Business Cycles in Small Open Economies
Jamaica and Trinidad and Tobago Cases

Patrice Borda*
Eryc Edinval**
Alain Maurin**
Jean Gabriel Montauban**

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Summary

The aim of this paper is to analyse the source of macroeconomic fluctuations in the small countries of Caribbean areas. Therefore, in accordance with the Mundell-Fleming hypothesis for the analysis of economic fluctuations in open economy, we use the VAR methodology for interest rate, money supply, the cover rate, the GDP and his deflator. We will restrict ourselves only to Jamaica and Trinidad and Tobago. Indeed, the analysis of the response functions shows a significant difference between theses states : Jamaica seems to be less vulnerable to external shocks than Trinidad and Tobago, for which the external balance enables international economic policies to be inforced in the country.

Résumé

L'objet de cet article est d'identifier les origines des sources des fluctuations de l'activité économique dans les petits pays de la zone Caraïbe. Ainsi, conformément aux hypothèses de Mundell-Fleming pour l'analyse des fluctuations en économie ouverte, nous estimons un modèle VAR incluant les taux d'intérêt, la masse monétaire, le taux de couverture, le PIB et son déflateur. Nous nous sommes limités uniquement aux cas de la Jamaïque et de Trinidad et Tobago. L'analyse des fonctions de réponse suggère qu'une différence subsiste entre ces deux états: la Jamaïque semble moins vulnérable aux chocs externes que Trinidad et Tobago pour lequel l'équilibre externe constitue un des canaux de transmissions des décisions de politiques économiques prises ailleurs.

* Cemafi and Lead.
** Lead and Université des Antilles et de la Guyane.
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The analysis of the interactions between real variables and nominal ones reappeared during the 1980's as one of the first centers of interest concerning the economic theory developments. The relative consensus between the keynesian school and the neoclassical one as regards the role of monetary variables and that of supply and demand factors in the explanation of economic fluctuations origins lets a doubt on the real efficiency of economic policies favouring one instrument or the other [Gordon (1981), Long and Plosser (1983), Barro 1989)]. The empirical examination of the contributions of the supply and demand shocks on short term variations of the economic activity was the object of numerous econometric works based on various methodological approaches. These ones mainly concerned developed countries and more particularly the USA. In this perspective, Hairaut (1990), using the Var methodology analysed the links existing between the actual GDP, the money supply, the monetary basis, credit, and the nominal interest rate of the American economy. The conclusions of this study lead to integrate the monetary and financial spheres into the economic fluctuations modelling. Recently, authors like Ahmed and Park (1994), showed that one could also take into account one variable symbolising the opening of economies. From this point of view, the product variance is explained, to a great extent, by external supply shocks. In the same way, Bruno and Portier (1994), widening Gali's (1992) analysis in open economies, showed that the post-war French economy fluctuations were due to the widespread increase in the real interest rates.

This paper extends the discussion to the case of small open economies and particularly that of insular countries of the Caribbean areas. The choice of theses countries brings some answers to the empirical verification about economies which are particularly sensitive to both internal and external shocks. In a first part, we recall the stylised facts in order to underline the specificities of these countries. In a second part, we briefly pass in review the theoretical supports for the economic fluctuations analysis in the Caribbean islands. In a third part, we show the results of the VAR models simulations.

1. A brief description of the economic fluctuations

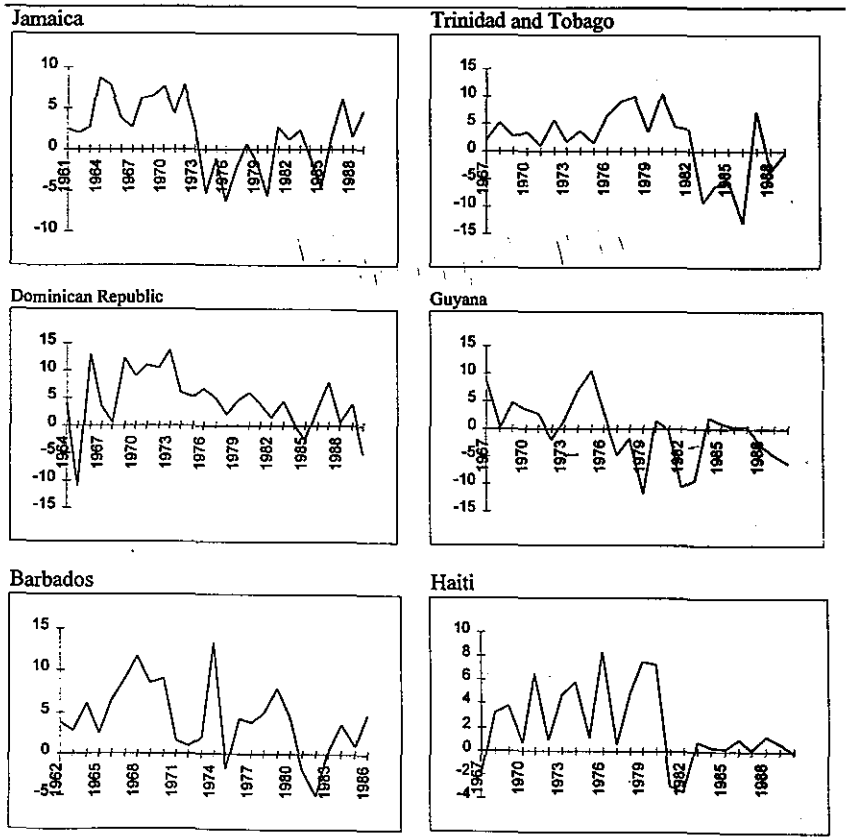
At first sight, the Caribbean economies can be described by several common characteristics. Indeed, they correspond to small insular countries with exiguous internal markets, limited natural resources and insufficient developing factors. For this reason, their economies are strongly oriented to the external market and depend a lot on their relationships with industrialised countries.

Their growth during the last three decades, was based on export possibilities and the increase of public expenditure respectively induced by preferential agreements for the access to large markets and the institutional relationships with American and European countries. However, a deeper analysis shows that, these countries can be distinguished by important differences in their productive structures, their international trade and their standard of living. To give an example, in 1990, the annual per capita

incomes of the poorest two countries, Haiti and Dominica, represented respectively less than 6 % and less than 30 % of those of the Bahamas and Barbados, the richest countries of this zone.

A global classification of the countries of this area allows us to distinguish two kinds of countries : those whose industries, public and private sectors are developed (Bahamas, Antigua and Barbuda, Barbados, Trinidad and Tobago), those which depend on agriculture and raw materials (Haiti, Grenade, Jamaica, Belize, Dominica, Guyana, St Kitts, St Vincent). So, even though the Caribbean region has reached average growth rates superior to those of Central America Countries, and comparable to those of the south Pacific Islands from 1960 to 1990, the countries which constitute this area show great divergences as for their reactions facing macroeconomic shocks (and above all, external shocks).

Graph 1. GDP growth rate (%)



Graph 1 illustrates very well the impact of these shocks on growth, in these islands. The curves also show that petroleum importing countries such as Guyana, Jamaica, and the Dominican Republic seemed to be rather vulnerable in front of the increase of petroleum prices during the 70 decade, whereas Barbados, Trinidad and Tobago benefited from it.

These shocks have various origins and even their character, either permanent or not, changes from one island to the other, by comparison with natural disasters those which proved to be positively or negatively the most significant ones, were mainly generated by modifications in the rules concerning the access to American and European markets, variations of global demand on exports, and variations of external financing. As a matter of fact, for the external trade, these islands exports were concentrated on a small number of products such as bananas, sugar, bauxite and benefited from preferential conditions for import markets. Yet, in the present context of world trade globalization and easing of restrictions, these exportations are more and more questioned by the other nations competition either directly and indirectly.

