# Money demand and economic uncertainty in Barbados

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**Money Demand and Economic Uncertainty in Barbados** (Draft)

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**Abstract**
Using the unrestricted error correction model proposed by Pesaran et al (2001), this paper investigates the relationship between economic uncertainty and money demand in Barbados. Results suggest that in the short run, agents tend to increase money holdings in the face of heightened uncertainty. However, this impact does not carry on into the longer term. Rather, the results suggest that nominal assets may become less attractive during prolonged periods of economic uncertainty.

**Keywords:** Money demand, economic uncertainty, Barbados, fixed exchange rate

**JEL Classification: C32; E41;**

## Introduction

Conventional economic wisdom suggests that the demand for real money balances is a function of income and interest rates: an increase in income tends to boost money demand, while interest rates – also known as the opportunity cost of holding money – reduces an economic agent's desire to hold money.

However, it has been argued that this traditional specification of money demand is highly restrictive. A recently developed strand of literature seeks to unveil the importance/relevance of the inclusion of economic uncertainty into the money demand equation. Consider the following scenarios proposed by Attah-Mensah (2004). If an economic agent's decision to hold money stems from finding the proper mix for his/her investment portfolio, the optimal level of money held by them will be – to a large extent – influenced by economic uncertainty. Here, risk-averse investors may prefer to hold safe and liquid monetary assets instead of risky assets (such as stocks and long-term bonds) in the face of increased economic uncertainty. In other words, money demand may be positively related to economic uncertainty. But, what about the case where economic uncertainties bring about pessimism about the future value of money? In such a scenario, nominal assets become riskier and economic agents could shift out of nominal assets, including money, into tangible assets such as gold or commodities. Thus, a negative relation emerges. This then implies that the exclusion of economic uncertainty from the money model can lead to erroneous conclusions, which in turn can have grave implications for monetary policy planning.

Notwithstanding this, there are still relatively few studies which include a measure economic uncertainty into the money demand equation. Moreover, of the few studies that exist, the empirical results are mixed, suggesting that differential impacts exist across nations. For instance, investigating the case of the Euro Area, Bruggeman, Donati and Warne (2003) find no link between economic uncertainty and money demand. In contrast, Choi and Oh (2003) finds that money demand in the US is positively related to output uncertainty, but negatively related to money growth uncertainty while Attah-Mensah (2004) reports that economic uncertainty results in a higher M1, but significantly reduces M2 in Canada. The discrepancies across studies would suggest a need for individual country modeling. As such, this study seeks to investigate the impact of economic uncertainty on money demand in Barbados.

Barbados, in this author's opinion, provides a very interesting case study. First, Barbados is among the few countries in the world that has managed to maintain a long-term peg[1]. Hence, any action which changes money balances only impacts on the balance-of-payments and by extension, affects the ability of the central bank to maintain the value of the BDS dollar. Therefore, economic uncertainty may have significant effects on the ability of the central bank to achieve its mandate of protecting the balance of payments and maintaining international reserves. Secondly, like many small open economies, the performance of the Barbados economy is heavily dependent on factors abroad, making the country highly susceptible to external shocks. Thus, unlike the aforementioned studies on money demand and economic uncertainty, pessimism about economy largely stems from uncertainty abroad and to some extent, lies out of the control of its policy makers. It follows that understanding the influence of economic uncertainty on money demand is imperative.

In addition to the importance of this paper to policymakers in Barbados, this study also makes a significant contribution to the existing literature. To the best of this author's knowledge, no study has been conducted a small open economy with a long-term peg. Thus, this paper will significantly add to the literature on money demand in countries with managed rate systems.

[1] On July 5, 1975, Barbados pegged its currency to the US dollar at a parity of BDS$2 to US $1; a rate which has been preserved up to the time of writing.

The remainder of this paper is outlined as follows. After the introduction, Section 2 describes the empirical approach, section 3 presents the results and finally, section 4 concludes.

## Empirical Approach

*Model*

Both the theoretical and empirical literature have identified income and interest rates to be the main factors influencing the demand for money. In this paper, the standard money demand function is augmented with an economic uncertainty index to explore the impact of economic uncertainty on money demand in Barbados. Formally

$$\frac{M}{P} = f(Y, r^{tbill}, EUI) \qquad (1)$$

where $\frac{M}{P}$ is the demand for real money balances (defined as the money supply divided by the Consumer price index), $Y$ represents real GDP, $r^{tbill}$ is the interest rate on 3-month treasury bills, and $EUI$ is an index of economic uncertainty.

