

# **The monetary policy transmission mechanism in Venezuela**

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## **Introduction**

The mechanism through which the actions of the central bank are transmitted to economic activity and prices continues to be a topic of discussion. The reason for this interest is twofold: first, there is the question of identifying the transmission channels of the monetary impulses; a second area of discussion centres on the problem of specifying the temporal structure of the relationships between a given set of variables affected by monetary policy decisions.

The aim of this paper is to contribute to the discussion from the perspective of Venezuela. It attempts both to identify the transmission channels of monetary policy and to provide empirical evidence of the extent to which monetary policy has an impact on economic activity and prices. Given the current inflationary environment in Venezuela, the study will be mainly concerned with the transmission of monetary policy to prices.

The paper is divided into three sections. The first section considers the main theories about the transmission channels of monetary policy. Policy implementation and the underlying transmission mechanisms in Venezuela are given special attention. In the second section, an empirical analysis is conducted using quarterly data for the period 1985–95. The analysis is based on a combination of VARs and error correction models in order to determine the impact of monetary policy variables on inflation. Finally, the implications of the estimated results for the conduct of monetary and exchange rate policies are analysed and some recommendations are made as regards monetary policy implementation.

## **1. The transmission mechanisms: theoretical aspects and recent experience in Venezuela**

### *(i) Theoretical frameworks*

Usually, the impact of changes in the money supply on prices and economic activity is not direct. Several ways exist by which such changes can be transmitted and will be finally reflected in prices and economic activity. The various relationships that over time bring about changes in the ultimate targets of economic policy in response to monetary policy shifts are known as the transmission channels of monetary policy.

Understanding the various transmission processes is important to appropriately select the policy instruments at the disposal of the monetary authorities and, at the same time, to assess the impact of the policy measures on the economy as a whole.

The discussion of the transmission mechanism has focused on three main approaches:

#### *(a) Transmission mechanism in closed economies*

This mechanism is implicit in the traditional IS-LM model and is known as the liquidity effect. According to this approach, changes in the monetary variables are transmitted indirectly to the target variables through variations in aggregate demand. Aggregate demand is influenced by interest rates which can be controlled by the monetary authorities.<sup>1</sup> The impact of changes in the monetary aggregates on the target variables depends on the shape of the aggregate supply curve.

#### *(b) Transmission mechanism in open economies*

For open economies the analysis can be confined to the case of a flexible exchange rate system, given that under fixed exchange rates the money supply is endogenous and cannot be used as a policy variable.

In a flexible exchange rate context, changes in the money supply influence the interest rate (except in the case of perfect capital mobility), which in turn affects consumption and investment as well as the exchange rate. The channel of transmission to aggregate demand is similar to the IS-LM model for closed economies. The effect on the exchange rate

<sup>1</sup> A complete description of this mechanism can be found in Mishkin (1996) and IMF (1996).

depends on the distribution of aggregate demand between tradable and non-tradable goods.

*(c) Transmission mechanism through bank credit*

Recently, a large body of literature has focused on identifying an additional channel of monetary transmission, originating in the allocation of bank credit.<sup>2</sup> The most important assumptions underlying this transmission mechanism are:

- there are three assets in the economy: money, bank loans and bonds;
- there exist economic agents for whom there is no substitute for bank credit for financing purposes;
- credit and bonds are not perfect substitutes for commercial banks.

Under these assumptions, monetary policy is not only transmitted through the liquidity effect but also through the supply of bank credit. This channel is not taken into consideration in the IS-LM model, given its assumption that bonds and bank loans are perfect substitutes (grouped together in a single category called “bonds”) for all agents.

Although this model has been developed in the context of a closed economy, its extension to an open economy should not present too many difficulties. In any event, the final qualitative effect would again be that prices and economic activity are affected by aggregate demand; and the distinction between the short and long-term effects will depend on the assumptions made with respect to aggregate supply.

*(ii) Specific channels of monetary policy transmission*

*(a) Interest rate effects:* changes in interest rates affect the marginal cost and marginal yield of capital as well as the average interest rate on outstanding debt. These effects are crucial to economic agents’ decisions concerning lending and borrowing. One of the key elements to take into account is the fact that monetary policy actions might not affect interest rates across the entire term structure in the same way.

*(b) Wealth effects:* changes in the availability of credit and in interest rates can lead to changes in asset prices, affecting agents’ wealth perceptions and spending patterns, as well as the ability to borrow and the

<sup>2</sup> For exhaustive discussions of the credit channel see Bernanke and Blinder (1988), Bernanke and Gertler (1995), Brunner and Meltzer (1988), Cecchetti (1995), Hubbard (1995) and Tsatsaronis (1995).

desirability of lending. Such effects can be considerable when assets are used as collateral for loans.

