

Inflation Targeting Framework and Interest Rates Transmission in Ghana: An Empirical Investigation

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Abstract

This paper investigates the long-and short-run rate of transmission of the prime rate to interest rates since the implementation of inflation targeting policy in Ghana. Monthly data covering the period January 2002 to March 2016 is used. The Johansen and Hansen parameter instability cointegration, the FMOLS and DOLS estimation procedures were used. The long-run results show incomplete pass-through of the prime rate to commercial banks' lending and deposit rates but over pass-through to the 91-day Treasury bill rate. The short-run adjustment shows relatively slow transmission of the prime rate to the respective interest rates. Given the findings, relevant policy suggestions are provided.

JEL Classification: C22; E43; E50

Keywords: inflation targeting, interest rates transmission, monetary policy, cointegration, Ghana.

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Abstract

This paper investigates the long-and short-run rate of transmission of the prime rate to interest rates since the implementation of inflation targeting policy in Ghana. Monthly data covering the period January 2002 to March 2016 is used. The Johansen and Hansen parameter instability cointegration, the FMOLS and DOLS estimation procedures were used. The long-run results show incomplete pass-through of the prime rate to commercial banks' lending and deposit rates but over pass-through to the 91-day Treasury bill rate. The short-run adjustment shows relatively slow transmission of the prime rate to the respective interest rates. Given the findings, relevant policy suggestions are provided.

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1 Introduction

In the last two decades, central banks of advanced countries have introduced inflation targeting (IT) as an anchor for monetary policy, with relatively good results in most cases. Such countries include New Zealand, Czech Republic, the United Kingdom, Canada, and Sweden. As explained by Guy et al. (1998), many of these economies have focused on targeting the inflation rate instead of the traditionally used intermediate targets (money supply, interest rate and exchange rate). The former approach which focuses on the inflation rate itself is IT.

The argument put forward by IT central banks is that; (i) the former use of money supply as the main objective for monetary policy (based on the assumption that there is some stable relationship between changes in the money supply and inflation rate) is no longer reliable (Stals, 1999); (ii) practical experience has demonstrated that short-term manipulation of the money supply to achieve other goals (higher employment or perhaps enhance output among others) may conflict with price stability; and (iii) central banks often appear to get more public criticism for rising inflation rate than lower ones, although they are at the same time subject to constant pressure to reduce unemployment and/or increase output. The IT policy helps to address these concerns by making inflation rather than employment, output, or some other criteria the primary objective of monetary policy (Guy et al., 1998).

Under the IT policy, monetary authorities explain their decision to achieve price stability given that low and steady inflation rate contributes more to economic growth. The conduct of the IT policy is straight forward in theory. The central bank forecasts the future path of inflation; the forecast is compared with the target inflation rate¹; the difference between the forecast and the

¹ The inflation rate the government believes is appropriate for the economy

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4 target determines how monetary policy has to be adjusted. IT central banks believe this policy has
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6 the ability to improve the performance of monetary policy in the medium to long term compared
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8 to the conventional procedures followed by non-inflation targeting central banks. What is crucial
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10 is that most of the IT policy countries have recorded significant falls in their levels of inflation
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12 although performances in developed countries dominate those in developing countries (see
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14 Mishkin and Schmidt-Hebbel, 2007; Kyereboah-Coleman, 2012).
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20 Ghana formally adopted an IT framework as its monetary policy in May, 2007. Following this, the
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22 central bank announced price stability as its primary objective. However implicit (without formal
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24 announcement) IT actually started in January 2002. The Bank of Ghana (BoG) Act 2002 (Act 612)
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26 gave operational independence to the central bank, and established an implicit IT framework and
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28 Monetary Policy Committee (MPC) for the implementation of the new policy². It is interesting to
29
30 note that, the adoption of the IT policy saw domestic debt to GDP decrease from about 31% in
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32 2001 to 13.5% in 2006 and inflation also decreasing from about 41.9% in 2001 to around 12.7%
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34 in 2006 (Maureen, 2008). Ghana's five-year success with implicit IT policy encouraged the country
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36 to formally adopt the policy in 2007 which made it the second country (after South Africa) in sub-
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38 Saharan Africa.
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45 Figure 1 shows the plot of the prime rate, the 91-day Treasury bill rate, the 182-day Treasury bill
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47 rate, the deposit rate, and the lending rate. As evident, all the series generally trend downwards
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49 during the period of IT policy. The trends of the financial market interest rates show high spread
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51 between the commercial banks deposit and lending rates as the deposit rates are relatively low
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53 compared to the lending rates. The high spread points to a likely disincentive to savings and high
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60 ² The goal and decisions of the MPC are communicated on regular basis to the general public.
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4 cost of borrowing to private investors. The Treasury bill rate however stayed higher compared to
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6 deposit rate of the commercial banks over the period, an indication of potential crowding out of
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8 private investment.
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10 11 **FIGURE 1** 12 13

