Interest Rate Pass-through and Monetary Policy Regimes in South Africa

By

Meshach Jesse Aziakpono
University of Stellenbosch Business School
Cape Town, South Africa
and
Magdalene Kasyoka Wilson
Department of Economics and Econometrics
University of Johannesburg

AERC Research Paper 259
African Economic Research Consortium, Nairobi
April 2013

1. Introduction

The monetary policy in South Africa serves to keep the rate of inflation within the target band of 3% to 6%. In practice, if the rate of inflation exceeds the 6% band, the South African Reserve Bank (SARB) will increase the official interest rate (the repo rate) in order to bring inflation to within the target range. According to the Taylor principle, to stabilize inflation a central bank should raise its interest rate instrument by more than a one-to-one increase in inflation (Woodford, 2003). It is now generally recognized that the success of a monetary policy in stabilizing inflation, and achieving inflation targets, depends to a large extent on the stickiness of market interest rates (commercial bank retail rates, other money market rates and capital market rates). For an effective monetary policy, it is necessary for a change in the official interest rate to be transmitted quickly to other interest rates and that the magnitude of the change that is passed on to other rates should be great enough to influence aggregate demand in some way (Lim, 2001; Fourie et al., 1999). If interest rate pass-through (PT) is incomplete, this could violate the Taylor principle and the monetary policy would fail to stabilize (Marotta, 2009). In other words, a quicker and fuller PT of changes in the official rate to market interest rates strengthens monetary policy transmission and may affect price stability. Therefore, in order to establish the effectiveness of the monetary policy transmission process, it is important to determine the degree of interest rate PT.

It is also important for central bankers and financial regulators to understand the nature of interest rate PT (whether PT is complete in the long or short run, and whether PT is asymmetric or not), because it is a direct way of gauging the degree of competitiveness and the soundness of the financial system, especially in the banking sector (Aydin, 2007; Hofmann, 2006). For example, as De Bondt (2005) notes, prices set by banks influence their margins and, therefore, bank profitability and the soundness of the banking system and financial stability. A symmetric and complete PT will signal a well functioning, competitive and efficient financial system, while an incomplete and asymmetric PT will suggest the opposite.

Following the early work of Hannan and Berger (1991), and Neumark and Sharpe (1992), which focuses on interest rate adjustment in the USA banking industry, there has been rapid international growth in empirical studies devoted to exploring the degree of stickiness of market interest rates and their asymmetry (Cottarelli and Kourelis, 1994; Cottarelli et al., 1995; Scholnick, 1996; Lim, 2001; Toolseman et al., 2002; Sander and Kleimeier, 2004, 2006b; Kleimeier and Sander 2006; Chong et al., 2006; Chionis and Leon, 2006; Charoenseang and Manakit, 2007; Egert et al., 2007; Aydin, 2007; De Graeve

et al., 2007; Sudo and Teranishi, 2008; Gambacorta, 2008; Liu et al., 2008; Wang and Lee, 2009; Marotta, 2009; and Kwapil and Scharler, 2009). To date, the evidence from this literature remains largely inconclusive. The pattern of empirical findings can be summarized as follows: First, most studies found sluggish and incomplete interest rate PT, that is, a less than one-to-one adjustment of market interest rates to a change in the policy rate. Second, there are considerable differences in PTs across countries as well as over time within a country. Third, interest rate PTs vary with the type of interest rate used. Finally, studies that consider asymmetric adjustment often find plenty of evidence of asymmetry, but the evidence remains diverse across countries and over time.

The reasons for the variation in the degree of PT and asymmetric PT across countries as well as over time include: monetary policy orientation, whether liberal or a controlled monetary policy regime (Gidlow, 1998; and Egert et al., 2007), and whether the monetary policy process has formal accountability and transparency measures (Kaketsis and Sarantis, 2006; Kleimeier and Sander, 2006; Gambacorta, 2008; and Liu et al., 2008), the stage of financial market development, the degree of financial market openness, the concentration within the banking sector (Cottarelli and Kourelis, 1994; Borio and Fritz, 1995; Mojon, 2000; and Weth, 2002), asymmetric information (Stiglitz and Weiss, 1981), switching cost, bank size (Cottarelli, Ferri and Generale, 1995; Angeloni et al., 1995; Berlin and Mester, 1999), and menu cost (Hannan and Berger, 1991; and Hoffman and Mizen, 2004).

Over time, monetary policy and the financial environment in South Africa, have undergone several reforms. Such reforms include the liberalization of the financial markets from the early 1980s, which resulted in the abolition of the credit and interest rates ceilings that were applicable to banks. Also, the high cash reserve and liquid asset requirements then in place were reduced (Gidlow, 2003). Subsequently, monetary policies have varied in their emphasis on market orientation. In 2000, the SARB formally adopted an inflation targeting monetary policy framework with a view to enhance the accountability and transparency of the monetary policy process. Moreover, the financial reforms stemming from the implementation of the De Kock Commission's recommendations led to an increase in the number of banks and competition between banks and other financial intermediaries such as building societies. However, the increased competition among financial intermediaries resulting from the financial reforms of the 1980s put pressure on the profit margins of financial institutions. By the late 1980s, owing to banks' and other financial institutions' slimmer profit margins, many began to rationalize and consolidate with a view to operating more efficiently. Consequently, many takeovers and mergers took place, which significantly reduced the number of banks. By 1992, the number of major banking groups had been reduced to four groups – ABSA, First National Bank, Nedcor and Stanbic. Combined, these groups have consistently held about 80% of the assets in the banking sector from 1992. The banking sector became highly concentrated, with the major banks acting in an oligopolistic manner (Okeahalam, 2001), which may reduce the efficiency of the banking sector and thereby affect the monetary transmission process.

Despite the changing financial environment in South Africa, which could affect the degree of interest rate PT, a systematic analysis of the degree of response of market interest rates to changes in the monetary policy stance has not been given adequate attention.

Two exceptions are De Angelis et al. (2005) and Aziakpono et al. (2007). However, the earlier attempts either focused on one monetary policy regime or on a few interest rates. For example, De Angelis et al. (2005) focuses on the period between 1998 and 2004 while Aziakpono et al. (2007), although covering a longer time span (1973 to 2004), focuses on two wholesale interest rates. The broad objective of this study is to attempt to fill this gap by exploring the degree of interest rate PT over time and across a wide range of interest rates in South Africa, in order to highlight the effect of the changing financial and monetary policy environment on the extent of PT. The specific objectives of the study are to:

1) provide a historical account of the various monetary policy and financial reforms in South Africa, highlighting the role of the official interest rate and the response of market interest rates;
2) evaluate the PT relative to each of the market interest rates over time;
3) determine the degree of asymmetric adjustment in the market interest rates to changes in the official bank rate; and,
4) highlight the policy implication of the findings.

Section 2 provides a brief overview of the structure of the financial system and monetary policies in South Africa, Section 3 reviews the literature, while the method of analysis is considered in Section 4, Section 5 presents and discusses the results, while Section 6 concludes.

2. Monetary policy and structure of financial system in South Africa: Some stylized facts

Structure of the financial system in South Africa

The financial system in South Africa comprises a highly developed stock market, broad and active Treasury bill and long-term debt markets, and a highly developed banking system. Financial intermediaries such as short-term and long-term insurance companies are also very active. A major turning point in the South African financial landscape occurred following the implementation of the De Kock Commission's recommendations. At the core of the Commission's recommendations was the liberalization of the financial system to allow free market principles to reign, as opposed to the earlier direct controls.

The deregulation of the financial system in the 1980s led to an increase in the number of banks. By 1989, the number of banks under the supervision of the Registrar of Banks rose to 60 from 50 in 1980 (Gidlow, 2003). Also, the balance sheets of these banks grew rapidly. The ensuing competition among banks and between banks and building societies pressurized the profit margins of banks. By the end of the decade, the profit margins of banks in South Africa became thin due, in part, to high costs of modern technology and non-performing loans. Consequently, in order to improve on the quality of their businesses, banks began to consolidate their positions instead of expanding their balance sheets quantitatively (Gidlow, 2003). Many takeovers and mergers occurred, which significantly reduced the number of banks. By 1992, the number of major banking groups had been reduced to four: ABSA Bank, First National Bank, Nedcor and Stanbic.

In 1995, a new banking Act (Banks Act 1995), which opened the way for foreign banks to open and operate branch offices in South Africa, was enacted. Consequently, the number of foreign banks with branch offices rose from four in 1995 to 15 in 2000, and has remained around the latter number. The entry of foreign banks was expected to increase competition in the domestic banking market. However, as noted by Gidlow (2003: 86), because of their inability to compete with the big four, "...foreign banks have chosen to enter niche markets that are not dominated by the corporate divisions of the big four South African commercial banks and the major investment bank". Thus, by implication, the entry of foreign banks did not reduce in any major way the market power of the four dominant banks, which continue to behave in an oligopolistic manner.

Table 1 provides an overview of the composition of assets of major banks and the number of banks from 1991 to 2008.[1] As noted earlier, in 1980 the number of banks under the supervision of the Registrar of Banks was 50, which rose to 60 in 1989. As shown in the table, by 1991 the number of registered banks was reduced to 35 while

another 11 were given provisional licences. By 2008 the number of registered banks had dropped to 17. In addition to the decline in the number of banks, the concentration in the banking sector is also evident from the total assets controlled by the dominant banks. In 1991 the four major banks controlled about 68% of the total assets of the banking sector. With the mergers and takeovers that continued, the asset share of the four banks rose to 83% in 1994. After a slowdown in the increase of their assets share, it resumed its growth in 2003 and by 2008 it reached a peak of 91.2%. On average, between 1991 and 2008, their share of total assets stood at about 82%.

By any standard, it is evident that the banking market in South Africa is highly concentrated. Economic theory suggests two possibilities in terms of the effect of such concentration in the banking sector on the adjustment of interest rates. The most common view, the so called structure-performance hypothesis, suggests that a highly concentrated banking industry will act in an oligopolistic manner, thus causing retail rates to be rigid and asymmetric in adjustment (Cottarelli and Kourelis, 1994; Borio and Fritz, 1995; Mojon, 2000; Weth, 2002; and Gambacorta, 2008). On the other hand, the efficient-structure hypothesis suggests that due to increased efficiency, as the more efficient banks take over the less efficient ones, concentration will improve the PT process (Gambacorta, 2008). Thus, it is unclear a priori, how the increasing concentration of the banking market in South Africa will affect the degree of interest rate adjustment.

Anecdotal evidence suggests that the banking system appears to have performed well. Historically, only a few financial crises have occurred. Most notable were the bank failures of BoE and Saambou, which were ranked sixth and seventh largest banks at the time. Saambou, the first casualty, was put under curatorship in February 2002 by the SARB. The failure of Saambou triggered the instability of BoE, and in order to prevent systemic risk the SARB guaranteed the deposits of BoE's customers. BoE was later integrated into Nedbank. Mboweni (2004) notes that from the last quarter of 1999 to the end of March 2003, twenty-two banks left the South Africa banking system. However, the exits were due to consolidation of the banking sector rather than failure of the medium and small banks.

Table 2 provides further information on the performance of the banking system by presenting information on the composition of banks' assets and liabilities. As indicated by the performance of the banking sector, the total assets as a percentage of GDP grew from 74.6% in 1991 to 116.6% in 2007. As the table also shows, banks have continuously depended on non-bank clients for deposits and loans. Between 1991 and 2007 the share of non-bank deposits of total liabilities ranged from 53.6% in 2003 to 76.9% in 1991. During the financial crisis of the late 1990s and early 2000s the share of deposits dropped, reaching a low level of 53.6% in 2003. Other sources of funds to banks include interbank loans, loans under repurchase agreements and foreign funding. In an open financial system, where banks have access to foreign finance, they may rely less on the accommodation facilities of a central bank, which, in turn, may affect how bank interest rates respond to changes in the official rate (Fourie et al., 1999). Overall, funding from foreign sources has remained relatively low. At the highest point in 2001, banks sourced only 7.6% of their total liabilities from foreign sources. In more recent years the share has been significantly lower, representing 5.3% of liabilities in 2007. Nevertheless, funds from foreign sources exceed loans received under the repo system, which is around 3% of total liabilities.

Table 1: Composition of major banks' assets

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Asset (million rand)																		
Absa	53,372	80,306	81,742	91,705	108, 493	123,156	133,011	148,507	150,921	169,961	202,484	227,685	260,686	295,803	358,607	446,402	579, 199	700,168
FNB	37,704	42,844	52,192	59, 676	67, 230	78,722	89,778	93,209	127,006	141,828	195,764	212,536	255,533	263,262	307,310	388,171	492,760	607,766
Investec	2,786	3,550	4,481	6,889	9, 916	13,008	20,007	32,541	43,161	50,627	62,977	63,964	83,837	72,396	97,129	117,836	146,394	170,528
Nedcor	32,304	35,947	40,900	44, 929	52, 282	63,144	74,932	82, 465	98,412	113,665	144,698	161,090	280,541	308,955	303,225	379,331	436,698	506,359
Standard	49,234	53,160	57,395	69, 738	82, 923	101,800	112,747	127, 818	137,518	150,988	184,724	215,717	318,306	385,197	436,281	530,761	659,110	861,396
Others	79,516	54,553	56,196	46,654	53,657	58,522	83,203	128,554	137,739	139,760	128,953	180,873	115,655	65,212	83,723	62,467	214,428	259,275
Big 5	175,400	215,807	236,710	272,937	320,844	379,830	430,475	484,540	557,018	627,069	790,647	880,992	1,198,903	1,325,613	1,502,552	1,862,501	2,314,196	2,846,217
Big 4	172,614	212,257	232,229	266,048	310,928	366,822	410,468	451,999	513,857	576,442	727,670	817,028	1,115,066	1,253,217	1,405,423	1,744,665	2,167,802	2,675,689
Total Assets	254,916	270,360	292,906	319,591	374,501	438,352	513,678	613,094	694,757	766,829	919,600	1,061,865	1,314,558	1,390,825	1,586,275	1,924,968	2,382,230	2,934,964
Percent of total asset																		
ABSA	20.9	29.7	27.9	28.7	29.0	28.1	25.9	24.2	21.7	22.2	22.0	21.4	19.8	21.3	22.6	23.2	24.3	23.9
FNB	14.8	15.8	17.8	18.7	18.0	18.0	17.5	15.2	18.3	18.5	21.3	20.0	19.4	18.9	19.4	20.2	20.7	20.7
Investec	1.1	1.3	1.5	2.2	2.7	3.0	3.9	5.3	6.2	6.6	6.8	6.0	6.4	5.2	6.1	6.1	6.1	5.8
Nedcor	12.7	13.3	14.0	14.1	14.0	14.4	14.6	13.5	14.2	14.8	15.7	15.2	21.3	22.2	19.1	19.7	18.3	17.3
Standard	19.3	19.7	19.6	21.8	22.1	23.2	21.9	20.9	19.8	19.7	20.1	20.3	24.2	27.7	27.5	27.6	27.7	29.3
Big 5	68.8	79.8	80.8	85.4	85.7	86.6	83.8	79.0	80.2	81.8	86.0	83.0	91.2	95.3	94.7	96.8	97.1	97.0
Big 4	67.7	78.5	79.3	83.2	83.0	83.7	79.9	73.7	74.0	75.2	79.1	76.9	84.8	90.1	88.6	90.6	91.0	91.2
Others	31.2	20.2	19.2	14.6	14.3	13.4	16.2	21.0	19.8	18.2	14.0	17.0	8.8	4.7	5.3	3.2	2.9	3.0
No of banks																		
Registered Banks	35(11)	35(8)	35	35	34	39	40	39	41	41	39	28	20	18	17	17	17	17
Branches of Foreign Banks					4	6	9	12	12	15	15	14	15	15	15	14	14	14
Controlling Companies	26	17	23	23	27	26	32	34	40	38	37	27	19	16	15	15	15	15
Local rep offices	30	31	33	40	46	58	60	58	57	61	56	52	44	44	47	43	46	43

Note: The big five are ABSA Bank, FNB, Nedbank, Standard Bank and Investec, while the big four exclude Investec.
Sources: Data were computed based on Bank Supervision Annual Reports of the SARB (Various Issues)

Table 2: Composition of assets and liabilities of banks: 1991–2007

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Assets																	
Total assets(mil rand)	247,556	257,543	277,625	319,591	374,501	438,352	513,678	613,094	694,757	766,829	919,600	1,061,865	1,314,558	1,390,825	1,586,275	1,924,968	2,330,509
Non-bank advances	206,386	201,934	218,682	250,051	295,517	349,781	412,860	486,725	538,839	585,426	669,547	784,744	836,694	941,665	1,132,086	1,429,227	1,765,372
Interbank Advances	21,416	11,136	11,793	10,452	11,530	13,910	16,281	20,957	27,252	30,881	43,878	51,012	54,967	64,671	68,150	90,359	108,741
Foreign currency loans	9,735	9,468	10,572	13,294	14,852	13,673	15,754	27,044	32,811	50,405	80,443	132,859	106,658	122,797	136,636	188,043	200,744
Others	10,019	35,005	36,578	45,794	52,602	60,988	68,783	78,368	95,855	100,117	125,732	93,250	316,239	261,692	249,403	217,339	255,652
Percent of Total assets																	
Non-bank advances	83.4	78.4	78.8	78.2	78.9	79.8	80.4	79.4	77.6	76.3	72.8	73.9	63.6	67.7	71.4	74.2	75.8
Interbank Advances	8.7	4.3	4.2	3.3	3.1	3.2	3.2	3.4	3.9	4.0	4.8	4.8	4.2	4.6	4.3	4.7	4.7
Foreign currency loans	3.9	3.7	3.8	4.2	4.0	3.1	3.1	4.4	4.7	6.6	8.7	12.5	8.1	8.8	8.6	9.8	8.6
Others	4.0	13.6	13.2	14.3	14.0	13.9	13.4	12.8	13.8	13.1	13.7	8.8	24.1	18.8	15.7	11.3	11.0
Percent of GDP																	
Total asset	74.6	69.2	65.1	66.3	68.3	70.9	74.9	82.6	85.4	83.2	90.2	90.9	104.3	99.7	102.7	110.3	116.6
Non-bank advances	62.2	54.3	51.3	51.9	53.9	56.6	60.2	65.6	66.2	63.5	65.6	67.1	66.4	67.5	73.3	81.9	88.3
Interbank advances	6.5	3.0	2.8	2.2	2.1	2.3	2.4	2.8	3.3	3.3	4.3	4.4	4.4	4.6	4.4	5.2	5.4
Foreign currency loans	2.9	2.5	2.5	2.8	2.7	2.2	2.3	3.6	4.0	5.5	7.9	11.4	8.5	8.8	8.8	10.8	10.0
Others	3.0	9.4	8.6	9.5	9.6	9.9	10.0	10.6	11.8	10.9	12.3	8.0	25.1	18.8	16.2	12.5	12.8
Liabilities																	
Total liabilities(mil rand)	247,556	257,543	277,625	319,591	374,501	438,352	513,678	613,094	694,757	766,829	919,600	1,061,865	1,314,558	1,390,825	1,586,275	1,924,968	2,330,509
Non-bank funding	190,450	178,245	189,861	224,235	270,142	321,065	372,374	430,582	473,266	504,002	551,745	638,594	705,247	828,063	1,008,732	1,241,182	1,516,958
Loans received under repo	9,877	10,169	8,158	6,831	7,753	7,119	6,291	13,830	18,490	25,983	23,664	29,360	45,063	51,361	53,451	62,421	72,072
Foreign funding	9,990	10,054	11,167	16,338	22,380	26,345	36,333	43,020	43,892	48,864	69,692	74,497	46,001	44,378	51,535	78,100	105,652
Interbank funding	29,011	21,032	26,425	20,499	17,365	16,710	19,460	27,502	35,152	41,890	76,320	92,117	72,657	71,153	83,304	105,286	128,896
Others	8,228	38,043	42,014	51,688	56,861	67,113	79,220	98,160	123,957	146,090	198,179	227,297	445,590	395,870	389,253	437,979	506,931
Percent of total liabilities.																	
Non-bank funding	76.9	69.2	68.4	70.2	72.1	73.2	72.5	70.2	68.1	65.7	60.0	60.1	53.6	59.5	63.6	64.5	65.1
Loans received under repo	4.0	3.9	2.9	2.1	2.1	1.6	1.2	2.3	2.7	3.4	2.6	2.8	3.4	3.7	3.4	3.2	3.1
Foreign funding	4.0	3.9	4.0	5.1	6.0	6.0	7.1	7.0	6.3	6.4	7.6	7.0	3.5	3.2	3.2	4.1	4.5
Interbank funding	11.7	8.2	9.5	6.4	4.6	3.8	3.8	4.5	5.1	5.5	8.3	8.7	5.5	5.1	5.3	5.5	5.5
Others	3.3	14.8	15.1	16.2	15.2	15.3	15.4	16.0	17.8	19.1	21.6	21.4	33.9	28.5	24.5	22.8	21.8
Percent of GDP																	
Total Liabilities	74.6	69.2	65.1	66.3	68.3	70.9	74.9	82.6	85.4	83.2	90.2	90.9	104.3	99.7	102.7	110.3	116.6
Non-Bank funding	57.4	47.9	44.6	46.5	49.3	52.0	54.3	58.0	58.2	54.7	54.1	54.6	55.9	59.3	65.3	71.1	75.9
Loans received under repo	3.0	2.7	1.9	1.4	1.4	1.2	0.9	1.9	2.3	2.8	2.3	2.5	3.6	3.7	3.5	3.6	3.6
Foreign funding	3.0	2.7	2.6	3.4	4.1	4.3	5.3	5.8	5.4	5.3	6.8	6.4	3.6	3.2	3.3	4.5	5.3
Interbank funding	8.7	5.7	6.2	4.3	3.2	2.7	2.8	3.7	4.3	4.5	7.5	7.9	5.8	5.1	5.4	6.0	6.4
Others	2.5	10.2	9.9	10.7	10.4	10.9	11.6	13.2	15.2	15.8	19.4	19.4	35.3	28.4	25.2	25.1	25.4
GDP(mil rand)	331,980	372,225	426,133	482,120	548,100	617,954	685,730	742,424	813,683	922,148	1,020,007	1,168,699	1,260,693	1,395,369	1,543,976	1,745,217	1,999,086

Sources: Data were computed based on Bank Supervision Annual Reports of the SARB (Various issues)

On the assets side of the balance sheet of banks, the main uses of funds remain loans and advances to non-bank clients, interbank loans and advances and foreign currency loans and advances. Evidently, the non-bank loans and advances significantly dominate the assets of banks, accounting, on average, for more than 75% of total assets. As a share of GDP (a measure of the extent to which the banks finance the private domestic economy), the ratio has grown over time to a level of 88.3% in 2007. Hence, the economy depends greatly on the credit from the banking sector and, by implication, the concentrated banking sector could take advantage of the market power it enjoys to exploit customers by keeping interest rates sticky.

