

ESTIMATING A MONETARY POLICY REACTION FUNCTION FOR THE DOMINICAN REPUBLIC

José R. Sánchez-Fung

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Abstract

This paper specifies and estimates a hybrid monetary policy base reaction function for the Dominican Republic (DR). The estimated reactions suggest that the Central Bank has been biased towards targeting the gap between the parallel and official exchange rates, apparently doing so in a more systematic fashion after the mid 1980s. Remarkably, these findings are in line with the Central Bank's long-standing endorsement of a multiple exchange rate regime, and could imply a process of learning, given the monetary authorities' preferences.

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Correspondence Address: José R. Sánchez-Fung, Department of Economics, Keynes College, University of Kent at Canterbury, Canterbury, Kent, CT2 7NP, England, UK.
Telephone: (44) 1227 827655; fax: (44) 1227 827850; email: jrs6@ukc.ac.uk.

EXECUTIVE SUMMARY

How do monetary authorities react to developments in the economy? This pressing issue has been widely addressed in the recent theoretical and empirical monetary economics literature. The empirical studies have, however, mainly focused on advanced economies, and particularly on the behaviour of the United States' Federal Reserve, whereas little work has been undertaken for developing countries.

The aim of this investigation is to specify and investigate empirically a monetary authorities' reaction function for a small developing economy, namely the Dominican Republic (DR). Specifically, the inquiry identifies the manner in which the Central Bank of the Dominican Republic (CBDR) has responded to its hypothetical policy informing variables. That is, the monetary base (the monetary policy instrument) is specified as a function of (1) the differential between the official and the parallel market exchange rates, (2) the gap between actual and potential output, and (3) the deviations of inflation from its long run trend. The exercise is undertaken using annual data from 1969-2000.

The estimated reactions suggest that the CBDR has emphasised targeting the gap between the parallel and official exchange rates, which is consistent with the institution's long-standing endorsement of a multiple exchange rate regime. This behaviour appears to be more systematic after the mid 1980s. Notably, at that point in time substantial internal and external economic imbalances occurred, mainly as a by-product of the onset of the debt crisis of the 1980s, but also due to country specific, structural, problems. Of direct relevance to the study at hand is the dramatic depletion of net foreign exchange reserves that took place in the lead up to the collapse of the exchange rate regime in 1985 and several stabilisation agreements with the IMF.

Considering these economically and politically costly adjustments, the paper's main finding could imply learning on behalf of the authorities, in the sense that they are probably not willing to nurture a deterioration of the economy by neglecting key policy variables. The fact that the CBDR has responded more decisively to developments in the exchange rate market after the mid 1980s can also be interpreted in the light of the literature that considers the costs of discretion in contrast to rules in the design and implementation of monetary policy.

This last element is crucial in addressing the question of whether or not greater independence should be granted to the CBDR's authorities. A more independent central bank could, for instance, focus on targeting an inflation rate set by a suitable government body. This might be desirable from a social planner's point of view since it facilitates the process of informing the public on its behaviour, and could help to enhance its credibility. Moreover, theoretical and empirical models have found that greater central bank independence and credibility, alongside policies such as inflation targeting, can help to reduce the variability of inflation and output, two prominent variables in a monetary authority's social welfare function.

ESTIMATING A MONETARY POLICY REACTION FUNCTION FOR THE DOMINICAN REPUBLIC

1. Introduction

The objective of this investigation is to analyse a monetary policy reaction function for the case of a small developing economy, namely the Dominican Republic (DR). Although this type of analysis has mushroomed recently for advanced economies (e.g. Clarida et al, 1998; Taylor, 1999), relatively little work has been undertaken for developing countries. Despite the fact that the explicit guidelines that central banks in developing economies ascribe to when taking their policy decisions would appear to be intractable for obvious institutional reasons, empirical evidence could help determine the fashion in which they implicitly react to key economic developments. As Taylor (1993) notes, it could be useful to employ the concept of a feedback policy rule even in a framework in which it is difficult, if not impossible, to follow a certain rule mechanically.