In view of these last years evolution, the global demand variations seem to have a direct effect on the economic performances of Caribbean countries. For example, the real GDP growth rate of industrialized countries, for a yearly average, passed from 3.5% for the 1983-1989 period, to 1.5% for the 1990-1993 one. In the same way, during the same periods, their imports fell from 7% to 3%. For the Caribbean area, this growth slackening in the industrialized countries had negative effects on transactions deficit and also on exchange terms, all the more as their export prices weakned.

Concerning the external financing, the Caribbean countries debt level conditions their fiscal and monetary policies. Then the consequences can affect the internal demand which can in turn have an influence on growth.

A simple approach is developed for measuring the shocks impacts on the output growth (see annex 1). It consist in defining and evaluating indicators which give a direct measure of losses or gains resulting from these shocks. For the exchange terms for example, such an indicator corresponds to the difference between the import and export prices from period $t-1$ period t. (see annex 1).

Table 1 presented below gathers together results[4] concerning Guyana, Jamaica, The Dominican Republic, Trinidad and Tobago during 1972-1991.
For Jamaica, the 1970s' negative shocks mainly resulted from the deterioration of the terms of trade. Yet, it benefited by the positive shocks of the early 80s due to the resumption of the exports. Then this movement inverted itself by the late 80s'. Among the elements able to explain this situation one can put forward the lack of any investment policy which could have allowed to face the loss of competitiveness, the weight of the external debt and the touristic sector crisis increased by among other things, the Gulf war and the opening of the eastern countries. To face all that, Jamaican government reinforced in the early 1990s stabilisation and structural adjustment programmes, undertaken since the end of the '70s.

[4] From the world Bank report about CGED countries
CGED : (Caribbean Group for Cooperation in Economic Development)

For Trinidad and Tobago, the first and second petroleum shocks had positive consequences. They allowed investments launching and social indexes improvement. Yet, the petroleum prices weakenings in 1975 and 1986 denounced the fragility of this economy which still depends strongly on the petroleum industry. So, since the late '80s, Trinidad and Tobago have known a certain recession which justified the setting up of a structural adjustment policy based on the re-launching of the non-pretroleum productive sector.

Table I. External shocks and the GDP growth rates[1].

	1972-75	1976-80	1981-85	1986-91
		as % of GDP		
Terms of trade effects				
Jamaica	2.47	1.74	-0.18	0.96
Dominican Republic	-0.26	1.12	0.95	0.46
Guyana	-1.05	3.36	5.70	-1.32
Trinidad and Tobago	0.74	-3.25	-0.02	3.06
Export volume				
Jamaica	0.70	0.23	0.66	-0.52
Dominica Republic	0.50	0.07	0.22	-0.35
Guyana	1.34	0.34	1.64	-1.44
Trinidad and Tobago	2.50	0.47	1.23	-0.77
Interest rate effect				
Jamaica	0.13	0.14	-0.22	-0.13
Dominican Republic	0.00	0.12	-0.13	-0.05
Guyana	-0.01	0.21	-0.23	-0.18
Trinidad and Tobago	-0.01	0.05	-0.04	-0.07
Additional debt service				
Jamaica	0.24	0.39	3.82	4.09
Dominican Republic	-0.17	0.37	1.99	2.25
Guyana	0.75	2.79	8.06	12.22
Trinidad and Tobago	-0.07	-0.19	0.00	-0.48
Total external shock				
Jamaica	3.53	2.51	4.08	4.40
Dominican Republic	0.07	1.68	3.03	2.31
Guyana	1.03	6.70	15.17	9.26
Trinidad and Tobago	1.69	-2.91	1.18	1.74
GDP growth				
Jamaica	1.35	-3.56	-0.10	3.55
Dominican republic	8.47	4.86	1.62	1.60
Guyana	3.62	-0.60	-3.86	-0.52
Trinidad and Tobago	3.50	8.06	-5.14	-1.48

Source : World Bank (1994).

[1] Negative values express a positive impact of shocks, and vice versa.

For the Dominican Republic, the main fact which stands out to the observer is the proponderance of defavorable external shocks during the 70s. These shocks were greatly compensated for a fall in export prices (more precisely sugar prices). However, the second petroleum shock has been far more severe, for it was accompanied with a reduction of US sugar products imports.

Comparatively to the other countries, Guyana more strongly underwent the shocks impact of the '70s and '80s, Guyana exports above all (sugar, bauxite, rice) appeared to be very vulnerable facing prices volatility which led neat deteriorations of the terms of trade.

Because of the lack of long series and homogeneous data for all countries, the empirical analysis in the first part will be reduced to the cases of Jamaica and Trinidad and Tobago. Besides, this choice allows us to compare two countries which, though they belong to the CARICOM most advanced countries have different productive structures and react differently to shocks.

2. Theoretical Foundations

The determination of factors allowing to explain growth in the Caribbean countries has been the object of publications in the economic literature since the beginning of the 50's. The debate was open by Lewis who argumented that the neoclassical and keynesian analyses are inappropriate to apprehend the problem of growth in the Caribbean economies because of their specificities. So, he put forward a model totally different from traditional hypotheses explaining the accumulation process by the coexistence of a traditional sector and a modern one and interactions between them (Lewis 1954).

After Lewis, other interpretations of economies functioning have been proposed. So Seers (1968) developed a model aiming at explaining the paradox of unemployment persistence despite an increasing salaries rate of the petroleum exporting countries. This one provoke lots of controverses which gave birth to various studies. For instanse, Kennedy demonstrated that it could be assimilated to a keynesian model if particular hypotheses were introduced.

If the first object to these contributions was the analysis of growth conditions and the explanation of underdevelopment in the Caribbean countries, nonetheless, they are closely linked to the questions about the explanation of the sources of variation of the economic activity in these countries. As a matter of fact, the debates initiated by Lewis and taken up again by others lead in fact to the following questions:

- Are the economic fluctuations of these economies determined by demand (with imports as simple components of the latter) ?

- Or are they determined by exports? In this case, are they very sensitive to the evolution of variables such as the money supply, the exchange rate and the prices level?

More generally, the theoretical frame most used today for the analysis of the fluctuations in open economy is the Mundell-Fleming model. This model inspired from Keynes, studies the consequences of economic policies measures (budgetary, fiscal and monetary) on the economic activity. The structure of the economy generally retained is described by five basic relationships. Three of them describe the conditions for internal balance (the good market, IS, and the money market, LM) and for the external balance characterised by the variations of the reserves of change (or the balance of payments, EE). The fourth one integrates the prices movements (i.e. the supply curve) whereas the last one is the money supply.

The use of this model for economic policy permits to analyse several cases which can be summarised in three points.

The first one is that of regulation policies, for instance, a fiscal policy generated by an increase of the government expenditure or a decrease of the imposition rate, this one is characterised both by an increase of the economic activity and of the interest rate. Two opposed effects then appear : the increase of the income on the first hand deteriorates the commercial balance if the propensity to import from domestic country is high ; and on the other hand, the increase of the interest rate which generates an increase of capital flows improving the balance of trade.
In this model the efficiency of the economic policy is conditioned both by the capital mobility and by the change system.

In flexible exchange rate system with a weak capital mobility, the deficit of current account caused by expansionist fiscal measures leads to a depreciation of the exchange rate improving the balance of trade. In presence of a perfect capital mobility, the domestic interest rates are determined by the world interest rates. So, any change in economic policy leads to an increase of interest rates bringing about a massive flow of foreign capital which appreciates the exchange rate. This movement associated with an excess of inflation provoked by the aggregated demand increase compensates the positive effect of the expansionist policy.