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15 Despite the considerable fall in the prime rate³, commercial banks lend at high interest rates to
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17 private investors. This questions the effectiveness of the prime rate in influencing lending rates in
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19 the Ghanaian economy. The interest rate on deposit accounts falls almost directly with the prime
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21 rate but lending rates turns to be sticky downwards. Commercial banks have always attributed
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23 these anomalies to default risk associated with loans. For the IT policy to promote saving,
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25 investment and economic growth, it should be effective on movement in financial market interest
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27 rates and credit creation in the economy. This is crucial because, although the implementation of
28
29 IT policy in Ghana has seen gradual fall of the previously high inflation rate (see Kyereboah-
30
31 Coleman, 2012), not all interest rates have responded adequately. Moreover, many empirical
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33 studies on this subject have focused on advanced countries with results rarely found in developing
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35 countries due to few countries adopting the policy.
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42 Notwithstanding, it is important to note that although a number of studies on Ghana has been
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44 conducted on this same topic (see, for example, Abradu-Otoo et al., 2003; Acheampong, 2005; Ghartey,
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46 2005; Amidu, 2006; CEPA, 2012; Kyereboah-Coleman, 2012; Fukac and Baldinin, 2014; Akosah, 2015),
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48 the present study make significant contribution. Aside the fact that we test the speed of adjustment of money
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50 market interest rates to the prime rate, similar to majority of the aforementioned studies, we go further to
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52 test asymmetric adjustment in the transmission of the prime rate to the respective interest rates. More so,
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59 ³ The prime rate is the BoG monetary policy rate or indicator.
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4 the approach to examining asymmetry adjustment in the present paper differ substantially from
5 those considered in the abovementioned papers on Ghana. This gives the present paper a different
6 focus from other studies on Ghana. In addition, existing studies provided divergent results on the
7 transmission of the prime rate to money market interest rates in Ghana.
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11 The rest of the paper is structured as follows: The next section provides a brief overview of
12 Ghana's financial system and banking structure. This is followed by a review of related literature
13 in Section 3, and a discussion of the model, data and the estimation strategy in Section 4. The
14 results are then reported and discussed in Section 5, after which the paper offers the implications
15 of the results, and concluding remarks in the last Section.
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18 **2 Ghana's financial system and banking structure: A brief overview**

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20 The structure of Ghana's financial system has undergone transformation since the 1980s. The
21 government initiated a financial liberalization policy under the Financial Sector Adjustment
22 Program (FINSAP) in 1988, supported by the International Monetary Fund and the World Bank
23 under the Economic Recovery Programme (ERP) in 1983. The main aim was to restructure the
24 financial system and clean up nonperforming assets in order to make them viable and profitable
25 (Aryeetey and Senbet, 2004). It was also meant to introduce technology, best practices in the
26 business environment, and risk management system, aimed at creating healthy competition. Some
27 of the reforms initiated under FINSAP, included fiscal and monetary operations, as well as
28 privatization. The removal of the restrictions on foreign and domestic market entries, and the
29 privatization of state-owned banks increased the number of commercial banks. Also, the
30 liberalization in the banking industry led to the removal of interest rate controls and credit ceiling
31 to allow banks compete for customers. The Exchange Control Act 1961 (Act 71) was replaced by
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4 the Foreign Exchange Act 2006 (Act 723) to eliminate the restrictions associated in the 1961 Act
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6 to a more liberalized foreign exchange regime (Quartey and Afful-Mensah, 2014).
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10 Between 1990 and 2000 the number of banks in the country remained at 17, out of this 9 were
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12 commercial banks, 5 merchant banks, and 3 development banks. At the end of 2010, the number
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14 of Banks had risen to 26. Out of these banks, ownership was evenly distributed - 13 of them were
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16 Ghanaian owned banks and the remaining 13 foreign owned. As at September, 2016, there were
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18 32 banks in Ghana with ownership structure as described earlier (BoG, 2016a). Rural and
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20 community banks which accounted for almost 5 percent of the banking system's total assets have
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22 also seen a significant improvement and by 2012 the number had risen to 133 reaching 137 in 2013
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24 and 140 in 2016 (BoG, 2016b). There has also been a remarkable increase in registered non-bank
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26 financial institutions; from 57 in 2014 (PWC, 2014; Quartey and Afful-Mensah, 2014) to 66 in
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28 June, 2016 (BoG, 2016c).
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36 It is important to note that the increase in the number of banks has reduced bank concentration as
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38 the market share of the dominant banks are gradually been distributed among new and emerging
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40 banks. For instance, Ghana Commercial Bank, Standard Chartered, Barclays Bank, and Social
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42 Security Bank together held 78.95% share of total assets of the banking sector in 1990. However,
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44 their dominance has declined continually reaching 66.84% in 1997, and 51.2% in 2005 (Owusu-
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46 Antwi and Antwi, 2013). However, the entrance of new banks did not make much impact on the
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48 dominance of the four commercial banks until the Ecobank Bank Ghana Ltd acquired The Trust
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50 Bank leading to a further decline in the market share of the top four banks to 38.6% (Ziorklui,
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52 2001 and PWC, 2014). Restructuring of the banking system in Ghana has indeed improved
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4 competition, therefore reducing dominance (Owusu-Antwi and Antwi, 2013). These developments
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6 are particularly important for the success of interest rate transmission in Ghana.
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10 **3 Literature review**

11 ***3.1 Theoretical background***

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14 There exists a large and expanding literature on rules for the specification of the prime rate and
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16 how monetary policy-makers have reacted to deviations of actual inflation from their – explicit or
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18 implicit - target rates or levels. This notwithstanding, the best known of these rules is the Taylor
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20 rule for interest rate determination (Taylor, 1993), which represents the behaviour and preferences
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22 of the monetary authorities. It stipulates how much the central bank should change the prime rate
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24 in response to changes in inflation, output, or other macroeconomic conditions in the economy. In
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26 particular, the rule stipulates that for each one per cent increase in inflation, the central bank should
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28 raise the prime rate by more than one percent. This approach to monetary policy analysis by central
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30 banks begin in theory with the specification of the central bank’s objective function and then derive
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32 the optimal rule for setting the prime rate in response to economic shocks. The prime rate deviates
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34 from the level consistent with the economy’s equilibrium real rate and the target inflation if the
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36 output gap is nonzero or if inflation deviates from its target. A positive output gap leads to a rise
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38 in the prime rate as does a deviation of actual inflation above the target rate. The Taylor rule
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40 therefore gives a general rule for the determination of the prime rate by central banks with enough
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42 evidence from advanced countries.
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52 ***3.2 Empirical literature***