Monetary policy in South Africa

In the 1970s, monetary policy mainly consisted of direct controls such as interest rate controls and credit ceilings, and high liquid asset and cash reserve requirements. These were aimed at controlling the growth in the monetary aggregate with a view to combating inflation (Strydom, 2000). The extensive controls of that period left little room for financial market development and the system was periodically characterized by extensive disintermediation.[2] The problems created by the extensive controls, and developments in the international environment – the demise of the Bretton Woods system of fixed exchange rates in 1971, and two oil crises in 1973/74 and 1979/80 – made a rigid monetary policy framework undesirable.

An attempt to improve the efficiency of monetary policy and to stimulate the development of the financial system led to the appointment of the Commission of Inquiry into the Monetary System and Monetary Policy in South Africa in 1977 (subsequently referred to as the De Kock Commission). The De Kock Commission was formed to review, among other things, exchange rate policy, monetary policy and the more general role of government regulation in the financial markets. The De Kock Commission submitted its interim report in 1978 and a final report in 1985. The recommendations of the De Kock Commission led to a significant shift in policy orientation from a control regime to more market-oriented monetary and financial policies.

As an integral part of the monetary policy framework, the De Kock Commission recommended active use of the discount policy, which was to be complemented by open market operations (OMO)[3] and variable cash reserve requirements. The discount policy, which is also known as the accommodation policy, has since become the dominant monetary policy instrument in South Africa. The accommodation policy consists of deliberate variations in the terms and conditions on which accommodation is granted. Variations in the terms and conditions take the form of changes in the quantity of liquidity provided to the market and the interest cost of accommodation[4] (Fourie et al., 1999).

In addition to the changes in the accommodation policy, which focus on the operating procedures of monetary policy, there have been changes to the monetary policy targeting frameworks. In the 1960s through to the early 1980s, the liquid asset ratio-based system was used with quantitative restrictions on interest rates and credit. From 1986, a pre-announced, flexible money supply targeting system[5] was used with emphasis on the use of the SARB discount rate in influencing the market interest rates. Money supply targeting was replaced by money supply guidelines in 1990. However, targeting money supply

became very difficult due to financial liberalization from the 1980s and the increasing openness of the capital account since 1995. Consequently, an eclectic monetary policy approach was introduced in the late 1990s, which supplemented the money supply guidelines with a set of indicators such as exchange rates, asset prices, output gap, balance of payments, wage settlements, total credit extension and the fiscal stance (Aron and Muellbauer, 2001). Finally, in 2000, formal inflation targeting was adopted. However, the operational procedure has been dominated by the accommodation policy of the SARB, complemented by OMO and variable cash reserve requirements. For the purpose of this discussion we focus on the operating procedure, mainly the accommodation policy, rather than the target framework.

Over time, changes to the accommodation policy varied in the extent to which market forces have been allowed to determine their operations. From 1980 until now, five major changes to the accommodation policy can be identified – from 1980 to May 1993, May 1993 to March 1998, March 1998 to September 2001, September 2001 to May 2005, and May 2005 to date.

The period from 1980 to May 1993 was marked by the large scale implementation of a market-oriented monetary policy framework stemming from the recommendations of the De Kock Commission.[6] In addition, discount policy and supporting open market operations emerged as the main policy instruments of the SARB, with the Bank rate featuring as the principal operational variable in the conduct of monetary policy. The Bank rate also served as a discount rate. During this era of accommodation policy, banks were allowed unrestricted access to liquidity through the discount window by discounting eligible papers with the SARB, and a long list of refinancing assets was available. The SARB also granted overnight loans to banks against the security of short-term Treasury bills and government stocks. One problem associated with this accommodation system was the complicated interest rate structure and the long list of refinancing assets (Fourie et al, 1999).

In May 1993, a new accommodation arrangement was introduced, which operated until March 1998. Unlike the previous one, the new arrangement did not allow banks unlimited access to liquidity. In addition, the new system of accommodation was limited to overnight loans at two different accommodation rates and against two categories of financial assets (Gidlow, 1998). As noted by Gidlow (1998), under this system accommodation became more restrictive and tight monetary policies were applied.

In an attempt to introduce more flexibility into the conduct of monetary policy, the SARB introduced a new accommodation system in March 1998, which remained in place until September 2001. This system, known as the repo system, involves regular repurchase transactions between the SARB and its banking clients. It provides an alternative system through which shortfalls in banking liquidity are accommodated at the borrowing window of the SARB by means of repurchase agreements relating to various securities which are tendered by banks to the SARB on a daily or intraday basis. An important feature of the repo system as operated during this period is that the repo rates could change on a daily or intraday basis in line with the results of the daily or intraday repo tenders, with the repo rate exerting a major influence on interest rates of banking institutions (Gidlow, 1998). This system introduced more flexibility in the interest rate structure. The repo system during this period represents the most liberal, market-oriented accommodation policy since inception.

In September 2001, the SARB introduced another adjustment to the repo system, which was in force until May 2005. The change was motivated by the belief of the monetary authorities that monetary policy would be more effective if changes in the repo rate had a more direct effect on the overnight interbank rate (ABSA, 2001). Consequently, the monetary transmission mechanism should work in such a way that changes in the repo rate would affect interbank rates first, which should then be transmitted to other money market rates, followed by other interest rates in the economy, rather than to the prime lending rate (ABSA, 2001). From September 2001 the repo system has entailed a fixed one-off adjustment to the spread between the repo rate and the interbank call rate (which represents a switch from the previous floating to a fixed repo rate), weekly repo tenders with a seven-day maturity instead of the previous daily or intraday tenders, a reduction in the margin between the repo rate and the interbank call rate, and changes to the cash reserve requirements (ABSA, 2001). This policy orientation signalled a move toward more control than that held by the previous regime.

From 25 May 2005, the SARB introduced further modifications to the repo system with a view to improving the efficiency, safety and flexibility of liquidity management and to promote a more active money market in South Africa through stimulating active trading among money market participants. The modifications to the repo system entailed, among other things, abolition of the supplementary refinancing facility as a regular daily square-off facility for banks, instead they were to be conducted on an infrequent basis; and abolition of the marginal lending facility as a monetary policy instrument.

3. Literature review

Theoretical framework

Interest rate adjustment: Conceptual definition

Market interest rate adjustment, or stickiness, can be used to describe the responsiveness of market interest rates to changes in other interest rates, such as the official interest rate. If a change in the official interest rate elicits a significantly smaller change in market interest rates, then the market rates are sticky. The literature also differentiates between adjustment in the short run and in the long run (Cottarelli and Kourelis, 1994). While there may be a considerable degree of response of market interest rates to changes in the official interest rate in the long run, and in some cases the adjustment may be complete, this may not be the case in the short run. Due to the adjustment and menu costs, banks may respond sluggishly to changes in the official rate in the short run. Moreover, there are limited alternative financing or investment sources to bank loans or deposits, or customers may not be aware of such alternatives in the short run because of information asymmetry. As a result, banks may not feel pressured to adjust their rates in the short run when the official rate changes (Cottarelli and Kourelis, 1994). Lastly, due to long-term relationships with their customers, banks may want to smooth interest rates changes (Egert et al., 2007). Consequently, a gap may exist between the long-run and short-run adjustment. A wide gap between the short-run and the long-run adjustments can be viewed as evidence of interest rate rigidity.

Much of the theoretical literature on interest rate adjustment tends to focus on short-term money market interest rates, especially the various deposit and lending rates of banks. The usual aim of central banks' operations is to influence the overall lending policies of banks and the demand for money and credit in the economy through changes in bank liquidity and interest rates in the money market (Mboweni, 2000). Changes in interest rates in the money markets should then be translated into long-term capital market interest rates, as suggested by the expectations theory of the yield curve.[7] However, as indicated by the liquidity preference theory of the yield curve, due to risks in long-term debts the long-term interest rates will not perfectly reflect the changes in short-term rates. As a result, adjustments in the long-term interest rates are expected to be slower than in the short-term money market interest rates in response to changes in the official interest rate.

Factors affecting the adjustment of interest rates

Theoretically, a number of factors may affect the adjustment of interest rates. These include: monetary policy orientation, that is, whether a liberal or controlled monetary policy regime is in place; financial structure – the concentration within the banking sector, the stage of financial market development, bank size, the degree of financial market openness; asymmetric information; and menu costs. We now briefly discuss some of the factors that affect the stickiness of market interest rates.

First, monetary policies that rely on direct control of interest rates and credit allocation are inherently rigid as changes in interest rates occur only when the monetary authority adjusts the set rates. In contrast, in a deregulated monetary policy environment, market forces are allowed to determine interest rates and credit allocation. In such an environment, market rates are more flexible and as such may adjust more readily to changes in the monetary policy stance (Gidlow, 1998).

The structure of the financial system could also affect the nature of interest rate adjustments. Financial structure relates to the degree of competition within the banking system, and between banks and other intermediaries. The level of competition in the financial system depends on the regulatory environment (for example, whether regulation complicates the entry of new banks – local or foreign – and other financial intermediaries), the number and size of intermediaries and the ownership structure (whether financial institutions are owned largely by the private sector or by the state), as well as the openness of the financial system. In a competitive market, profit-maximizing behaviour will require banks to adjust their rates promptly to changes in the market conditions, but if market forces are weak (for example, due to barriers to entry or absence of competition from non-bank intermediaries) inefficiency will not be penalized and bank interest rates may be more rigid (Cottarelli and Kourelis, 1994; Thompson, 2006).

Also, in a highly concentrated banking market, oligopolistic behaviour of banks may cause interest rates to adjust asymmetrically to an increase or decrease in the official rate. The asymmetric adjustment of interest rates can be explained using two competing hypotheses: the collusive behaviour of banks and adverse customer reaction (Hannan and Berger, 1991; Neumark and Sharpe, 1992; Scholnick, 1996; Lim, 2001; and De Bondt, 2005). The collusive behaviour hypothesis suggests that deposit rates will move rigidly upward when the official rate is increased, while the lending rates will move rigidly downward in the case of a decrease in the official rate. On the other hand, the adverse customer reaction hypothesis implies that deposit rates will move rigidly downward when the official rate is decreased, while the lending rates will move rigidly upward in the case of an increase in the official rate.

The ownership structure of banks (that is, whether state-owned or private sector-owned) is another factor that could influence the speed of adjustment of interest rates. A state-dominated banking system results in banking concentration or some form of monopoly, which may cause rigidity in the interest rates as noted above. In addition, due to political pressures or simple inefficiency, bank interest rates will be more rigid in a banking system dominated by state-owned banks (Cottarelli and Kourelis, 1994).

The response of domestic banks to changes in the official rate also depends on the extent to which banks rely on the accommodation facilities for their liquidity needs that

are provided by the central bank. If the financial system is sufficiently open and banks can easily access external sources of finance, banks' reliance on the accommodation facilities from the central bank might be reduced (Fourie et al., 1999). Consequently, in an open financial system the response of bank interest rates to changes in the official rate may be slower than when the market is not open.

Stiglitz and Weiss (1981) provide another explanation for interest rate rigidity based on asymmetric information. If banks perceive the risk of default to be very high, they will maintain a large spread between lending and deposit rates. If this cushion is very large, the market lending rate may be relatively insensitive to small changes in the official rate.

Finally, the level of development of the financial system affects the degree of interest rate adjustment. A well-developed financial system offers alternative financial instruments and intermediaries for investors and savers, thereby providing alternative investment or financing sources to bank loans and deposits. In addition to the availability of other financial intermediaries, alternative financing or investment sources include active and broad markets for Treasury bills, long-term bonds (both government and private), and an active stock market. In such a developed financial system, no single financial intermediary enjoys absolute market power and interest rates are more flexible in responding to changes in market conditions.

The foregoing discussion shows that several factors, which vary from country to country, could cause the stickiness of market interest rates. Moreover, stickiness will vary within a country as the financial environment changes. These variations are critical to the calibration and execution of a monetary policy. Little wonder, therefore, that the relationship between official interest rates and market interest rates has given rise to a growing empirical literature. What follows is a review of some of the empirical studies.

Empirical evidence

The empirical literature on interest rates adjustment has grown, especially those that analyse PT in advanced countries and, more recently, in some emerging market economies. In addition to exploring the general degree of adjustment of bank interest rates in response to changes in the monetary policy rate, many studies have also explored the specific possibility of asymmetric adjustment. Table 3 summarizes interest rate PT studies. The results of the studies show cross-country differences in interest rate PT and within country variation over time. The level of PT also depends on the interest rates used. Some studies found evidence of asymmetric adjustment, while others did not. Moreover, in studies that found asymmetric adjustment in banking interest rates, the nature of the adjustment varied from country to country.

Table 3: Summary of empirical PT and asymmetric PT studies

Study	Country	Policy rate	Market interest rate	Sample	Estimation method	SR-PT (immediate PT)	LR-PT	Speed of adj.	Asymmetric adj.			Remark
									Present	Increase	Decrease	
Hulsewig et al. (2009)	Euro area	Nominal short term Euro Interbank Offered Rate (EURIBOR)	Retail bank lending rates	1999Q1 to 2002Q4	New Keynesian DSGE model	0.54 (54%)	NA	NA	NA	NA	NA	Incomplete PT
Kwapil and Scharler (2009)	Euro area and USA	3 months money market rate	Several deposit and lending rates and their weighted averages	Monthly: 1995:1 to 2003:3	EG cointegrating relationship and ARDL	USA (average): DR=0.97 LR=0.79 Euro area: DR=0.16 LR=0.34	USA (average): DR=0.93 LR=0.57 Euro area: DR=0.32 LR=0.48	NA	No	NA	NA	In USA PT nearly complete for DR but not for LR and PT was largely symmetric. In euro area PT was incomplete for DR and LR and PT was essentially symmetric
Marotta (2009)	Nine EMU countries and the UK	1 month National Interbank rate	National short-term business lending rate	Monthly: 1994:1 to 2003:9	EG cointegrating relationship, ARDL and dynamic OLS	Range from 0.12-1.07 to 0.15-0.89 for the period before and after break	Range from 0.40-1.36 to 0.20-1.01 for the period before and after break.	ECM ranges from (-0.19)-(-0.61) to (-0.29)-(0.95)	Present in only France and the Netherlands			Mostly incomplete and persistent cross-country heterogeneous. Weak evidence of asymmetric PT

continued next page

Table 3 Continued

Study	Country	Policy rate	Market interest rate	Sample	Estimation method	SR-PT (immediate PT)	LR-PT	Speed of adj.	Asymmetric adj.			Remark
									Present	Increase	Decrease	
Wang and Lee (2009)	The USA and nine Asian countries	Money market rate, inter-bank call rate and Federal fund rate	Deposit and lending rates	Monthly: 1988:2 to 2000:12	Asymmetric threshold cointegration test and EC-EGARCH (1,1)-M model	Range from 0.0003 to 0.473 for Asian countries and 0.854 for the US for DR while for LR the values range from -0.004 to 0.179 for Asian and 0.918 for the USA	DR: range from 0.103 to 0.876 for Asian and 0.99 for the USA. LR: range from 0.229 to 0.731 for Asian and 0.857 for the USA	NA	Asymmetric PT in 5 of 10 countries in DR and asymmetric PT in 3 of 10 countries in LR			Incomplete PT for Asian countries, but complete for the USA DR. Also evidence of collusive pricing in some Asian countries
Liu et al. (2008)	New Zealand	Overnight interbank rate, 2-year bond yield, 5-year bond yield and Official cash rate (OCR)	Fixed mortgage rates with maturity of 1–5 years, floating mortgage rate, 6-month time deposit, bond rates, base lending rate	Monthly: 1994:8 to 2004:12	Phillips and Loretan non-linear least squares, EG-OLS, ARDL model, structural error correction model, MAL	No evidence of complete PT. The PT for mortgage rates vary from 0.324 to 0.883; for base LR is 0.506; and for time DR is 0.436	PT is incomplete for all retail rates except one. The PT for mortgage rates vary from 0.183 to 0.934; for base LR is 0.761; for time DR is 0.825 and for bond 0.603 and 0.457*	MAL after policy change mortgage rates vary from 0.22 to 1.96; for base LR is 2.36; and for time DR is 1.46	Weak evidence of asymmetric PT	MAL ranges from 0.58 to 1.74	MAL ranges from 0.45 to 2.25	The long-run PT of retail rates varies across financial products. Short-term rates show higher degree of PT and faster speed of adjustment than long-term rates and there is some evidence of asymmetric adjustment of retail rates

continued next page

Table 3 Continued

Study	Country	Policy rate	Market interest rate	Sample	Estimation method	SR-PT (immediate PT)	LR-PT	Speed of adj.	Asymmetric adj.			Remark
									Present	Increase	Decrease	
Gambacorta (2008)	Italy (a panel of 73 banks)	Repo rate of the Bank of Italy and the ECB interest rates on main financing operation	Short-term lending rate and rate on current account (as deposit rate)	Quarterly: 1993:3 to 2001:3	Balanced panel data, GMM estimator by Arellano and Bond	Lending and deposit rates: about 0.45	Lending rate: complete PT (about 1.01) and incomplete PT for deposit rate (about 0.7)	ECM of -0.4 for lending rate and -0.6 for deposit rate	NA	NA	NA	Heterogeneity in the bank rate PT exists, but only in the short run. Short-run PT in lending rate is lower for liquid and well-capitalized banks. While heterogeneity in PT in deposit rate depend on liability structure of banks.
Sudo and Teranishi (2008)	12 Euro countries	ECB policy rate	Bank loan interest rates	Monthly: 2003:1 to 2008:5	Error correction model	Range from 0.20 to 0.81	Not reported	ECM: ranges from -0.07 to -0.42	NA	NA	NA	Bank loan rate in all the countries show some degree of stickiness and varies across countries
De Graeve et al (2007)	Belgium (a panel of 31 banks)	Money market rate	Deposit and lending rates of 13 products	Monthly: 1993:1 to 2002:12	Panel cointegration and error correction model with heterogeneity	Lending rates: range from 0.194 to 0.982 and deposit rate from 0.022 to 0.852	Lending rates: 0.651 to 0.994 and deposit 0.533 to 0.98	MAL: ranges from 0.167 to 1.448 for lending rate and from 0.222 to 2.431 for deposit rate	No clear asymmetry in lending rates while for deposit rates there is strong indication of asymmetric adjustment	Deposit rate: most rates adjust faster when the rate is above equilibrium		The long-run PT is complete for four out of 13 products while majority exhibit incomplete PT. Lending rates PT more complete than deposit rate
Aydin (2007)	Turkey	Money market rate	Lending rates: corporate, housing, cash and automobile loans	Monthly: 2001:6 to 2005:5	Panel cointegration and error correction model with heterogeneity and ARDL	Corporate loan: -0.224, housing loan:-0.16, cash loan: -0.215 and automobile loan: -0.638	Corporate loan: 0.631, housing loan:1.588, cash loan: 1.065 and automobile loan: 1.082	MAL: Corporate loan: 1.19, housing loan:2.90, cash loan: 1.67 and automobile loan: 0.84	NA	NA	NA	Short-run PTs are generally insignificant and incomplete. Long-run PTs are higher for all types of loans when the loan market is functioning more properly

continued next page

Table 3 Continued

Study	Country	Policy rate	Market interest rate	Sample	Estimation method	SR-PT (immediate PT)	LR-PT	Speed of adj.	Asymmetric adj.			Remark
									Present	Increase	Decrease	
Aziakpono et al. (2007)	South Africa	Repo rate (discount rate)	Overnight prime interbank lending rate and NCD rate	Monthly: 1973:1 to 2004:8 (six sub-periods)	EG cointegration and ECM and Asymmetric ECM	LR: ranged from 0.282 to 1.147 NCD: 0.761 to 1.09	LR: ranged from 0.899 to 1.218 NCD: 0.845 to 1.09	MAL: LR: ranged from 2.17 to 0.25, NCD: ranged from 1.65 to 0.012	Very weak evidence of asymmetry for both interest rates			Long-run PTs are generally very high and the speed of adjustment very fast for the two whole sale rates. Evidence of asymmetry very weak
Egert et al (2007)	5 Central and Eastern European countries and 3 euro area countries	Individual country's policy rate	Short-term and long-term money market rates and deposit and lending rates	Monthly: 1994:1 to 2005:12	Dynamic OLS, ARDL, EG cointegration and multi-variate cointegrated VAR	Not reported	Vary across country and over time and largely incomplete PT for both lending and deposit rates but nearly complete for market rate	Not reported	Present: but the pattern was not clear	NA	NA	PT in on average higher for the CEE countries than in core euro area countries
Charoenseang and Manakit (2007)	Thailand	14-day repo rate	Lending and deposit rates of commercial nks and finance companies	Monthly: 2000:6 to 2006:7	EG cointegration and ECM and asymmetric ECM	Very low and incomplete PT in all interest rates except the interbank rate where PT is complete	Low and incomplete PT in all interest rates except the interbank rate where PT is complete	MAL: commercial bank lending rate: 0.256, 15.47 and 15.0; deposit rates:12.52, 8.45 and 7.09 while finance companies deposit rates: 7.42 and 11.3	There is no significant asymmetric adjustment, but short-term deposit rates and lending rates of commer-cial banks and finance companies are more rigid down-ward than upward			There is only small PT to financial market interest rates and on average the commercial bank lending rate tend to adjust lower than deposit rates

