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CONVERGENCE OF INFLATIONARY SHOCKS: EVIDENCE FROM THE CARIBBEAN

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ABSTRACT

In this paper we aim to shed some light on the inflation dynamics in the Caribbean. We analyse the inflation rates for twelve countries using various time series methods. The results show that the inflation rates are mean reverting processes and that there is evidence of a convergence club in inflation rates within the area, which contradicts previous studies. Our contribution implies a high degree of similarity in the dynamics of our target countries' inflation rates.

Keywords: Caribbean, inflation persistence, monetary union and unit roots

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I. Introduction

Since the formation of the European Union (EU) several regions of the world have expressed interest in forming similar unions. This, in turn has stimulated much research on the potential of monetary unions across the world (Edwards, 2006; Jayaram et al, 2006; Coleman, 2010). One of the criteria for a successful union is similarity in inflation rates across the group of relevant countries. Given this, the knowledge of inflation dynamics is a pre-requisite for the design and successful implementation of a common monetary policy. Indeed Miles (2006) points to the possibility of a nation joining a common currency union and subsequently experiencing a negative shock. Since such a country no longer has control of the exchange rate then with sticky prices, the likely impact would be a loss of output with the possibility of recessions and output volatility.

If there are differences in the rate at which inflation returns to its baseline following a shock, policy makers in a monetary union will be confronted with the design of a monetary policy for diverse or even conflicting economic environments. Consequently, policy aimed at stimulating growth may not jeopardise price stability in one country but has the opposite effect in another with further knock-on effects in that country. Frequently the design of monetary policy assume that the series is stationary, thus if there is low persistence in inflation among all member countries, meaning that inflation will tend to move close to some average value within a year or two then it is possible that the policymakers may get it "right". If however there is varying degrees of persistence, the more asymmetric are the shocks and the greater would be the risk to the stability of a monetary union. Knowing whether inflation rates react in a similar manner to shocks, is crucial for the design of a successful common monetary policy strategy**.** And this is not news: the optimum currency areas (OCAs) theory by Mundell (1961) establishes the pre-conditions for the success of a monetary union, amongst them, the lack of asymmetric shocks. Given that most central bank's monetary policy target is price stability or inflation control, an area composed of different countries with dissimilar evolution in their inflation rates might create difficulties to achieve price stability in the zone. Hence, symmetry of shocks is a necessary condition for the success of any monetary union.[1]

[1] We thank an anonymous referee for pointing that out.

Empirical evidence on inflation persistence is mixed, depending on the countries selected and the methodology employed. Levin and Piger (2003), Harvey et al. (2006), Benati (2008), find evidence of low inflation persistence while O'Reilly and Whelan (2004), and Gadea and Mayoral (2006) find the opposite. A finding that has emerged in recent research is that inflation persistence has fallen over the years, coinciding with inflation targeting policies (Osborn, 2009; Beechy, 2009). Perhaps this justifies monetary policy that is based on a stationary inflation series. Be that as it may, Coenen (2007) advises that *"…..a cautious monetary policy-maker is well-advised to take monetary policy decisions under the assumption that the economy is characterised by a substantial degree of inflation persistence until strong evidence in favour of a regime with low-inflation persistence has emerged."*

Research has also shown that inflation persistence is likely to be an issue for countries that are highly dependent on natural resources as they are the ones that are likely to be very susceptible to trade shocks. This is especially relevant in the context of the Caribbean since the majority of countries in the region are dependent on either natural resources or tourism. Moreover inflation persistence is important in the context of the monetary union because of the potential link between monetary policy and the well-being of the poor. In their paper, Easterly and Fischer (2000) look at the impact of monetary policy on households with different income levels. They conclude that poorer households are more burdened from price volatility following a change in monetary policy. This is a likely outcome for poorer countries in a monetary union. In other words, asymmetries in the memory of inflation are especially relevant in analysing the feasibility of a monetary union because of the potential for winners and losers to emerge. The incentive to renege on commitment to the union will be far greater for the losers, which in turn can pose a significant threat to the stability of the monetary union. Indeed testing for inflation persistence can be interpreted as taking a peek into the future with regards to the failure or success of a monetary union and common monetary policy. Hence, according to the Lucas critique dissimilar and persistence inflationary shocks may increase the short run tradeoff between inflation and unemployment; differences in inflation rates, may affect the way individuals form their expectations via different real interest rates, which can also affect debt risk premia within the zone. Also, it may be seen as an external competitiveness gap within the area, which all-in-all may increase the likelihood of further asymmetric shocks (Busetti et al., 2007).

In light of the above discussion it is important to understand the inflationary process across a group of countries that appear to be determined to form a monetary union. It facilitates the design of monetary policy rules to perform reasonably well under a range of alternative models of inflation determination which differ with respect to the degree of inflation persistence that they induce in the member countries. This is especially pertinent to the policy makers of the Caribbean region since the decision to form a monetary union has been made without any rigorous research into whether monetary experiences of the individual countries support the successful establishment of a union. Thus the aim of this paper is to investigate whether there is heterogeneity in the dynamics of inflation rates among several of the islands of the Caribbean and in so doing shed some light on the degree of difficulty and hence the feasibility of the establishment on a monetary union. The outline of the paper is as follows. In section 2 we examine some important background issues and review the relevant literature. In section 3 we discuss the methodology, the results are presented and discussed in Section 4 and section 5 is the conclusion.

