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Abstract

This paper investigates the validity of Fisher's hypothesis in determining nominal interest rates for five small developing countries—The Bahamas, Barbados, Guyana, Jamaica, and Trinidad and Tobago. We augment the traditional Fisher test equation by introducing the US nominal interest rate. Results indicate that there is a long run relationship for The Bahamas and Trinidad and Tobago; and for Jamaica during the period when the country is under a floating exchange regime. The nominal interest rate in each of the latter countries is positively related to the US nominal rate. Specifically, in The Bahamas the relationship is one-for-one, and for the others it is greater than one-for-one. Expected inflation only has an effect in Jamaica and Trinidad and Tobago, although the relationship is negative in the case of the latter. Fisher's hypothesis, even in its augmented form, does not appear to be a suitable framework for determination of nominal interest rates for Barbados and Guyana.

Keywords: interest rates; developing countries; Fisher's hypothesis, monetary policy

JEL: E43; E52; F41

1. Introduction

Economists and policymakers have long been concerned about the factors that influence the determination of interest rates. In many cases, this concern has focused on the relation of interest rates to the domestic rate of inflation. The theoretical underpinning for examination of this relationship usually begins with Fisher (1930). Fisher pointed out that in long-run equilibrium nominal interest rates adjust to changes in inflationary expectations induced by changes in the money supply growth rate. Thus nominal interest rate movements mirror the movements in expected inflation, leaving *ex ante* real interest rates constant, *ceteris paribus*. This last statement does not signify that real interest rates will remain constant over time. Rather it signifies that changes in real interest rates are likely the result of changes in real economic factors (Kinal and Lahiri, 1988). Fisher's hypothesis, if true, has implications for the scope of monetary policy. Specifically, it implies that real interest rates are determined only by real factors and consequently, monetary policy has no influence on real rates.

A considerable volume of research has investigated Fisher's hypothesis. With relatively few exceptions, for example, Thornton (1996), Payne and Ewing (1997) and Berument et al. (2007), the theoretical and empirical work on the determination of interest rates focused on developed countries. In most studies, the question of whether Fisher's hypothesis is valid appears to be merely an empirical matter. Their main concern is the documentation of the nature of the relationship.

The current study addresses these shortcomings in the literature in several ways. First, the study focuses on the determination of interest rates for five small developing countries from the

Caribbean—The Bahamas, Barbados, Jamaica and Trinidad and Tobago over the period 1975-2006 and Guyana over the period 1994-2006—within the framework of Fisher's hypothesis. Another departure of the current study is that it takes into account the structural economic characteristics that might allow for the Fisher relation to have relevance for the countries under study.

The Bahamas and Barbados have each maintained conventional fixed pegs with the United States dollar (USD) since the early 1970s. Over roughly the first half of the period under study, Jamaica and Trinidad and Tobago also maintained conventional fixed pegs with the USD. While the latter countries, including Guyana, currently have flexible exchange rate regimes *de jure*, their exchange rates are so closely maintained within narrow bands vis-à-vis the USD that the International Monetary Fund (IMF) classifies their regimes as fixed *de facto* (IMF, 2006). Therefore, shocks to the US are readily transmitted to each Caribbean country since defence of the "anchor" reduces the ability of each country's central bank to respond to these shocks, via monetary policy actions.

Another structural feature is that all five countries are highly open, with trade (exports plus imports) accounting for well over 75% of their respective Gross Domestic Products. Each country is highly dependent on the US for imports of consumer goods. Thus, there is a high pass-through from inflation in the US to domestic inflation in each country.

Taken together these characteristics suggest that each Caribbean country is structurally dependent on the US economy. Given that the US Federal Reserve (FED) controls inflation through manipulation of interest rates, such structural dependence implies that monetary policy in the countries under study is not discretionary, but to a great extent mimics US monetary policy. In this paper, this is taken into account by examining Fisher's relation augmented with nominal interest rates from the US.

In investigating the augmented Fisher's hypothesis for each country, four questions are of interest. First, is there a long-run relationship between the domestic nominal interest rate, domestic inflation, and the US nominal interest rate? Second, if such a relationship exists, does the domestic nominal interest rate move unit proportionally with expected domestic inflation? Third, what is the speed of adjustment of the nominal interest rate to changes in *unanticipated* inflation? Fourth, does the nominal US interest rate Granger-cause the domestic nominal interest rate? Since the exchange rate regime of Jamaica and Trinidad and Tobago changed over the period under study, the sample is also split in order to determine if this change may have altered the relationship between nominal interest rates and inflation in those countries. Given the close relationship between interest rates and exchange rates, failure to take this switch into account could give misleading results and lead to erroneous conclusions.

The analysis begins in Section 2 with a discussion of the different versions of the traditional Fisher hypothesis and how each can be tested. Section 3 describes the data used in the study and outlines the econometric methodology employed. The empirical evidence is presented and discussed in Section 4. Section 5 provides concluding remarks.

2. The Fisher Hypothesis

In his classic contribution to the theory of interest rate determination, Fisher (1930) hypothesised that a change in the money supply growth rate leads to a full perception of the change in inflation and a concomitant adjustment of nominal interest rates over the long run. Inherently, this hypothesis also suggests that *ex ante* real interest rates will be unresponsive to movements in anticipated inflation. Put another way, any variation in inflation is fully absorbed in nominal interest rates, and *ex ante* real rates only respond to changes in real factors, such as the productivity of capital and time preference of consumers. If real interest rates respond to anticipated inflation over the long run, then it implies that nominal interest rates have not fully absorbed inflationary movements and the traditional Fisher hypothesis is not valid.

Darby (1975) and Feldstein (1976) argue that the Fisher hypothesis is a net-of-tax relationship. They note that if the real interest rate is independent of anticipated inflation, the nominal taxable interest rate must adjust *greater* than one-for-one with anticipated inflation. This strong form of the hypothesis can be expressed as follows:

$$i_t = \frac{1}{1-\tau} r_t^e + \frac{1}{1-\tau} \pi_t^e + \frac{1}{1-\tau} r_t^e \pi_t^e \qquad (1)$$

where i_t is the nominal interest rate, r_t^e is the *ex ante* real interest rate, π_t^e is the *ex ante* real inflation rate, and τ is the average tax rate on interest income. Since $0 < \tau < 1$, if Fisher's hypothesis is valid, i_t responds greater than unit proportionally to changes in π_t^e.