continued next page

Table 3 Continued

Study	Country	Policy rate	Market interest rate	Sample	Estimation method	SR-PT (immediate PT)	LR-PT	Speed of adj.	Asymmetric adj.			Remark
									Present	Increase	Decrease	
Chionis and Leon (2006)	Greece	1-month money market rate	Lending and deposit rates	Monthly: 1996:7 to 2004:9	Static regression, EG cointegration and ECM and asymmetric ECM	Lending rates PT: before EMU 0.09 and after EMU 0.508. Deposit rate PT: before EMU 0.063 and after EMU 0.64	Lending rates PT: before EMU 1.86 or 0.926 and after EMU 0.50 or 0.78. Deposit rate PT: before EMU 0.50 or 1.24 and after EMU 0.63 or 0.68	Not reported	NA	NA	NA	PTs were more complete before the joining the EMU than after
Chong et al. (2006)	Singapore	The benchmark 3-month Singapore interbank offered rate (SIBOR)	Lending and deposit rates of commercial banks and finance companies	Monthly: 1983:1 to 2002:12	EG cointegration and ECM and asymmetric ECM	Very low and incomplete PT in all interest rates	Low and incomplete PT in all interest rate	MAL: commercial bank lending rate: 8.3; deposit rates: 13.2, 7.0, 6.6 and 6.0 while finance companies' lending rate: 12.4 and 19.5 deposit rates: 12.7, 4.8, 5.0 and 5.3	There is significant asymmetric adjustment. Both lending and deposit rates adjust faster when the rates are above the equilibrium than when they are below it.	Comm-ercial Banks: Lending rate: 6.9; Deposit rate: 10.5, 5.5, 5.5 and 5.7 Finance companies: Lending rates: 10.6 and 14.7; Deposit rate: 9.8, 3.9, 4.2 and 4.7	Comm-ercial Banks: Lending rate: 10.4; Deposit rate: 18.6, 9.4, 8.4 and 6.9 Finance companies: Lending rates: 14.7 and 30.1; Deposit rate: 18.5, 6.2, 6.1 and 6.0	PT for both loans rates and deposit rates are not complete, and PT for deposit rates are higher than oan rates. Also the l PT on finance companies' deposit rates is statistically higher than that of commercial banks

continued next page

Table 3 Continued

Study	Country	Policy rate	Market interest rate	Sample	Estimation method	SR-PT (immediate PT)	LR-PT	Speed of adj.	Asymmetric adj.			Remark
									Present	Increase	Decrease	
Sander and Kleimeier (2006b)	8 CEECs and 4 euro area countries	1-month money market rate	Several retail loans rates and deposit rates	Monthly: 1993:1 to 2003:12 Three sub-periods: 1993–1997, 1996–2000, and 1999–2003	Symmetric error correction model and asymmetric error correction models: TAR, B-TAR and M-TAR	Incomplete PT in all interest rates	PT to loan rate was complete only for the CEEC and not the other countries. PT to deposit rate was incomplete for all countries	NA	NA	NA	NA	PT in CEECs is more complete and faster than the aggregate euro zone
De Bondt (2005)	Euro area	Overnight interest rate	Deposit and loan rates	Monthly: 1996:1 to 2001:5	ECM, VECM and VAR	Incomplete in the short run for all interest rate	Incomplete PT to deposit rates but complete PT for most lending rates	ML (monthly): DR (ranged from 3 to 23.8), LR (ranged from 2.8 to 10.2)	NA	NA	NA	PT is quicker since the introduction of the euro
De Angelis et al. (2005)	South Africa	Repo rate	Prime interbank rate, Prime lending rate and NCD	Monthly: 1998:3 to 2001:9 and 2001:9 to 2004:11	Engle-Granger cointegration and ECM and Guisan (2001) mixed dynamic model	NA	PT mostly complete in all interest rates but slightly higher during first monetary policy regime	NA	NA	NA	NA	PT mostly complete in all interest rates but slightly higher during first monetary policy regime

continued net page

Table 3 Continued

Study	Country	Policy rate	Market interest rate	Sample	Estimation method	SR-PT (immediate PT)	LR-PT	Speed of adj.	Asymmetric adj.			Remark
									Present	Increase	Decrease	
Tieman (2004)	Transition economies (compares Romania with others)	Central bank policy rate	Short and long-term deposit and lending rates	Monthly: 1995:1 to 2004:2	Error correction framework	Incomplete PT in all interest rates but PT to deposit rate higher than lending rate	Higher long-run PT in more recent years	Deposit rates adjust much faster than lending rates	NA	NA	NA	PT is higher in deposit rates than lending rates and adjustment is quicker in deposit rate
Jankee (2004)	Mauritius	Interbank money market rate	Commercial banks 3-month deposit rate and housing loan rate	Monthly: 1988:9 to 2003:9	Johansen cointe-gration, TAR, M-TAR	PT for DR= 0.413 and LR= 0.242	Not reported	ECM for DR = -0.641 and LR = -0.601	Present only in lending rate	LR adjust slower when there is an increase	LR adjust faster when there is a decrease	PT is higher in DR than in LR, but asymmetry only exists in LR
Scholnick (1996)	Malaysia and Singapore	Wholesale rates	Short-term lending deposit and rates	Monthly: 1983:1 to 1992:11 and 1994:4	Johansen cointe-gration and ECM and asymmetric ECM.	Low PT: Malaysia (DR= 0.08 and LR =0.10); Singapore (DR=0.12 and LR=0.12)	Not reported	ML (months): Malaysia DR=6.2 and (LR=11.4), Singapore (DR=7.0 and LR =7.5)	Present in all except LR in Singapore	AML (months): Malaysia (DR=3.0 and LR=8.8); Singapore (DR =4.7 and LR=8.3)	AML (months): Malaysia (DR=7.5 and LR=6.1); Singapore (DR = 7.4 and LR= 9.9)	In both countries banks tend to adjust their deposit rates downward more rapidly than upward. The speed of adjustment varies between the countries
Cottarelli et al. (1995)	Italy	Discount rate and money market	Lending rates	Monthly: 1986:6 to 1993:12	ECM	Incomplete (0.07)	Nearly complete (0.92)	NA	NA	NA	NA	Low PT in the short run but relatively high in the long run

continued next page

Table 3 Continued

Study	Country	Policy rate	Market interest rate	Sample	Estimation method	SR-PT (immediate PT)	LR-PT	Speed of adj.	Asymmetric adj.			Remark
									Present	Increase	Decrease	
Neumark and Sharpe (1992)	USA (255 banks)		6-month CD and money market account	Monthly: 1983:10 to 1987:11	Panel data: OLS, partial adjustment model and switching model of partial adjustment	NA	NA	NA	Present			Banks are quicker to adjust deposit rates downward when above equilibrium than they are to adjust upward when below equilibrium
Hannan and Berger (1991)	USA (398 banks)	3-months TBR	Money market deposit rate	1983:9 to 1986:12	Multinomial logit estimation	NA	NA	NA	Present	Deposit rates more rigid when there is an increase	Deposit adjust faster when there is a decrease	Firms in more concentrated markets exhibit greater price rigidity and deposit rates are more rigid for increases than for decreases

*Based on Phillips-Loretan estimates and PT from interbank rate to retail rates.

On the magnitude of interest rate PT, both in the long and short run, all the studies appear to be consistent in showing cross-country differences, irrespective of the interest rates, the method used and the period covered. Also consistent with theoretical prediction, the PTs in the long run are generally higher than in the short run. To illustrate, in a recent study, Kwapil and Scharler (2009) carried out a comparative analysis of the PT from policy rate to retail interest rates in the euro area and the USA. They analysed monthly data from January 1995 to September 2003 for various deposit and lending rates. They found the average long-run PT to be lower in the euro area than the USA. Whereas the PT from policy rate to most categories of deposit rates was nearly complete in the USA, it was only 0.32 in the euro area. The long-run PT to lending rates was also lower in the euro area at 48%, compared with 57% in the USA.

The differences in PT have been observed not only between the USA and the euro area, but also across the euro area. Such studies include Marotta (2009), who covers nine euro countries and the UK; Sudo and Teranishi (2008), 12 euro countries; and De Bondt (2005), who covers the euro area. De Bondt (2005) also reviewed nine euro areas specifically. From the review, the author found that all the studies show cross-country differences in the interest rate PT, but the pattern of cross-country differences was not very clear. However, as the author indicated, "it seems the case that short-term bank lending rates to enterprises in Belgium, Spain and the Netherlands adjust less sluggishly after three months compared with the other euro area countries" (De Bondt, 2005: 40).

Motivated by some of the weaknesses and the inconclusive nature of the studies he reviewed, the author further explored the PT process for both the bank deposit and the lending interest rates at the level of the euro area. Consistent with most of the earlier cross-country studies that he reviewed, De Bondt (2005) found an incomplete immediate PT of market interest rates to retail bank interest rates. His findings further show that of all the retail bank interest rates, there was a higher rigidity in the interest rates on overnight deposits and deposits redeemable at notice of up to three months with a long-term PT of almost 40%.

A host of other individual country studies were conducted in the euro area. These include Cottarelli et al. (1995) for Italy; Winker (1999) for Germany; Burgstaller (2003) for Austria; Chionis and Leon (2006) for Greece; Aydin (2007) for Turkey; and De Graeve et al. (2004) and Baugnet et al. (2007) for Belgium. Consistent with the other euro area studies, a review of these studies shows different levels of PT across the countries and interest rates. Some of the studies also found evidence of different PT before and after the country joined the EMU (see, for example, Chionis and Leon, 2006, for Greece), thus showing that PT may not be constant over time within a country. A comparison of three UK studies' results also suggests that the interest rate PT in the UK has been increasing over time (see Heffernan, 1997; Mizen and Hofmann, 2002; and Hofmann and Mizen, 2004). Tieman (2004) analyses different time periods in Romania and finds that more recent periods produced higher long-run PT coefficients, which the author attributes to a more developed and competitive financial system.

A growing number of studies have also been conducted in emerging market economies. These include Scholnick (1996) on Singapore and Malaysia; Iregui et al. (2002) on Colombia and Mexico; and Espinosa-Vega and Rebucci (2002) and Berstein and Fuentes (2003) on Chile. The results of these studies remain inconclusive about the extent of PT.

Studies have also shown differences in PT across interest rates. Notably, studies have documented differences in PT between deposit and lending rates (see, for example, Kwapil and Scharler, 2009; Wang and Lee, 2009; De Bondt, 2005; and Tieman, 2004). In addition to the differences between deposit and lending rates, studies have shown some differences in PT within a segment of the market. For example, Lowe and Rohling (1992) looked at the stickiness of different lending rates (housing loans, secured and unsecured personal loans, business loans and credit cards) in Australia. The authors find that consumer loans exhibit more stickiness than business loans, which they attribute to switching cost. By contrast, Aydin (2007) found in Turkey that consumer loans responded much faster than business loans to a change in the official rate. Among the consumer rates, the credit card rate was found to be the stickiest, and the owner-occupied housing rate was the least sticky.

Moreover, the differences in degree of PT across interest rates relate to the maturity of interest rates used. A general consensus among studies is that the shorter the maturity of lending or deposit rate, the faster and larger the PT (see, for example, Egert et al., 2007; De Bondt, 2005; and Espinosa-Vega and Rebucci, 2002).

Lastly, results of studies that explore the specific possibility of asymmetric adjustment have also been mixed. While some studies found evidence of significant asymmetry in adjustments (see, for example, Hannan and Berger, 1991, and Neumark and Sharpe, 1992 for USA; and Scholnick, 1996, for Singapore and Malaysia), others did not (for example, Lowe and Rohling, 1992, for Australia; and Espinosa-Vega and Rebucci, 2002 for Chile). Also, the nature of the asymmetric adjustments depends on whether it is in the long run or short run and on the type of interest rate – whether deposit or lending rates. For example, using three bank interest rates in Australia, Lim (2001) found that interest rate adjustments are asymmetric in the short run but not in the long run. See Table 3 for more contrasting evidence on the asymmetric adjustment.

While a voluminous literature has explored interest rate adjustment around the world, studies from Africa remain scanty. Jankee's (2004) study, which examines the rigidity of commercial bank interest rates in Mauritius, is the only known study from Africa other than South Africa. The study was based on the Johansen Cointegration, TAR, and M-TAR models and used quarterly data from September 1988 to September 2003. The author found that interest rate PT is higher in the DR (0.413) than in the LR (0.242), but exists asymmetrically only in the LR.

As regards South Africa, two notable attempts at estimating interest rate PT are those by De Angelis et al. (2005) and Aziakpono et al. (2007). Both studies focus on the PT of wholesale interest rates, but while the former used three interest rates – the prime interbank lending rate, the prime lending rate and the money market rate (money market negotiable certificates of deposit, or NCDs) – the latter only use two wholesale interest rates: the prime interbank lending rate and the NCD rate. De Angelis et al. (2005) specifically focus on the relationship between the wholesale interest rates and repo rates for two periods: March 1998–September 2001 when the repo system was first introduced, and September 2001–November 2004 when adjustments were made to the repo system. De Angelis et al. (2005) found that the PT of the wholesale rates was higher (almost one-for-one PT) during the first repo system than the second repo system. The study did not however, explore the possibility of asymmetric adjustment in bank interest rates.

Aziakpono et al. (2007) explore the extent of interest rate PT for the period 1973 to 2004, which is divided into six sub-periods corresponding to different monetary policy regimes. In addition to estimating the degree of PT of the official rate, the authors also explore the possibility of asymmetric adjustment in interest rates. Their results show that the wholesale interest rates record a high speed of adjustment throughout the period, which suggests effective monetary transmission to wholesale rates. The results further show that there was a higher speed of adjustment during more market-oriented policy regimes than less market-oriented eras. Regarding the asymmetric adjustment of interest rates, the wholesale interest rate shows very weak evidence of asymmetric adjustment.

Despite the attempt by the two previous studies to analyse the degree of PT in South Africa, the analyses were evidently limited in scope and focused only on a few interest rates. Furthermore, both analyses ended in 2004. With constant changes in the financial and monetary environment, there is a need for further studies that will not only cover more interest rates, but extend the analysis to more recent periods. Specifically, the current study follows the line of analysis carried out in Aziakpono et al. (2007), but following the trend in the global literature extends the study in three important aspects. First, the current study covers a broad spectrum of interest rates. Hence, unlike Aziakpono et al. (2007), which only analyses two wholesale rates, this study covers a wider array of interest rates to provide a more robust result for policy proposals. Second, following Toolseman et al. (2002), Sander and Kleimeier (2006b), and Aziakpono (2008), we complement the analysis of the monetary policy regimes with a rolling window technique to trace the dynamics of interest rate adjustment over time. This is necessary as developments in financial systems may not always be reflected in the changes in the monetary policy regime. Finally, the current study extends the analysis to December 2007, thereby providing the most up-to-date analysis of interest rate adjustment in South Africa.

4. Methodology

Data and sources

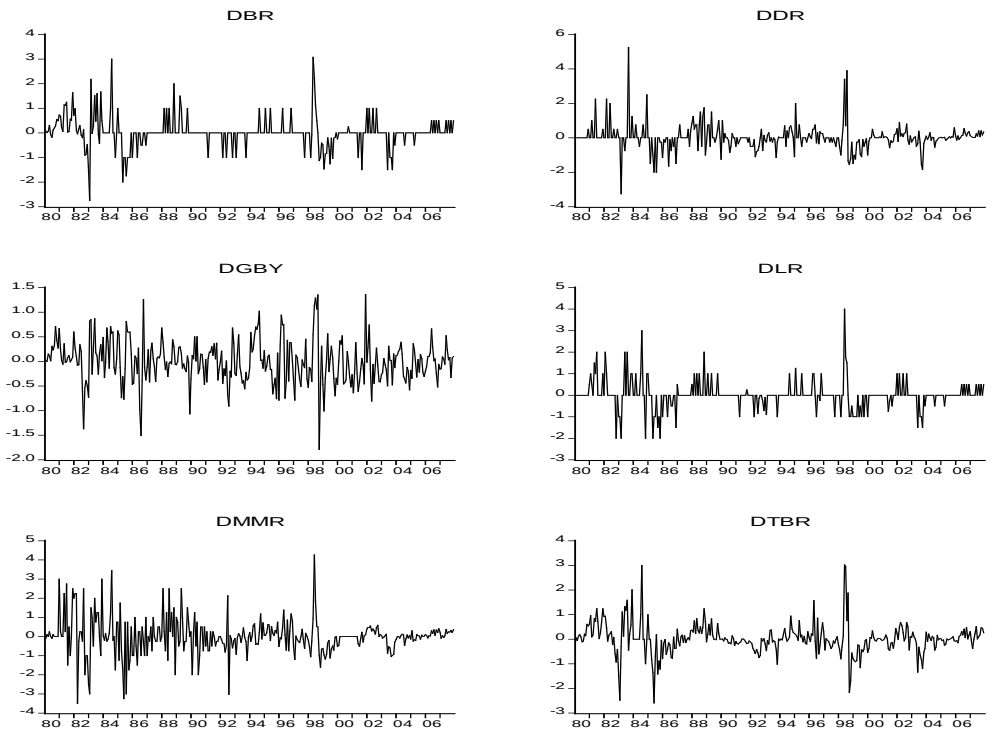
This section will investigate the PT of changes in the official interest rate to market interest rates in South Africa. Our aim is to cover as broad a spectrum of market interest rates as possible. To this end we collected data on six market interest rates series. All the series are obtained from the International Monetary Fund (IMF) International Financial Statistics (IFS) CD ROM of May 2008. The interest rates series used are: the Bank rate (BR), lending rate (LR), deposit rate (DR), money market rate (MMR), Treasury bill rate (TBR) and government bond yield (GBY). The Bank rate[8] is the rate at which the SARB discounts commercial papers to commercial banks (line 60 of the IMF IFS); the deposit rate is the rate on 88-91-day-notice fixed deposits (line 60l); the lending rate represents the prime lending rates of major commercial banks (line 60p);[9] the money market rate is the rate on interbank deposits at call (line 60b); while the Treasury bill rate is the tender rate on 91-day bills (line 60c). The government bond yield is the secondary market yield on bonds with maturities over 10 years (line 61). All rates were measured in level.

Our sample covers the period January 1980 to December 2007.[10] We carried out three sets of analyses. First, we carried out the analysis for the entire sample period. Second, in order to capture the effects of different monetary policy regimes we subdivided the sample period to capture the approximate monetary policy regimes[11] as discussed in Section 3, namely January 1980 to December 1985, January 1986 to April 1993, May 1993 to February 1998, March 1998 to September 2001 and September 2001 to December 2007.[12] Lastly, we used a rolling sample period of six years (72 observations). Therefore, we analysed 23 samples from January 1980 to December 1985, as well as the intervening periods until January 2002 to December 2007. The rolling window analysis enables us to trace the dynamic development of PT over time. This is necessary as developments in the financial system and the economy other than monetary policy changes can also affect PT. Unlike the analysis based on the monetary policy regimes, the rolling window analysis will capture the dynamic development of the interest rate PT in the economy over time.

Figure 1 presents a graphical plot of changes in each of the interest rates over time. As is evident from the figure, changes of varying magnitude have been made to the bank rate (repo rate) over time. Such changes, which have been either an upward or downward adjustment to the bank rate, range between 50 and 200 basis points, and sometimes up to 300 basis points. This illustrates the importance attached to the adjustment of the Bank rate as a tool of monetary policy. Of the other interest rates, the commercial bank

lending rates followed the changes in the BR closely, followed by the deposit rate and Treasury bill rate. Changes in the government bond yield reflect changes in the BR the least, followed by the money market rate. With the exception of the lending rate, the other interest rates tend to adjust more frequently and with a lower magnitude than the bank rate. This is especially the case with GBY and MMR. One can also observe smaller adjustments in all the interest rates from 1998.

Figure 1: Changes in interest rates, 1980–2007



Note: D represents changes in the relevant interest rate

Table 4 presents the results of a simple correlation matrix for the level and first difference series for the entire period. As the table shows, the LR has the highest correlation with the BR, a correlation of 72%, which is followed closely by the TBR, with a correlation coefficient of 71%. The MMR is also fairly highly correlated with the BR, with a correlation coefficient of 61%. The least correlation occurs in the GBY, with a correlation coefficient of 31%, followed by the DR with a correlation coefficient of 35%.

In what follows, we present the method used to analyse how changes in the BR are transmitted to the other interest rates. In particular, we are concerned with the magnitude and speed of PT and whether there is asymmetry in the PT.

Table 4: Correlation matrix

Lelvel Series						
	BR	**DR**	**GBY**	**LR**	**MMR**	**TBR**
BR	1.00					
DR	0.94	1.00				
GBY	0.70	0.73	1.00			
LR	0.99	0.94	0.70	1.00		
MMR	0.96	0.95	0.69	0.96	1.00	
TBR	0.98	0.96	0.70	0.98	0.98	1.00
First difference series						
	DBR	**DDR**	**DGBY**	**DLR**	**DMMR**	**DTBR**
DBR	1.00					
DDR	0.35	1.00				
DGBY	0.31	0.19	1.00			
DLR	0.72	0.50	0.31	1.00		
DMMR	0.61	0.37	0.25	0.58	1.00	
DTBR	0.71	0.40	0.43	0.77	0.65	1.00
Observations	335	335	335	335	335	335

Source: Computed by authors

The model

The primary model showing the relationship between the interest rates is specified as:

$$MR_t = \alpha_0 + \alpha_1 BR_t + \varepsilon_t \quad (1)$$

where BR_t represents the official interest rate, exogenously determined by the SARB; MR_t denotes the endogenously determined market interest rates (here LR, DR, TBR, MMR and GBY); ε_t is the stochastic error term; while α_0 and α_1 are the long-run parameters, respectively. Based on the cost-of-funds approach, the constant term α_0 denotes the fixed markup/markdown on the retail interest rates (LR and DR). For the lending rate, the constant term includes the credit risk premium (Marotta, 2009). It is expected that $0 \leq \alpha_1 \leq 1$. If α_1 is close to zero, the degree of long-run PT is slow, while a value of 1 for the α_1 implies a complete PT. Because of market imperfections, asymmetric information, fixed menu cost, high switching cost, and adverse customer reaction, it is unlikely that the value of α_1 will be equal to 1. It is also possible that α_1 could record a value higher than 1, in which case there is over-pass-through. This may occur where banks charge higher interest rates in an attempt to offset the higher risks resulting from asymmetric information, rather than reducing the supply of loans (De Bondt, 2005).

Estimation technique

The econometric technique used for estimating Equation 1 depends on the time series properties of the data: whether the variables are stationary at level or not, and if they are nonstationary at level, and whether they are cointegrated or not. Therefore, a natural starting point for the analysis is to test all the series for unit root. This study uses the modified Dickey-Fuller (DF) test, based on a generalized least squares (GLS) detrending series (commonly called the DF-GLS test), as proposed by Elliot et al. (1996), and the Ng and Perron (2001) tests for unit root. In contrast to the standard Dickey-Fuller and Phillip-Perron (PP) tests that are commonly used, which have been criticized for their poor size and power properties,[13] Elliot et al. (1996) have shown that the DF-GLS test has good size and power properties. Similarly, the Ng and Perron (2001) test, which is another modification of the standard augmented Dickey-Fuller (ADF) test, has good size and power properties (Rapach and Weber, 2004). In both tests, the unit root hypothesis is tested against the alternative of no unit root.

