**Journal of Business and Economics, ISSN 2155-7950, USA**
**January 2014, Volume 5, No. 1, pp. 1-10**

**http://www.academicstar.us**

# Interest Rate Pass-through and Monetary Policy in South Africa: Evidence from ARDL and FMLS Models

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**Abstract:** This paper examines the degree of pass-through and adjustment speed of the prime rate in response to changes in the repo rate in South Africa for the period 1998M4-2011M1. Inflation targeting was adopted in February 2000 as the monetary goal for the South African Reserve Bank (SARB). The repo rate was adopted as the policy rate at the same time. We use the ARDL and FMLS estimators to test for cointegration over the whole sample period 1998M4-2011M1. We split the sample at the February 2000 date and repeat the estimates for each sample. For the pre-February 2000 sample, both the ARDL and FMLS, the degree of pass-through is complete. For the whole sample and the 2000M2-2011M1, the results are close to 1 ranging from 0.90 to 0.97. The error-correction models (short-run) estimates for the repo rate pass-through range from 0.85 to 0.92. The speed of adjustment ranges from -1.66 to -0.06. The pass-through coefficient in South Africa closely resembles those of middle-income to high-income countries. Overall, our results confirm that the monetary policy rate has more influence before 2000 and less so during the period when inflation-targeting was adopted as the main goal of the SARB. Our results are similar to Aziakpono et al. (2007) and De Angelis et al. (2005).

**Key words:** interest rate pass-through; monetary policy; incomplete pass-through; ARDL; FMLS
**JEL codes:** E43, F41, E52

## 1. Introduction

There is generally an acceptance that monetary policy actions influence economic activity with a time lag that ranges from 4 months to 2 years (Romer & Romer, 1989). There are six identifiable channels of monetary policy transmission to economic activity: (1) the interest rate channel, (2) the bank lending channel, (3) the balance sheet channel, (4) the asset price channel, (5) the exchange rate channel, and (6) the expectation channel. Of these, the interest channel is often viewed as more important since all other channels are related to changes in it (Isakova, 2008). The South African Reserve Bank (SARB) relies on the idea that changes in the policy rate (the repo) prompt similar changes in the prime rate. Under perfect information with no uncertainty, adjustments costs, and perfect competition, market interest rates including the prime rate, the responses to policy rate change should be immediate and one-for-one. Such an outcome is a complete repo rate pass-through to the prime rate. More often than not, most cases are characterized by the incomplete pass-through to market rates. The objective of this

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paper is to establish whether this assertion holds when the SARB changes the repo rate as part of its monetary policy. We do so by relating the repo rate to the prime rate using monthly data for the 1998M4–2011M1.

Specifically, the paper deals with four questions. First, are changes in the repo rate transmitted to the prime rate or are changes in prime rates transmitted to the repo rate in the short run (the causality issue)? Second, is there complete interest repo pass-through to the prime rate? Third, whether the repo rate pass-through differs across two estimators; the autoregressive distributed lag model (ARDL) and the Fully-Modified Least Squares (FMLS). Fourth, to present empirical evidence on interest rate pass-through (IRPT) to the prime rate in South Africa for periods before and after the adoption of inflation-targeting (IT) in February 2000. The question is whether or not inflation targeting contributes to improvements in interest rate pass-through in a small open economy.

The paper is organized as follows. Section 2 is a brief review of selected literature related to interest rate pass-through. Section 3 presents the methodologies employed in the paper. Section 4 is a discussion of results followed section 5 concludes.

## 2. A Selected Review of Literature

Aziakpono et al. (2007) and De Angelis et al. (2005) are the only studies that have estimated interest pass-through for various interest rates in South Africa. They found that the long-run pass-through of policy rates to lending and deposit rates ranged from 0.93 to 1.04 and 0.44 to 1.20 respectively. For the short-run rate pass-through to lending and deposit rates were 0.40 to 0.92 and -0.01 to 0.80 respectively. De Angelis et al. (2005) focused only on the period between1998 and 2004 and their results are lower than those in Aziakpono et al. (2007). Kleimeier and Sander (2006) investigated interest rate pass-through in four Common Monetary Area (CMA) countries that belong to the South African Custom Union (SACU). They found that the homogeneity of the lending markets in the CMA contributed to fast and complete interest rate pass-through. Bifang and Howells (2002) argue that the first link in the interest rate pass through chain in all monetary regimes is the link between official rates and market rates. They argue that it is not the rate at which the central bank supplies liquidity but the way banks and non-banks react to changes in the rates on loans charged by banks, changes in asset values, and changes in the rate they earn on their savings. The logic of this viewpoint is that there is a clear link between official rates and market rates which implies high rates of interest pass-through.

