposit Rate**	**-3.4****	**0.319**	**-0.392**	**0.000**
1	1994-2001	Lending Rate	-1.641	0.181	-0.134	0.049
2	1995-2002	Lending Rate	-2.624	0.262	-0.146	0.119
3	1996-2003	Lending Rate	-2.867	0.306	-0.158	0.100
4	1997-2004	Lending Rate	-3.000	0.348	-0.156	0.108
5	1998-2005	Lending Rate	-2.798	0.298	-0.084	0.451
6	1999-2006	Lending Rate	-2.727	0.317	-0.073	0.420
7	2000-2007	Lending Rate	-3.7**	0.368***	-0.043	0.623
	1994-2007	**Lending Rate**	**-2.948**	**0.448****	**-0.400**	**0.000**

Conc. Rank		Dep. Variable	Engle and Granger Model			
			ADF	CRDW	ECM coefficient	*ECM (prob).*
	ZAMBIA					
1	1994-2001	Deposit Rate	-2.383	0.248	-0.242	0.026
2	1995-2002	Deposit Rate	-2.134	0.235	-0.305	0.004
3	1996-2003	Deposit Rate	-3.865**	0.703*	-0.563	0.000
4	1997-2004	Deposit Rate	-2.578	0.578*	-0.394	0.000
5	1998-2005	Deposit Rate	-1.983	0.456**	-0.437	0.000
6	1999-2006	Deposit Rate	-1.981	0.465**	-0.399	0.000
7	2000-2007	Deposit Rate	-2.548	0.239	0.032	0.000
	1994-2007	**Deposit Rate**	**-3.865****	**0.483****	**-0.334**	**0.000**
1	1994-2001	Lending Rate	-2.636	0.489**	-0.441	0.000
2	1995-2002	Lending Rate	-3.4**	0.430**	-0.435	0.000
3	1996-2003	Lending Rate	-3.201*	0.374***	-0.353	0.000
4	1997-2004	Lending Rate	-1.606	0.386**	-0.344	0.002
5	1998-2005	Lending Rate	-7.032*	1.377*	-1.112	0.000
6	1999-2006	Lending Rate	-5.823*	1.082*	-0.537	0.000
7	2000-2007	Lending Rate	-1.745	0.101	-0.911	0.000
	1994-2007	**Lending Rate**	**-5.45***	**0.920***	**-0.462**	**0.000**

A3: ERROR CORRECTION RESULTS

ΔBR is the change in the central bank/policy rate
ΔDeposit Rate representes change in the deposit rate
ΔLending Rate represents change in the lending rate
The symmetric error correction coefficient is denoted by EC_{t-1}
The asymmetric error correction coefficient representing adjustments down to equilibrium is denoted by EC^{+}_{t-1}
The asymmetric error correction coefficient representing adjustments up to equilibrium is denoted by EC^{-}_{t-1}

Conc. Rank		Dep. Variable	Explanatory Variables									
			Constant	*Prob.*	ΔBR	*Prob.*	EC_{t-1}	*Prob.*	EC^{+}_{t-1}	*Prob.*	EC^{-}_{t-1}	*Prob.*
	SOUTH AFRICA											
7	1994-2001	ΔDeposit Rate	0.000	0.996	0.782	0.000	-0.407	0.000				
		ΔDeposit Rate	-0.041	0.618	0.777	0.000			-0.325	0.037	-0.542	0.012
6	1995-2002	ΔDeposit Rate	-0.017	0.767	0.759	0.000	-0.497	0.000				
		ΔDeposit Rate	-0.026	0.727	0.759	0.000			-0.473	0.007	-0.535	0.023
5	1996-2003	ΔDeposit Rate	-0.045	0.439	0.759	0.000	-0.379	0.000				
		ΔDeposit Rate	-0.073	0.366	0.760	0.000			-0.319	0.049	-0.466	0.025
4	1997-2004	ΔDeposit Rate	-0.071	0.221	0.767	0.000	-0.399	0.000				
		ΔDeposit Rate	-0.101	0.189	0.769	0.000			-0.328	0.042	-0.499	0.013
2	1998-2005	ΔDeposit Rate	-0.055	0.343	0.779	0.000	-0.392	0.000				
		ΔDeposit Rate	-0.079	0.302	0.781	0.000			-0.336	0.039	-0.472	0.020
1	1999-2006	ΔDeposit Rate	-0.013	0.690	0.613	0.000	-0.113	0.330				
		ΔDeposit Rate	0.030	0.396	0.566	0.000			-0.285	0.293	0.174	0.311
	1994-2007	**ΔDeposit Rate**	**0.005**	**0.899**	**0.771**	**0.000**	**-0.361**	**0.000**				
		ΔDeposit Rate	**-0.010**	**0.839**	**0.772**	**0.000**			**-0.322**	**0.007**	**-0.419**	**0.006**
7	1994-2001	ΔLending Rate	-0.033	0.480	0.741	0.000	-0.496	0.000				
		ΔLending Rate	-0.182	0.001	0.682	0.000			0.294	0.166	-0.964	0.000
6	1995-2002	ΔLending Rate	-0.002	0.968	0.768	0.000	-0.581	0.000				
		ΔLending Rate	-0.124	0.056	0.725	0.000			-0.023	0.926	-0.653	0.025
5	1996-2003	ΔLending Rate	-0.037	0.420	0.807	0.000	-0.446	0.000				
		ΔLending Rate	-0.188	0.001	0.749	0.000			-0.347	0.115	-0.899	0.000
4	1997-2004	ΔLending Rate	-0.052	0.229	0.792	0.000	-0.505	0.000				
		ΔLending Rate	-0.200	0.000	0.725	0.000			-0.514	0.040	-0.926	0.000
2	1998-2005	ΔLending Rate	-0.045	0.294	0.790	0.000	-0.500	0.000				
		ΔLending Rate	-0.203	0.000	0.720	0.000			-0.558	0.029	-0.929	0.000
1	1999-2006	ΔLending Rate	-0.011	0.594	0.869	0.000	0.607	0.000				
		ΔLending Rate	-0.006	0.825	0.866	0.000			-0.661	0.000	-0.542	0.008
	1994-2007	**ΔLending Rate**	**0.000**	**0.997**	**0.820**	**0.000**	**-0.435**	**0.000**				
		ΔLending Rate	**-0.093**	**0.004**	**0.790**	**0.000**			**0.206**	**0.196**	**-0.798**	**0.000**

