INFLATION DYNAMICS IN THE ECCU

Preliminary, For Discussion Only

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Abstract

This paper investigates inflation dynamics in Eastern Caribbean Currency Union (ECCU) using two approaches: (i) the Autoregressive Distributed Lag model ARDL for co-integration developed by Pesaran et al (2001) and (ii) a structural VAR. The estimated results for the ARDL model indicate that in both the long and short run US CPI and oil prices are the most significant influences on the ECCU inflation rate. level with largest impact with money growth being significant only at the ten percent level. At the country specific level there is considerable heterogeneity in the determinants of inflation in both the short and long run. Results from the error correction model also show that shocks to domestic inflation are very short-lived. At the ECCU level, inflation reverts to its equilibrium level in less than one quarter. At the country specific level it was found that Antigua and Barbuda

and St. Lucia adjusted the fastest while Dominica and St. Kitts and Nevis adjusted the slowest.

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1.0 Introduction

The objective of this paper is to assess the determinants of inflation in the OECS/ECCU area. The ECCU consist of eight countries sharing a common currency, Central Bank and pool their reserves this type arrangement is usually referred to as a Currency Board. The Eastern Caribbean dollar, which is the currency, is at a fixed parity with the US dollar of EC$ 2.70 to US$ 1.00. The economics literature on fixed exchange rates essentially posits that the inflation rate in these types of regimes will be similar to that of the country to which they are pegged. Under a fixed exchange rate, the central bank effectively imports the monetary policy of the country to which they are fixed. Indeed, where the exchange rate is irrevocably fixed, and widely believed to be so, the central bank effectively no longer has its own monetary policy. Essentially fixing one's exchange rate to one particular currency implies floating in relation to many others that are important trading partners; incomplete pass-through implies a less than perfect relationship between domestic and foreign prices even in a currency board.

Given that all of these islands are small open economies, it is without a doubt that foreign factors exert a great deal of influence on the domestic price level. However, the exact nature and speed of the transmission is not well understood. This study comes on the heels of rising cost of living in these islands given the recent irruption of both oil and commodity prices across the world causing prices to increase sharply in the islands. Therefore, it is important we understand the factors which drive inflation in order to design optimal policies to combat inflation.

Like all other Central Banks, though not pursued as vigorously as those that have adopted an inflation targeting policy, price stability is one of the goals of the ECCB. This concern with price level stability emanates not only from the need to maintain macroeconomic stability, but also from its social

consequences. Therefore, the aim of this paper is to increase our understanding of the inflation process in the ECCU by investigating both external and domestic factors that may impact on the domestic price level. Given the dearth of studies in this area for the ECCU this paper attempts to fill the gap.

An econometric model is estimated using the Autoregressive Distributed Lag model of Pesearan et al (2001) and the SVAR. The study covers the period from 1990 quarter one to 2007 quarter four (1990 Q1-2007Q4). The data include as explanatory variables nominal money supply (M2), real exchange rate (er), oil prices (oilp), output gap (ygap)[1], and foreign prices proxied by the US CPI. These variables are typical of those applied in other empirical analysis of inflation in small open economies (SOE) countries. ECCU inflation rates are used as the dependent variables in the estimation.

The layout of the paper is as follows: section one looks at the theories and the measurement of inflation. Section two, some stylized facts about inflation in the ECCU and other related variables are presented, section three a literature review is presented. Section four outlines the methodology and variables, section five discusses the results and section six presents recommendations and conclusions.

2.0 Theories of Inflation

In general low and moderate rates of inflation are seen as having a beneficial effect on the economy; when the inflation rate becomes high and volatile this tends to have a negative effect on the economy. These negative effects are manifested through uncertainty (discourages investment), redistribution of income, shoe leather and menu costs, hoarding, relative price distortions, possible bouts of hyperinflation and stimulates capital

[1] The output gap is computed using the Hodrick-Prescott Filter. The H-P filter uses a smoothing parameter or lambda of 1600 because of the use of quarterly data.

flight (into foreign assets, precious metals, or unproductive real estate). It also inhibits growth, makes economic planning a nightmare, and, in its extreme form, evokes social and political unrest.

Economic theory posits several possible explanations for inflation in a country; these may be grouped as the monetarist, structuralist and output gap or Philips curve approaches. The monetarists, led by Milton Friedman, view inflation as the outcome of excessive money growth. Their hypothesis is that money can be viewed as a substitute for real and financial assets; therefore, any increase in the money supply will not be held as idle balances but spent on these items. The increased expenditure creates a situation whereby there is excess demand leading to price increase and hence an acceleration in the rate of inflation.

The Philips Curve hypothesis, as first put forward by Professor Philips (1958), and later refined and challenged by Friedman and Lucas, highlights the role of excess demand in creating inflation. This approach shows the tradeoff between high inflation and low unemployment. Hence, governments that want to lower unemployment can do so if they are willing to tolerate higher rates of inflation.

Structuralists argue the role of supply-side constraints as a cause of monetary growth and therefore, a source of inflation (see Bernanke, 2005). In these models, inflation is often driven by bottlenecks in the real economy. In developing countries, food supply is relatively inelastic: occasional excess demand arising, for example, after an increase in nonagricultural incomes cannot be absorbed quickly enough to avoid price increases. Likewise, foreign exchange constraints often lead to inflation. If food imports are restricted, negative supply shocks such as droughts or locust invasion will lead to food shortages and price increases. Furthermore, when wages are indexed and monetary policy is accommodative, an initial increase in prices

will lead to wage adjustments to compensate for the lost real income, reinforcing inflation inertia.

Theories that are usually used to analyze inflation in open economies are the Scandinavian and Purchasing Power Parity models. The Scandinavian model posits that overall inflation in a SOE with a fixed exchange rate is determined by imported inflation and the gap in productivity growth. Therefore, inflation in these countries is not solely the result of imported inflation but also domestic factors resulting from the gap in productivity growth

What we come away with from the above analysis is that in a small open economy, any changes in the trading and pegged partner price level will be transmitted almost one for one into the domestic price level. However, there can be deviations in the two price levels because of differences in productivity growth in the tradable and non-tradable goods sector in the domestic economy. Essentially what this theory says is that PPP may not hold at least in the short run for a SOE with a strict peg because of domestic factors.

Loungani and Swagel (2001) highlight four causes of inflation in developing countries; these are demand pressures, supply shocks, inflation inertia and fiscal and monetary policies. We will add to these the role that changes in the exchange rate and foreign factors play in the domestic price level. In a small open economy operating under a fixed exchange regime movements in international/ foreign prices can affect the domestic price level through at least four channels, these are the cost-push, demand pull, institutional and monetary views Scarfe, B.L (1973).

3.0 Stylized Facts

Generally the ECCU countries have enjoyed low and moderate rates of inflation. The average across the area is about three percent (3%) annually; the explanation for this low rate of inflation is usually explained by having the US dollar as the nominal anchor for the exchange rate. This is, however, juxtaposed against the fact there is some heterogeneity in the rates of inflation between the countries, in that some may have rates lower and above the average.

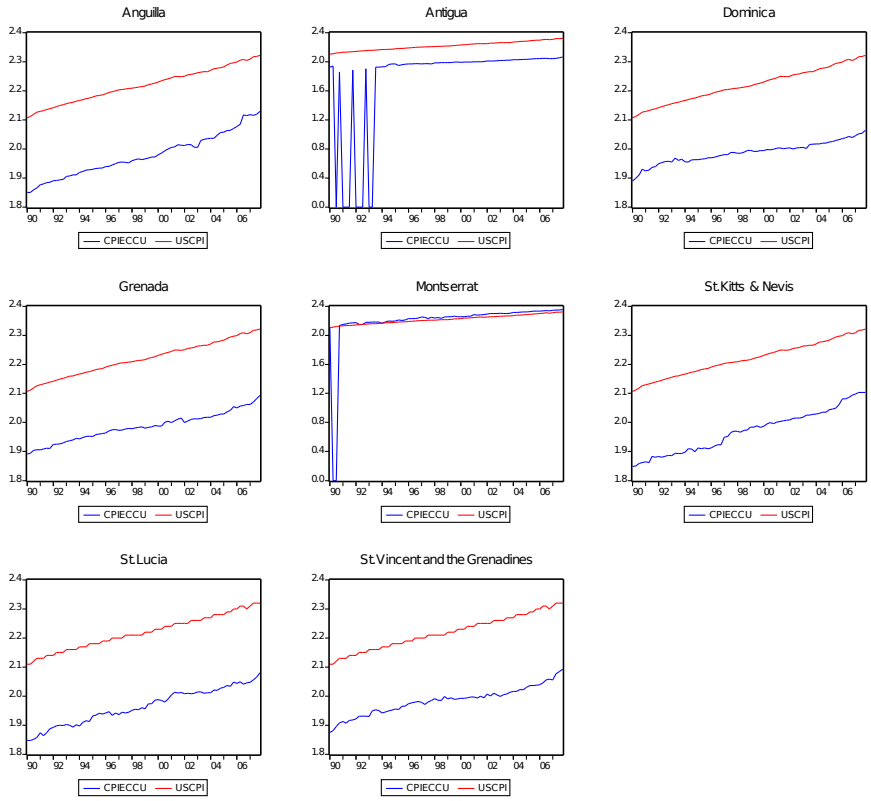
We take a cursory look at the data to get a feel for the data. Tables one and two shown in Appendix A, show the correlation and covariance matrices among the variables, with CPI_ECCU being the dependent variable and all the other variables are independent. Table one which shows the correlation matrix, we observe that there is strong positive correlation between the CPI of the ECCU countries and the US CPI, oil prices (loil_p), output gap (ygap) these relationships are the weakest in the case of Grenada.