The contribution of the paper is to determine if/to what extent the Dominican Republic's monetary authorities have reacted in a rule-like fashion¹. Organised thinking on phenomena such as, for example, that highlighted by Dornbusch and Giovannini (1990, pages 1290-1291) "Interestingly...in the case of the Dominican Republic, a one-to-one fixed exchange rate was made a provision of the constitution. And even that was not enough to stop fiscal and monetary policies ultimately inconsistent with the fixed exchange rate", could benefit from the outcome of the investigation.

¹ It is worth noting at the outset that the investigation does not provide an assessment of what would have been, or could be, the most suitable monetary policy framework for the DR. Mishkin and Savastano (2001), for example, explore such an issue for Latin America as a region, although the DR is not amongst the countries they consider in detail.

The paper focuses on the calculation of the approximate direction and magnitude of the monetary authorities' reactions. Particularly, have the parameters of a hypothetical central bank's reaction function been constant through time? How can the econometric outcome of estimating such a function be rationalised (a) economically and (b) institutionally? What are the policy implications?

The rest of the investigation tackles these questions as follows. Section 2 provides an overview of monetary policy in the Dominican Republic. In section 3 a monetary policy base reaction function for the Dominican Republic is motivated. The time series econometric analyses and corresponding economic interpretation of such a relationship are undertaken in section 4. Section 5 provides a brief conclusion.

2. Monetary Policy in the Dominican Republic

The Central Bank of the Dominican Republic (CBDR) was founded, and the Dominican Peso (DR\$) first introduced, in 1947. As stipulated in the CBDR's 'Organic Law', the Governor of the institution is appointed by the constitutionally elected President of the country, and can be removed at any moment². Additionally, the Secretary of Finance and the Secretary of Industry and Commerce are members *ex-officio* of the Monetary Board. Seven additional members complete the Board, and they are also appointed by the President.

A further interesting aspect to highlight is that monetary policy in the DR has been virtually the same for over three decades. Instruments such as foreign exchange market interventions

² See <http://www.bancentral.gov.do/> for further details on the structure of the CBDR.

(e.g. Sarno and Taylor, 2001) and domestic credit to the government have been amongst the key elements in the CBDR's policy toolkit during most of its history. However, from the beginning of the 1990s the CBDR has increasingly implemented 'less direct' instruments such as open market operations, chiefly by issuing short-term papers called *CBDR's Certificates of Participation*. The use of that type of instrument has not, however, significantly diminished the active implementation of the more traditional ones highlighted above. More likely they have complemented each other. Nonetheless, given the financial underdevelopment of the DR, the oligopolistic structure of its commercial banking system, and the (probably) limited credibility of the monetary authorities with the general public, the effectiveness of the *Certificates of Participation*, or of any other comparable instrument, is likely to be limited, at least under the prevalent institutional setting.

An additional point to note in relation to monetary policy making in the DR is how the exchange rate market has been organised. The DR has for a long time had a 'multiple' exchange rate regime. At present, the system is composed of the official, banking system, and extra-banking system (parallel) exchange rate markets. It should be pointed out that although the economy's foreign exchange market has historically been a multiple one, the parallel market is arguably the crucial one to look at. The monetary authorities could, and have in the past tried, under adverse circumstances (e.g., bubbles, speculative attacks, or other non-real elements), to influence the market exchange rate short-run trajectory with the intention of keeping a 'favourable' foreign exchange environment.

3. A Monetary Policy Reaction Function for the Dominican Republic

In attempting to estimate a monetary policy reaction function for the Dominican Republic, particular attention has to be given to its specification. The most likely (primary) demand management instrument to be used by the monetary authorities in a developing country is the monetary base, or high-powered money³. Such a variable can be expressed as $H = R + C$, where H is the monetary base, R are official foreign exchange reserves, and C is domestic credit. Monetary policy instruments frequently employed in developed countries, e.g. interest rates (Bernanke and Blinder, 1992), are less likely to be implemented, given the unique transmission mechanism of monetary policy in developing economies (Montiel, 1991). For instance, in the DR ceilings were imposed on market interest rates until the beginning of the 1990s⁴.