In the case of fixed exchange rate, a weak capital mobility means that a budgetary policy leads to a reduction of money supply (caused by trade deficit), which leads in its turn to an increase movement of the interest rates. The trade deficit generated by these changes in economic policy is compensated by the purchase of change reserves. If the foreign capital is perfectly mobile the eviction effect of public expenditure upon private ones is alleviated. An obvious conclusion is inspired by this last remark : any change of economic policy is all the more efficient as the capital mobility is strong in case of fixed exchange rate.

The second point concerns the role of prices in macroeconomic adjustment. The model supposes that their evolution is guided by the internal demand and the exchange rate variations. The main results about the efficiency of the economic policy are not modified. Indeed, in the system of fixed exchange rate whatever the importance of the capital mobility the expansionist policy generates an excess of inflation which reduces the agents real wealth (real cash balance effect). The domestic goods are then forgotten for imported goods, provoking thus a deficit in the current account. However, in the system of flexible change trade, an expansionist fiscal policy proved to be efficient in presence of a weak capital mobility since exchange rate depreciates. In the model, taking the prices account modifies the effects of economic policy shocks (either monetary or budgetary) without inverting their effects on the economic variables.

At last, the third point is the extension of the model to the supply policy. This can be possible by the introduction of a supply shock which could be assimilated, for the Caribbean countries, to a shock on intermediate goods generally imported. The fall in the intermediate goods prices will lead to the increase of the production and interest rate which leads to a drop in prices. The impact of such a policy on the current account remains undetermined. For the drop in prices stimulates imports because of the dependence of the economic activity on equipment and exports too, because of the increase of the goods and services supply.

3. Empirical Analysis of the fluctuations sources

In the first part, we have described the economic fluctuations of the Caribbean states in analysing the shocks undergone by simple methods. In the same way, we have exposed in the second part the theoretical outline which seems to give a relevant framework for the analysis of the stylised facts and for the understanding of the functioning of these small open economies. Now it is advisable to establish very rigorously the empirical verification of these assumptions. For that purpose, the var modelling is a relevant framework. The model retained includes the nominal interest rate, r_t, the money supply, m_t, the cover rate, e_t, the GDP, y_t, and the deflator, p_t. After presenting the methodological foundations, we will present the analysis of sources of disturbances.

3.1. The VAR model

The Caribbean countries are diverse and heterogeneous in their production systems and their relations with the rest of the world. Therefore, it seems difficult to draw a unique structural model that would lead to a comparative analysis of the economic fluctuations in these small open economies. In this respect, the VAR methodology is an excellent recourse, since it allows an entirely endogenous specification without any prior restriction other than the selected variables and the lag of the autoregressive process.

If we define a vector $X_t = [y_t, m_t, r_t, p_t, e_t]'$, the model will be formulated as followed :

$$\Phi(L)X_t = \eta + \varepsilon_t \qquad (1)$$

$\Phi(L)$ is the polynomial $\Phi(L) = I_n + \Phi_1 L + \Phi_2 L^2 + \ldots$, which depends upon the lag operator L, and whose coefficients Φ_k correspond to $n \times n$ format matrixes.ε_t is the matrix error vector of variance and covariance, Σ.

Without restricting the structures of errors, OLS method applied equation after equation leads to consistent estimators.

As far as the numerical applications are concerned, it would be more appropriate to consider long quarterly data as they allow an in-depth analysis of causalities and adjustments between variables. However, the data available in Caribbean countries do not allow such exercises. Nonetheless, the VAR approach can still be used in the analysis of the dynamic movements between variables.

Before estimating the model, an approach of the long-term properties of each series is necessary by using the tests of unit root test. In this purpose, we use Henin's and Jobert's strategy (1992), which consists in applying sequentially the ADF test to models that include either a trend or/and a constant, only a constant or only a delayed variable (example of the *random walk*). The statistics obtained from the test are respectively τ_t , τ_μ and τ and their corresponding critical values -3.60, -3.00 and -1.95 (Dickey and Fuller (1979)).

The following graphs reproduce these results. To make them easier to read, we will consider the example of Trinidad and Tobago's GDP. Through the AIC and BIC criteria, one lag is considered for the differentiated variable. The hypothesis of unitary root in the equation (1) (see annexe B) has to be accepted ($\tau_t = -1.48$). We then estimate the significativity of the trend in the equation (4) by examining t_t statistics. We have $t_1 = 1.13$, so the trend is not significant. We then apply the unit root test to the equation(2). The value of τ_μ leads us to reject the hypothesis I(1). Likewise, the constant is not significant in the equation (5). Eventually, we accept the hypothesis I(1) since $\tau = 1,66$ in equation (3).

The model was estimated on the period 1966-1987 for Trinidad and Tobago and 1961-1989 for Jamaica. The BIC and HQ criteria lead us to choose a model with only one lag.

Table 2. Unit root test I(1)/I(0) for Trinidad et Tobago

series	lag	$\tau_t(1)$	$t_t(4)$	$\tau_\mu(2)$	$t_a(5)$	$\tau(3)$	Comment
y	1	-1.48	-1.13	-1.35	1.75	1.66	I(1)
e	1	-2.63	0.05	-2.85	0.23	-2.18	I(1)
m	1	-1.70	1.43	-1.12	1.76	1.66	I(1)
r	1	-2.69	1.34	-0.72	0.71	0.65	I(1)
p	0	-3.07	3.27				I(1)+T

Table 3. Unit root test I(1)/I(0) for Jamaica

series	lag	$\tau_t(1)$	$t_t(4)$	$\tau_\mu(2)$	$t_a(5)$	$\tau(3)$	Comment
y	0	-1.26	4.37				I(1)+T
e	0	-2.69	0.36	-2.69	-0.09	-2.01	I(1)
m	1	-3.27	3.53				I(1)+T²
r	0	-3.40	0.99	-0.05	1.55	1.5	I(1)
p	0	-2.26	2.94				I(1)+T²

3.2. Impulse responses

If we had to use a macroeconometric model that would reflect the hypothesis of Mundell-Fleming model through selected variables, the dynamic multipliers would thus represent a good approach to describe a variable's response to a shock caused by another variable. Indeed, these multipliers permit to measure the immediate, delayed or long term impact of any other exogenous variable's variation on the endogenous variables of a model.

With the VAR models, this multipliers analysis is possible through the functions of response to a shock ,which could be identified from the moving average form of the process X_t. In fact, since $\Phi(L)$ is reversible (his roots determinant are outside the unit disk), according to Wold theorem (see Lütkepohl (1994)), the model could be represented by a MA representation of the form :

$$X_t = \mu + \Psi(L)\varepsilon_t \qquad (2)$$

where $\psi(L) = \Phi(L)^{-1}\varepsilon_t$ is an infinite length polynomial and $\text{cov}(\varepsilon_t) = \Sigma$. The components of X_t are expressed to the errors by the relation :

$$X_t = \mu + \varepsilon_t + \Psi_1\varepsilon_{t-1} + \Psi_2\varepsilon_{t-2} + \ldots \qquad (3)$$

At time $t+s$, we have

$$X_{t+s} = \mu + \varepsilon_{t+s} + \Psi_1\varepsilon_{t+s-1} + \Psi_2\varepsilon_{t+s-2} + \ldots \qquad (4)$$

leading to the following function in s:

Monetary shocks

We notice that both the rate of interest and the money supply diminish instantaneously in the beginning of the period. At the same time, we also observe that both prices and interest rates decrease similarly (0.40%). At last, note also that the trade balance first declines significantly, then goes back to a profitable level after three years.