*Measuring Economic Uncertainty*

Barbados, like most other small island developing states, can be characterised by its small size, narrow productive bases and high vulnerability to external shocks. In particular, the performance of the country is highly dependent on the performance of countries abroad, chiefly, the UK, US and Canada. It is thus assumed that economic uncertainty in Barbados is largely due to uncertainties abroad and so, is approximated by a weighted average of the economic uncertainty in the UK, US and Canada. Since uncertainty is not directly observable, an eclectic approach is adopted in this study. Following much of the related literature (see for instance: Bruggeman, Donati and Warne, 2003; Attah-Mensah, 2004;) risk and uncertainty are assumed to be the same and as such, economic uncertainty is proxied by a measure economic volatility.

Economic volatility in the US, UK and Canada, is measured by the volatility of the industrial production index. These volatilities are extracted using Generalised autoregressive conditional heteroskedasticity (GARCH) models, introduced by Engle (1982) and generalised by Bollerslev (1986). The GARCH model is specifically designed to simultaneously model the mean and conditional variance of a series. In general, the GARCH(*p*,*q*) model can be expressed as:

$$y_t = \alpha_0 + \sum_{i}^{n} \beta_i X_t + \varepsilon_t \qquad \varepsilon_t \sim N(0, h_t);$$
$$h_t = \psi + \sum_{i}^{q} \varphi_i \varepsilon_{t-i}^2 + \sum_{i}^{p} \delta_i h_{t-i} \qquad (2)$$

where the above specification states that the $y_t$ series depends on a constant ($\alpha_0$), *k* exogenous and/or predetermined variables ($x_t$), and a shock; the conditional variance (volatility) of the industrial production, $h_t$, depends on a constant ($\psi$), the previous period's squared random component (referred to as ARCH effects or the short-run persistence of shocks) and the previous periods' variance.

An index of economic uncertainty is then constructed as

$$EUI = \sum_{j}^{n} \lambda_j \frac{(h_i - \bar{h}_i)}{\sigma_h} \qquad (3)$$

Where $\lambda_j$ is the weight attached to each volatility and is the trade weight for the US, UK and Canada.

*Econometric Approach*

Over the last three decades, several econometric techniques have been proposed for modeling the long-run and corresponding short run relationship between time series variables. The most popular in the literature are the Engle and Granger (1987) two-step estimator, the multivariate Johansen (1988) and Johansen and Juselius (1990) methodologies, Johansen's (1996) full information maximum likelihood procedures and the fully modified OLS procedures of Phillips and Hansen (1990). A major limitation of these approaches is that they require the series under observation to be I(1) (non-stationary). In this study, the unrestricted error correction model proposed by Pesaran et al (2001) – where short and long-run effects are estimated jointly from a general autoregressive distributed-lag (ARDL) model – is employed. Unlike the aforementioned methodologies, this approach is applicable irrespective of whether the underlying regressors are purely I(0), purely I(1) or mutually cointegrated.

The first step of the bounds approach involves estimating the ECM by OLS. Specifically,

$$\Delta y_t = c_0 + \pi_y y_{t-1} + \pi_x x_{t-1} + \sum_{i=1}^{p} \psi_i \Delta y_{t-i} + \sum_{i=0}^{q} \phi_i \Delta x_{t-i} + u_t \quad (4)$$

where y is the money demand variable and $x$ represents *EUI*, $r^{tbill}$ and $Y$ identified above; $\phi_i$ and $\psi_i$ are the short-run coefficients; $\pi_x$ and $\pi_y$ are the level effects and thus the long-run coefficients are computed $-\frac{\pi_x}{\pi_y}$, as $\pi_y$ also represents the speed of adjustment to the long-run relationship. Finally, $u$ is a disturbance term.

The lag lengths $p$ and $q$ in Equation (1) are initially set to 12. Then a "general – to – specific" specification search technique (see Hendry and Richard, 1982; Campos et al., 2005;) is employed in order to obtain a parsimonious representation of the data generating process.