If the series are found to be stationary at levels, Equation 1 will be estimated using the ordinary least squares (OLS) technique. However, if the series are not stationary at level, but stationary at first difference, the cointegration test will be carried out to establish whether or not the pair of the series is cointegrated. If the pair of the first differenced stationary series is not cointegrated, then Equation 1 will be estimated with the first differenced series to avoid the problem of spurious regression. Thus the estimation equation becomes:

$$\Delta MR_t = \delta_0 + \delta_1 \Delta BR_t + \delta_i \sum_{i=1}^{n} \Delta BR_{t-i} + \lambda_i \sum_{j=1}^{m} \Delta MR_{t-j} + \varepsilon_t \quad (2)$$

where the symbol Δ represents a first difference of the relevant variables as defined under Equation 1 above, and n and m denotes the number of lags chosen based on the significance of the lag in a general to specific framework with a maximum lag set at four. δ_0 and δ_1 are short-run intercept and slope coefficients. The slope coefficient, δ_1, is interpreted as a short-run immediate PT. As noted in the previous section, due to menu costs and information asymmetry, the short-run PT (δ_1) will be different from the long-run PT (α_1) and therefore we also use the gap between the two as an indication of the stickiness of interest rates. Following Kwapil and Scharler (2009) we compute the long-run PT (α_1) from the parameters of Equation 2 as:

$$\alpha_1 = \left(\sum_{i=0}^{n} \delta_i\right) / \left(\sum_{j=1}^{m} \lambda_j\right) \quad (3)$$

For cointegrated series the study uses the asymmetric error correction model, as indicated in Charoenseang and Manakit (2007), De Graeve et al. (2007), and Scholnick

(1996) following Hannan and Berger (1991) and Neumark and Sharpe (1992). The benefit of this method derives from the fact that it can be used to test for differences in adjustment in interest rates when they are above or below their equilibrium level. In addition, it can be used to determine how long it takes for the interest rates to adjust to changes in the official interest rate.

Before describing the asymmetric error correction method used for cointegrated series, we first turn attention to the methods used to determine whether or not the pair of interest rates is cointegrated. The study employs four approaches to test for cointegration in the pair of interest rates: the Johansen maximum likelihood approach,[14] the Engle-Granger approach, the cointegrating regression Durbin-Watson (CRDW) test and the error-correction-based test. Given that the first three methods are fairly well known in the literature, we do not discuss them here and only briefly describe the fourth method.

The error-correction-based cointegration test, popularized by Banerjee et al. (1986), Campos and Ericsson (1988), Kremers (1989), Hendry and Ericsson (1991) and Kremers et al. (1992), uses the t-ratio of the coefficient on the error-correction term in a dynamic model of Equation 4 as follows:

$$\Delta MR_t = \delta_0 + \delta_1 \Delta BR_t + \delta_i \sum_{i=1}^{n} \Delta BR_{t-i} + \lambda_i \sum_{j=1}^{m} \Delta MR_{t-j} + \phi EC_{t-1} + \varpi_t \quad (4)$$

where, as noted earlier, the symbol Δ represents a first difference of the relevant variable, ϖ_t is the white noise error term, δ_1 is the short-run PT and λ_i is the coefficient of the lagged dependent variable. EC_t is the residual from the cointegrating regression based on the OLS estimation of Equation 1. ϕ is the coefficient of the error correction term, which measures the degree of adjustment to equilibrium. Following Kremers et al. (1992), we test the null hypothesis $\phi = 0$, i.e., that MR_t and BR_t are not cointegrated. If, based on the t-ratio, the null hypothesis is rejected at conventional levels of significance, we can conclude that there is cointegration between the pair of interest rates. Thus market forces are in operation to restore long-run equilibrium following a short-run disturbance. Kremers et al (1992) noted that the error-correction-based test is preferable to the Engle-Granger method, because it uses available information more efficiently than the latter. Therefore, in bivariate analysis many authors tend to rely on the results of the error-correction-based test as opposed to the other methods (see, for example, Weth, 2002; De Bondt, 2005; Sander and Kleimeier, 2004; 2006a, b; and Aziakpono et al., 2007). If the various methods provide conflicting results, we follow the trend in the recent literature and base our conclusion on the error-correction-based test, even if the other methods do not find evidence of cointegration.

Asymmetric error correction framework

If cointegration is found between the variables, an error correction model would be estimated for the relationship to examine the short-run dynamics using Equation 4. From Equation 4, following Doornik and Hendry (1994) and Scholnick (1996), we compute the mean lag as follows:

$$ML = (1 - \delta_1) / \phi \tag{5}$$

Equation 5 represents the adjustment lag, or the degree of rigidity, for the symmetric error correction model. A high *ML* shows high rigidity or slow adjustment of market interest rates in response to changes in the official rate. The converse is the case if the *ML* is low. However, as noted by Scholnick (1996), this specification assumes that adjustment is symmetric (i.e., adjustment is the same) when the market rate is above or below its equilibrium level.

In order to determine the asymmetric adjustment when the market interest rate is above or below equilibrium level, the residuals from the cointegrating equation are simply divided into two series, EC^+ and EC^-, where

$$\begin{aligned} EC^+ &= EC, \quad \text{if} \quad EC > \mu \\ EC &= 0, \quad \text{if} \quad EC < \mu \end{aligned} \tag{6}$$

and

$$\begin{aligned} EC^- &= 0, \quad \text{if} \quad EC < \mu \\ EC &= 0, \quad \text{if} \quad EC > \mu \end{aligned} \tag{7}$$

where μ is the mean of *EC*. The asymmetric specifications in equations 6 and 7 are introduced as separate variables (in the form of dummy variables) in the error correction model, Equation 4, to obtain an asymmetric short-run dynamic equation as follows:

$$\Delta MR_t = \delta_0 + \delta_1 \Delta BR_t + \delta_i \sum_{i=1}^{n} \Delta BR_{t-i} + \lambda_i \sum_{j=1}^{m} \Delta MR_{t-j} + \phi_1 EC^+_{t-1} + \phi_2 EC_{t-1}\, \varpi_t \tag{8}$$

where ϕ_1 and ϕ_2 are the coefficients of the error correction term when the interest rate is above and below equilibrium, respectively.

The corresponding asymmetric means lags are derived as:

$$ML^+ = (1 - \delta_1) / \phi_1 \tag{9}$$

and

$$ML^{-} = (1 - \delta_1) / \phi_2 \quad (10)$$

The mean lags in equations 9 and 10 are the asymmetric adjustment lags in the market interest rates if they are above and below their equilibrium means, respectively. The absence of asymmetry is tested using the Wald test based on the restriction that $\phi_1 = \phi_2$ in Equation 8. If equality is accepted there is no asymmetry, otherwise asymmetry exists.

5. Empirical results

The empirical analysis commences by testing the unit root using the DF-GLS and Ng and Perron (2001) tests. Tables A1 and A2 in the Appendix present the unit root test results: Table A1 presents results for the rolling window, while Table A2 presents results for the regimes. Overall, the unit root results suggest that the interest rates are I(1) series.

Cointegration test results

As described earlier, we used four methods to test for cointegration in the pair of interest rates: the Johansen maximum likelihood method, the Engle-Granger method, the CRWD test and the error-correction-based test. Tables A3 and A4 in the Appendix present the rolling windows and regimes, the summary of the cointegration tests,[15] the long-run PT, the short-run PT, the symmetric error correction coefficients and the symmetric mean lag.

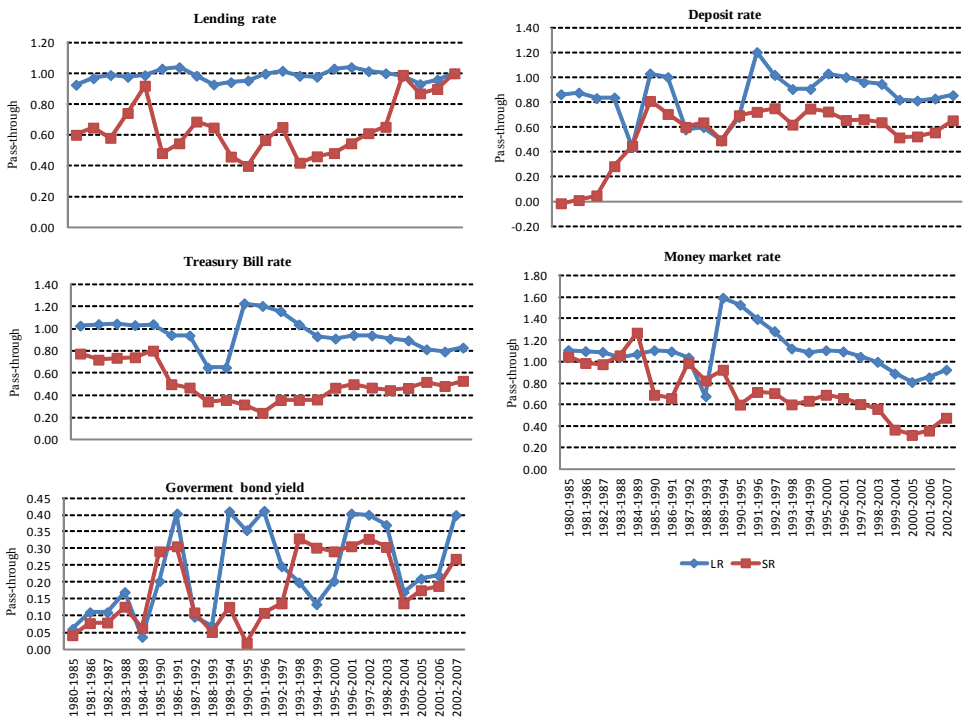
Overall, the four cointegration tests are largely in agreement in either accepting or rejecting the null hypothesis of no cointegration. In most cases, where there are discrepancies, the error-correction-based test, along with some other cointegration methods, could not lead to acceptance of the null hypothesis of no cointegration. Moreover, the results of the rolling windows and the policy regimes are quite similar for all the interest rates. Comparing the different interest rates, the results suggest that the strongest evidence of cointegration occurs in the pair with the lending rate, the Treasury bill rate and the money market rate, where in each case the null hypothesis of no cointegration could not be rejected in two rolling windows and one regime. In the case of the lending rate, in the last rolling window and regime, the LR reflects the BR so closely that the models could not be estimated. The least evidence of cointegration was found with the GBY, where the null hypothesis of no cointegration could not be rejected in 10 out of 23 rolling windows, three out of five regimes and in the full sample. Alongside the GBY is the deposit rate, where the null of no cointegration could not be rejected in five out of 23 rolling windows and in one out of six regimes, including the full sample.

Long-run and short-run pass-through

Figures 2 and 3 present the respective graphical plots of the long-run and short-run PT coefficients for the rolling window and regimes. Broadly speaking, as the results

show, with the exception of GBY and during the periods when cointegration was not found in DR, TBR and MMR, the long-run PT of all the interest rates is quite high, hovering around one, thus suggesting an almost one-for-one PT in the long run for either the regimes or the rolling window and the full sample. The high interest rate PT in this study is consistent with the findings of other emerging markets studies (see, for example, Sander and Kleimeier, 2006b for Central and Eastern European countries). This suggests a relatively efficient long-run monetary transmission within the money market. Consistent with the liquidity premium theory of the yield curve, the long-run PT to the capital market interest rate is far lower than the other interest rates for all the periods. This is also consistent with the finding of earlier studies that show that the shorter the maturity of an interest rate, the faster and larger the PT (see, for example, Egert et al. 2007; and Espinosa-Vega and Rebucci, 2002). This indicates a decreasing effect of monetary policy as the transmission works through the different stages of the transmission mechanism before it eventually reaches the ultimate goal of the policy.

Figure 2: Long-run and short-run PTs for rolling windows

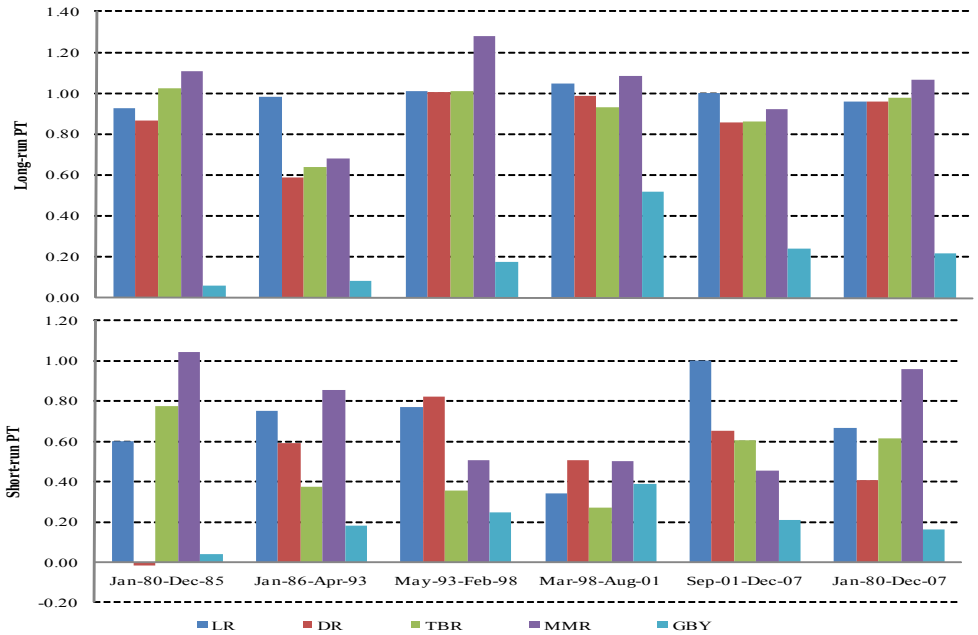


Source: Based on authors' computation

Next, attention is turned to the short-run PT. As noted in Section 3, the gap between the long-run and the short-run PTs also indicates whether interest rates are sticky or not in the short run. As is evident from Figure 2, and as expected, the short-run PTs were lower than those of the long-run PTs. However, for all the interest rates the gap between the long-run PT and the short-run PT has been decreasing in recent years.

It is worth noting that the short-run PTs have increased during the last monetary policy regime, corresponding to the era of inflation targeting. Thus, the improvement in the transparency and credibility of monetary policy during the inflation targeting era has helped to improve the speed of transmission of monetary policy.

Figure 3: Long-run and short-run PTs for regimes



Source: Based on authors' computation

A close examination of the relationship between the long-run and short-run PTs vis-à-vis the developments in the monetary and financial environment show some agreement. The first observation relates to the effects of the implementation of the recommendation of the De Kock Commission. The effect can be observed in the rolling windows of 1980–1985 and 1986–1991. Implementation of some of the recommendations began not too long after submission of the interim report in 1978, however, the effects may not have been fully evident until the early 1980s. Hence, although a high long-run PT was observed during those periods, market interest rates were still sticky in the short run. However, the stickiness varies across the market interest rates. While the money market and Treasury bill rates appear to have responded to the reforms quite quickly, the bank interest rates, and lending and deposit rates persisted and only responded gradually. For the TBR and the MMR, the short-run PTs were close to one, and for the MMR the short-run PT was virtually equal to the long-run PT. The response of the TBR and MMR during the period is consistent with the observation of the De Kock Commission at the time they were completing the final report. It observed that "the Treasury bill market today is broader and much more active and competitive than five or ten years ago, and

produces more realistic and market-related interest rates" (De Kock Commission, 1985: A31). The same was observed about the money market.

With regard to bank interest rates, there are differences in the level of response between the two rates. The deposit rate was more rigid than the lending rate. As the competition in the banking market increased following deregulation, the short-run PT increased in both interest rates and the gap between the long run and short run gradually narrowed.

Another observation is that, with the exception of the lending rate, when there was no cointegration between market interest rates and the official rates, the short-run PTs also recorded very low values. These occurred largely during the mid-1980s to mid-1990s. Interestingly, those periods correspond to the era of political crisis in South Africa. In the period 1986 to 1993 there was a collapse in domestic investment and huge capital flight due to political and economic uncertainties. The combination of the difficulties experienced during those periods must have culminated in the weak transmission of monetary policy that is evident in the low PT. However, as the political situation improved following the 1994 election and the eventual inauguration of multiracial democracy and the subsequent lifting of the remaining financial sanctions against the country, the economy and the financial systems gained stability and the monetary transmission process also improved.

Mean adjustment lags and asymmetric adjustment

Mean adjustment lags

Along with the magnitude of the adjustment in the long run, a major concern for policy makers is the speed of the transmission: whether it is quick or sluggish. In other words, the question is how long it takes for the full adjustment to be accomplished in the long run. As noted by Marotta (2009), from a policy point of view, a reduced long-run PT could be offset by faster adjustment to it. Moreover, policy makers are interested to know whether the adjustment in bank interest rates is asymmetric or not. The results of the mean adjustment lags are reported in Tables A3 and A4 in the Appendix, while the results of the asymmetric adjustment are reported in Tables 5 and 6, with Table 5 reporting the results for the rolling windows and Table 6 the regimes including the full sample.

Overall, the mean lag results mirror the spread between the long-run and short-run PTs. A closer look at the mean lags across the rolling windows and regimes reveals three groups of interest rates. First is the LR with low mean lags of less than a month throughout the periods. This suggests a fairly high speed of adjustment in the commercial bank LR to changes in the official rate. The second group comprises DR, TBR and MMR, where the full adjustment is slower than the LR and often more than one month. Of the three interest rates, the DR appears to have the highest mean lag, and, therefore, the slowest speed of adjustment. The last interest rate is the GBY, which has the slowest speed of adjustment compared to the other interest rates. On average, for the periods where cointegration was found, it takes approximately seven months for the GBY to respond fully to a change in the official rate. This further suggests that the transmission of monetary policy action to the ultimate goal could take a considerable amount of time.

Table 5: Asymmetric error correction terms and mean adjustment lags for rolling windows

Interest rates	Rolling sample		Asymmetric error correction terms						ML		Summary		
			ECT^{+}_{t-1}		ECT^{-}_{t-1}		Wald Test						
	From	To	Coeff	t-stat	Coeff	t-stat	F-stat	PV	ML*	MP^{-}	PT mechanism	Adjustment rigidity	Hypothesis
Lending rate	1980	1985	-1.11	-6.69	0.02	0.13	19.66	0.00	0.33	21.10	Asymmetric	Downward	Collusive pricing arrangement
Lending rate	1981	1986	-0.95	-6.15	-0.13	-0.89	11.55	0.00	0.33	2.49	Asymmetric	Downward	Collusive pricing arrangement
Lending rate	1982	1987	-0.92	-6.58	-0.16	-1.08	10.69	0.00	0.39	2.30	Asymmetric	Downward	Collusive pricing arrangement
Lending rate	1983	1988	-1.05	-7.80	-0.02	-0.18	22.81	0.00	0.17	8.19	Asymmetric	Downward	Collusive pricing arrangement
Lending rate	1984	1989	-0.45	-3.23	-0.49	-2.37	0.01	0.90	0.18	0.16	Symmetric		
Lending rate	1985	1990	-0.46	-2.48	-0.88	-7.07	2.86	0.10	1.19	0.62	Asymmetric	Upward	Custermer reaction
Lending rate	1986	1991	-0.35	-2.02	-0.80	-6.16	3.43	0.07	1.41	0.61	Asymmetric	Upward	Custermer reaction
Lending rate	1987	1992	-0.91	-6.89	0.80	2.61	19.36	0.00	0.31	0.35	Asymmetric	Downward	Collusive pricing arrangement
Lending rate	1988	1993	-0.96	-7.19	0.52	1.12	7.66	0.01	0.35	0.65	Asymmetric	Downward	Collusive pricing arrangement
Lending rate	1989	1994	-0.84	-7.11	0.25	0.50	3.60	0.06	0.59	1.99	Asymmetric	Downward	Collusive pricing arrangement
Lending rate	1990	1995	-0.97	-8.09	-0.66	-2.53	0.95	0.33	0.61	0.91	Symmetric	More downward	Collusive pricing arrangement
Lending rate	1991	1996	-0.88	-6.46	-0.59	-2.25	0.74	0.39	0.51	0.75	Symmetric	More downward	Collusive pricing arrangement
Lending rate	1992	1997	-0.82	-6.04	-0.79	-2.73	0.01	0.94	0.43	0.44	Symmetric		
Lending rate	1993	1998	-0.51	-3.15	-1.04	-9.09	6.55	0.01	1.20	0.59	Asymmetric	Upward	Custermer reaction
Lending rate	1994	1999	-0.59	-3.28	-1.00	-8.44	3.24	0.08	0.93	0.55	Asymmetric	Upward	Custermer reaction
Lending rate	1995	2000	-0.46	-2.48	-0.88	-7.07	2.86	0.10	1.19	0.62	Asymmetric	Upward	Custermer reaction
Lending rate	1996	2001	-0.35	-2.02	-0.80	-6.16	3.43	0.07	1.41	0.61	Asymmetric	Upward	Custermer reaction
Lending rate	1997	2002	-0.18	-0.72	-0.75	-5.46	3.05	0.09	2.40	0.56	Asymmetric	Upward	Custermer reaction
Lending rate	1998	2003	-0.27	-1.09	-0.64	-5.14	1.27	0.26	1.31	0.56	Symmetric	More upward	Custermer reaction
Lending rate	1999	2004	-0.003	-8.61	-0.13	-5.20	25.79	0.00	0.07	0.001	Asymmetric	Upward	Custermer reaction
Lending rate	2000	2005											
Lending rate	2001	2006	-0.04	-0.29	-0.17	-2.70	0.52	0.47	2.40	0.59	Symmetric	More upward	Custermer reaction
Lending rate	2002	2007											