In the above observation, the mechanisms of the Mundell-Fleming model are to be found again. Indeed, this shock could be interpreted as an increase in the money supply stemming from the monetary authorities. Consequently, the LM curve moves to the right, which causes thus a decline in the interest rates and an imbalance of the trade balance due to flight of capital. In order to re-establish the equilibrium on the market of good and services, prices fall.

Shocks of interest rates

It is relevant to note that a shock of the interest rates on the GDP, the money supply, the interest rates and prices is inoperative in a very short term. Only the margin rate responds instantaneously. Nevertheless, the effect is short since the trade balance goes back to its initial position after one period. Meanwhile, the effects on the GDP, prices, the money supply and the interest rates peak. The graphs representing the evolution of the last two variables show an opposite evolution.
We should not be surprised by this last fact, for, according to the keynesian theory, the interest rates are the transmission canal of the monetary policies. If we notice that prices are the slowest adjustable variables, we could then conclude that inflation is one of the major problems in this country.

Shocks of prices

When prices increase, the product decreases significantly, which leads the country's economy towards a long period of recession. Note that these shocks are the one which have the most unfavorable effects on the economy. This observation substantiates the idea put forward above about the previous shock, which is that stabilization of prices should be one of public authorities' main priorities.
The result of the analysis highlights a common pattern among developing countries. Indeed, since their productive structure is less developed than in industrialized countries, their are more vulnerable and more affected by shocks of supply than by shocks of demand.

Finally, we notice that, in response to such a shock, the trade balance progressively deteriorates, which could be explained by the arbitration between domestic goods and foreign products.

$$\frac{\partial X_{i,t+s}}{\partial \varepsilon_{jt}} = \Psi_s \qquad (5)$$

The function clearly shows that the coefficient $\Psi_{ij,s}$ measures the incidence at the date $t+s$ of the i^{th} variable $(X_{i,t+s})$ on a unit variation at the date t of the innovation of the j^{th} variable (ε_{jt}).

This formalization has however two inconveniences. First, it offers a great many solutions. Secondly, the components of ε_t do not verify the hypothesis of no serial autocorrelation and independence since there are causality links between variables.

The most commonly adopted approach to obtain a unique representation in which the innovations could be interpreted as independent shocks, consists in imposing the orthogonalization of the residuals (Sims 1980) through the decomposition $SS' = \Sigma$. When setting $w_t = S\varepsilon_t$ and $\Gamma_i = \Psi_i S$ we obtain the following function which gives a clear representation of the shocks :

$$X_t = \Gamma_0 w_t + \Gamma_1 \varepsilon_{t-1} + \Gamma_2 \varepsilon_{t-2} + \ldots \qquad (6)$$

with $E\{w_i w_i'\} = I$.

The response functions we figured rely upon Choleski's decomposition of Σ. Their graphic representation brings out interesting results.

Case of Jamaica

Shocks of demand

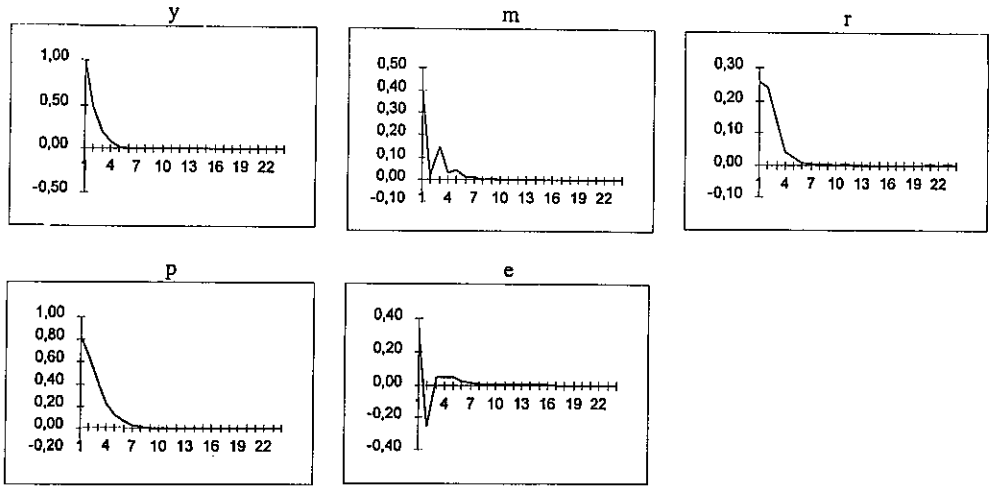
In a very short term, a GDP shock leads to positive effects on selected variables. Besides the GDP, the most significant effects are the 0.8% rise in prices and the evolution of cover rate. As we clearly observe, during the second period, the trade balance deteriorates, from 0.40% to -0.20%. This shock of the demand seems first to benefit more significantly foreign markets. Nonetheless, the economy responds relatively rapidly to the shock, going back at the end of the second period to its initial position before the shock.

From a theoretical viewpoint, what does the analysis of the variables responses to such a positive demand shock reveal ? In accordance with the conclusions drawn by Mundell-Fleming model, prices rise rapidly by 0.80%. Besides, the money supply increases, allowing to compensate for the loss in wealth profit caused by prices rise. The rate of interest decreases then over a few years after the shock. Therefore, the deterioration of trade balance by 0.60% results from the excessive demand for goods, which increases the imports.

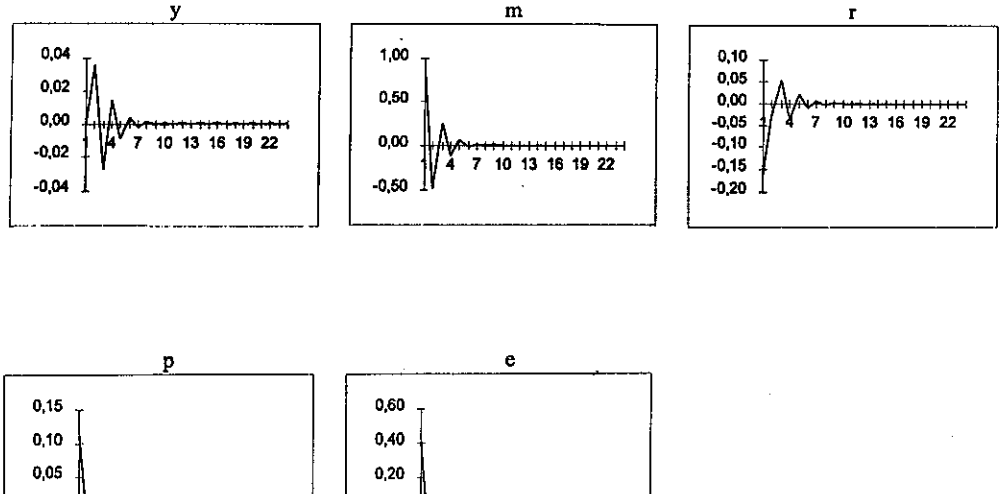
Besides, the balance trade's response corroborates the hypothesis of the J curve, because the balance becomes positive again only two years after the shock.