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54 Some studies have focused on interest rates and its response to monetary policy decision in Ghana.
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56 In a related study, Ghartey (2005) finds a significant relationship between Treasury bill rate and
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58 the monetary policy rate (transmission mechanism from policy rate to Treasury bill rate) for Ghana
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4 for the period 1994-2004. Acheampong (2005) indicates variations in prime rate affects the lending
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6 interest rate but not the deposit interest rate. The paper examined the prime-rate-money-market-
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8 interest rate channel in Ghana using time-series estimation methods and data spanning September
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10 1994 to February 2014. It was concluded that money market rate (lending and deposit) respond
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12 sluggishly to the prime rate in Ghana. On the other hand, Akosah (2015) found the prime rate to
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14 be effective in signalling money market rates in long and short term rates but this effect was
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16 considered incomplete (i.e., not one-to-one). In a cross sectional study of 18 universal banks, it
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18 was found that the effect of the prime rate on the lending rate of banks in Ghana though negative
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20 was insignificant (Amidu, 2006). This indicates that universal banks did not respond to monetary
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22 policy decisions as expected. Kovanen (2011) analysed interest rate pass-through using time series
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24 and panel bank-specific data of 20 largest banks in Ghana during the period 2005 to 2010. The
25
26 focused variables were the interbank market interest rate and the 91-day Treasury bill interest rate
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28 which are expected to be relevant bench mark for pricing of retail lending and deposit rates. The
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30 findings suggest, the interbank interest rate respond to changes in the BoG's prime rate with one
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32 month lag in all the models estimated. Long run deviation in the interbank interest rate from the
33
34 prime rate nonetheless suggests the prime rate may not always have provided an accurate reference
35
36 point for the interbank rate due to uncertainty. CEPA (2012) further shows that the prime rate
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38 largely influences the short term interest rates (91-day Treasury bill rate and the interbank rate)
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40 relative to long term rates. Notwithstanding, these studies there is clear evidence of significant
41
42 reduction of inflation rate and volatility with fairly rapid adjustment to long run equilibrium in the
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44 IT policy regime (Kyereboah-Coleman, 2012; Bawumia and Abradu-Otoo, 2003). However, the
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46 effectiveness of the IT policy on interest rates transmission remain crucial for monetary policy to
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48 address in Ghana.
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4 Regarding the empirical literature elsewhere, there have also been diverse views concerning
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6 monetary policy transmission under IT regime reported by several studies. Examples of such
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8 studies include Charoenseang and Manakit (2007) who investigated monetary policy transmission
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10 in an inflation targeting era in Thailand from June 2000 to July 2006. By employing Engle-Granger
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12 co-integration and the error-correction model, they analysed the relationship between the prime
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14 rate and the financial market interest rates. There was only a small pass-through effect of the prime
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16 rate to financial market interest rates. On the average, the commercial banks' lending rates tend to
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18 adjust lower than the deposit rates consistent with the findings by Chong et al. (2006) who stressed
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20 that lending and deposit rates, are more rigid and take much time in responding to monetary policy
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22 surprises, a situation which has been attributed to information asymmetry in the banking system.
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24 With asymmetric adjustment analysis, the commercial bank's lending rates took more time to
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26 adjust to the prime rate compared with those of deposit rates.
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35 Froyen and Berument (2009) studied interest rates transmission under IT regime in New Zealand
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37 by Vector Autoregressive (VAR) estimates using monthly data. They looked directly at the impact
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39 of innovations in the prime rate on long-term interest rates in a pre and post IT regime. During the
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41 period of IT (i.e. 1992-2008) both short-term and long-term interest rates in New Zealand were
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43 lower and less volatile than in the pre-IT period. The response declined even more when only the
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45 post-1994 period was considered. Thus, greater anchoring of inflationary expectations is a possible
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47 reason for this decline. However, Roley and Sellon (1995) suggested that many empirical studies
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49 found only a weak relationship of the impact of policy actions on interest rates.
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55 Hemachandra (2011) examined the relationship between the prime rate and other macroeconomic
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57 variables in Sri Lanka using the OLS estimation method. The study found out that 1 percent
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4 increase in the prime rate increased the Treasury bill rate by 1.20 percent. The current and previous
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6 prime rates were also found to influence current deposit rate of the commercial banks. Specifically,
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8 a 1 percentage increase in previous prime rate increased the current weighted average deposit rate
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10 by 0.69 percent significantly. Thus not only current prime rate but historical prime rates will have
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12 effect on deposit rates. Misati et al. (2011) studied the size and speed of interest rate in Kenya and
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14 found incomplete pass-through in both the short-and long-run.
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20 *3.3 Asymmetric adjustment process: A survey*