(c) *Exchange rate effects*: when the exchange rate is sensitive to variations in interest rates, it has an impact on prices and economic activity by changing the cost of raw materials, the competitiveness of the tradable goods sector and resource allocation.

*(iii) The transmission of monetary policy in Venezuela*

To assess the impact of the monetary variables on the target variables of economic policy, monetary programming models have been adopted by the Central Bank of Venezuela as an instrument to improve the efficiency of monetary policy. Its use has entailed the selection of an intermediate variable, preferably a monetary aggregate, which guides policy in the process of influencing a final target variable, such as the rate of inflation, the level of economic activity or the external balance.

The choice of a monetary aggregate rather than an interest rate was based on the intuitive insight that, in a small economy with severe distortions, the imbalances between the supply of and demand for money are transmitted directly to aggregate demand, and indirectly to prices (Da Costa (1990)). In addition, the Venezuelan economic authorities put direct controls on interest rates in an attempt to control the domestic component of the monetary base through the availability of credit to the financial system.

From November 1960 to 18th February 1993, Venezuela used the exchange rate as a nominal anchor, thus limiting its ability to control the money supply. This exchange rate arrangement collapsed at the beginning of 1983 as a result of macroeconomic mismanagement, in particular chronic fiscal deficits and unsustainable exchange rate overvaluation. Table 1 shows that high domestic inflation in the context of a fixed exchange rate regime undermined the competitiveness of the Venezuelan economy, creating expectations of a future devaluation. The debt crisis, triggered when the international financial community stopped financing indebted countries in the wake of the Mexican crisis in 1992, also contributed to a worsening of the economic situation.

Between February 1983 and February 1989, a system of exchange controls based on multiple exchange rates was in place. This complicated monetary management even more since it operated like a fixed exchange rate system albeit with several exchange rates.

Table 1  
Economic indicators

|                | Current<br>account<br>(millions of US\$) | Unemploy-<br>ment rate<br>(in percent) | GDP<br>(Growth rate, in percent) | Inflation | M1    |
|----------------|--|--|----------------------------------|-----------|-------|
| 1979 . . . . . | 350                                      | 5.6                                    | 3.4                              | 12.3      | 6.7   |
| 1980 . . . . . | 4,728                                    | 5.7                                    | -1.7                             | 21.6      | 13.7  |
| 1981 . . . . . | 4,000                                    | 6.1                                    | 0.4                              | 16.2      | 7.1   |
| 1982 . . . . . | -4,246                                   | 7.1                                    | 0.8                              | 9.6       | -8.4  |
| 1983 . . . . . | 4,427                                    | 10.3                                   | -4.3                             | 6.3       | 31.2  |
| 1984 . . . . . | 4,651                                    | 13.4                                   | 0.1                              | 12.2      | 7.5   |
| 1985 . . . . . | 3,327                                    | 12.1                                   | 0.2                              | 11.4      | 12.4  |
| 1986 . . . . . | -2,245                                   | 10.3                                   | 6.5                              | 11.6      | 22.1  |
| 1987 . . . . . | -1,390                                   | 8.5                                    | 3.6                              | 28.1      | 34.4  |
| 1988 . . . . . | -5,809                                   | 6.9                                    | 5.8                              | 29.5      | 22.8  |
| 1989 . . . . . | 2,161                                    | 9.6                                    | -8.9                             | 84.5      | 9.5   |
| 1990 . . . . . | 8,279                                    | 9.9                                    | 6.2                              | 36.5      | 41.2  |
| 1991 . . . . . | 1,736                                    | 8.7                                    | 9.7                              | 31.0      | 51.3  |
| 1992 . . . . . | -3,365                                   | 7.1                                    | 6.1                              | 31.9      | 8.3   |
| 1993 . . . . . | -1,804                                   | 6.3                                    | 0.3                              | 45.9      | 10.6  |
| 1994 . . . . . | 2,541                                    | 7.5                                    | -2.9                             | 70.8      | 130.0 |
| 1995 . . . . . | 2,255                                    | 10.2                                   | 3.4                              | 56.6      | 34.2  |

In 1984 a macroeconomic adjustment programme was implemented to deal with the distortions created by the exchange controls (a huge gap, of 130%, existed between the official and the free market exchange rate) and the high inflation rate. Included in this adjustment programme was the *Programa Económico Cuantificado* that was designed to serve as a reference for the implementation of the economic policy and the monetary programming exercise.