In practice, the assumption is usually made that both r_t^e and π_t^e are small, so that the product r_t^e * π_t^e becomes negligible (Fama, 1975; Darby, 1975). Due to the difficulty in observing real interest rates, another simplifying assumption is that the real interest rate is constant but can fluctuate due to random shocks:

$$r_t^e = r^* + \xi_t \tag{2}$$

where r^* is a positive constant and ξ_t is a normally distributed, mean zero shock with constant variance: $\xi_t \sim N(0, \sigma_\xi^2)$. Incorporation of these two assumptions into Equation 1 gives the semi-strong version of the Fisher hypothesis:

$$i_t = \frac{1}{1-\tau} r^* + \frac{1}{1-\tau} \pi_t^e + \frac{1}{1-\tau} \xi_t \tag{3}$$

If the effects of taxes on returns are ignored, or if interest income is exempt from taxation, that is $\tau = 0$, then we have an exposition of Fisher's original weak-form hypothesis:

$$i_t = r^* + \pi_t^e + \xi_t \tag{4}$$

Equation 4 implies that nominal interest rates are unit proportional to changes in expected inflation in the long run subject to short-run zero mean shocks. For the purposes of estimation, Equation 4 can be expressed as:

$$i_t = \beta_0 + \beta_1 \pi_t + \xi_t \tag{5}$$

where β_0 is the constant *ex ante* real interest rate, π_t is the actual inflation rate at time *t* and β_1 represents the long-run impact of π_t on i_t. If $\beta_1 = 1$ then a positive long-run unit proportional relationship exists between i_t and π_t. In order for Equation 5 to be interpreted as an equilibrium relationship, then ξ_t must be a stationary process. If ξ_t is not stationary, then i_t and π_t have no long-run relationship and implies that Fisher's equilibrium hypothesis does not hold.

Evidence in support of Fisher's original hypothesis of a one-for-one relation between nominal taxable yields and anticipated inflation (Equation 4) was found by Fama (1975). However, articles by Hess and Bicksler (1975), Jones (1977) and Nelson and Schwert (1977), among others, challenged the assumption of a constant real interest rate. Their evidence suggested that real rates varied inversely with expected inflation and consequently, nominal taxable rates adjust at a less than one-for-one rate with anticipated inflation. Fama and Gibbons (1982) countered that as long as the variation in the real rate is accounted for, the nominal taxable yields will rise unit proportionally with anticipated inflation. Fama and Gibbons conclude that the real rate is independent of inflation and that any changes in the real rate are swamped by changes in anticipated inflation. According to the loanable funds theory, the decision to save and invest depends on the real interest rate. Therefore taxable yields must include both a tax premium and an inflation premium. Thus, evidence that supports the pre-tax Fisher hypothesis (Equation 4) suggests that investors are suffering from "fiscal illusion" (Tanzi, 1980).

An alternative explanation for the relationship between interest rates and inflation expectations was advanced by Carmichael and Stebbing (1983). The argument is that provided there is some regulation of interest rates and provided that there is substitutability of financial and monetary assets, there may be an inversion of Fisher's hypothesis, especially in after-tax terms. They suggest that it may be possible for the nominal interest rate to be constant over the long run, while the real interest rate will move inversely one-for-one with the rate of expected inflation. Moreover, Carmichael and Stebbing argue that the two versions are mutually exclusive—if the standard Fisher hypothesis holds, then the inverted version should be rejected and vice versa.

3. Data and Econometric Methodology

All data used in the study are taken from the International Monetary Fund (IMF) online data base available at: http://imfstatistics.org/imf/. The series are quarterly and run from 1975(1)-2006(2) for The Bahamas, Barbados, Jamaica, Trinidad and Tobago and the US. Required series for Guyana are only jointly available for the period 1994(1)-2006(2). The series used are the consumer price index (2000 = 100) for each Caribbean country; and the treasury bill (t-bill) rate for all countries including the US, as a measure of the nominal interest rate. The quarterly inflation rate is modelled as $\ln(CPI_t / CPI_{t-1})$.

Following Fama (1975) and Warner and Wallace (1993), the inflation rate at time *t*+1 is used to proxy expected inflation, consistent with the current quarter's interest rate incorporating forecasts of next quarter's inflation rate, which implies perfect foresight in the spirit of Fama's (1975) pioneering work. Consequently, nominal interest rates at time *t* are matched up with the actual inflation rate at time *t*+1 which gives us the following estimable relationship:

$$i_t = \beta_0 + \beta_1 \pi_{t+1} + \xi_t \qquad (6)$$

where π_{t+1} is the actual inflation rate at time *t*+1 and other variables are as previously defined.

In this work, Equation 6 is augmented with the US interest rate. The motivation for this, discussed earlier, is based on the structural dependence of these Caribbean territories on the US economy. The exchange rates of these five countries are pegged or closely maintained vis-à-vis the USD reducing their capacity for independent monetary policy; and there is a high pass-through from inflation in the US to domestic inflation in each country since these countries are dependent on the US for imports, especially consumer goods. Therefore, the resulting equation is estimated[1]:

$$i_t = \beta_0 + \beta_1 \pi_{t+1} + \beta_2 i_t^{US} + \xi_t \qquad (7)$$

where i_t^{US} is the US nominal interest rate and all variables are as previously defined.