Kapwil and Scharler (2006) explain incomplete interest rate pass-through by appealing to the behavior of banks. They argue that banks have an incentive not to raise interest rates too much because borrowers who accept higher loan rates are likely to be of poor quality. If borrowers take up loans at high rates, they are more likely to choose riskier projects, reducing the expected value of the amount paid back (the moral hazard problem). Egert et al. (2007) suggest macroeconomic conditions like rapid growth and higher inflation often encourages banks to easily pass on changes in the interest rate to the prime rate and then to their lending and deposit rates. This reasoning might explain how South African banks were able to raise the loan rates as the prime rate rose to 9.6% in October 2010. Kapwil and Scharler (2006) presented results that show the pass-through rate in the euro area is below 0.55 in all cases. Isakova (2008) found near complete pass-through in Kyrgyzstan. In some cases, there are instances when the prime and loan rates overshoot in response to a change in the policy rate. Overshooting occurs when the pass-through coefficient is more than one. This phenomenon can be explained by the overreaction of creditors to rising interest rates as they hedge their credit risks in the face of uncertainty.

According to West (2008), the repurchase rate (here after, repo) is the rate that is used for borrowing and lending between the South African Reserve Bank (here after, SARB) and commercial banks (Absa, FNB, Nedbank, Standard Bank, and other banks). By changing the supply of available funds, the SARB can affect short-term interest rates that are determined by demand and supply market forces. The short-term rate in turn affects the yield curve which is often used as a predictor of economic growth. The repo rate is set by the Monetary Policy Committee (MPC) of the SARB which meets every two months. During the period leading to an announcement by the SARB, financial markets engage in speculation and positioning in terms of whether the MPC will change the repo (if so, by how much) or leave it unchanged.[1] This has been the practice before 2000 when a rate called the SAREP1 (which varied daily) played the repo rate's role. The role of the prime rate has evolved from being an "actual" or "best" lending rate to that of a reference rate to which banks may link their own floating interest rates on loans and advances. The current spread between the prime and repo rates is currently fixed at 350 basis points (3.5%). Under SARB Governor Tito Mboweni, a determination had been made that the size of the spread (3.5%) was or should be irrelevant to the setting of lending rates since the prime was to be used merely as a reference rate or benchmark for the pricing of loans by banks. Figure 2 shows a steady spread between 2001M9 and 2010M10, except for the period before 2001M9 and after 2010M10. On the other hand, Figure 1 shows the prime rate and repo rate moving in unison over the time under examination. The vertical distance between the prime and the repo rate is 3.5% except for pre-2001M9 and post-2001M9 periods. This observation suggests that the repo rate and the prime rate may be cointegrated, that is, there exists an equilibrium relationship between these two variables.