The covariance matrices show the degree of co movement between the CPI of the respective ECCU countries and the other variables is quite weak although it's a positive relationship in that they do move together.

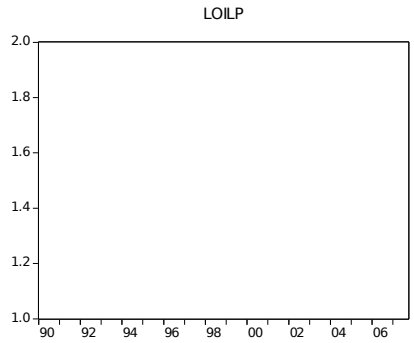
Below we plot the CPI of the respective ECCU countries[2] against that of the US; graph 1 show that there is considerable amount of co-movement between the CPI's. In general the rate of inflation for the ECCU countries have tended to be lower than that of the US, however, a lot more volatile than the US. Potential reason why the ECCU CPI may be lower than that of the US is because of price controls in these islands that prevent the full pass through effect of price increases.

[2] The countries are listed in the graph from 1-8 in the following order Anguilla, Antigua and Barbuda, Dominica, Grenada, Montserrat Saint Kitts & Nevis, Saint Lucia, and Saint Vincent & the Grenadines. This ordering remains throughout the section.

Graph 1-Plot of ECCU Countries CPI against US CPI in Logarithms

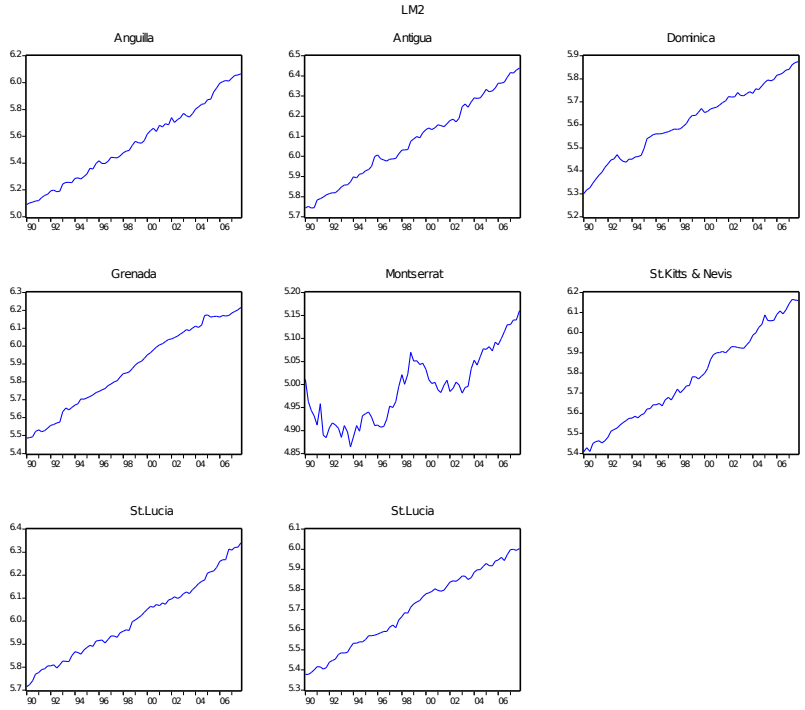


Graph 2-Plot of Oil Prices in Logarithms



The graph above shows the movement in international oil prices. We hypothesize that when oil prices increase the inflation rate in these countries should increase since they are energy dependent countries with little or no alternative form of energy. This type of inflation is cost push inflation in which the cost of raw materials leads to an increase in the price of finished goods.

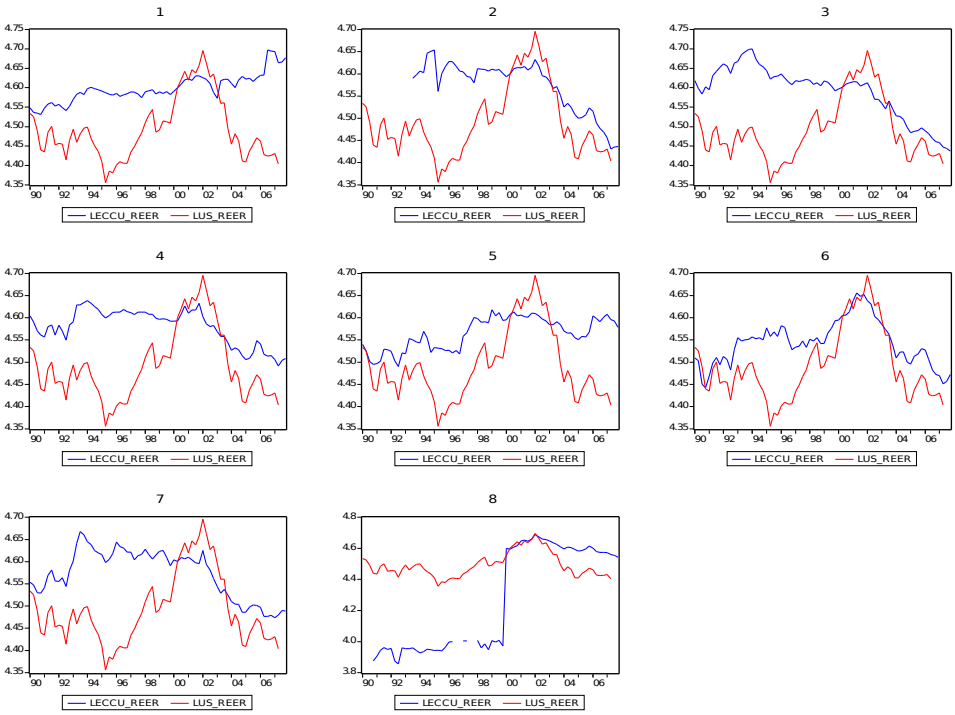
Graph 3-Plot of ECCU Countries M2 in Logarithms



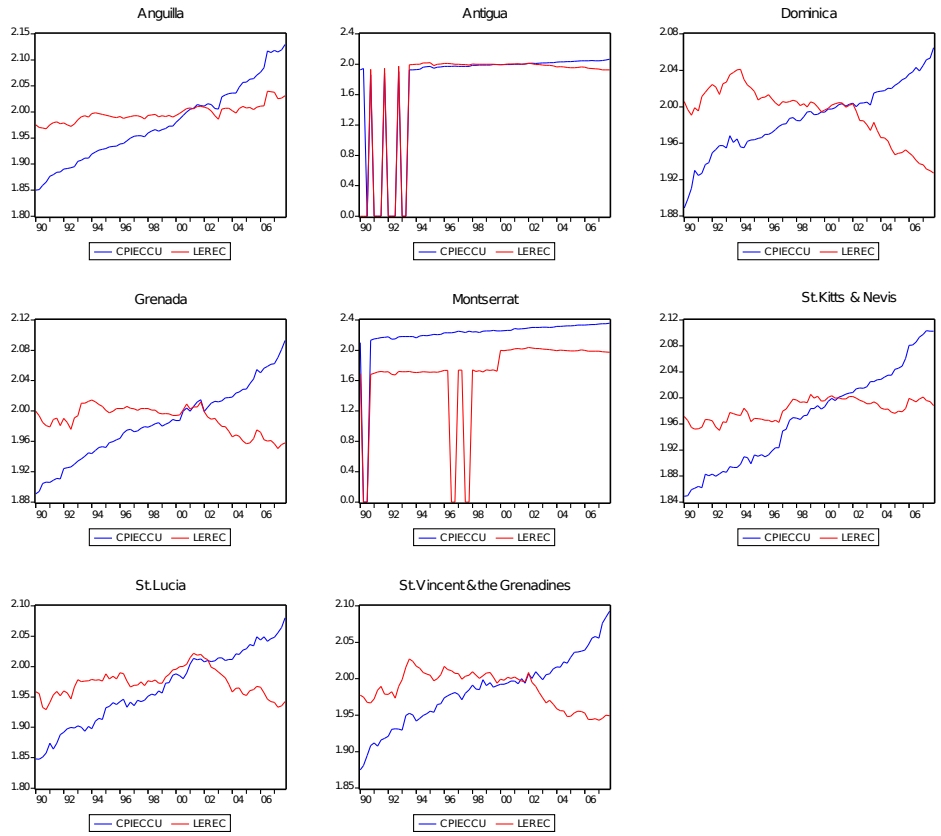
A plot of the growth rate of monetary aggregates is shown in Graph 3. In all the countries we see the growth rate of monetary liabilities has been trending upward in a rather stable fashion except in the case of Montserrat where there is a structural break in the data.