On the basis of the different approaches and empirical findings, it is reasonable to construe that the relationship between interest rates and inflation cannot be established *a priori*. The null hypothesis for the standard Fisher effect is $\beta_1 = 1$ while the null for the inverted Fisher effect is $\beta_1 = 0$. Alternatively, if $\beta_2 = 1$, then this suggests that nominal interest rates in each country move one-for-one with US nominal interest rates, implying that inflation in the US is directly responsible for determining interest rates in the Caribbean. Finally, a value of β_1 between zero and one provides evidence that both the domestic nominal and real interest rates respond to changes in anticipated (domestic) inflation (contrary to the strict implications of the traditional and inverted Fisher hypotheses); and a value of β_2 between zero and one provides evidence that the domestic nominal and real interest rates respond to changes in the nominal interest rate in the US.

Since Jamaica and Trinidad and Tobago moved from conventional fixed peg regimes with the United States dollar (USD) to floating rate regimes in 1991 and 1993 respectively, their samples will be divided in order to determine if a regime shift may have altered the relationship between

[1] The lack of available data on average tax rates for the Caribbean countries under investigation precludes us from investigating the semi-strong version of Fisher's hypothesis. However, this allows our findings to be compared with previous research which typically reports results based on estimation of Equation 5

nominal interest rates and inflation in these countries.[2] In an attempt to remove any possible disequilibrium effect on the nominal interest rate/inflation rate relationship occasioned by each country's move to a different exchange rate regime, a gap of two years on either side of the year of floating is imposed. The intention is to clearly define the two periods to see if exchange rate regimes have any influence on Fisher's interest rate/inflation rate relationship hypothesis. For Jamaica, the two subperiods are 1975(1)-1989(4) and 1993(1)-2006(2) and for Trinidad and Tobago 1975(1)-1991(4) and 1995(1)-2006(2).

To test for the presence of a long-run relationship, the maximum likelihood method developed by Johansen (1988, 1991) is utilised. Following Johansen, an *m*-dimensional (*m*x1) vector autoregressive model (VAR), *y*, with Gaussian errors can be expressed by:

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + ... + A_k y_{t-k} + \mu + \varepsilon_t \text{ , } t = 1, 2, \ldots, \text{T} \tag{8}$$

where ε_t is *i.i.d*. By taking first-differences on the vector, the model in vector error correction (VECM) form is:

$$\Delta y_t = \Gamma_1 \Delta y_{t-1} + \Gamma_2 \Delta y_{t-2} + ... + \Gamma_{k-1} \Delta y_{t-k+1} - \pi y_{t-1} + \mu + \varepsilon_t \tag{9}$$

The π matrix conveys information about the long-run relationship between y_t variables. Testing for cointegration involves testing for the rank of π matrix, *r,* by examining whether the eigenvalues of π are significantly different from zero. Johansen (1991) proposes two test statistics for testing the number of cointegrating vectors (or the rank of π): the trace (*Tr*) and the maximum

[2] Guyana also moved from a fixed peg to a floating rate, but data is only available after the year in which they floated, 1988.

eigenvalue (L-max) statistics. The null hypothesis for the trace test is that there are at most r cointegrating vectors, while for the max eigenvalue test, the null $r = 0$ is tested against the alternative that $r = 1$; $r = 1$ against the alternative $r = 2$; and so forth. The Schwarz Information Criterion (SIC) will be used to select the number of lags required in the cointegration test.

A necessary precondition to testing for cointegration is to inspect the unit root properties of the variables under consideration. Several tests for the presence of unit roots in time-series data are popular in the literature. In this study, unit roots are tested using the Dickey-Fuller (DF)/Augmented Dickey-Fuller (ADF) test by Dickey and Fuller (1979, 1981); the Phillips-Perron (PP) test by Phillips and Perron (1988); and the KPSS test by Kwiatkowski, Phillips, Schmidt and Shin (1992). A conclusion on the degree of integration is made based on the agreement of *at least* two of the three unit root tests. The SIC is employed to determine the lag length k.

Finally, to examine whether a short-run relationship exists, the Granger-causality test developed from the seminal paper of Granger (1969) will be employed. Basically, this test seeks to ascertain whether or not the inclusion of past values of a variable x do or do not help in the prediction of present values of another variable y. If variable y is better predicted by including past values of x than by not including them, then, x is said to Granger-cause y.

4. Results and Analysis

The procedures described in the previous section are employed to test the validity of Fisher's hypothesis for 5 Caribbean countries. Before these procedures are implemented, summary statistics are calculated and provided in Table 1. The annualised inflation rate, calculated as 4* $\ln(CPI_t / CPI_{t-1})$, is also reported. Results show that of the 4 countries with observations over the entire sample period, Jamaica has experienced the highest quarterly and annual inflation rates as well as the highest spread between t-bill rates. Subject to the caveat that data for Guyana is over a much shorter sample, summary statistics indicate rates of inflation and t-bill rates similar to those for The Bahamas, Barbados, and Trinidad and Tobago.

To determine whether the real interest rate for each Caribbean country can be considered to be constant, formal testing through the use of the ADF, PP and KPSS unit root tests (see Table 2) were conducted to discern the stationarity of the series. Plots of each series are also shown in Figure 1. The tests indicate that the real interest rate is constant only for The Bahamas and Barbados, supporting Fama's (1975) contention, but not for Jamaica, Trinidad and Tobago, and Guyana. Further testing indicates that the first difference of the real interest rate for Jamaica, Trinidad and Tobago and Guyana is constant (stationary). This finding serves to change our interpretation of the constant term in Equation 7. That is, in the case of The Bahamas and Barbados, the evidence indicates that the real interest rate is constant, but can fluctuate due to random shocks, which implies the weak form of the Fisher hypothesis. On the other hand, it is the change in the real interest rate which is constant over time, but fluctuates due to random shocks in Jamaica, Guyana and Trinidad and Tobago.

As a preliminary investigation into the long-run relationship between the nominal interest rate and inflation, Figure 2 plots the domestic t-bill series for each Caribbean country and the US along with the one-period (quarterly) inflation rate and the annualised inflation rate, respectively. A visual inspection of Figure 2 shows that for The Bahamas, the domestic t-bill rate appears to closely follow the long-run behaviour and short-run fluctuations in the US t-bill rate, but slightly less so for the inflation rate, with a lag. For Barbados, Jamaica, and Guyana, the visual evidence shows no similar trends between or among the t-bill rate, inflation rates and US t-bill rate, while for Trinidad and Tobago there appears to be some indication that the domestic t-bill rate and inflation rate are moving in opposite directions.