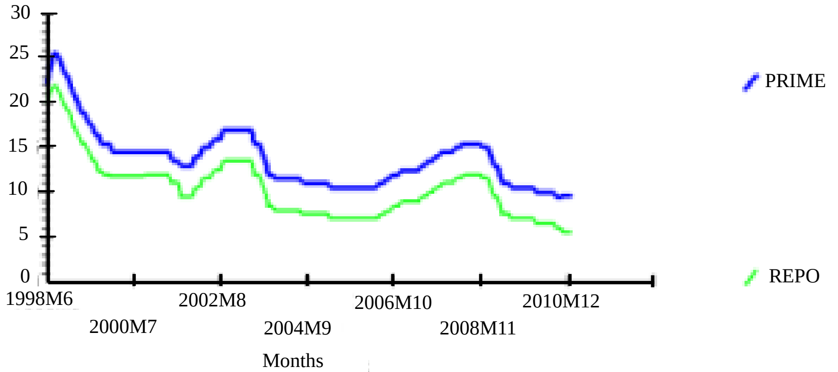


**Figure 1 The Prime Rate and the Repo Rate (%)**

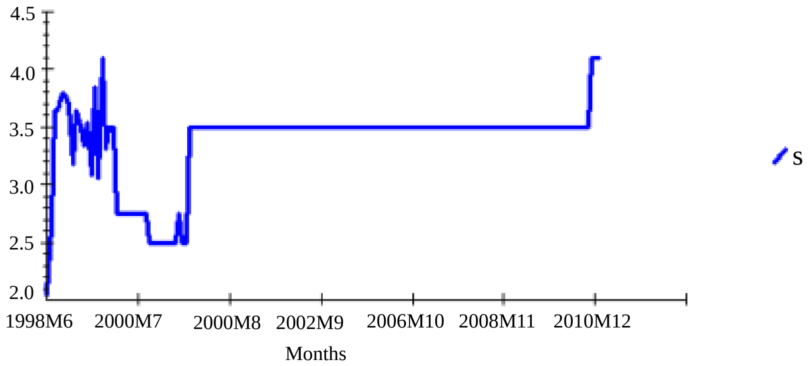


**Figure 2 The Spread between the Prime Rate and the Repo Rate (%)**

[1] Gidlow (1998) has a detailed account of the SARB's monetary policy.

Figure 2 also reveals a rise in the spread from 3.5% to 4.00% after 2010M10. In October 2010, the prime rate was 9.5% with the repo rate at 6% so that the spread was 3.5%. However, in November 2010, the prime rate increased to 9.6% as the repo rate fell to 5.5%, increasing the spread to 4.1%. One explanation for this is that banks increased loan rates using the 9.5% prime rate as a reference or benchmark. That is, the markup means banks increased the spread and thus improved profitability after 2010M10. Another way to explain this is that the SARB has put increasing pressure for banks to meet the Basel III by holding higher levels of capital. In fact, Basel III requires that long-term deposits be matched by long-term loans.

The repo rate (repurchase rate) is the interest at which commercial banks (such ABSA, Standard Bank, FNB, and Nedbank) borrow from SARB.[2] To make profit banks lend this money to bank customers at a higher prime rate. Thus, the repo rate, a short-term money market rate, is a crucial determinant of commercial bank funding costs. Thus, sustained movements in the repo will always end up in a compensating move in bank's prime lending and deposit rates. Each day, the SARB makes available a certain amount of funding to commercial banks through repo transactions which involves banks selling securities to the SARB in return for funds. The funds are made available against the obligation to purchase back the securities at an agreed price at a future date. Since the repo rate is variable, the banks essentially determine the rate at which they submit bids since the final repo rate is the average of the rates attached to all successful bids.[3] In order to avoid borrowing at the punitive rate, banks often increase the rate at which they bid for repo funds, pushing the repo rate upwards.

## 3. Methodology

Although there are several methods for conducting the cointegration test, this paper uses the autoregressive distributed lag (ARDL) modeling approach and the Fully Modified Least Squares (FMLS) estimator for comparison.[4] The FMLS estimator is only available for long-run analysis.

### 3.1 ARDL Modeling or Bounds Testing Procedure

The ARDL modeling was popularized by Pesaran and Pesaran (1997), Pesaran et al. (2001), Pesaran and Smith (1998), and Pesaran and Shin (1999). The main advantages of the ARDL are that it can be employed even if the variables are I(0) or I(1) and this dispenses with the need to carry out unit root tests. Another advantage is that it can accommodate a sufficient number of lags to ensure validity of the data generating process in a general-to-specific modeling approach. If the variables are cointegrated, this means that there exists an error-correction model (ECM) that integrates short-run dynamics with long-run ensuring with no loss of long-run information. Finally, in using the ARDL, one avoids problems associated with non-stationary data.

The ARDL modeling is carried out in three steps. First, the ARDL testing procedure begins by conducting the bounds test (or F test) for the null of no cointegration. The calculated F-statistic is compared to critical values tabulated in Pesaran et al. (2001) or Pesaran and Pesaran (1997). If the calculated F-statistic is larger than the tabulated upper critical value, the null of no cointegration is rejected regardless of whether variables are I(0) or

[2] The repo rate in South Africa plays a similar role to the federal funds rate in the U.S. The interest rate that the borrowing bank pays to the lending bank to borrow the funds is negotiated between two banks, and the weighting average of this rate across all such transactions is the *federal funds effective rate*.

[3] In the event that commercial banks are not able to borrow adequate funding from the repo tender, they can use the marginal lending facility. The problem with using this facility is that it increases the cost of funds for the bank since the marginal lending rate is always punitive—well above the repo rate and the prime rate.

[4] The widely used estimators include the residual-based Engle-Granger (1987) test, maximum likelihood-based Johansen (1988, 1991, 1995), and the Johansen-Juselius (1990) tests. For more details, see Shrestha (2005).