Turning to the targets of monetary policy, it could be argued that, since the DR has for a long time had a multiple exchange rate regime, some sort of exchange rate indicator should be one of the key (implicit) central bank's targets. Historically, the official exchange market has been utilised for various purposes, e.g. foreign exchange rationing, not only in the DR but in many developing countries as well. At present, the most important are (and have been for sometime) the service of the foreign debt and the purchase of oil. Henceforth, devaluation generates an automatic increase in (at least) both the prices of the debt service and all products derived from oil. Variations in such prices have wide ranging effects on the macroeconomy, and significantly undermine the popularity of the party in office.

³ McCallum's (e.g. 1988) popular nominal feedback rule also considers the monetary base as the policy instrument.

⁴ Young et al (1999) provide a concise description of financial repression in the DR, which was considerable until the wide-ranging economic reforms undertaken at the beginning of the 1990s.

The other variables (implicit targets) worth considering in a reaction function for the DR are relatively standard in the literature. Specifically, reactions of the central bank to an output gap (see Clarida et al, 1999) and to an inflation gap are allowed for. Therefore, a hypothetical monetary policy rule for the DR can be written as

$$h = \beta_0 + \beta_1(y - y^*) + \beta_2(e^m - e^o) + \beta_3(\pi - \pi^*) + \varepsilon, \quad (1)$$

where: h is the monetary base; $(y - y^*)$ is the output gap, where y is actual and y^* is potential real GDP; $(e^m - e^o)$ is the difference between the nominal market exchange rate e^m and the nominal official exchange rate e^o ; $(\pi - \pi^*)$ is the inflation gap, where π is actual and π^* is trend inflation; and ε is expected to be a well-behaved disturbance term. β_0 , β_1 , β_2 and β_3 are coefficients to be empirically estimated.

Equation (1) can be seen as a *hybrid* monetary policy reaction function (see McCallum, 2000), in which the monetary base reacts to the developments over time in the series $(y - y^*)$, $(e^m - e^o)$, $(\pi - \pi^*)$ or to all. Such an equation appears suitable to capture the objectives of the CBDR. Explicitly, the cardinal goals of such an institution are to promote and maintain monetary, exchange rate, and credit conditions that help sustain the purchasing power of the Dominican Peso (DR\$), internal price stability, and economic growth⁵.

It is worth emphasising that the *crucial target* in (1) is $(e^m - e^o)$, a differential the authorities would want to keep as small as possible. Given that the larger $(e^m - e^o)$, the higher the probability of a collapse of the official exchange rate regime, $\beta_2 < 0$ would be observed *if* the authorities are willing to defend the official rate from bubbles, speculative attacks, or other

⁵ As stipulated by the ‘Organic Law of the CBDR’, the ‘Monetary Law’, and the ‘Constitution’ of the DR.

non-real factors⁶. Such an outcome could be generated mainly by depletion of foreign reserves (e.g. Lizondo, 1987; Sarno and Taylor, 2001), but could also be paired with a reduction in domestic credit, in order to reduce liquidity. However, under adverse, real, circumstances, it is difficult (if not impossible) to keep an overvalued currency.

The output gap measure included in (1), $(y - y^*)$, is intended to serve as a measure of whether the economy is above (below) its potential, and therefore of inflationary (deflationary) pressures. So, $\beta_1 < 0$ could be expected, unless the authorities follow a *lean with the wind* policy, which might not be time-consistent. Finally, $(\pi - \pi^*)$ accounts for reactions of the monetary authorities to inflationary developments. Therefore, $\beta_3 < 0$ should be expected.

4. Empirical Analysis

4.1. Data

The econometric analysis of the hypothetical reaction function rationalised in section 3 will be undertaken using annual data for the period 1969-2000⁷. The monetary base h is given by

⁶ Therefore, $(e^m - e^o)$ could be seen as a criterion economic agents employ in determining how ‘credible’ the exchange rate system is at each point in time.