II. Background and literature review

The first attempt at creating a union in the West Indies dates back to 1958, with the formation of the West Indian Federation.[2] The West Indian Federation[3] was established by the British Caribbean Federation Act of 1956 with the aim of creating a political union among its members, independent from Britain as a single state (similar to Canadian Confederation, Australian Commonwealth, or Central African Federation). It comprised of the ten territories: Antigua and Barbuda, Barbados, Dominica, Grenada, Jamaica, Montserrat, the then St Kitts-Nevis-Anguilla, Saint Lucia, St Vincent and Trinidad and Tobago (colonies of the United Kingdom). The Federation however faced several problems including: the governance and administrative structures imposed by the British; disagreements among the territories over policies, especially with regards to taxation and central planning; a reluctance on the part of most Territorial Governments to surrender power to the Federal Government; and the location of the Federal Capital. However the decisive factor, which led to the demise of the Federation was the withdrawal of Jamaica.

[2] In fact since1922 it has been the view of successive British Governments that a Federation of the West Indies should be established (long before the conceptualization of the EU). However it did not happen until thirty-six years later. We thank an anonymous referee for this comment.

[3] Information obtained from http://www.caricom.org/jsp/community/community_index.jsp?menu=community and Brewster (1970).

The result of national referendum in 1961 on its continued participation in the Federation, showed a majority support for the withdrawal of Jamaica from the Federation. This subsequently led to a movement within Jamaica for national independence from Britain. It also led to the now famous statement of Dr Eric Williams (the Premier of Trinidad and Tobago at that time) that, one from ten leaves nought, in reference to the withdrawal of Jamaica. Moreover it signified and justified his decision to withdraw Trinidad and Tobago from the Federal arrangement. With the withdrawal of the two largest member states the Federation collapsed in January 1962.

The next attempt at creating a union was initiated in 1989 whereupon the Heads of Government of the member states of Caribbean Community (CARICOM)4 convened a meeting with the aim of promoting the economic integration across the islands of the Caribbean**.** The outcome of this meeting was the formation of the West Indian Commission to develop a proposal to prepare the region for the challenges of the 21st century. In 1992 the Commission final report was completed and it recommended a deepening and widening of the Caribbean integration process via the establishment of the CARICOM single market and economy. The deepening of integration emphasized both trade and financial integration. A significant element of the latter was monetary integration; the economies of the Caribbean should move towards a monetary union by the establishment of a common currency and a CARICOM monetary authority to manage this currency. A two tiered approach was proposed and a monetary union was expected to be achieved by the year 2000.

At the turn of the century it was clear that the region was far behind in terms of it goal. In 2006 the members of CARICOM approved an agreement to establish the CARICOM single market and economy (CSME). The latter included the adoption of a single currency with the implementation of the Caribbean Monetary Union (CMU) in 2008. At a meeting in 2007 there was yet another recommendation, this time for a phased implementation of the single economy. Phase 1 was to take place between 2008 and 2009 and Phase 2 is to take

[4] CARICOM is an organization of 15 Caribbean nations and dependencies. It was preceded by Caribbean Free Trade Association (CARIFTA) which was founded in 1965. While a free-trade area had been established under CARIFTA, it did not provide for the free movement of labour and capital, or the coordination of agricultural, industrial and foreign policies. In 1972, Commonwealth Caribbean leaders at the Seventh Heads of Government Conference decided to transform CARIFTA into CARICOM. It is only with the establishment of the latter that a common market and eventually a single economy became a goal.

place between 2010 and 2015. The implementation of a CARICOM Monetary Union is a component of Phase 2.

More than ten years after the initial proposed date there is still no monetary union among the Caribbean economies and the target time has been revised over the last decade. Why is this? Early research on monetary union in the region (and its lack of progress) is limited and lacks any rigorous framework (Nichols et al, 2000; Anthony and Hughes-Hallett, 2000). Later research employ a gravity model to examine the potential for trade integration between Caribbean economies (Moreira and Mendoza, 2007; Elliott, 2007). Both papers conclude that gains from trade between these economies are likely to be limited. Nevertheless, they also argue that closer economic ties can produce gains which are not captured by more conventional economic models, for example economies of scale in the provision of social infrastructure, improved governmental institutions and a greater regional voice on international issues through improved foreign policy coordination. A study by Augustine (2008) that utilised synchronisation measures also concluded that the idea of a monetary union in the Caribbean is not feasible. According to the author, a key requirement of monetary union - synchronisation of the business cycles in the economies of the region - is absent.