I(1). However, if the calculated F-statistic is smaller than the tabulated lower critical value, the null of no cointegration is not rejected. Finally, if the calculated F-statistic is between the lower and upper critical value, the result is inconclusive without additional information. The results in Table 1 confirm the existence of an equilibrium relationship at the 5% level of significance if the prime rate (Pr) is the dependent variable and the repo rate (*Rp*) is the independent or "forcing variable". The F-statistic is 7.27 which is above the upper critical value of 4.855. Since there are only two variables we bounds tested $F_{Rp}(Rp \mid Pr)$ and the result is 3.83 that lies between 3.793 and 4.855. The result is inconclusive. Table 1 also points to the existence of a single cointegration vector which means that there exists an error-correction model (Equation (2) below). The ARDL estimator estimates $(p+1)^k$ number of regressors in order to obtain an optimal lag for each variable, where $k$ is the number of variables (two in our case) and $p$ is the maximum number of lags that remove serial correlation. Selection criteria such as AIC and SBC are used to determine optimal lags (SBC tends to choose the smallest possible lag to produce a parsimonious model).

**Table 1 Bounds Testing for Cointegration**

| Dependent Variable | Number of Variables | F-Statistics @ 95% (Case II: Intercept and no trend) | |
|---|---|---|---|
| | | Lower Critical Value | Upper Critical Value[5] |
| | | 3.793 | 4.855 |
| $F_{Rp}(Rp \mid \mathrm{Pr})$ | 2 | F(2,113) = 3.83 | |
| $F_{P_r}(\mathrm{Pr} \mid Rp)$ | 2 | F(2,113) = 7.27 | |

The second step involves estimating long-run estimates using the ARDL. If the long-run holds, it means that there exists an error-correction representation. Third, the error-correction model is estimated to obtain the speed of adjustment to a long-run equilibrium following a shock to the system. As part of output, the ARDL model yields both diagnostic tests and stability tests. The diagnostic tests check for serial correlation, normality, functional form and heteroscedasticity. Stability tests are examined by displaying two graphs: the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ).[6] Each graph has a pair of straight lines drawn at the 5% level of significance. If either of the lines is crossed, the null hypothesis that the regression is correctly specified must be rejected at the 5% level of significance. The CUSUM is critical in detecting systematic changes in regression coefficients while the CUSMSQ detects any departure from the constancy of the regression coefficients in a sudden or haphazard way (Pesaran & Pesaran, 1997). Finally, the best fitting model can be examined by looking at the difference between actual and forecast values. Small the differences point to a better the fit of the ARDL model to data.

The objective is to establish whether the repo rate and the prime rate are cointegrated by employing the ARDL approach. The long-run model is given as:

$$\mathrm{P}r_t = \beta_0 + \beta_1 Rp_t + e_t \tag{1}$$

where $Pr_t$ is the prime rate at time $t$, $Rp_t$ is the prime rate at time $t$, and $e_t$ is an error term.

In Equation (1), $\beta_0$ represents an immediate pass-through or a constant loan intermediation margin (Payne, 2007). It gives the reaction of the prime rate to a change in the repo rate within the same period, one month. If $\beta_1 = 1$, there is a complete interest rate pass-through while if $\beta_1 < 1$, this indicates an incomplete pass-through. Finally, if $\beta_1 = 0$, it indicates that there is zero repo rate pass-through to prime interest rates. This result is unlikely

[5] The critical values are taken from Pesaran and Pesaran (1997, p. 478).

[6] CUSM and CUSUMSQ graphs are not reported here in order to preserve space. These are available from the author.

in the presence of monetary policy that targets inflation via changes in the policy rate. From Equation (1), the error-correction version of the ARDL model is given by:

$$\Delta \Pr_t = \alpha + \sum_{k=1}^{n} \phi_k \Delta \Pr_{t-k} + \sum_{k=0}^{n} \lambda_k \Delta Rp_{t-k} + \delta_1 \Pr_{t-1} + \delta_2 Rp_{t-1} + \varepsilon_t \qquad (2)$$