			Explanatory Variables									
Conc. Rank		**Dep. Variable**	Constant	*Prob.*	ΔBR	*Prob.*	EC_{t-1}	*Prob.*	EC^{+}_{t-1}	*Prob.*	EC^{-}_{t-1}	*Prob.*
	BOTSWANA											
1	1994-2001	ΔDeposit Rate	-0.036	0.563	-0.136	0.456	-0.408	0.000				
		ΔDeposit Rate	0.119	0.042	-0.044	0.775			-1.108	0.000	0.067	0.556
2	1995-2002	ΔDeposit Rate	0.001	0.978	0.070	0.653	-0.351	0.000				
		ΔDeposit Rate	0.120	0.004	0.073	0.549			-1.181	0.000	0.069	0.444
4	1997-2004	ΔDeposit Rate	0.003	0.912	0.067	0.374	-0.050	0.642				
		ΔDeposit Rate	0.022	0.446	0.066	0.375			-0.190	0.238	0.120	0.507
5	1998-2005	ΔDeposit Rate	-0.005	0.850	0.063	0.422	-0.039	0.717				
		ΔDeposit Rate	0.009	0.754	0.061	0.438			-0.145	0.389	0.069	0.683
	1994-2007	**ΔDeposit Rate**	**-0.015**	**0.657**	**0.100**	**0.373**	**-0.347**	**0.000**				
		ΔDeposit Rate	**0.093**	**0.156**	**0.144**	**0.007**			**-0.891**	**0.000**	**0.079**	**0.378**
1	1994-2001	ΔLending Rate	0.022	0.183	0.102	0.050	-0.239	0.004				
		ΔLending Rate	0.023	0.221	0.104	0.052			-0.260	0.073	-0.228	0.032
2	1995-2002	ΔLending Rate	0.030	0.053	0.159	0.003	-0.152	0.110				
		ΔLending Rate	0.022	0.211	0.147	0.007			-0.063	0.648	-0.256	0.088
3	1996-2003	ΔLending Rate	0.017	0.320	0.264	0.000	-0.257	0.026				
		ΔLending Rate	0.003	0.856	0.242	0.000			-0.107	0.477	-0.515	0.013
4	1997-2004	ΔLending Rate	0.015	0.368	0.206	0.000	0.011	0.887				
		ΔLending Rate	0.007	0.689	0.219	0.000			-0.094	0.517	-0.459	0.018
5	1998-2005	ΔLending Rate	0.030	0.058	0.245	0.000	-0.267	0.014				
		ΔLending Rate	0.017	0.332	0.225	0.000			-0.124	0.375	-0.526	0.009
6	1999-2006	ΔLending Rate	0.026	0.069	0.278	0.000	-0.234	0.038				
		ΔLending Rate	0.025	0.121	0.276	0.000			-0.220	0.143	-0.256	0.211
7	2000-2007	ΔLending Rate	0.005	0.667	0.388	0.000	-0.505	0.000				
		ΔLending Rate	0.000	0.984	0.384	0.000			-0.478	0.000	-0.606	0.018
	1994-2007	**ΔLending Rate**	**0.013**	**0.339**	**0.413**	**0.000**	**-0.353**	**0.000**				
		ΔLending Rate	**0.006**	**0.704**	**0.408**	**0.000**			**-0.272**	**0.028**	**-0.414**	**0.000**

			Explanatory Variables									
Conc. Rank		**Dep. Variable**	Constant	*Prob.*	ΔBR	*Prob.*	EC_{t-1}	*Prob.*	EC^{+}_{t-1}	*Prob.*	EC^{-}_{t-1}	*Prob.*
	NIGERIA											
1	1994-2001	ΔDeposit Rate	0.029	0.791	0.027	0.037	-0.241	0.020				
		ΔDeposit Rate	0.145	0.276	0.139	0.003			-0.489	0.011	-0.079	0.582
2	1995-2002	ΔDeposit Rate	-0.032	0.788	0.138	0.003	-0.308	0.005				
		ΔDeposit Rate	0.073	0.634	0.196	0.046			-0.481	0.014	-0.168	0.315
3	1996-2003	ΔDeposit Rate	-0.026	0.840	0.039	0.001	-0.330	0.002				
		ΔDeposit Rate	0.126	0.470	0.103	0.005			-0.518	0.004	-0.142	0.420
4	1997-2004	ΔDeposit Rate	0.005	0.967	0.035	0.009	-0.313	0.003				
		ΔDeposit Rate	0.212	0.241	0.115	0.007			-0.551	0.002	-0.085	0.614
5	1998-2005	ΔDeposit Rate	-0.004	0.976	0.093	0.051	-0.443	0.000				
		ΔDeposit Rate	0.030	0.871	0.103	0.002			-0.477	0.008	-0.392	0.093
6	1999-2006	ΔDeposit Rate	-0.036	0.771	0.053	0.008	-0.447	0.000				
		ΔDeposit Rate	-0.072	0.698	0.041	0.008			-0.412	0.017	-0.493	0.018
7	2000-2007	ΔDeposit Rate	-0.021	0.860	0.025	0.043	-0.428	0.000				
		ΔDeposit Rate	-0.071	0.690	0.007	0.038			-0.378	0.024	-0.495	0.016
	1994-2007	**ΔDeposit Rate**	**-0.015**	**0.872**	**0.459**	**0.000**	**-0.392**	**0.000**				
		ΔDeposit Rate	**0.220**	**0.060**	**0.455**	**0.000**			**-0.726**	**0.000**	**-0.133**	**0.225**
1	1994-2001	ΔLending Rate	0.024	0.679	0.154	0.006	-0.134	0.049				
		ΔLending Rate	0.158	0.037	0.171	0.029			-0.589	0.001	0.002	0.984
7	2000-2007	ΔLending Rate	-0.048	0.463	0.056	0.043	-0.043	0.623				
		ΔLending Rate	-0.041	0.647	0.055	0.001			-0.057	0.687	-0.028	0.853
	1994-2007	**ΔLending Rate**	**-0.002**	**0.986**	**0.707**	**0.000**	**-0.400**	**0.000**				
		ΔLending Rate	**0.096**	**0.374**	**0.706**	**0.000**			**-0.536**	**0.000**	**-0.252**	**0.037**