To test the existence of a level relationship between $y_t$ and $x_t$ in (4), two separate statistics are used: an F-test on the joint null hypothesis that the coefficients of the lagged level variables are jointly zero, i.e. $H_0^{\pi_y} : \pi_y = 0,\ H_0^{\pi_x} : \pi_x = 0'$ and a t-test on the lagged dependent variable, $y_{t-1}$ $(H_0^{\pi_y} : \pi_y = 0)$.

It should be noted that these F- and t-statistics follow a non-standard distribution. Hence, instead of the conventional critical values, these tests involve two asymptotic critical bounds, covering all possible classifications of the variables, i.e. whether they are I(1), I(0) or mutually cointegrated. The lower bound assumes that the variables are purely I(0), and the upper bound values assume that they are purely I(1). If the computed test statistic is outside the bounds, a conclusive inference can be drawn without needing to know the integration/cointegration status of the underlying regressors. Hence, if the test statistic exceeds its respective upper critical values then there is evidence of a long-run relationship regardless of the order of integration of the variable; if below the lower bounds the null of no-cointegration cannot be rejected. However, if it lies between the bounds, inference is inconclusive and knowledge of the order of the integration of the underlying variables is required before conclusive inferences can be made.

*Data*
The dataset consists of quarterly observations over the period 1982(1)-2010(1). Observations on the money supply, Treasury bill rate and real GDP for Barbados are obtained from the Central Bank of Barbados, while the industrial indices and consumer price index is taken from the International Monetary Fund Financial Statistics Database. All variables, excepting the EUI and interest rates, are expressed in natural logarithms.

## Results

As a preliminary step to the empirical analysis, the order of integration of the variables is determined. The results (shown in Table 1) suggest a mixture of I(1) and I(0) variables, justifying the use of the unrestricted ECM. Next, the presence of a cointegrating relationship is tested. The bounds test is presented in Table 2, which suggests that all test statistics are significant at the 10% level.

Table 1: Unit root test

| Variables | ADF | | | | Decision |
|---|---|---|---|---|---|
| | Level | Nature of the Series | 1st difference | Nature of the series | |
| *M* | -2.79 | Intercept and trend | -3.77*** | Intercept | I(1) |
| *Y* | -2.71 | Intercept and trend | -10.21*** | No intercept, no trend | I(1) |
| $r^{tbill}$ | -3.88*** | Intercept and trend | N.A. | N.A. | Trend Stationary |
| *EUI* | -3.24*** | No intercept, no trend | N.A. | N.A. | I(0) |

Note: ***, ** and * indicate significance at the 1, 5 and 10 percent levels respectively

Table 2: Bounds tests

| F-test statistic | T-test statistic |
|---|---|
| 16.43*** | -3.706* |

Notes:

1. Asymptotic critical value bounds can be found in Tables CI(iii) and CII(iii) Case V: Unrestricted intercept and no trend for k = 4 in Pesaran et al (2001).
2. ***, ** and * indicate significance at the 1, 5 and 10 percent levels respectively

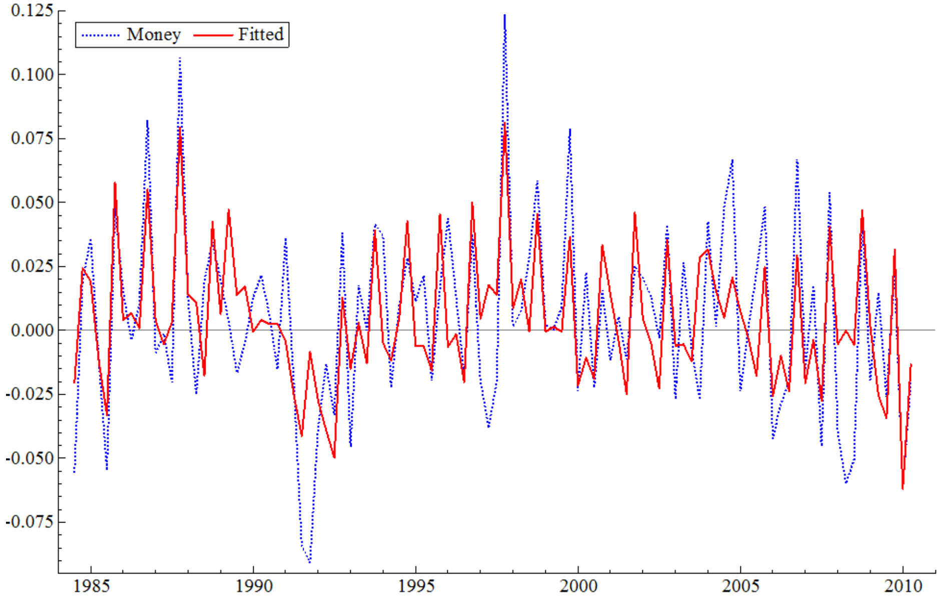
The parsimonious unrestricted ECM specification, obtained by sequentially deleting the insignificant variables, is presented in Table 3. The model appears to be well specified – passing all diagnostic tests – and also seems to effectively explain money patterns in Barbados (as evidenced by Figure 1). Moreover, the coefficient on the $M_{t-1}$ term is negative and highly significant as required, and implies about 10% of the discrepancy between the past and current equilibrium is eliminated in each period.

