EXPLORING THE RELATIONSHIP BETWEEN THE US MONETARY POLICY AND THE REGIONAL ECONOMIC FLUCTUATIONS

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Presented at the Annual Review Seminar, Research Department,
Central Bank of Barbados
July 27 - 30, 1999

Exploring the Relationship between the US Monetary Policy and the Regional Economic Fluctuations

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First draft

Working Paper
June 1999

Abstract. Recent studies have shown that economic fluctuations in small open economies are driven by external shocks (Cushman, Zha (1995), Hoffmaister, Roldos, Wickham (1997)). Using Caribbean countries as case study (Antigua and Barbuda, Belize, Barbados, Dominica, Dominican Republica, Saint-Kitts and Nevis, Saint-Vincent, Barbados, Saint-Lucia, Jamaica Suriname and Trinidad and Tobago), we specify and estimate a panel vector autoregressive model for GDP, real exchange rate, consumer price index and world interest rate. The resulting impulse functions are consistent with traditional open economy theory and highlight the importance of real exchange rate as transmission channel.

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1 Introduction

Caribbean countries will face numerous economic and political challenges for the next years. One of them, is that probably these small open economies will react differently to the Fed and European Central Bank monetary policy. For instance, unexpected strong real growth in the US economy might lead to increase both exports and tourism product in the area.

A series of recent research has pointed out the significance of the factors in explaining the features of macroeconomics fluctuations for industrialized countries. For instance, Blanchard and Quah (1989) specified a small VAR (output and unemployment) that tries to identify aggregate demand and supply shocks. They assumed that supply shocks can have permanent effect on the level of output while demand shocks can have only temporary effects. Shapiro and Watson (1988) used a system that included real output, total labour hours, inflation and real interest rate. This set of variables allowed them to identify four different disturbances, two to aggregate supply they identified as shocks to labour supply and technology and two to aggregate demand they referred to IS and LM shocks. These authors found that aggregate demand shocks had a smaller impact on real GDP than Blanchard and Quah did. Cushman and Zha (1995) offered an empirical evidence by using a larger system with eleven variables[3] for the identification of Canadian monetary policy. The estimated impulse functions are consistent with the general view of existing monetary analyses under flexible exchange rate.

However less attention has been paid to the sources of business cycles in developing countries. In a recent paper, Watson (1996), has analysed the monetary mechanisms for Trinidad and Tobago throughout a vector autoregressive model that contains exchange rate, loan rate, loans, total deposits, GDP, unemployment, treasury bill rate and retail price index. Following Watson (1996) : *monetary transmission mechanism works more through the credit rather than through the money channel.*

Agenor, Mcdermott and Prasad (1999) analysed the cross-correlation between domestic industrial output and several macroeconomic variables. Regional fluctuations are examined by using several univariate detrending procedures[4]. The results indicated : *many similarities between macroeconomic fluctuations in developing and industrial countries*[5] *and some differences*[6].

We extends the discussion to the case of small open economies and particularly the case of Caribbean countries. Their choice brings some answers to the empirical verification about economies which are particularly sensitive to both domestic and foreign shocks. This paper seeks to understand the role of the US monetary policy in the regional fluctuations. We focus on 12 Caribbean countries. This work helps to analyse the stylized facts on regional evolutions using a panel vector autoregressive framework for output, exchange rate, consumer price index and world interest rate.

[3] They have used : the US dollar price of Canadian currency, the monetary aggregate M1, the consumer price index, the total exports to the US, the total imports from the US, the US industrial production, the US consumer price index and the world total exports commodity price index.

[4] For an overview of detrending techniques, see Baxter and King (1995).

[5] Procyclical real wages, countercyclical variation in government expenditure.

[6] Countercyclical variation in the velocity of monetary aggregates.

The rest of this paper is organised as follows. Section 2 briefly discusses the analysis of economics policy effect in existing open economy models. In section 3, the procedures used to estimate the model are discussed with particular emphases on the treatment of identifying restrictions. The simulations of the model follow in section 4.

2 Background

The basic framework most used for the analysis of the fluctuations in open economy is that of Mundell-Fleming[7]. With fixed wages and static exchange rate expectations, a fall in money supply appreciates home currency in both nominal and real terms[8]. Thus, the channel of monetary transmission occurs through an exchange rate effect. In the Dornbusch (1976) overshooting model, a negative money supply shock increases the interest rate from the liquidity effect and appreciates home currency to maintain uncovered interest parity in the short run before other variable can adjust. A foreign disturbance can affect the home economic throughout the price channel. Regarding external shocks, in the simplest Mundell-Fleming model, a fall in the world interest rate, although reducing the home interest rate, tends to depress the home economy on balance because it appreciates home currency and worsens the trade balance.