Graphs 4 and 5 showing the real effective exchange rate (REER) of the ECCU compared with of the US and the ECCU CPI. As shown in Graph 4 the ECCU and US REER tend to move together, with the ECCU having a lagged effect. The graphs are consistent with what we have been witnessing as it relates to the depreciation of the US dollar. The depreciating US dollar implies that EC dollar is also depreciating relative to other currencies, making it more expensive for purchasing imports from non-US sources. This is the exchange rate pass-through effect of inflation. Graph five shows the effect of the REER against that of the CPI.

Graph 4-Plot of ECCU Countries REER against US REER in Logarithms


1
2
3
4
5
6
7
8
LECCU_REER
LUS_REER

Graph 5 Plot of ECCU Countries REER against the CPI of the respective countries



Testing for common cycles and trends between the ECCU CPI, US CPI and oil prices; the results show that ECCU countries and the US share five common trends and four common cycles for the CPI[3]. In the case of oil prices it was that ECCU CPI and the oil prices share three common trends and six common cycles.[4]

[3] The Johansen test for co integration test using the maximum Eigen value and trace statistics suggested 5 co integrating relationships using the assumption of trend and intercept in co integrating equation. Lag length selected was one based on the HQ and SIC test statistics.

[4] The results from this test are available from the author upon request at **hodge.allister@gmail.com**.

4.0 Literature Review

For the literature review section we will only analyse those studies which are similar to the methodology used in this paper and to environments of the ECCU countries.

Downes, A (1985) investigated the causes of inflation in Barbados during the period of 1960-77. Using econometric techniques (OLS) he regressed the price level proxied by the CPI on the prime lending rate (interest rate), wage rate and the import price. His study found strong evidence of foreign factors (import prices) being the leading factor in driving the inflation process in Barbados. Import price accounted for almost 73 percent of total inflation for the period under study. The interest rate variable exerted an 8 percent influence on overall inflation. The deficiency of his study is that his regression may be spurious however, given the time of his study this was not issues then.

Sun, Y and Dattagupta, R (2008) utilizing cointegration techniques tested whether the purchasing power parity PPP held for the ECCU region, given its peg with the US dollar. In their study in the first stage of their study the authors investigated whether there was long run relationship between the ECCU and US CPI's using co-integration. In the second stage they estimated a country specific error correction model for the short run relationships among the variables. The authors found evidence that the PPP theory does not hold for the ECCU, suggesting that the US and ECCU price are not co-integrated.

For the short-run dynamics from the error correction model, it was found that speed of adjustment back to equilibrium for the ECCU was very fast, occurring in about eight months. The country specific speed of adjustment

ranged from 3 to 27 months. The central conclusion of their study was that price movements within the ECCU was not primarily governed by imported inflation from the USA, but has domestic components built into it. Additionally, the authors concluded the reason that PPP does not hold for the ECCU may be as result of persistent deviation in prices in the non-tradable goods sector.

Ginting, E (2007) assessed whether inflation in India attracted inflation in Nepal. Nepal, which shares a common border with India, also pegs its local currency to the Indian rupee, therefore; it was expected that any price movements in India would be reflected in Nepal since the Indian Rupee is the nominal anchor for the Nepalese dollar. The methodology used in the study was the Johansen cointegrating technique. In the study showed that the exchange rate does transmit price developments but not in a straight forward way. The evidence as they showed only turns up after controlling for transitory components of headline inflation in both India and Nepal. It was found that core inflation in both India and Nepal are cointegrated and in the short run when the two deviate, the speed of adjustment back to equilibrium only takes seven months.

Other studies which have utilized cointegration techniques for single country analysis are Williams, O and Olumuyiwa, A.S (2004). Their study investigated the factors driving inflation in the Dominican Republic, using quarterly data for the period 1991-2002 and the following variables, m2 growth, output gap, import price index, domestic consumer price index, nominal exchange rate and interest rates. They uncovered evidence that all the variables were in fact driving inflation in the Dominican Republic, albeit with disequilibrium in the money market exerting the greatest influence.

Using panel cointegration methodology, Barnichon, R and Peiris, S.R (2007) examined the sources of inflation in Sub- Saharan Africa. The authors used

two variables in their analysis, the output and money gaps. It was established that both gaps played a significant role in explaining inflation; however, a greater influence was exerted by the money gap.

Disentangling domestic and imported core inflation Bj◄rland,H (2000) estimated a Structural VAR to ascertain which components made up a larger share of the CPI basket in Norway. In his paper the author, separates headline and core inflation. Core inflation as defined in his paper, *"that part of inflation that has no impact on GDP"*. The author found evidence that domestic core inflation is the main component of CPI inflation rather than imported core inflation.

Starting from the hypothesis that globalization has slowed inflationary pressures across the world, Mody, A and Ohnsorge, F (2007) set out to test this hypothesis for the E.U. that is whether globalization has slowed inflation within the E.U.? As a methodological framework the authors used panel data techniques to draw their conclusions.

Pauwels, L and Genberg, H (2001) investigating the determinants of inflation in Hong Kong which like the ECCU has a currency board arrangement in place. The authors estimated a New Keynesian Phillips Curve (NKPC) in which the marginal cost of production plays a significant role with forward looking expectations. The model was estimated using a GMM framework, the results from the model showed that prices adjusted very quickly.

5.0 Analytical Framework

One of the difficulties with most of the literature cited above is that the time series properties of the data are usually not analysed within a panel data framework but single country analysis is done. This study will make use of

testing for panel unit roots, using a variety of tests in order to rule out the possibility of a spurious regression.

It is well documented that the standard unit root tests (eg Augmented Dickey Fuller test ADF) can have low power against the stationary alternative (Campbell and Perron, 1991). Panel unit root tests may have more power and are expected to provide more reliable evidence of stationarity, although cross section cointegration may bias the panel tests Banerjee, Marcellino and Osbat 2001. Popular test for unit roots in panel data are by Levin, Lin and Chu (2002) (LLC), Im, Pesaran and Shin (2003) (IPS) and Breitung (1999).

The panel unit root test alluded to above are generalizations of the ADF unit root test. The null hypothesis of a panel unit root is investigated against the alternative of a stationarity process for all cross sections (Anguilla,……. And Saint. Vincent and the Grenadines).The test statistics are asymptotically distributed as standard normal Banerjee (1999).

Once test for unit roots are conducted we can then move on to test for cointegration. There are several methods available to test for the existence of the long-run equilibrium relationship (cointegration) among time-series variables. The most widely used methods include the Engle and Granger test (1987), fully modified OLS procedure of Phillip and Hansen (1990), Gregory and Hansen (1996) and the maximum likelihood-based Johansen (1988, 1991) and Johansen-Juselius tests (1990). All these methods require that the variables in the system are integrated of order one I(1). In addition, these methods suffer from low power and do not have good small sample properties. Due to these problems, a newly developed autoregressive distributed lag (ARDL) approach to cointegration has become popular in recent years.

The ARDL modeling approach was originally introduced by Pesaran and Shin (1999) and further extended by Pesaran et al. (2001). This approach has numerous econometric advantages in comparison to other cointegration methods. The main advantage of this approach is that it can be applied regardless of whether the variables are I(0), I(1) or fractionally integrated Pesaran and Pesaran (1997, pp. 302–303)].

Another advantage of this approach is that it provides robust results in small sample sizes and estimates of the long-run coefficients are super consistent in small sample sizes Pesaran and Shin (1999). The endogeneity problem and inability to test hypotheses on the estimated long-run coefficients as evidenced in some other approaches are resolved. Furthermore, a dynamic error-correction model (ECM) can be derived from ARDL that integrates the short-run dynamic with the long-run equilibrium without losing long-run information Banjeree et al (1993). It is also argued that using the ARDL approach avoids problems resulting from non-stationary time series data Laurenceson and Chai (2003).

In light of the above advantages alluded to by the literature, we use the ARDL approach for co-integration analysis and the resulting ECM. An ARDL representation of inflation dynamics is formulated below:

$$\Delta\pi_{ECCU} = \alpha_0 + \beta_1\sum_{p=1}^{n}\Delta\pi_{ECCU_{t-p}} + \beta_2\sum_{p=1}^{n}\Delta\pi_{US_{t-p}} + \beta_3\sum_{p=1}^{n}\Delta loil\_p_{t-p} + \beta_4\sum_{p=1}^{n}\Delta leccu\_reer_{t-p} + \beta_5\sum_{p=1}^{n}\Delta lm2_{t-p}$$

$$\beta_6\sum_{p=1}^{n}\Delta ygap_{t-p} + \delta_1\pi_{US_{t-1}} + \delta_2 loil\_p_{t-1} + \delta_3 leecu\_reer_{t-1} + \delta_4 lm2_{t-1} + \delta_5 ygap_{t-1} + \varepsilon_{1t} \ldots\ldots\ldots\ldots\ldots 1$$

For the purposes of brevity the other equations are not represented here. It is important to note however, that there are six other equations with the

explanatory variables being used as the dependent variables in the subsequent equations. These equations are the long run equations which are used to test for cointegration.