More recently, Turner and Pentecost (2010) employ a time series methodology to analyse the potential of a monetary union in the Caribbean. Specifically the authors use structural vector auto-regressions (SVAR) to investigate the impact of demand and supply shocks on output and prices in four Caribbean economies. They find a low degree of correlation between the aggregate demand and supply innovations across the countries and hence conclude that there is little support for a working monetary union and that its failure is not surprising. Moreover they suggest that a monetary union might create macroeconomic inflexibility which, in turn, would hinder appropriate adjustments taking place following a shock with potential asymmetric consequences.

In this paper we extend the work by Turner and Pentecost (2010) on monetary union in the Caribbean in several ways. First we focus on inflation persistence in the region. The main reason for focussing on inflation dynamics and their degree of persistence is simple; under a unique common central bank deciding the monetary policy for all its member states, how similar the evolution of the member states' inflation rates needs to be so as to have a similar

transmission mechanism in all of them, without creating persistent differences in unemployment rates? Second we perform the analysis for twelve Caribbean economies. Third rather than a SVAR technique we employ a unit root methodology. An advantage of this approach is that it allows a non-linear framework to study the movement in price levels. It may be the case that a series' rate of adjustment back to its equilibrium following a shock depends on the size of its deviation from that equilibrium. Specifically, the greater the deviation, the increasingly mean-reverting the series is expected to become. It is also conceivable that, even though the series may be strongly mean-reverting when deviations are large, its rate of mean reversion could become so low when it is close to equilibrium that the series becomes indistinguishable from a random walk. Similar analysis has been applied to other areas of economic research, for example income convergence (Christopoulos and Tsionas, 2007and Chong et al., 2008) and real exchange rate analysis (Taylor et al., 2001 and Paya et al., 2003).

There is no shortage of research on inflation dynamics. While the majority of the work tend be concentrated on developed countries (Coenen, 2007; Pivetta and Reis, 2007; Capporale and Kontonikas, 2009) emerging and developing countries have received some attention in recent times (Alagidede et al., 2012; Cuestas and Harrison, 2010; Cuestas et al., 2011). There have been some attempts at studying inflation in the Caribbean. Payne (2008) explores inflation and inflation uncertainty in three Caribbean islands. Using and ARMA-GARCH specification the author concludes that while Bahamas and Jamaica exhibit a high degree of persistence, the evidence for Barbados suggest lower persistence. Boyd and Smith (2006, 2007) employ a simple unit root analysis based on the Augmented Dickey Fuller test to investigate inflation persistence in the region. They find that Eastern Caribbean Central Bank countries, Belize, Barbados and the Bahamas have low persistence in contrast to Guyana and Jamaica, while Antigua & Barbuda and Trinidad & Tobago fall somewhere in the middle. While there is no reference or discussion with respect to the implication of their results for monetary union, both studies cast some doubts on the success of a common monetary policy regime in the region. In a manner similar to Turner and Pentecost (2010) our research also represent an extension of Boyd and Smith (2006 & 2007) by focusing on an extended time period to 2009Q4 (with variations for data availability across countries) and by utilising more recent and advanced techniques in the analysis of unit root. Furthermore our analysis is used in order to better understand the potential of a monetary union and a common monetary policy in the region.

III. Econometric methodology

In order to analyse the order of integration of the inflation rates for the individual countries, we consider two groups of unit root tests: linear tests based on Ng and Perron (2001) and non-linear tests based on Kapetanios et al. (2003) (KSS) and Sollis (2009); fractional integration tests by Robinson (1995) and club convergence analysis by Phillips and Sul (2007).

Ng and Perron (2001) propose some upgraded versions of previously existing unit root tests which improve the performance of the earlier tests. In order to do this, Ng and Perron (2001) combine a modified information criterion for the lag length and a generalised least squares method for detrending the data. However, the Ng and Perron (2001) tests are based on a linear data generation process (DGP).

Within the nonlinear framework, KSS develop a unit root test that takes into account the possibility of a globally stationary exponential smooth transition autoregressive (ESTAR) process under the alternative hypothesis. This makes it possible to characterise any process as a two regime process for which the change in regimes is smooth rather than abrupt. This implies that the process might behave as an *I(0)* process in the outer regime, but as an *I(1)* process in the inner regime. This implies that the autoregressive parameter gets smaller and the variable tends to revert faster to its fundamental equilibrium the further it deviates from the equilibrium. This basically implies that the speed of mean reversion will be dependent on the strength of the shock. The analysis of unit roots in this context can be done by means of using the following regression:

$$\Delta y_t = \alpha y_{t-1} + \gamma y_{t-1}(1 - exp\{-\theta y_{t-1}^2\}) + \sum_{i=1}^{p} \theta_i \Delta y_{t-i} + \varepsilon_t, \qquad (1)$$

where ε_t is $iid(0,\sigma^2)$ with $\theta > 0$.