			Explanatory Variables									
Conc. Rank		**Dep. Variable**	Constant	*Prob.*	ΔBR	*Prob.*	EC_{t-1}	*Prob.*	EC^{+}_{t-1}	*Prob.*	EC^{-}_{t-1}	*Prob.*
	ZAMBIA											
1	1994-2001	ΔDeposit Rate	0.006	0.919	0.782	0.000	-0.404	0.000				
		ΔDeposit Rate	-0.030	0.709	0.777	0.000			-0.318	0.038	-0.529	0.012
2	1995-2002	ΔDeposit Rate	-0.012	0.836	0.771	0.000	-0.403	0.000				
		ΔDeposit Rate	-0.054	0.485	0.768	0.000			-0.316	0.037	-0.548	0.009
3	1996-2003	ΔDeposit Rate	-0.040	0.495	0.759	0.000	-0.374	0.000				
		ΔDeposit Rate	-0.066	0.413	0.760	0.000			-0.320	0.046	-0.459	0.030
4	1997-2004	ΔDeposit Rate	-0.066	0.252	0.768	0.000	-0.396	0.000				
		ΔDeposit Rate	-0.096	0.212	0.769	0.000			-0.328	0.041	-0.497	0.016
5	1998-2005	ΔDeposit Rate	-0.023	0.493	0.636	0.000	-0.135	0.204				
		ΔDeposit Rate	0.006	0.912	0.623	0.000			-0.292	0.207	-0.039	0.814
6	1999-2006	ΔDeposit Rate	-0.052	0.374	0.779	0.000	-0.390	0.001				
		ΔDeposit Rate	-0.075	0.325	0.781	0.000			-0.335	0.037	-0.472	0.022
7	2000-2007	ΔDeposit Rate	0.022	0.431	0.567	0.004	0.320	0.000				
		ΔDeposit Rate	0.095	0.021	0.536	0.000			-0.391	0.060	0.385	0.037
	1994-2007	**ΔDeposit Rate**	**-0.006**	**0.860**	**0.766**	**0.000**	**-0.334**	**0.000**				
		ΔDeposit Rate	**-0.014**	**0.754**	**0.766**	**0.000**			**-0.306**	**0.007**	**-0.369**	**0.009**
1	1994-2001	ΔLending Rate	-0.035	0.458	0.749	0.000	-0.471	0.000				
		ΔLending Rate	-0.187	0.001	0.696	0.000			0.317	0.148	-0.951	0.000
2	1995-2002	ΔLending Rate	-0.013	0.775	0.776	0.000	-0.435	0.000				
		ΔLending Rate	-0.181	0.003	0.732	0.000			0.351	0.111	-0.928	0.000
3	1996-2003	ΔLending Rate	-0.037	0.417	0.813	0.000	-0.413	0.001				
		ΔLending Rate	-0.201	0.001	0.759	0.000			0.389	0.084	-0.891	0.000
4	1997-2004	ΔLending Rate	-0.054	0.220	0.799	0.000	-0.474	0.000				
		ΔLending Rate	-0.218	0.000	0.733	0.000			0.612	0.021	-0.920	0.000
5	1998-2005	ΔLending Rate	-0.046	0.286	0.797	0.000	-0.467	0.000				
		ΔLending Rate	-0.225	0.000	0.728	0.000			0.678	0.013	-0.932	0.000
6	1999-2006	ΔLending Rate	-0.024	0.273	0.881	0.000	-0.328	0.000				
		ΔLending Rate	0.012	0.747	0.874	0.000			-0.602	0.015	-0.204	0.131
7	2000-2007	ΔLending Rate	-0.025	0.470	0.485	0.000	-0.911	0.000				
		ΔLending Rate	-0.067	0.120	0.464	0.000			-0.724	0.000	-1.039	0.000
	1994-2007	**ΔLending Rate**	**-0.006**	**0.804**	**0.773**	**0.000**	**-0.462**	**0.000**				
		ΔLending Rate	**-0.056**	**0.097**	**0.758**	**0.000**			**-0.169**	**0.269**	**-0.663**	**0.340**

A4: MEAN ADJUSTMENT LAGS

Italicised lags are not statistically significant given the probability values of the sign of their corresponding error correction term's coefficient.

Additionally, only where both EC+t-1 and EC-t-1 lags are statistically significant do we apply the Wald test to determine if the resultant EC+t-1 and EC-t-1 lags are statistically significant do we apply the Wald test to determine if the resultant mean adjustment lags are truly different.