Table 6: Asymmetric error correction terms and mean adjustment lags for regimes

Interest rates	Rolling sample		Asymmetric error correction terms						Summary			
			ECT^{+}_{t-1}		ECT^{-}_{t-1}		Wald Test		ML				
	From	To	Coeff	t-stat	Coeff	t-stat	F-stat	PV	ML*	MP^{-}	PT mechanism	Adjustment rigidity	Hypothesis
Deposit rate	1980	1985	-0.24	-2.02	-0.32	-2.94	0.16	0.69	4.03	3.06	Symmetric	More upward	Collusive pricing arrangement
Deposit rate	1981	1986	-0.23	-1.84	-0.35	-3.10	0.34	0.56	4.29	2.83	Symmetric	More upward	Collusive pricing arrangement
Deposit rate	1982	1987	-0.21	-1.68	-0.48	-4.10	1.61	0.21	4.60	2.07	Symmetric	More upward	Collusive pricing arrangement
Deposit rate	1983	1988	-0.23	-1.32	-0.42	-2.69	0.42	0.52	3.22	1.80	Symmetric	More upward	Collusive pricing arrangement
Deposit rate	1984	1989											
Deposit rate	1985	1990	0.19	1.00	-0.69	-4.66	8.83	0.00	1.81	0.50	Asymmetric	Upward	Collusive pricing arrangement
Deposit rate	1986	1991	0.18	0.91	-0.80	-4.79	9.21	0.00	2.29	0.52	Asymmetric	Upward	Collusive pricing arrangement
Deposit rate	1987	1992											
Deposit rate	1988	1993											
Deposit rate	1989	1994											
Deposit rate	1990	1995											
Deposit rate	1991	1996	-0.32	-1.95	-0.06	-0.47	1.14	0.29	0.85	4.54	Symmetric	More downward	Custermer reaction
Deposit rate	1992	1997	-0.49	-2.83	-0.10	-0.63	2.27	0.14	0.50	2.52	Symmetric	More downward	Custermer reaction
Deposit rate	1993	1998	-0.22	-0.94	-0.81	-4.40	2.88	0.09	2.07	0.55	Asymmetric	Upward	Collusive pricing arrangement
Deposit rate	1994	1999	-0.27	-1.17	-0.53	-3.07	0.57	0.45	0.95	0.49	Symmetric	More upward	Collusive pricing arrangement
Deposit rate	1995	2000	0.19	1.00	-0.69	-4.66	8.83	0.00	1.81	0.50	Asymmetric	Upward	Collusive pricing arrangement
Deposit rate	1996	2001	0.18	0.91	-0.80	-4.79	9.21	0.00	2.30	0.52	Asymmetric	Upward	Collusive pricing arrangement
Deposit rate	1997	2002	0.004	0.02	-0.80	-4.45	5.35	0.02	98.60	0.47	Asymmetric	Upward	Collusive pricing arrangement
Deposit rate	1998	2003	-0.14	-0.77	-0.70	-4.24	3.31	0.07	2.60	0.53	Asymmetric	Upward	Collusive pricing arrangement
Deposit rate	1999	2004	-0.36	-2.51	-0.16	-1.15	0.66	0.42	1.32	3.94	Symmetric	More downward	Custermer reaction
Deposit rate	2000	2005	-0.34	-2.96	-0.09	-0.66	1.53	0.22	1.39	5.60	Symmetric	More downward	Custermer reaction
Deposit rate	2001	2006	-0.41	-2.37	-0.15	-0.73	0.55	0.46	1.12	2.99	Symmetric	More downward	Custermer reaction
Deposit rate	2002	2007	-0.16	-1.08	-0.21	-1.30	0.03	0.87	2.13	1.66	Symmetric	More upward	Collusive pricing arrangement

Note: ML – mean lag
Source: Authors' estimation

Table 6 Continued

Interest rates	Regime		Asymmetric error correction terms						ML		Summary		
			$ECT^{+}t-1$		$ECT^{-}t-1$		Wald Test				PT mechanism	Adjustment rigidity	Hypothesis
	From	To	Coeff	t-stat	Coeff	t-stat	F-stat	PV	ML^{+}	MP^{-}			
Lending rate	Jan-80	Dec-85	-1.11	-6.69	0.02	0.13	19.66	0.00	0.33	21.10	Asymmetric	Downward	Collusive pricing arrangement
Lending rate	Jan-86	Apr-93	-0.61	-3.92	-0.87	-2.94	0.49	0.49	0.36	0.25	Symmetric		
Lending rate	May-93	Feb-98	-0.80	-5.92	0.08	0.36	8.12	0.01	0.27	2.59	Asymmetric	Downward	Collusive pricing arrangement
Lending rate	Mar-98	Aug-01	-0.58	-3.17	-1.20	-8.86	6.11	0.02	1.23	0.59	Asymmetric		Custermer reaction
Lending rate	Sep-01	Dec-07											
Lending rate	Jan-80	Dec-07	-0.62	-9.23	-0.30	-4.92	10.24	0.00	0.51	1.06	Asymmetric	Downward	Collusive pricing arrangement
Deposits rate	Jan-80	Dec-85	-0.24	-2.02	-0.32	-2.94	0.16	0.69	4.03	3.06	Symmetric	More upward	Collusive pricing arrangement
Deposits rate	Jan-86	Apr-93											
Deposits rate	May-93	Feb-98	-0.14	-1.16	0.04	0.48	1.16	0.28	2.42	7.43	Symmetric	More downward	Custermer reaction
Deposits rate	Mar-98	Aug-01	-0.62	-2.27	-1.20	-4.62	1.71	0.20	0.81	0.42	Symmetric		
Deposits rate	Sep-01	Dec-07	-0.18	-1.17	-0.18	-1.16	0.00	0.99	1.96	1.98	Symmetric		
Deposits rate	Jan-80	Dec-07	-0.04	-0.85	-0.24	-5.05	7.13	0.01	16.30	2.52	Asymmetric	Upward	Collusive pricing arrangement

Note: ML – mean lag
Source: Authors' estimation

Again, as manifested in the short-run PT, during the 1980s the mean lags for TBR and MMR were very low, indicating a high speed of adjustment. For example, for the TBR during the first four rolling windows (1980–85 to 1983–88), the long-run PT was accomplished, on average, in 14 days. In the case of the MMR, the speed of adjustment was even faster for the same period; it averaged two days for full long-run PT to be accomplished. As noted earlier, this reflects the intensity of activities and competition in the Treasury bill and interbank money markets, which ultimately produced more realistic and market-related interest rates following the implementation of the recommendations of the De Kock Commission. In the case of bank interest rates, the speed was much slower. The lending rates for the first four rolling windows averaged 15 days for the long-run PT to be accomplished, while the deposit rate took an average of three months during the same period. However, as the competition in the banking sector gained momentum in the latter part of the 1980s, the speed of adjustments increased significantly, especially for the deposit rate, dropping to an average of 13 days and 22 days for lending and deposit rates, respectively, in the next two rolling windows.

Subsequently, the effect of the political and economic uncertainties had an adverse effect on the transmission mechanism of monetary policy. This is evident in the TBR where the speed of adjustment slowed for the period captured by the rolling windows from 1985–1990 to 1990–1995, but peaked during the 1989–1994 rolling window when it took an average of six months and 25 days for the long-run PT to be completed. In the interbank money market, the effect of the uncertainty subsided quite quickly, only manifesting during the three rolling windows from 1984–1989 to 1986–1991. During these periods, the average speed of adjustment dropped to about 28 days for the long-run PT to be realized. This was a significant drop from an average of two days in the earlier four rolling windows. In the retail banking sector, the effect of the uncertainties was more prolonged in the deposit market, where it persisted for about five rolling windows, and for most of these periods cointegration could not be found between the official rate and the deposit rate. By contrast, the effect on the lending rate was quite swift, occurring during the rolling windows of 1989–1994 and 1990–1995, with an average speed of adjustment of 22 days. Lastly, in the case of the long-term debt market, the effects appeared to reach their peak during the 1989–1994 and 1990–1995 rolling windows, when it took an average of nine months and seven days, and 12 months and three days, respectively, for the full adjustment to be completed.

The post-1994 period, captured in the rolling windows between 1992–1997 and 1998–2003, appears to have had a very positive effect on the transmission mechanism of monetary policies. Apart from the political stability, the good macroeconomic policies and the new accommodation policy (from May 1993 to March 1998, and the modified systems from March 1998 to September 2001 and September 2001 to May 2005) must have played a role in the apparent improvement in the transmission mechanism of the period. As the results show, the speed of adjustment of the lending rate for the seven rolling windows was, on average, about 19 days, which is about three days faster than during the era of uncertainty. In the case of the deposit rate, the average speed of adjustment for the period was about 24 days; a remarkable improvement from the crisis period when the long-run relationship between the deposit rate and the official rate collapsed. During the same period, the TBR took an average of one month and two days for the full long-run adjustment to be completed, while it took 28 days for the MMR.

With regard to the government bond yield, the speed of adjustment stood at an average of five months and nine days in the first four rolling windows stretching from 1993–1998 to 1996–2001. This was also a significant drop from the earlier four rolling windows when the speed of adjustment stood at nine months and 19 days.

Lastly, there is some decline in the speed of adjustment in most of the interest rates (but most apparent in the MMR) from the 1999–2004 to the last rolling windows. For most interest rates, the declined in the speed of adjustment peaked during the 1999–2004 and 2000–2005 rolling windows. The history of the financial system during this period suggests that the weakened monetary transmission mechanism could be attributed to the financial crisis in South Africa around 2001/02 concerning the demise of Saambou Bank Ltd in 2002, then the seventh largest bank in the country. This becomes more evident when one considers the fact that the MMR, the interbank deposit at call, experienced the worst decline in the speed of adjustment during that period, falling to an average level of six months and 10 days for the two rolling windows (1999–2004 and 2000–2005), from an average of 28 days in the previous seven rolling windows. For other interest rates the speed of adjustment stood at 22 days for the lending rate and two months for deposit as well as Treasury bill rates. Evidently, the banking crisis of that period must have made interbank deposits (especially with the smaller banks) unattractive, thereby weakening the transmission mechanism through that channel. Nevertheless, despite the banking crisis the relatively high long-run and short-run PTs during this period may be a result of the inflation targeting regime since 2000, which has introduced greater transparency in the conduct of monetary policy. The transparency of inflation targeting must have helped to offset the negative effects of banking crises on the transmission of monetary policy (see Liu et al. 2008; and Kleimeier and Sander, 2006). The results of the last rolling window suggest that as the effects of the crisis died off and that of the inflation targeting regime become stronger, the speed of adjustment started to increase. Thus, we believe that the speed of adjustment will increase further if the SARB continues to implement inflation targeting.

Asymmetric adjustment

The question of whether or not there is asymmetry in the adjustment of commercial bank rates is investigated using the Wald test, by testing the equality between the coefficients of the positive and negative residuals in the asymmetric error correction model. The test is limited to commercial bank lending and deposit rates, as the theoretical argument in the literature focuses on the behaviour of banks (see, for example, Hannan and Berger, 1991; and Scholnick, 1996). The results of the asymmetric mean lags are reported in tables 5 and 6. Based on the rolling window analysis, the results suggest the existence of asymmetry in lending rates, with the null hypothesis of no asymmetry being accepted in only six out of 21 cases where cointegration was found. In the 15 cases where the results suggest asymmetric adjustment in the lending rate, there are some indications that the direction of asymmetry had changed over time. In the rolling windows of 1980–1985 and 1983–1988, the lending rate was significantly more rigid in downward adjustment than upward adjustment, thus lending support to collusive behaviour by banks in the credit market. By contrast, in the rolling windows of 1993–1998 and 1997–2002, the

lending rate was more rigid in adjusting upward, thus supporting the theory of negative customer reaction. Similarly, although the Wald test was not statistically significant in the last rolling window where cointegration was found, the evidence tended towards the negative customer reaction hypothesis as opposed to the collusive hypothesis.

Based on these regimes, the Wald test suggests that there is asymmetry in the lending rate in four out of five regimes, including the full sample. The only regime where there was no evidence of asymmetry is the second regime, from January 1986 to April 1993. For the first and third regimes and the full sample, the lending rate adjustment was more rigid downward than upward, and it was particularly rigid during the first regime (1980–1985). In the fourth regime, from March 1998 to August 2001, the adjustment of the lending rate was more rigid upward than downward. Therefore, the results of the regimes are consistent with those of the rolling windows. Overall, the evidence seems to suggest that the banks are becoming more sensitive to customer reaction in the credit market than in being collusive, as suggested by Scholnick (1996), Lim (2001) and De Bondt (2005). This is a welcome development given that the banking sector is still highly concentrated and it suggests that the banks are becoming more competitive rather than collusive in the credit market.

In the case of the deposit rate, there are some indications of asymmetric responses to changes in the official rate. This is more evident when one considers the rolling windows and the full sample results. In the instances where there is statistically significant asymmetric adjustment, the evidence suggests that there is rigidity in the deposit rate moving upward rather than downward when there is a change in the official rate, thus confirming the evidence of collusive behaviour among banks in the deposit market, as suggested by Hannan and Berger (1991) and Neumark and Sharpe (1992). In contrast to the lending rate adjustment that supports the negative customer reaction hypothesis, the deposit rate's adjustment suggests collusive behaviour among banks. This may call for some intervention on the part of the regulatory authorities to protect customers from exploitation by banks.

6. Conclusion

This study examined the degree of response of market interest rates to changes in the official rate and to determine whether the commercial banks' interest rate adjustment is asymmetric. The analysis used six-monthly interest rate series – bank rate, lending rate, deposit rate, Treasury bill rate, money market rate and government bond yield – for the period 1980 to 2007. The analysis was carried out for the full sample, a six-year rolling window (to trace the dynamic adjustment of interest rates over time) and five monetary policy regimes to determine the effect of monetary policy orientation on the nature of the adjustment. The empirical analyses comprised cointegration and asymmetric error correction models.

The findings of this study have a number of implications for monetary and financial policies. First, the high speed of adjustment of market interest rates to monetary action during the periods of market-oriented reforms suggests that interference with market forces may further slow down the PT process, thereby reducing the effectiveness of monetary policy. There are some indications that the formal accountability and transparency entrenched in the inflation targeting regime since 2000 have been helping to improve the speed of monetary transmission. Further improvements in the accountability and transparency of the monetary policy framework would be a step in the right direction. Second, the stable and high speed of PT to the prime lending rate of commercial banks may be an indication that targeting the prime lending rate of commercial banks (the practice in the previous regime) may be as effective as targeting the prime interbank lending rate, in line with current practice. Moreover, the declining effect of monetary transmission through the stages of the transmission mechanism, as shown by the weak PT to the capital market interest rate, is an indication that it may take a very long time before the effect of a monetary policy action, such as changing the repo rate, can be felt.

The finding that banks may be behaving in a collusive manner in the deposit market may call for some forms of intervention to ensure that depositors are protected from exploitation by banks. Any exploitation in the form of low interest earnings on deposits may further worsen the already low-saving habit of the population. However, it is worth noting that despite the high level of concentration in the banking industry in South Africa, the short-run PT is on the increase. This suggests that concentrating the banking system in four major banks (that is, the four pillars supported by the government) may not be a bad idea. Any intervention aimed at preventing exploitation of depositors may not be targeted at reducing the level of concentration; instead, regulations may target more transparent banking operations to ensure that banks do not extract unnecessary funds from depositors.

Notes

1. Consistent data on the earlier period are not readily available.

2. Because of the control on interest rates, companies and individuals bypassed the banking system and increasingly made direct loans.

3. The open market operations entail the outright sale or purchase of domestic securities.

4. The accommodation granted by the SARB refers to "the financial assistance or 'refinancing' granted to banks and discount houses at their instance, either in the form of rediscounting Treasury bills and other acceptable financial instruments or in the form of collateral lending against the security of such instruments" (De Kock Commission Report, 1985: A18).

5. The broad monetary aggregate, M3 was used (this includes notes and coin held by the public, plus all types of deposits, short, medium and long-term, of the domestic private sector with South African banking institutions). Between 1986 and 1998 the target range or guideline was announced on an annual basis, but, subsequently, the guideline was operated on a three-year basis.

6. Although, following the submission of the Commission interim report in 1978 some market-oriented reforms were introduced in 1979, they become more manifest from 1980.

7. For a discussion of the expectation theory and the liquidity premium theory of the yield curve, see Mishkin (2007).

8. In March 1998, the SARB rate was introduced as the repurchase agreement rate (repo rate) with the introduction of the repo system.

9. Regarding the commercial banks' interest rates, following some of the earlier studies (see, for example, Hofmann and Mizen, 2004; De Graeve et al., 2004; Sander and Kleimeier, 2006a; and Aydin, 2007), it would have been more insightful to use different interest rates according to financial products across the commercial banks. However, the lack of data on such interest rates compels us to limit the analysis to the selected interest rates.

10. We exclude the 1970s in the analysis because the period was dominated by heavy government regulation of the financial system and interest rate controls that left little room for interest rate adjustment.

11. The monetary policy regimes are based on changes to the accommodation policy of the SARB, which focuses on the operational procedure of monetary policy. Although monetary

policy frameworks have changed over time in terms of targets, such as the monetary targeting of the 1980s, the eclectic monetary policy approach in the late 1990s, and the current inflation targeting from 2000, the operational procedure has continually been dominated by the accommodation policy of the SARB, complemented by open market operations and variable cash reserve requirements. For the purpose of this discussion we focus on the operating procedure, mainly the accommodation policy, rather than the target framework. The effect of inflation targeting is captured in the last two rolling windows.

12. For the purpose of the empirical analysis, the last two monetary policy regimes, from September 2001 to December 2007, are grouped together. This is to avoid the problem of the small degree of freedom given the limited observations in some of the regimes. Moreover, the operation of the repo rate remains the same during this period.

13. The poor size and power properties refer to the tendency to over-reject the null hypothesis of nonstationarity when it is true and under-reject it when it is false. See Harris (1995: 39) for a detailed discussion of these problems as they relate to ADF and PP unit root tests.

14. See Aziakpono (2008) for a description of how the test was used.

15. The full results of the cointegration tests are available from the authors on request.

References

Angeloni, I., L. Buttiglione, G. Ferri, E. Gaiotti. 1995. "The credit channel of monetary policy across heterogenous banks: A case study of Italy". Temi di discussion Banca d'Italia, No 256. September.Roma: Central Bank of Italy.

Aron, J. and J. Muellbauer. 2001. "Estimating monetary policy rules for South Africa". Working Paper Series WPS/2001-07. Centre for the Study of African Economies, Oxford University.

ABSA. 2001."The Reserve Bank's refinancing system and the workings of the interbank market". *Economic Perspective, Third Quarter.* Johannesburg: ABSA Group Ltd.

Aydin, H.I. 2007. "Interest rate pass-through in Turkey". Research and Monetary Policy Department Working Paper No 07/05. The Central Bank of the Republic of Turkey, Ankara.

Aziakpono, M.J. 2008. "Financial and monetary autonomy and interdependence between South Africa and the SACU countries". *South Africa Journal of Economics,* 76(2): 189–211.

Aziakpono, M.J. 2006. "Financial integration amongst the SACU countries: evidence from interest rate pass-through analysis". *Journal for the Studies in Economics and Econometrics,* 30(2): 1–23.

Aziakpono, M.J., S. Kleimeier and H. Sander. 2007. "Banking market integration in the SADC countries: Evidence from interest rate analyses". Working Paper RM 07/047. Maastricht Economic Research School on Technology and Organisation (METEOR), University of Maastricht. Available online http://edocs.ub.unimaas.nl/loader/file.asp?id=1284.

Aziakpono, M.J., M. Wilson and J. Manual. 2007. "Adjustment of commercial banks' interest rates and the effectiveness of monetary policy in South Africa". *African Finance Journal,* 9(1): 1–20.

Banerjee, A., J.J. Dolado, D.F. Hendry and G.W. Smith. 1986. "Exploring equilibrium relationships in econometrics through static models: Some Monte Carlo evidence". *Bulletin,* 48: 253–77.

Baugnet, V., M. Collin and E. Dhyne. 2007. "Monetary policy and the adjustment of the Belgian private bank interest rates – an econometric analysis". National Bank of Belgium Research Department.

Berlin, M. and L.J. Mester. 1999. "Deposits and Relationship Lending". *Review of Financial Studies,* 12(3): 579-607.

Berstein, S. and R. Fuentes. 2003. "Concentration and Price Rigidity: Evidence for the Deposit Market in Chile". Available online: http://www.cemla.org/pdf/redix/RED-IX-ch-Berstein-Fuentes.pdf

Borio, C.E.V. and W. Fritz. 1995. "The response of short-term bank lending rates to policy rates: A cross-country perspective". In BIS, *Financial Structure and Monetary Policy Transmission Mechanism,* Basle, March: 106–53.

Burgstaller, J. 2003. "Interest rate transmission to commercial credit rates in Austria". Working Paper No. 0306. Austria, John Kepler University of Linz.

Campos, J. and N.R. Ericsson. 1988. "Econometric Modelling of Consumers' Expenditure in Venezuela". International Finance Discussion Paper No. 325. Board of Governors of the Federal Reserve System, Washington, D.C.

Charoenseang, J. and P. Manakit. 2007. "Thai monetary policy transmission in an inflation targeting era". *Journal of Asian Economics,* 18: 144–57.

Chionis, D.P. and C.A. Leon. 2006. "Interest rate transmission in Greece: Did EMU cause a structural break?" *Journal of Policy Modelling,* 28: 453–66.

Chong, B.S., M-H. Liu and K. Shrestha. 2006. "Monetary transmission via the administered interest rates channel". Journal of Banking and Finance, 30: 1467–84.

Cottarelli, C., G. Ferri and A. Generale. 1995. "Bank Lending Rates and Financial Structure in Italy: A Case Study". *IMF Staff Papers,* September, 42(3): 670–700.

Cottarelli, C. and A. Kourelis. 1994. "Financial Structure, Bank Lending Rates and the Transmission of Monetary Policy". *IMF Staff Papers,* 41(4): 587–623.

De Angelis, C., M.J. Aziakpono and A.P. Faure. 2005. "The transmission of monetary policy under the repo system in South Africa: An empirical analysis". *South African Journal of Economics,* 73(4): 657–73.

De Bondt, G.J. 2005. "Interest rate pass-through: empirical results for the Euro Area". *German Economic Review,* 6(1): 37–78.

De Graeve, F., O. de Jonghe and R.V. Vennet. 2007. "Competition, transmission and bank pricing policies: Evidence from Belgian loan and deposit markets". *Journal of Banking and Finance,* 31: 259–78.

De Graeve, F., O. de Jonghe and R.V. Vennet. 2004. "The determinants of pass-through of market conditions to bank retail interest rates in Belgium". NBB Working Papers Research Series No. 47. National Bank of Belgium, Brussels.

De Kock Commission. 1985. "The monetary system and monetary policy in South Africa". Final Report of The Commission of Inquiry into the Monetary System and Monetary Policy in South Africa. Republic of South Africa. Pretoria.

Doornik, J. and D.F. Hendry. 1994. *PC-GIVE 8.0: An Interactive Econometric Modelling System.* London: International Thompson Publishing.

Egert, B., J. Crespo-Cuaresma and T. Reininger. 2007. "Interest rate pass-through in central and eastern Europe: Reborn from ashes merely to pass away?" *Journal of Policy Modelling,* 29: 209–25.

Elliot, G., T.J. Rothenberg and J.H. Stock. 1996. "Efficient tests for an autoregressive unit root". *Econometrica,* 64: 813–36.

Espinosa-Vega, M.A. and A. Rebucci. 2002. "Retail bank interest rate pass-through: Is Chile atypical?" *IMF Working Papers* 03/112, Washington, D.C. International Monetary Fund. .

