Interest rate Volatility, Asymmetric Interest rate Pass-through and the Monetary Transmission Mechanism in the Caribbean compared to US and Asia.

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ABSTRACT

We analyse asymmetric interest rate pass through, the impact of interest rate volatility on interest rates and the monetary transmission mechanism in the countries of the CSME[1] using the Asymmetric TAR and MTAR cointegration models and the EC-EGARCH(1, 1)-M model proposed by Wang and Lee (2009) who examined the same issue for the US and nine Asian countries. *First,* our results show that there is complete pass through in the retail lending rate for Trinidad and Tobago and for St. Lucia and therefore, by extension in all the countries of the OECS[2] but not the other countries of the CSME. This result is similar to Wang and Lee (2009) who found complete pass through for the US deposit rate but not in the rates of the other nine Asian countries. *Second*, in Wang and Lee (2009) the results of the TAR and MTAR models show asymmetric cointegrating relationships in the lending rate of three countries and the deposit rate of five countries out of ten countries. Comparatively, our results show asymmetric cointegrating relationship in the lending and deposit rate of only three countries out of six: Jamaica, Guyana and St. Lucia. *Third,* the results from the conditional mean equation in the EC-EGARCH(1, 1)-M model in Wang and Lee (2009) show that for the countries with asymmetric cointegrating relationships, the lending rate displays downward adjustment rigidity and the deposit rate displays upward adjustment rigidity. While our results show that both rates for Jamaica display upward adjustment rigidity and both rates for Guyana and St. Lucia display downward adjustment rigidity. *Finally,* similar to Wang and Lee (2009) our results from the EC-EGARCH(1, 1)-M models show that the effect of interest rate volatility on interest rates varies among countries. Three out of ten countries from Wang and Lee (2009) support the collusive pricing arrangement hypothesis while in our case it happens only in two countries out of six from the CSME: Guyana and St. Lucia. Moreover, the leverage effect exists in the lending rate for two out six countries in the CSME as it happens in Wang and Lee (2009) in two out of ten countries. Along the same lines the leverage effect exist in the deposit rate of three countries in the CSME, Contrary to Wang and Lee (2009) who do not find any evidence at all.

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1 Caribbean Single Market and Economy

2 Organization of Eastern Caribbean states

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1 Introduction

Most economies worldwide have implemented some form of expansionary monetary policy and/or other types of stabilization policies to soften the blow of the recent Global Financial Crisis. The Bank of England for example, reduced interest rates to as low as 0.5% in 2010. These policies are only effective if the mediums through which they enter the real economy are operating efficiently. More specifically, the central bank can influence the economy via interest rates, only if the government policy rate is successfully transferred to the retail lending and deposit rates. If the central bank for example; increases or decreases its policy interest rate then commercial banks should respond accordingly by transferring any costs associated with the change in the central banks rate to the retail lending and deposit rates. This process of interest rate pass through ultimately determines the effectiveness of monetary policy since it is the retail rate that truly influences the market demand and supply of loans and deposits, therefore it has the real impact on economic activity such as inflation, investment and overall growth in GDP.

If the central bank can transfer all the cost associated with an increase in its policy rate to the retail rates then this is considered to be complete pass through, this situation is very rare, according to recent research by Wang and Lee (2009), only the US economy has achieved complete pass through in its deposit rate. If the central bank can transfer a part of the cost to the retail rates then this is considered to be incomplete pass through and if they transfer more than the cost then it is considered to be over pass through. Kwapil and Scharler (2010) show that if interest rate pass through is incomplete there is no guaranteed equilibrium under the standard Taylor rule. Cottarelli and Kourelis (1994) believes that profit maximizing institutions such as commercial banks will only change the lending rate or borrowing rate if the cost of doing so is less than the adjustment cost associated with the change. If it is cheaper to keep the current interest rates fixed even when the money market rate has changed then this is the action that will be taken. Whether pass through is incomplete, complete or more than complete, monetary policy is only effective if there is a long run relationship between the central bank's interest rates and the retail interest rates. If the adjustment towards the long run equilibrium is the same between increases and decreases in the interest rate then the pass through is symmetric. However, if there are different adjustment patterns for increases and decreases towards the long run equilibrium the adjustment process is asymmetric.

Research has highlighted that for many countries the interest rate adjustment process is rigid on the downside for lending rates and rigid on the up side for deposit rates. Lowe and Rolling (1992) provide four main theoretical explanations for interest rate stickiness. Adverse selection via agency costs; Banks face possible adverse selection and moral hazard when they increase the lending rate because the less risky investors find higher interest rates unattractive, increase in interest rates may not necessarily lead to an increase in the bank's net receipts because there is a higher probability that borrowers will default. As a result banks may be unwilling to increase lending rates resulting in upward stickiness. Switching costs is also another major factor influencing loan rate stickiness. The higher the switching cost the less attractive is a reduction in the lending rate to potential customers because of the high administrative fees associated with switching from one bank to the next. This means that banks will more or likely be less willing to reduce their interest rate because it will not attract more customers anyway given the high cost of switching from on bank to the next. Risk sharing is the third reason for interest rate stickiness. This arises if the borrowers are risk averse, which means they are more comfortable with a steady rate of interest. With this in mind commercial banks may be unwilling to constantly change their interest rates which may potentially cause them to lose customers. Consumer irrationality is the last reason why interest rates continue to be sticky; lowering interest rates will again attract the more risk averse borrowers via a process of reverse adverse selection. According to Ausubel (1991) addressing the issue of credit card interest rate stickiness. The theory implies that it is disadvantageous for the bank to compete by reducing credit card rates because they are more likely to attract those who 'fully intend to borrow' i.e. high risk credit card holders. Hannan and

Berger (1991) found that deposit rates generally demonstrate upward rigidity and the more compact financial markets with smaller firms have more deposit rate rigidity (asymmetric adjustments). According to Wang and Lee (2009), the linear model used by most researchers to test for interest rate pass through is biased towards rejecting the existence of interest rate pass trough given that it does not account for asymmetries in the adjustment process and other asymmetries.

Considering this, we wish to investigate asymmetric interest rate pass through, the impact of interest rate volatility on the retail deposit and lending interest rates and the overall monetary transmission mechanism in the Caribbean region. We employ the Threshold Autoregressive (TAR) and Momentum-Threshold Autoregressive (MTAR) asymmetric cointegration model proposed by Enders and Siklos (2001) and the Error Correction exponential GARCH in the mean EC-EGARCH (1,1)-M model proposed by Wang and lee (2009). Monthly data for the CSME or CARICOM which contains within it a 30 year old monetary union the OECS is employed. Even though Hannan and Berger (1991) showed a smaller pass through in the EMU than in the US, Karagiannis, Panagopoulos and Vlamis (2010) has found some evidence to indicate complete pass through in the EMU. Given that data shows almost parallel movement between the lending and deposit rates in our group of countries we expect new findings on the level of pass through and the overall operations of the monetary system. Currently Mamingi, Boamah and Jackman (2008) provide little evidence on interest rate pass through in the Caribbean. They analyse the impact of the central banks minimum deposit rate on the commercial banks lending rate in Barbados from 1980 to 2007 using a partial adjustment error correction model. The results show that the lending rate movements are sticky in the short run however there is complete pass through in the long run.

Their research does no account for asymmetric adjustments; the error correction model does not incorporate any GARCH elements to counter the heteroskedasticity problems in the cointegrating errors. It is a single country analysis and it does not assess the effects of the central banks rate on the retail deposit rate which is an important factor especially in the Caribbean where the information systems are poor, firms are smaller and the financial markets are less developed. These are important issues to consider when examining interest rate pass through in economic and/or monetary unions. Our research is important since commercial Banks provides most of the funds for investment in the CSME; they play an important role in the transmission of monetary policy in these countries. Also the EC-EGARCH(1, 1) model deals with heteroskedasticity problem which is prevalent in interest rate models. Mojan (2000) and Ehrmann et al. (2003) argue that competition in the financial market between banks and/or financial institutions and the increase in interest rate volatility have great impact on the speed and the level of interest rate pass through.

The first form of economic union among Caribbean countries after the failure of the Caribbean federation in 1962 was CARIFTA[3] in 1978. It has evolved to the present CARICOM which is in the process to further transforming the current common market to a monetary union the CSME. Yet little attempts have been made to understand how monetary policy operates in the region. Toolsema, Sturm and Haan (2002), Angeloni and Ehrmann (2003) and Sander and Kliemer (2004 and 2006) research on the European monetary union and the South African Customs Union (SACU) among others, have analysed the process of interest rate pass through between groups of countries with economic agreements among themselves but not in the CSME or the OECS. The countries of the SACU practice a quasi currency board agreement with South Africa where each country still maintain their own central bank which is quite different from other monetary unions like the EMU and the OECS where there is a single central bank conducting policy for all its members. Sander and Kliemer (2004) outline that the structure of the banking system and the level of information technology will determine the speed and the completeness of interest rate pass trough. Their results suggest that the difference that exists in the level of pass through among countries in the same economic union is due to imperfect

[3] Caribbean free trade area later to be renamed CARICOM and then the CSME

competition in the banking system. There are different levels of interest rate stickiness and varying types of asymmetric cointegrating relationships between the monetary policy rate and the retail interest rates in the South African currency union. Their research analysed how the level and the speed of pass trough changes as the structure of the union changes. Our research differs from Kliemer and Sander (2004 and 2006) in two major ways. First their study done on the EMU cannot assist us with the OECS because the interest rates are the same for all seven countries in the OECS which would indicate homogenous pass trough between the countries. Secondly, the CSME is not yet a monetary union and there is no dominant country like the SACU where South Africa is the dominant country. It is novel because it provides new information on monetary transmission mechanism in the Caribbean region, which is important not only for its members and associate members but for other common markets, customs union and monetary unions. The CSME is a unique case study given that it contains within it monetary union the OECS.

The remainder of the paper is organised as follows; section 2 analyses the current literate on interest rate pass through, section 3 outline the data and methodology, section 4 discusses our results and section 5 concludes. An appendix collects the tables and figures.

2 Literature Review

The literature on interest rate pass through is very extensive. Research is present for a variety of countries and group of countries using various techniques and procedures, our research uses the methodology of Wang and Lee (2009) who examine the interest rate pass through mechanism between the money market rate and the retail rates in the US and nine Asian countries; Hong Kong, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Thailand and Taiwan using the TAR and MTAR models. They also examined the impact of interest rate volatility on interest rates using a EC-EGARCH(1, 1)-M model. The TAR and MTAR models account for asymmetric adjustments and the EC-EGARCH(1, 1) deals with the problem of heteroskedasticity in the cointegrating errors and volatility in the model. A summary of the results is given in table 2 extracted from their original paper. The results from the TAR model showed asymmetric cointegrating relationship in the deposit rate for four of the countries; Hong Kong, Indonesia, Malaysia and the US and the lending rate for Hong Kong. The MTAR model showed asymmetry in the deposit rate for Hong Kong Malaysia Philippines Singapore and Taiwan and the lending rate model for Hong Kong, Philippines and Taiwan. The countries displaying asymmetry in the MATAR framework are used in the EC-EGARCH-M(1, 1). The results show that adjustment rigidity exist in some countries; Hong Kong, Philippines and Taiwan lending rate displayed downward adjustment rigidity and at the same time Hong Kong, Malaysia, Philippines, Singapore and Taiwan deposit rate display upward rigidity. Interest rate volatility has a positive effect on Hong Kong, Japan and Malaysia lending rate and Philippines and US deposit rate and a negative effect on Korea, Malaysia and Taiwan deposit rate and Philippines Singapore and Thailand Lending rates.

The conditional variance equation show positive asymmetry Hong Kong, Japan, Korea, Taiwan, Thailand and US deposit rate and Hong Kong lending Singapore Lending rate. The leverage effect (negative asymmetry in the conditional variance) exists for Korea and Thailand lending rate. Overall the results found complete pass through only for the US deposit rate, there is incomplete pass through for the US lending rate and both deposit and lending rate for the remainder of the countries. The results also show that in the cases where interest rate pass through is incomplete, commercial banks mark up the retail interest rates to cover the cost associated with an increase in the money market rate and mark down the retail rate if the money market rate decreases. These results reiterate the importance of asymmetric cointegration models.

There are a host of researchers who examined the issue before Wang and Lee (2009). Many of whom examined interest rate pass through in various ways for the EMU. Toolsema, Sturm and Haan (2002) use monthly data to analyse the similarities between interest rate pass-through of six[4] European monetary Union (EMU) counties over time. First they use the model developed by Cottareli and Kourelis (1994) to establish a linear relationship between the government money market rate and the respective retail interest rates given the impact multiplier. Second, they use the fully Modified OLS estimator proposed by Phillips and Hanson (1990) to account for any cointegration among the variables. The Hansen (1992) parameter instability test indicates an unstable relationship between the money market rate and the lending rate overtime for all six countries. Therefore any long run stability between the variables assumed under the cointegration will be rejected given that the data in itself is unstable. The results for the full sample indicate no cointegration. However, the results from the rolling regression indicate cointegration and stable impact multipliers among subsamples of the data. An error correction mechanism comprising of rolling regression techniques is used to estimate the short run dynamics of the sample periods that are cointegrated. The results show little convergence among the different pass-through rates for the different countries in the study. This model is limited since is does not account for asymmetric adjustments or heteroskedastic errors, which are important when dealing with interest rate models. Angeloni and Ehrmann (2003) examine the interest rate pass through in Europe before and after the inception of the European Monetary Union (EMU). They split the data set in 2 subgroups; group one consisting of data before the EMU and group two consist of data after the countries join the union. They employ OLS along with specific VAR's to examine if monetary policy has converged between counties given the introduction of the union. The results of the paper confirm the premise however; there is little evidence to suggest that the speed of adjustment parameter has increased since the countries join the union.