But in contrast to the main conclusion of the Mundell-Fleming model Svensson and Wijnbergen (1989) have shown that a fall in the world interest rate can cause a net expansionary effect on home economy through the intertemporal substitution.

As we mentioned in the introduction, recent empirical research on the issues has provided some mixed evidence concerning the exchange rate effect. Using the joint behavior of exchange rate, interest rate, money and price of five major industrial countries, Sims (1992) has noted several puzzles : positive interest rate shocks are associated with persistent increase in home price and depreciation of home currency. Gilli and Roubini (1993) have used a similar technique to analyse the G-7 countries. Following these authors, a positive home interest shock affects the home currency in all other G-7 countries except the US economy.

[7] See Mundell (1963), Fleming (1962).

[8] Interest rate remains unchanged.

3 A structural VAR model

3.1 Specification and identifying restrictions

In this section, we present the specification of the model estimated in this paper. We begin with a discussion of the variables included in the model followed by a discussion of the structure of the VAR model and how we resolve the identification problem. Our model contains 4 variables : output, consumer price index, real exchange rate and world interest rate. These variables should capture the economics relationship that determines the behavior of small open economies. For instance, movements in real exchange rate are likely to be correlated with domestics supply shocks and shocks from abroad. Given the growing importance of international trade and capital flows (globalization) to the Caribbean countries, it is necessary to incorporate the effects of shocks from abroad. Thus, we include as foreign variable, the world interest rate. We use a vector autoregressive model similar to Cushman and Zha (1995). The evolution of these variables is described by :

$$B(L)\Delta x_t = \epsilon_t \tag{1}$$

where Δx_t is a vector of observations, $B(L)$ is a matrix polynomial in the lag operator L and ε_{it} is the vector of innovations, with :

$$\Delta x_t = \begin{pmatrix} \Delta x_{1i,t} \\ \Delta x_{2,t} \end{pmatrix}, \quad B(L) = \begin{pmatrix} B_{11}(L) & B_{12}(L) \\ 0 & B_{22}(L) \end{pmatrix}, \quad \epsilon_t = \begin{pmatrix} \epsilon_{1i,t} \\ \epsilon_{2,t} \end{pmatrix} \tag{2}$$

We can keep these well known hypotheses :

$E(\epsilon_t) = 0$ and $E(\epsilon_t \epsilon_t') = \sum = (\sigma_{ij})$

The small open economy assumption provides the restriction $B_{21}(L) = 0$. This implies that the second block $\Delta x_{2,t}$ is exogenous to Δx_{1it} (the first block). For the model, we let : $\Delta x_{1i,t} = (\ \Delta y_{i,t}, \ \ \Delta p_{i,t}, \ \ \Delta e_{i,t}\ )'$ and $\Delta x_{2,t} = (\ \Delta i_t^*\ )'$. $\Delta y_{i,t}$, $\Delta p_{i,t}$, $\Delta e_{i,t}$, $\Delta\ i_t^*$ are respectively output, consumer price index, real exchange rate and world interest rate. $\epsilon_{1i,t}$ can be interpreted as domestic innovations whereas $\epsilon_{2,t}$ is assimilated to foreign innovations. The reduced form of (1) is a model that describes how the historical data contained in Δx_t. By rewriting (1) as a moving average representation and assuming that B_0 which is the coefficient matrix of L_0 is non singular :

$$\Delta x_t = B(L)^{-1}\epsilon_t = C(L)\epsilon_t \tag{3}$$

To obtain the dynamic responses of the endogenous variables, it's useful to orthogonalize the vector of innovations ϵ_t such as :

$$\epsilon_t = S(L)\nu_t \qquad with \sum = SS' \tag{4}$$

Equation (3) can also be expressed as :

$$\Delta x_t = D(L)\nu_t \qquad \nu_t = (\ \nu_{iy,t} \quad \nu_{ip,t} \quad \nu_{ie,t} \quad \nu_{ii^*,t}\ )' \tag{5}$$

where $\nu_{iy,t}$, $\nu_{ip,t}$, $\nu_{ie,t}$, $\nu_{ii^*,t}$ can be interpreted respectively as domestic supply shocks, domestic demand shocks (or nominal), real exchange rate shocks and world interest rate shocks. The long run equilibrium implies two additional restrictions : short-run movements in output are driven by domestic demand shocks (or foreign shocks). However, these shocks are permitted to have only temporary effects on the level of output. Demand shocks cause real exchange rate to deviate temporally from its long run equilibrium, but are permitted not to have a long run effect. These assumptions are in accordance with the long run neutrality in nominal shocks[9]. These considerations suggest the following restrictions :

$$D_{yp}(1) = D_{ep}(1) = 0 \tag{6}$$

Where $D_{ij}(1) = 0$, means that the long-run effect of j on i is null.