IMPULSE RESPONSES FOR JAMAICA

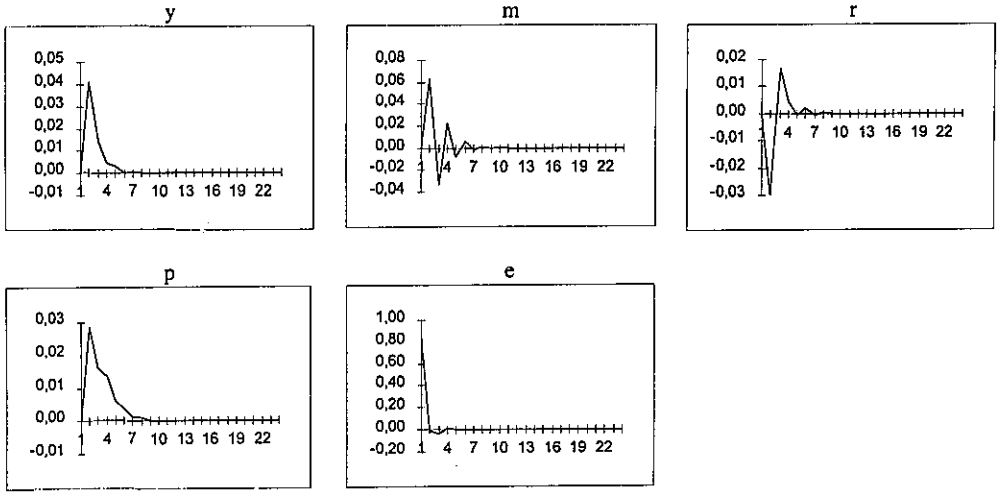
Responses to a GDP shock



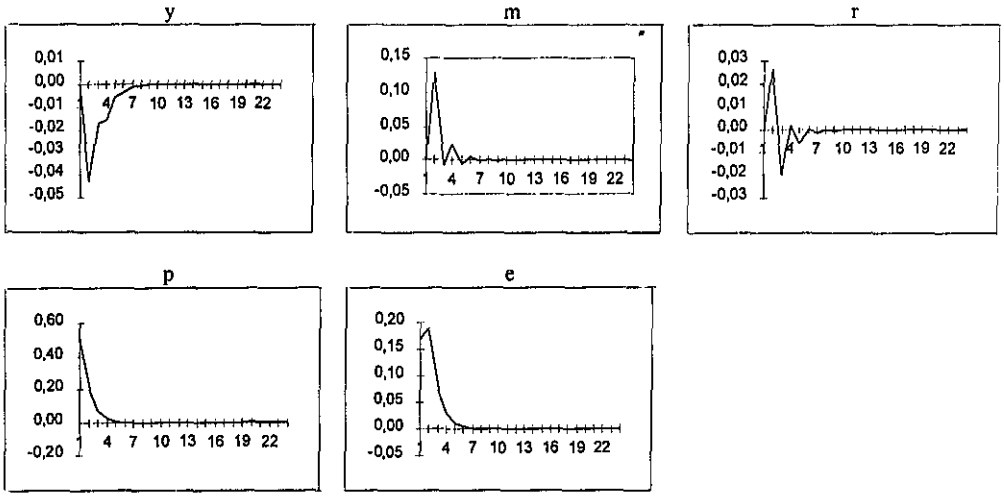
Responses to a monetary shock



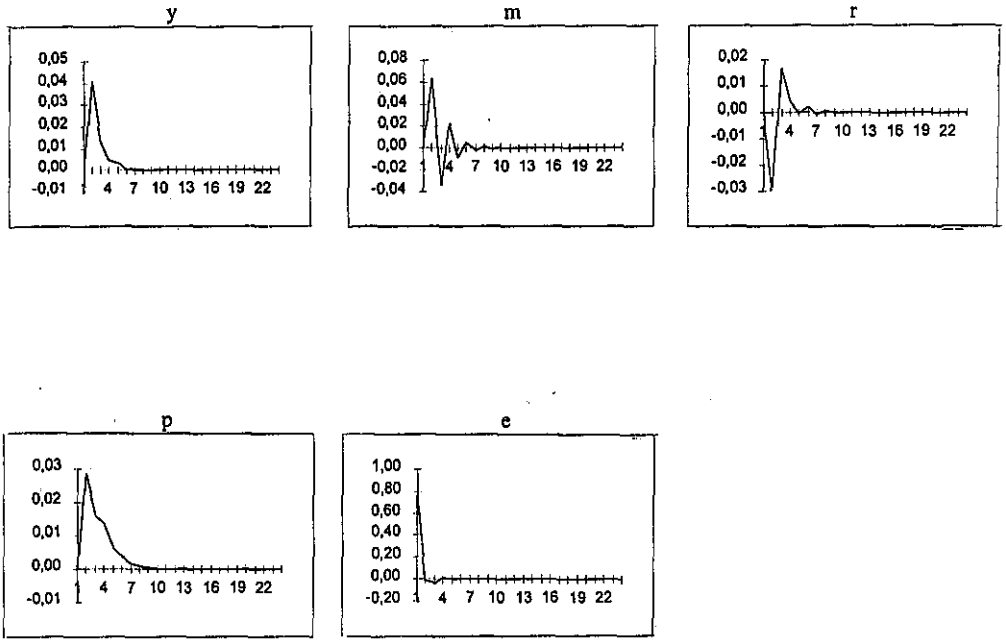
Responses to an interest rate shock



Responses to a prices shock

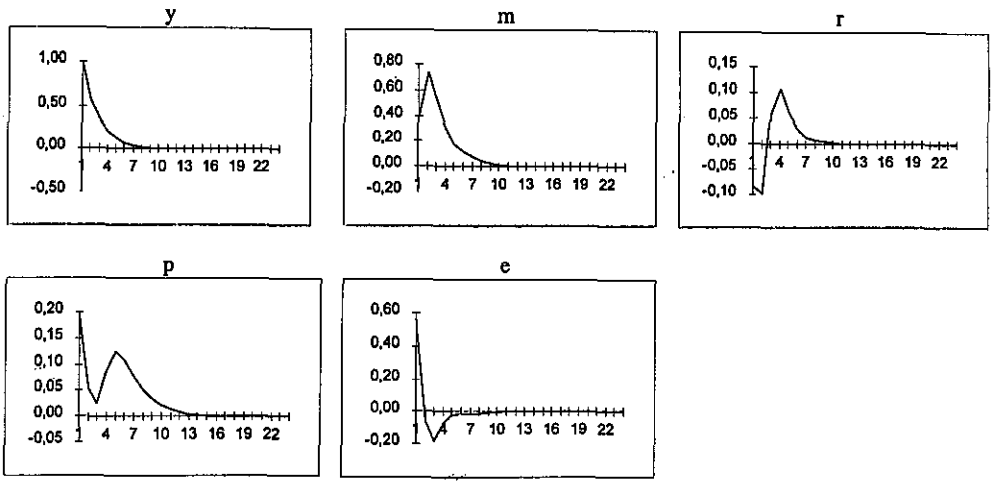


Responses to an external shock

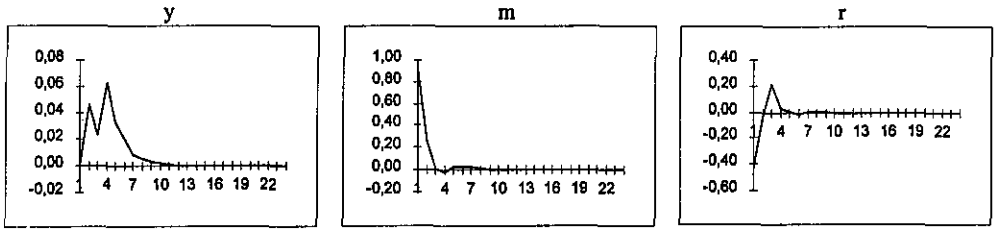


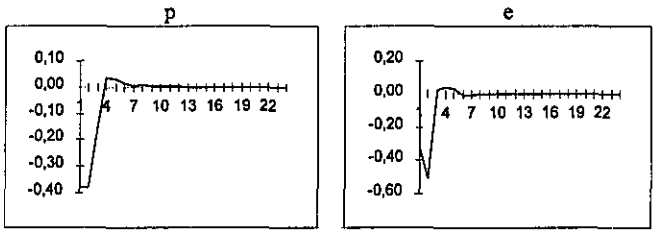
IMPULSE RESPONSES FOR TRINIDAD ET TOBAGO