To test for the presence of long-run relationship as given in Equation 1, the first stage in ARDL approach is to conduct bounds testing for Equation. Bounds test involve performing an F-test on the null hypothesis of no cointegration against the null of cointegration.

$H_0 = \delta_1 \ldots\ldots\ldots \delta_6 = 0$ Null Hypothesis

Alternative

$H_1 = \delta_1 \ldots\ldots\ldots \delta_6 \neq 0$

The calculated F-statistics in this procedure has a non-standard distribution. Thus, the calculated F-statistic is compared with two sets of critical values tabulated by Pesaran et al. (2001). One set assumes that all variables are I(0) and the other assumes they are I(I). If the calculated F-statistic is larger than the upper bound critical value, then the null hypothesis of no cointegration is rejected irrespective of whether the variables are I(0) or I(1). If it is below the lower bounds, then the null hypothesis of no cointegration cannot be rejected. If it falls inside the critical value band, the test is inconclusive.

Once cointegration is established, the lag length is selected for each variable. The ARDL method estimates the number of regressions to determine the optimal lag length for each variable. The appropriate lag length for each variable can be selected using Schwartz-Bayesian Criteria (SBC), Akaike's Information Criteria (AIC) or Hanan Quin (HQ) criteria. However, it is usually preferable where the SBC and AIC test conflict to choose the SBC test since it is a Bayesian test that usually chooses the most parsimonious model in this case the shortest lag length.

If cointergration is found then we could go ahead and estimate an error correction model based on the Granger Representation theorem. The ECM is given by equation below

$$\Delta\pi_{ECCU} = \alpha_0 + \beta_1 \sum_{p=1}^{n} \Delta\pi_{ECCU_{t-p}} + \beta_2 \sum_{p=1}^{n} \Delta\pi_{US_{t-p}} + \beta_3 \sum_{p=1}^{n} \Delta loil\_p_{t-p} + \beta_4 \sum_{p=1}^{n} leccu\_reer_{t-p} + \beta_5 lm2_{t-p} +$$

$$\beta_6 \sum_{p=1}^{n} ygap_{t-p} + \psi ECM_{t-1} + \xi_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2$$

Where ECM is the error correction term defined by:

$$ECM_t = \pi_{ECCUt} - \alpha_0 - \beta_1 \sum_{p=1}^{n} \pi_{ECCUt-p} - \beta_2 \sum_{p=1}^{n} \pi_{USt-p} - \beta_3 \sum_{p=1}^{n} loil\_p_{t-p} - \beta_4 \sum_{p=1}^{n} leccu\_reer_{t-p} -$$

$$\beta_5 \sum_{p=1}^{n} lm2_{t-p} - \beta_6 \sum_{p=1}^{n} ygap_{t-p} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3$$

As a check for the robustness of the model to be estimated above a structural VAR is also estimated to assess whether both models yield similar results. The model follows work done by McCarthy (2000) by specifying VAR assuming a recursive structure of the economy. As assumptions we assume that, foreign price level as proxy by the US price level is exogenous to the system and thus affects all other variables in the system. Demand shocks to GDP affect all other variables with exception of oil prices and the US CPI. Money supply shocks affect domestic CPI and a real effective exchange rate shock affects domestic CPI. The author imposes the Choleski decomposition to indentify the SVAR.[5]

The recursive structure of the economy assumed is:

$$\Delta LOILP = E_{t-1} LOILP + \mu_t^{loilp}$$
$$\Delta USCPI = E_{t-1} USCPI + \mu_t^{loilp} + \mu_t^{uscpi}$$
$$\Delta YGAP = E_{t-1} YGAP + \mu_t^{loilp} + \mu_t^{uscpi} + \mu_t^{ygap}$$
$$\Delta LM2 = E_{t-1} LM2 + \mu_t^{loilp} + \mu_t^{uscpi} + \mu_t^{ygap} + \mu_t^{lm2}$$
$$\Delta LEREC = E_{t-1} LEREC + \mu_t^{loilp} + \mu_t^{uscpi} + \mu_t^{ygap} + \mu_t^{lm2} + \mu_t^{lerec}$$
$$\Delta ECCUCPI = E_{t-1} ECCUCPI + \mu_t^{loilp} + \mu_t^{uscpi} + \mu_t^{ygap} + \mu_t^{lm2} + \mu_t^{lerec} + \mu_t^{eccucpi} \ldots\ldots\ldots 4$$

Δ is the difference operator, the other variables are defined as before. We assume in this equation that only oil prices can affect oil prices, the US cpi is affected by it own past values and oil prices. The output gap is affected by changes in the US cpi and oil prices through the cost channel. The final

[5]

equation is the one of interest, where all the other variables we assume affect the CPI of the respective countries for the ECCU.

The choice of lag length is selected using either the AIC, SBC or HQ test. From the structural VAR we can compute impulse responses of the domestic CPI's from shocks to the domestic and foreign variables; from the impulse responses we can compute Variance decomposition. The use of the Variance decomposition is important because while the impulse response gives the direction of the response of the domestic CPI it does not give the magnitude of the shock which is what the variance decomposition establishes.

6.0 Data and Empirical Results

Variables used in study are based on theory and these include. US CPI used as a proxy variable for foreign and import price. Average oil price (Brent, Texas &Dubai Crude) expressed in domestic currency. Money supply denoted by M2. Real Effective Exchange Rate for ECCU countries denoted LECER. Output gap-calculated using the HP filter and a smoothing parameter of 1600 because of the use of quarterly data. Respective ECCU countries CPIs all variables with the exception of the output gap are expressed in logarithms. Fiscal deficit for the ECCU countries are omitted out since a long enough time series could not be found.

Table 1- reports the results for the Panel unit root tests

Variables	IPS Test-Individual Root	LLC Test-Common Root
CPI_ECCU	-13.07**	-9.05-**
CPI_US	-6.87-**	
Loil_P	-0.04-*	
LM2	0.21- *	0.13-*
LECCU_REER	-1.49- *	-1.62- *

YGAP	-18.22- **	-8.40- **

* Denotes Non-Stationary Variable I(1). ** Denotes Stationary Variables I(0)

Table 2- Individual Unit Roots-Philips-Peron Test

Countries	AXA	A&B	DCA	GDA	MRT	SKN	STL	**SVG**
CPI_ECCU	**1.06***	**-4.43****	**-4.22****	**0.61***	**-4.17****	**-2.51***	**-3.43***	-2.25*
CPI_US	**-3.69****	**-3.69****	**-3.69****	**-3.69****	**-3.69****	**-3.69****	**-3.69****	
Loil_P	**-1.95***	**-1.95***	**-1.95***	**-1.95***	**-1.95***	**-1.95***	**-1.95***	
LM2	**-3.41***	**-3.71***	**-3.42**	**-1.28***	**-3.49****	**-3.38***	**-1.43***	-2.73*
LECCU_R	**-3.03***	**-1.97***	**-1.58**	**-0.87***	**-4.45****	**-1.70***	**-0.25***	-1.83*
EER								
YGAP	-3.05**	-8.46	-6.30	-2.79**	-1.75*	-6.96**	-6.95**	-6.71**

* Denotes Non-Stationary Variable I(1). ** Denotes Stationary Variables I(0).

The above unit root test reported in tables three and four show that there is a mixture of both I (0) and I(1) variables. The tests are robust across methodologies given that both the Panel and Individual unit root test support each other in the definition of I(1) and I(0) variables.

As mentioned earlier, the variables considered in this study are a mixture of I (0) and I (1) series. Test for cointegration based on Johansen (1991; 1995) and the Johansen-Juselius (1990) method require that all the variables be of equal degree of integration, i.e., I(1). Therefore, these methods of cointegration are not appropriate and cannot be employed here. Hence, the rationale for using the ARDL modelling approaches for cointegration analysis in this study.

The results from the test for cointergration at the ECCU level indicate that there is co-integration present since the calculated critical values exceed the critical values/test statistics at all levels of significance. The report is shown below in Table 3 where the regression equation is tested with both intercept and trend in equation.

Table 3- Bounds Test For cointegration- F Test (6,36)

Variables	5% I(0)/I(1)	**Calculated Critical Value**
Cpieccu	**2.75/ 3.88**	23.42
CpiUSA	**2.75/ 3.88**	24.12
Loilp	**2.75/ 3.88**	6.78
lereccu	**2.75/ 3.88**	6.21
Lm2	**2.75/ 3.88**	14.29
ygap	2.75/ 3.88	15.87

Test Statistics are obtained from Tables by Pesaran and Shin

Test for co integration at the country level are reported in Appendix A. The findings show that there is no cointegration for Anguilla while cointegration holds for all the other countries.