3.2 Data and estimation issues

Our model contains 12 Caribbean countries and most of variables come from the International Financial Statistics. The Federal Fed funds rate was chosen as an indicator of US monetary policy (Bernanke and Blinder (1992)). The sample was divided in two panel of annual observations. The first panel contains 6 countries : Trinidad and Tobago, Jamaica, Barbados, Guyana, Dominican Republica and Suriname from 1979 through 1993. The second one, contains 6 countries : Saint-Kitts and Nevis, Antigua and Barbuda, Saint-Vincent, Saint-Lucia, Dominica and Belize from 1979 through 1994. We have estimated the previous VAR in differences with two lags for the first one and three lags for the second one. We also find an evidence of country specific intercepts and thus, we add them into the model. Time specific effect is taken into account by the world interest rate that has the same value for each country.

As we mentioned above, the VAR contains 4 variables that are the real output growth rate, consumer price growth rate and world real interest growth rate. The small open economy restriction[10] implies that estimates are based on seemingly-unrelated-regressions technique.

4 What drive regional fluctuations ?

In this section, we begin with a discussion of the relative importance of external shocks and domestic shocks followed by the analyse of the variance decomposition.

[9] Real business cycles school believes that aggregate-supply shocks are the driving forces of output fluctuations.

[10] The world real interest growth rate is treated as exogenous block .

4.1 Dynamic adjustment of output

In long-run, positive domestic supply shocks lead to a permanently raise of output in the Non-OECS countries (figure 1). In contrast, real exchange rate shocks have contractionary effects ; the decline in output is accompanied by an immediate and permanent appreciation of the Caribbean currency (see figure 5). By construction, nominal shocks effects are temporary. Thus, the impact of domestic demand shocks on the output die out in about two years. This result is consistent with the newclassical view of aggregate fluctuations. The real output in Non-OECS group reacts negatively to world interest shocks ; the reason is that high interest rate leads to a decrease in investment. The associated variance decomposition (table 1) shows that variation of output has been dominated by real exchange rate shocks. Supply shocks play more important role in short-run. In contrast, real output is not driven by world interest rate (accounting for only 3.68% of the variation).

Figure 1. GDP (Non-OECS countries)

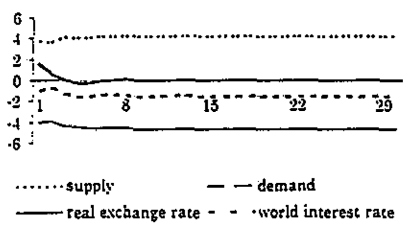


Table 1. Percentage of the variance of output due to (Non-OECS countries)

horizon	$\nu_{iy,t}$	$\nu_{ip,t}$	$\nu_{ie,t}$	$\nu_{ii^*,t}$
1	41.89	8.08	47.43	2.58
5	38.08	11.32	47.03	3.55
10	38.00	11.37	46.94	3.67

Turning to the OECS countries, we notice that domestic supply shocks have persistence effects and demand shocks has insignificant effects on real output. Interestingly, we find that world interest rate have positive implications for GDP in short-run. The impulse response function becoming negative about five years after. An exchange rate appreciation leads to an contractionary output about 1.6% (versus 4.6% for Non-OECS countries). Regarding the variance decomposition of output, we notice that supply shocks are the most important factor in explaining variation in real output in both short-run and long-run, and thus accounting for 79.36 to 69.78 percent of the variation (see table 2). These findings are in accordance with recent studies on the relative importance of supply shocks as sources of business cycles in European and US economies.

Figure 2. GDP (OECS countries)

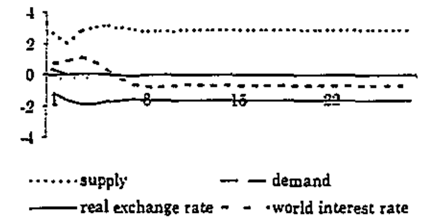


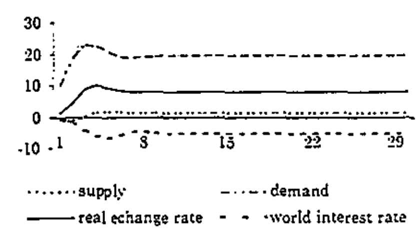
Table 2. Percentage of the variance of output due to (OECS countries)

horizon	$\nu_{iy,t}$	$\nu_{ip,t}$	$\nu_{ie,t}$	$\nu_{ii^*,t}$
1	79.36	1.58	12.55	6.49
5	72.96	4.34	12.75	9.93
10	69.78	4.32	12.21	13.97

4.2 Dynamic adjustment of price

All response functions (see figures 3 and 4) have the expected shapes: consumer price in the Caribbean countries are driven by nominal shocks. Thus, change inflation rate are explained mostly by domestic factors rather than external factors. However, world interest rate shocks have greater positive implications for OECS countries. This result appears to be consistent with the real exchange rate variations (see figure 5 and 6).