In Equation (2), $\phi$s and $\lambda$s represent short-run dynamics of the model whereas $\delta_1$ and $\delta_2$ represent a long-run relationship. The null hypothesis of no cointegration is $\delta_1 = \delta_2 = 0$. This test is necessary to establish whether the repo rate and the prime rate are cointegrated. The monthly data on the repo and prime rate was obtained from the SARB. It covers the period 1998M4-2011M1. The choice of 1998M4 as the starting date is related to various attempts by the SARB to initiate steps towards adopting the repo rate as a monetary policy rate. The ARDL method was applied to three sets of the sample: the whole period, 1998M4 to 2011M1, the period from 1998M4 to 2001M1, and the period 2001M2 to 2011M1. The period from 1998M4 to 2001M1 is before a formal introduction of the repo rate as a policy rate. In addition, during this period, South Africa had not formally adopted inflation targeting (IT) as a policy goal. The period from 2001M2 to 2011M1 represents the time when the repo rate is a policy variable and IT as a target of the SARB.

### 3.2 The Fully-Modified Least Squares (FMLS) Approach

Following Panopoulou (2005) and Phillips and Hansen (1990) let $z_t$ and $u_t$ be two bivariate processes, with $z_t = [y_t, x_t]^T$ and $u_t = [u_{1t}, u_{2t}]^T$. Furthermore assume that $u_t$ is a VAR (1) process that is driven by$e_t = [e_{1t}, e_{2t}]^T$ and the data generating mechanism for $y_t$ is given as follows.

$$y_t = \theta x_t + u_{1t} \qquad (3)$$

$$\Delta x_t = u_{2t} \qquad (4)$$

$$\begin{pmatrix} u_{1t} \\ u_{2t} \end{pmatrix} = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \begin{pmatrix} u_{1t-1} \\ u_{2t-1} \end{pmatrix} + \begin{pmatrix} e_{1t} \\ e_{2t} \end{pmatrix} \qquad (5)$$

$$\begin{pmatrix} e_{1t} \\ e_{2t} \end{pmatrix} \sim NIID[\begin{pmatrix} 0 \\ 0 \end{pmatrix} \begin{pmatrix} \sigma_{11} & \sigma_{12} \\ \sigma_{21} & \sigma_{22} \end{pmatrix}] \text{ for all } t=1,2, \ldots .T \qquad (6)$$

In order for $y_t$ and $x_t$ to be I(1) variables and the cointegration error to be an I(0) process, the eigenvalues of the matrix $A = [a_{ij}]$, $i,j = 1,2$ are assumed to be less than one. The long-run covariance matrix $\Omega$ and the one-sided covariance matrix $\Delta$are required to define asymptotic nuisance parameters are given by the following equations. In Equations (8)-(10), $I$ is an identity matrix?

$$\Omega = (I - A)^{-1} \Sigma (I - A^T)^{-1} \qquad (8)$$

$$\Delta = G(I - A^T)^{-1} \qquad (9)$$

where $\Sigma$ is the innovations covariance matrix of the VAR and $G$ is the unconditional covariance matrix of $u_t$ given by

$$vecG = (I - A \otimes A)^{-1} vec\Sigma \qquad (10)$$

The estimation of Equations (4) and (5) can be accomplished by an OLS estimator which is consistent the larger the sample size. However, (a) "long-run correlation" and (b) "endogeneity" problems usually referred as "second-order effects" remain when one conducts any statistical inference on the cointegrating vector. Phillips and Hansen (1990) employ semi-parametric corrections for (a) and (b) which modifies the OLS estimate of $\theta$ in Equation (3) and its standard error to give rise to the FMLS method via a consistent estimation of $\Omega$ and $\Delta$ in Equations (8) and (9) respectively. The method suggested requires two procedures; the selection of a kernel estimator and the choice of bandwidth. Thus, in Equation (3), the dependent variable is the prime rate (Pr) that is regressed on an I(I) regressor (the repo rate) without an intercept or time trend.[7] The selection of the lag window (Bartlet, Tukey, equal weight, and Parzen) is available from *Microfit*.[8] With the lag window chosen, the next task is to specify the length of the lag window.[9] For this paper, the lag window chosen is the Parzen window and 12 is chosen as the length of the lag window. The Parzen window ensures positive standard errors while the length of the window takes the frequency of data. Other lengths were tried but the length of 12 produced the best results. The FMLS results are presented in Table 2 (Panels B, D, and F).