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22 Asymmetric adjustment process appears to be rather common and has been reported by Kleinmeier
23
24 and Sander (2006) for the Southern African Customs Union (SACU) region and Kwapil and
25
26 Scharler (2010) for the U.S. and the Euro zone. A wide range of literature on the asymmetric
27
28 adjustment of interest rate cover advanced economies. Most of these studies found the interest
29
30 transmission process to be sluggish and asymmetric in advanced economies with little evidence
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32 for developing countries (Malile, 2013).
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38 Several indicators in the financial system contribute to the asymmetry of interest rate pass-through.
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40 Roelands (2012) and Jamilov and Egert (2013) attributed it to factors such as the level of liquidity
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42 in the banking sector, capital and liquidity requirements of banks, maturity mismatch of the
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44 assessment of credit risk by banks, maturity mismatch of loan and deposit portfolio, level of
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46 economic growth, level of competition in the banking sector, type of bank customers, credibility
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48 of monetary policy, among others.
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53 The study by Roelands (2012) confirms that capital constraints make banks charge higher lending
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55 interest rate with slow pass-through of the Federal Fund rate using interest rate data in the US
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57 economy. Jamilov and Egert (2013) investigated the asymmetric adjustment of interest rate for
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4 Armenia, Azerbaijan, Georgia, Kazakhstan, and Russia using monthly interest rate data in an
5
6 ARDL model. The study found some asymmetric effect for only Georgia and Kazakhstan though
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8 not statistically significant. In another study, Sznajderska (2012) investigated asymmetric
9
10 adjustment of deposits and lending rates in Polish commercial banks to changes in interbank rates
11
12 during the period 2004-2011. The findings suggest that banks are faster in adjusting their rates for
13
14 credits when the error correction term is below their threshold values in Poland.
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20 Other studies have identified menu costs (Hofmann and Mizen, 2004) and collusive hypotheses
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22 (Hannan and Berger, 1991) to be the primary factors of the rigidities in interest rates adjustment.
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24 Interest rate pass-through may be incomplete due to the cost associated with continuous
25
26 adjustment. Such costs may be menu costs, information costs, and non-pecuniary costs associated
27
28 with adjustments (Hofmann and Mizen, 2004). Menu cost involves the cost of changing pricelist
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30 and expenditure on adverts to notify customers about products, a situation which is costly and time
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32 consuming for banks and financial institutions (Madsen and Yang, 1998). In the face of these costs,
33
34 pass-through can only be complete when changes in prime rates are significant and permanent
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36 (Cottarelli and Kourelis, 1994; Dutta et al., 1999). In addition, anticipated changes must be
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38 successive and in the same direction. Hence, the market will hardly respond to minor changes in
39
40 prime rates. The reason is that, menu costs create flat profit functions with limited incentive to
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42 vary rates when the changes in prime rates are small (Hofmann and Mizen, 2004).
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51 Lowe and Rohling (1992) provide a further explanation to interest rate rigidities as switching cost.
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53 The study found that mortgage interest rates in Australia were sticky downwards due to switching
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55 cost. They explained switching costs such as loan establishment fees, stamp duty, early repayment
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57 fees associated with moving from one housing loan to another. This is likely to deter borrowers
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59 from switching to another financial institution to access loan.
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4 Hannan and Berger (1991) discusses the collusive behaviour of banks in the financial market. They
5 explained that if the banking sector is either concentrated or less competitive, it is more likely for
6 banks to use their market power to maximize profits. Such collusion is however likely to break
7 down with changes in prices. Break down in collusion is associated with greater costs when deposit
8 rates increase compared to when they decrease. However, the opposite cost effect holds for lending
9 rates. Moreover, lags between changes in interest rates and the reactions of customers to such
10 changes bid up costs associated with deposit rates. Hannan and Berger (1991) therefore explains
11 lending rates as being rigid downwards whereas deposit rates are rigid upwards.
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25 Scholnick (1996) provides evidence of asymmetric response between lending and deposit rates in
26 the banking industry in Malaysia and Singapore caused by collusive behaviour. Lim (2001) reports
27 that collusive behaviour among banks leads to sticky lending and deposit rates in the short-run.
28 Deposit rates have been found to be rigid upwards in many studies in asymmetric adjustment
29 models given that banks in concentrated markets are less likely to change deposit rates (Carlton,
30 1986; Hannan and Berger, 1991). The size, number of banks, the degree of competition and
31 structure of the banking system influence the stickiness of financial market interest rates (Cottarelli
32 and Kourelis, 1994, Biekpe, 2011). Other factors such as constraints associated with the movement
33 of capital and entry barriers account for the sluggish adjustments in rates (see Cottareli and
34 Kourelis, 1994).
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52 **4 Empirical methodology**

53 ***4.1 Empirical model***

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4 To examine the long-run relationship and ascertain the degree of transmission of the prime rate to
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6 market interest rates in Ghana, the paper follows the modelling technique of Cook and Hahn (1988)
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8 and Charoenseang and Manakit (2007) and specifies the following equation.
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$$I_t = a_0 + a_1 PR_t + \varepsilon_t \quad (1)$$

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16 where I_t represents the interest rates (i.e. lending rate, deposit rate or Treasury bill rate)
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18 endogenously determined in the financial market, PR_t represents the prime rate, ε_t is the
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20 stochastic error term with zero mean and constant variance. a_0 measures the constant mark up.
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22 The long-run parameter a_1 indicates the rate of transmission of the prime rate to the respective
23
24 interest rates. The rate of transmission is expected to be between zero and one. The long-run
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26 adjustment is complete when a_1 is equal to one and is incomplete when it is less than one.
27
28 However, over pass-through will make the value to be greater than one. A complete pass-through
29
30 means that changes in the prime rate is transmitted in equal proportion to the respective interest
31
32 rate. Theoretically, this paper expects the prime rate to be positively related to the interest rates.
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34 Inflation does not enter the model if economic agents' expectation of inflation coincides with that
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36 of the monetary authorities captured by changes in the prime rate. Ceteris paribus, economic agents
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38 pay little attention to inflation when they believe monetary authorities will commit to the set
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40 inflation target and price stability.
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51 The short-run adjustment of the interest rates to changes in the prime rate is examined through the
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53 error-correction procedure if the variables in equation (1) are co-integrated. In this case, the paper
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55 estimates the Error-Correction Model (ECM) of the following form;
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$$\Delta I_t = \beta_0 + \sum_{j=1}^p \beta_{1j} \Delta PR_{t-j} + \sum_{j=1}^p \beta_{2j} \Delta I_{t-j} + \beta_3 ECT_{t-1} + \mu_t \quad (2)$$

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5 where β_0 and β_1 are short-run intercept and prime rate coefficients respectively. The prime rate
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7 coefficient β_1 is interpreted as a short-run transmission parameter. Δ is the first difference operator,
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10 μ_t denotes the error term, ECT_{t-1} is the lagged error correction term computed from the long-run
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12 cointegrated relationship of equation (1) with the formula $ECT_{t-1} = I_{t-1} - \alpha_o - \alpha_1 PR_{t-1} \cdot \beta_3$ which
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14 represents the error correction adjustment speed when the interest rates are away from their
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16 equilibrium levels is expected to be negative and statistically significant. Under the assumption of
17
18 cointegration the mean adjustment lag (MAL) of a complete transmission is calculated by
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24 $(1 - \beta_1) / \beta_3$.