Figure 3. Consumer price index (Non-OECS countries)



Tables 3 and 4 show the variance decompositions derived from the structural VAR. We notice that the errors variance for consumer price index is dominated by nominal shocks at all horizons. As the horizon lengthens, the contribution of nominal shocks to the variance of inflation decrease while the contribution of world interest rate increase mostly for OECS countries. However, domestic supply shocks play a marginal role in explaining price movements.

Table 3. Percentage of the variance of price due to (Non-OECS countries)

horizon	$\nu_{iy,t}$	$\nu_{ip,t}$	$\nu_{ie,t}$	$\nu_{ii^*,t}$
1	0.42	98.70	0.64	0.22
5	1.52	80.07	13.13	5.26
10	1.49	79.16	13.29	6.03

Figure 4. Consumer price index (OECS countries)

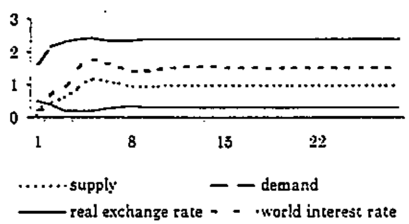


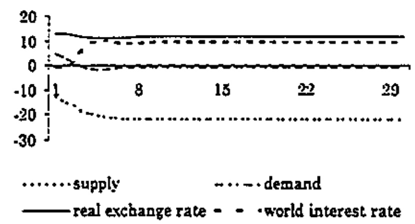
Table 4. Percentage of the variance of price due to (OECS countries)

horizon	$\nu_{iy,t}$	$\nu_{ip,t}$	$\nu_{ie,t}$	$\nu_{ii^*,t}$
1	0.13	89.64	8.43	1.78
5	7.55	70.01	6.79	15.63
10	7.82	68.89	6.83	16.44

4.3 Dynamic adjustment of real exchange rate

As required by the identification restriction, the effects of an expansionary demand shocks on the real exchange rate is necessary temporary for Non OECS countries. Domestic supply shocks, lead to a gradual depreciation, while an exchange rate shocks cause an immediate increase in the real exchange rate. The latter converge to a new long run equilibrium (see figure 5) In contrast, a positive world interest rate shock leads to an appreciation. Moreover, this change of a permanent nature. It is interesting to note that the jump in the real exchange rate is nearly the same as that of consumer price index (figure 4). These two variables converge to their new log-run equilibrium in about 6 years.

Figure 5. Real exchange rate (Non-OECS countries)



The associated variance decomposition (table 5) shows that real exchange rate is dominated at all forecast horizons by domestic supply shocks and by its own past behaviour. World interest rate and demand shocks play only small roles in the real exchange rate variations.

Table 5. Percentage of the variance of real exchange rate due to (Non-OECS countries)

horizon	$\nu_{iy,t}$	$\nu_{ip,t}$	$\nu_{ie,t}$	$\nu_{ii^*,t}$
1	42.86	8.97	43.09	0.06
5	39.32	10.41	38.65	11.07
10	39.20	10.97	38.50	11.30

Regarding the OECS group, we notice that response of real exchange rate to supply shocks are more persistent than world interest rate and demand shocks. These effects last for about 6 years before substantially dying out (figure 6). The most striking of these results is that world interest rate shocks have insignificant effects on the real exchange rate movements. The corresponding analysis of errors variance decomposition shows that exchange rate variation are driven mostly by domestic supply shocks and its own shocks.