MAL: Symmetric Mean Adjustment Lag

MAL+: Mean Adjustment Lag when the bank rate is above its equilibrium with the official rate and the impulse is for bank rates to fall

MAL-: Mean Adjustment Lag when the bank rate is below its equilibrium with the official rate and the impulse is for bank rates to rise

			MAL	**MAL+**	**MAL-**	**WALD TEST**	
Conc. Rank							
	SOUTH AFRICA	**Dep. Variable**				*F-stat*	*Prob.*
7	1994-2001	Deposit Rate	0.536	0.685	0.411	7.363	0
6	1995-2002	Deposit Rate	0.485	0.509	0.45	8.61	0
5	1996-2003	Deposit Rate	0.637	0.751	0.515	6.306	0.003
4	1997-2004	Deposit Rate	0.583	0.705	0.464	6.898	0.002
2	1998-2005	Deposit Rate	0.564	0.654	0.465	6.401	0.003
1	1999-2006	Deposit Rate	3.425	1.523	2.494	N/A	N/A
	1994-2007	**Deposit Rate**	**0.633**	**0.708**	**0.545**	**10.358**	**0**
7	1994-2001	Lending Rate	0.523	1.082	0.33	7.738	0.001
6	1995-2002	Lending Rate	0.399	12.041	0.422	8.321	0
5	1996-2003	Lending Rate	0.434	*0.725*	0.28	9.326	0.005
4	1997-2004	Lending Rate	0.412	0.535	0.298	7.152	0.001
2	1998-2005	Lending Rate	0.42	0.501	0.301	6.356	0.003
1	1999-2006	Lending Rate	0.215	0.203	0.248	13.215	0
	1994-2007	**Lending Rate**	**0.413**	**1.018**	**0.263**	**25.715**	**0**

Conc. Rank			MAL	MAL+	MAL-	WALD TEST	
	BOTSWANA	**Dep. Variable**				*F-stat*	*Prob.*
1	1994-2001	Deposit Rate	2.786	0.942	*15.619*	N/A	N/A
2	1995-2002	Deposit Rate	2.647	0.785	*13.506*	N/A	N/A
4	1997-2004	Deposit Rate	*18.554*	*4.908*	*7.79*	N/A	N/A
5	1998-2005	Deposit Rate	*24.042*	*6.458*	*13.544*	N/A	N/A
	1994-2007	**Deposit Rate**	**2.594**	***0.961***	***10.861***	**37.88**	**0**
1	1994-2001	Lending Rate	3.756	3.453	3.937	14.356	0
2	1995-2002	Lending Rate	*5.52*	*13.571*	*3.331*	N/A	N/A
3	1996-2003	Lending Rate	2.868	*7.108*	1.471	N/A	N/A
4	1997-2004	Lending Rate	*74.947*	*8.284*	1.702	N/A	N/A
5	1998-2005	Lending Rate	2.832	*6.238*	1.473	N/A	N/A
6	1999-2006	Lending Rate	3.088	*3.283*	*2.823*	N/A	N/A
7	2000-2007	Lending Rate	1.211	1.289	1.017	12.3654	0
	1994-2007	**Lending Rate**	**1.665**	**2.175**	**1.428**	**11.48**	**0**

Conc. Rank			MAL	MAL+	MAL-	WALD TEST	
	NIGERIA	**Dep. Variable**				*F-stat*	*Prob.*
1	1994-2001	Deposit Rate	4.042	1.76	*10.826*	N/A	N/A
2	1995-2002	Deposit Rate	2.8	1.674	*4.784*	N/A	N/A
3	1996-2003	Deposit Rate	2.913	1.73	*6.298*	N/A	N/A
4	1997-2004	Deposit Rate	3.081	1.607	*10.357*	N/A	N/A
5	1998-2005	Deposit Rate	2.049	1.882	*2.286*	N/A	N/A
6	1999-2006	Deposit Rate	2.119	2.33	1.945	9.372	0
7	2000-2007	Deposit Rate	2.28	2.625	2.008	8.629	0
	1994-2007	**Deposit Rate**	**1.38**	**0.751**	***4.097***	**19.747**	**0**
1	1994-2001	Lending Rate	6.31	1.408	*515.111*	N/A	N/A
7	2000-2007	Lending Rate	*21.814*	*16.465*	*33.91*	N/A	N/A
	1994-2007	**Lending Rate**	**0.732**	**0.548**	**1.168**	**15.784**	**0**

Conc. Rank			MAL	MAL+	MAL-	WALD TEST	
	ZAMBIA	**Dep. Variable**				*F-stat*	*Prob.*
1	1994-2001	Deposit Rate	0.539	0.7	0.421	7.806	0.001
2	1995-2002	Deposit Rate	0.567	0.734	0.423	7.935	0.001
3	1996-2003	Deposit Rate	0.644	0.75	0.522	6.149	0.003
4	1997-2004	Deposit Rate	0.587	0.705	0.465	6.763	0.002
5	1998-2005	Deposit Rate	*2.704*	*1.291*	*9.752*	N/A	N/A
6	1999-2006	Deposit Rate	0.566	0.653	0.464	8.256	0.003
7	2000-2007	Deposit Rate	-13.369	*1.185*	1.204	N/A	N/A
	1994-2007	**Deposit Rate**	**0.7**	**0.765**	**0.635**	**10.107**	**0**
1	1994-2001	Lending Rate	0.533	*0.959*	0.319	N/A	N/A
2	1995-2002	Lending Rate	0.515	*0.763*	0.288	N/A	N/A
3	1996-2003	Lending Rate	0.452	*0.619*	0.27	N/A	N/A
4	1997-2004	Lending Rate	0.425	0.435	0.29	6.326	0
5	1998-2005	Lending Rate	0.435	0.4	0.291	8.256	0
6	1999-2006	Lending Rate	0.363	0.208	0.615	9.365	0
7	2000-2007	Lending Rate	0.565	0.74	0.516	7.325	0
	1994-2007	**Lending Rate**	**0.492**	***1.431***	***0.366***	N/A	N/A