KSS assume that the variable is a unit root process in the central regime so that $\alpha = 0$, although the process is globally stationary. The null hypothesis of unit root implies $H_0 : \theta = 0$. However, this test cannot be performed directly over θ, since in practice the

parameter γ cannot be identified under the null hypothesis. KSS propose the use of a first order Taylor approximation for equation (1), which basically makes it linear in parameters;

$$\Delta y_t = \beta y_{t-1}^3 + \sum_{i=1}^{p} \theta_i \Delta y_{t-i} + error \qquad (2)$$

Testing $H_0 : \beta = 0$ against $H_1 : \beta < 0$ is testing for unit roots in the outer regime. In our case, the KSS test is applied to the demeaned inflation rates, so as to test for mean reversion.

As pointed out by KSS amongst many others, traditional (linear) unit root tests may suffer from important power distortions in the presence of nonlinearities in the DGP i.e. the likelihood of Type II Error increases. In our case, let us suppose a nonlinear model with two regimes; an inner regime and an outer regime. If we think the way most central banks set their inflation targets, this nonlinear framework makes perfect sense. If inflation is close to the inflation target, monetary policy actions may not take place given that it may imply higher unemployment at least in the short run, and the variable may have a unit root (inner regime). However, for greater deviations from the equilibrium (outer regime), monetary authorities may decide to increase interest rates or decrease money supply to reduce those deviations, and therefore the variable may behave as a stationary process and mean reverting for further deviations from the target. Hence, we have a variable which reverts quicker to the equilibrium, the greater the initial deviation after a shock.

In addition, we apply the Sollis (2009) test. Sollis proposes a unit root test which distinguishes asymmetric or symmetric effects under the alternative hypothesis, i.e. the speed of mean reversion will be different depending on the sign of the shock, not only the size. This asymmetric ESTAR model (AESTAR) can be written as,

$$\Delta y_t = G_t(\gamma_1, y_{t-1})\{S_t(\gamma_2, y_{t-1})\rho_1 + (1 - S_t(\gamma_2, y_{t-1}))\rho_2\} y_{t-1} + \sum_{i=1}^{p} \theta_i \Delta y_{t-i} + \varepsilon_t \qquad (3)$$

where

$G_t(\gamma_1, y_{t-1}) = 1 - \exp(-\gamma_1 (y_{t-1}^2))$, with $\gamma_1 \geq 0$

and

$S_t(\gamma_2, y_{t-1}) = \{1 + \exp(-\gamma_2 y_{t-1})\}^{-1}$, with $\gamma_2 \geq 0$.

Similar to the KSS test, the null hypothesis of unit root can be specified as $H_0 : \gamma_1 = 0$. Yet again, to avoid the problem of identification of some of the parameters, Sollis (2009), by means of Taylor approximations, proposes the following auxiliary equation,

$$\Delta y_t = \beta_1 y_{t-1}^3 + \beta_2 y_{t-1}^4 + \sum_{i=1}^{p} \theta_i \Delta y_{t-i} + error \qquad (4)$$

Thus, testing for unit roots in model (4) implies testing $H_0 : \beta_1 = \beta_2 = 0$. When the latter null hypothesis is rejected, it is possible to test for the null hypothesis of symmetric ESTAR, i.e. $H_0 : \beta_2 = 0$, by means of standard hypotheses tests. This is of particular importance for variables which persistence may be different depending on the sign of the shock, in absolute terms. In our case, an increase in the inflation rate, may be more difficult to tackle than a reduction in the rate of inflation.

The aforementioned unit root tests only consider integer numbers for the order of integration, say *d*. Hence, in order to take into account non-integer orders of integration, we also apply the tests of Robinson (1995). Fractionally integrated (or *I(d)*) models can be specified as,

$$(1 - L)^d x_t = u_t, \qquad t = 1, \ldots, T, \qquad (5)$$

where u_t is a covariance stationary *I(0)* process, whose spectral density function is positive and finite at the zero frequency, *d* can be any real number, and *L* is the lag operator. The closer is the parameter *d* to 1, the more persistent the process is, and the effect of shocks on the variable will last longer.

Robinson (1995) developed, then, a multivariate semiparametric method to estimate the parameter *d* in equation (5). Hence, this test may be applied to individual series or to a panel of variables, allowing in the latter, for different intercept and slope for each member of the panel. With this approach we can test the null that all the *d* parameters are the same, which will give as some insights into the degree of homogeneity of persistence of shocks and speed of mean reversion.

Finally, to gain some robustness in the analysis, in particular whether we can find a common group of convergence (club convergence) between the inflation rates of our target countries, we also apply Phillips and Sul (2007) panel club convergence approach. This methodology is based upon Fischer and Stirbock (2004), which assumes that some individuals of the panel which belong to the same club converge to the club-specific steady-state equilibrium. Hence, Phillips and Sul's technique is based on a nonlinear time varying factor model which takes into account the possibility of transitional heterogeneity. Thus, with this approach we can identify groups of countries which converge to the same steady-state equilibrium.