⁷ Such a time span is analysed given that the late 1960s onwards can be regarded as modern democratic times in the DR. From 1930 to 1961 a dictatorship prevailed, whereas from 1961 until 1965 institutional and political instability reigned, ending with a civil war in April 1965. It should also be noted that annual data is used in the investigation given that a higher frequency series for GDP is not readily available. Considering the well-known shortcomings of such data in developing countries, further manipulations (e.g. extrapolation to higher frequency) could compromise accuracy, with relatively small gains in terms of the *information* the series contain. Nevertheless, given the fashion in which monetary authorities behave in economies such as the DR (probably with considerable lags, amongst other factors because of the operating constraints they face), studying their behaviour through annual data should help characterise their reactions in a sensible way.

the log of the sum of the IMF's International Financial Statistics' *lines 31n* and *32*⁸, normalised by nominal GDP (*line 99b*). The DR\$/US\$ nominal official and market exchange (sell) rates used in the calculation of $(e^m - e^o)$ were obtained from the CBDR, and are in logs. The inflation gap $(\pi - \pi^*)$ and the output gap $(y - y^*)$ are expressed as deviations of inflation (annual change in the log of the DR's consumer price index *line 64*) and log real GDP (*line 99b* divided by *line 99bip*) from their potential values, π^* and y^* , respectively. The estimation of trend inflation and potential real GDP are achieved by passing π and y through the Hodrick-Prescott filter (HPF) (Hodrick and Prescott, 1997). A value of 6.5 is used for the HPF's smoothness parameter, as suggested by Ravn and Uhlig (forthcoming) for the analysis of annual data⁹.

Preliminary, visual, information on the behaviour of the data described above can be obtained from Figures 1 and 2. Figure 1 reflects the dramatic depletion of net foreign exchange reserves that took place in the lead up to the collapse of the exchange rate regime in 1985. During this interval the country had to sign three agreements with the IMF, in January 1983, September 1984, and January 1985, ending with the first devaluation of the official exchange rate in January 1985.

Also of interest is Figure 2's portrayal of the output and inflation gap measures, in the light of the concerns that surround the statistical application of the HPF (e.g. Harvey and Jagger, 1993). Figure 2 depicts that around the mid 1970s, real GDP was above its long run potential, declining below it at the beginning of the 1980s, probably as a result of the second oil price

⁸ Those lines comprise the assets (or sources) side of the central bank's balance sheet.

⁹ Other methods can be employed in the estimation of trend output. However, the above seems plausible as an output gap measure for a developing economy (see, for example, De Masi, 1997).

shock¹⁰. Afterwards the output gap increases again until real GDP falls below its trend level around 1985-1986, which happens to be a burdensome stabilisation period after the collapse of the fixed exchange rate regime in 1985. Subsequently, a widening in the output gap can be perceived until just before the start of the 1990s, when a downturn of actual relative to potential real GDP is apparent. Figure 2 also reveals that developments in the output gap tend to precede similar swings in the inflation gap, as could be expected.

Before proceeding to the formal econometric analyses, the univariate characteristics, notably the order of integration $[I(d)]$, of the sequences involved in the study have to be examined. In order to do so the Phillips and Perron (PP) (1988) unit root test is implemented. The results, which are exhibited in Table 1, point to the fact that the series under scrutiny do not contain a unit root in their levels, i.e. they are $I(0)$. Consequently, the OLS analyses of the levels of the variables to be undertaken below should provide reliable, *non-spurious*, estimates.

4.2. Estimates of the Monetary Policy Reaction Function

The version of (1) to be empirically estimated can be written as:

$$h_t = \beta_0 + \sum_{j=1}^m \theta_j h_{t-j} + \sum_{i=0}^n \left\{ \beta_{1i} (y - y^*)_{t-i} + \beta_{2i} (e^m - e^o)_{t-i} + \beta_{3i} (\pi - \pi^*)_{t-i} \right\} + \lambda DUMMY85_t + \varepsilon_t \quad (2)$$

Equation (2) is an autoregressive distributed lag, or dynamic linear regression, model of orders (m, n) $[ADL(m, n)]$ (See Hendry et al, 1984). The main economic intuition behind a relation like (2) is that the central bank probably acts gradually, i.e. it smoothes changes in its policy instrument (through the parameter θ), and might not have total control of the mechanism

¹⁰ The first oil price shock of the 1970s did not affect the DR considerably, mainly due to favourable export commodity prices.

under consideration¹¹. The reader should also pay attention to the fact that (2) comprises reactions by the monetary authorities to past, current, and (implicitly) *future* economic developments. The latter applies given that e^m can be considered a *forward-looking* asset (see Svensson, 2000). Statistically, equation (2) could help to account for the usual complications introduced by preliminary, as well as wrongly measured data. Consequently, allowing for lagged, as well as contemporaneous, reactions by the monetary authorities appears to be sensible¹².