SR (ΔBR) is the short run symmetric change in the official /policy rate
SR (ΔBR)+ is the short run asymmetric positive change in the official/policy rate
SR (ΔBR)- is the short run asymmetric negative change in the official/policy rate

Table E1							Explanatory Variables						WALD TEST	
Conc. Rank		Dep.Variable	Constant	*prob.*	SR (ΔBR)	*prob.*	Constant	*prob.*	SR (ΔBR)+	*prob.*	SR (ΔBR)-	*prob.*	SR	
	SOUTH AFRICA												*F-stat*	*Prob.*
7	1994-2001	Deposit Rate	0.006	0.929	0.782	0.000	-0.003	0.963	0.762	0.000	0.700	0.000	15.178	0.000
6	1995-2002	Deposit Rate	-0.003	0.959	0.759	0.000	-0.011	0.878	0.742	0.000	0.692	0.000	28.995	0.000
5	1996-2003	Deposit Rate	-0.019	0.757	0.759	0.000	-0.023	0.747	0.725	0.000	0.700	0.000	22.168	0.000
4	1997-2004	Deposit Rate	-0.032	0.598	0.767	0.000	-0.046	0.504	0.771	0.000	0.682	0.000	14.457	0.000
2	1998-2005	Deposit Rate	-0.013	0.828	0.779	0.000	-0.018	0.790	0.755	0.000	0.722	0.000	24.429	0.000
1	1999-2006	Deposit Rate	-0.018	0.365	0.613	0.000	-0.050	0.568	0.748	0.000	0.739	0.000	41.870	0.000
3	2000-2007	Deposit Rate	0.010	0.717	0.586	0.000	0.013	0.686	0.567	0.000	0.596	0.000	0.457	0.366
	1994-2007	**Deposit Rate**	0.005	0.904	0.720	0.000	0.005	0.906	0.719	0.000	0.722	0.000	52.203	0.000
7	1994-2001	Lending Rate	-0.004	0.942	0.741	0.000	-0.002	0.969	0.757	0.000	0.768	0.000	14.501	0.000
6	1995-2002	Lending Rate	0.004	0.000	0.768	0.000	0.002	0.979	0.786	0.000	0.786	0.000	65.178	0.000
5	1996-2003	Lending Rate	-0.013	0.783	0.807	0.000	-0.008	0.883	0.806	0.000	0.834	0.000	75.620	0.000
4	1997-2004	Lending Rate	-0.016	0.722	0.792	0.000	-0.008	0.885	0.786	0.000	0.837	0.000	59.572	0.000
2	1998-2005	Lending Rate	-0.015	0.733	0.790	0.000	-0.008	0.878	0.786	0.000	0.831	0.000	45.716	0.000
1	1999-2006	Lending Rate	-0.014	0.557	0.869	0.000	-0.040	0.124	1.037	0.000	0.759	0.000	8.427	0.000
3	2000-2007	Lending Rate	-0.001	0.939	0.902	0.000	-0.017	0.251	1.012	0.000	0.837	0.000	0.146	0.841
	1994-2007	**Lending Rate**	0.987	0.000	0.826	0.000	0.006	0.849	0.806	0.000	0.852	0.000	123.735	0.000

Table E2							Explanatory Variables						WALD TEST	
Conc. Rank		Dep.Variable	Constant	*prob.*	SR (ΔBR)	*prob.*	Constant	*prob.*	SR (ΔBR)+	*prob.*	SR (ΔBR)-	*prob.*	SR	
	BOTSWANA												*F-stat*	*Prob.*
1	1994-2001	Deposit Rate	-0.037	0.586	-0.136	0.456	0.022	0.750	-0.519	0.053	0.425	0.114	7.082	0.000
2	1995-2002	Deposit Rate	-0.016	0.779	0.070	0.775	9.578	0.000	-0.207	0.517	0.193	0.584	9.237	0.000
3	1996-2003	Deposit Rate	-0.003	0.902	0.064	0.319	0.001	0.971	0.036	0.697	0.098	0.321	3.654	0.652
4	1997-2004	Deposit Rate	0.003	0.823	0.064	0.385	0.007	0.773	0.029	0.782	0.104	0.350	12.048	0.000
5	1998-2005	Deposit Rate	-0.006	0.792	0.063	0.422	-0.006	0.820	0.057	0.594	0.068	0.579	15.715	0.000
6	1999-2006	Deposit Rate	0.001	0.979	0.052	0.484	-0.001	0.953	0.071	0.492	0.029	0.799	4.365	0.569
7	2000-2007	Deposit Rate	-0.007	0.752	0.042	0.563	-0.008	0.727	0.055	0.602	0.029	0.788	5.365	0.126
	1994-2007	**Deposit Rate**	-0.015	0.676	0.100	0.373	0.010	0.781	-0.131	0.414	0.374	0.046	20.498	0.000
1	1994-2001	Lending Rate	0.008	0.724	0.102	0.050	0.032	0.155	-0.016	0.852	0.376	0.000	15.499	0.000
2	1995-2002	Lending Rate	0.008	0.761	0.159	0.003	0.034	0.163	-0.017	0.894	0.395	0.000	10.108	0.000
3	1996-2003	Lending Rate	0.010	0.544	0.264	0.000	0.014	0.415	0.190	0.012	0.272	0.001	6.592	0.000
4	1997-2004	Lending Rate	0.010	0.544	0.206	0.000	0.014	0.415	0.190	0.012	0.272	0.000	8.299	0.000
5	1998-2005	Lending Rate	0.019	0.236	0.245	0.000	0.020	0.246	0.201	0.006	0.217	0.009	9.413	0.000
6	1999-2006	Lending Rate	0.018	0.206	0.278	0.000	0.015	0.299	0.262	0.000	0.211	0.004	10.139	0.000
7	2000-2007	Lending Rate	0.007	0.519	0.388	0.000	0.006	0.677	0.270	0.000	0.241	0.000	10.612	0.000
	1994-2007	**Lending Rate**	0.014	0.339	0.413	0.000	0.021	0.160	0.295	0.000	0.446	0.000	10.921	0.000