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27 The adjustment speed of the interest rates may differ when they are below or above the long-run
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29 equilibrium (Chong et al., 2006). This result is crucial as the financial market is often slow in
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31 responding to monetary policy surprises due to the presence of information asymmetry (moral
32
33 hazard and adverse selection) which makes commercial banks charge high interest rate rather than
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35 reducing loans supply as explained by De Bondt (2005). Within this context, commercial banks
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37 will only reduce their base rate if they expect continuous decline in the prime rate. On the other
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39 hand, the fear that borrowers will default leads to higher constant mark-up raising the lending rates.
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41 Further explanation to information asymmetry is that commercial bank interest rates are
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43 administratively determined which respond slowly to small changes in the prime rate (Dutta et al.,
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45 1999). The banks will respond only when they expect the monetary policy authorities to commit
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47 to either reducing or increasing its rate significantly. Also, investors in financial markets are often
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49 less likely to switch to different financial products due to limited information on interest rates,
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51 particularly under imperfect competition (Hannan and Berger, 1991). Lastly, due to high switching
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53 costs, economic agents may not shift to other products/institutions (Heffernan, 1997) when prices
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4 change leading to price rigidity in the financial market. All these factors may explain the stickiness
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6 in the interest rates in adjusting fully to changes in the prime rate.
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10 In testing for information asymmetry in the financial market interest rates when they are above or
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12 below their equilibrium levels, the dummy variable (d) is used in the asymmetric adjustment as
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14 specified by Chong et al. (2006) and shown in equation (3).
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$$\Delta I_t = \pi_0 + \pi_1 \Delta PR_t + \pi_2 d ECT_{t-1} + \pi_3 (1-d) ECT_{t-1} + e_t \quad (3)$$

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23 where $d=1$ if the residual ECT_{t-1} is positive and 0 if it is negative. To test the difference in
24
25 adjustment speed, the standard Wald test is employed. The difference in the adjustment speed is
26
27 attributed to information asymmetry in the financial market. Faster adjustment is anticipated when
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29 the expected difference between the current prime rate and the future prime rate is large, while a
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31 slower adjustment is expected if the reverse holds true.
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36 **4.2 Data**

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39 Monthly data covering the period January 2002 to March 2016 is used. The data for the prime rate
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41 (PR) and the interest rates - the 91-day Treasury bill rate (TBILL91), 182-day Treasury bill
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43 (TBILL182), commercial banks' lending rate (LR), and commercial banks deposit rate (DR) are
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45 obtained from the database of the BoG. The Treasury bill rates are the interest rates offered in the
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47 open market in order to attract funds from the general public. It is the major source of government
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49 borrowing to finance maturing debt and budget deficits. Lending rates are charged by commercial
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51 banks on loans advanced to the private investors and consumers. In this paper the lending rate is
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53 proxied by the commercial banks' lending rate which forms the basis for determining all other
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55 sectors interest rates. Deposit rate is the interest rate paid to savers by commercial banks.
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4 Commercial banks pay different rates on deposits depending on how long savers are willing to
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6 keep their funds under different conditions. The current paper makes use of the 3-month deposit
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8 interest rate as proxy for deposit interest rate.
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10 11 12 **4.3 Estimation strategy** 13

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15 In order to avoid the generation of spurious results normally associated with time series data, the
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17 variables require testing for the existence of unit root. This paper makes use of the parametric
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19 Augmented Dickey-Fuller (ADF) unit root test by Dickey and Fuller (1979; 1981), the non-
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21 parametric Phillips-Perron (PP) unit root test by Phillips and Perron (1988) and the Zivot-Andrews
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23 (Zandrews) test by Zivot and Andrews (1992) which controls for one structural break. The
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25 relevance of the unit root testing is to determine the order of integration of the variables. In each
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27 test, the null hypothesis of unit root (non-stationarity) is tested against the alternative hypothesis
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29 of the absence of unit root (stationarity). Tables A.1.1 - A.1.3 (see the Appendix) report the results
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31 of the unit root tests according to ADF, PP and Zandrews unit root tests respectively. According
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33 to the ADF and PP results, all the variables considered are integrated of order one or $I(1)$ at 1%
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35 level of significance. These outcomes are further confirmed by the Zandrews test as the null
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37 hypothesis of unit root without a structural break is not rejected at the 5% level of significance for
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39 all variables. That is, regardless of the unit root testing procedure used, all the variables can be
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41 treated as integrated of order one or $I(1)$.
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51 The prime rate is assumed to move closely with the financial market interest rates. Therefore, the
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53 paper examined the presence of cointegration relationships among the variables using the Trace
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55 test within the framework of the Johansen (1991) cointegration test procedures and the Johansen
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57 et al. (2000) cointegration procedures which controls for structural break(s) in the series. The
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4 Johansen cointegration Trace test results without and with structural break(s) are reported in
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6 columns 1 and 2 of Tables A.2.1 – A.2.4 respectively (see the Appendix). The results clearly show
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8 there is evidence of cointegration in all the estimated models (except that for TBILL182) at least
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10 at the 5% level of significance levels. Since no cointegration relationship is found between
11
12 TBILL182 and the prime rate, in what follows we do not consider results related to this
13
14 relationship. In the case of the other variables (LR, DR and TB92), the evidence of cointegration
15
16 validate the use of the ECM in equation (2) for the analysis as a further examination of the
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18 coefficient of the error-correction term (β_3) (see Table 2). As evident these coefficients are all
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20 negative and highly significant indicating valid long-run relationship among the variables.
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27 **5 Empirical results and discussion**