The OLS estimates of equation (2) adopt an initial lag length of 2, i.e. an $ADL(2,2)$ ¹³. Such a specification would seem appropriate as a starting point in the present analysis, notably given the frequency of the data at hand. Also, note that equation (2) incorporates an impulse dummy variable, *DUMMY85*, with a value of 1 in 1985 and 0 otherwise. The timing and nature of the dummy is given by the year in which the first devaluation of the official DR\$/US\$ exchange rate took place, which is arguably the most consequential event in the time span under scrutiny (see Figure 1)¹⁴.

¹¹ Note the pervasive role of uncertainty in such type of functions, a topic that is still not well understood by economists. See, for example, Goodhart (1999) for insights on the subject.

¹² Equation (2) also encompasses a popular specification in the monetary policy reaction function literature in which the central bank does not reacts contemporaneously to economic developments. Hendry et al (1984) label this variant of the *ADL* a *dead-start* model.

¹³ It could be the case that the explanatory variables been modelled are endogenous, and therefore OLS is not appropriate. However, Wickens and Breusch (1988) have shown that the instrumental variables (IV) estimation of a ‘transformed’ *ADL* model (e.g. Bewley, 1979) like (2) provides the same estimates and standard errors as the OLS estimation. See also Banerjee et al (1990).

¹⁴ The official exchange rate had been DR\$1.00 = US\$1.00 since the foundation of the CBDR in 1947. Further details on the consequential stabilisation programmes and structural adjustment policies undertaken in the period leading to 1985 can be found in Coutts et al (1986).

Table 2 column (1) exhibits the long-run solutions to the estimation of equation (2) for the period 1972-2000. Notably, the long run coefficients affecting $(e^m - e^o)$, $(y - y^*)$ and $(\pi - \pi^*)$ are not statistically well determined, whereas λ is significant at the 5% level. However, note that the null hypothesis that all the long-run coefficients are zero is rejected at the 5% level by the $WALD - \chi^2$ test. Additionally, the joint relevance of all lags up to 2 is not rejected (see reported statistic $LAGS - F$) at the 1% level. A battery of diagnostic statistics is also complied with.

Given the large amount of coefficients which are not significant in column (1) the model was subjected to a reduction process (see Hendry, 1995). The final, preferred, specification is

$$h_t = \beta_0 + \theta h_{t-1} + \beta_2 (e^m - e^o)_t + \beta_{22} (e^m - e^o)_{t-2} + \lambda DUMMY85_t + \varepsilon_t \quad (3)$$

The corresponding long-run coefficients are displayed in column (2) of Table 2¹⁵. The outcomes show that the coefficient affecting the variable $(e^m - e^o)_t$ is negative, significant at the 1% level, and displays a reasonable magnitude (-0.66), with an absolute t -ratio of 4.61. The coefficient λ is also negative and statistically significant, with an absolute t -ratio of 20. Moreover, the coefficient θ , which has a value of 0.62 that is significant at the 1% level, hints to the practice of instrument smoothing by the monetary authorities.

A striking element arising from the estimation of equation (3) is the coefficient affecting the variable $(e^m - e^o)_{t-2}$, 1.47, which is positive and significant at the 1% level. However, given the economically and statistically reasonable contemporaneous effect captured by the

¹⁵ Note that the model reduction process implies the exclusion of the output and inflation gaps from the reaction function. However, given the important role played by the exchange rate as a channel of monetary policy transmission in an economy like the DR, this seems a sensible modelling choice.

coefficient of $(e^m - e^o)_t$, the statistically significant (although not much so economically) effect of $(e^m - e^o)_{t-2}$ on the relationship at hand probably emerges due to pervasive dynamics underlying the data under study. Therefore, the positive coefficient on β_2^* reported in column (2) should be interpreted cautiously.