Sander and Kleimeier (2002) investigated the interest rate pass through in EMU countries. The results indicated that short run and long run pass through is different depending on the sample period. Sander and Kleimeier (2006) investigated the interest rate pass-through in

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[4] Belgium, France, Germany, Italy, the Netherlands and Spain

four[5] countries from the South African Customs union (SACU). They made an effort to correct for the asymmetry in the EMU found in Toolsema et. al.'s (2002), by modelling interest rate pass through in a Threshold Autoregressive (TAR), a Momentum Threshold Autoregressive (MTAR) and a Band Threshold Autoregressive (BTAR) cointegration and error correction mechanism. They employed an automatic model selection procedure to establish which model best suit the data. The results suggest that the central bank's lending rate had long run impact of the respective money market rate. There was complete pass though in South Africa which occurred more swiftly than usual, while to the other extreme Namibia illustrated more interest stickiness and asymmetric convergence which they believe is due to market imperfections. Their methodology like Toolsema et al. (2002) does not treat heteroskedasticity in the cointegrating errors.

Egert, Crespo-Cuaresma and Reininger (2007) as well, investigated the interest rate pass through in five European counties[6] instead of the standard cointegration and error correction model; they use a cointegrated VAR model and error correction procedure. The results show that short to long term deposit rate has a significantly higher pass through than the overnight deposit rate. Additionally, the money market rate pass through more to the corporate lending rates than the deposit or household lending rates. The pass-through for these countries are also declining overtime which Egert et. al (2007) believes will continue to decline in the future. This is contrary to modern developments where the interest rate pass through should increase as financial market get more developed in these countries. The pass through for these countries appears to be greater than some EMU members for example Austria and Germany, there was insufficient evidence to support pass through to the long term market rates, this is because the yield curve tend to get less stable at longer ends of the maturity spectrum. The research also found asymmetries in the monthly Money market rate, and among the short run and long run dynamics.

[5] South Africa, Lesotho, Namibia and Swaziland
[6] Czech Republic, Hungary, Poland Slovakia and Slovenia

The most recent research on interest rate pass through in the EMU by Karagiannis, Panagopoulos and Vlamis (2010) who examine interest rate pass through in Europe and the US as it relates to the recent global financial crisis. They use a disaggregated general-to -specific (GETS) model to analyse the short run and long run interest rate elasticities and also the effectiveness of the interest rate pass trough mechanism in the Euro area and the US. The findings indicate varying results for the transmission of interest rate pass through and the completeness of the pass through in the US and the Euro area. For the Euro area there is evidence to suggest that the money market rate is more influential than the central Banks rate as it is transmitted to both the lending and deposit rate while the central banks rate is transmitted to the lending rate only. Both upward and downward movements in the money market rate are transmitted to the retail lending rate, confirmed as both parameters are statistically significant. There is complete pass through from the money market rate to the deposit rate and incomplete pass through from the Money market rate to the lending rate. For the US the interest rate pass through from the Central Bank rate to the both the deposit rate and the lending rate are both significant, both upward and downward movements are significant although the magnitude of the speed of adjustment parameter for upward adjustment is ten times greater in absolute terms which may indicate asymmetry. The results also suggest that there is complete pass through from the Central bank rate to both the deposit and lending rate in the US. There exists no pass through from the money market rate to either retail rates in the US, indicating that the central bank rate is more effective. For the EU there is negative asymmetry relates to the deposit rate; banks pass only negative movements to the depositors. On the contrary as it relates to the loan rate there is higher positive asymmetry, banks tend to pass more of the increases in money market rate to the lender than decreases, which to us is not surprising considering they are profit maximizing entities. For the US as well, the asymmetry is the same as the EU for deposit rate, on the other hand there is also negative asymmetry for the lending rate in this case.

Other single country studies such as Burgsteller (2003) analyse the level and the speed of pass through from the central bank rate to the lending rate in Australia. They employ a structural VAR and regular time series cointegration tests. The results suggest that in the short term the Australian lending rate is relatively inflexible to changes in the central banks rate. There is also incomplete and asymmetric pass trough as the level of pass through was significantly different for negative as oppose to positive adjustments. Lending rates tend to adjust quicker to decreases in policy rate then increases. Atesoglou (2003) investigates the interest rate pass trough transmission from the federal funds rate to the prime interest rate. The split the data set into two sub-periods the capture the effects of both. They employ OLS and standard time series cointegration tests in the analysis. The results showed cointegration in both sub-sample indicating that the federal funds rate is being transmitted to the prime rate. There were however no test for asymmetries or incomplete pass trough between both variables. Although there was an increase in the level and the speed of transmission after joining the EMU, interest rate pass through between the policy rate and the lending and deposit rate is not complete.

Chionis and Leon (2006) examined interest rate transmission from the policy rate to the lending and deposit rate in Greece. They employed standard cointegration test and error correction mechanism accounting for a structural break after Greece entered the EMU in 2001. The results show that the pas through transmission increase for both the lending rate and the deposit rate after Greece join the EMU also the speed of transmission increase because of the stability gained from joining the EMU. Scholnick (1996) examine asymmetric interest rate pass through in Singapore and Malaysia. Using an asymmetric error correction model, they showed that deposit rate adjustment was more rigid when it is above its equilibrium path than when it is below in both countries. There is downward rigidity in the deposit lending rate in both countries which suggests that banks reduce deposit rates quicker than they are willing to increase them. Therefore the asymmetric models becomes even more relevant, the next section outlines the data sources, the TAR, MTAR and EC-EGARCH (1,1)-M model.

3 Data and Methodology

3.1 Data

Asymmetric interest rate pass through from the government policy rate to the retail interest rates and the effect of interest rate volatility on interest rates in the CSME is examined using monthly data from 1995:01 to 2010:04. Data is collected from the IMF International Financial Statistics on the treasury bill rate, the commercial banks' retail lending rate and retail deposit rate for six countries from the CSME; Barbados, Guyana, Haiti, Jamaica, Trinidad and Tobago and St. Lucia[7]. Most research on interest rate pass through in the literature use the money market rate instead of the Treasury bill rate, however data on the money market rate for the Caribbean insufficient. Also due to the nature of these economies, the 90 day Treasury bill rate is the true rate that influences monetary policy. Our data set begins 1995 because most Caribbean countries changed their financial markets from fixed to flexible exchange rate regime between 1991 and 1993, this would allow the market sufficient time to adjust without any structural break in the data. Currently, Barbados is the only country in CSME apart from the countries of the OECS that still has a fixed exchange rate system. Suriname is the only member from CSME that is excluded from the research due to insufficient data points.

3.2 Methodology

In order to test if there is long run interest rate pass through between the treasury bill rate and the retail lending and deposit interest rates, first, the Augmented Dickey Fuller (1979) unit root test and the Phillips Perron (1988) unit root test are employed to test the integration of each variable. Second, if the variables are integrated first order, interest rate pass through can be examined using the TAR and MTAR cointegration models. Wang and Lee (2009) argues that

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[7] St. Lucia is the only country included from the OECS given that the union has a single central bank, the interest rates for all the countries from the OECS is the same. The Eastern Caribbean Central Bank is in St. Lucia so we use St. Lucia as the representative for the OECS.

previous research on interest rate pass through may have biased results because they rely on the symmetric cointegration test of Engle and Granger (1987). This test is sometimes deficient because it does not account for asymmetric adjustments in the data. Enders and Siklos (2001) have provided an alternative to the Engle and Granger (1987) test which incorporates asymmetric adjustment. Consider the following linear equation

$$RR_t = \hat{\beta}_0 + \hat{\beta}_1 PR_t + u_t \qquad (1)$$

where RR_t is the retail deposit rate or the retail lending rate and PR_t is the policy rate[8], we wish to investigate what proportion of the Treasury bill rate passes through to each of the retail interest rate in the long run. If both interest rates in each equation are I(1) then equation one is cointegrated if the error term u_t is stationary.

The traditional Engel and Granger (1987) unit root test regresses the differenced error term Δu_t on previous error terms u_{t-1} from equation (1) as follows

$$\Delta u_t = \rho u_{t-1} + \varepsilon_t, \qquad (2)$$

Equation (2) implies that the cointegration relationship between the variables is symmetric overtime, which means that the value of the present error term u_t changes by ρu_{t-1} whether the previous period's error term u_{t-1} is positive or negative. However if this is not the case, the cointegration relationship is asymmetric and the Engel and Granger (1987) cointegration test outlined in equation (2) is mis-specified. Contemporary research using time series data has indicated that relationship between most major macro economic variables do not adjust symmetrically overtime see Wang and lee (2009). Enders and Granger (1998) found evidence to

8 In this case the policy rate is the Treasury bill rate unlike most of the existing literature that uses the money market rate as the policy rate.

indicate that the relationship between short term and long term interest rates is better modelled using an asymmetric framework. Enders and Siklos (2001) has generalised the Enders and Granger (1998) threshold auto regressive unit root test to make it applicable to test for asymmetric cointegrating relationship between more than one variable. Enders and Granger (1998) confirm that the present unit root and cointegration test have low power if the true relationship between the variables is asymmetric. This research employs the threshold autoregressive (TAR) and the momentum (MTAR) models proposed by Enders and Siklos (2001).

2.1 Asymmetric TAR and MTAR models

Given equation (1) above, if there is asymmetry, equation (2) would be mis-specified, therefore Enders and Siklos (2001) provides the following alternative specification to test for asymmetric cointegration among the interest rates;

Threshold autoregressive (TAR) by writing equation (2) as

$$\Delta u_t = I_t \rho_1 u_{t-1} + (1 - I_t)\rho_2 u_{t-1} + \varepsilon_t \qquad (3)$$

Where I_t is the Heaviside indicator function and is specified as follows

$$I_t = \begin{cases} 1 \; if \quad u_{t-1} \geq \tau \\ 0 \; if \quad u_{t-1} < \tau \end{cases} \qquad (4)$$

Here τ is the threshold value which is used to determine the value of the indicator I_t. If u_{t-1} is greater than or equal to the threshold value (τ) then I_t is equal to one, if u_{t-1} is less the threshold value (τ), I_t is equal to zero. $\varepsilon_t \sim iid$, with mean zero and constant variance. If there auto correlation is present in the model then equation (3) should be rewritten as

$$\Delta u_t = I_t \rho u_{t-1} + (1 - I_t)\rho_2 u_{t-1} + \sum_{j=1}^{p} \gamma_j \Delta u_{t-j} + \varepsilon_t \qquad (5)$$

τ is generally unknown, and therefore has to be estimated. The procedure proposed by Chan (1993) is commonly used in the literature to estimate the value of τ;

Let r_t represent the series of retail interest[9] rate in our model, the procedure is as follows;

1. Sort the series in ascending order ranging from the smallest to the largest value irrespective of time.
2. To treat the problems arising from outliers, delete the smallest and the largest 15% of the observation, keeping just the median 70%.
3. Use OLS to estimate the model repeatedly with all the possible values of τ, and choose the model that provides the minimum error sum of squares which is the model with the correct threshold value.

According to Enders and Siklos (2001); the true nature of the nonlinearity is normally unknown, so Enders and Granger (1998) and Cancer and Hansen (1998) has provided an alternative specification to the TAR model, where the indicator variable depends on the changes in the previous periods error term rather than just the error itself, this is the momentum threshold auto regressive model or the (MTAR) which is specified as follows;

$$\Delta u_t = M_t \rho_1 u_{t-1} + (1 - M_t)\rho_2 u_{t-1} + \varepsilon_t \qquad (6)$$

Where M_t the new indicator variable is given as

[9] Deposit or lending rate

$$M_t = \begin{cases} 1 \ if \ \ \Delta u_{t-1} \ \ \geq \ \ \tau \\ 0 \ if \ \ \Delta u_{t-1} \ \ < \ \ \tau \end{cases} \quad (7)$$

Once more, to account for auto correlation equation (6) must be rewritten as

$$\Delta u_t = M_t \rho_1 u_{t-1} + (1 - M_t)\rho_2 u_{t-1} + \sum_{j=1}^{p} \gamma_j \, \Delta u_{t-j} + \varepsilon_t \quad (8)$$

This MTAR allows us to identify the different impact of upward and downward changes in the error term over time, more specifically it provides a platform for policy to target short term interest rates since it shows if the u_t series exhibit more momentum in one direction or the or the other, see Enders and Siklos (2001). Note that the true nature the asymmetry in our analysis is unknown therefore we will use both the TAR and MTAR models in to examine interest rate pass trough in our group of countries. Providing that the interest rate variables are I(1) and the value of threshold is known, then equations (3),(5), (6) or (8) can be consistently estimated using OLS and the necessary condition for cointegration is that $-2 < (\rho_1 \rho_2) < 0$.