Table E3							Explanatory Variables						WALD TEST	
Conc. Rank		Dep.Variable	Constant	*prob.*	SR (ΔBR)	*prob.*	Constant	*prob.*	SR (ΔBR)+	*prob.*	SR (ΔBR)-	*prob.*	SR	
	NIGERIA												*F-stat*	*Prob.*
1	1994-2001	Deposit Rate	-0.019	0.875	0.701	0.000	-0.004	0.968	0.780	0.004	0.833	0.000	19.374	0.000
2	1995-2002	Deposit Rate	-0.014	0.789	0.739	0.000	-0.002	0.948	0.713	0.000	0.780	0.000	12.635	0.000
3	1996-2003	Deposit Rate	-0.018	0.735	0.691	0.000	-0.007	0.929	0.714	0.000	0.656	0.000	8.240	0.000
4	1997-2004	Deposit Rate	-0.031	0.579	0.678	0.000	-0.006	0.910	0.705	0.000	0.635	0.000	10.374	0.000
5	1998-2005	Deposit Rate	-0.013	0.803	0.669	0.000	-0.037	0.891	0.680	0.000	0.657	0.000	11.766	0.000
6	1999-2006	Deposit Rate	-0.025	0.456	0.683	0.000	-0.007	0.873	0.723	0.000	0.640	0.000	12.673	0.009
7	2000-2007	Deposit Rate	0.019	0.463	0.693	0.000	0.365	0.855	0.708	0.000	0.677	0.000	13.265	0.001
	1994-2007	**Deposit Rate**	-0.008	0.938	0.482	0.000	0.034	0.720	0.429	0.007	0.700	0.000	13.651	0.000
1	1994-2001	Lending Rate	-0.046	0.571	0.154	0.006	0.104	0.130	0.128	0.342	1.177	0.000	7.365	0.000
2	1995-2002	Lending Rate	-0.042	0.527	0.110	0.344	0.110	0.776	0.196	0.213	-0.008	0.968	4.256	0.356
3	1996-2003	Lending Rate	-0.039	0.486	0.128	0.272	0.092	0.917	0.181	0.196	-0.007	0.893	3.257	0.257
4	1997-2004	Lending Rate	-0.036	0.448	0.118	0.251	0.078	0.085	0.167	0.181	-0.007	0.824	4.366	0.660
5	1998-2005	Lending Rate	-0.033	0.414	0.109	0.231	0.070	0.366	0.154	0.167	-0.006	0.760	4.365	0.366
6	1999-2006	Lending Rate	-0.031	0.382	0.101	0.214	0.062	0.237	0.142	0.154	-0.006	0.701	4.365	0.146
7	2000-2007	Lending Rate	-0.047	0.470	0.056	0.043	-0.073	0.293	0.204	0.253	-0.023	0.829	16.582	0.008
	1994-2007	**Lending Rate**	0.008	0.000	0.707	0.000	0.147	0.099	-0.069	0.643	0.989	0.000	15.567	0.007

Table E4												WALD TEST	
Conc. Rank		Dep.Variable	Explanatory Variables									SR	
	ZAMBIA		Constant	prob.	SR (ΔBR)	prob.	Constant	prob.	SR (ΔBR)+	prob.	SR (ΔBR)-	prob.	F-stat	Prob.
1	1994-2001	Deposit Rate	0.006	0.929	0.782	0.000	-0.003	0.963	0.762	0.000	0.700	0.000	16.878	0.000
2	1995-2002	Deposit Rate	-0.015	0.814	0.771	0.000	-0.026	0.716	0.752	0.000	0.677	0.000	22.015	0.000
3	1996-2003	Deposit Rate	-0.019	0.757	0.759	0.000	-0.023	0.747	0.725	0.000	0.700	0.000	14.358	0.000
4	1997-2004	Deposit Rate	-0.032	0.598	0.768	0.000	-0.046	0.504	0.771	0.000	0.682	0.000	9.364	0.000
5	1998-2005	Deposit Rate	-0.013	0.828	0.636	0.000	-0.018	0.790	0.755	0.000	0.722	0.000	11.788	0.000
6	1999-2006	Deposit Rate	-0.025	0.470	0.779	0.000	-0.021	0.591	0.589	0.000	0.633	0.000	13.370	0.006
7	2000-2007	Deposit Rate	0.019	0.477	0.567	0.004	0.022	0.474	0.555	0.000	0.583	0.000	14.401	0.000
	1994-2007	**Deposit Rate**	-0.010	0.780	0.766	0.000	-0.014	0.724	0.733	0.000	0.699	0.000	15.074	0.000
1	1994-2001	Lending Rate	-0.004	0.942	0.749	0.000	-0.002	0.969	0.757	0.000	0.768	0.000	10.642	0.045
2	1995-2002	Lending Rate	0.004	0.939	0.776	0.000	0.001	0.979	0.786	0.000	0.771	0.000	8.369	0.000
3	1996-2003	Lending Rate	-0.013	0.783	0.813	0.000	-0.008	0.883	0.806	0.000	0.834	0.000	18.842	0.000
4	1997-2004	Lending Rate	-0.016	0.722	0.799	0.000	-0.008	0.885	0.786	0.000	0.837	0.000	21.098	0.000
5	1998-2005	Lending Rate	-0.015	0.733	0.797	0.000	-0.008	0.878	0.786	0.000	0.831	0.000	15.368	0.000
6	1999-2006	Lending Rate	-0.019	0.437	0.881	0.000	-0.044	0.098	1.042	0.000	0.771	0.000	9.365	0.000
7	2000-2007	Lending Rate	0.007	0.000	0.485	0.000	-0.009	0.440	1.002	0.000	0.826	0.000	7.365	0.000
	1994-2007	**Lending Rate**	-0.006	0.832	0.773	0.000	-0.019	0.534	0.825	0.000	0.714	0.000	18.596	0.041