IV. Data and Results

In this paper we have used quarterly inflation rates for the following countries: Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, St Kitts & Nevis, St Lucia, St Vincent & Grenadines, Suriname and Trinidad & Tobago. The data have been obtained from the *International Financial Statistics* database of the International Monetary Fund. For most countries the date spans from 1981:1 to 2009:4, except for Belize and Guyana which data starts in 1984:2 and 1995:1, respectively

The inflation rates are displayed in Figure 1. In all the target countries, the inflation rates were quite high at the beginning of the sample. This reflects the repercussion of the debt crisis. In most cases the inflation rates have been kept as a single digit for most of the sample, with a sharp increase in 2007-2008. This is primarily due to the increase in oil prices and the rise in food prices. Between March 2006 and March 2008 the international food price index nearly doubled in nominal terms, rising 82 percent. Food price inflation has increased across the entire Caribbean region, affecting both food exporting and food importing countries. Given five earlier years of relatively subdued inflationary pressures this represents a significant increase in food prices, which in turn, had a direct impact on overall inflation in countries of the region because "food" carries the highest weighting in the calculation of the consumer price index.

Other country–specific factors would have also contributed to inflation, for example an additional tax levy on imports in Barbados; the insufficiency of domestic agricultural food production arising from floods in Trinidad; and an expansionary fiscal stance to accommodate central government debts in Guyana and Trinidad. Dominica, Grenada, St

Kitts & Nevis, St Lucia, St Vincent & Grenadines belong to Eastern Caribbean Central Bank (ECCB) group of countries. In these countries there was a surcharge on fuel, as well as shortage of agriculture products arising from a reduction traditional backyard gardening and destructive weather patterns. In Belize the rise in prices in the 90s was primarily due to the imposition of a value added tax while in more recent times it was a result of a significant increase in the price of staples. Unlike the other countries Suriname started off with low rates of inflation, however the fallout from the debt crisis was simply delayed with a massive debt overhang to which the authorities responded by printing more money.

The case of Jamaica needs particular attention, given that the annual inflation rate jumped to nearly 100% at the beginning of the 90s. The process of implementing monetary policy in Jamaica has undergone fundamental changes over the period 1990 to 2003. These changes began with the transformation of the Jamaican economy in 1990s by a wide range of structural reforms aimed at increasing the role of market forces in resource allocation and creating a stable macroeconomic environment. The liberalization of the foreign exchange market in 1990 and the capital account in 1991 represented two major steps in the reform process. Following liberalization, the economy experienced severe macroeconomic instability, evidenced by a large depreciation in the currency, unprecedented inflation rates and a decline in real interest rates. In particular, the significant depreciation in the exchange rate the consumer price index, by 53 % in the weighted average selling rate in September 1991 to December 1991 contributed to inflation reaching this record level. Poor domestic policies also contributed to the rise in inflation. Specifically, there was the substitutability of short-term debt with money which showed up in an increase in the money supply during 1991; large wage settlements due to trade union pressures in 1993 and government intervention in support of troubled financial institutions which resulted in increased public expenditures. Schuler (1998) argues that the most inflationary policy in the 1990s was a result of the government's practice of constantly borrowing money directly from the Bank of Jamaica to finance its deficit. The year 1996 mark a milestone in the conduct of monetary policy in Jamaica. Base money targeting, which sought to achieve inflation in the range of 11 – 15 percent for the fiscal year 1996/97 was an important step towards achieving single digit inflation in the ensuing years.

In Table 1 we summarise the results of the Ng and Perron (2001), KSS and Sollis (2009) unit root tests. Columns 2-4 contain the linear unit root tests proposed by Ng and Perron (2001).

These results indicate that the evidence against the null hypothesis of unit root is very limited; the null hypothesis of unit root is rejected only for the cases of Belize and Jamaica. Based on these results we conclude that inflation is not a stationary series in ten out of twelve countries in the region. If this is true, then monetary policy based on the assumption of a stationary inflation rate is inappropriate and ineffective monetary policy will be the natural outcome.[5]

In columns 5 and 6, we report the results of the KSS and Sollis (2009) unit root tests, respectively. It is clear that taking into account the possibility of a nonlinear STAR model, the results point to the rejection of the null, in favour of a nonlinear and globally stationary process in all cases, except in St Vincent & Grenadines. This is in stark contrast to the earlier results of the linear tests. In eleven out of twelve countries, inflation is stationary in a non-linear context. In additional the results are also in conflict with previous empirical work on the region. Based on our results, the task of designing monetary policy will be less complicated and on this basis it is possible to establish a successful monetary union for these countries. However for St Vincent & Grenadines inflation is more persistent; policies which are appropriate for the other countries may not be appropriate St Vincent & Grenadines - a one-size fits-all approach to monetary policy will not work - there and may be the need for buffering measures in order to support any potential loss of welfare.

We now proceed to check whether shocks have symmetric or asymmetric effects for countries in which the unit root null hypothesis is rejected. This is done by means of testing $H_0 : \beta_2 = 0$ in equation (4). The results[6] indicate that the null hypothesis of symmetric shocks is rejected for all countries, except in Belize, Jamaica and Trinidad & Tobago. This means that the impact of a negative shock is different from a positive shock for these countries. These results are not surprising since for Belize and Jamaica the DGP seem to be linear. It follows that policy makers need to be especially vigilant when there is a negative shock. Strict monetary policy may be necessary since this represents a difficult situation for an economy.