Responses to an GDP shock

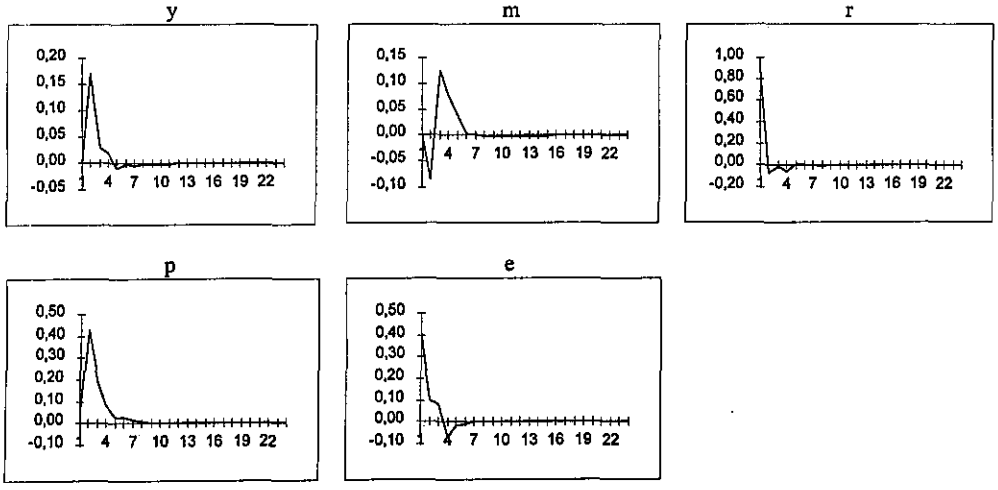


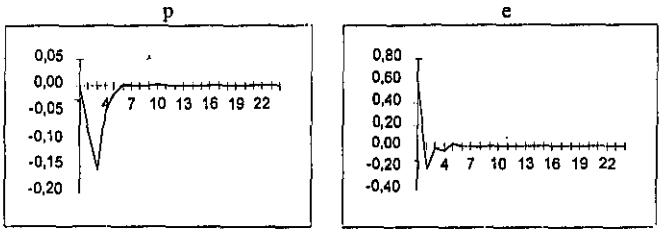
Responses to a monetary shock



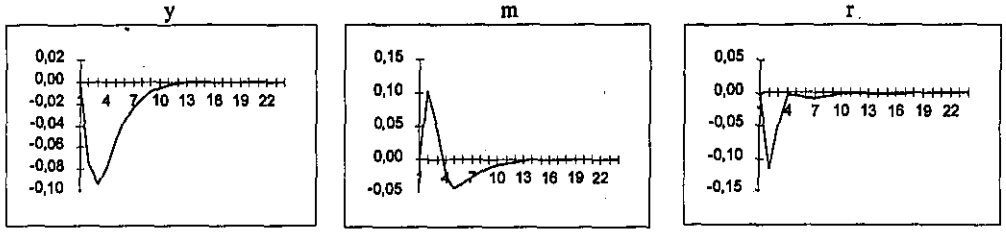


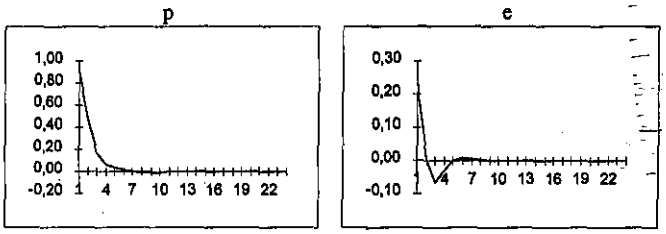
Responses to an interest rate shock



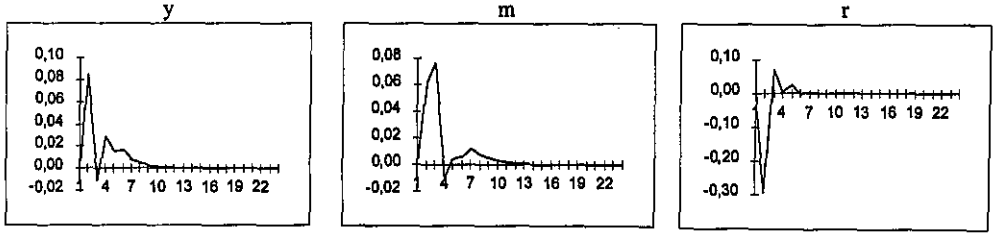


Responses to a prices shock





Responses to an external shock



External shocks

According to the graphs showing responses to an external shock caused for example by an increase in exporting prices, none of the variables responds instantaneously.

Note that, after a short time of adjustment (about one period), the interest rate declines while the money supply, the GDP and prices increase. However, the phenomenon affects more significantly the money supply. The graphs also show that, a period later, all the variables undergo a reversed trend after these instantaneous responses. The most significant one is that of the money supply, whose graph shows its lowest level -0.30 % during a same period. These observation could lead to the idea that the money supply might play an essential role in regulating the economic activity. In other words, after an external shock, the money supply seems to be the instrument one tends to act upon to stabilize the economy.
As a result of such a shock, it is logic to observe at first a price rise. The latter leads then to a decrease in the trade balance, as it is clearly indicated in the graph representing the evolution of cover rate. Then, a net increase occurs for some time. This observation is also valid for most of the shocks that substantiate the hypothesis of the J curve.

Case of Trinidad and Tobago

Shocks of demand

A brief comparative study between Trinidad and Jamaica underlines several significant facts.
- The effects of this shock on Jamaica and Trinidad and Tobago GDPs are quasi identical.
- The inflationist effects are less important (0.20 for Trinidad and 0.80 for Jamaica). While a continuous decrease in prices was observed in Jamaica, tree well distinct phases are necessary to explain prices evolution in Trinidad and Tobago. In a first time, we notice that prices rapidly fall since they recover from their initial level before the shock. In a second time, prices rise again, then, at last, slowly decrease again. As those countries' economic situation confirms it, this phenomenon consequently indicates that while having a lower inflation than Jamaica, Trinidad and Tobago finds it difficult to curb.

- Both Jamaica and Trinidad and Tobago money supply responds in the same way and proportions during the first period- (0.40%). However, a difference remains: whereas in Jamaica, the growth in the money supply lasts over two periods, in Trinidad and Tobago the growth slowly ceases by the end of these two ones. Similarly, the interest rate and the money supply are also negatively correlated on a relatively long period, which corresponds to the traditional conclusions drawn by the Mundel-Fleming model.

The observations done on Jamaica cover rate also apply for Trinidad and Tobago, since the graphs have the same profile. The hypothesis of the J curve is once again verified.

In short, the results seem in accordance with the predictions of the Mundell-Fleming model: the budget policy barely affects the economy's long term equilibrium, since its expansionist effect benefits to a great extent to world activities.

Monetary shocks

Contrary to Jamaica, the immediate effect of a monetary shock undergone by Trinidad and Tobago consists in the deterioration of the trade balance and the decrease in prices. The GDP and the interest rates increase only at the end of the two periods , while the money supply lowers. Note that the product falls by 0.02% during the second period, followed then by a change of trend. Recession appears during the fourth period.

Likewise, let's observe that in the case of Trinidad and Tobago, the dynamic caused by the shocks of the interest rates leads to trade deficits more important in Trinidad and Tobago than in Jamaica. As a result, the trade balance appears as one of the monetary policy transmission canal.