Before testing for cointegration, the unit root properties of the domestic and US t-bill rates and the inflation rate are examined. Table 2 contains the results. The results from the tests indicate that the t-bill rate and one-period inflation rate follow I(1) processes for The Bahamas and Trinidad and Tobago over the 1975(1)-2006(2). All series are stationary for Barbados, while for Jamaica and Guyana, the t-bill rate is I(1) but inflation is I(0). When the series for Jamaica and Trinidad and Tobago are divided to ascertain whether a shift from fixed exchange rates with the US to floating regimes has any influence on the interest rate/inflation rate relationship, the findings differ from those over the entire sample (see Table 3). For Jamaica, over 1975-1989, the t-bill rate is I(1) and inflation is I(0). Conversely, over 1993-2006, the nominal interest rate and inflation all follow I(1) processes. For Trinidad and Tobago, the t-bill rate is I(1) and inflation I(0) for each sub-sample.[3] The US t-bill rate is I(1) over each period.

[3] The results using the annualised inflation rate are identical and thus not reported for brevity.

Based on these results, we proceed to test for cointegration between the nominal interest rate and inflation using the Johansen method for The Bahamas and Trinidad and Tobago from 1975(1)-2006(2), and for Jamaica from 1993(1)-2005(2). Prior to testing for cointegration, we establish the lag length of the VAR since the Johansen procedure is sensitive to the number of lags used in the test (Gonzalo, 1989). We allow for up to 12 lags (3 years) of each series and test using the SIC.

Table 4 reports the results for the trace test and maximum eigenvalue test for cointegration between the one-period rate of inflation and the t-bill rate. The tests indicate that there is one cointegrating relationship for The Bahamas, Jamaica and Trinidad and Tobago over the periods as indicated in the table. Table 5 also shows the cointegrating vectors normalised on the nominal interest rate. Tests to determine if there is a unit proportional relationship between the domestic nominal interest rate and inflation and/or between the domestic nominal interest rate and the US nominal interest rate respectively in each country are conducted. For The Bahamas, evidence supports a one-for-one relationship with the US interest rate, while there is no such finding for Jamaica and Trinidad and Tobago. In Jamaica, the nominal interest rate is positively related to inflation and the US interest rate and responds greater than unit proportionally during the period when it maintains a flexible exchange rate regime. The nominal interest rate is inversely related to inflation and positively related to the US interest rate in Trinidad and Tobago. Table 5 also reports the speed of adjustment of the nominal interest rate to unanticipated inflation. The speed of adjustment for each quarter is 20% in The Bahamas, 26.9% in Jamaica and 9% in Trinidad and Tobago.

Although the unit root properties of the series preclude the establishment of a long-run relationship for Barbados and Guyana, we estimated Equation 7 using ordinary least squares, with the appropriate variables differenced as necessary. Results for Barbados indicate the nominal interest rate is not impacted by expected inflation, but is inversely related to the change in the US nominal interest rate (coefficient of -0.520 significant at 10%). For Guyana, the change in the nominal interest rate depends positively on expected inflation (coefficient of 0.174 significant at 10%), but is not affected by the change in the US nominal interest rate.

Finally, we perform Granger-causality tests to determine whether any short-run relationships exist. Variables in the different countries are differenced as necessary in order to satisfy the stationarity requirements of the tests. Tables 5 and 6 report the results. Over 1975(1) to 2006(2), there is evidence of short-run causality from the nominal rate in the US to the nominal rate for The Bahamas and from inflation to the nominal interest rate for Jamaica. For tests on the sub-samples for Jamaica and Trinidad and Tobago, there is evidence to suggest that the US interest rate Granger-causes the nominal interest rate in Trinidad and Tobago over 1995(1) to 2006(2); however, no evidence of Granger-causality is found for Jamaica.

5. Concluding Remarks

This paper sought to determine interest rates in five small developing countries—The Bahamas, Barbados, Guyana, Jamaica, and Trinidad and Tobago—within the framework of Fisher's classical (1930) hypothesis using the techniques of cointegration and error correction. Fisher's hypothesis in its standard form posits that the nominal interest rate would adjust one-for-one with anticipated domestic inflation and consequently real ex ante interest rates would be constant over the long run.

In this work, the standard Fisher relation is augmented with the US t-bill rate, to account for each country's structural dependence on the US, especially import dependence.

Overall, findings do not support Fisher's original hypothesis of a one-for-one relation between nominal taxable yields and anticipated inflation posited in Fama (1975). First, the real interest rate is constant in only The Bahamas and Barbados, while the change in the real interest rate is constant for the other countries. Second, while there was evidence of a long-run relationship, results are diverse. Evidence for The Bahamas suggests that its nominal interest rate moves one-for-one with the US nominal interest rate; for Trinidad and Tobago the nominal interest rate is inversely related to expected inflation but positively related to the US nominal interest rate; and for Jamaica (after 1993), the nominal interest rate is positive related to both expected inflation and the US nominal interest rate. It is possible that some unknown influence may be driving the nominal interest rate and inflation rate in opposite directions, a phenomenon that probably warrants further research to identify other possible determinants of the nominal interest rate in Trinidad and Tobago. Third, the speeds of adjustment of the nominal interest rate towards long-run equilibrium in The Bahamas, Trinidad and Tobago, and Jamaica are 20%, 9%, and 26.9% respectively.

Our results also indicated that there was an interesting structural change in the long-run relationship for Jamaica, which occurred after it floated its currency in 1991. Another point is that it is important to also examine short-run relationships. The short-run results for The Bahamas reinforce the long-run results; however, the short-run effects of the identified relationships for Jamaica and Trinidad and Tobago over the full and sub samples suggest that there is some deviation with respect to the established long-run policy.