Figure 6. Real exchange rate (OECS countries)

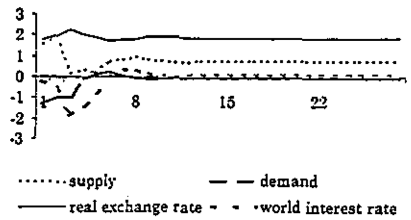


Table 6. Percentage of the variance of real exchange rate due to (OECS countries)

horizon	$\nu_{iy,t}$	$\nu_{ip,t}$	$\nu_{ie,t}$	$\nu_{ii^*,t}$
1	35.15	21.82	42.62	0.39
5	40.62	18.19	24.28	16.88
10	39.65	17.16	22.58	20.60

5 Summary and conclusions

The purpose of this paper has been to analyse the regional fluctuations of 12 Caribbean countries using a panel Vector autoregressive model. We assumed that fluctuations in real output, consumer price index, real exchange rate are the result of four types of economic forces : domestic supply shocks, domestic demand shocks and world interest rate shocks. Accordingly, we estimated a simple VAR driven by four exogenous disturbances which are identified so that they can be interpreted as the basic forces introduced above. Several conclusions can be drawn from this paper.

Firstly, while domestic demand shocks are relatively less important in causing short run fluctuations in real output, domestic supply shocks play a significant role in inducing long-term movements. Secondly, the analysis of response functions suggests that the sources of regional fluctuations in Non-OECS countries differ from the OECS countries. Real exchange rate shocks have greater impact on output, inflation in Non-OECS countries than in OECS countries. And thirdly, external shocks such as a raise of world interest rate, played a small role on the macroeconomic fluctuations in the OECS countries. This result may reflect differences in the structure of the OECS countries, for instance, in the concentration of primary exports. It suggests also that the implementation of a monetary union coupled with exchange rate arrangement prevents the real exchange rate playing any substantial role. In this case, The exchange rate is like a buffer for shocks from abroad.

In summary, the main source of output fluctuations in both the OECS countries and Non OECS countries are real, exchange rate and domestic supply shocks even in the short-run. It is interesting to note that these results are partially in accordance with those supply responses observed for other industrial countries.

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Appendix

Real output growth rate
and world real interest growth rate

Figure 7. Saint-Vincent

Figure 8. Saint Kitts and Nevis

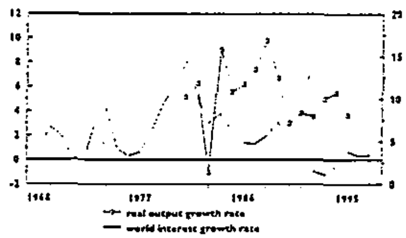

Figure 9. Guyana

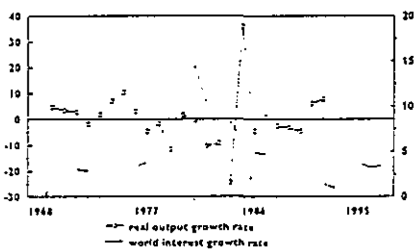

Figure 10. Trinidad and Tobago

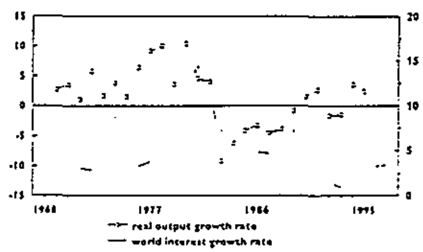

Figure 11. Suriname

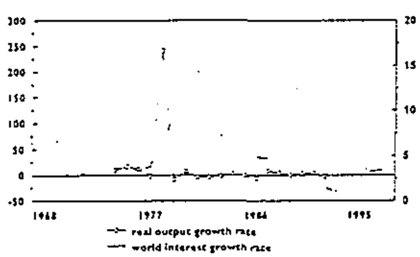

Figure 12. Belize

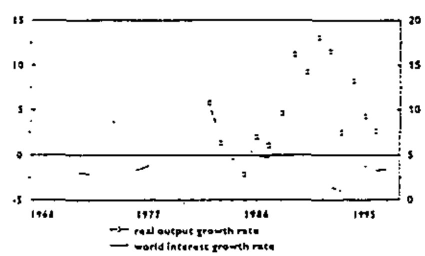

Figure 13. Barbados

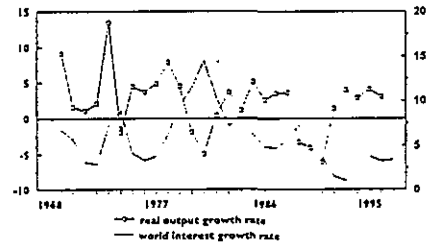

Figure 14. Dominica

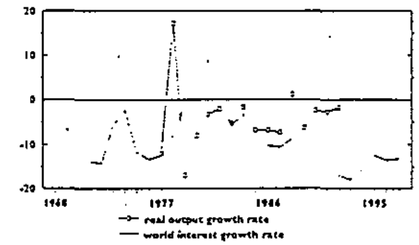

Figure 15. Antigua and Barbuda