It cannot be assumed that the true nature of the relationship between the variables in our model is asymmetric, we follow Enders and Siklos (2001) to test if the model is symmetric. Additionally, to corroborate the results, we test the null hypothesis $\rho_1 = \rho_2$, this follows a regular f-distribution. If we reject the null it means that the model is asymmetric. Enders and Siklos (2001) propose the following Φ statistic to test the hypothesis of asymmetric cointegration, the null hypothesis is $\rho_1 = \rho_2 = 0$, if the null is rejected then there exist an asymmetric cointegration relationship among the interest rates.

Providing that the government policy rate for the countries in CSME cointegrate with the respective retail interest rates, the error correction model is needed to capture the short run dynamics of the cointegrating relationship which is important. Wang and Lee (2009) believes that traditional error correction mechanism are incapable of treating heteroskedasticity therefore they propose the error correction GARCH in the mean; EC-EGARCH (1,1)-M model. This model will be employed; given that the problem of heteroskedasticity is normally prevalent in errors of the interest rate analysis. The next section outlines the model in detail.

3.2.2 The asymmetric EC-EGARCH (1, 1)-M model

Let us outline the model and its assumptions. Recall equation (3.1), which specifies the long run relationship between retail interest rate and the government policy rate;, where RR_t is the retail lending or deposit rate and PR_t is the government policy rate and u_t is the long run error term. According to Wang and Lee (2009) the parameter β_0 is the fixed mark-up or mark-down in the retail interest rates depending on whether to parameter is positive or negative and β_1 measure the level of interest rate pass through; there is complete pass through if β_1 = 0, there is incomplete pass through if β_1 < 0, and there over pass through if β_1 > 0, if there are no heteroskedasticity and auto correlation problems the usual asymmetric error correction model will take the form,

$$\Delta RR_t = \theta_0 + \sum_{i=1}^{p} \theta_i \Delta RR_{t-i} + r\Delta PR_t + \gamma_1 M_t \hat{u}_{t-1} + \gamma_2 (1 - M_t)\hat{u}_{t-1} + v_t \qquad (9)$$

Where $\hat{u}_{t-1}$ is the usual error correction term, if however, there exist heteroskedasticity in the errors of equation (1) the asymmetric error correction model from equation (9) on its own is not enough to provide the best short run estimates, therefore the EC-EGARCH-M model proposed by Wang and Lee (2009) is used. Equations (10) and (11) respectively, are the conditional mean and the conditional variance equations for the model;

$$\Delta RR_t = \theta_0 + \sum_{i=1}^{p} \theta_i \Delta RR_{t-i} + \sum_{j=1}^{q} \varphi_i \Delta v_{t-j} + r\Delta PR_t + s\sqrt{\sigma_t^2} + \gamma_1 M_t \hat{u}_{t-1} + \gamma_2 (1 - M_t)\hat{u}_{t-1} + v_t \qquad (10)$$

$$\log(\sigma_t^2) = \omega + \alpha \left|\frac{v_{t-1}}{\sigma_{t-1}}\right| + k \frac{v_{t-1}}{\sigma_{t-1}} + b \log(\sigma_{t-1}^2) \quad (11)$$

Let us define each of the variables in equations (10) and (11): ΔRR_t is the differenced retail lending or deposit rate; ΔPR_t is the differenced Treasury bill rate, its parameter r shows how the changes in the retail deposit or lending rate is affected by changes in the Treasury bill rate. ΔRR_{t-i} is the lag autoregressive term, $AR(p)$, Δv_{t-j} is the lag moving average term $MA(q)$, $\sqrt{\sigma_t^2}$ is the time varying standard deviation of the error term v_t, which represents the effect of the interest rate volatility in the mean equation. If the associated parameter s shows the effect of interest rate volatility on interest rates, if it is significantly positive then interest rate volatility has a significant impact on the volatility margins of the interest rates, if however it is significantly negative then the reverse holds true, $M_t\hat{u}_{t-1}$ and $(1 - M_t)\hat{u}_{t-1}$ are the MTAR asymmetric error correction terms which explains the short run dynamics of the model and also corrects any auto correlation in the asymmetric threshold error correction mechanism, where $\hat{u}_{t-1}$ is the previous periods long run error term and $\gamma_1 and\, \gamma_2$ show the effect of the asymmetric error correction term on the retail interest rates, they can be classified as the speed of adjustment parameters. According to Wang and Lee (2009), if these speed of adjustments parameters are positive, interest rates are very responsive to changes in the long run error, conversely, if the speed of adjustment parameters are negative, interest rates are not so responsive to fluctuations in the long run error

The mean equation is also used to examine adjustment rigidity of the retail interest rates. If $\Delta\hat{u}_{t-1} \geq \hat{\tau}$ after the adjustment of the government policy rate, this implies that changes in the long run error of the government policy rate are less than changes in the retail interest rates, which means it is necessary to lower the adjustment margins of the retail interest rates. If

$\Delta\hat{u}_{t-1} < \hat{\tau}$, changes in the long run error of the government policy rate is greater than changes in the retail interest rate , therefore, in this case it is necessary to increase the adjustment margins of the retail interest rates. The asymmetric adjustment parameters $M_t\hat{u}_{t-1}$ and $(1 - M_t)\hat{u}_{t-1}$in the mean equation allows the margins of the retail interest rates to adjust accordingly. Their associated parameters $\gamma_1 and\, \gamma_2$ are the adjustment speed of the positive and negative error terms respectively, see Wang and Lee (2009). Adjustment rigidity exist if $\gamma_1 \neq \gamma_2$; there is upward adjustment rigidity if $|\gamma_1| > |\gamma_2|$ and downward adjustment rigidity if $|\gamma_1| < |\gamma_2|$. The parameter k in conditional variance equation (12) shows asymmetric adjustment effect of the conditional variance of the interest rates. If it is significant and greater than zero then there is an asymmetric effect in the conditional variance, if it is significant yet smaller than zero then there is a leverage effect, see Wang and Lee (2009).

The log likelihood function to estimate the asymmetric EC-EGARCH (1,1)-M model is as follows;

$$\log L = -(T/2)\log(2\pi) - (1/2)\sum_{t=1}^{T}(v_t^2/\sigma_t^2) \quad (12)$$

If the true cointegrating relationship is symmetric then equation (11) should be re-specified to a symmetric form as

$$\Delta RR_t = \theta_0 + \sum_{i=1}^{p}\theta_i\Delta RR_{t-i} + \sum_{j=1}^{q}\varphi_i\Delta v_{t-j} + r\Delta PR_t + s\sqrt{\sigma_t^2} + \gamma_1\hat{u}_{t-1} + +v_t \quad (13)$$

If there are no asymmetries and no heteroskedasticity in the cointegration relationship between the government policy rate and the respective retail interest rate, revert to a simplified version of the error correction model specified as follows;

$$\Delta RR_t = \theta_0 + \sum_{i=1}^{p} \theta_i \Delta RR_{t-i} + + r\Delta PR_t + \gamma_1 \hat{u}_{t-1} + v_t \quad (14)$$

Additionally if there is heteroskedasticity but no cointegrating relationship employ just the EGARCH (1, 1)-M equation by re-specifying equation (11) as

$$\Delta RR_t = \theta_0 + \sum_{i=1}^{p} \theta_i \Delta RR_{t-i} + \sum_{j=1}^{q} \varphi_i \Delta v_{t-j} + r\Delta PR_t + s\sqrt{\sigma_t^2} + v_t \quad (15)$$

The usual post estimation diagnostic test for the error correction models are used as well. The next section provides the results of the unit root test and its diagnostics, the Wald test and F-tests, the cointegration tests, the long run parameter estimates, the results from the error correction models and the EC-GARCH-M models.

4 Empirical Results and Discussion

4.1 Unit root and asymmetric cointegration Tests results

Table 4 show the results for the Augmented Dickey-Fuller (1979) and the Phillips Perron (1988) unit root tests. The lag lengths for both tests are selected automatically by the AIC criterion. The results are as follows: Both tests confirm that all three interest rates; the treasury bill rate, the lending rate and the deposit rate for Barbados, Guyana, Haiti, Jamaica and Trinidad and Tobago are integrated first difference I(1) series at the 1% , 5% and 10% level of significance. The results from the Dickey Fuller (1979) test show that the Treasury bill rate, the deposit rate and the lending rate for St. Lucia[10] and by extension the other member of the OECS are integrated first difference I(1) series, while the results from the Phillips Perron (1988) test show that the treasury bill rate and the deposit rate are stationary at levels. Notwithstanding this, all six countries

[10] All the countries from the OECS have one single central bank therefore they have the same Treasury bill rate, the results from one country can generalize for all the counties in the union.

including St. Lucia[11] are examined for asymmetric cointegration relationships between the Treasury bill rate and the respective retail rates. Before doing so, a DOLS[12] model is estimated for equation (1) to obtain the long run parameters for relationship between the Treasury bill rate and the deposit and lending rates for all countries, the results are given in table 4. The results show there is complete pass through from the Treasury bill rate to the retail lending rates for Trinidad and Tobago and St. Lucia only. This is similar to the results for the US see Wang and Lee (2009) who found complete pass through for the US deposit rate but incomplete pass through for the remaining nine Asian countries in their study. Complete pass through for the US deposit rate is expected given that the US has a highly developed and functioning financial system which allows commercial banks to fully transfer any increases in their financing cost to the consumers by increasing the retail rates. This is not the case for the countries from Asia or CSME except Trinidad and Tobago, St. Lucia and by extension the other members of the OECS, who can successfully transfer any changes in the Treasury bill rate to their retail lending rates. Monetary policy is more coordinated among these countries, which make monetary policy more effective. There are similar results for the EU see Karagiannis et al (2010). The interdependence of the monetary policy between countries ensures that monetary policy is carried out in the best interest of all countries hence it is more efficient. There is complete pass through from the money market rate to the deposit rate in the EU.

There is a significant mark up effect for the lending rate for all six countries; Barbados, Guyana, Haiti, Jamaica and Trinidad and Tobago and St. Lucia, ranging from as high as 19.95 for Haiti to a low of 0.766 for Jamaica. While, there is a significant mark down effect for the deposit rate for Haiti, Guyana, Jamaica and St. Lucia. Wang and Lee (2009) also found a significant mark up for the lending rate all Asian countries in their study and the US. They found a significant mark up effect for the deposit rate for seven out of the nine Asian countries but not for the US.

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[11] The ADF test confirms that the Treasury bill rate, the lending rate and deposit rate are I(1) for St. Lucia.
[12] Dynamic Ordinary Least Squares: provides better estimates of the long run parameters since the variables are nonstationary in their levels

The next step examines asymmetric cointegration between the Treasury bill rate and the respective retails rates using the TAR and MTAR cointegration models, the results are given in Table 5. The TAR model shows asymmetric cointegration for Guyana, Jamaica and St. Lucia lending and deposit rates, however, symmetric cointegration for Barbados, Haiti and Trinidad and Tobago. Compared to the results from Wang and Lee (2009), the TAR model shows asymmetry for four of the ten countries in their study, Hong Kong Indonesia and the US deposit rate and Hong Kong Lending rate only. The MTAR model in Wang and lee (2009) found asymmetric cointegration in Hong Kong, Malaysia, the Philippines, Singapore and Taiwan. The results from our MTAR model show asymmetric cointegration for Guyana, Jamaica, and St. Lucia lending rate but symmetric cointegration for Barbados, Haiti and Trinidad and Tobago. There is asymmetric cointegration for Guyana and St. Lucia deposit rate but symmetric cointegration for Barbados, Haiti, Jamaica and Trinidad and Tobago. Our results of the F-test suggest cointegration for both the deposit and lending rate for all countries. The Standard post estimation diagnostic tests indicate no auto-correlation but reject the null hypothesis of a constant variance in the cointegrating errors in both the TAR and MTAR models for each country. The regular unrestricted error correction models are not sufficient to correct for heteroskedasticity in the cointegrating errors, so we employ the error correction exponential GARCH in the mean model, proposed by Wang and Lee (2009). The results are provided in the next section.

4.2 Results for the Error Correction and the EC-EGARCH(1,1)-M model

The EC-EGARCH(1,1)-M model is outline by equations (10) and (11) which are the conditional mean and variance equation respectively. The symmetric EC-EGARCH (1,1)-M model is estimated for Barbados, Haiti and Trinidad and Tobago lending and deposit rates and asymmetric EC-EGARCH(1,1)-M model is estimated for Guyana, Jamaica and St. Lucia. The results are displayed in tables 6 to 11 and summarised in table 1.