From a policy perspective, our results suggest that monetary policy in The Bahamas, Jamaica, and Trinidad and Tobago is dependent on monetary policy in the US in the long run (and short run for The Bahamas). These findings could be as a result of the fact that The Bahamas is completely, though unofficially, dollarised while as earlier indicated, Jamaica and Trinidad and Tobago actively intervene in the foreign exchange market in order to maintain stability of their currencies vis-à-vis the USD.

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Table 1: Summary Statistics of Interest and Inflation Rates 1975(1)-2006(2)

	The Bahamas	Barbados	Jamaica	Trinidad and Tobago	Guyana	United States
Tbill Rate						
Mean	4.292	5.786	18.779	6.169	8.804	3.808
Maximum	9.523	15.513	48.913	11.983	19.470	6.037
Minimum	0.060	0.303	6.840	3.033	2.920	0.917
Std. Dev.	2.512	2.689	6.667	2.882	4.867	1.714
1-Per. Inflation						
Mean	1.004	1.231	4.167	2.023	1.553	NA
Maximum	3.732	6.348	19.983	7.336	7.180	NA
Minimum	-0.096	-3.945	-0.085	-0.175	-0.501	NA
Std. Dev.	3.678	1.648	3.714	1.325	9.731	NA
Ann. Inflation						
Mean	4.017	4.923	16.669	8.093	6.214	NA
Maximum	14.927	25.393	79.933	29.344	28.721	NA
Minimum	-0.386	-15.778	-0.341	-0.701	-2.003	NA
Std. Dev.	3.242	6.593	14.855	5.300	1.788	NA
Obs.	126	126	126	126	50	126

Notes: TBILL stands for treasury bill. 1-Per. inflation stands for one-period (quarterly) rate of inflation. Ann. inflation stands for the annualised (yearly) inflation rate. NA means "not applicable".

Table 2: Unit Root Tests

	ADF		PP		KPSS		Decision
	Level	1st. Diff.	Level	1st. Diff.	Level	1st. Diff.	
The Bahamas 1975-2006							
real interest rate	-3.507*	NA	-3.475*	NA	0.084	NA	I(0)
t-bill	-2.674	-9.420**	-2.259	-9.358**	0.824**	0.039	I(1)
1-Per. Inflation	-1.929	-10.929**	-5.669**	NA	0.780**	0.022	I(1)
Barbados 1975-2006							
real interest rate	4.299**	NA	-4.406**	NA	0.193	NA	I(0)
t-bill	-3.617**	NA	-2.825	-6.581**	0.317	NA	I(0)
1-Per. Inflation	-8.599**	NA	-9.256**	NA	0.698*	0.097	I(0)
Jamaica 1975-2006							
real interest rate	-1.021	-9.392**	-3.317	-9.056**	0.300**	0.238	I(1)
t-bill	-1.941	-8.096**	-1.565	-5.590**	0.685*	0.252	I(1)
1-Per. Inflation	-4.452**	NA	-4.620**	NA	0.186	NA	I(0)
Trinidad & Tobago 1975-2006							
real interest rate	-0.680	-10.872**	-2.458	-18.127**	0.813**	0.077	I(1)
t-bill	-1.601	-7.714**	-1.188	-7.493**	0.693*	0.165	I(1)
1-Per. Inflation	-2.624	-13.041**	-7.837**	NA	1.013**	0.017	I(1)
Guyana 1994-2006							
real interest rate	-1.921	-9.276**	-2.542	-9.276**	0.797**	0.120	I(1)
t-bill	-1.615	-4.392**	-1.201	-4.397**	0.788**	0.079	I(1)
1-Per. Inflation	-6.047**	NA	-6.017**	NA	0.291	NA	I(0)
US 1975-2006							
t-bill	-2.481	-4.556**	-1.830	-9.099**	0.773**	0.059	I(1)

Notes: 1-Per. inflation stands for one-period (quarterly) rate of inflation. Critical values are obtained from MacKinnon (1991). Unit roots were conducted using a constant as the only deterministic component for each test. ** denotes significance at 1% and * denotes significance at 5%. The last column indicates the order of integration of each series.

Table 3: Unit Root Tests of Sub-samples for Jamaica, Trinidad and Tobago and the US

	ADF		PP		KPSS		Decision
	Level	1st. Diff.	Level	1st. Diff.	Level	1st. Diff.	
Jamaica 1975-1989							
t-bill	-0.353	-6.099**	-0.229	-4.579**	0.858**	0.124	I(1)
1-Per. Inflation	-4.303**	NA	-4.213**	NA	0.122	NA	I(0)
Jamaica 1993-2006							
t-bill	-0.557	-7.519**	-2.167	-3.464**	0.746**	0.063	I(1)
1-Per. Inflation	-2.905	-7.692**	-2.896	-15.022**	0.528*	0.441	I(1)
Trinidad & Tobago 1975-1991							
t-bill	-1.664	0.633	-1.976	-3.465**	0.662*	0.672*	I(1)
1-Per. Inflation	-6.586**	NA	-6.638**	NA	0.592*	0.116	I(0)
Trinidad & Tobago 1995-2006							
t-bill	-1.248	-5.134**	-1.019	-5.147**	0.607*	0.146	I(1)
1-Per. Inflation	-4.453**	NA	-4.470**	NA	0.422	NA	I(0)
US 1975-1989							
t-bill	-1.634	-6.989**	-1.750	-6.705**	0.179	NA	I(1)
US 1993-2006							
t-bill	-2.062	-3.485**	-1.622	-3.656**	0.414	NA	I(1)
US 1975-1991							
t-bill	-1.583	-7.355**	-1.728	-7.079**	0.181	NA	I(1)
US 1995-2006							
t-bill	-1.852	-3.119**	-1.381	3.171**	0.564*	0.144	I(1)

Note: See note to Table 3.