Table 3: Parsimonious unrestricted ECM estimates

| Dependent Variable: $\Delta M_t$ | | |
|---|---|---|
| | *Coefficients* | *Estimated Long-Run Coefficients* |
| $\Delta EUI_{t-2}$ | **0.014** (2.263) | - |
| $\Delta y_{t-3}$ | **0.281** (2.102) | - |
| $\Delta y_{t-7}$ | **0.387** (2.927) | - |
| $M_{t-1}$ | **-0.101** (3.706) | - |
| $EUI_{t-1}$ | -0.009 (-2.547) | **-0.090** |
| $Y_{t-1}$ | 0.116 (3.996) | **1.147** |
| $r_{t-1}^{tbill}$ | -0.005 (-2.547) | **-0.045** |
| *Diagnostic Checks* | | |
| AR 1-5 test | 0.754 [0.586] | |
| ARCH 1-4 test | 0.485 [0.747] | |
| Normality test | 2.739 [0.254] | |
| Heteroscedasticity test | 0.766 [0.726] | |
| RESET23 test | 2.114 [0.127] | |

Note: T-statistics are given in parentheses below the variables; p-values are in square parentheses beside the statistics for each diagnostic test.

Figure 1: Parsimonious unrestricted ECM




Looking first at the short-run, results suggest that only income and economic uncertainty seem to significantly impact money demand. Of particular interest, the coefficient on the economic uncertainty variable is positive, implying that in the short-term, increased economic uncertainty leads to a rise in the desired money holdings. This finding is consistent with the theory of the risk-adverse economic agent who, in an uncertain environment, substitutes his risky securities for more money. However, there are some distinct differences in how the variables affect economic agents in the short and long run. Specifically, while, interest rates appear to have no impact in the short-run, the estimates suggest that in the long term, interest rates reduce money demand with a semi-interest elasticity of –0.045. Then, though the income variable retains its positive and significant coefficient, the sign on the economic uncertainty index coefficient changes: that is, in the long run, economic uncertainty tends to reduce the money holdings of agents.

The next logical question would be: why is there such a discrepancy between the long-run and short term effects of economic uncertainty? One possible explanation could be that as period of economic uncertainty lengthens, agents may be concerned about the value of money. In such a scenario, agents may opt to adjust their portfolio and invest in “real assets” such as houses or precious metals, as nominal assets such as money balances become less attractive. Taken together, the results imply that in the face of economic uncertainty economic agents tend to substitute their risky assets for money in the short run. However, as time progresses, real assets tend to be more attractive and as such, the agents’ portfolios are adjusted, resulting in a reduction in money holdings.

## Concluding Remarks

This aim of this study is to investigate the relationship between money demand in Barbados and economic uncertainty. To this end, the standard money demand function is augmented with an economic uncertainty index based on the economic uncertainty of Barbados’s main trading partners – the US, UK and Canada. Based on the findings, one can conclude that economic uncertainty does in fact have a significant impact on money demand in Barbados. But, there appears to be some disparities in how economic uncertainty affects money demand in the short and long run. Specifically, in short term, agents tend to increase money holding when in an uncertain environment. But, during prolonged periods of economic uncertainty, nominal assets themselves become riskier, resulting in reduced money balances.

These findings have important policy implications for Barbados. Of particular note, economic uncertainties abroad may have a significant impact on the money supply in Barbados, and by extension, the country’s balance of payments. This implies that the country may need to monitor and forecast future economic uncertainties and take these projections into account when making changes to its monetary stance.

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