[5] A number of macroeconomic models (Dornbusch, 1976; Taylor, 1979, 1980; Calvo, 1983; and Ball, 1993) assume that inflation rates are stationary and from an empirical perspective central banks frequently design monetary policy on the assumption that inflation is a stationary process, as is the growth rate of the monetary base — the main instrument of monetary policy for a number of countries.

[6] Available upon request to the authors.

In Table 2, we summarise the results of applying Robinson (1995) multivariate tests. The findings show that the variables in general show very low speed of mean reversion following a shock. In other words the variable needs long periods of time to return to equilibrium. It is important to point out that although the results of tests based on Sollis and Robinson are in conflict on the basis of the stationarity outcome, they are in agreement on the basis of the mean reversion outcome. The former is not surprising since the DGP of both tests are different - in the Sollis' test it is nonlinear, while in the Robinson's it is linear. However regardless of the underlying DGP both indicate that there is mean reversion.

To test how (dis-)similar the effects of shocks are, i.e. symmetric vs. asymmetric shocks, we have performed a test to check whether the order of integration of the inflation rates for these countries is the same. This will give us some insights into the homogeneity of the speed of mean reversion within the area. Based on this test it is not possible to reject the null of equality of *d*. These results are slightly in contrast with previous studies on the suitability of a monetary union in these countries. Not being able to reject the null of equality of *d* implies that shocks have similar effects on the inflation rates of our target economies, which means that a shock will not have asymmetric effect upon the inflation rates. However, some problems may arise since the speed of mean reversion is very slow, i.e. the order of integration is quite close to 1.

Finally, in order to add some robustness to the fact that the degree of mean reversion is similar in all our countries, we apply the Phillips and Sul (2007) test for club convergence. We have applied the test to the complete sample of time series observations excluding Guyana and Belize, since their samples start much later than for the rest. The null of convergence is rejected in the conventional t-statistic of the so-called *log t* regression is lower than -1.65. In our case, the value of the t-statistic is 5.746, so the null that all the countries form a club cannot be rejected. We have also included all the countries in our pool, but starting the sample in 1995:1, i.e. to have complete time series for all the countries. The results are consistent with our previous findings in the sense that when considering 1995:1 the starting point, the null that all countries form a club cannot be rejected since the t-statistic is 3.716. This result is an important one as it indicates that shocks affecting all countries do so in a similar fashion and a union-wide common set of monetary policies would be appropriate, if pursuing price stability for all member states.

V. Conclusion

In this paper we have focused on inflation persistence with a view to assessing the potential of Caribbean integration. Using data on inflation for twelve Caribbean countries we employ unit roots tests, fractional integration tests and a club convergence test. The results are very interesting since we find some evidence to suggest that shocks tend to have similar effect on the inflation rates of our target countries. This is based on the following (i) the presence of mean reversion as indicated by both non-linear unit roots and fractional integration tests (ii) the high degree of homogeneity in the persistence of the shock as indicated by the fractional integration tests and (iii) the presence of a convergence club as indicated by the Phillips and Sul (2007) test.

While there is mean reversion, it is especially slow as there is a long period of time before the inflation rate is restored to equilibrium. Hence the main implication is that monetary authorities may be unable or unwilling to wait for the restoration and hence there may the need to implement appropriate policies to hasten the equilibrium process. This line of action is natural as indicated by the non-linear unit root test where in the presence of large deviation from the equilibrium the monetary authorities may decide to increase or decrease money supply so as to reduce the deviation. Furthermore it is unlikely that a single monetary policy aimed at hastening the equilibrium will exacerbate the effects of shocks in any one country since is not possible to reject the hypothesis that shocks have similar effects. In addition the convergence test supports the mean reversion result of both the unit root and fractional integration tests; inflation rates across Caribbean countries appear to be converging overtime. Again this supports our earlier statement that a common monetary policy will not be detrimental. On the basis of our analysis of inflation persistence we are able to conclude that the outlook for the Caribbean integration movement is positive one. However, this is only a necessary condition for the success of a common central bank. More work and analysis need to be done to assess whether all the conditions for a monetary union, as established by the OCAs theory, are fulfilled in order to avoid similar problems face recently in the Eurozone.

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Table 1: Individual unit root tests results

Country	MZa	MZt	MSB	MPT	KSS	Sollis
Bahamas	0.263	0.238	0.904	50.005	-3.01**	7.55**
Barbados	-0.001	-0.001	0.99	55.10	-2.68**	7.20**
Belize	-10.60**	-2.207**	0.208**	2.684**	-4.39**	13.70**
Dominica*	0.20	0.22	1.08	68.25	-3.92**	13.15**
Grenada*	0.69	1.00	1.45	130.19	-5.21**	26.47**
Guyana	0.14	0.10	0.72	33.60	-3.53**	5.38**
Jamaica	-14.10**	-2.63**	0.18**	1.81**	-4.14**	20.25**
St Kitts & Nevis*	-0.40	-0.24	0.59	22.47	-3.99**	10.53**
St Lucia*	0.41	0.47	1.14	78.58	-2.75**	12.14**
St Vincent & Grens.*	0.59	0.52	0.87	51.00	-0.62	2.96
Suriname	-14.90**	-2.727**	0.183**	1.653**	-5.12**	29.8**
Trinidad & Tobago	0.05	0.03	0.58	23.54	-3.20**	5.13**