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29 This section of the paper reports and discusses the estimated long-run transmission of the prime
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31 rate, short-run dynamic adjustment process and the asymmetric short-run adjustment results. The
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33 long-run results presented in Table 1⁴ were obtained by estimating equation (1) using the Fully
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35 Modified Ordinary Least Square (FMOLS) and the Dynamic Ordinary Least Square (DOLS). As
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37 often argued, these estimates are more robust in the presence of serial correlation and
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39 heteroscedasticity usually associated with time series data (Phillip, 1995).
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45 All the interest rates are positively related to the prime rate and highly significant according to the
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47 FMOLS and DOLS estimates. The long run estimates show the responsiveness of the market
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49 interest rates to the monetary surprises (indicated by changes in the prime rate) of the central bank.
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52 The short term money market interest rate depicts an over pass-through as indicated by the
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57 ⁴ In this Table we also report the Hansen parameter instability cointegration test (Hansen 1992) associated with the
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59 FMOLS and DOLS. Hansen test has the null hypothesis that the series are cointegrated. As evident the p -values which
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61 are >0.2 are all not significant. This provides additional support for the cointegration results reported earlier.
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4 coefficients of the TBILL91 (1.1541 and 1.2002 for FMOLS and DOLS estimates respectively).
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6 Thus, the 91-day Treasury bill rate responds more than proportionately to changes in the prime
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8 rate. The high responsiveness of the Treasury bill rate proves its competitiveness as against the other
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10 market interest rates which further reflect the effectiveness of the central bank in the management
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12 of credit to control inflation in the open market. Moreover, regular interventions by the monetary
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14 authorities to raise Treasury bill rate to finance maturing debt can also result in the over-pass-
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16 through. Although, there is incomplete pass-through in both the lending (0.6531 and 0.6579 for
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18 FMOLS and DOLS estimates respectively) and deposit rates (0.3201 and 0.3197 for FMOLS and
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20 DOLS estimates respectively) of the commercial banks, the lending rate is more responsive to the
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22 prime rate. The lending rate happens to be more competitive in the long-run relative to the deposit
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24 rate. This finding suggests a form of collusive behaviour among the banks as deposit rate appear
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26 to be more rigid upward than lending rate (see, for instance, Hannan and Berger, 1991). The result
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28 is not consistent with the findings of Amidu (2006) who found a negative but insignificant
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30 relationship between the prime rate and the lending rate. It is worth noting that, as expected,
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32 FMOLS and DOLS results are similar even though the magnitude of the coefficients differ.
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43 **INSERT TABLE 1 HERE**

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46 The short-run estimates (see Table 2) show that the short term money market interest rate (91-day
47
48 Treasury bill rate) is highly significant at 1% level. This confirms that the money market rate is
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50 highly responsive to changes in the prime rate both in the short-and long-run, possibly making the
51
52 short term rate an effective instrument to managing domestic credit (demand) and hence inflation.
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54 As shown in Table 2, it takes about 2-3 months (i.e. about 2.875) for the 91-day Treasury bill
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56 (TBILL91) to respond completely to the prime rate, making them relatively more competitive in
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4 the financial market as shown by their Mean Adjustment Lag (MAL). The result is consistent with
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6 the findings of Acheampong (2005) for Ghana and Mahasi and Pokhriyal (2013) for Kenya. The
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8 lending and deposit rates of commercial banks are the most sluggish in adjusting to long-run
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10 equilibrium taking approximately 13 months (12.99 and 13.115) respectively as shown by their
11
12 MAL. It can be explained that only when the commercial banks expect permanent and significant
13
14 changes in the prime rate will they have the incentive to adjust the lending and deposit interest
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16 rates according to the menu cost hypothesis (Cotarella and Kourelis, 1994). Commercial banks
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18 have also explained that high default risks and non-performing loans contribute to the
19
20 unwillingness to reduce lending rates significantly when the prime rate falls consistently (De
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22 Bondt, 2005). In the short run, all the variables show incomplete pass-through. The short-run
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24 results for the 91-day Treasury bill rate shows it is more competitive than the others since its
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26 coefficient is the highest (0.7700).
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35 **INSERT TABLE 2 HERE**
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38 The standard Wald test is used to test the speed of adjustment when the rate of transmission is
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40 above or below equilibrium in the presence of information asymmetry. The null hypothesis $\pi_2 = \pi_3$
41
42 states no difference in the adjustment speed, while the alternative hypothesis of $\pi_2 \neq \pi_3$ means
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44 otherwise when the prime rate transmission is either above or below equilibrium (Chong et al.,
45
46 2006). The results (see Table 3) shows the 91-day Treasury bill (TBILL91) rate adjust faster from
47
48 above equilibrium (4.5 months) than when it is below equilibrium (5.4 months). The fact that the
49
50 TBILL91 adjusts faster to equilibrium depicts high degree of its responsiveness to the prime rate
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52 in the financial market. From Table 3, the adjustment speed differs in the DR as its probability
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54 value is greater than 5% by the Wald test implying little significance of information asymmetry in
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4 the adjustment process. Stated differently, the Wald test is not significant in the DR showing that
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6 information asymmetry plays little role in its adjustment process. The adjustment speed is also
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8 longer here (27.6 months from above equilibrium and 45.9 months from below equilibrium).
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10 However, the test shows the significance of information asymmetry in the commercial bank
11
12 lending rates. The LR responds faster when it is above equilibrium (i.e. 20.3 months) than when it
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14 is below equilibrium (i.e. 31.5 months) even though both rates of adjustment are sluggish. Kovanen
15
16 (2011) explained these variations as follows; during periods when the prime rate has been falling,
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18 the convergence of market interest rate towards the long-term equilibrium appears to be faster and
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20 statistically significant. On the other hand, during periods of rising prime rates, the convergence is
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22 not statistically significant.
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30 **INSERT TABLE 3 HERE**
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32 33 **6 Concluding remarks and policy recommendations** 34