**Table 2 Long-Run Results: Dependent Variable: Prime**

| Estimator and Sample Period | Regressor | Coefficient | Standard Error | t-Ratio |
|---|---|---|---|---|
| ARDL (2,2) Model Sample (1998M4-2011M1) Panel A | C<br>Repo | 4.30<br>0.90 | 0.77<br>0.08 | 5.56<br>11.83 |
| | Diagnostic Test Statistics<br>Serial Correlation, $x^2(12)$ = 16.42[0.173], Functional Form, $x^2$ (1) = 0.083[0.773]<br>Normality, $x^2(2)$ = 757.15[0.000], Heteroscedasticity, $x^2(1)$ = 2.29[0.130], $R^2$ = 0.995, Durbin-Watson Statistic = 1.92, F(5, 112) = 5115.7[0.007] | | | |
| Fully Modified Least Squares (FMLS) | C<br>Repo | 3.68<br>0.97 | 0.18<br>0.02 | 20.92<br>62.59 |
| (Parzen Weights, Lag = 4, trended case) Sample (1998M4-2011M1) Panel B | | | | |
| ARDL (4,1) Model Sample(1998M4-2000M1) Panel C | C<br>Repo | 3.40<br>1.00 | 0.24<br>0.02 | 14.31[0.00]<br>67.60[0.00] |
| | Diagnostic Test Statistics<br>Serial Correlation, $x^2(1)$ = 0.77[0.380], Functional Form, $x^2$ (1) = 2.44[0.118]<br>Normality, $x^2(2)$ = 0.294[0.863], Heteroscedasticity, $x^2(1)$ = 4.68[0.031], $R^2$ = 0.997, Durbin-Watson Statistic = 1.93, F(6, 11) = 636.31.7[0.000] | | | |
| | | | | |
| Fully Modified Least Squares (FMLS) | C<br>Repo | 3.20<br>1.00 | 0.77<br>0.04 | 4.17[0.001]<br>22.24[0.000] |
| (Parzen Weights, Lag = 4, trended case): Sample (1998M4-2000M1) Panel D | | | | |
| ARDL (1,1) Model Sample (2000M2-2011M1) Panel E | C<br>Repo | 4.44<br>0.87 | 0.69<br>0.07 | 6.42[0.00]<br>13.02[0.00] |
| | Diagnostic Test Statistics<br>Serial Correlation, $x^2(12)$ = 14.76[0.380], Functional Form, $x^2$ (1) = 3.05[0. 081]<br>Normality, $x^2(2)$ = 9351.8[0.000], Heteroscedasticity, $x^2(1)$ = 0.612[0.434], $R^2$ = 0.997, Durbin-Watson Statistic = 1.98, F(3, 128) = 2023.1[0.000] | | | |
| Fully Modified Least Squares (FMLS) | C<br>Repo | 4.01<br>0.93 | 0.20<br>0.02 | 19.94[0.000]<br>45.34[0.00] |
| (Parzen Weights, Lag = 4, trended case): Sample (2000M1-2011M2) Panel F | | | | |

[7] Both the repo rate and the prime rate are I(1) while the same variables in first differences are I(0).
[8] All estimates were carried out using the *Microfit* package, Version 4.0
[9] For more details on the lag window and the length of the lag window, see Newey and West (1987, 1994).

## 4. Results

All results are presented in Tables 2 and 3 in the Appendix. The long-run results from ARDL and FMLS methods are presented in Panels A to F in Table 2. Panels A, C, and E present long-run estimates of the interest rate pass-through from samples 1998M4-2011M1, 1998M4-2001M1, and 2000M2-2011M1 respectively. Panels B, D, and F show similar results from the FMLS approach. Taking the 1998M4-2011M1 first, the ARDL and FMLS show that the repo pass-through to the prime rate is incomplete as the estimates are 0.90 and 0.97 respectively (Panels A and B). For the 1998M4-2000M1 period, ARDL and FMLS estimates of the repo rate pass-through to prime rates are unity respectively. In other words, prior to the adoption of the repo rate as a policy rate and IT as a target, there was complete repo rate pass-through to the prime regardless of the estimator employed. Finally, the 2000M2-2011M1 pass-through estimates are 0.90 and 0.93. Above all, there are three results that noteworthy in Table 2. First, the repo rate pass-through from the ARDL is 0.90 for the 1998M4-2011M1 is identical to the 2000M2-2011M1 (Panels A and E). Second, the repo rate pass-through from the FMLS for the 1998M4-2011M1 (0.97) is sis close to the 2000M2-2011M1 (0.93) (Panels C and E). Finally, all the all results in Panels A–F, show the estimates of repo rate pass-through as positive and significant at the 5% level of significance. In Panel C diagnostic tests show that the model passes the tests for functional, serial correlation, normality, and heteroscedasticity. Models A and E fail the normality tests. The normality assumption is important in small samples but it is not generally required when the sample is large as in our case (Pesaran & Pesaran, 1997).