Note: The order of lag to compute the tests has been chosen using the MAIC suggested by Ng and Perron (2001). The latter authors propose the MZa and MZt tests which are the modified versions of Phillips' (1987) and Phillips and Perron's (1988) Za and Zt tests; the MSB which is related to Bhargava's (1986) R1 test; and, finally, the MPT test that is a modified version of Elliot, Rothenberg and Stock's (1996) Point Optimal Test. The Ng-Perron tests include an intercept, whereas the KSS test has been applied to the de-meaned data. The symbol ** means rejection of the null hypothesis at the 5% significance level. The critical values for the Ng-Perron tests and F-test have been taken from Ng and Perron (2001) and Sollis (2009), respectively, whereas those for the KSS have been obtained by Monte Carlo simulations with 50,000 replications. Countries marked with an * indicate that they belong to ECCB group of countries.

Critical Values

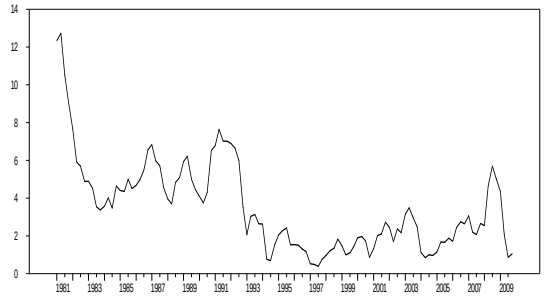
Significance level	MZa	MZt	MSB	MPt	KSS	Sollis
5%	-8.100	-1.980	0.233	3.170	-2.149	4.886
10%	-5.700	-1.620	0.275	4.450	-1.864	4.009

Table 2: Robinson's (1995) test. Pooled estimation

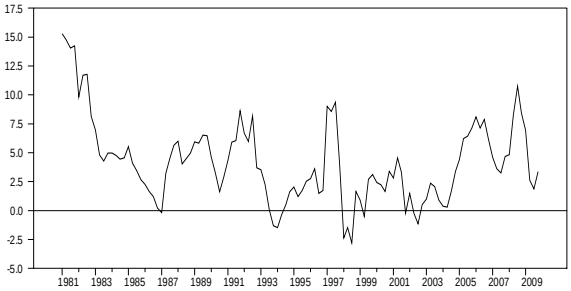
Country	Est. *d*	Std. Error	p-value
Bahamas	0.928	0.136	0.000
Barbados	0.810	0.136	0.000
Belize	0.977	0.136	0.000
Dominica	0.763	0.136	0.000
Grenada	0.867	0.136	0.000
Guyana	0.634	0.136	0.000
Jamaica	1.067	0.136	0.000
St Kitts & Nevis	0.697	0.136	0.000
St Lucia	0.763	0.136	0.000
St Vincent & Grens.	0.812	0.136	0.000
Suriname	0.573	0.136	0.000
Trinidad & Tobago	1.020	0.136	0.000

Note: Test for equality of *d* coefficients: F(11,444) = 1.2559 Prob > F = 0.2477

Figure 1: Inflation rates in the Caribbean



The Bahamas



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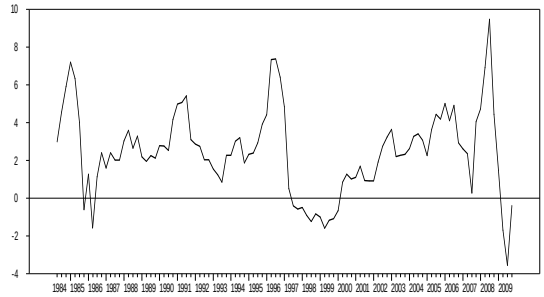

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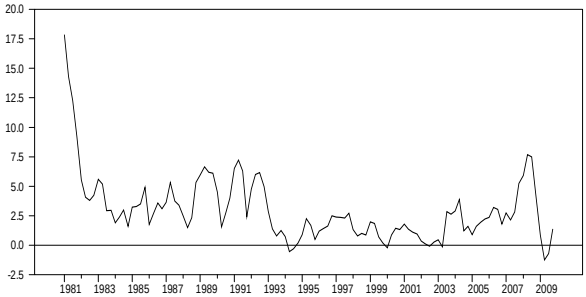
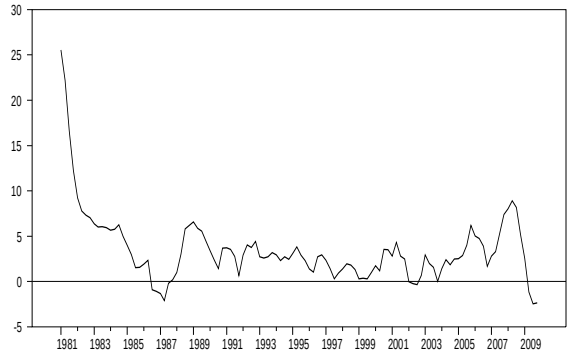
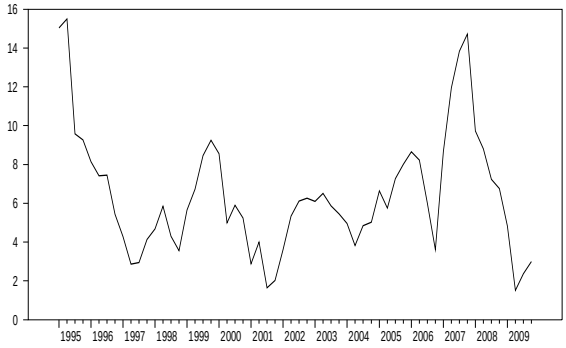