Fourie, L.J., H.B. Falkena and W.J. Kok. 1999. *Student Guide to the South African Financial System Second Edition.* Cape Town: Oxford University Press.

Gambacorta, L. 2008. "How do banks set interest rates?" *European Economic Review,* 52: 792–819.

Gidlow, R. 2003. "Banks". In C. van Zyl, Z. Botha and P. Skerritt, eds, *Understanding South African Financial Markets.* Pretoria: Van Schaik Publishers.

Gidlow, R.M. 1998. "Instruments of monetary policy in South Africa". SA Financial Sector Forum. Available online: http://www.finforum.co.za/ecpolicy/impconts.htm

Hannan, T.H. and A.N. Berger. 1991. "The rigidity of prices: Evidence from the banking industry". *The American Economic Review,* 81(4): 938–45.

Harris, R.J.D. 1995. *Using Cointegration Analysis in Econometric Modelling.* London: Prentice Hall/Harvester Wheatsheaf.

Heffernan, S. 1997. "Modelling British interest rate adjustment: An error correction approach". *Economica,* 1197(64): 211–31.

Hendry, D.F. and N.R. Ericsson. 1991. "Modelling the demand for narrow money in the United Kingdom and the United States". *European Economic Review,* 35: 833–81.

Hofmann, B. 2006. "EMU and the transmission of monetary policy: Evidence from business lending rates". *Empirica,* 33: 209–29.

Hofmann, B. and P. Mizen. 2004. "Interest rate pass-through and monetary transmission: Evidence from individual financial institutions' retail rates". *Economica,* 71: 99–123.

Hulsewig, O., E. Mayer and T. Wollmershauser. 2009. "Bank behaviour, incomplete interest rate pass-through, and the cost channel of monetary policy transmission". *Economic Modelling,* 26: 1310–27.

Iregui, A.M., C. Milas and J. Otero. 2002. "On the dynamics of lending and deposit interest rates in emerging markets: A non-Linear approach". *Studies in Nonlinear Dynamics and Econometrics,* 6(3): Article 4.

Jankee, K. 2004. "Testing for nonlinearities in the adjustments of commercial banks' retail rates to interbank rates: The case of Mauritius". Paper presented at the 7th annual conference of the African Econometric Society. Stellenbosch, South Africa.

Kaketsis, A. and N. Sarantis. 2006. "The effects of monetary policy changes on market interest rates in Greece: An event study approach". *International Review of Economics and Finance,* 15: 487–504.

Kleimeier, S. and H. Sander. 2006. "Expected versus unexpected monetary policy impulses and interest rate pass-through in Euro-zone retail banking markets". *Journal of Banking and Finance,* 30: 1839–70.

Kremers, J.J.M. 1989. "U.S. Federal indebtedness and the conduct of fiscal policy". *Journal of Monetary Economics,* 23: 219–38.

Kremers, J.J.M., N.R. Ericsson and J.J. Dolado. 1992. "The power of cointegration tests". *Oxford Bulletin of Economics and Statistics,* 54: 325–48.

Kwapil, C. and J. Scharler. 2009. "Interest rate pass-through, monetary policy rules and macroeconomic stability". *Journal of International Money and Finance,* 29(2): 236–51.

Kwapil, C. and J. Scharler. 2006. "Interest rate pass through, monetary policy rules and macroeconomic stability". Working Paper No. 118. Oesterreichichische Nationalbank, Vienna.

Lim, G.C. 2001. "Bank interest rate adjustments: Are they asymmetric?" *The Economic Record,* 77(237): 135–47.

Liu, M-H., D. Margaritis and A. Tourani-Rad. 2008. "Monetary policy transparency and pass-through of retail interest rates". *Journal of Banking and Finance,* 32: 501–11.

Lowe, P. and T. Rohling. 1992. "Loan Rate Stickiness: Theory and Evidence". Research Discussion Paper No. 9206. Reserve Bank of Australia.

Marotta, G. 2009. "Structural breaks in the lending interest rate pass-through and the Euro". *Economic Modelling,* 26: 191–205.

Mboweni, T.T. 2000. "A new monetary policy framework". Appendix to the Statement of the Monetary Policy Committee, 6 April. Pretoria: South African Reserve Bank

Mboweni, T. 2004. "The South African Banking Sector: An Overview of the past 10 years". Basle: Bank for international settlements.

Mishkin, F.M. 2007. *The Economics of Money, Banking and Financial Markets.* 8th Edition. Addison Wesley.

Mizen, P. and B. Hofmann. 2002. "Base rate pass-through: Evidence from banks' and building societies' retail rates". Working Paper No. 170, Bank of England.

Mojon, B. 2000. "Financial Structure and the Interest Rate Channel of ECB Monetary Policy". Working Paper No. 40. European Central Bank.

Ng, S. and P. Perron, 2001. "Lag length selection and the construction of unit root tests with good size and power". *Econometrica,* 69(6): 1519–54.

Neumark, D. and S.A. Sharpe. 1992. "Market structure and the nature of price rigidity: Evidence the market for consumer deposits". *The Quarterly Journal of Economics,* CVII: 657–80.

Okeahalam, C.C. 2001. "Structure and conduct in the commercial banking sector of South Africa". Paper presented at the TIPS 2001 Annual Forum. Available online: http://www.tips.org.za/files/499.pdf

Rapach, D.E. and C.E. Weber. 2004. "Are real interest rates really nonstationary? New evidence from tests with good size and power". *Journal of Macroeconomics,* 26: 409–30.

Sander, H. and S. Kleimeier. 2006a. "Interest rate pass-through in the Common Monetary Area of the SACU countries". *South African Journal of Economics,* 74(2): 215–29.

Sander, H. and S. Kleimeier. 2006b. "Convergence of interest rate pass-through in a wider Euro zone?" *Economic System,* 30: 406–23.

Sander, H. and S. Kleimeier. 2004. "Convergence in Eurozone retail banking? What interest rate pass-through tells us about monetary policy transmission, competition and integration". *Journal of International Money and Finance,* 23: 461–92.

Scholnick, B. 1996. "Asymmetric adjustment of commercial bank interest rates: Evidence from Malaysia and Singapore". *Journal of International Money and Finance,* 15(3): 485–96.

Sharpe, S.A. 1997. "The effect of consumer switching costs on prices: A theory and application to the bank deposit market". *Review of Industrial Organization,* 12(1): 78–94.

Stiglitz, J.E. and A. Weiss. 1981. "Credit rationing in markets with imperfect information". *The American Economic Review,* 71(3): 393–410.

Strydom, P. 2000."South African monetary policy towards the end of the 20th Century." Retrieved November 15, 2010, from First National Bank: https://www.fnb.co.za/economics/rt001212c.asp

Sudo, N. and Y. Teranishi. 2008. "Optimal Monetary Policy under Imperfect Financial Integration". Discussion Paper No. 2008-E-25. IMES Discussion Paper Series, Bank of Japan.

Thompson, M.A. 2006. "Asymmetric adjustment in the prime lending-deposit rate spread". *Review of Finance Economics,* 15: 323–9.

Tieman, A. 2004. "Interest rate pass-through in Romania and other Central European economies". IMF Working Paper, WP/04/211.Washington DC: International Monetary Fund

Toolseman, L.A., J.E. Sturm and J. de Hann. 2002. "Convergence of monetary transmission in EMU: New evidence". CESifo Munich Working Paper, 465. Munich: CESifo.

Wang, K-M. and Y-M. Lee. 2009. "Market volatility and retail interest rate pass-through". Economic Modelling, 26: 1270–82.

Weth, M.A. 2002. "The Pass-Through from Market Interest Rates to Bank Lending Rates in Germany". Discussion Paper No. 11/02. Economic Research Centre of the Deutsche Bundesbank, Germany.

Winker, P. 1999. "Sluggish adjustment of interest rates and credit rationing: An application of unit root testing and error correction modelling". *Applied Economics,* 31: 267–77.

Woodford, M. 2003. *Interest and Prices: Foundations of a Theory of Monetary Policy.* Princeton: Princeton University Press.

Appendix

Table A1: Unit root results for rolling windows

			1980-1985	1981-1986	1982-1987	1983-1988	1984-1989	1985-1990	1986-1991	1987-1992	1988-1993	1989-1994	1990-1995	1991-1996	1992-1997	1993-1998	1994-1999	1995-2000	1996-2001	1997-2002	1998-2003	1999-2004	2000-2005	2001-2006	2002-2007
BR																									
	Level	Intercept	-0.75	-0.94	-0.86	-1.13	-0.93	-0.61	0	-0.48	-0.67	-0.51	-0.5	-0.72	-0.82	-1.3	-1.5	-1.56	-1.15	-1.31	-1.24	-0.4	-1.569	-1.76c	-1.48
		Intercept & trend	-1.12	-0.83	-1.27	-1.42	-0.74	-1.87	-0.98	0.07	-0.32	-1.23	-0.43	-0.24	-1.09	-2.95c	-1.78	-1.68	-1.96	-2.07	-2.73	-2.38	-2.76	-2.71	-1.35
DF-GLS	1st Diff	Intercept	-5.84a	-5.43a	-2.1b	-1.42	-4.03a	-5.50a	-7.43a	-7.61a	-2.15b	-7.27a	-8.38a	-8.31a	-8.31a	-3.47a	-4.84a	-3.4a	-4.91a	-5.07a	-3.19a	-0.78	-2.48b	-3.65a	-3.42a
		Intercept & trend	-6.09a	-6.51a	-6.07a	-2.79	-5.96a	-6.24a	-7.51a	-8.16a	-8.94a	-7.49a	-8.63a	-9.16a	-8.65a	-4.75a	-5a	-4.51a	-5.02a	-5.09a	-3.25b	-1.64	-2.52	-2.39	-3.65b
	Level	Intercept	-1.04	-1.74	-2.07	-1.79	-1.8	-0.37	0.05	-0.28	-0.49	-0.73	-0.43	-0.76	-1.12	-3.94	-4.65	-5.25	-4.11	-3.69	-7.85c	-0.84	-10.4b	-8.46b	-4
		Intercept & trend	-4.88	-2.3	-3.51	-2.11	-1.87	-8.1	-1.6	0.19	-0.02	-1.81	-0.93	-0.19	-1.49	-17.2c	-9.6	-6.43	-7.98	-9.89	-25.6a	-11	-27.7a	-41.6a	-5.65
NP	1st Diff	Intercept	-31.50a	-28.20a	-9.36b	-3.45	-23.50a	-30.00a	-35.00a	-35.2a	-2.38	-34.8a	-35.4a	-56a	-56a	-14.4a	-26.9a	-14.8a	-27.2a	-28.1a	-10b	-1.51	-8.01c	-16.8a	-11.3b
		Intercept & trend	-32.30a	-33.60a	-30.40a	-8.99	-31.80a	-32.40a	-35.10a	-35.2a	-36a	-35.1a	-35.3a	-42.3a	-43.4a	-24a	-27.7a	-23.5b	-27.8a	-28.1a	-11.8	-4.3	-8.21	-7.39	-12.2
DR																									
	Level	Intercept	-0.55	-0.85	-0.96	-1.12	-0.58	-0.68	-0.44	-0.62	-0.61	-0.33	-0.36	-0.72	-0.85	-0.88	-1.09	-1.78c	-1.67c	-1.5	-0.98	0.03	-1.21	-1.23	-1.12
		Intercept & trend	-1.32	-0.42	-1.13	-1.04	-0.26	-0.87	-1.02	0.06	-0.59	-1.21	-0.63	-0.32	-1.21	-3.82a	-2.18	-2.01	-2.69	-2.7	-2.11	-1.53	-1.74	-1.55	-0.97
DF-GLS	1st Diff	Intercept	-8.13a	-7.86a	-8.05a	-7.79a	-7.55a	-7.70a	-8.01a	-3.05a	-0.66	-1.85c	-1.32	-8.01a	-2.39b	-7.04a	-6.79a	-1.8c	-6.19a	-6.2a	-5.79a	-3.26a	-5.07a	-5.12a	-4.77a
		Intercept & trend	-8.27a	-8.49a	-8.25a	-7.77a	-7.94a	-8.31a	-8.14a	-8.46a	-8.04a	-3.91a	-2.16	-8.77a	-8.27a	-7.34a	-7a	-3.05c	-6.27a	-6.3a	-5.96a	-4.53a	-5a	-5.17a	-5.3a
	Level	Intercept	-0.63	-1.15	-1.82	-2.54	-0.84	-0.66	-0.56	-0.44	-0.59	-0.4	-0.26	-0.73	-1.17	-2.31	-2.3	-7.56c	-7.73c	-5.43	-3.32	0.09	-3.3	-3.08	-3.03
		Intercept & trend	-4.9	-0.77	-2.22	-2.68	-0.4	-0.79	-1.91	0.29	-0.35	-2.17	-1.34	-0.35	-1.75	-44.5a	-16.5c	-10.2	-17.7b	-21.2b	-9.26	-4.82	-5.75	-6.57	-3.48
NP	1st Diff	Intercept	-35.40a	-39.70a	-53.10a	-54.80a	-40.30a	-49.50a	-36.90a	-8.33b	-1.76	-5.77c	-5.25	-38.6a	-7.92c	-33.1a	-34.1a	-6.88c	-32.4a	-32.4a	-33.9a	-16.9a	-28.4a	-28.6a	-28.7a
		Intercept & trend	-35.40a	-35.10a	-41.20a	-44.60a	-38.90a	-38.10a	-35.80a	-33.2a	-29.7a	-18b	-11.4	-33.8a	-35.3a	-34.8a	-34.4a	-14.6c	-32.9a	-32.9a	-32.7a	-25.3a	-27.6a	-28.7a	-30.5a
GBY																									
	Level	Intercept	0.0568	-0.94	-1.19	-0.08	-1.41	-2.31b	-1.57	-1.85c	-0.26	-1.74c	-2.03b	-2.07b	-1.8c	-2.49b	-1.66c	-1.63c	-1.91c	-0.69	-0.28	0.73	0.58	-0.08	-0.75
		Intercept & trend	-2.4	-2.51	-1.64	-1.08	-1.96	-2.52	-2.41	-2.11	-1.5	-2.16	-2.09	-2.12	-2.19	-2.63	-2.22	-3.23b	-2.53	-2.76	-1.92	-2.35	-2.39	-2.83c	-2.27
DF-GLS	1st Diff	Intercept	-5.26a	-6.06a	-5.86a	-4.12a	-4.58a	-4.64a	-5.26a	-5.41a	-4.54a	-5.13a	-4.88a	-4.6a	-5.26a	-5.39a	-4.85a	-5.93a	-5.05a	-4.65a	-6.38a	-2.35b	-6.94a	-4.53a	-4.74a
		Intercept & trend	-5.31a	-6.24a	-6.26a	-5.86a	-5.85a	-5.39a	-6.46a	-6.23a	-5.95a	-5.17a	-5a	-5.25a	-5.39a	-5.62a	-5.69a	-6.04a	-5.63a	-5.75a	-6.44a	-5.11a	-6.96a	-6.13a	-5.55a
	Level	Intercept	0.26	-2.12	-3.27	-0.07	-3.66	-11.40b	-4.4	-7.15c	-1.38	-6.3c	-8.69b	-8.83b	-7.34c	-13.5b	-5.64	-8.08c	-7.96c	-2.41	-0.56	1.14	0.99	-0.12	-1.04
		Intercept & trend	-11.9	-14.20c	-5.94	-2.8	-8.02	-13.2	-11.7	-10	-7.99	-12	-9.13	-9.5	-9.35	-14.3c	-10.8	-21.2b	-12.8	-14.6c	-6.15	-9.46	-9.9	-15.7c	-11.1
NP	1st Diff	Intercept	-29.10a	-56.70a	-53.80a	-22.50a	-23.80a	-22.30a	-24.40a	-30.5a	-21.6a	-29.5a	-26.7a	-23.1a	-30.4a	-28.7a	-24.6a	-31.4a	-32.9a	-21a	-33.2a	-11.6b	-42.2a	-18.8a	-30.2a
		Intercept & trend	-29.20a	-57.70a	-57.60a	-46.00a	-56.00a	-27.10a	-32.00a	-34.8a	-30.2a	-29.1a	-27.7a	-28a	-29.2a	-30.2a	-30.1a	-32.1a	-32.9a	-28.2a	-33.3a	-23.1b	-37.2a	-28.4a	-33.4a

continued next page

Table A1 Continued

			1980-1985	1981-1986	1982-1987	1983-1988	1984-1989	1985-1990	1986-1991	1987-1992	1988-1993	1989-1994	1990-1995	1991-1996	1992-1997	1993-1998	1994-1999	1995-2000	1996-2001	1997-2002	1998-2003	1999-2004	2000-2005	2001-2006	2002-2007
LR																									
	Level	Intercept	-0.83	-0.77	-0.61	-0.91	-2.06b	-1.3	-0.06	-0.44	-0.75	-0.41	-0.57	-0.78	-0.86	-1.27	-1.51	-1.45	-1.13	-1.28	-1.14	-0.42	-1.73c	-1.92c	-1.48
		Intercept & trend	-1.89	-1.06	-1.02	-0.92	-2.22	-1.55	-1.04	0.21	-0.49	-1.23	-0.39	-0.45	-1.12	-2.99c	-1.82	-1.57	-2.01	-2.46	-2.28	-2.17	-2.52	-2.55	-1.35
DF-GLS	1st Diff	Intercept	-6.18a	-3.09a	-1.1	-1.64c	-4.46a	-1.95b	-8.7a	-1.82c	-2.97a	-1.04	-7.9a	-7.54a	-7.54a	-4.16a	-5.4a	-3.6a	-5.28a	-5.39a	-3.78a	-1.22	-2.4b	-2.25b	-3.42a
		Intercept & trend	-6.34a	-6.67a	-5.38a	-6.34a	-4.62a	-7.63a	-8.81a	-8.88a	-9.72a	-2.2	-8.12a	-8.02a	-7.74a	-5.4a	-5.55a	-5.01a	-5.36a	-5.41a	-3.82a	-1.97	-2.44	-2.29	-3.65b
	Level	Intercept	-1.3	-0.9	-1.17	-1.66	-19.10a	-3.85	-0.03	-0.22	-1.38	-0.57	-0.54	-0.98	-1.3	-4.16	-4.65	-4.64	-3.78	-3.44	-5.11	-0.81	-12.6b	-10.6b	-4
		Intercept & trend	-15.80c	-5.19	-1.97	-1.79	-54.20a	-7.25	-1.74	0.46	-2.03	-1.78	-0.86	-0.67	-1.71	-18b	-9.53	-5.76	-8.12	-17.3b	-14.2c	-8.5	-21.4b	-31.6a	-5.65
NP	1st Diff	Intercept	-32.50a	-15.40a	-2.86	-3.5	-21.60a	-2.85	-35.40a	-2.75	-6.7c	-4.52	-35.4a	-35.1a	-35.1a	-18.7a	-29.6a	-15.2a	-29.1a	-29.6a	-22.2a	-2.44	-8.04c	-7.07c	-11.3b
		Intercept & trend	-32.90a	-33.40a	-25.70a	-36.30a	-23.30b	-34.80a	-35.30a	-34.8a	-36.1a	-11.7	-35.3a	-35.3a	-35.2a	-27.8a	-30.2a	-25.5a	-29.5a	-29.7a	-27.7a	-4.88	-8.27	-7.24	-12.2
MMR																									
	Level	Intercept	-0.77	-1.08	-1.08	-1.17	-0.87	-0.87	-0.88	-0.89	-0.85	-0.6	-0.6	-0.77	-1.05	-1.49	-1.56	-1.63c	-1.37	-1.34	-1.24	-0.37	-1.22	-1.94c	-1.93c
		Intercept & trend	-1.21	-1.1	-1.5	-1.26	-0.65	-1.11	-1.35	-0.68	-1.01	-1.84	-0.58	-0.31	-1.33	-3.22b	-1.94	-1.88	-2.41	-2.38	-2.26	-1.63	-1.88	-2.22	-1.86
DF-GLS	1st Diff	Intercept	-7.96a	-7.97a	-1.97b	-1.37	-9.26a	-0.85	-0.93	-10.6a	0.06	-0.92	-0.6	-8.85a	-9.44a	-4.12a	-4.94a	-4.88a	-4.81a	-3.08a	-3.33a	-2.14b	-2.9a	-3.5a	-1.85c
		Intercept & trend	-8.07a	-8.3a	-7.24a	-3.39b	-9.76a	-10.1a	-9.23a	-11.2a	-8.06a	-8.9a	-7.38a	-10.1a	-9.95a	-5.12a	-5.09a	-5.01a	-4.84a	-3.98a	-3.53b	-3.1c	-3.38b	-3.52b	-2.2
	Level	Intercept	-1.07	-2.02	-2.78	-2.73	-1.68	-1.23	-1.61	-1.31	-1.36	-1.06	-0.52	-0.99	-2	-4.96	-4.76	-6.05c	-5.03	-3.9	-5.61	-0.81	-4.12	-9.29b	-8.81b
		Intercept & trend	-4.22	-2.69	-4.23	-3.01	-1.43	-1.68	-3.88	-1.52	-1.69	-5.52	-1.47	-0.38	-2.66	-20.5b	-10.2	-7.59	-11.5	-13.1	-13.5	-5.41	-6.44	-16.1c	-11.3
NP	1st Diff	Intercept	-35.20a	-35.00a	-4.84	-3.27	-34.60a	-0.3	-0.9	-34.9a	-0.27	-1.47	-0.5	-41.4a	-37a	-19.3a	-27.1a	-27.2a	-26.7a	-13b	-18.4a	-8.46b	-12.3b	-18.6a	-6.5c
		Intercept & trend	-35.10a	-35.80a	-34.10a	-13.7	-35.20a	-43.40a	-32.50a	-33.5a	-22.2a	-34.1a	-23.5b	-31.2a	-34.5a	-26.9a	-27.7a	-27.7a	-26.9a	-19.9b	-24.2a	-14.9c	-15.8c	-18.7b	-8.84
TBR																									
	Level	Intercept	-0.86	-1.03	-1.17	-1.33	-0.97	-1.06	-1.33	-0.77	-0.74	-0.76	-0.66	-0.66	-0.78	-1.61c	-1.61	-1.8c	-1.51	-1.48	-1.45	-0.2	-1	-1.29	-1.3
		Intercept & trend	-1.58	-0.98	-1.48	-1.53	-0.81	-1.33	-3.77a	-0.44	-0.67	-1.38	-0.62	-0.18	-1.09	-3.54b	-2.01	-2.06	-2.47	-2.51	-2.55	-1.61	-1.83	-1.77	-1.25
DF-GLS	1st Diff	Intercept	-4.83a	-4.09a	-4.08a	-2.36b	-5.08a	-2.39b	-1.95b	-3.92a	-3.83a	-3.97a	-4.59a	-6.24a	-6.32a	-4.98a	-5.25a	-5.2a	-5.23a	-4.55a	-4.52a	-2.91a	-3.95a	-4.53a	-4.47a
		Intercept & trend	-5.02a	-5.3a	-5a	-3.75a	-5.26a	-2.67	-2.04	-4.49a	-5.84a	-4.4a	-4.94a	-7.17a	-6.84a	-6.05a	-5.4a	-5.38a	-5.23a	-4.77a	-4.63a	-3.97a	-4.3a	-4.54a	-4.55a
	Level	Intercept	-1.44	-2.24	-3.23	-2.73	-1.96	-2.7	-3.52	-0.93	-1.08	-1.28	-0.73	-0.59	-0.97	-6.12c	-5.19	-7.48c	-5.67	-4.77	-6.76c	-0.4	-3.24	-3.55	-4.03
		Intercept & trend	-8.49	-3.37	-4.65	-3.12	-2.11	-4.33	-230.00a	-1.08	-1.14	-4.15	-2.2	-0.05	-1.35	-24.7a	-10.8	-9.1	-12	-14.6c	-13.7	-5.34	-6.42	-7.35	-5.02
NP	1st Diff	Intercept	-26.90a	-20.50a	-20.50a	-6.96c	-28.10a	-8.31b	-5.92c	-21.8a	-21.9a	-23.2a	-25.5a	-33.3a	-35.5a	-25.8a	-29a	-28.5a	-29.4a	-24.5a	-26a	-13.97a	-19.7a	-25.3a	-26.6a
		Intercept & trend	-27.80a	-29.10a	-27.00a	-15.30c	-29.00a	-10.3	-6.44	-25.4a	-31.9a	-25.2a	-27a	-34.7a	-34.4a	-99.2a	-29.6a	-29.5a	-28.8a	-26.3a	-26a	-21.3b	-22.6b	-25.2a	-25.7a