Table 4: Johansen Cointegration Tests

	Trace Test		Maximum Eigenvalue Test	

Bahamas 1975(1)-2006(2)

	Null; Alternative	Statistic	Null; Alternative	Statistic
	r = 0; r > 0	45.085**	r = 0; r = 1	23.371**
	r ≤ 1; r > 1	7.714	r = 1; r = 2	8.849

Cointegrating Vectors: $i_t = 0.717 i_t^{US}$ ** LR Test of restriction [1, -1] on i_t^{US} : 2.344

Speed of adjustment: -0.20**

Trinidad and Tobago1975(1)-2006(2)

	Null; Alternative	Statistic	Null; Alternative	Statistic
	r = 0; r > 0	46.945**	r = 0; r = 1	38.109**
	r ≤ 1; r ≥ 1	8.836	r = 1; r = 2	7.013

Cointegrating Vector: $i_t = -7.534\pi_{t+1}$ ** $+1.182 i_t^{US}$ ** LR Test of restriction [1, -1] on π_{t+1}: 29.339**

LR Test of restriction [1, -1] on i_t^{US} : 16.136** Speed of Adjustment: -0.091**

Jamaica1993(1)-2006(2)

	Null; Alternative	Statistic	Null; Alternative	Statistic
	r = 0; r > 0	32.472**	r = 0; r = 1	22.780*
	r ≤ 1; r ≥ 1	9.691	r = 1; r = 2	9.089

Cointegrating Vector: $i_t = 4.472\pi_{t+1}$ ** $+ 2.463 i_t^{US}$ ** LR Test of restriction [1, -1] on π_{t+1} :12.748**

LR Test of restriction [1, -1] on i_t^{US} : 9.711** Speed of Adjustment: -0.269**

Notes: *r* denotes the number of cointegrating vectors. Critical values for the Trace and Max tests are obtained from MacKinnon, Haug and Michelis (1999). The LR tests are distributed $\chi^2_{df=1}$ and are conducted under the null that the restriction is binding. ** denotes significance at 1% and * denotes significance at 5%.

Table 5: Granger-Causality Tests 1975(1)-2006(2)

Country	Null Hypothesis	Test Statistic	Conclusion
The Bahamas	Δi_t^{US} does not Granger-cause Δi_t	3.737*	Δi_t^{US} Granger-causes Δi_t
	$\Delta \pi_{t+1}$ does not Granger-cause Δi_t	0.776	$\Delta \pi_{t+1}$ does not Granger-cause Δi_t
Barbados	Δi_t^{US} does not Granger-cause i_t	1.871	Δi_t^{US} does not Granger-causes i_t
	π_{t+1} does not Granger-cause i_t	1.074	π_{t+1} does not Granger-cause i_t
Jamaica	Δi_t^{US} does not Granger-cause Δi_t	0.217	Δi_t^{US} does not Granger-cause Δi_t
	π_{t+1} does not Granger-cause Δi_t	2.744*	π_{t+1} Granger-causes Δi_t
Trinidad and Tobago	Δi_t^{US} does not Granger-cause Δi_t	1.082	Δi_t^{US} does not Granger-cause Δi_t
	$\Delta \pi_{t+1}$ does not Granger-cause Δi_t	0.104	$\Delta \pi_{t+1}$ does not Granger-cause Δi_t
Guyana	Δi_t^{US} does not Granger-cause Δi_t	1.156	Δi_t^{US} does not Granger-cause Δi_t
	π_{t+1} does not Granger-cause Δi_t	1.376	π_{t+1} does not Granger-cause Δi_t

Notes: The statistic reported is the F-statistic for up to 4 lags of each variable. ** denotes significance at 1% and * denotes significance at 5%.

Table 6: Granger-Causality Tests of Sub-samples for Jamaica and Trinidad and Tobago

Country	Null Hypothesis	Test Statistic	Conclusion
<u>Jamaica</u>			
Pegged Rate (1975-1989)	Δi_t^{US} does not Granger-cause Δi_t	0.232	Δi_t^{US} does not Granger-cause Δi_t
	π_{t+1} does not Granger-cause Δi_t	0.715	π_{t+1} does not Granger-cause Δi_t
Floating Rate (1993-2006)	Δi_t^{US} does not Granger-cause Δi_t	0.460	Δi_t^{US} does not Granger-cause Δi_t
	$\Delta\pi_{t+1}$ does not Granger-cause Δi_t	1.134	$\Delta\pi_{t+1}$ does not Granger-cause Δi_t
<u>Trinidad and Tobago</u>			
Pegged Rate (1975-1991)	Δi_t^{US} does not Granger-cause Δi_t	0.255	Δi_t^{US} does not Granger-cause Δi_t
	π_{t+1} does not Granger-cause Δi_t	1.180	π_{t+1} does not Granger-cause Δi_t
Floating Rate (1995-2006)	Δi_t^{US} does not Granger-cause Δi_t	3.511*	Δi_t^{US} Granger-causes Δi_t
	π_{t+1} does not Granger-cause Δi_t	1.321	π_{t+1} does not Granger-cause Δi_t

Notes: See note to Table 6.