Dominica



Grenada



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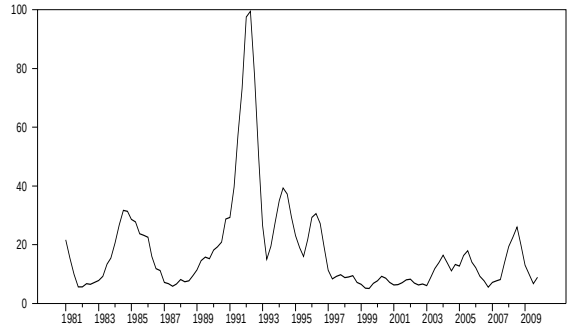

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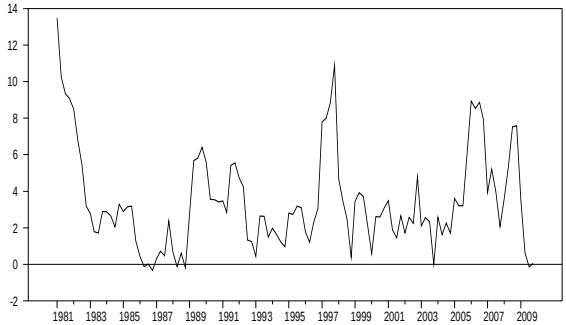
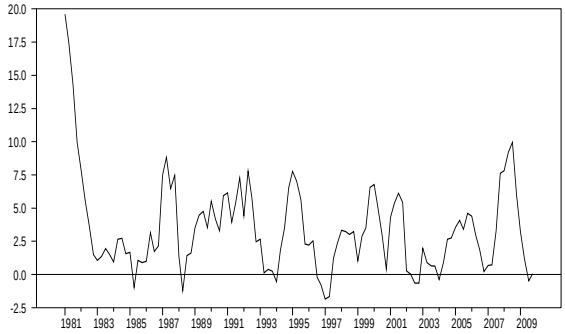


St. Kitts & Nevis



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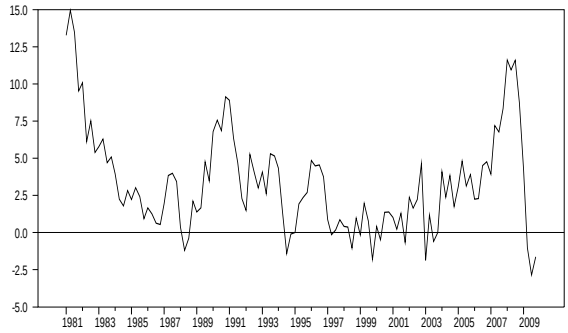
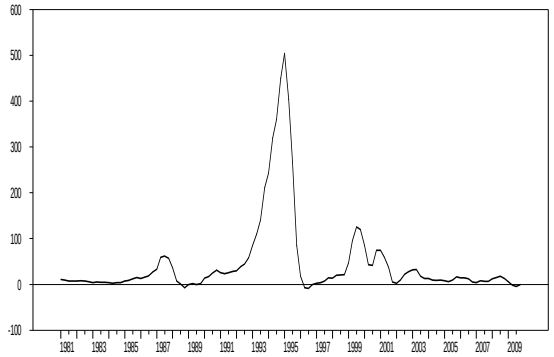
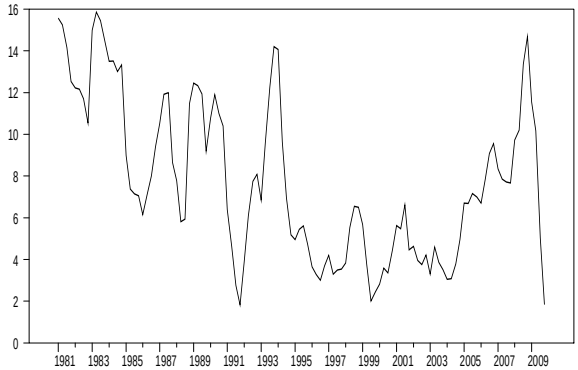


St Vincent & Grenadines



Suriname



Trinidad & Tobago