4.2.1 Deposit rate:

Barbados: the parameters s and γ_1 are statistically significant, the negative value for s indicates that interest rate volatility has a negative effect on changes in the retail deposit rate. $\gamma_1$is also negative, therefore the speed of adjustment parameter does not fluctuate much with the long run equilibrium error. Bias adjustments could allow the short run disequilibrium in the lending rate to converge to its long run equilibrium, see Wang and Lee (2009) ***Guyana:*** the parameters r, statistically significant and greater than zero. Unlike Barbados, this shows a positive relationship between the deposit rate adjustment margins and the Treasury bill rate. Interest rate volatility s has a negative effect on changes in the retail deposit rate similar to Barbados. The parameters γ_1, γ_2 and k are negative; the retail interest rate does not change a lot with the long run equilibrium error and there is leverage effect in the conditional variance. There is downward adjustment rigidity given that $|\gamma_1| < |\gamma_2|$ in the model for the deposit rate. ***Haiti:*** γ_1 and s are negative and significant; the retail deposit rate does not fluctuate as much with the long run equilibrium error and interest rate volatility has a negative effect on the retail deposit rate. k and r, are positive, there is an asymmetric effect in the conditional variance and a positive relationship between the treasury bill adjustment margins and the retail deposit rate***.*** ***Jamaica:*** The speed of adjustment parameters γ_1 and γ_2 are positive, as a result, the deposit rate changes to a great extent overtime with the long run equilibrium error. There is leverage effect since k are negative. Here, there is upward adjustment rigidity given that $|\gamma_1| > |\gamma_2|$ in the model for the deposit rate. ***Trinidad and Tobago***: There is a positive relationship between the deposit rate adjustment margins and the Treasury bill rate, Interest rate volatility has a negative effect on changes in the retail deposit rate given that s is negative. The parameter $\gamma_1$is significantly negative indicating that the retail deposit rate does not fluctuate to a great extent with the long run equilibrium error. Like the lending rate for Haiti, bias adjustments could allow the short run disequilibrium in the lending rate to converge to its long run equilibrium, see Wang and Lee (2009). The parameter k is negative for the deposit signalling that there exists a leverage effect in the conditional variance. ***St. Lucia****:* and by extension the rest of the OECS: k is positive there is asymmetric effect in the conditional variance, γ_1 and γ_2 are less than zero so deposit rate does not fluctuate as much with the long run error, here like Barbados, Haiti, Guyana and Trinidad and Tobago, bias adjustments could allow the short run disequilibrium in the lending rate to converge to its long run equilibrium, see Wang and Lee (2009). There is downward adjustment rigidity in the deposit rate since $|\gamma_1| < |\gamma_2|$.

4.2.2 Lending Rate:

Barbados: there is an asymmetric effect in the conditional variance, the parameter k is significantly positive. The parameter r statistically significant for the retail lending rate, this positive adjustment ratio indicates that there is a positive relationship between the lending rate adjustment margins and the Treasury bill rate in Barbados. ***Guyana:*** there is an asymmetric effect in the conditional variance since the parameter k is significantly positive. Here the parameters r is significantly less than zero, the negative adjustment ratio shows a negative relationship between the lending rate adjustment margins and the Treasury bill rate. γ_2 is less than zero so the retail lending rate fluctuates less with the long run error. Like the deposit rate, $|\gamma_1| < |\gamma_2|$ showing downward adjustment rigidity. ***Haiti:*** all four parameters s, r, k and γ_1 are significantly negative. Interest rate volatility has a negative effect on the conditional variance, there is a negative relationship between the lending rate adjustment margins and the Treasury bill rate and the lending rate changes to a minor extent overtime with the long run equilibrium error. Once more, bias adjustments could allow the short run disequilibrium in the lending rate to converge to its long run equilibrium, see Wang and Lee (2009). The parameter k has opposite effect to the deposit rate; here there is a leverage effect in the conditional variance for the lending rate. ***Jamaica:*** there is a leverage effect in the conditional variance since the parameter k is significantly positive. γ_2 is greater than zero, as a result the retail lending rate fluctuates very much with the long run equilibrium error. Like the deposit rate, $|\gamma_1| > |\gamma_2|$ showing upward adjustment rigidity. This indicates that the collusive price arrangement is supported for the deposit and lending rate see Wang and Lee (2009). ***Trinidad and Tobago***: like the deposit rate, **t**here is a positive relationship between the lending rate adjustment margins and the Treasury bill rate, k is also negative for the lending rate signalling that there exists a leverage effect in the conditional variance***. St. Lucia:*** k is positive so there is also asymmetric effect in the conditional variance for the lending rate. The speed of adjustment parameters γ_1 and γ_2 are positive meaning that the lending rate changes a lot overtime with the long run equilibrium error. There is downward adjustment rigidity in the lending as well since $|\gamma_1| < |\gamma_2|$. Interest rate volatility has no effect on changes in the retail lending rate and deposit rate given that s is insignificant.

4.3 Empirical Discussion

Table 1 summarizes our results and table 2 summarizes the results from Wang and Lee (2009). There is complete pass through to the retail lending rate for Trinidad and Tobago and St. Lucia, but there is incomplete pass through for the other countries in the study. This is similar to the results of Wang and Lee (2009), where there is incomplete pass through for most of the countries except for the US deposit rate. Wang and Lee (2009) outline that under the classical assumption of the Bertrand model, if information in the banking system is symmetric and the market is perfectly competitive, the marginal price must equal to marginal cost. Therefore, any changes in marginal cost should offset a unit elastic change in marginal prices. The one to one ratio indicates that under such market mechanism the pass through is complete. This only exists in the lending rate for Trinidad and Tobago, St. Lucia and by extension the rest of the OECS but not in the other countries in CSME. This is good for Trinidad and Tobago and the OECS since the retail lending rate stimulate investment and the supply of loanable funds which is a key avenue for expansionary monetary policy.

For the other countries where there is no pass through, their markets are too small to be perfectly competitive; changes in the marginal cost are not fully transferred to marginal prices, resulting in incomplete pass through due to asymmetric information in the Banking system. Fundamentally, there is incomplete pass through in each of these countries because interest rates are not determined by the market but by other external factors, see Wang and Lee (2009). For example, the government might want to stimulate the economy by artificially inducing commercial banks to reduce the retail lending rate. This new loan rate is different from the real equilibrium rate that would have been determined by the market mechanism. The pass through coefficient in this case does not reflect a true change which contributes to incomplete pass through in the long run. This is a disadvantage to central banks because they fail to achieve the objective that they tried to achieve in the first instance and monetary policy is less effective.

For the countries with asymmetric cointegration, the literature shows that the lending rate displays downward rigidity or sticky on the down side while the deposit rate displays upward rigidity or sticky on the upside, see Wang and Lee (2009). There is upward adjustment rigidity in the deposit rate for Hong Kong Malaysia the Philippines, Singapore and Taiwan and downward rigidity in the lending rate for Hong Kong Philippines and Taiwan. Compared to our results; there is upward adjustment rigidity for Jamaica lending and deposit rates, and downward adjustment rigidity for Guyana and St. Lucia lending and deposit rates. The upward adjustment rigidity of Jamaica deposit rate and the downward adjustment rigidity of Guyana and St. Lucia lending rate are similar to the results of Wang and Lee (2009). They argue that downward adjustment rigidity in the lending rate is consistent with the collusive pricing arrangement hypothesis. From our results, St. Lucia and Guyana lending rate display downward adjustment rigidity which is also indicative of collusive pricing hypothesis. De Bondt (2005) claims that if there is asymmetric information in the market mechanism, the borrower has less incentive to repay their debt; in this situation the banks loses more as interest rates increases. Wang and Lee (2009) suggest that in this case, the bank has to increase its lending rate to cover losses that may occur due to borrower's default. This is why the lending rate in some countries will not fall in response to a decline in the Treasury bill rate, they are rigid downwards. Jamaica does not display this characteristic since its lending rate is rigid on the upside.

Similar to the results of Wang and Lee (2009), our results show that the lending rate is associated with a mark up for all countries. Commercial Banks mark up the lending rate regardless if there is pass through or not. The aim of the bank is to cover the cost or any losses they may incur due to increase in the Treasury bill rate. On the contrary, only one country out of ten from Wang and Lee (2009) show a mark down in the deposit rate compared to four out of six countries from our study. Haiti, Guyana, Jamaica and St. Lucia all show mark downs for the deposit rates but only Hong Kong from Wang and Lee (2009). Our results show that in most instances mark ups are more significant than mark downs as in Wang and Lee (2009).

Notice as well that the retail interest rates in each country in our sample move together, if the deposit rate for a particular country is rigid downwards then the lending rate is also rigid downwards and vice versa. The nature of the banking system does not allow each interest rate to move independent of the other. Figures 1 to 12 plot the movement of all three interest rates over time for each country. Observe that movements in the deposit and lending rate are almost parallel to each other. Tables 12 and 13 give the summary statistics for the interest rate variables in levels and first differences respectively.

5 Conclusion

This paper analyses level of asymmetric interest rate pass through and the impact of interest rate volatility on the retail lending and deposit rate in the CSME using the Asymmetric TAR and MTAR cointegration models, and the EC-EGARCH(1, 1)-M model of Wang and Lee (2009), who did the same for the US and nine Asian countries. Our results show that there is incomplete pass through for all countries in CSME except for the lending rate for Trinidad and Tobago, St. Lucia and by extension all the countries in the OECS. Wang and Lee (2009) found similar pass through for the US deposit rate. The TAR and MTAR models show asymmetric cointegration for Guyana, Jamaica and St. Lucia both lending and deposit rates. The data for St. Lucia, Guyana and Jamaica support the collusive pricing arrangement hypothesis. Compared to Wang and Lee (2009) where there is asymmetric cointegration the deposit rate for five countries and the lending rate for three countries out of ten. The results from the EC-EGARCH(1, 1)-M models shows that for the countries where there is asymmetric cointegration the deposit rate has upward adjustment rigidity and the lending rate has downward adjustment rigidity. Compared to our results, there is asymmetric cointegration for Guyana, Jamaica and St. Lucia lending and deposit rates. Unlike the countries from Asia, see Wang and Lee (2009), both rates for Jamaica display upward adjustment rigidity and both rates for Guyana and St. Lucia display downward adjustment

Note that volatility has a negative effect on the deposit rate for Barbados, Guyana Haiti and Trinidad and Tobago, a positive effect on the deposit rate for Jamaica, a negative effect on the lending rate for Guyana but no effect on either the deposit rate or the lending rate for St. Lucia. Compared to Wang and Lee (2009), it has a positive effect on the deposit rate of the Philippines and the US and negative effect in Korea, Malaysia, Thailand and Taiwan. Volatility has a positive effect in Hong Kong, Japan and Malaysia and a negative effect in the Philippines, Singapore and Taiwan lending rates. Overall, the findings of this paper provides information on the level of asymmetry, the impact of volatility on interest rate determination and the type of rigidity in each of the different retail rates in the CSME. It also provides a comparison of the effectiveness of monetary policy in the Caribbean with monetary policy in the US and Asia and the impact of interest rates volatility which generates risk on the retail interest rates in the CSME, the US and Asia. The findings are useful to policymaker, central banks and potential investors who want to compare the risk and return on their investment in Caribbean the US and Asia.

Appendix 1: Results Summary

	Mark up/ mark down $\hat{\beta}_0$	Full Pass through $\hat{\beta}_1$	Pass through mechanism	Impact of interest rate volatility s	Asymmetry of the conditional variance k	Adjustment rigidity	hypothesis
Barbados							
deposit	Mark up	no	symmetric	negative			
Lending	Mark up	no	symmetric		positive		
Guyana							
deposit		no	asymmetric	negative	negative	downward	
Lending	Mark up	no	asymmetric	negative	positive	downward	CPA
Haiti							
deposit		no	symmetric	negative	positive		
Lending	Mark up	no	symmetric		negative		
Jamaica							
deposit		no	asymmetric		negative	Upward	CPA
Lending	Mark up	no	asymmetric	positive	positive	Upward	
Trinidad and Tobago							
deposit		no	symmetric	negative	Negative		
Lending	Mark up	yes	symmetric		Negative		
St. Lucia					positive		
deposit		no	asymmetric		positive	downward	
Lending	Mark up	yes	asymmetric			downward	CPA

Table 1: Results summary for each country from the CSME, CPA mean collusive pricing arrangement hypothesis.

	Mark up/ mark down $\hat{\beta}_0$	Full Pass through $\hat{\beta}_1$	Pass through mechanism	Impact of interest rate volatility s	Asymmetry of the conditional variance k	Adjustment rigidity	hypothesis
Hong Kong							
deposit		no	asymmetric		positive	upward	
Lending	Mark up	no	asymmetric	positive	positive	downward	CPA
Indonesia							
deposit	Mark up	no					
Lending	Mark up	no					
Japan							
deposit		no			positive		
Lending	Mark up	no		positive			
Korea							
deposit	Mark up	no		negative	positive		
Lending	Mark up	no			negative		
Malaysia							
deposit	Mark up	no	asymmetric	negative		upward	
Lending	Mark up	no		positive			
Philippines							
deposit	Mark up	no	asymmetric	positive		upward	
Lending	Mark up	no	asymmetric	negative		downward	CPA
Singapore							
deposit	Mark up	no	asymmetric		positive	upward	
Lending	Mark up	no	symmetric		positive		
Thailand							
deposit	Mark up	no		negative	positive		
Lending	Mark up	no		negative	negative		
Taiwan							
deposit	Mark up	no	asymmetric	negative	positive	upward	
Lending	Mark up	no	asymmetric		positive	downward	CPA
Us							
deposit		yes	symmetric	positive	positive		
Lending	Mark up	no					

Table 2: Results Summary for the US and nine Asian countries: Extracted from Wang and Lee (2009), CPA mean collusive pricing arrangement hypothesis.