Figure 1: Plots of Real Interest Rate

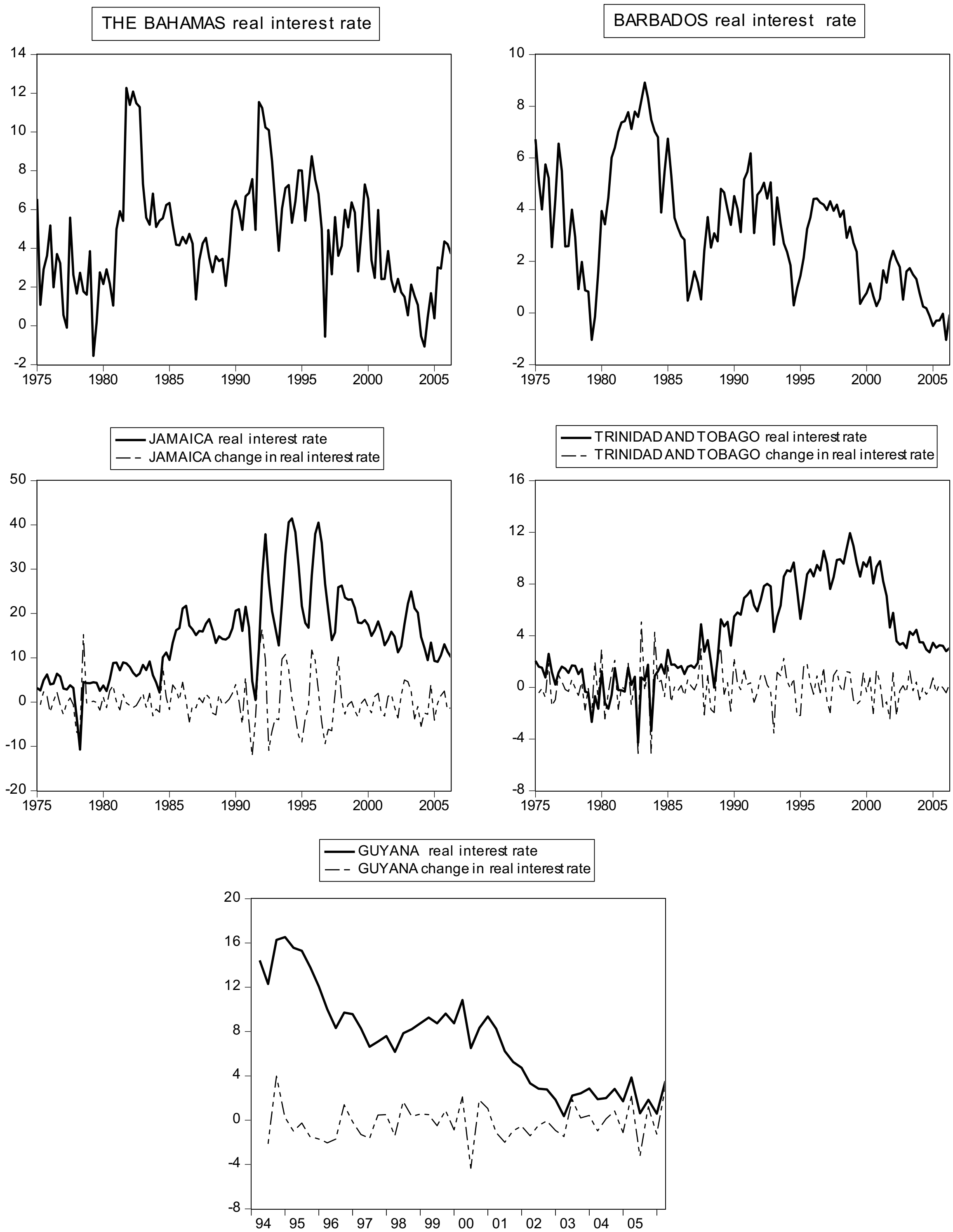
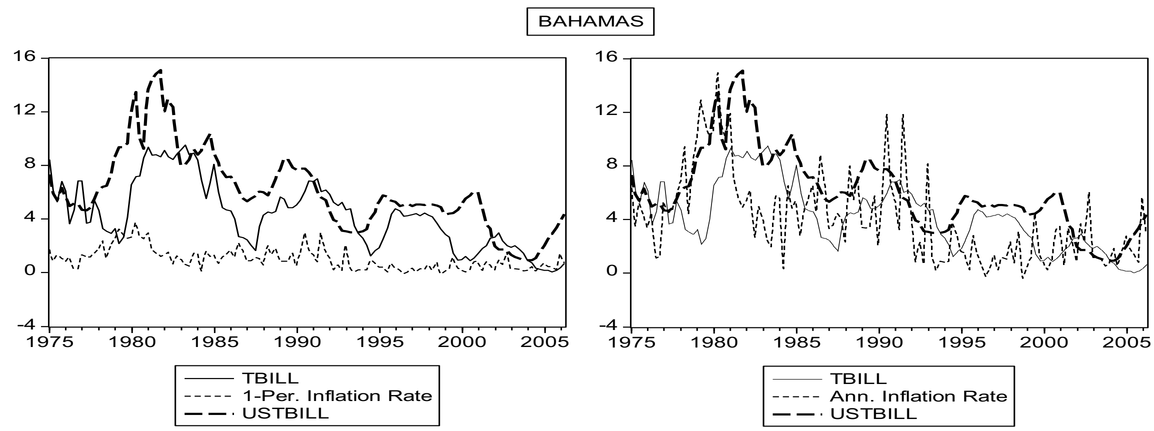
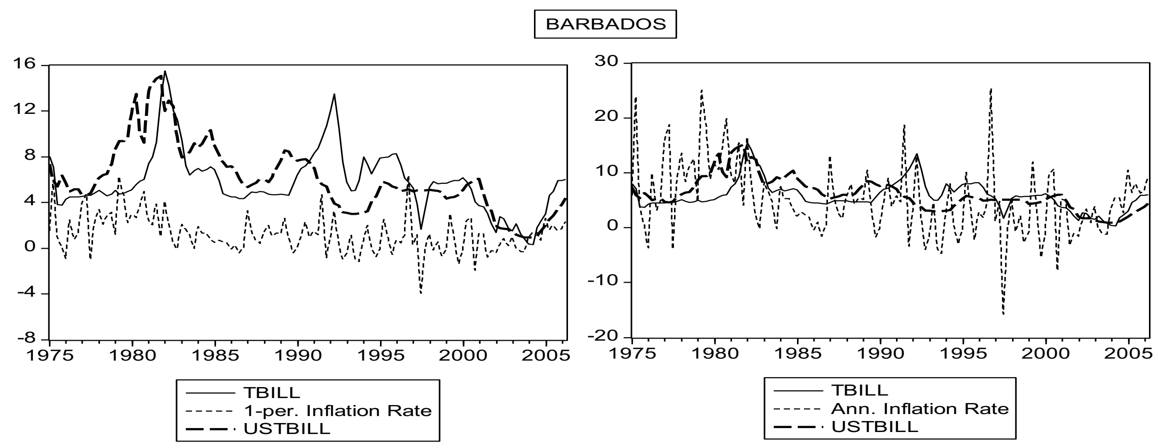