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36 This paper has investigated the rate of transmission of the prime rate to financial market interest
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38 rates in Ghana for the period January 2002 to March 2016. The Johansen and Hansen parameter
39
40 instability cointegration, the FMOLS and the DOLS estimation procedures were used. The long
41
42 run results reveal that the prime rate is crucial in determining interest rates in Ghana. The prime
43
44 rate was found to be significant in determining the lending, deposit and the 91-day Treasury bill
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46 rate in the financial market especially in the long-run. The rate of transmission, however, differs
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48 depending on the type of interest rate under consideration. The 91-day Treasury bill rate shows
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50 over-pass-through making it the most responsive in the market, signalling its effectiveness in
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52 managing liquidity and stabilizing the economy. There is incomplete pass-through in the
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54 commercial banks' deposit rate whiles the lending rate is almost complete. In the short-run, the
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4 effect of the prime rate on the deposit rate was not significant while that on the lending rate was
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6 weakly significant. The commercial banks deposit rate proved to be the most sticky and
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8 uncompetitive in the financial market.
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12 Based on these findings, the study recommends effective communication of the IT policy by the
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14 Bank of Ghana. The periodic monetary committee decisions on the prime rate should be effectively
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16 communicated to the general public through press releases and publications in the dailies, as well
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18 as other forms of the media. Economic agents will factor these policies in their decisions if they
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20 are fully aware and understand the policies better. Simultaneously, the Bank of Ghana should be
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22 committed to steering the economy along the inflation path that it sets for the economy. This will
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24 make the policy more credible and instil the confidence of the public in anchoring expectations.
25
26 To ensure competition among commercial banks in the country, regular publishing of lending and
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28 deposit rates is needed to allow the public make informed decision on borrowing and saving. This
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30 should be done regularly as the prime rate is reviewed to make customers switch or bargain for
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32 interest rates. To further address the asymmetry between lenders and borrowers, the Credit
33
34 Reference Bureau system should be strengthened to collect accurate data on borrower's
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36 characteristics to reduce default rate in the economy. It is important that commercial banks also
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38 consider factors such as default rate, profitability, operating expenses and several others in addition
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40 to the prime rate in determining their lending and deposit rates. The present paper could not
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42 consider all these variables. Notwithstanding, this does not affect the main results reported in this
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44 paper given that all the estimated models are cointegrated.
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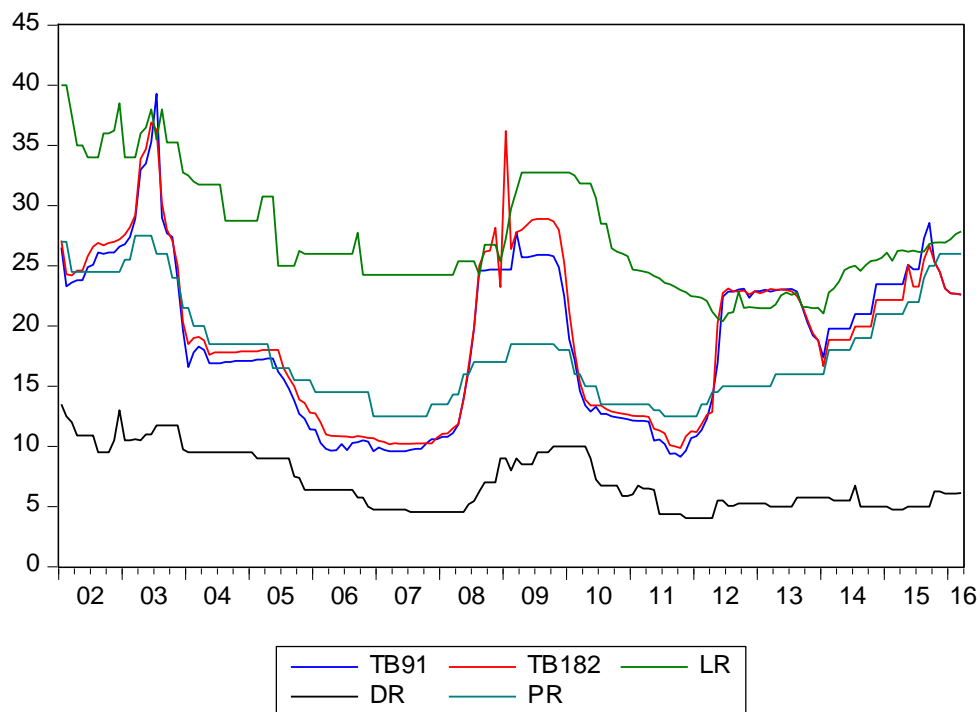
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FIGURE**Figure 1: Trends in the 91 and the 182 Treasury bill rates, the prime rate, the deposit interest rate, and the lending interest rate**

Note: Prime rate (PR), 91 Treasury bill rate (TB91), 182 Treasury bill rate (TB182), deposit interest rate (DR), lending interest rate (LR)

TABLES

Table 1 Long run transmission of the prime rate to the respective interest rates

FMOLS				DOLS		
Dependent Variables	(α_1)	Standard Error	Hansen (Lc)	(α_1)	Standard Error	Hansen (Lc)
TBILL91	1.1541***	0.3970	0.2606	1.2002***	0.1531	0.0048
DR	0.3201***	0.0735	0.3417	0.3197***	0.0420	0.0051
LR	0.6531***	0.1729	0.1505	0.6579***	0.0840	0.0026

Note: *** indicates significant at the 1% level. PR is the independent variable. Hansen (Lc) is the Hansen parameter instability cointegration test statistic. All Hansen (Lc) test statistic have p -values > 0.2 .