Appendix 3.2: Tables

	levels			First difference		
	ADF Tests Statistic	PP test rho	Z(t)	ADF Tests Statistic	PP test rho	Z(t)
Barbados						
Treasury bill	-2.408(8)	-7.195	-2.075	-5.959(4)*	-129.194(4)*	-9.928*
deposit	-2.167(6)	-3.118	-1.181	-4.807(3)*	-218.121(4)*	-13.734*
Lending	-2.885(6)	-5.587	-1.684	-4.248(9)*	-207.497(4)*	-13.021*
Haiti						
Treasury bill	-2.816 (4)	-10.214	-2.153	-6.832(1)*	-100.309(4)*	-8.538*
deposit	-2.290 (8)	-6.336	-1.628	-5.683(3)*	-234.552(4)*	-15.956*
Lending	-2.576 (6)	-16.813	-3.170	-5.040(11)*	-230.926(4)*	-19.820*
Guyana						
Treasury bill	-2.192(12)	-5.351	-3.559	-4.478(4)*	-187.739(4)*	-12.493*
deposit	-2.360(8)	-2.140	-1.909	-5.162(3)*	-189.637(4)*	-13.011*
Lending	-2.310(6)	-3.179	-2.590	-5.390(4)*	-158.933(4)*	-11.730*
Jamaica						
Treasury bill	-2.647(8)	-10.283	-2.230	-6.066(7)*	-161.801(4)*	-11.509*
deposit	-1.698(6)	-9.373	-3.346	-6.083(8)*	-182.005(4)*	-12.854*
Lending	-2.997(6)	-3.321	-2.597	-8.409(1)*	-170.006(4)*	-13.299*
St. Lucia						
Treasury bill	-2.042(3)	-19.163**	-3.063**	-6.652(4)*	-220.967(4)*	-19.473*
deposit	-2.807(5)	-16.036**	-2.892**	-5.887(4)*	-182.561(4)*	-13.419*
Lending	-2.614(7)	-11.456**	-2.380**	-5.320(6)*	-195.993(4)*	-13.730*
Trinidad and Tobago						
Treasury bill	-1.067(8)	-0.786	-0.356	-8.613(1)*	-113.218(4)*	-9.169*
deposit	-0.676(6)	-3.912	-1.252	-9.140(1)*	-237.638(4)*	-16.565*
Lending	-0.927(6)	-1.606	-0.775	-9.108(1)*	-174.413(4)*	-12.467*

Table 3: Results for the unit root test for the deposit and lending rate for each country ** and * represents significance at the 5% and 1% level respectively. Lags are in brackets.

	$\hat{\beta}_0$	$\hat{\beta}_1$	$h_o: \hat{\beta}_1 = 1$
Barbados			
Deposit	2.05(0.000)	0.437(0.000)	762.180(0.000)
Lending	8.22(0.000)	0.299(0.000)	1259.890(0.000)
Haiti			
Deposit	-2.371(0.000)	0.700(0.000)	68.780(0.000)
Lending	19.954(0.000)	0.116(0.1.37)	135.800(0.000)
Guyana			
Deposit	-0.468(0.001)	0.891(0.000)	31.320(0.000)
Lending	13.563(0.000)	0.339(0.000)	3851.000(0.000)
Jamaica			
Deposit	-3.658(0.000)	0.749(0.000)	79.370(0.000)
Lending	0.766(0.443)	1.149(0.000)	9.580(0.002)
St. Lucia			
Deposit	-3.568(0.000)	1.359(0.000)	6.280(0.013)
Lending	4.256(0.002)	1.381(0.000)	2.500(0.116)
Trinidad and Tobago			
Deposit	0.029(0.919)	0.760(0.000)	73.900(0.000)
Lending	5.989(0.000)	0.969(0.000)	1.150(0.286)

Table 4: Dynamic Ordinary Least Square Estimation of the long run parameters from equation (1), the Wald test examines the hypothesis of complete pass through; $h_o: \hat{\beta}_1 = 1$, p-values are in parentheses.

	TAR				MTAR			
	lags	Φ	F-statistic	τ	lags	MΦ	F-statistic	τ
Barbados								
deposit	1	9.350	21.720*	-0.013	2	10.040	21.740*	-0.019
Lending	2	9.250	17.210*	-0.021	3	9.940	17.570	-0.006
Haiti								
deposit	3	9.270	11.840*	-0.062	2	10.040	14.240*	-0.031
Lending	2	9.250	12.660*	-0.171	4	9.850	10.170	-0.040
Guyana								
deposit	1	9.350	90.680*	-0.0802	4	9.850	13.650*	-0.051
Lending	2	9.250	27.710*	-0.045	2	10.040	27.790*	-0.014
Jamaica								
deposit	2	9.250	25.860*	-0.141	3	9.940	21.31*	-0.192
Lending	3	9.270	23.360*	-0.151	4	9.850	13.610*	-0.014
St. Lucia								
deposit	2	9.250	42.090*	-0.235	2	10.040	41.090*	-0.138
Lending	2	9.250	39.930*	-0.029	2	10.040	43.170*	-0.030
Trinidad and Tobago								
deposit	2	9.250	23.700*	-0.090	3	9.940	18.400*	-0.057
Lending	2	9.250	23.580*	-0.024	4	9.850	12.880*	-0.054

	$\boldsymbol{\rho_1}$	ρ_2	$\rho_1 = \rho_2$	$\boldsymbol{\rho_1}$	ρ_2	$\rho_1 = \rho_2$
Barbados						
deposit	-0.881	-0.682	2.25(0.144)	-0.647	-0.824	1.780(0.184)
Lending	-0.734	-0.653	0.19(0.665)	-0.663	-0.779	0.790(3.75)
Haiti						
deposit	-0.591	-0.575	0.010(0.933)	-0.660	-0.390	2.670(0.104)
Lending	-0.558	-0.553	0.000(0.981)	-0.642	-0.376	2.630(0.107)
Guyana						
deposit	-1.117	-0.697	13.300(0.000)*	-0.961	-0.465	6.600(0.011)*
Lending	-1.063	-0.670	12.010(0.000)*	-0.908	-0.337	24.970(0.000)*
Jamaica						
deposit	-0.927	-0.525	8.130(0.004)*	-0.769	-0.669	0.290(0.594)
Lending	-1.05	-0.494	8.370(0.004)*	-0.867	-0.415	6.110(0.014)*
St. Lucia						
deposit	-1.653	-1.148	14.180(0.000)*	-1.661	-1.662	13.920(0.000)*
Lending	-1.688	-1.354	9.910(0.000)*	-1.696	-1.288	15.750(0.000)*
Trinidad and Tobago						
deposit	-0.583	-0.664	0.260(0.605)	-0.658	-0.627	0.040(0.838)
Lending	-0.600	-0.656	0.070(0.796)	-0.642	-0.427	2.600(0.109)

Table 5: Results for the TAR and MTAR asymmetric cointegration test, * represents significance at the 1% level, and rejection of the null hypothesis of symmetry in the lower half of the table, p-values are in parenthesis. Φ is the 5% critical value extracted from Wane (2004), τ is the threshold value

Barbados

Deposit Rate			Lending Rate		
coefficient	estimate	p-value	coefficient	estimate	p-value
s	-0.969	0.000*	s	0.698	0.625
θ_1	0.115	0.109	θ_1	-0.087	0.733
θ_2	0.007	0.820	θ_2	0.143	0.081
θ_3	0.041	0.311	θ_3	0.025	0.800
θ_4	0.0692	0.097	θ_4	-0.004	0.972
θ_5	0.136	0.002*	θ_5	0.111	0.223
θ_6	0.027	0.622	φ_1	-1.085	0.613
φ_1	0.358	0.000*	φ_2	0.044	0.245
φ_2	0.035	0.070	φ_3	0.009	0.854
φ_3	0.023	0.267	φ_4	0.069	0.068
φ_4	0.007	0.711	φ_5	-0.019	0.625
φ_5	-0.001	0.941	φ_6	-0.001	0.990
φ_6	0.035	0.050	φ_7	0.018	0.708
φ_7	0.005	0.758	φ_8	-0.001	0.981
φ_8	0.031	0.054	φ_9	0.041	0.172
φ_9	0.038	0.023*	φ_{10}	0.042	0.185
φ_{10}	0.053	0.006*			
r	0.002	0.766	r	0.060	0.046*
γ_1	-7.554	0.000*	γ_1	17.360	0.627
Variance Equation					
ω	-6.173	0.000	ω	-3.80	0.004*
α	1.287	0.000	α	-0.303	0.061
k	-0.069	0.583	k	0.273	0.047*
b	-0.233	0.014	b	0.003	0.991
Durbin-Watson stat	2.156		Durbin-Watson stat	1.819	

Table 6: Estimated results from the EC-EGARCH(1,1)-M for Barbados, coefficients from equation (10) and (11), * represent 1% level of significance

Guyana

Deposit Rate			Lending Rate		
coefficient	estimate	p-value	coefficient	estimate	p-value
s	-0.908	0.000	s	-0.157	0.000
θ_1	-0.1667	0.000	θ_1	0.045	0.000
θ_2	0.070	0.000	θ_2	-0.153	0.0000
θ_3	-0.082	0.000	θ_3	-0.030	0.221
θ_4	-0.041	0.001	θ_4	-0.030	0.1274
θ_5	0.187	0.000	θ_5	0.001	0.950
			θ_6	0.048	0.004
φ_1	0.339	0.000	φ_1	0.025	0.000
φ_2	0.056	0.000	φ_2	-0.007	0.062
φ_3	0.0151	0.037	φ_3	0.021	0.000
φ_4	0.017	0.050	φ_4	0.002	0.611
			φ_5	0.025	0.000
-			φ_6	-0.001	0.694
-			φ_7	0.014	0.000
-			φ_8	-0.009	0.000
-			φ_9	0.007	0.074
-			φ_{10}	0.021	0.000
r	0.039	0.000	r	-0.012	0.000
γ_1	-1.239	0.000	γ_1	-0.029	0.201
γ_2	-1.974	0.000	γ_2	-0.090	0.007
Variance Equation					
ω	-4.113	0.000	ω	-1.014	0.000
α	0.879	0.000	α	1.246	0.000
k	-1.336	0.000	k	1.381	0.000
b	0.253	0.000	b	0.967	0.000
Durbin-Watson stat	2.156		Durbin-Watson stat	1.819	

Table 7: The estimated results from the EC-EGARCH(1,1)-M for Guyana, coefficients from equation (10) and (11), * represent 1% level of significance

Haiti

Deposit Rate			Lending Rate		
coefficient	estimate	p-value	coefficient	estimate	p-value
s	-2.256	0.000	s	-0.183	0.068
θ_1	-0.355	0.000	θ_1	-0.761	0.000
θ_2	-0.192	0.005	θ_2	-0.643	0.000
θ_3	-0.124	0.217	θ_3	-0.361	0.000
θ_4	0.063	0.592	θ_4	-0.320	0.000
θ_5	0.091	0.393	θ_5	-0.172	0.000
θ_6	-0.002	0.982	θ_6	0.067	0.058
φ_1	11.54	0.000	φ_1	1.337	0.000
φ_2	0.177	0.007	φ_2	0.061	0.001
φ_3	0.095	0.080	φ_3	0.001	0.959
φ_4	-0.019	0.774	φ_4	0.059	0.000
φ_5	0.104	0.095	φ_5	0.055	0.000
φ_6	-0.007	0.913	φ_6	0.054	0.000
φ_7	0.090	0.136	φ_7	0.071	0.000
φ_8	-0.145	0.023	φ_8	-0.012	0.191
φ_9	0.160	0.000	φ_9	-0.086	0.000
-			φ_{10}	-0.100	0.000
r	0.213	0.000	r	-0.031	0.076
γ_1	-58.950	0.000	γ_1	-23.534	0.000
Variance Equation					
ω	0.088	0.000	ω	-1.643	0.000
α	-0.078	0.000	α	2.205	0.000
k	0.066	0.000	k	-0.719	0.000
b	0.899	0.000	b	0.892	0.000
Durbin-Watson stat	2.156		Durbin-Watson stat	1.819	

Table 8: display the estimated results from the EC-EGARCH(1,1)-M for Haiti, coefficients from equation (10) and (11), * represent 1% level of significance

Jamaica

Deposit Rate			Lending Rate		
coefficient	estimate	p-value	coefficient	estimate	p-value
s	0.115	0.30	s	0.215	0.000
θ_1	0.055	0.00	θ_1	0.062	0.000
θ_2	0.050	0.009	θ_2	0.067	0.080
θ_3	0.302	0.000	θ_3	0.073	0.023
θ_4	-0.047	0.172	θ_4	0.056	0.444
θ_5	-0.095	0.000	θ_5	0.066	0.231
θ_6	-0.153	0.000	φ_1	0.014	0.000
θ_7	-0.079	0.000	φ_2	0.025	0.948
φ_1	-0.0502	0.127	φ_3	0.022	0.314
φ_2	0.064	0.000	-		
φ_3	-0.036	0.000	-		
φ_4	0.026	0.018	-		
r	0.016	0.066	r	0.023	0.838
γ_1	0.843	0.000	γ_1	0.005	0.251
γ_2	0.609	0.012	γ_2	0.003	0.0011
Variance Equation					
ω	-4.240	0.000	ω	-0.000	0.991
α	-1.821	0.068	α	-0.050	0.001
k	-14.360	0.000	k	0.045	0.021
b	8.109	0.000	b	0.991	0.000
Durbin-Watson stat	1.800		Durbin-Watson stat	1.591	

Table 9: The estimated results from the EC-EGARCH(1,1)-M for Jamaica, coefficients from equation (10) and (11), * represent 1% level of significance