Figure 2: Plots of Nominal Interest Rate, Inflation Rate and US Nominal Interest Rate





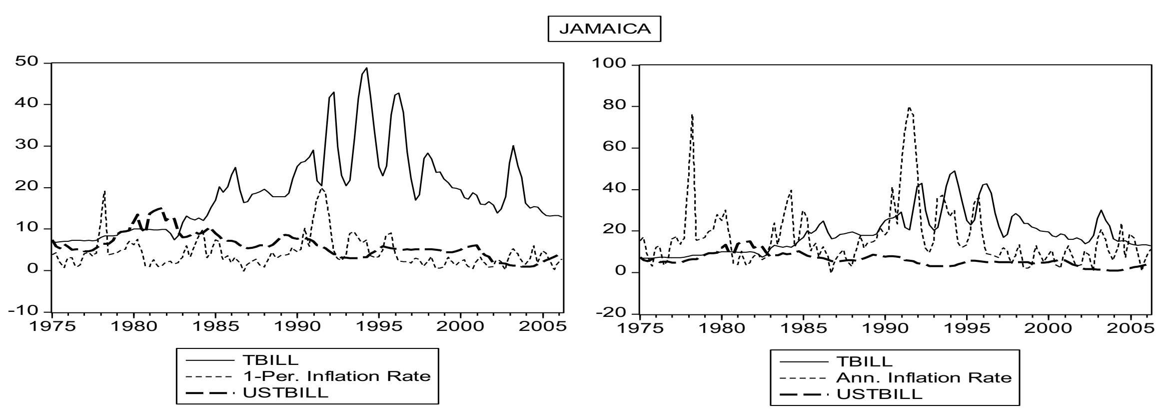
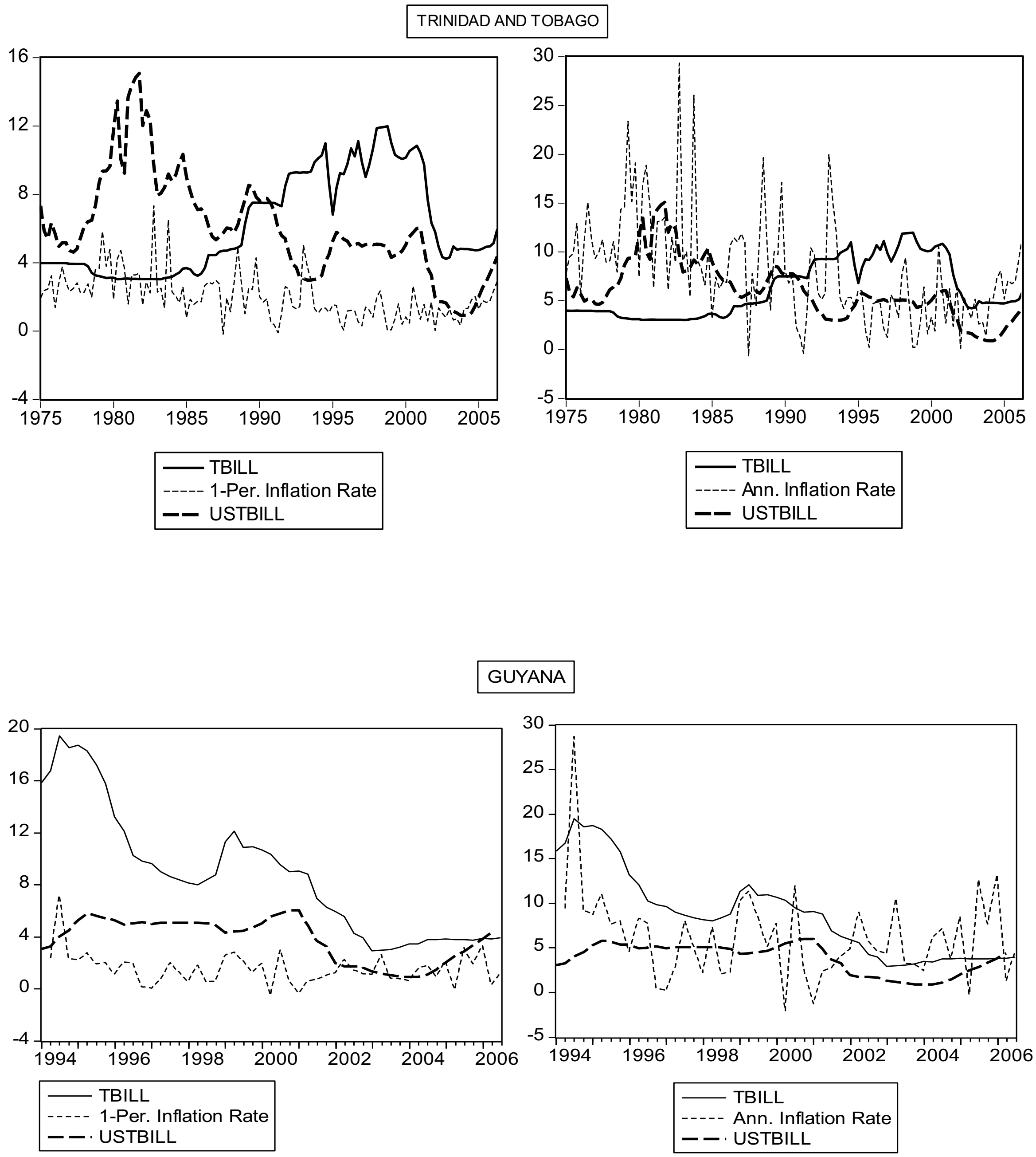


Figure 2: Plots of Nominal Interest Rate, Inflation Rate and US Nominal Interest Rate



Notes: TBILL stands for treasury bill rate of the relevant Caribbean country. 1-Per. inflation rate stands for one-period (quarterly) rate of inflation. Ann. inflation rate stands for the annualised (yearly) inflation rate. USTBILL stands for the US treasury bill rate.