A5 continued...: LONG RUN (LR) MAGNITUDE OF ADJUSTMENT

LR (BR) is the short run symmetric positive change in the official/policy rate
LR (ΔBR+) is the short run asymmetric positive change in the official/policy rate
LR (ΔBR-) is the short run asymmetric negative change in the official/policy rate

Table E5											WALD TEST	
Conc. Rank		Dep. Variable	Explanatory Variables								LR	
	SOUTH AFRICA		Constant	prob.	LR (BR)	prob.	Constant	prob.	LR (ΔBR+)	LR (ΔBR-)	F-stat	Prob.
7	1994-2001	Deposit Rate	-1.412	0.002	0.983	0.000	0.007	1.222	0.935	0.931	1.237	0.112
6	1995-2002	Deposit Rate	-1.462	0.001	0.984	0.000	0.037	0.583	0.953	0.970	3.266	0.365
5	1996-2003	Deposit Rate	-1.401	0.000	0.973	0.000	0.004	0.831	1.013	1.009	3.657	0.127
4	1997-2004	Deposit Rate	-0.909	0.001	0.931	0.000	0.052	0.597	1.104	1.085	2.169	0.958
2	1998-2005	Deposit Rate	-0.435	0.041	0.887	0.000	0.014	0.774	1.114	1.082	9.327	0.070
1	1999-2006	Deposit Rate	-0.428	0.000	0.864	0.000	0.046	0.727	1.171	1.096	4.366	0.668
3	2000-2007	Deposit Rate	0.217	0.563	0.908	-	0.083	0.531	1.005	1.047	0.316	0.370
	1994-2007	**Deposit Rate**	-0.389	0.046	0.916	0.000	0.021	0.590	0.925	0.850	9.264	0.095
7	1994-2001	Lending Rate	2.718	0.000	1.033	0.000	0.028	0.418	1.295	1.157	15.366	0.040
6	1995-2002	Lending Rate	2.881	0.000	1.024	0.000	-0.028	1.540	1.333	1.127	4.366	0.090
5	1996-2003	Lending Rate	3.097	0.000	1.010	0.000	0.042	0.431	1.252	1.115	8.366	0.457
4	1997-2004	Lending Rate	3.430	0.000	0.984	0.000	-0.072	1.125	1.240	1.147	5.368	0.126
2	1998-2005	Lending Rate	3.575	0.000	0.973	0.000	0.034	0.522	1.371	1.113	7.366	0.357
1	1999-2006	Lending Rate	3.690	0.000	0.964	0.000	-0.081	0.918	1.247	1.179	9.366	0.057
3	2000-2007	Lending Rate	0.004	0.842	1.018	-	-0.071	0.584	1.337	1.094	0.569	0.889
	1994-2007	**Lending Rate**	3.544	0.000	0.982	0.000	-0.033	0.245	1.101	0.949	7.366	0.060

Table E6											WALD TEST	
Conc. Rank		Dep. Variable	Explanatory Variables								LR	
	BOTSWANA		Constant	prob.	LR (BR)	prob.	Constant	prob.	LR (ΔBR+)	L (ΔBR-)	F-stat	Prob.
1	1994-2001	Deposit Rate	4.038	0.003	0.417	0.000	0.019	0.595	0.703	0.699	2.895	0.216
2	1995-2002	Deposit Rate	2.621	0.002	0.516	0.000	-0.026	0.583	0.723	0.742	8.031	0.012
3	1996-2003	Deposit Rate	0.209	0.542	0.805	-	-0.014	0.335	0.789	0.785	0.376	0.950
4	1997-2004	Deposit Rate	-0.375	0.044	0.884	-	0.084	0.086	0.884	0.845	0.981	0.887
5	1998-2005	Deposit Rate	1.108	0.100	0.606	0.000	0.030	0.531	0.808	0.830	2.193	0.654
6	1999-2006	Deposit Rate	2.775	0.000	0.905	-	-0.033	0.727	0.913	0.857	0.612	0.889
7	2000-2007	Deposit Rate	2.983	0.000	0.681	-	0.062	0.063	0.546	0.786	0.419	0.887
	1994-2007	**Deposit Rate**	5.884	0.001	0.295	0.007	0.009	0.815	0.271	0.923	1.092	0.625
1	1994-2001	Lending Rate	4.099	0.000	0.788	0.000	0.078	0.079	1.008	0.820	2.259	0.354
2	1995-2002	Lending Rate	4.304	0.000	0.828	0.000	-0.040	0.351	0.987	0.845	0.013	0.890
3	1996-2003	Lending Rate	1.872	0.000	0.973	0.000	-0.039	0.504	0.917	0.818	4.859	0.120
4	1997-2004	Lending Rate	1.893	0.000	0.972	0.000	-0.051	0.675	0.912	0.856	7.114	0.045
5	1998-2005	Lending Rate	1.907	0.000	0.971	0.000	-0.041	0.149	1.196	0.816	1.386	0.892
6	1999-2006	Lending Rate	3.097	0.000	0.889	0.000	-0.050	0.439	0.981	0.903	0.982	0.945
7	2000-2007	Lending Rate	4.253	0.000	0.811	0.000	-0.005	0.660	0.625	0.586	0.013	0.954
	1994-2007	**Lending Rate**	1.591	0.005	0.976	0.000	0.015	0.291	0.773	0.797	4.859	0.136