Trinidad and Tobago

Deposit Rate			Lending Rate		
coefficient	estimate	p-value	coefficient	estimate	p-value
s	-1.659	0.000	s	0.124	0.362
θ_1	-0.349	0.000	θ_1	-0.076	0.004
θ_2	-0.006	0.907	θ_2	-0.009	0.798
θ_3	-0.025	0.623	θ_3	0.099	0.007
θ_4	-0.114	0.001	θ_4	0.1014	0.006
θ_5	-0.025	0.621	θ_5	-0.060	0.017
θ_6	0.0153	0.811	θ_6	0.073	0.091
θ_7	0.092	0.006	θ_7	-0.0748	0.126
θ_8	-0.021	0.560	θ_8	0.234	0.000
-			θ_9	0.095	0.000
-			θ_{10}	0.018	0.419
-			θ_{11}	0.054	0.120
φ_1	17.056	0.000	φ_1	-0.032	0.887
φ_2	-0.009	0.914	φ_2	0.110	0.042
φ_3	0.154	0.098	φ_3	-0.076	0.011
φ_4	0.179	0.055	φ_4	-0.042	0.273
φ_5	0.220	0.016	φ_5	0.220	0.000
φ_6	0.109	0.111	φ_6	0.151	0.000
			φ_7	-0.021	0.604
			φ_8	0.059	0.148
r	0.277	0.000	r	0.2477	0.000
γ_1	-51.602	0.000	γ_1	-0.656	0.552
Variance Equation					
ω	-2.286	0.000	ω	-3.331	0.000
α	0.869	0.000	α	-1.359	0.000
k	-0.331	0.000	k	-1.670	0.000
b	-0.086	0.232	b	-0.518	0.000
Durbin-Watson stat	2.380		Durbin-Watson stat	1.878	

Table 10: The estimated results from the EC-EGARCH (1, 1)-M for Trinidad and Tobago, coefficients from equation (10) and (11), * represent 1% level of significance

St. Lucia

Deposit Rate			Lending Rate		
coefficient	estimate	p-value	coefficient	estimate	p-value
s	-0.325	0.1563	s	0.002	0.977
θ_1	0.017	0.7643	θ_1	-0.110	0.118
θ_2	0.045	0.0095	θ_2	-0.061	0.116
θ_3	-0.071	0.1775	θ_3	0.085	0.002
θ_4	0.050	0.0045	θ_4	0.033	0.297
θ_5	-0.184	0.0000	-		
θ_6	0.106	0.0001	-		
φ_1	0.682	0.0000	φ_1	-0.103	0.000
φ_2	-0.027	0.4942	φ_2	0.329	0.000
φ_3	0.052	0.3153	φ_3	-0.147	0.003
φ_4	0.087	0.0000	φ_4	0.004	0.952
φ_5	0.252	0.0000	φ_5	-0.258	0.000
φ_6	-0.051	0.4184	φ_6	0.132	0.002
φ_7	0.063	0.0409	φ_7	0.016	0.782
r	0.043	0.2379	r	0.063	0.022
γ_1	-3.762	0.0000	γ_1	3.046	0.000
γ_2	-4.114	0.0000	γ_2	6.865	0.000
Variance Equation					
ω	-6.135	0.0000	ω	-1.998	0.000
α	1.195	0.0000	α	1.350	0.000
k	0.6946	0.0000	k	1.070	0.000
b	-0.265	0.0351	b	0.618	0.000
Durbin-Watson stat	2.156		Durbin-Watson stat	1.819	

Table 11: The estimated results from the EC-EGARCH(1,1)-M for St. Lucia, coefficients from equation (10) and (11), * represent 1% level of significance

Barbados	Barbados TBR	Guyana TBR	Haiti TBR	Jamaica TBR	St. Lucia TBR	Trinidad and Tobago TBR
Mean	4.439	6.971	16.66	19.742	5.635	7.369
Median	4.710	4.450	17.20	17.335	6.000	7.000
Maximum	8.400	18.840	27.83	43.650	6.400	12.110
Minimum	0.240	2.840	4.000	10.490	4.450	1.150
Std. Dev.	2.024	3.955	7.160	7.385	0.529	2.939
Skewness	-0.173	1.131	0.034	1.468	-1.252	-0.124
Kurtosis	2.336	3.661	1.815	4.943	3.315	1.981
Jarque-Bera	4.270	42.350	8.740	94.048	47.800	8.203
Probability	0.118	0.000	0.012	0.000	0.000	0.0163
	DR	DR	DR	DR	DR	DR
Mean	3.9994	5.761	9.352	11.383	4.059	5.802
Median	4.250	3.7300	9.100	8.565	4.180	6.780
Maximum	5.710	13.11	18.210	29.710	7.150	9.930
Minimum	2.530	2.310	0.500	5.150	2.760	1.130
Std. Dev.	1.012	3.494	4.707	5.685	0.953	2.298
Skewness	-0.346	0.504	0.015	1.530	0.692	-0.504
Kurtosis	1.581	1.878	2.098	4.523	3.810	1.931
Jarque-Bera	19.03	17.357	5.053	88.692	19.310	16.23
Probability	0.000	0.000	0.079	0.000	0.000	0.000
	LR	LR	LR	LR	LR	LR
Mean	9.551	16.000	21.693	23.748	11.945	13.435
Median	9.750	16.25	20.700	19.290	12.370	13.000
Maximum	10.950	19.390	31.200	48.560	16.210	17.500
Minimum	8.000	14.540	13.620	15.89	9.080	8.750
Std. Dev.	0.753	1.4729	4.573	8.623	1.429	2.787
Skewness	-0.428	0.462	0.552	1.151	0.662	-0.069
Kurtosis	2.101	2.062	2.003	3.066	3.749	1.654
Jarque-Bera	11.74	13.22	13.74	40.243	17.366	13.640
Probability	0.002	0.001	0.001	0.000	0.000	0.001

Table 12: Summary statistics for the interest rates for all countries; here and from now on, TBR is the treasury bill rate, DR is the deposit rate and LR is the lending rate

	Barbados	Guyana	Haiti	Jamaica	St. Lucia	Trinidad and Tobago
	DTBR	DTBR	DTBR	DTBR	DTBR	DTBR
Mean	-0.024	-0.0826	-0.087	-0.090	-0.009	-0.035
Median	-0.040	0.000	0.000	-0.095	0.000	0.000
Maximum	2.330	2.630	6.020	15.020	1.000	1.179
Minimum	-1.720	-1.590	-7.600	-8.030	-1.950	-1.850
Std. Dev.	0.413	0.4151	2.006	2.047	0.285	0.419
Skewness	1.183	1.208	-0.299	2.425	-1.994	-1.267
Kurtosis	11.81	14.869	7.081	20.655	18.800	8.578
Jarque-Bera	634.560	1118.721	105.637	2542.404	1992.749	279.954
Probability	0.000	0.000	0.000	0.000	0.000	0.000
	DDR	DDR	DDR	DDR	DDR	DDR
Mean	-0.013	-0.057	-0.059	-0.144	-0.009	-0.026
Median	0.000	0.000	0.000	-0.065	0.000	-0.020
Maximum	0.980	1.340	8.600	5.590	3.220	2.270
Minimum	-0.990	-1.470	-4.390	-8.230	-3.590	-2.020
Std. Dev.	0.168	0.269	1.449	1.074	0.374	0.559
Skewness	-0.647	-0.840	1.111	-2.193	-1.374	0.548
Kurtosis	20.423	16.587	11.184	26.385	77.817	7.240
Jarque-Bera	2327.640	1428.693	446.544	4292.899	42038.77	143.09
Probability	0.000	0.000	0.000	0.000	0.000	0.000
	DLR	DLR	DLR	DLR	DLR	DLR
Mean	-0.007	-0.027	-0.021	-0.154	-0.010	-0.039
Median	0.000	0.000	0.000	-0.085	0.000	0.000
Maximum	0.750	0.459	9.099	3.979	3.080	2.000
Minimum	-0.500	-0.750	-8.299	-4.940	-4.730	-2.000
Std. Dev.	0.155	0.124	2.163	0.907	0.479	0.387
Skewness	1.257	-2.926	0.147	-0.646	-3.868	-0.130
Kurtosis	13.990	17.859	8.061	14.840	63.360	13.004
Jarque-Bera	962.227	1944.930	159.500	1075.820	27774.320	746.936
Probability	0.000	0.000	0.000	0.000	0.000	0.000

Table 13: Summary Statistics of the I(1) interest rates for all countries, here and from now on; DTBR is the differenced treasury bill rate, DDR is the differenced deposit rate and DLR is the differenced lending rate

Appendix 3: Figures

Barbados

Figure 1: Time plot of Barbados interest rates in levels

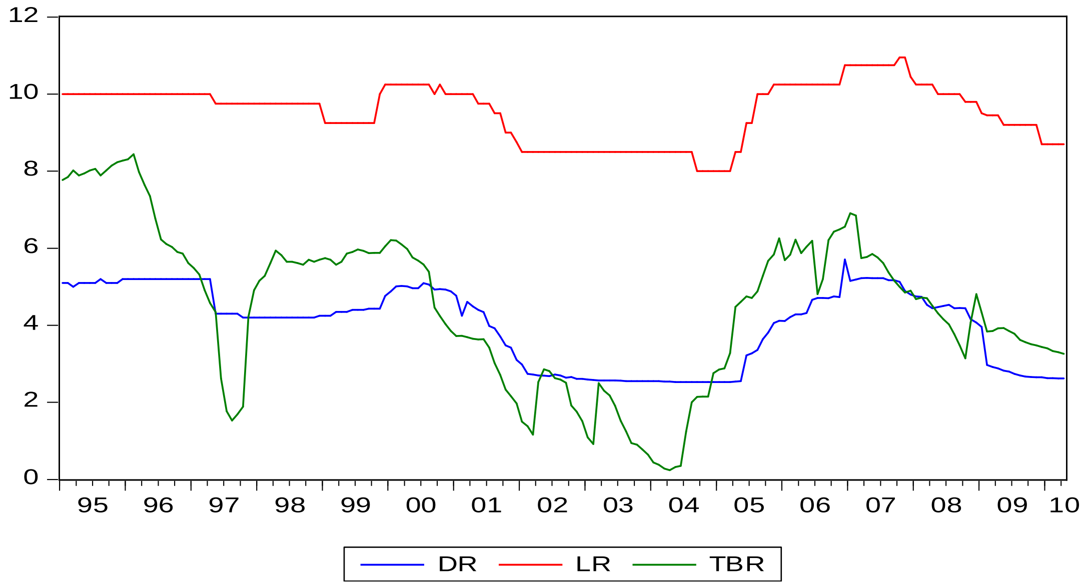
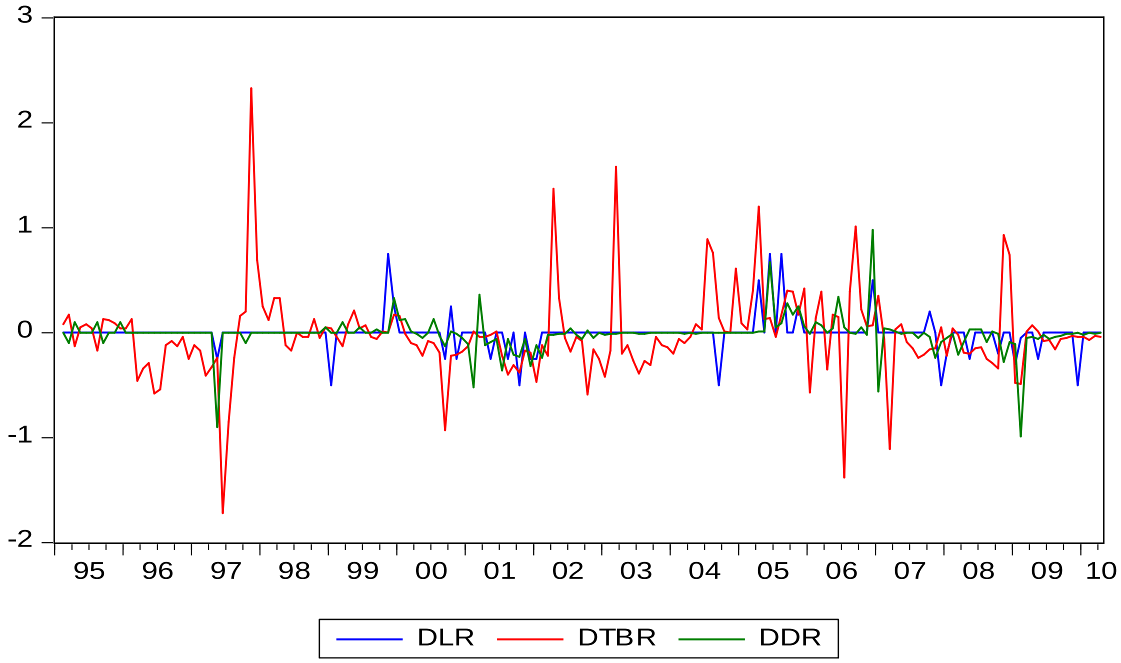