Note: : a= significant at 1% b=significant at 5% c=significant at 10%

Table A2: Unit root results for regimes

			BR	DR	GBY	LR	MMR	TBR
1980M1-1985M12								
DF-GLS	Level	Intercept	-0.75	-0.55	0.05	-0.83	-0.77	-0.86
		Intercept & trend	-1.12	-1.32	-2.4	-1.89	-1.21	-1.58
	1st Diff	Intercept	-5.84a	-8.13a	-5.26a	-6.18a	-7.96a	-4.83a
		Intercept & trend	-6.09a	-8.27a	-5.31a	-6.34a	-8.07a	-5.02a
NP	Level	Intercept	-1.04	-0.63	0.26	-1.3	-1.07	-1.44
		Intercept & trend	-4.88	-4.9	-11.9	-15.80c	-4.22	-8.49
	1st Diff	Intercept	-31.50a	-35.40a	-29.10a	-32.50a	-35.20a	-26.90a
		Intercept & trend	-32.30a	-35.40a	-29.20a	-32.90a	-35.10a	-27.80a
1986M1-1993M4								
DF-GLS	Level	Intercept	-0.62	-0.72	-1.65c	-0.64	-1.04	-1.61
		Intercept & trend	-0.26	-0.49	-2.55	-0.3	-0.88	-1.56
	1st Diff	Intercept	-8.36a	-8.43a	-5.8a	-2.24c	-1.02	-2.11b
		Intercept & trend	-8.47a	-8.43a	-6.55a	-2.36	-1.36	-2.25
NP	Level	Intercept	-0.73	-1.08	-6.48c	-0.79	-2.27	-5.98c
		Intercept & trend	-0.44	-0.85	-13	-0.53	-2.3	-10.1
	1st Diff	Intercept	-43.00a	-44.40a	-31.90a	-4.51	-0.77	-7.40c
		Intercept & trend	-43.10a	-43.90a	-36.50a	-4.65	-2.15	-7.95
1993M5-1998M2								
DF-GLS	Level	Intercept	-0.33	-0.79	-1.89c	-0.51	-0.64	-0.62
		Intercept & trend	-1.52	-1.44	-1.89	-1.61	-1.37	-1.14
	1st Diff	Intercept	-7.53a	-8.22a	-4.6a	-6.93a	-5.92a	-6.12a
		Intercept & trend	-7.57a	-8.26a	-4.74b	-6.96a	-6.51a	-6.53a
NP	Level	Intercept	-0.35	-1.28	-8.38b	-0.68	-0.89	-0.79
		Intercept & trend	-4.47	-4.52	-8.44	-5.16	-4.21	-3.34
	1st Diff	Intercept	-28.40a	-31.90a	-23.70a	-28.30a	-24.50a	-26.30a
		Intercept & trend	-28.40a	-28.70a	-23.60b	-28.30a	-27.10a	-27.20a
1998M3-2001M8								
DF-GLS	Level	Intercept	-2.37b	-1.55	-1.3	-2.48b	-3.59b	-1.42
		Intercept & trend	-3.71b	-2.72	-2.85	-3.4b	-4.78b	-2.66
	1st Diff	Intercept	-4.29a	-4.7a	-3.87a	-5.21a	-5.9a	-3.58b
		Intercept & trend	-4.13a	-4.73a	-4.2a	-5a	-5.43a	-3.63b
NP	Level	Intercept	-2.03	-7.13c	-5.23	-0.89	-0.75	-5.17
		Intercept & trend	-1.69	-22.30b	-11.7	-1.6	-1.03	-12.4
	1st Diff	Intercept	-6.55c	-19.60a	-18.60a	-6.00c	-4.07	-15.20a
		Intercept & trend	-6.38	-18.90b	-22.50b	-6.36	-4.01	-15.30c
2001M9-2007M12								
DF-GLS	Level	Intercept	-1.51	-1.16	-0.78	-1.51	-1.94c	-1.35
		Intercept & Trend	-1.53	-1.07	-2.29	-1.53	-1.98	-1.35
	1st Diff	Intercept	-3.22b	-5a	-7.29a	-3.22b	-3.03b	-3.88a
		Intercept & Trend	-3.26b	-5.37a	-7.32a	-3.26b	-3.45b	-4.54a
NP	Level	Intercept	-6.24c	-3.44	-1.6	-6.24c	-12.00b	-4.25
		Intercept & Trend	-7.78	-3.65	-11.4	-7.78	-14.70c	-5.02
	1st Diff	Intercept	-13.20b	-28.40a	-44.90a	-13.20b	-14.50b	-19.90a
		Intercept & Trend	-13.4	-30.50a	-39.20a	-13.4	-17.60b	-25.10a

Note: : a= significant at 1% b=significant at 5% c=significant at 10%

Table A3: Summary of interest rate PT analysis for rolling windows

Interest rates	Rolling sample		Cointegration?				Intercept		Long-run PT		Short-run PT		ECT_{t-1}		ML
	From	To	JJ	EG	CRDW	ECM-Base	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	
Lending rate	1980	1985	yes	yes	yes	yes	4.39	15.50	0.93	48.42	0.60	7.54	-0.47	-5.39	0.86
Lending rate	1981	1986	yes	yes	yes	yes	3.69	9.92	0.97	39.90	0.65	8.36	-0.51	-5.61	0.69
Lending rate	1982	1987	yes	yes	yes	yes	3.30	9.56	0.99	43.42	0.58	7.36	-0.55	-6.23	0.76
Lending rate	1983	1988	yes	yes	yes	yes	3.49	11.32	0.98	46.14	0.74	9.79	-0.51	-6.04	0.51
Lending rate	1984	1989	yes	yes	yes	yes	3.48	17.53	0.99	74.17	0.92	14.90	-0.47	-4.80	0.17
Lending rate	1985	1990	yes	yes	yes	yes	2.77	7.00	1.03	40.54	0.48	6.05	-0.73	-8.12	0.71
Lending rate	1986	1991	yes	yes	yes	yes	2.56	7.69	1.04	47.12	0.54	7.01	-0.62	-7.01	0.73
Lending rate	1987	1992	yes	yes	yes	yes	3.46	16.99	0.98	72.87	0.69	8.63	-0.49	-4.76	0.65
Lending rate	1988	1993	yes	yes	yes	yes	4.40	18.10	0.93	59.08	0.65	9.26	-0.73	-6.72	0.48
Lending rate	1989	1994	yes	yes	yes	yes	4.13	15.13	0.94	53.60	0.46	6.88	-0.67	-8.34	0.81
Lending rate	1990	1995	yes	yes	yes	yes	3.97	16.62	0.95	60.62	0.40	5.67	-0.89	-10.20	0.67
Lending rate	1991	1996	yes	yes	yes	yes	3.40	10.20	1.00	44.30	0.57	6.73	-0.80	-8.05	0.55
Lending rate	1992	1997	yes	yes	yes	yes	3.14	9.90	1.02	47.19	0.65	8.15	-0.81	-7.90	0.43
Lending rate	1993	1998	yes	yes	yes	yes	3.56	9.94	0.98	42.21	0.42	5.59	-0.85	-9.28	0.68
Lending rate	1994	1999	yes	yes	yes	yes	3.68	9.87	0.98	41.08	0.46	6.32	-0.87	-9.23	0.62
Lending rate	1995	2000	yes	yes	yes	yes	2.77	7.00	1.03	40.54	0.48	6.05	-0.73	-8.12	0.71
Lending rate	1996	2001	yes	yes	yes	yes	2.56	7.69	1.04	47.12	0.54	7.01	-0.62	-7.01	0.73
Lending rate	1997	2002	yes	yes	yes	yes	2.93	9.89	1.01	49.69	0.61	8.17	-0.57	-6.27	0.68
Lending rate	1998	2003	yes	yes	yes	yes	3.18	12.49	1.00	55.55	0.65	9.87	-0.54	-6.36	0.65
Lending rate	1999	2004	yes	no	yes	yes	3.47	14.76	0.98	48.84	0.85	13.78	-0.21	-3.00	0.73
Lending rate	2000	2005	no	no	no	no	3.99	19.98	0.93	48.73	0.87	27.30			
Lending rate	2001	2006	no	yes	no	yes	3.79	26.02	0.96	64.57	0.90	30.93	-0.14	-2.86	0.74
Lending rate	2002	2007	no	no			3.50		1.00		1.00				

contiued next page

Table A3 Continued

Interest rates	Rolling sample		Cointegration?				Intercept		Long-run PT		Short-run PT		ECT_{t-1}		ML
	From	To	JJ	EG	CRDW	ECM-Base	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	
Deposit rate	1980	1985	no	no	yes	yes	0.63	1.01	0.87	20.48	-0.01	-0.12	-0.28	-4.80	3.58
Deposit rate	1981	1986	yes	no	yes	yes	0.52	0.59	0.88	15.12	0.01	0.09	-0.30	-4.99	3.35
Deposit rate	1982	1987	yes	yes	yes	yes	1.41	1.81	0.83	16.19	0.05	0.39	-0.35	-5.50	2.68
Deposit rate	1983	1988	yes	yes	yes	yes	2.02	3.11	0.84	18.77	0.28	1.90	-0.33	-3.92	2.16
Deposit rate	1984	1989	no	no	no	no	0.03		0.44		0.45	3.53			
Deposit rate	1985	1990	yes	no	yes	yes	-2.24	-3.63	1.03	26.08	0.81	7.38	-0.30	-3.52	0.63
Deposit rate	1986	1991	yes	yes	yes	yes	-1.89	-4.02	1.00	32.24	0.71	6.77	-0.35	-3.92	0.85
Deposit rate	1987	1992	no	no	no	no	0.02		0.58		0.60	3.40			
Deposit rate	1988	1993	no	no	no	no	-0.04		0.60		0.64	4.77			
Deposit rate	1989	1994	no	no	no	no	-0.05		0.49		0.49	3.66			
Deposit rate	1990	1995	no	no	yes	no	-0.06		0.68		0.70	5.16			
Deposit rate	1991	1996	yes	yes	yes	yes	-4.00	-6.39	1.20	28.47	0.72	5.77	-0.17	-2.11	1.64
Deposit rate	1992	1997	yes	yes	yes	yes	-1.56	-2.83	1.02	27.28	0.75	6.09	-0.27	-2.80	0.91
Deposit rate	1993	1998	yes	yes	yes	yes	0.06	0.12	0.91	28.73	0.62	5.10	-0.56	-5.16	0.68
Deposit rate	1994	1999	yes	no	yes	yes	-0.08	-0.14	0.91	24.73	0.75	6.29	-0.42	-4.12	0.59
Deposit rate	1995	2000	yes	no	yes	yes	-2.24	-3.63	1.03	26.08	0.72	6.02	-0.32	-3.78	0.86
Deposit rate	1996	2001	yes	yes	yes	yes	-1.89	-4.02	1.00	32.24	0.66	5.69	-0.36	-4.03	0.94
Deposit rate	1997	2002	yes	yes	yes	yes	-1.38	-3.47	0.96	35.21	0.66	6.23	-0.44	-4.66	0.76
Deposit rate	1998	2003	yes	yes	yes	yes	-1.17	-3.38	0.95	38.69	0.64	6.79	-0.44	-5.18	0.81
Deposit rate	1999	2004	no	yes	yes	yes	0.24	0.82	0.82	33.38	0.52	6.43	-0.26	-3.55	1.84
Deposit rate	2000	2005	no	no	yes	yes	0.30	1.08	0.81	31.09	0.52	7.11	-0.22	-3.43	2.13
Deposit rate	2001	2006	no	yes	yes	yes	0.36	1.76	0.83	39.53	0.56	7.75	-0.29	-3.60	1.51
Deposit rate	2002	2007	no	no	yes	yes	0.24	1.03	0.86	35.07	0.65	8.73	-0.18	-2.68	1.89

continued next page

Table A3 Continued

Interest rates	Rolling sample		Cointegration?				Intercept		Long-run PT		Short-run PT		ECT_{t-1}		ML
	From	To	JJ	EG	CRDW	ECM-Base	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	
TBR	1980	1985	yes	yes	yes	yes	-0.83	-5.00	1.03	91.83	0.78	14.63	-0.68	-6.84	0.33
TBR	1981	1986	yes	yes	yes	yes	-1.05	-4.36	1.04	66.33	0.72	12.88	-0.61	-6.40	0.46
TBR	1982	1987	yes	yes	yes	yes	-1.11	-4.80	1.04	68.99	0.74	12.06	-0.62	-6.28	0.42
TBR	1983	1988	yes	yes	yes	yes	-0.79	-3.26	1.03	61.74	0.74	10.50	-0.48	-4.79	0.54
TBR	1984	1989	yes	yes	yes	yes	-0.74	-3.26	1.04	67.95	0.80	10.42	-0.32	-3.09	0.63
TBR	1985	1990	yes	yes	yes	yes	-0.59	-1.13	0.94	27.79	0.50	5.17	-0.47	-5.62	1.07
TBR	1986	1991	yes	yes	yes	yes	-0.61	-1.45	0.94	33.56	0.47	5.13	-0.48	-5.83	1.1
TBR	1987	1992	no	no	no	no	0.00		0.65		0.34	5.39			
TBR	1988	1993	no	no	no	no	-0.02		0.65		0.36	5.40			
TBR	1989	1994	yes	yes	yes	yes	-4.31	-7.48	1.23	33.09	0.32	3.40	-0.10	-1.63	6.83
TBR	1990	1995	yes	yes	yes	yes	-4.09	-9.07	1.20	40.56	0.24	2.43	-0.17	-2.37	4.52
TBR	1991	1996	yes	yes	yes	yes	-3.42	-6.27	1.15	31.32	0.36	2.97	-0.30	-3.38	2.11
TBR	1992	1997	yes	yes	yes	yes	-1.85	-3.19	1.04	26.33	0.36	2.90	-0.30	-3.25	2.13
TBR	1993	1998	yes	yes	yes	yes	-0.35	-0.64	0.93	26.50	0.36	3.50	-0.55	-6.55	1.17
TBR	1994	1999	yes	yes	yes	yes	-0.05	-0.10	0.91	25.85	0.47	5.01	-0.50	-6.00	1.07
TBR	1995	2000	yes	yes	yes	yes	-0.59	-1.13	0.94	27.79	0.50	5.17	-0.47	-5.62	1.07
TBR	1996	2001	yes	yes	yes	yes	-0.61	-1.45	0.94	33.56	0.47	5.13	-0.48	-5.83	1.09
TBR	1997	2002	yes	yes	yes	yes	-0.27	-0.78	0.91	38.02	0.45	5.94	-0.55	-6.88	1.01
TBR	1998	2003	yes	yes	yes	yes	0.02	0.05	0.89	41.73	0.47	6.97	-0.50	-6.93	1.06
TBR	1999	2004	yes	yes	yes	yes	1.01	4.53	0.81	42.54	0.52	9.13	-0.25	-3.77	1..91
TBR	2000	2005	yes	yes	yes	yes	1.23	5.82	0.79	39.37	0.48	8.51	-0.25	-4.04	2.05
TBR	2001	2006	yes	yes	yes	yes	0.98	6.41	0.83	53.15	0.53	10.26	-0.42	-5.39	1.13
TBR	2002	2007	yes	yes	yes	yes	0.73	7.07	0.86	80.46	1.00		0.00	3.30	

continued next page

Table A3 Continued

Interest rates	Rolling sample		Cointegration?				Intercept		Long-run PT		Short-run PT		ECT_{t-1}		ML
	From	To	JJ	EG	CRDW	ECM-Base	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	
MMR	1980	1985	yes	yes	yes	yes	-1.34	-4.67	1.11	57.08	1.05	9.42	-0.81	-6.79	0.06
MMR	1981	1986	yes	yes	yes	yes	-1.17	-2.96	1.10	42.48	0.99	8.57	-0.91	-6.69	0.01
MMR	1982	1987	yes	yes	yes	yes	-0.99	-2.84	1.09	47.41	0.98	8.79	-0.98	-7.24	0.02
MMR	1983	1988	yes	no	yes	yes	-0.05	-0.12	1.04	34.72	1.06	8.10	-0.41	-3.52	0.14
MMR	1984	1989	yes	no	yes	yes	-0.09	-0.18	1.07	34.28	1.27	8.76	-0.29	-2.47	0.93
MMR	1985	1990	yes	yes	yes	yes	-3.01	-5.77	1.11	32.99	0.69	7.29	-0.37	-4.67	0.83
MMR	1986	1991	yes	yes	yes	yes	-2.87	-6.49	1.09	37.33	0.66	7.38	-0.33	-4.38	1.02
MMR	1987	1992	yes	no	yes	no	0.14	0.16	1.04	18.42	0.99	3.75	-0.11	-1.19	0.12
MMR	1988	1993	no	no	no	no	-0.06		0.68		0.83	4.01			
MMR	1989	1994	yes	yes	yes	yes	-9.42	-9.39	1.59	24.66	0.93	3.69	-0.25	-2.74	0.30
MMR	1990	1995	yes	yes	yes	yes	-8.85	-12.45	1.53	32.64	0.60	2.72	-0.37	-3.48	1.09
MMR	1991	1996	yes	yes	yes	yes	-7.03	-11.70	1.39	34.39	0.72	4.13	-0.63	-5.11	0.45
MMR	1992	1997	yes	yes	yes	yes	-5.54	-8.36	1.28	28.54	0.71	3.85	-0.55	-4.48	0.53
MMR	1993	1998	yes	yes	yes	yes	-3.30	-6.00	1.12	31.39	0.60	5.65	-0.45	-5.39	0.89
MMR	1994	1999	yes	yes	yes	yes	-2.69	-4.84	1.09	30.57	0.64	6.68	-0.43	-5.32	0.84
MMR	1995	2000	yes	yes	yes	yes	-3.01	-5.77	1.11	32.99	0.69	7.29	-0.37	-4.67	0.83
MMR	1996	2001	yes	yes	yes	yes	-2.87	-6.49	1.09	37.33	0.66	7.38	-0.33	-4.38	1.02
MMR	1997	2002	yes	yes	yes	yes	-2.24	-6.47	1.05	43.74	0.61	8.58	-0.38	-5.05	1.03
MMR	1998	2003	yes	yes	yes	yes	-1.43	-4.05	1.00	40.06	0.56	8.60	-0.28	-4.64	1.54
MMR	1999	2004	yes	no	no	yes	-0.07	-0.19	0.89	26.76	0.37	6.36	-0.11	-2.73	5.87
MMR	2000	2005	yes	no	no	yes	0.76	2.12	0.81	23.63	0.32	5.71	-0.10	-2.80	6.81
MMR	2001	2006	yes	no	yes	yes	0.53	1.96	0.85	31.24	0.36	6.72	-0.16	-3.47	4.10
MMR	2002	2007	yes	no	yes	yes	0.08	0.61	0.93	65.00	0.48	11.07	-0.44	-5.99	1.18

continued next page

Table A3 Continued

Interest rates	Rolling sample		Cointegration?				Intercept		Long-run PT		Short-run PT		ECT_{t-1}		ML
	From	To	JJ	EG	CRDW	ECM-Base	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	
GBY	1980	1985	no	no	no	no	0.11		0.06		0.04	0.71			
GBY	1981	1986	no	no	no	no	0.03		0.11		0.08	1.15			
GBY	1982	1987	no	no	no	no	0.03		0.11		0.08	1.07			
GBY	1983	1988	no	no	no	no	0.02		0.17		0.13	1.90			
GBY	1984	1989	no	yes	no	yes	15.63	37.54	0.04	1.31	0.06	0.95	-0.19	-3.71	4.98
GBY	1985	1990	no	no	no	yes	11.90	15.82	0.20	4.20	0.29	3.25	-0.16	-2.66	4.57
GBY	1986	1991	no	no	no	yes	8.26	13.63	0.40	10.06	0.31	3.44	-0.14	-2.55	4.80
GBY	1987	1992	no	no	no	yes	14.66	37.19	0.10	3.70	0.11	1.27	-0.15	-2.44	6.09
GBY	1988	1993	no	no	no	no	-0.07		0.07		0.05	0.65			
GBY	1989	1994	yes	no	no	yes	9.29	11.24	0.41	7.71	0.13	1.13	-0.09	-1.96	9.25
GBY	1990	1995	yes	no	no	yes	10.14	11.29	0.35	5.99	0.02	0.15	-0.08	-1.95	12.10
GBY	1991	1996	yes	no	no	yes	9.31	8.83	0.41	5.78	0.11	0.83	-0.11	-2.27	8.39
GBY	1992	1997	yes	no	no	yes	11.48	9.56	0.25	3.02	0.14	1.02	-0.10	-2.22	8.79
GBY	1993	1998	no	no	no	yes	12.02	12.98	0.20	3.30	0.33	3.40	-0.10	-2.25	6.55
GBY	1994	1999	yes	no	no	yes	13.12	14.46	0.13	2.31	0.30	3.47	-0.13	-2.65	5.31
GBY	1995	2000	no	no	no	yes	11.90	15.82	0.20	4.20	0.29	3.25	-0.16	-2.66	4.57
GBY	1996	2001	no	no	no	yes	8.26	13.63	0.40	10.06	0.31	3.44	-0.14	-2.55	4.79
GBY	1997	2002	no	no	no	no	-0.05		0.40		0.33	3.95			
GBY	1998	2003	no	no	no	no	-0.02		0.37		0.30	4.30			
GBY	1999	2004	no	no	no	no	-0.07		0.17		0.14	1.56			
GBY	2000	2005	no	no	no	no	-0.07		0.21		0.18	1.89			
GBY	2001	2006	yes	no	no	no	-0.05		0.22		0.19	2.22			
GBY	2002	2007	yes	no	no	yes	5.38	10.20	0.40	7.25	0.27	3.75	-0.07	-2.31	10.48