In stage two of the ARDL model, having found evidence of cointegration among the variables, we can now go on to estimate the long run or cointegrating relationship which is shown in Table 3. In estimating the long run equation we chose four lags since that data is in quarterly format over the period 1990Q1-2007Q4. As outlined earlier, when the various tests for the choice of lag length conflict it is better to go with the SBC test since it usually chooses the most parsimonious model. In this case the SBC test chose a lag length of one while the AIC and HQ chose three.

.

Table 4- Coefficients from the long run relationship

Variables	Coefficient-SBC (1,0,0,0,1,0)
LCpiUSA	.21595*
Loilp	.59946*
Lereccu	.46858**
Lm2	-.29478 **
ygap	-

*Significant at all levels **Significant at ten percent level -Insignificant

All the estimates from the cointegrating equation for the ECCU are significant with the exception of the output gap (ygap). The coefficient for the money growth, while significant, carries the incorrect sign. The results show that for the ECCU level as a whole a one percent shock in oil prices would lead to a 0.60 per cent increase in domestic inflation.

Having looked at the long run relationship we know from the Granger representation theorem that we can go on to estimate an error correction model. Table 5 presents the results from the ECM; all of the variables are significant with the exception of the money growth variable (LM2). The variables also carried the correct signs and the Error Correction term shows that speed of adjustment is very fast, 100 per cent of the deviation from equilibrium, with the half life showing the speed of adjustment takes places in a less than a quarter or in other words the rate of inflation tends to revert back to its equilibrium rate very fast suggesting that inflation in the union is short lived.

Table 5 – ERROR CORRECTION MODEL-ECM

Variables	Coefficient-SBC (1,0,0,0,1,0)
CpiUSA	.25386 *
Loilp	.70470 *
lereccu	.55083 *
Lm2	1.4306**
ygap	-
EC TERM	-1.1755*
HALF LIFE[6]	0.89

*Significant at all levels **Significant at ten percent level

The error correction model suggests also that in the short run increases in the rate of inflation is dominated by foreign factors. However, these results must be taken with prudence since the model may be incorrectly specified by not including a number of domestic variables.

The results for the error correction model for the individual countries are reported in Appendix B. The results suggest that among the countries there is heterogeneity for the determinants of inflation. In some countries factors driving inflation are purely exogenous as in the case of St Kitts and Montserrat, while for some there is mixture of both exogenous and domestic factors as in the case of St Vincent & the Grenadines and St.Lucia. The speed of adjustment for all the countries is relatively fast with Antigua& Barbuda and St.Lucia adjusting the fastest with Dominica and St.Kitts& Nevis adjusting the slowest. St. Kitts & Nevis about 11 per cent of the deviation from equilibrium took place in six and half quarters. While for Dominica 19 per cent of the deviation was corrected in three quarters.

Both Antigua & Barbuda and Saint Lucia adjust in less than quarter while it takes Dominica over three quarters too adjust and St. Kitts& Nevis

[6] Half Life is calculated using the formula –ln2/ln(1+β)

adjusting in about six quarters. These results are calculated from the implied half life formula. The results for the error correction model for the individual countries are reported in Appendix A. The results suggest that among the countries there is heterogeneity for the determinants of inflation. In some countries factors driving inflation are purely exogenous as in the case of St .Kitts& Nevis and Montserrat, while for some there is mixture of both exogenous and domestic factors as in the case of In the case of Antigua it was found that shock in oil prices accounted for about 0.89 percent of the price developments, the real effective exchange rate accounted for roughly 0.37 percent and the output gap for approximately 8 percent. Both US CPI and money growth were insignificant in explaining price developments in the case of Antigua & Barbuda. 94 per cent of the deviation from equilibrium occurs in less than a quarter for Antigua and Barbuda.

- For Dominica the results from the ECM turn up some interesting results in that none of the variables are significant.
- In the case of Grenada it was found that that a one per cent shock in US CPI accounts for approximately 0.84 percent the inflation rate, the real effective exchange rate accounts for roughly 0.40 percent and the output gay account for approximately 0.024 percent while oil prices and money exert very negligible influence. Approximately 49 per cent of the deviation form equilibrium occurred in a quarter.
- For St.Kitts & Nevis a one percent increase in the US CPI leads to a 27 per cent increase in the domestic CPI, while a one per cent shock in the real effective exchange rate leads to a 0.79 per cent increase in the CPI.
- The results for Saint Lucia show a one per cent increase in the US CPI leads to the 0.47 per cent increase in the domestic price level. A one per cent increase in real effective exchange rate accounts for 0.24 per cent increase in prices, a one percent increase in oil prices leads to a 0.03 per cent increase in the domestic price level with the output gap

exerting a negligible one percent. 92 per cent of the deviation from equilibrium was adjusted in less than quarter.

- The results for St Vincent and the Grenadines show a one per cent increase in the US CPI leads to the 0.60 per cent increase in the domestic price level. A one per cent increase in real effective exchange rate accounts for 0.44 per cent increase in prices, a one per cent increase in oil prices leads to a 0.027 per cent increase in the domestic price level. Roughly 50 per cent of the deviation from equilibrium was adjusted in exactly one quarter for St. Vincent.

For Montserrat a one percent increase in the US CPI leads to a 0.67 percent increase in the domestic CPI. Money growth was found to exert a one per cent increase in the domestic price level while the other variables in that oil prices was shown to have a negative sign implying that an increase in oil prices decreases inflation however this figure is less than a percent. Montserrat was also found to adjust very quickly with 59 percent of the adjustment from equilibrium coming in less than a quarter.

Plots of the Cumulative sum of squares are shown in Appendix C, show the coefficients of the equations are stable since they lie within the critical bounds band. The equations are of a good fit shown by the generally high R-squared, autocorrelation is also free from the models since the Durbin Watson test is either very close to two or at two for all the equations.

The Impulse Responses derived from the SVAR shown in Appendix C highlight that for all of the countries a one percent shock in the foreign/exogenous variables have a significant impact on the CPI. However, this effect is short lived with rates returning back to equilibrium in about two quarters. While these results differ some what from those from the ARDL model it does show like the ARDL ECM that the return to equilibrium occurs fairly rapidly.

7.0 Conclusion and Recommendation

In conclusion it was found that in the long run for the ECCU as a whole that exogenous factors were the leading causes of inflation in these economies US CPI, oil prices and the real exchange rate. However, in the country specific equations it was found that there were some domestic factors which help to contribute to inflation such as excess demand proxied by the output gap and money supply. In the short run for the ECCU as whole foreign factors remained to be the leading cause of inflation. For country specific short run impacts it was found that both domestic and foreign variables were found to be the main determinants of inflation.

Addressing the question of should the ECCB move to inflation targeting regime, the answer to this question is no, why? First and foremost the ECCB cannot pursue both exchange rate management and price management at the same time. Secondly, the ECCB has already adopted a de facto or quasi inflation targeting regime by having its exchange rate fixed to the US dollar. Therefore, the ECCB imports the monetary policy of the US which has a general preference for low inflation which the EECB adopts through the exchange rate peg and high volume of trade with US.

While the study does offer some ideas as to the main determinants of inflation in the ECCU the results must treated with caution as the there are number price restrictions that prevent the full pass through of price changes into the domestic economy. Hence, in order to get a more refined understanding of the inflation process in the ECCU policy makers should allow the full pass through effects of the price changes.

Secondly, in order to develop a rate of inflation for the ECCU a weighting system was used which could have skewed the results. This study proposes the development of a Harmonized CPI basket for the ECCU to allow much

more cross country comparative studies to be done. Also, the paucity of data prevented a much richer study from being done, data on labour cost and deficits were not readily available emphasizing the need to develop better data collection.

Limitations to the paper are that the cross sectional composition of the data could not be exploited which could have perhaps yielded more robust and efficient results.

As it regards to policy prescriptions to help curtail or mitigate the recent inflationary pressures, I would argue that policy makers, should:

- First identify those goods and services in which the prices seem to be increasing sharply. Moreover, these goods and services should be deemed as necessary not just any good service should be selected. Also, the program should be targeted and specific in that only vulnerable groups should be eligible for the benefits emanating from these selected goods and services.
- Policies geared towards reducing consumption tax, the VAT and import duties should not be pursued since they can have delirious effects on the fiscal deficit. If these types of policies must be pursued it must be done targeting those specific goods that are needed to enjoy a comfortable standard of living.
- Minimum wage increases should be either halted or increased based on the current level on inflation to prevent an inflation wage spiral.
- As a long term strategy governments should also seek to identify cheaper sources of imports from other countries such as those in Central and South America.
- Another possible measure to deal with inflation may be to consider a revaluation of the currency which of course must be done with issues of competiveness in mind. This will of course require further

investigation to ascertain the possible effects of a revaluation of the currency.

- Countries should also seek to take advantage of the Petro Caribe initiative while developing a long term energy plan that will seek to cut down on the importation of oil products. As long term energy strategy countries can use the savings realised from the Petro Caribe deal to devise and invest in renewable energy resources eg wind, solar energy.

At best, this is the best policy makers can hope to achieve as the most of the pressure on price increases are exogenous, which they have very little or no control over.