Figure 2: Time plot of Barbados interest rates first Difference



Guyana

Figure 3: Time plot of Guyana interest rates in levels

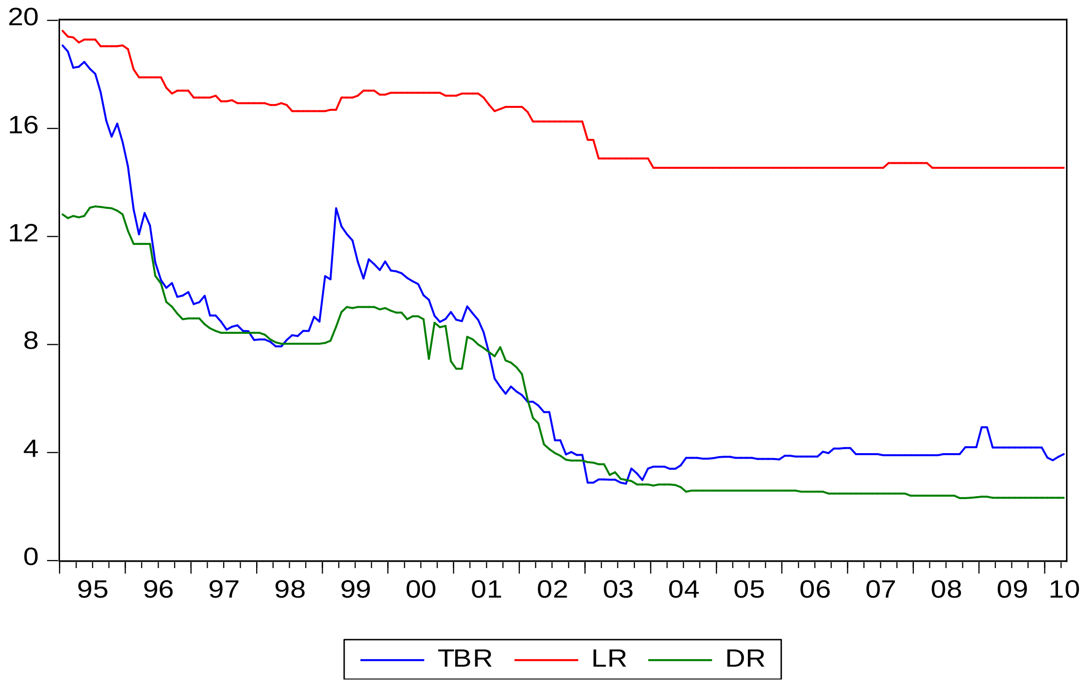
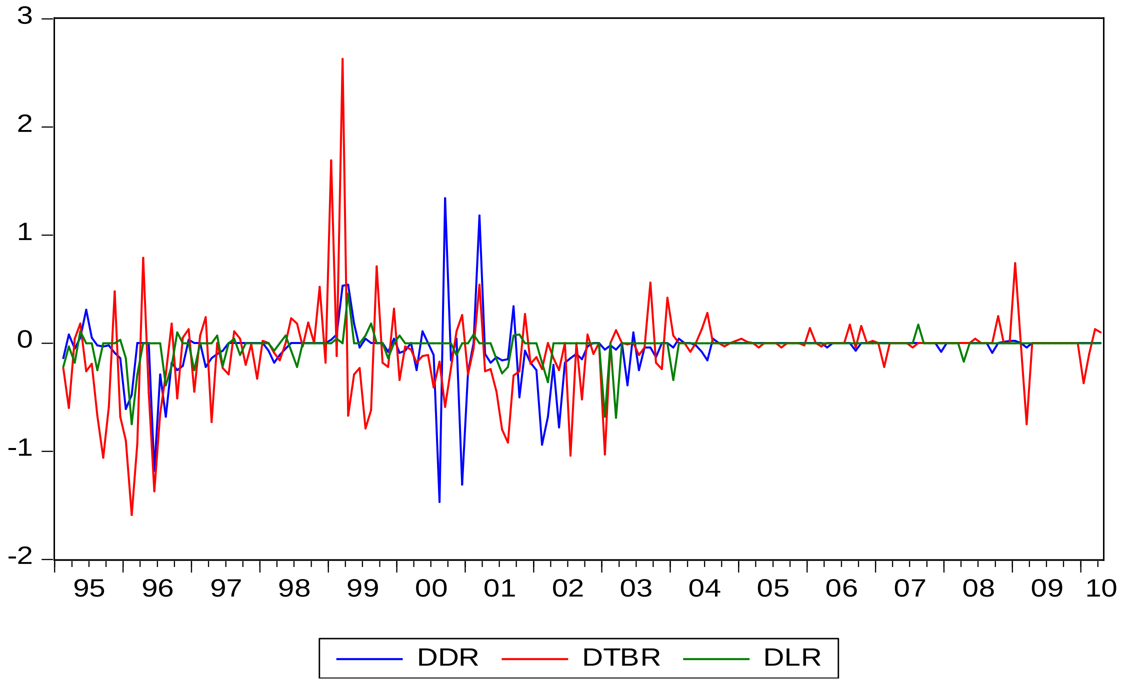


Figure 4: Time plot of Guyana interest rates first Difference



Haiti

Figure 5: Time plot of Haiti interest rates in levels

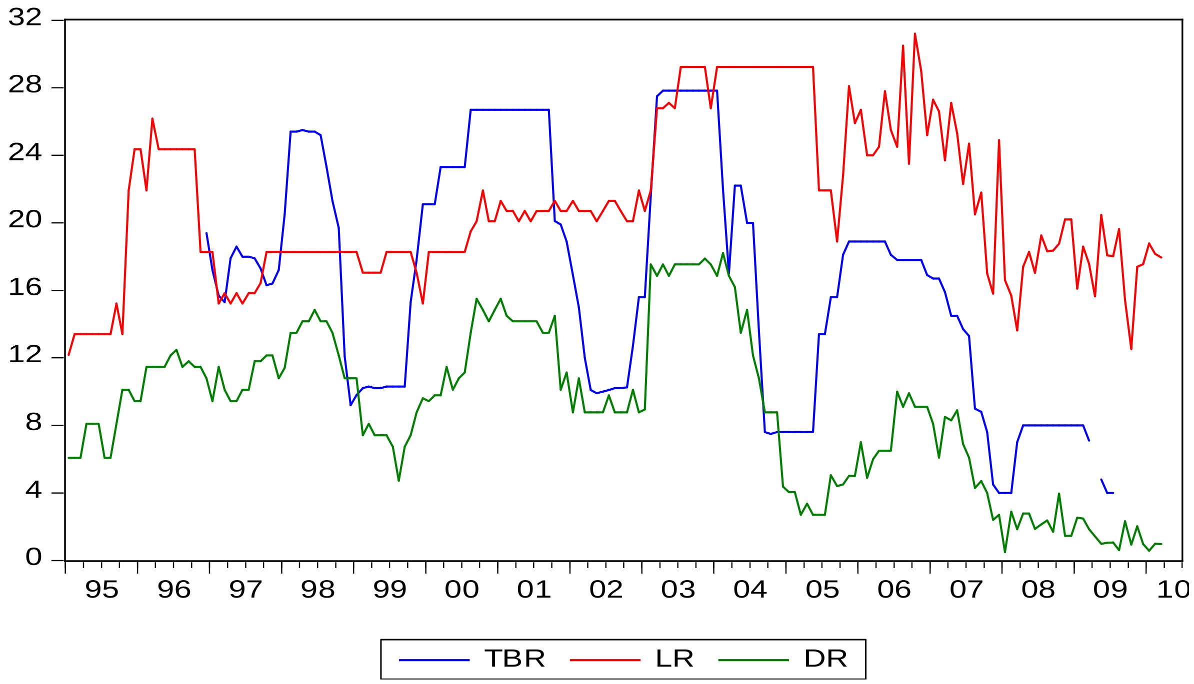
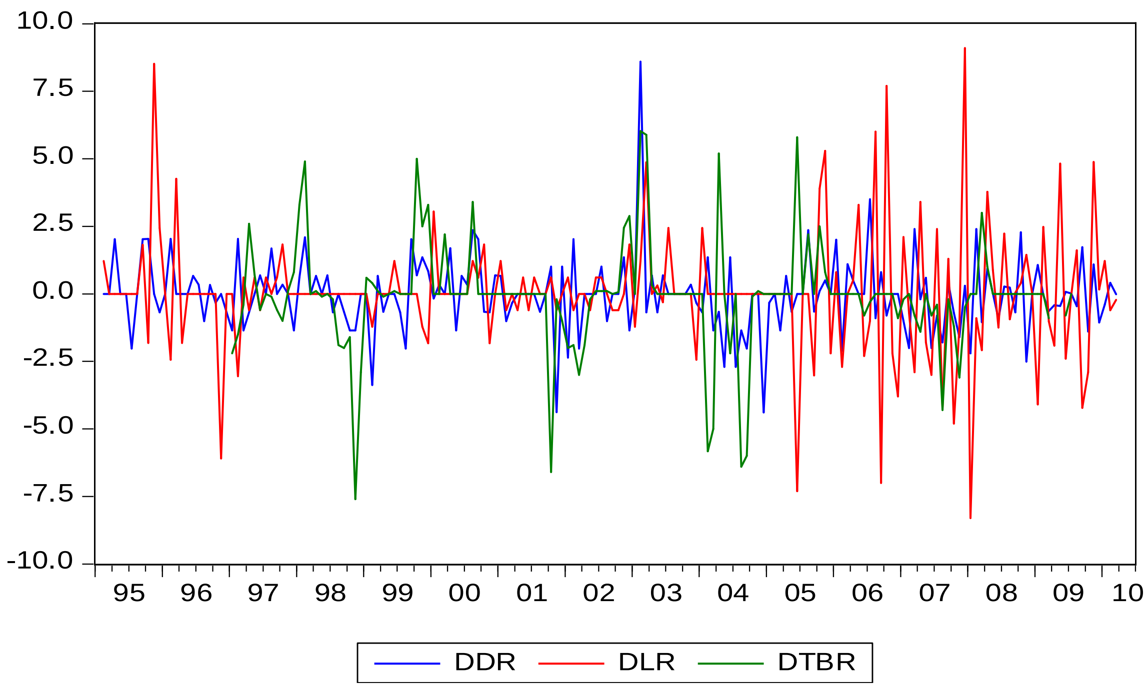


Figure 6: Haiti interest rates first difference



Jamaica

Figure 7: Time plot of Jamaica interest rates in levels

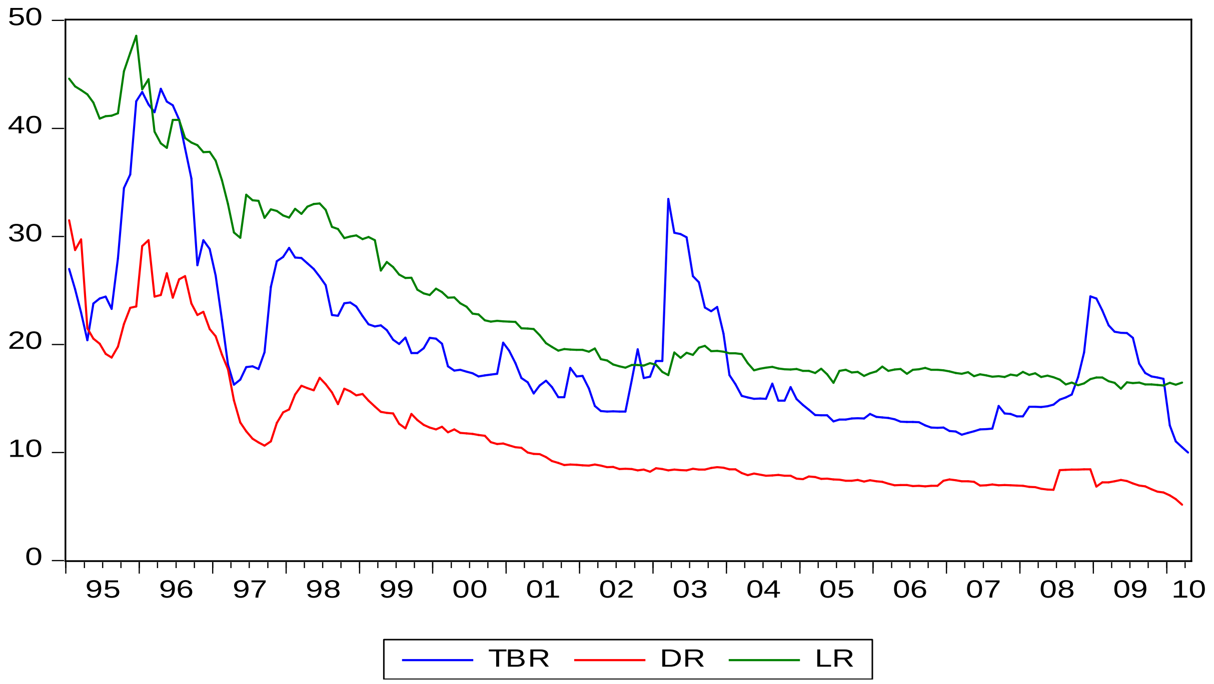
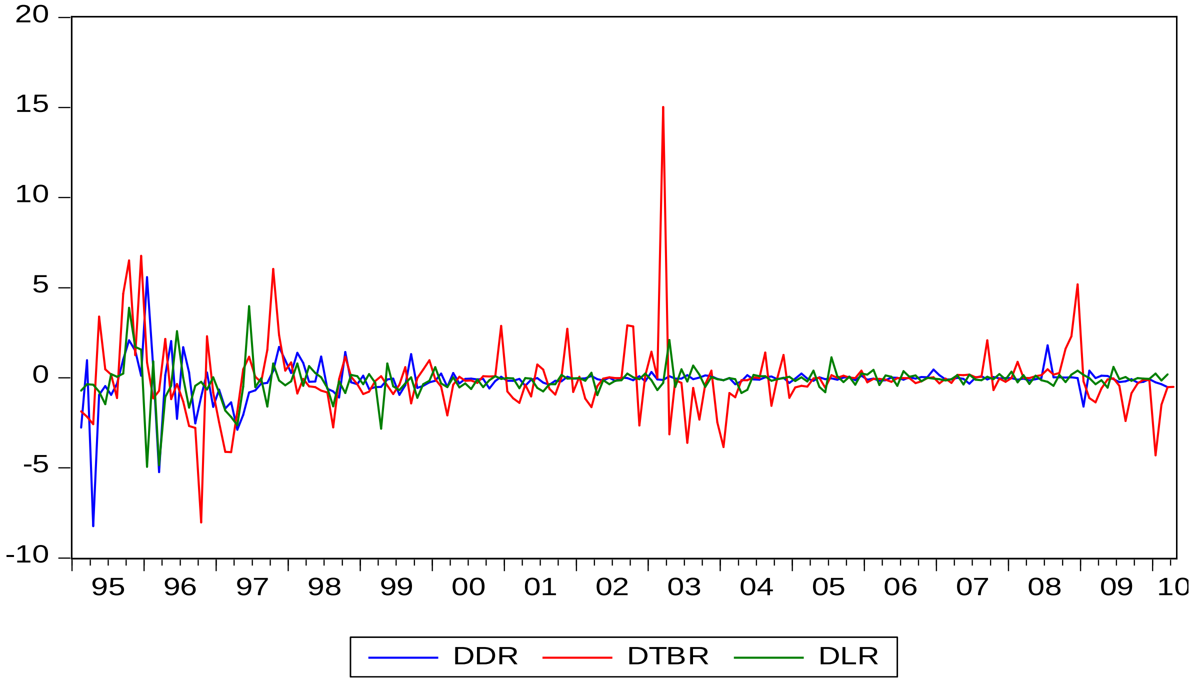