**Table 3 Short-run Results: Dependent Variable: $\Delta$ Prime**

| | Regressor | Coefficient | Standard Error | t-Ratio |
|---|---|---|---|---|
| ARDL (2,2) Model Sample(1998M4-2011M1) Panel A | dC | 0.37 | 0.18 | 2.03[0.045] |
| | dPrime1 | -0.53 | 0.08 | -7.01[0.000] |
| | dRepo | 0.85 | 0.03 | 28.77[0.000] |
| | dREPO1 | 0.53 | 0.08 | 7.24[0.000] |
| | ECM(-1) | -0.09 | 0.05 | -1.90[0.059] |
| ARDL (4,1) Model Sample (1998M4-2000M1) Panel B | dC | 5.65 | 1.14 | 4.98[0.000] |
| | dPrime1 | -0.26 | 0.16 | -1.65[0.00] |
| | dPrime2 | 0.01 | 0.13 | 0.12[0.904] |
| | dPrime3 | 0.20 | 0.08 | 2.41[0.033] |
| | dRepo | 0.95 | 0.17 | 5.40[0.000] |
| | ECM(-1) | -1.66 | 0.31 | -5.28[0.000] |
| ARDL (1,1) Model Sample(2000M2-2011M1) Panel C | dC | 0.26 | 0.12 | 2.08[0.040] |
| | dRepo | 0.92 | 0.021 | 44.15[0.00] |
| | ECM(-1) | -0.06 | 0.030 | -1.95[0.053] |

There are no short-run dynamics from the FMLS approach. The short run dynamics are shown in Table 3 in Panels A to C representing various ARDL models from ARDL (2,2), ARDL (4,1), and ARDL (1,1). In Panel A, the short-run repo rate pass-through is 0.85 but 0.53 for the repo rate lagged once. More important is the ECM is small at -0.09 which suggests an adjustment process. This means that any changes to the repo rate the rate of adjustment towards a long-run equilibrium is 9%. The coefficient of a one-lag prime rate (-0.53) is significant. In Panel B, the repo rate interest pass-through is 0.95 and 0.92 in Panel C. Unlike Panel A, where the prime rate is lagged once, the prime rate is lagged three times but only the third lag is significant. The ECM term is properly signed (-1.66) and significant at the 5% level. The speed of adjustment is faster at 52.8% within a month. This is not surprising at all given that the long-run repo rate interest pass-through is 1 (See Table 2, Panel C). In Panel C, the adjustment speed of 6% also partly explains the long-run result of 0.90 in Table 2 (Panel E). Overall, short-run repo pass-through estimates are smaller than long-run estimates. The FMLS was employed to produce long-run interest pass-through in Table 2 (Panels B, D, and F).

## 5. Concluding Remarks

The paper addressed questions concerning the relationship between the prime rate and the repo rate over the period 1998M4 to 2011M1. First, are changes in the repo rate transmitted to the prime rate or are changes in prime rates transmitted to the repo rate in the short run? From Table 2, it is clear that it is changes in the repo rate that lead to changes in the prime rate. In other words, the repo rate is the “forcing variable” in Equation (1). Second, is there complete interest repo pass-through to the prime rate? In Table 3, the short-run repo rate pass-through estimates range from 0.85 to 0.92 indicating less than complete pass through for sample sizes 1998M4-2011M1, 1998M4-2000M1, and 2000M2-2011M1. In Table 2, repo rate pass-through estimates range from 0.90 to 1.00. In Table 2, Panels C and D, the repo rate pass-through is complete from the ARDL and FMLS estimators. Thus, one can conclude that prior to the introduction of the repo as a policy variable and inflation-targeting by the SARB, the pass-through is complete since the interest rate coefficient equals one.[10] One plausible explanation is the fact that during that period, the use of the “bank rate system” to accommodate bank liquidity via overnight loans enabled banks to quickly absorb any changes to the bank rate. Our results are similar to Aziakpono et al. (2007) and De Angelis et al. (2005).

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[10] Incidentally, prior to the introduction of the repo rate, the SARB used the bank rate or the SAREP1 (West, 2008).

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