Note: TBR is Treasury bill rate, MMR is money market rate and GBY is Government bond yield. JJ is the Johansen method, EG the Engle-Granger method, CRDW the cointegration regression Durbin-Watson test, ECM-base the error-correction-base test, and ML is mean lag.
Source: Estimates by authors

Table A4: Summary of interest rate PT analysis for regimes

Interest rates	Regime		Cointegration?				Intercept		Long-run PT		Short-run PT		ECTt-1		ML
	From	To	JJ	EG	CRDW	ECM-Base	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	
Lending rate	Jan-80	Dec-85	yes	yes	yes	yes	4.39	15.50	0.93	48.42	0.60	7.54	-0.47	-5.39	0.86
Lending rate	Jan-86	Apr-93	yes	yes	yes	yes	3.53	20.85	0.98	84.16	0.75	10.55	-0.51	-5.41	0.33
Lending rate	May-93	Feb-98	yes	yes	yes	yes	3.20	10.14	1.01	47.25	0.77	7.86	-0.68	-5.74	0.49
Lending rate	Mar-98	Aug-01	yes	yes	yes	yes	2.30	5.37	1.05	35.99	0.34	4.12	-0.96	-9.50	0.68
Lending rate	Sep-01	Dec-07	no	no	no	no			1.00		1.00				
Lending rate	Jan-80	Dec-07	yes	yes	yes	yes	3.82	38.19	0.96	131.46	0.67	19.00	-0.45	-11.19	0.74
Deposits rate	Jan-80	Dec-85	no	no	yes	yes	0.63	1.01	0.87	20.48	-0.01	-0.12	-0.28	-4.80	3.58
Deposits rate	Jan-86	Apr-93	no	no	no	no	-0.01		0.59		0.59	4.24			
Deposits rate	May-93	Feb-98	yes	yes	yes	yes	-1.27	-2.65	1.01	30.87	0.82	5.41	-0.39	-2.84	0.45
Deposits rate	Mar-98	Aug-01	yes	yes	yes	yes	-2.15	-4.85	0.99	32.85	0.51	3.70	-0.92	-6.17	0.53
Deposits rate	Sep-01	Dec-07	no	no	yes	yes	0.26	1.10	0.86	35.31	0.65	8.99	-0.18	-2.61	1.97
Deposits rate	Jan-80	Dec-07	yes	yes	no	yes	-0.44	-1.63	0.96	49.08	0.41	6.84	-0.13	-5.23	4.42
Treasury Bill rate	Jan-80	Dec-85	yes	yes	yes	yes	-0.83	-5.00	1.03	91.83	0.78	14.63	-0.68	-6.84	0.33
Treasury Bill rate	Jan-86	Apr-93	no	no	no	no	-0.02		0.64		0.38	4.42			
Treasury Bill rate	May-93	Feb-98	yes	yes	yes	yes	-1.41	-2.63	1.01	27.74	0.36	2.27	-0.39	-3.21	1.63
Treasury Bill rate	Mar-98	Aug-01	yes	yes	yes	yes	-0.83	-1.81	0.93	29.91	0.27	2.69	-0.86	-7.49	0.85
Treasury Bill rate	Sep-01	Dec-07	yes	yes	yes	yes	0.73	7.07	0.86	80.09	0.61	12.94	-0.69	-7.46	0.58
Treasury Bill rate	Jan-80	Dec-07	yes	yes	yes	yes	-0.48	-3.37	0.98	94.12	0.62	17.27	-0.19	-6.76	2.04
Money market rate	Jan-80	Dec-85	yes	yes	yes	yes	-1.34	-4.67	1.11	57.08	1.05	9.42	-0.81	-6.79	0.06
Money market rate	Jan-86	Apr-93	no	no	yes	no	-0.02		0.68		0.86	4.27			
Money market rate	May-93	Feb-98	yes	yes	yes	yes	-5.45	-8.14	1.28	28.12	0.51	2.79	-0.45	-4.19	1.09
Money market rate	Mar-98	Aug-01	yes	yes	yes	yes	-3.17	-8.76	1.09	44.27	0.50	6.77	-0.86	-7.81	0.58
Money market rate	Sep-01	Dec-07	yes	yes	yes	yes	0.07	0.52	0.92	64.01	0.46	11.06	-0.40	-6.24	0.19
Money market rate	Jan-80	Dec-07	yes	yes	yes	yes	-1.35	-5.55	1.07	60.26	0.96	14.69	-0.16	-5.14	0.24
Gov. bond yield	Jan-80	Dec-85	no	no	no	no	0.11		0.06		0.04	0.71			
Gov. bond yield	Jan-86	Apr-93	yes	yes	no	yes	14.88	37.21	0.08	3.02	0.18	2.02	-0.17	-3.32	4.76
Gov. bond yield	May-93	Feb-98	yes	no	no	yes	12.44	8.90	0.18	1.84	0.25	1.39	-0.09	-1.90	8.51
Gov. bond yield	Mar-98	Aug-01	no	no	no	no	0.00		0.52		0.39	3.82			
Gov. bond yield	Sep-01	Dec-07	no	no	no	no	-0.03		0.24		0.21	2.39			
Gov. bond yield	Jan-80	Dec-07	no	no	no	no	-0.01		0.22		0.16	4.41			

Note: JJ is the Johansen method, EG the Engle-Granger method, CRDW the cointegration regression Durbin-Watson test, ECM is the error-correction-base test, and ML the mean lag.
Source: Estimates by authors

Other recent publications in the AERC Research Papers Series:

Relative Price Variability and Inflation: Evidence from the Agricultural Sector in Nigeria, by Obasi O. Ukoha, Research Paper 170.

A Modelling of Ghana's Inflation: 1960–20031, by Mathew Kofi Ocran, Research Paper 171.

The Determinants of School and Attainment in Ghana: A Gender Perspective, by Harry A. Sackey, Research Paper 172.

Private Returns to Education in Ghana: Implications for Investments in Schooling and Migration, by Harry A. Sackey, Research Paper 173.

Oil Wealth and Economic Growth in Oil Exporting African Countries, by Olomola Philip Akanni, Research Paper 174.

Private Investment Behaviour and Trade Policy Practice in Nigeria, by Dipo T. Busari and Phillip C. Omoke, Research Paper 175.

Determinants of the Capital Structure of Ghanaian Firms, by Jochua Abor, Research Paper 176.

Privatization and Enterprise Performance in Nigeria: Case Study of some Privatized Enterprises, by Afeikhena Jerome, Research Paper 177.

Sources of Technical Efficiency among Smallholder Maize Farmers in Southern Malawi, by Ephraim W. Chirwa, Research Paper 178.

Technical Efficiency of Farmers Growing Rice in Northern Ghana, by Seidu Al-hassan, Research Paper 179.

Empirical Analysis of Tariff Line-Level Trade, Tariff Revenue and Welfare Effects of Reciprocity under an Economic Partnership Agreement with the EU: Evidence from Malawi and Tanzania, by Evious K. Zgovu and Josaphat P. Kweka, Research Paper 180.

Effect of Import Liberalization on Tariff Revenue in Ghana, by William Gabriel Brafu-Insaidoo and Camara Kwasi Obeng, Research Paper 181.

Distribution Impact of Public Spending in Cameroon: The Case of Health Care, by Bernadette Dia Kamgnia, Research Paper 182.

Social Welfare and Demand for Health Care in the Urban Areas of Côte d'Ivoire, by Arsène Kouadio, Vincent Monsan and Mamadou Gbongue, Research Paper 183.

Modelling the Inflation Process in Nigeria, by Olusanya E. Olubusoye and Rasheed Oyaromade, Research Paper 184.

Determinants of Expected Poverty Among Rural Households in Nigeria, by O.A. Oni and S.A. Yusuf, Research Paper 185.

Exchange Rate Volatility and Non-Traditional Exports Performance: Zambia, 1965–1999, by Anthony Musonda, Research Paper 186.

Macroeconomic Fluctuations in the West African Monetary Union: A Dynamic Structural Factor Model Approach, by Romain Houssa, Research Paper 187.

Price Reactions to Dividend Announcements on the Nigerian Stock Market, by Olatundun Janet Adelegan, Research Paper 188.

Does Corporate Leadership Matter? Evidence from Nigeria, by Olatundun Janet Adelegan, Research Paper 189.

Determinants of Child Labour and Schooling in the Native Cocoa Households of Côte d'Ivoire, by Guy Blaise Nkamleu, Research Paper 190.

Poverty and the Anthropometric Status of Children: A Comparative Analysis of Rural and Urban Household in Togo, by Kodjo Abalo, Research Paper 191.

African Economic and Monetary Union (WAEMU), by Sandrine Kablan, Research Paper 192.

Economic Liberalization, Monetary and Money Demand in Rwanda: 1980–2005, by Musoni J. Rutayisire, Research Paper 193.

Determinants of Employment in the Formal and Informal Sectors of the Urban Areas of Kenya, by Wambui R. Wamuthenya, Research Paper 194.

An Empirical Analysis of the Determinants of Food Imports in Congo, by Léonard Nkouka Safoulanitou and Mathias Marie Adrien Ndinga, Research Paper 195.

Determinants of a Firm's Level of Exports: Evidence from Manufacturing Firms in Uganda, by Aggrey Niringiye and Richard Tuyiragize, Research Paper 196.

Supply Response, Risk and Institutional Change in Nigerian Agriculture, by Joshua Olusegun Ajetomobi, Research Paper 197.

Multidimensional Spatial Poverty Comparisons in Cameroon, by Aloysius Mom Njong, Research Paper 198.

Earnings and Employment Sector Choice in Kenya, by Robert Kivuti Nyaga, Research Paper 199.

Covergence and Economic Integration in Africa: the Case of the Franc Zone Countries, by Latif A.G. Dramani, Research Paper 200.

Analysis of Health Care Utilization in Côte d'Ivoire, by Alimatou Cissé, Research Paper 201.

Financial Sector Liberalization and Productivity Change in Uganda's Commercial Banking Sector, by Kenneth Alpha Egesa, Research Paper 202.

Competition and Performance in Uganda's Banking System by Adam Mugume Research Paper 203.

Parallel market exchange premiums and customs revenue in Nigeria, by Olumide S. Ayodele and Francis N. Obafemi, Research Paper 204.

Fiscal Reforms and Income Inequality in Senegal and Burkina Faso: A Comparative Study, by Mbaye Diene, Research Paper 205.

Factors Influencing Technical Efficiencies among Selected Wheat Farmers in Uasin Gishu District, Kenya, by James Njeru, Research Paper 206.

Exact Configuration of Poverty, Inequality and Polarization Trends in the Distribution of well-being in Cameroon, by Francis Menjo Baye, Research Paper 207.

Child Labour and Poverty Linkages: A Micro Analysis from Rural Malawian Data, by Leviston S. Chiwaula, Research Paper 208.

The Determinants of Private Investment in Benin: A Panel Data Analysis, by Sosthène Ulrich Gnansounou, Research Paper 209.

Contingent Valuation in Community-Based Project Planning: The Case of Lake Bamendjim Fishery Re-Stocking in Cameroon, by William M. Fonta, Hyacinth E. Ichoku and Emmanuel Nwosu, Research Paper 210.

Multidimensional Poverty in Cameroon: Determinants and Spatial Distribution, by Paul Ningaye, Laurent Ndjanyou and Guy Marcel Saakou, Research Paper 211.

What Drives Private Saving in Nigeria, by Tochukwu E. Nwachukwu and Peter Odigie, Research Paper 212.

Board Independence and Firm Financial Performance: Evidence from Nigeria, by Ahmadu U. Sanda, Tukur Garba and Aminu S. Mikailu, Research Paper 213.

Quality and Demand for Health Care in Rural Uganda: Evidence from 2002/03 Household Survey, by Darlison Kaija and Paul Okiira Okwi, Research Paper 214.

Capital Flight and its Determinants in the Franc Zone, by Ameth Saloum Ndiaye, Research Paper 215.

The Efficacy of Foreign Exchange Market Intervention in Malawi, by Kisukyabo Simwaka and Leslie Mkandawire, Research Paper 216.

The Determinants of Child Schooling in Nigeria, by Olanrewaju Olaniyan, Research Paper 217.

Influence of the Fiscal System on Income Distribution in Regions and Small Areas: Microsimulated CGE Model for Côte d'Ivoire, by Bédia F. Aka and Souleymane S. Diallo, Research Paper 218.

Asset price Developments in an Emerging stock market: The case study of Mauritius by Sunil K. Bundoo, Research Paper 219.

Intrahousehold resources allocation in Kenya by Miriam Omolo, Research Paper 220.

Volatility of resources inflows and Domestic Investment in Cameroon by Sunday A. Khan, Research Paper 221.

Efficiency Wage, Rent-Sharing Theories and Wage Determination in Manufacturing Sector in Nigeria by Ben E. Aigbokhan, Research Paper 222.

Government Wage Review Policy and Public-Private Sector Wage Differential in Nigeria by Alarudeen Aminu, Research Paper 223.

Rural Non-Farm Incomes and Poverty Reduction in Nigeria by Awoyemi Taiwo Timothy, Research Paper 224.

After Fifteen Year Use of the Human Development Index (HDI) of the United Nations Development Program (UNDP): What Shall We Know? by Jean Claude Saha, Research Paper 225.

Uncertainty and Investment Behavior in the Democratic Republic of Congo by Xavier Bitemo Ndiwulu and Jean-Papy Manika Manzongani, Research Paper 226.

An Analysis of Stock Market Anomalies and Momentum Strategies on the Stock Exchange of Mauritius by Sunil K. Bundoo, Research Paper 227.

The Effect of Price Stability On Real Sector Performance in Ghana by Peter Quartey, Research Paper 228.

The Impact of Property Land Rights on the Production of Paddy Rice in the Tillabéry, Niamey and Dosso Regions in Niger by Maman Nafiou, Research Paper 229.

An Econometric Analysis of the Monetary Policy Reaction Function in Nigeria by Chukwuma Agu, Research Paper 230.

Investment in Technology and Export Potential of Firms in Southwest Nigeria by John Olatunji Adeoti, Research Paper 231.

Analysis of Technical Efficiency Differentials among Maize Farmers in Nigeria by Luke Oyesola Olarinde, Research Paper 232.

Import Demand in Ghana: Structure, Behaviour and Stability by Simon Kwadzogah Harvey and Kordzo Sedegah, Research Paper 233.

Trade Liberalization Financing and Its Impact on Poverty and Income Distribution in Ghana by Vijay K. Bhasin, Research Paper 234.

An Empirical Evaluation of Trade Potential in Southern African Development Community by Kisukyabo Simwaka, Research Paper 235.

Government Capital Spending and Financing and Its Impact on Private Investment in Kenya: 1964-2006 by Samuel O. Oyieke, Research Paper 236.

Determinants of Venture Capital in Africa: Cross Section Evidence by Jonathan Adongo, Research Paper 237.

Social Capital and Household Welfare in Cameroon: A Multidimensional Analysis by Tabi Atemnkeng Johannes, Research Paper 238.

Analysis of the Determinants of Foreign Direct Investment Flows to the West African and Economic Union Countries by Yélé Maweki Batana, Research Paper 239.

Urban Youth Labour Supply and the Employment Policy in Côte d'Ivoire by Clément Kouadio Kouakou, Research Paper 240.

Managerial Characteristics, Corporate Governance and Corporate Performance: The Case of Nigerian Quoted Companies by Adenikinju Olayinka, Research Paper 241.

Effects of Deforestation on Household Time Allocation among Rural Agricultural Activities: Evidence from Western Uganda by Paul Okiira Okwi and Tony Muhumuza, Research Paper 242.

The Determinants of Inflation in Sudan by Kabbashi M. Suliman, Research Paper 243.

Monetary Policy Rules: Lessons Learned From ECOWAS Countries by Alain Siri, Research Paper 244.

Zimbabwe's Experience with Trade Liberalization by Makochekanwa Albert, Hurungo T. James and Kambarami Prosper, Research Paper 245.

Determinants in the Composition of Investment in Equipment and Structures in Uganda by Charles Augustine Abuka, Research Paper 246.

Corruption at household level in Cameroon: Assessing Major Determinants by Joseph-Pierre Timnou and Dorine K. Feunou, Research Paper 247.

Growth, Income Distribution and Poverty: The Experience Of Côte d'Ivoire From 1985 To 2002 by Kouadio Koffi Eric, Mamadou Gbongue and Ouattara Yaya, Research Paper 248.

Does Bank Lending Channel Exist In Kenya? Bank Level Panel Data Analysis by Moses Muse Sichei and Githinji Njenga, Research Paper 249.

Governance and Economic Growth in Cameroon by Fondo Sikod and John Nde Teke, Research Paper 250.

Analyzing Multidimensional Poverty in Guinea: A Fuzzy Set Approach by Fatoumata Lamarana Diallo, Research Paper 251.

The Effects of Monetary Policy on Prices in Malawi by Ronald Mangani, Research Paper 252.

Managerial Characteristics, Corporate Governance and Corporate Performance: The Case of Nigerian Quoted Companies by Olayinka Adenikinju, Research Paper 253.

Public Spending and Poverty Reduction in Nigeria: A Benefit Incidence Analysis in Education and Health by Uzochukwu Amakom, Research Paper 254.

Supply Response of Rice Producers in Cameroon: Some Implications of Agricultural Trade on Rice Sub-sector Dynamics by Ernest L. Molua and Regina L. Ekonde, Research Paper 255.

Effects of Trade Liberalization and Exchange Rate Changes on Prices of Carbohydrate Staples in Nigeria by A. I. Achike, M. Mkpado and C. J. Arene, Research Paper 256.

Underpricing of Initial Public Offerings on African Stock Markets: Ghana and Nigeria by Kofi A. Osei, Charles K.D. Adjasi and Eme U. Fiawoyife, Research Paper 257.

Trade Policies and Poverty in Uganda: A Computable General Equilibrium Micro Simulation Analysis by Milton Ayoki, Research Paper 258.

THIS RESEARCH STUDY was supported by a grant from the African Economic Research Consortium. The findings, opinions and recommendations are those of the author, however, and do not necessarily reflect the views of the Consortium, its individual members or the AERC Secretariat.

Published by: The African Economic Research Consortium
P.O. Box 62882 – City Square
Nairobi 00200, Kenya

Printed by: Modern Lithographic (K) Ltd
P.O. Box 52810 – City Square
Nairobi 00200, Kenya

ISBN 978-9966-023-37-7

Contents

List of tables
List of figures
Abstract
Acknowledgements

1. Introduction 1

2. Monetary Policy and Structure of Financial System in South Africa: Some Stylized Facts 4

3. Literature Review 11

4. Methodology 25

5. Empirical Results 32

6. Conclusion 42

Notes 43

References 45

Appendix 49

List of tables

1.	Composition of major banks' assets	6
2.	Composition of assets and liabilities of banks: 1991–2007	7
3.	Summary of empirical PT and asymmetric PT studies	14
4.	Correlation matrix	27
5.	Asymmetric error correction terms and mean adjustment lags for rolling window	36
6	Asymmetric error correction terms and mean adjustment lags for regimes	37

Appendix

A1.	Unit root results for rolling windows	49
A2.	Unit root results for regimes	51
A3.	Summary of interest rate PT analysis for rolling windows	52
A4.	Summary of interest rate PT analysis for regimes	57

List of figures

1.	Changes in interest rates, 1980–2007	26
2.	Long-run and short-run PTs for rolling windows	33
3.	Long-run and short-run PTs for regimes	34

Abstract

The goal of monetary policy in South Africa is to keep the rate of inflation within the target band of 3% to 6%. It is generally recognized that the success of monetary policy in achieving this will, to a large extent, depend on the stickiness of market interest rates (commercial bank lending and deposit rates, other money market rates and capital market rates). The stickiness of market rates is often regarded as an obstacle to the smooth transmission of monetary policy impulses. Yet, a systematic measure of the degree of response of market interest rates to changes in monetary policy stance has not received adequate attention in South Africa. Against this backdrop, this paper uses symmetric and asymmetric error correction modelling techniques and monthly interest rate data for the period 1980 to 2007 to explore the stickiness of interest rates in South Africa. The study finds that the speed of adjustment of market interest rates varies across the rates. The highest speed is in the lending rate, followed by the Treasury bill rate and money market rate, closely followed by the commercial bank deposit rate, while the government bond yield has the lowest adjustment speed. Evidence shows that the commercial banks are becoming increasingly more competitive in the credit market, while the opposite is true for the deposit market, where the evidence seems to support banks' collusive behaviour. To minimize this, regulations may target more transparent banking operations to ensure that banks do not exploit depositors. Lastly, there are some indications that the formal accountability and transparency measures entrenched in the inflation targeting regime from 2000 have helped improve the speed of monetary transmission.

JEL Classification: *E43, E52, E58, F36*
Key words: *Interest rates, monetary policy, asymmetric adjustment, South Africa, cointegration analysis*

Acknowledgements

We are profoundly grateful to the AERC for the financial and technical support that enabled us to carry out the research. We are also grateful to Professor Ibi Ajayi, Professor Olu Ajakaiye and Dr Leslie Lipschitz of the IMF Institute, and all the resource persons and fellow researchers of Group B for their input during AERC research workshops. We would like to thank Professor Jen Snowball, Mr Joel Barnor, Ms Debra Kwangware, Mr Ziv Chinzara, Mr Gardner Rusike and others for their assistance during the research. Lastly, we would like to thank the two anonymous reviewers for their valuable comments on the earlier version of the paper. Any errors and omissions are entirely ours.