Table 2 Short-run error-correction results

Variables	β_1	β_3	MAL
Δ TBILL91	0.7700(0.00)	-0.0800 (0.0033)	2.875
Δ DR	0.0390(0.5852)	-0.0740(0.0044)	12.99
Δ LR	0.2367 (0.0762)	-0.0582 (0.0373)	13.115

Note: β_1 is the short run transmission parameter of the prime rate and β_3 is the co-efficient of the error correction term. The values in parenthesis are the probabilities. Δ PR is the independent variable

Table 3 Asymmetric short run adjustment results

Variables	π_1	π_2	π_3	MAL ⁺	MAL ⁻	Wald Test
Δ TBILL91	0.6275(0.00)	0.0821(0.02)	0.0690(0.15)	4.54	5.40	7.6706(0.00)
Δ DR	0.1099(0.13)	0.0323(0.38)	0.0194(0.57)	27.56	45.88	0.8295(0.48)
Δ LR	0.3739(0.01)	0.0308(0.42)	0.0199(0.58)	20.33	31.46	3.8683(0.02)

Note: MAL⁺ = $(1 - \pi_1) / \pi_2$ is the mean adjustment lag when the degree of transmission is above equilibrium whiles MAL⁻ = $(1 - \pi_1) / \pi_3$ represents otherwise. The values in parenthesis are the probabilities.

APPENDIX

PRE-TEST TABLES

Table A.1.1 ADF Unit Root Test Results

Variables	Levels		First Difference	
	No Trend	Trend	No Trend	Trend
TBILL91	-2.700414	-2.695253	-10.15046***	-10.13675***
TBILL182	-2.272432	-2.242162	-7.207494***	-7.201105***
DR	-2.712473	-2.528994	-13.50832***	-13.56125***
LR	-2.732258	-2.172058	-14.08135***	-14.29297***
PR	-1.104911	-0.339573	-5.372512***	-13.57032***

Source: Authors.

Note: *** indicates rejection of the null hypothesis of unit root at the 1 per cent level

Table A.1.2 PP Unit Root Test Results

Variables	Levels		First Difference	
	No Trend	Trend	No Trend	Trend
TBILL91	-2.279772	-2.259256	-14.48213***	-10.48790***
TBILL182	-2.427037	-2.341777	-14.48213***	-14.46807***
DR	-2.712473	-2.515755	-13.52190***	-13.57372***
LR	-2.731272	-2.164477	-14.04332***	-14.25354***
PR	-1.578466	-0.645391	-13.25681***	-13.78342***

Source: Authors.

Note: *** indicates rejection of the null hypothesis of unit root at the 1 per cent level.

Table A.1.3 Zandrews Unit Root Test Results

Variables	Intercept	Trend	Intercept + Trend
TBILL91	-3.354	-3.940	-3.926
TBILL182	-2.807	-3.158	-3.292
DR	-3.408	-2.696	-3.682
LR	-2.705	-2.619	-2.856
PR	-1.641	-1.956	-2.001

Source: Authors.

Note: The 5 per cent critical values for the intercept, trend and intercept + trend models are -4.80, -4.42 and -5.08 respectively.

Table A.2.1 Johansen cointegration test for TBILL91

Trace Test without Structural Break				Trace Test with Structural Break			
Hypothesized No. of CE(s)	Trace Statistic	Prob.	95%	Hypothesized No. of CE(s)	Trace Statistic	Prob.	95%
None*	15.28941	0.0537	15.49471	None*	43.00	0.0096	36.79
At most 1	1.075528	0.2997	3.841466	At most 1	6.43	0.8552	18.51

Trace statistic indicates cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

*** MacKinnon-Haug Michelis (1999) p-values

Table A.2.2 Johansen cointegration test for TBILL182

Trace Test without Structural Break				Trace Test with Structural Break			
Hypothesized No. of CE(s)	Trace Statistic	Prob.	95%	Hypothesized No. of CE(s)	Trace Statistic	Prob.	95%
None	12.47528	0.1355	15.49471	None	34.11	0.0934	36.79
At most 1	0.689058	0.4065	3.841466	At most 1	5.30	0.9277	18.51

Trace statistic indicates no cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

*** MacKinnon-Haug Michelis (1999) p-values

Table A.2.3 Johansen cointegration test for DR

Trace Test without Structural Break				Trace Test with Structural Break			
Hypothesized No. of CE(s)	Trace Statistic	Prob.	95%	Hypothesized No. of CE(s)	Trace Statistic	Prob.	95%
None*	31.28796	0.0001	15.49471	None*	37.91	0.0352	36.50
At most 1	1.233810	0.2667	3.841466	At most 1	6.16	0.8611	18.34

Trace statistic indicates cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

*** MacKinnon-Haug Michelis (1999) p-values

Table A.2.4 Johansen cointegration test for LR

Trace Test without Structural Break				Trace Test with Structural Break			
Hypothesized No. of CE(s)	Trace Statistic	Prob.	95%	Hypothesized No. of CE(s)	Trace Statistic	Prob.	95%
None*	27.44036	0.0005	15.49471	None*	52.88	0.0005	37.01
At most 1	0.788252	0.3746	3.841466	At most 1	15.74	0.1264	18.68

Trace statistic indicates cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

*** MacKinnon-Haug Michelis (1999) p-values