The results of the analysis are in accordance with the economic theory : the increase in the money supply consequently leads the interest rates to diminish. An increase in the demand for goods and services occurs then, which should also deteriorate the trade balance. To re-establish the balance on the goods and services market, prices rise.

Shocks of interest rates

A positive shock on nominal interest rates increases instantaneously both interest rates and prices by respectively 0.9 and 0.5. However, these ones fall in a medium term. The GDP and prices increase after two years while the money supply and interest rates decrease. The balance of trade improves only from the second period through the sixth period. It is also relevant to notice that prices respond similarly to the GDP to re-establish the balance on the goods and services market.

Shocks of prices

When a negative shock on prices occurs, the trade balance and prices instantaneously increase (respectively 0.90 and 25). At the same time, the product and the interest rates decrease. A shift in trend for both product and interest rates occurs respectively three years and two years after the shock . Nevertheless, these two variables still respond negatively. A possible comparison with Jamaica would show that such a shock on the Trinidadian economy is more significant, reaching a maximum of 0.09 as opposed to 0.04 for Jamaica. Similarly, the adjustment to the equilibrium occurs in a longer time in the case of Trinidad and Tobago. The money supply increases after two years by 0.10% then goes down. It improves again only five years after the shock.

The trade balance deteriorates rather rapidly. It becomes however negative from the second year. Once again, the trade balance appears as the adjustment variable facing negative shocks.

External shocks

As in the case of Jamaica, if we assimilate an external shock to a rise in exporting prices, the trade balance improves rather rapidly. The GDP and the money supply increase while the interest rate decreases significantly. It is thus a deflationist shock on prices. Few years after this shock, the trade balance deteriorates. Such an effect could be explained intuitively as followed : the increase in the exports contributes to rising the goods and services supply. Eventually, the money supply and prices fall since the increase in the goods and services supply is financed by foreign capital. The decrease of the interest rates, caused by the increase of the supply allows less capital inflow and consequently, deteriorates the trade balance.

3.3. The variance decomposition

The decomposition of the forecast error is the second approach that Sims put forward to measure the dynamic interactions between economic variables represented by the model MA. The idea is to determine the origin of the shocks that prevail in the evolution of a variable. To be more precise, if we consider a set of variables that represents the dynamic of an economic phenomenon, this decomposition allows us to quantify the contribution of a variable in the variability of the forecast error of another variable.

If we start from (6), by noting the forecast in t of X at the horizon h, the forecast error noted $\hat{e}_{t+h/t}$ is written :

$$\hat{e}_{t+h/t} = \sum_{i=0}^{h-1} \Psi_i \varepsilon_{t+h-i} = \sum_{i=0}^{h-1} \Psi_i S S^{-1} \varepsilon_{t+h-i} \qquad (7)$$

which is according to w_t,

$$\hat{e}_{t+h/t} = \sum_{i=0}^{h-1} \Gamma_i w_{t+h-i} \qquad (8)$$

we have then,

$$V\{\hat{e}_{t+h/t}\} = \sum_{i=0}^{h-1} \Gamma_i^2 V\{w_{t+h-i}\} \qquad (9)$$

This relation shows that the forecast error's variance of a component of X_t, can be written as a weighed sum of the structural innovations' variances.

Since $E\{w_t w_t\} = I$, the variance of $\hat{e}_{t+h/t}$ is given by :

$$V\{\hat{e}_{t+h/t}\} = \sum_{i=0}^{h-1} \Gamma_i^2 \qquad (10)$$

which allows us to write for the k^{th} component of X_t :

$$V\{\hat{e}_{t+h/t,k}\} = \sum_{j=1}^{n} \sum_{i=0}^{h-1} \Gamma_{kji}^2 \qquad (11)$$

Hence the following equation that measures the contribution of the j^{th} variable's innovation in the forecast error variance of variable k.

The results obtained from studying Jamaica and Trinidad are gathered in the following tables 4 and 5.

Table 4. Variance decomposition for Jamaica

		GDP			
horizon	GDP	Money	Interest rate	Prices	Cover rate
1	100	0	0	0	0
2	97,17	0,10	2,45	0,15	0,13
3	97,00	0,15	2,53	0,16	0,14
4	96,96	0,17	2,54	0,18	0,14
10	96,94	0,17	2,55	0,19	0,14
		Money			
1	16,30	83,69	0	0	0
2	12,73	83,23	2,42	1,29	0,31
3	13,50	82,31	2,58	1,21	0,38
4	13,37	82,15	2,83	1,23	0,41
10	13,45	82,05	2,85	1,23	0,42
		Interest rate			
1	6,67	2,55	90,78	0	0
2	11,35	2,37	86,13	0,06	0,08
3	12,52	2,55	84,72	0,10	0,10
4	12,64	2,66	84,50	0,10	0,10
10	12,68	2,71	84,40	0,10	0,10
		Prices			
1	68,57	1,24	3,28	26,90	0
2	73,77	0,86	4,44	20,87	0,05
3	75,78	0,79	4,53	18,81	0,06
4	76,30	0,77	4,62	18,23	0,07
10	76,50	0,76	4,63	18,02	0,07
		Cover rate			
1	11,67	16,17	0,24	2,83	69,08
2	14,81	16,44	6,81	5,29	56,62
3	14,64	16,52	7,71	5,64	55,47
4	14,77	16,47	7,86	5,69	55,20
10	14,95	16,44	7,85	5,69	55,07

In the case of Jamaica, they reveal without any ambiguity that the GDP's fluctuations could be explained mostly by its own innovations. At the end of 10 years, these ones remain superior to 96%. The charts also indicate that the interest rate represents the second factor of shocks whereas innovations in money, prices, and cover rate have less significant effects. As for the money, only its own shocks and those of the GDP count. The dynamic enhanced by the interest rate could be explained first by its own impulsions then by those of the GDP and money. Finally, besides their own fluctuations, prices could be explained essentially by shocks of the GDP while the cover rate is explained by shocks of money and GDP.

Table 5. Variance decomposition for Trinidad and Tobago

		GDP			
horizon	GDP	Money	Interest rate	Prices	Cover rate
1	100	0	0	0	0
2	96,79	0,16	2,12	0,41	0,51
3	96,38	0,18	2,00	0,95	0,47
4	95,79	0,42	1,95	1,30	0,51
10	95,41	0,51	1,92	1,59	0,55
		Money			
1	15,03	84,96	0	0	0
2	42,47	56,20	0,43	0,65	0,24
3	50,34	47,29	1,19	0,65	0,51
4	52,48	44,95	1,43	0,64	0,48
10	53,56	43,63	1,46	0,85	0,48
		Interest rate			
1	0,73	18,27	80,99	0	0
2	1,49	16,41	72,95	1,19	7,94
3	1,72	19,79	69,14	1,36	7,97
4	2,69	19,60	68,49	1,34	7,87
10	3,09	19,50	68,15	1,35	7,88
		Prices			
1	3,74	14,29	0,17	81,78	0
2	2,62	18,56	11,98	66,42	0,39
3	2,48	18,54	13,36	63,68	1,91
4	2,91	18,36	13,63	63,06	2,01
10	5,08	17,98	13,40	61,55	1,97
		Cover rate			
1	30,76	10,41	16,57	5,21	37,03
2	23,72	27,35	13,33	3,96	31,61
3	25,32	26,47	13,45	4,16	30,57
4	25,49	26,30	13,67	4,18	30,34
10	25,51	26,32	13,66	4,18	30,31

In the case of Trinidad and Tobago, the shocks of the GDP and the money predominate in the explanation of their own fluctuations, but to a lesser extent than for Jamaica. Indeed, in the case of money for example, the contribution of these shocks declines relatively rapidly, going from 85% ($h =$) to 43% ($h = 10$). Compared to Jamaica, we also notice that the cover rate , as a second factor of shocks, influences significantly the interest rates (about 8%). As for the interest rate, it could be explained by its own dynamic which intervenes at more than 68% and the dynamic of the money. However, contrary to Jamaica, the GDP is not as valid an explanation as opposed to the cover rate

Conclusion

In our analysis, it appears that, in the case of Jamaica, the budgetary shocks influence considerably the dynamic of the economic activity, being a stabilizing instrument for the economy. Besides, by highlighting the recessive characteristic of the economy, the analysis of the shocks of prices leads us to emphasize the importance of hazards that affect the structure of supply. In the case of Trinidad and Tobago, external shocks are the sole to give an account of movements in the economic activity and in the interest rates.