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Appendix A

Table I

Correlation Matrix

Anguilla	CPIECCU
CPIECC	1.00000
U	0
USCPI	0.98994
	0
LOILP	0.83304
	9
LEREC	0.92174
	2
LM2	0.99083
	0
YGAP	0.89760
	8
Antigua	CPIECCU
&	
Barbuda	
CPIECC	1.00000
U	0
USCPI	0.55498
	8
LOILP	0.30664
	5
LEREC	0.89395
	3
LM2	0.54830
	4
YGAP	0.44877
	7

Dominica	CPIECCU
CPIECCU	1.000000
USCPI	0.978258
LOILP	0.749600
LEREC	-0.767793
LM2	0.977920
YGAP	0.505697
Grenada	CPIECCU
CPIECCU	1.000000
USCPI	0.103982
LOILP	0.239497
LEREC	-0.167351
LM2	0.074606
YGAP	0.439325

St.Kitts& Nevis	CPIECCU
CPIECCU	1.000000
USCPI	0.990242
LOILP	0.802051
LEREC	0.754042
LM2	0.988136
YGAP	0.924075

Saint Lucia	CPIECCU
CPIECCU	1.000000
USCPI	0.991538
LOILP	0.778405
LEREC	0.146681
LM2	0.983336
YGAP	0.478777

St. Vincent & the Grenadines

	CPIECCU
CPIECCU	1.000000
USCPI	0.977167
LOILP	0.760702
LEREC	-0.474620
LM2	0.957627
YGAP	0.945262

Montserrat	CPIECCU
CPIECCU	1.000000
USCPI	0.453481
LOILP	0.209222
LEREC	0.578150
LM2	0.223575
LGDP	0.035308

Table II

Covariance Matrix

Anguilla	CPIECCU
CPIECCU	0.005287
USCPI	0.004187
LOILP	0.013955
LEREC	0.001050
LM2	0.020705
YGAP	0.008109
Antigua & Barbuda	CPIECCU
CPIECCU	0.435700
USCPI	0.021306
LOILP	0.046631
LEREC	0.421546
LM2	0.073221
YGAP	0.028615
St Kitts& Nevis	CPIECCU
CPIECCU	0.005286
USCPI	-0.004183
LOILP	0.013427
LEREC	0.000859
LM2	0.016029
YGAP	0.006012

Dominica	CPIECCU
CPIECCU	0.001332
USCPI	0.002077
LOILP	0.006303
LEREC	-0.000807
LM2	0.005460
YGAP	0.000827

Saint Lucia	CPIECCU
CPIECCU	0.003699
USCPI	0.003508
LOILP	0.010907
LEREC	0.000194
LM2	0.010105
YGAP	0.002271

St. Vincent & the Grenadines	CPIECCU

CPIECCU	0.002181
USCPI	0.002654
LOILP	0.008185
LEREC	-0.000523
LM2	0.008573
YGAP	0.003367

Montserrat	CPIECCU
CPIECCU	0.140803
USCPI	0.009897
LOILP	0.018087
LEREC	0.115190
LM2	0.006289
LGDP	0.017482
Grenada	CPIECCU
CPIECCU	0.002313
USCPI	0.002775
LOILP	0.008768

LEREC	-0.000482
LM2	0.010685
	0.003107

Appendix B

Test for Cointegration

Variables	5% I(0)/I(1)	Calculated Critical Value
Anguilla	-	-
Antigua	2.96	3.24
Dominica	2.96	3.74
Grenada	2.96	3.20
Montserrat	2.96	3.04
St.Kitts & Nevis	2.96	3.11
St. Lucia	2.96	4.02
St.Vincent & the	2.96	4.22

Grenadines		

Error Correction Model ECCU Countries

Variables	ANT	DOM	GRE	MONS	SKN	SLU	STV&G
CpiUSA	-	-	.843	.671	.265	.474	.605
Loilp	.891	-	.009	-.005	-.014	.029	.027
lereccu	.374	-	.398	-.001	.791	.240	.442
Lm2	-	-	.002	.009	-	-.262	-.168
ygap	.083	-	.024		-	.013	-.131
EC	-.940	-.189	-.489	-.588	-.102	-.919	-.496
TERM							
HALF LIFE[7]	0.246	3.29	1.069	0.777	6.512	0.274	1.004
R-Squared	.045	0.60	0.64	0.40	0.74	0.64	0.622
D-W	1.89	1.90	1.77	1.94	2.10	2.25	2.04

- Insignificant variables

Long Run Equations

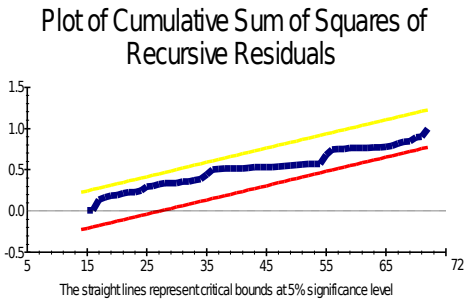
Variables	ANT	DOM	GRE	MONS	SKN	SLU	STV&G
CpiUSA	.679	-	1.72	1.14	2.60	.512	1.22
Loilp	.068	-	.018	-	-	.015	-
lereccu	-	-	.292	-	-	.261	.371
Lm2	-	-	-.239	-	-	.164	-.339
ygap	-.021	-	.050	-	-	-	.596

- Insignificant variables

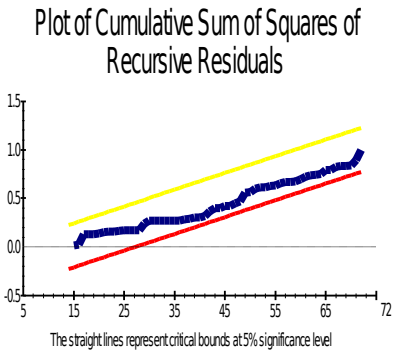
[7] Half Life is calculated using the formula –ln2/ln(1+β)