The diagnostic statistics of the equation are also satisfactory. The null hypothesis that all the long-run coefficients are zero is rejected by the $WALD - \chi^2$ test, and the relevance of all the lags included is confirmed by the $LAGS - F$ statistic. Also note that the $SCHWARZ$ information criterion supports column (2) over column (1).

In order to further explore the behaviour of the coefficients under scrutiny, the investigation proceeds by estimating equation (3) recursively. Chiefly, such a method implies the calculation of the coefficients of interest over a period ranging from 1 to $M - 1$, and subsequently analysing them for the span comprised between M and T , where T denotes the total number of observations considered. The results are displayed in Figure 3, which plots the coefficients of the variables h_{t-1} , $(e^m - e^o)_t$, and $(e^m - e^o)_{t-2}$ together with their two standard error bands. After eyeballing this set of graphs the reader should be able to perceive the existence of at least two distinct monetary policy regimes within the sample under analysis, a fact that is also supported by the corresponding 1-step ahead, $N \downarrow$, and $N \uparrow$ recursive Chow tests exhibited in Figure 4¹⁶. Remarkably, the first and second panels in Figure 3 signal what could be hypothetically interpreted as a firmer monetary policy stance roughly after 1985.

¹⁶ N indicates the number of observations. See Doornik and Hendry (2001) for details on these tests.

4.3. Discussion

What crucial facts underlie the above findings? After the first devaluation of the Dominican Peso in 1985 a multiple exchange rate market has prevailed. Crucially, post-1985 the official foreign exchange rate can be broadly characterised as a crawling peg. However, Obstfeld and Rogoff (1995, page 74) rightly state, “...crawling pegs share many of the basic problems of garden-variety fixed rates”. In spite of this, the performance of the DR’s economy during 1985-2000 has, on average, been satisfactory, backed by a reasonable degree of macroeconomic stability.

This period, and particularly the lapse 1985-1990, is not, however, free of economic turmoil. The highest inflation rate in the history of the DR was registered in 1990 (see Figure 2), and a stand-by agreement with the IMF was approved in August 1991. A major private banking sector crisis at the end of the 1980s, the high oil prices of 1990 (mainly a result of the Gulf War), and recurrent government deficits are amongst the main causes of such events.

The behaviour of the CBDR after the mid-1980s (notably that portrayed by Figure 3’s first two panels) could, henceforth, be interpreted as evidence that throughout that lapse its authorities have behaved in a more systematic fashion. Such a stance could imply that the monetary authorities learn about how the economy evolves, and about the way in which their actions are transmitted, as in Bertocchi and Spagat (1993), notably given the collapse of the exchange rate regime in the mid-1980s elucidated above. If the authorities are assumed to behave rationally, it is unlikely that they would be willing to nurture episodes that in the past proved to be costly economically, politically, and in terms of their reputation. The relevance of the rules versus discretion literature (Kydland and Prescott, 1977) for the case under analysis is palpable.

5. Conclusion

The aim of this paper has been to specify and estimate a hybrid monetary authorities' base reaction function for the Dominican Republic during the time span 1972-2000. The estimated reactions suggest that the Central Bank has been biased towards targeting the gap between the parallel and official exchange rates, apparently doing so in a more systematic fashion after the mid 1980s. Considering the economically and politically costly adjustments that were undertaken at that point in time, the findings could imply learning on behalf of the authorities, which is reflected in an apparent inclination to follow rule-like decision making procedures, given their choice of exchange rate policy.

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TABLE 1**Phillips-Perron (PP) unit root test**

Variables	PP test (1970-2000)
h	-4.71
$(y - y^*)$	-4.45
$(e^m - e^o)$	-3.69
$(\pi - \pi^*)$	-10.14

Notes:

1. Only a constant was added to the PP tests.
2. The 1% MacKinnon (1991) critical value for all variables (except inflation) is -3.6574 . For the variable inflation the sample period is 1972-2000, and the corresponding PP 1% critical value is -3.6751 .