Figure 8: Time plot of Jamaica interest rates first difference



St. Lucia

Figure 9: Time plot of St. Lucia interest rates levels

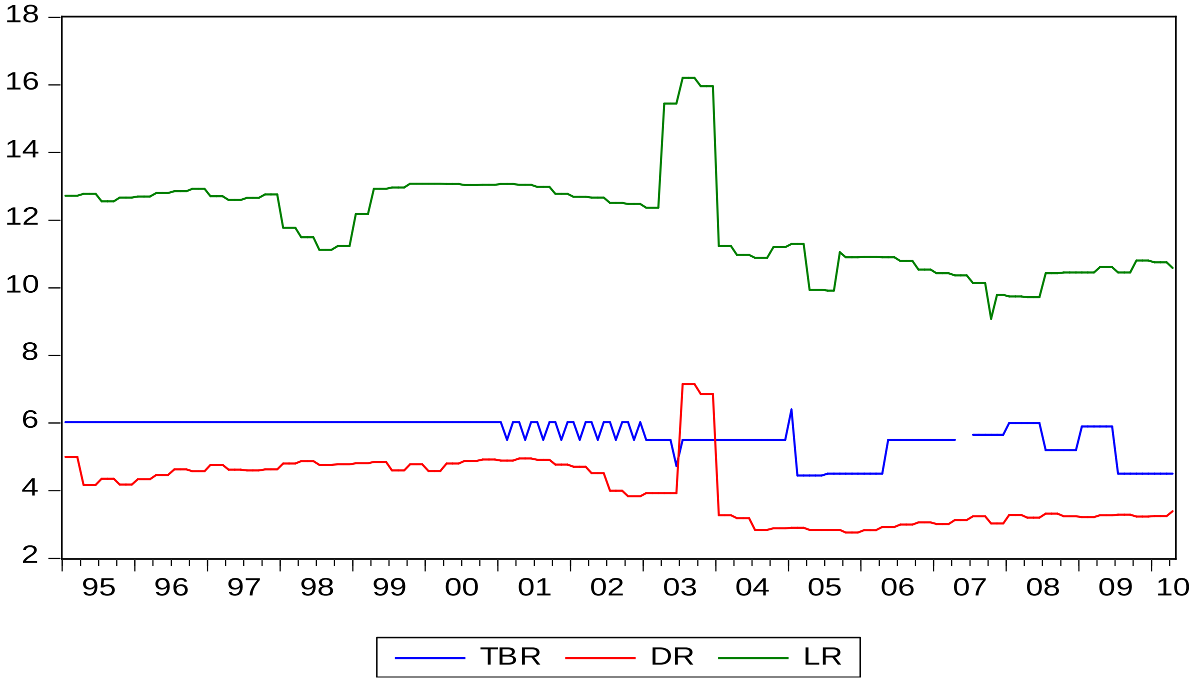
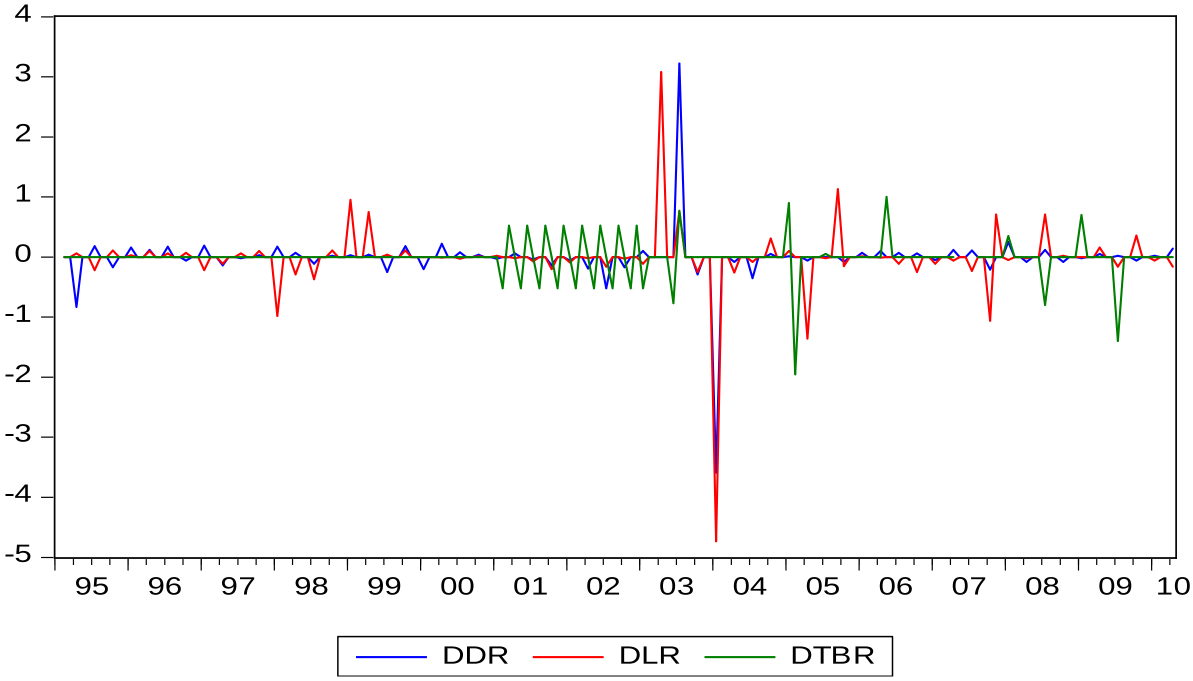


Figure 10: Time plot of St. Lucia interest rates first difference



Trinidad and Tobago

Figure 11: Time plot of Trinidad and Tobago interest rates in levels

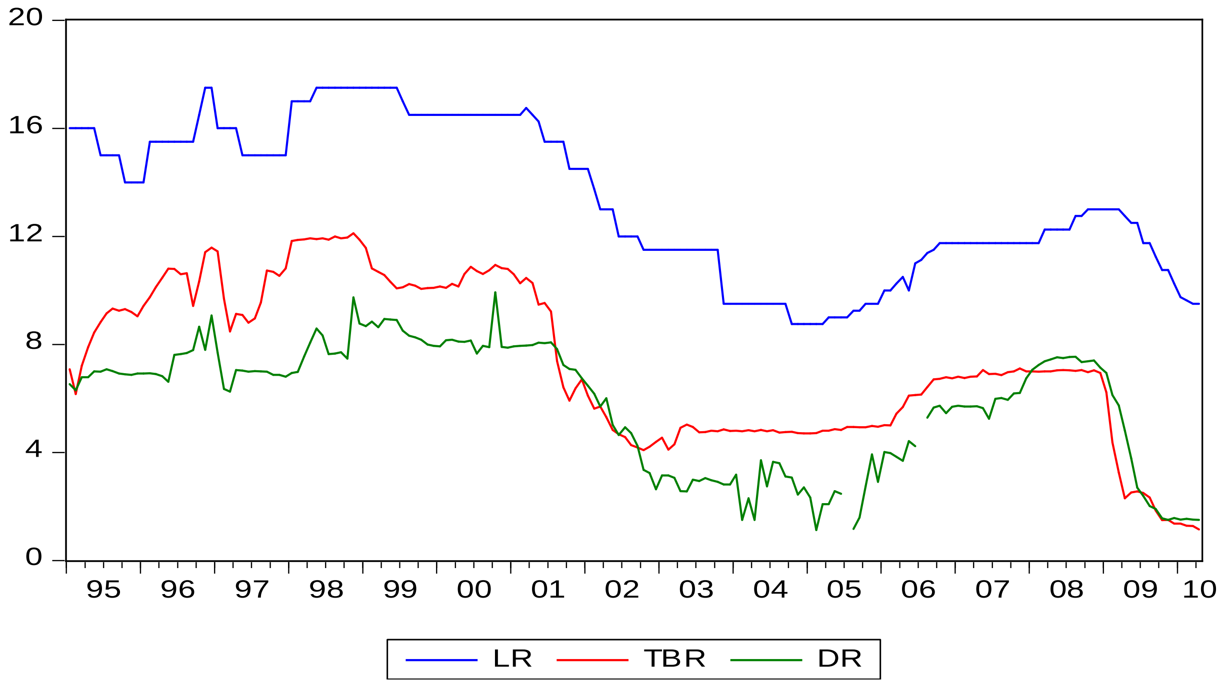
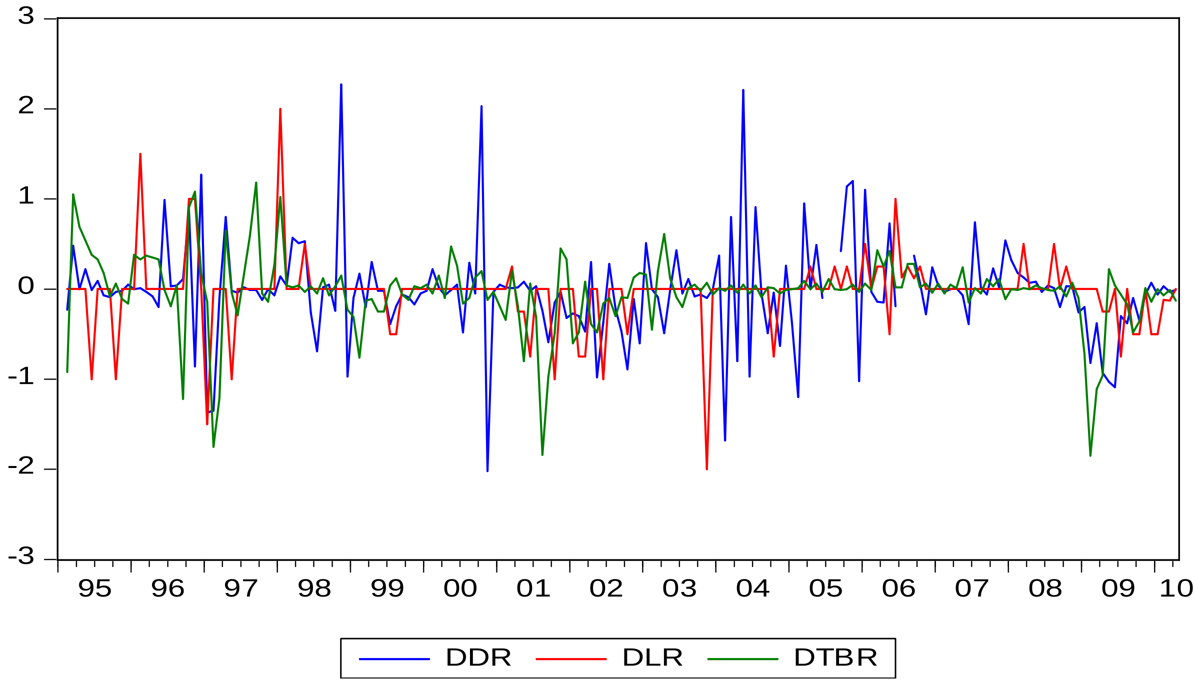


Figure 12: Time plot of Trinidad and Tobago interest rates in first difference



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