Appendix C

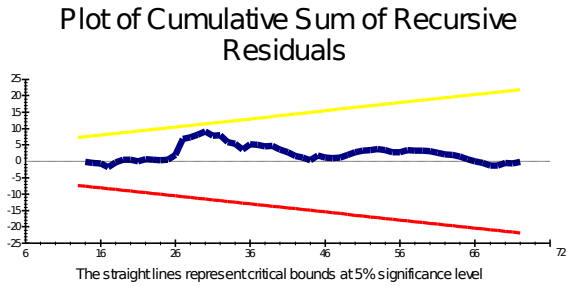
Dominica



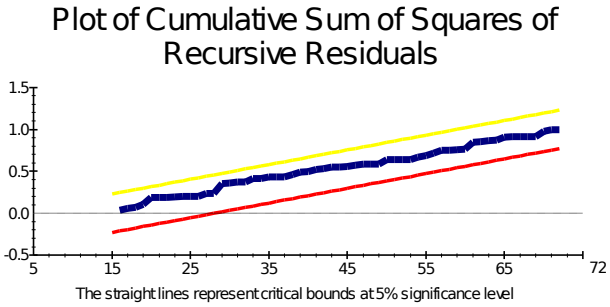
Grenada



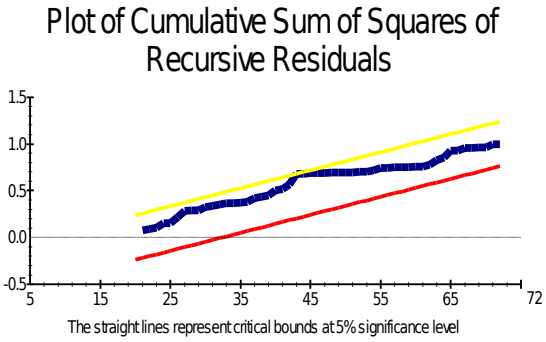
Montserrat



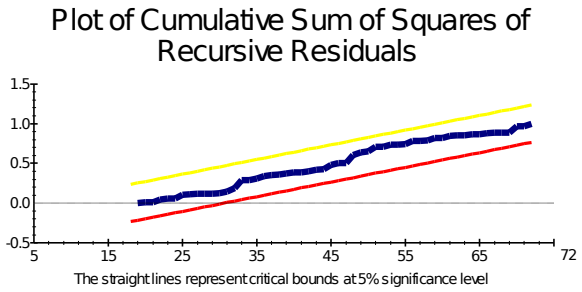
St.Kitts & Nevis

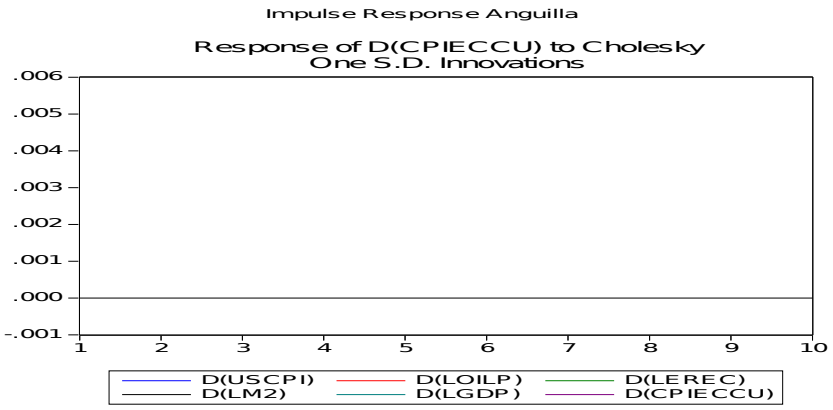


Saint Lucia

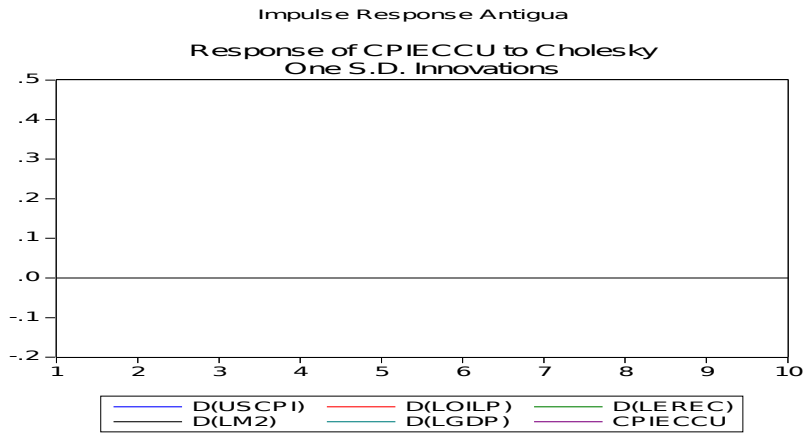


St.Vincent & the Grenadines

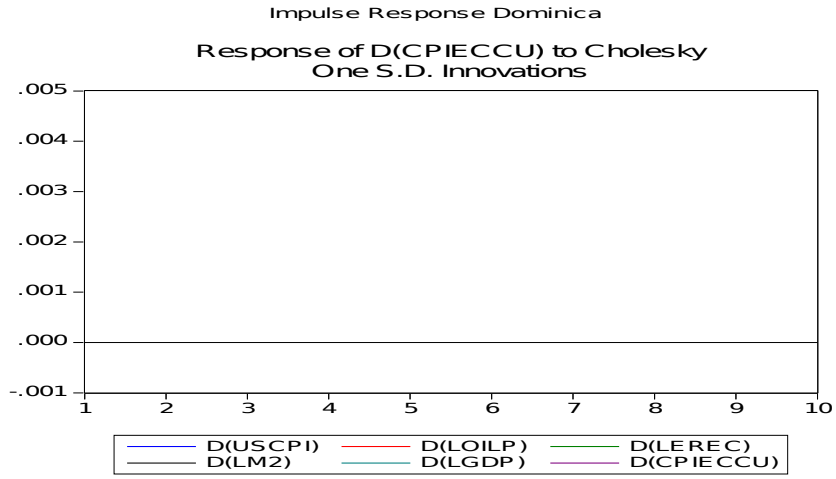




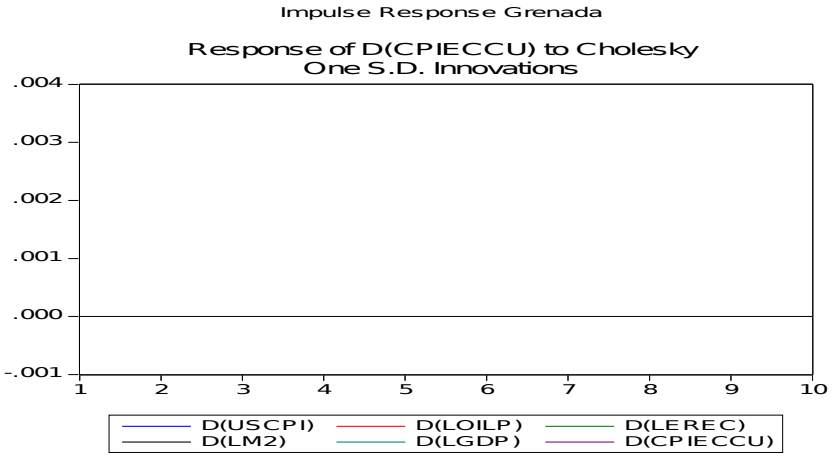
Period	S.E.	D(USCPI)	D(LOILP)	D(LEREC)	D(LM2)	D(LGDP)	D(CPIECCU)
1	0.001787	0.119970	0.393420	91.56595	0.231431	0.006212	7.683021
2	0.001932	13.12164	0.340293	75.49900	0.769267	3.934162	6.335641
3	0.001950	12.88484	0.439522	74.91906	0.984978	4.574445	6.197157
4	0.001953	12.95110	0.440559	74.76279	1.048397	4.605316	6.191834
5	0.001953	12.95739	0.441488	74.73464	1.047835	4.627590	6.191057
6	0.001953	12.95826	0.441523	74.72564	1.047922	4.636309	6.190350
7	0.001953	12.95803	0.441557	74.72406	1.048314	4.637758	6.190278
8	0.001953	12.95798	0.441555	74.72378	1.048358	4.638054	6.190277
9	0.001953	12.95798	0.441554	74.72369	1.048362	4.638148	6.190274
10	0.001953	12.95797	0.441554	74.72366	1.048364	4.638171	6.190273



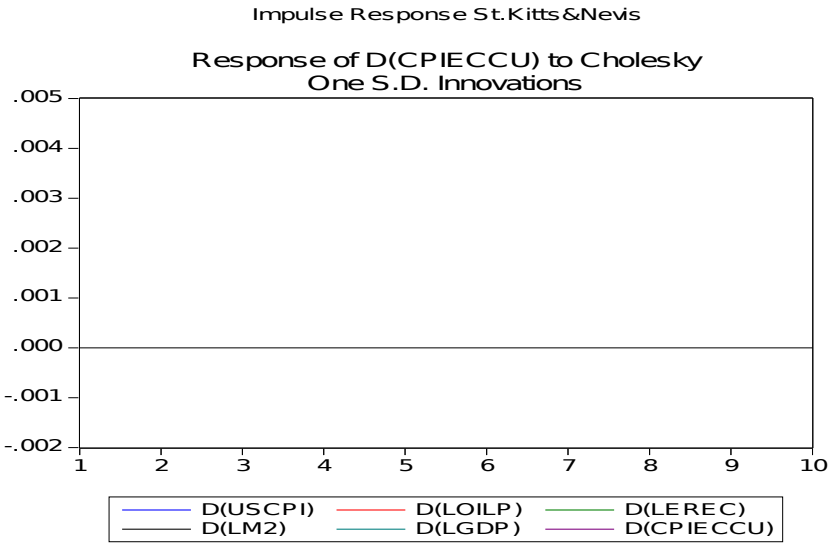
Period	S.E.	D(USCPI)	D(LOILP)	D(LEREC)	D(LM2)	D(LGDP)	CPIECCU
1	0.001803	0.115750	0.045764	84.75947	0.000604	1.217075	13.86134
2	0.001925	0.540675	6.278847	75.69389	0.507546	1.065634	15.91340
3	0.001940	0.598556	6.264450	72.53015	0.659921	3.161703	16.78522
4	0.001949	0.592242	6.369738	71.83043	0.609383	3.229653	17.36855
5	0.001951	0.636633	6.654767	71.13775	0.606916	3.289262	17.67468
6	0.001953	0.654742	6.766702	70.69118	0.611058	3.412749	17.86356
7	0.001954	0.661299	6.817487	70.46589	0.605795	3.465973	17.98356
8	0.001954	0.667607	6.862637	70.31527	0.603480	3.492296	18.05871
9	0.001955	0.671780	6.890855	70.21389	0.602782	3.514141	18.10656
10	0.001955	0.674111	6.907313	70.15110	0.601971	3.527982	18.13753



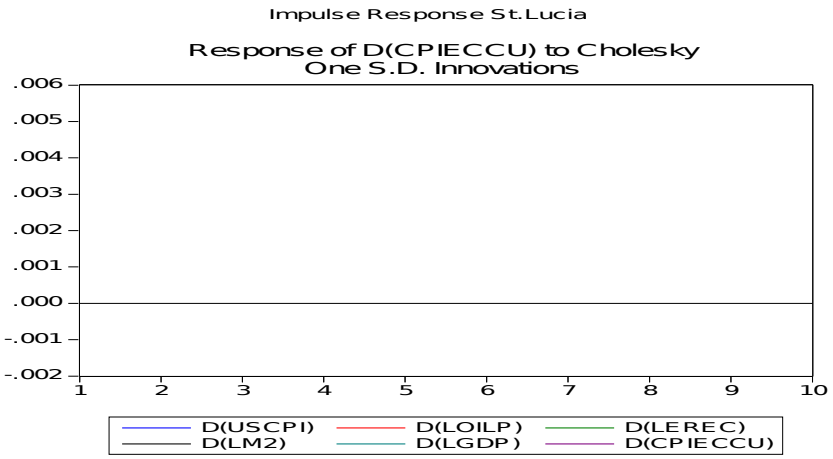
Period	S.E.	D(USCPI)	D(LOILP)	D(LEREC)	D(LM2)	D(LGDP)	D(CPIECCU)
1	0.001776	14.25044	2.206980	9.251846	1.440153	4.752869	68.09771
2	0.001931	14.02273	2.932078	12.18539	1.426458	4.610717	64.82263
3	0.001953	14.01733	2.933555	12.22651	1.430443	4.610005	64.78217
4	0.001955	14.01714	2.934932	12.22664	1.430659	4.611485	64.77914
5	0.001956	14.01710	2.934949	12.22668	1.430661	4.611525	64.77909
6	0.001956	14.01709	2.934961	12.22670	1.430661	4.611542	64.77905
7	0.001956	14.01709	2.934962	12.22670	1.430661	4.611543	64.77905
8	0.001956	14.01709	2.934962	12.22670	1.430661	4.611543	64.77905
9	0.001956	14.01709	2.934962	12.22670	1.430661	4.611543	64.77905
10	0.001956	14.01709	2.934962	12.22670	1.430661	4.611543	64.77905