TABLE 2
Long-run solutions to OLS Estimation of Equation (2)

Sample period 1972-2000	Dependent variable: h	
	Column (1)	Column (2)
β_0^*	-1.470 (0.171)	-1.525 (0.106)
β_1^*	3.000 (8.522)	-
β_2^*	2.131 (1.446)	2.125 (0.870)
β_3^*	-2.383 (2.655)	-
<i>DUMMY85</i>	-9.562 (3.468)	-7.659 (2.026)
Diagnostic statistics		
R^2	0.97	0.94
<i>RSS</i>	0.1860	0.3386
<i>AR – F</i>	1.95 (2, 14)	2.53 (2, 22)
<i>ARCH – F</i>	0.44 (1, 14)	0.39 (1, 22)
<i>NORM – χ^2</i>	4.78 (2)	4.32 (2)
<i>RESET – F</i>	0.43 (1, 15)	0.56 (1, 23)
<i>WALD – χ^2</i>	10.33 (4)*	18.86 (2)**
<i>LAGS – F</i>	8.75 (8, 16)**	23.80 (2, 24)**
<i>SCHWARZ</i>	-3.54	-3.87

Notes:

1. Coefficients' standard errors are in parentheses.
2. The diagnostic statistics are as follows: coefficient of determination (R^2); residuals sum of squares (*RSS*); residual serial correlation (*AR – F*); autoregressive conditional heteroscedasticity (*ARCH – F*); normality (*NORM – χ^2*); Ramsey's functional form misspecification test (*RESET – F*); a test of the null that all long-run coefficients are zero (*WALD – χ^2*); a test of the significance of all lags up to n (*LAGS – F*); and the *SCHWARZ* model selection information criterion. The null distribution is given by $\chi^2(\cdot)$ or $F(\cdot, \cdot)$, where the degrees of freedom are in parentheses. For *AR*, *ARCH*, and *RESET* the first degree of freedom indicates the maximum lag length. The values of the tests are displayed.
3. ** and * indicate that a diagnostic statistic is significant at the 1% and 5% levels, respectively. See Doornik and Hendry (2001) for further details on these tests.