Table E7							Explanatory Variables				WALD TEST	
Conc. Rank		Dep. Variable	Constant	*prob.*	LR (BR)	*prob.*	Constant	*prob.*	LR (ΔBR+)	L (ΔBR-)	LR	
	NIGERIA										*F-stat*	*Prob.*
1	1994-2001	Deposit Rate	3.519	0.030	0.567	0.000	0.017	0.531	0.628	0.624	5.696	0.112
2	1995-2002	Deposit Rate	5.666	0.001	0.669	-	0.074	0.520	0.645	0.663	10.833	0.000
3	1996-2003	Deposit Rate	7.506	0.000	0.719	-	0.021	0.299	0.705	0.701	3.176	0.124
4	1997-2004	Deposit Rate	6.795	0.000	0.817	-	0.026	0.814	0.801	0.796	1.818	0.123
5	1998-2005	Deposit Rate	3.947	0.000	0.860	-	-0.036	0.798	0.880	0.802	0.606	0.137
6	1999-2006	Deposit Rate	4.145	0.652	0.874	-	-0.020	0.459	0.902	0.807	2.188	0.167
7	2000-2007	Deposit Rate	1.803	0.257	0.849	-	0.115	0.117	0.887	0.772	3.219	0.366
	1994-2007	**Deposit Rate**	-0.016	0.983	0.856	0.000	-0.037	0.732	0.726	0.612	3.892	0.357
1	1994-2001	Lending Rate	12.874	0.000	0.484	0.000	-0.041	0.538	0.978	0.873	0.540	0.156
2	1995-2002	Lending Rate	1.532	0.004	0.965	-	-0.054	0.720	0.973	0.913	2.813	0.366
3	1996-2003	Lending Rate	-2.356	0.562	1.098	-	-0.043	0.159	1.276	0.871	7.660	0.046
4	1997-2004	Lending Rate	-4.236	0.356	1.028	-	-0.053	0.468	1.046	0.964	9.916	0.037
5	1998-2005	Lending Rate	-3.365	0.432	0.932	-	-0.005	0.704	0.987	0.835	4.186	0.669
6	1999-2006	Lending Rate	-3.890	0.000	1.025	-	-0.035	0.168	1.074	0.931	1.817	0.369
7	2000-2007	Lending Rate	8.166	0.000	0.796	0.000	-0.089	0.457	0.687	0.997	2.813	0.156
	1994-2007	**Lending Rate**	6.612	0.000	0.917	0.000	0.135	0.139	0.465	1.088	7.660	0.000

Table E8							Explanatory Variables				WALD TEST	
Conc. Rank		Dep. Variable	Constant	*prob.*	LR (BR)	*prob.*	Constant	*prob.*	LR (ΔBR+)	L (ΔBR-)	LR	
	ZAMBIA										*F-stat*	*Prob.*
1	1994-2001	Deposit Rate	-1.412	0.002	0.983	0.000	0.021	0.650	0.984	0.956	1.475	0.924
2	1995-2002	Deposit Rate	-1.462	0.000	0.984	0.000	-0.028	0.637	0.790	0.811	1.737	0.845
3	1996-2003	Deposit Rate	-1.401	0.001	0.973	0.000	-0.016	0.366	0.974	0.897	4.548	0.365
4	1997-2004	Deposit Rate	-0.909	0.001	0.931	0.000	0.092	0.094	0.966	0.924	8.215	0.065
5	1998-2005	Deposit Rate	-0.435	0.041	0.887	0.000	0.033	0.581	0.883	0.907	12.998	0.036
6	1999-2006	Deposit Rate	0.568	0.005	0.796	0.000	-0.036	0.795	0.998	0.937	6.165	0.089
7	2000-2007	Deposit Rate	0.865	0.017	0.776	0.000	0.068	0.069	0.597	0.859	4.383	0.126
	1994-2007	**Deposit Rate**	-0.431	0.024	0.921	0.000	0.019	0.598	0.837	0.923	7.999	0.047
1	1994-2001	Lending Rate	2.718	0.000	1.033	0.000	0.085	0.086	1.102	0.897	0.799	0.924
2	1995-2002	Lending Rate	2.881	0.000	1.024	0.000	-0.043	0.384	1.079	0.923	1.913	0.854
3	1996-2003	Lending Rate	3.097	0.000	1.010	0.000	-0.043	0.551	1.002	0.894	2.639	0.755
4	1997-2004	Lending Rate	3.430	0.000	0.984	0.000	-0.055	0.738	0.997	0.936	3.112	0.652
5	1998-2005	Lending Rate	3.575	0.000	0.973	0.000	-0.044	0.163	1.307	0.892	3.421	0.685
6	1999-2006	Lending Rate	3.690	0.000	0.964	0.000	-0.054	0.480	1.072	0.988	7.500	0.027
7	2000-2007	Lending Rate	4.046	0.507	0.926	0.000	-0.006	0.721	1.012	0.856	11.250	0.012
	1992-2007	**Lending Rate**	3.525	0.000	0.985	0.000	-0.036	0.172	1.100	0.954	8.365	0.024