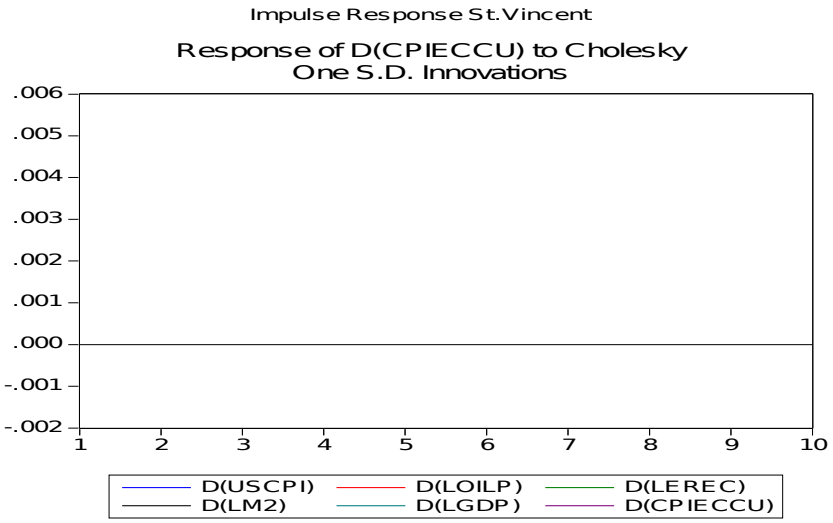
Period	S.E.	D(USCPI)	D(LOILP)	D(LEREC)	D(LM2)	D(LGDP)	D(CPIECCU)
1	0.001839	0.812033	4.676305	25.47897	0.118830	10.81923	58.09463
2	0.001945	14.67020	4.949029	22.00362	2.331840	10.08642	45.95889
3	0.001953	14.50162	5.095088	21.86900	2.672620	10.15189	45.70977
4	0.001956	14.56926	5.085103	21.81266	2.804844	10.14426	45.58387
5	0.001956	14.57145	5.104263	21.81584	2.804042	10.14073	45.56367
6	0.001956	14.57195	5.104595	21.81539	2.804011	10.14056	45.56349
7	0.001956	14.57204	5.104573	21.81531	2.804179	10.14052	45.56337
8	0.001956	14.57204	5.104586	21.81531	2.804184	10.14052	45.56336
9	0.001956	14.57204	5.104588	21.81531	2.804184	10.14052	45.56336
10	0.001956	14.57204	5.104588	21.81531	2.804184	10.14052	45.56336



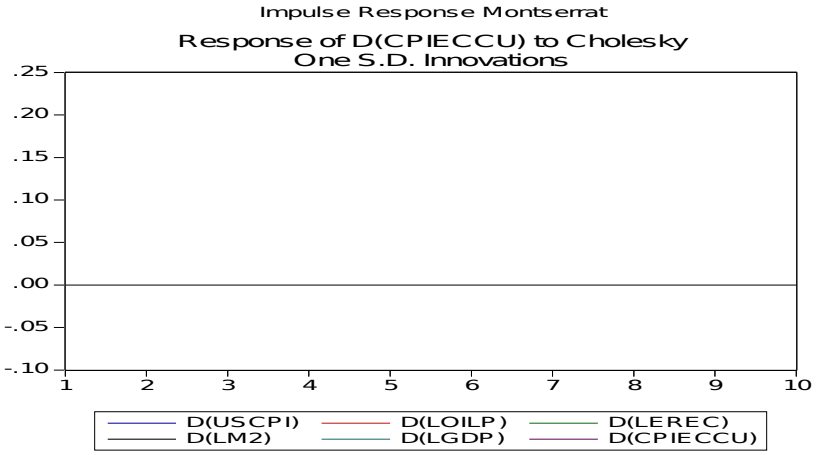
Period	S.E.	D(USCPI)	D(LOILP)	D(LEREC)	D(LM2)	D(LGDP)	D(CPIECCU)
1	0.001729	0.000762	3.190268	57.20317	0.119905	0.078602	39.40730
2	0.001937	0.137596	3.334528	57.88633	0.143275	0.729850	37.76842
3	0.001951	0.173626	3.329167	57.79797	0.149237	0.877875	37.67212
4	0.001956	0.175265	3.329049	57.79012	0.160979	0.879275	37.66531
5	0.001956	0.175443	3.330050	57.78907	0.161496	0.879267	37.66467
6	0.001956	0.175442	3.330043	57.78898	0.161559	0.879365	37.66461
7	0.001956	0.175455	3.330055	57.78896	0.161560	0.879375	37.66459
8	0.001956	0.175455	3.330056	57.78896	0.161563	0.879377	37.66459
9	0.001956	0.175455	3.330056	57.78896	0.161563	0.879377	37.66459
10	0.001956	0.175455	3.330056	57.78896	0.161563	0.879377	37.66459



Period	S.E.	D(USCPI)	D(LOILP)	D(LEREC)	D(LM2)	D(LGDP)	D(CPIECCU)
1	0.001740	5.606104	2.560593	11.83543	1.268648	1.802784	76.92645
2	0.001923	4.980996	4.995689	10.70242	1.112811	3.448069	74.76002
3	0.001943	5.204393	5.089214	10.56999	1.188970	3.876014	74.07142
4	0.001952	5.231115	5.101029	10.57296	1.190741	3.872268	74.03189
5	0.001953	5.231038	5.106613	10.57188	1.191475	3.872894	74.02610
6	0.001954	5.230957	5.106783	10.57171	1.191535	3.873805	74.02521
7	0.001954	5.231082	5.106781	10.57170	1.191635	3.873856	74.02495
8	0.001954	5.231080	5.106779	10.57170	1.191636	3.873897	74.02491
9	0.001954	5.231084	5.106781	10.57170	1.191638	3.873897	74.02490
10	0.001954	5.231084	5.106781	10.57170	1.191639	3.873899	74.02490



Period	S.E.	D(USCPI)	D(LOILP)	D(LEREC)	D(LM2)	D(LGDP)	D(CPIECCU)
1	0.001847	4.937568	1.692096	23.18599	0.385248	0.485645	69.31345
2	0.001944	9.733420	3.823976	21.21851	0.690499	0.652435	63.88116
3	0.001952	9.567196	4.679154	20.92963	1.247621	0.652978	62.92343
4	0.001955	9.582710	4.715096	20.90580	1.255377	0.705462	62.83555
5	0.001955	9.580059	4.712890	20.89640	1.281519	0.724902	62.80423
6	0.001955	9.580990	4.712362	20.89510	1.284229	0.729039	62.79828
7	0.001955	9.580906	4.712424	20.89486	1.284584	0.730222	62.79700
8	0.001955	9.580854	4.712424	20.89477	1.284759	0.730612	62.79658
9	0.001955	9.580843	4.712418	20.89474	1.284826	0.730731	62.79644
10	0.001955	9.580841	4.712416	20.89473	1.284844	0.730765	62.79640



Period	S.E.	D(USCPI)	D(LOILP)	D(LEREC)	D(LM2)	D(LGDP)	D(CPIECCU)
1	0.001833	8.784321	1.323695	12.38661	0.155164	0.698064	76.65215
2	0.001917	12.85712	9.096797	10.20352	0.896993	3.027070	63.91850
3	0.001919	12.27439	8.722832	9.755020	1.006369	2.916722	65.32467
4	0.001920	12.45103	9.022676	9.683591	1.065150	2.967891	64.80966
5	0.001920	12.42610	9.003273	9.662494	1.073747	2.961802	64.87258
6	0.001920	12.43336	9.016182	9.659212	1.076028	2.963796	64.85142
7	0.001920	12.43257	9.015567	9.658252	1.076622	2.963503	64.85349
8	0.001920	12.43280	9.016064	9.658094	1.076678	2.963584	64.85278
9	0.001920	12.43279	9.016064	9.658051	1.076716	2.963573	64.85281
10	0.001920	12.43280	9.016080	9.658043	1.076716	2.963575	64.85279