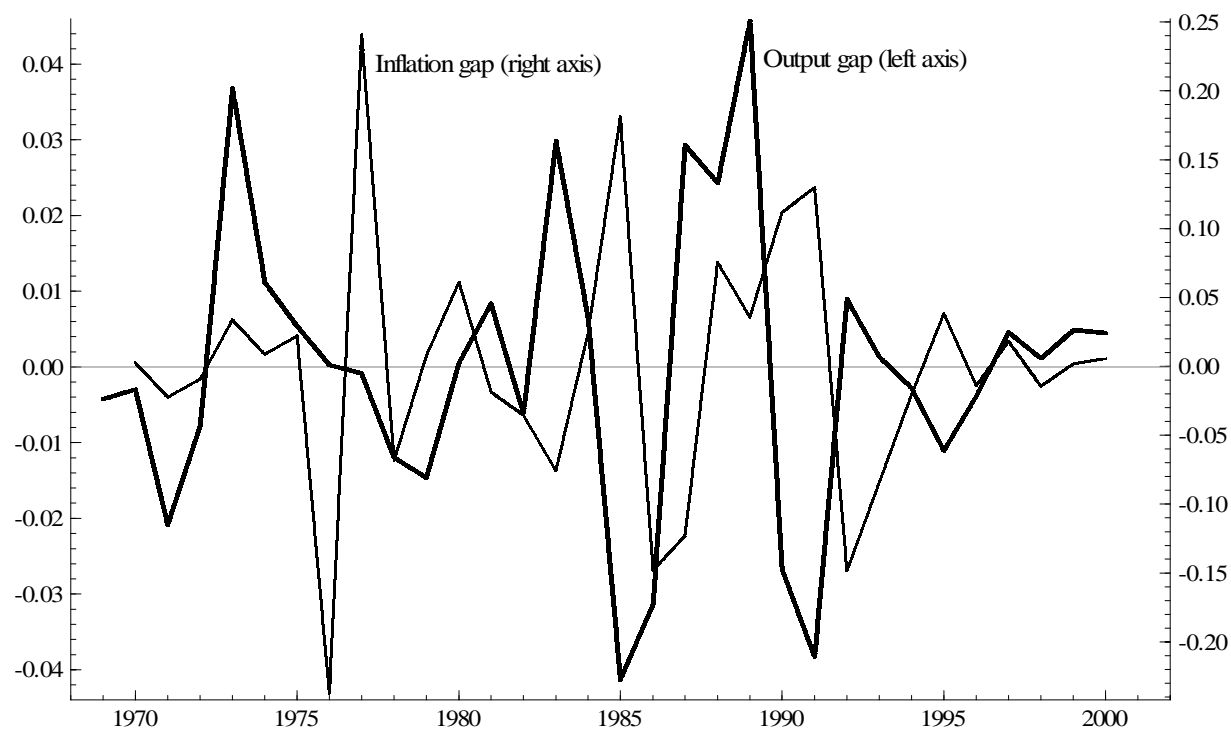
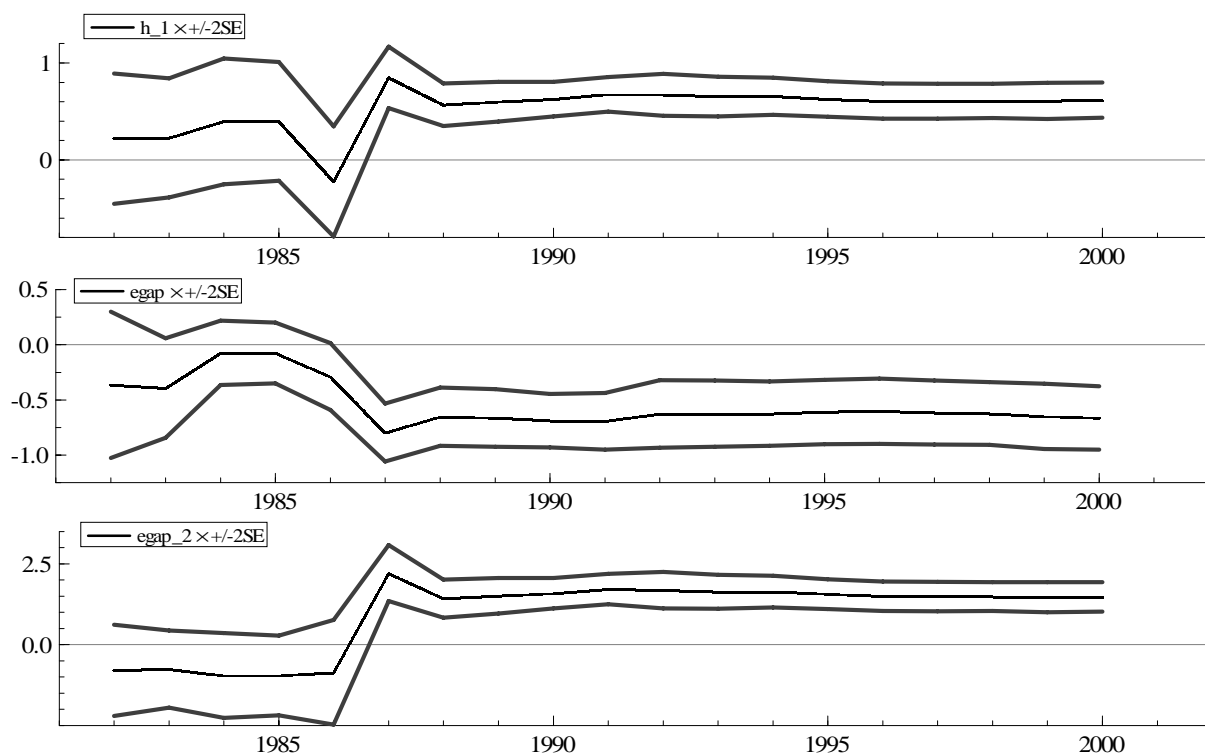
Figure 1 Log Monetary Base and Percent Exchange Rate Differential, 1969-2000**Figure 2 Output Gap and Inflation Gap (percent), 1970-2000**

Figure 3 Recursive Coefficients, Equation (3)**Figure 4 Recursive Chow tests, Equation (3)**