To summarize, the analysis of the shocks that create a macroeconomic dynamic between selected variables, seems to be relatively close to the theoretical scheme defined by the Mundell-Fleming model.

Annex A
General Methodology for evaluation of External Shocks (World Bank (1992))

In this annex, three types of direct shocks and one indirect are considered:

Direct shocks

1) Terms of trade effect
2) Global demand export volume effect
3) Interest rate effect

Indirect shock

4) Cumulative impact of additional borrowing due to shocks

1) Terms of trade effect

The methodology used to estimate the impact of terms of trade variation is presented. Firstly, import and export price effects are estimated separately and later combined to obtain the total terms of trade external shock. This approach can be extended to further desegregation based on different trade categories.

Terms of trade

Import and export values, gained or lost by country as a consequence to changes in the terms of trade, are obtained using the following approach.

$$TOTT_t = TOTM_t - TOTX_t \qquad t = (1971,....,1991)$$

$TOTT_t$ represents the net effect of terms of trade variation at time t due to import and export price changes from time t-1 to t. We suppose that unfavorable terms of trade effect OTT_t, is positive.

Import effect

$$TOTM_t = VM_t(PM_t - PM_{t-1})$$

Where:

$VM_t = \frac{M_t}{PM_t}$ = volume of merchandise imports by the country at time t

M_t = value of merchandise imports by the country at time t (CIF, current US$)

PM_t = unit value of imports at time t

A positive value for $TOTM_t$ represents a loss in imports value by the country at time t, due to an unfavorable import price change from time t-1 to t.

Export effect

$$TOTX_t = VE_t(PE_t - PE_{t-1})$$

where:

$VE_t = \frac{E_t}{PE_t}$ = volume of merchandise exports by the country at time t

E_t = value of merchandise exports by the country at time t (FOB, current US$)

PE_t = unit value of exports at time t

A positive $TOTX_t$ means a gain in export value by the country at time t, due to a favorable export price variation from time t-1 to t.

Adding together the import and export effects:

$$TOTT = [(VM_t(PM_t - PM_{t-1})] - [VE_t(PE_t - PE_{t-1})]$$

Thus, a positive $TOTT_t$ is an unfavorable shock. Note that $TOTT_t$ gives the net result for one year. To compute the terms of trade effect over a number of years, these terms may be summed.

2) Global Demand: export volume effect (EVE)

The global demand shock is estimated by looking at the quantity effect. The export volume effect indicates that the country's share of world export is changed as a consequence of growth/slowdown in the world demand. A positive EVE_t is an unfavorable shock on the current account.

$$EVE_t = E_{t-1}(TXVW_t - GRXW_t) \qquad t = (1970,..., 1991)$$

E_{t-1}, is the value of merchandise exports by the country at time t-1 (FOB, current US$)

EVE_t is the value of exports by the country at time t if it is assumed that there is no change in price from time t-1 to t.

and $TXVW_t$ is the expected rate of growth in the world export volume at time t, based on the previous ten years. The estimate is obtained through:

$$\log XVW_t = a + bt_i \qquad b = TXVW_t \qquad i = t-11,..., t-1$$

XVW_t = Volume of world merchandise exports at time t

$GRXVW_t = (XVW_t - XVW_{t-1}) / XVW_{t-1}$ is the growth rate in the world export volume from time t-1 to t.

3) Interest rate effect

$IRF_t = LTVIR_{t-1}(i_t - i_{t-1}) \qquad t = (1970, \ldots, 1991)$

IRF_t is the loss/gain in interest payments at time t caused by movements in the international interest rate.

$LTVIR_t$ is the volume of long-term debt at time t-1 sensitive to changes in international interest rate. It is computed by adding together the share of public and publicly guaranteed long-term debt at variable interest rate and the total private non-guaranteed debt. The later is assumed to be interest sensitive.

i = Six-month LIBOR on US dollar deposits.

A positive IRF_t as determined by an increase in the international interest rate, means a worsening in the country's obligation or an unfavorable shock.

4) Cumulative impact of additional borrowing due to shocks

Assume that additional net external financing at time t due to impact of all shocks at that time, net of other responses, is $ANEF_{t1}$. Then at time t+1 this gives rise to an additional burden of UM_{t+1} where:

$$CUM_{t+j} = ANEF_t(i_{t+1})$$

If one continues to assume that the interest is paid each period then at time t+j

$$CUM_{t+j} = ANEF_{t+j-1}(i_{t+j}) + ANEF_{t+j-2}(1+i_{t+j-1})i_{t+j} + \ldots$$

Thus the cumulative impact of additional net external financing can become quite large. On the other hand under favorable shocks ANEF may be negative thereby reducing or even making the overall burden favorable. This could then be interpreted as an increase in reserves.

Annexe B
Henin and Jobert strategy for the ADF test

We start from the five following equations:

(1) $\Delta X_t = a + bt + \rho X_{t-1} + \sum_k \gamma_k \Delta X_{t-k} + \varepsilon_t$

(2) $\Delta X_t = a + \rho X_{t-1} + \sum_k \gamma_k \Delta X_{t-k} + \varepsilon_t$

(3) $\Delta X_t = \rho X_{t-1} + \sum_k \gamma_k \Delta X_{t-k} + \varepsilon_t$

(4) $\Delta X_t = a + bt + \sum_k \gamma_k \Delta X_{t-k} + \varepsilon_t$

(5) $\Delta X_t = a + \sum_k \gamma_k \Delta X_{t-k} + \varepsilon_t$

We sort out the number of lags in the equation (1) with the help of the criterion BIC. Then we apply a downward sequentiel procedure which main stages are:

Stage I: We test $\rho = 0$ in the equation (1) by using the statistique τ_t. if τ_t is lower than the critical value, we go to stage II, if not we test the coefficient of the determinist trend with the standards t-Student. If $b = 0$ we go to the stage III, if not $X_t \sim I(0) + T + C$ or $X_t \sim I(0) + T$ depending on whether a is different from zero or not.

Stage II: We test $b = 0$ in the equation (4) according to the t-Student. If it is the case, we go to the stage III, if not, we concluded that $X_t \sim I(I) + T^2$.

Stage III: We consider the equation (2). We test the hypothesis of unit root from the statistic τ_μ. If $\rho = 0$, we go to the stage IV, if not we test the nullity of a according to the
t-Student. If $a = 0$ then $X_t \sim I(0)$, if not $X_t \sim I(0) + C$.

Stage IV: We test once again the nullity of a in the equation (5) according to the t of Student. if $a = 0$ then we go to stage V, if not $X_t \sim I(1) + T$.

Stage V: We test $\rho = 0$ in the equation (3) according to the statistic τ. If $\rho = 0$ then $X_t \sim I(1)$, if not $X_t \sim I(0)$.

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