Although some studies suggested that a stable and close relationship could be observed between nominal income and money (M1), a broader concept of money (M2) was used as the intermediate target of monetary policy, while inflation was chosen as the ultimate target variable (León and Montiel (1990)). Hence, the Bank tried to control M2 in spite of its lack of policy instruments. This was the first stage of the monetary programming exercise in Venezuela.

León and Olivo (1988) reported econometric evidence in favour of a relationship between changes in the money supply (M1) and inflation.

However, the relationship was unstable and, furthermore, the model suggested a lag of an average 17 months for the money supply impulses to be fully transmitted to prices. For these reasons, they ruled out the use of M1 as an intermediate target in the short-term price stabilisation strategy.

The monetary programming approach based on M2 as the intermediate variable was applied only up to 1988, owing to the implementation in early 1989 of a new macroeconomic adjustment programme, this time supported by the IMF. As a result, the monetary programme was redefined to take account of the IMF approach. The aim of this new macroeconomic adjustment programme was to curb the current account deficit and halt the acceleration of inflation (see Table 1). Both the current account deficit and the higher rate of inflation were unwelcome results of the exchange controls and the fiscal imbalances. In December 1988, international reserves sank to their lowest level in the last 20 years.

In the context of the new economic programme, the role of monetary policy was defined as that of maintaining sound monetary and financial conditions in order to achieve both price and exchange rate stability (Banco Central de Venezuela (1991)).

In an environment of greater economic freedom and interest rate liberalisation which made it possible to improve the effectiveness of monetary policy, the Bank adopted a more flexible set of policy instruments. Thus, in November 1989 the Bank initiated open market operations using its own bonds (zero coupon bonds) and made these operations its main policy instrument.

In this second stage of the monetary programme under an extended facility agreement with the IMF, the transmission mechanism of monetary policy was redefined by the Bank. The monetary base became the intermediate variable and net domestic credit was adopted as the operational variable of the monetary programme. The inflation rate became the ultimate target variable (Banco Central de Venezuela (1991)).

Although it was clear from the start that the inflation rate was the main target of the adjustment programme, the deep recession of 1989 compelled the fiscal authorities to pursue economic growth as another target. Fiscal discipline therefore loosened. As a result, from 1990 there was an obvious contradiction between the promotion of economic growth and price stability. This conflict brought about a significant rise in interest rates, undermining solvency in the banking system.

During this stage, the monetary programming model was based on an estimate of M2 in real terms. Its nominal value was arrived at by using a price index consistent with the inflation target. The monetary multiplier was then computed and the demand for high-powered money estimated. The rest of the programme was designed to determine the appropriate level of central bank credit to the private sector in order to avoid substantial divergences between the supply of and the demand for high-powered money. The basic instrument used to manage credit to the private sector was the Bank's own bonds. With some changes, this model was applied rigorously between 1989 and the end of 1993, the year in which the transition was made to a new economic policy, which was introduced at the beginning of 1994, when a new Government was voted into power.

It should be noted that after two years of vigorous economic growth (1991 and 1992), two attempted coups d'état exacerbated the uncertainty about the implementation of the economic programme and put pressure on the foreign exchange reserves. This situation led the monetary authorities to introduce a crawling peg in October 1992 as a way of preserving the viability of the balance of payments; the inflation target was therefore abandoned.

In spite of the technical and conceptual improvements achieved during this stage of the implementation of the programme, there is not enough empirical evidence to support the change in the intermediate variable from M2 to the monetary base. It could perhaps be argued that, within the financial programming model of the IMF, domestic credit is the key variable for achieving both external balance and price stability.

Finally, as a result of the balance-of-payments crisis at the beginning of 1994 and the collapse of the crawling-peg system, following the banking crisis, caused by both the high level of interest rates and the lack of banking supervision, a system of exchange controls was introduced by the Government in the first half of 1994. This placed further constraints on the conduct of monetary policy. The Bank's response to the new situation was to redefine its intermediate and operational variables. The premise of its analysis was that exchange controls could be likened somewhat to a fixed exchange rate regime: the inflation objective could be pursued by treating net domestic assets as the operational variable so as to bring about a development of the international reserves that would support the current nominal exchange rate, the latter serving as the nominal

anchor (or intermediate target) for prices (Banco Central de Venezuela (1995)).

Again, the instrument used by the Bank to influence net domestic credit to the private sector and in turn the external assets, was the issuance of its own securities, now called "Monetary Stabilisation Bonds" (TEMs).

## 2. Empirical analysis

The aim of this section is to identify empirically the main channels through which monetary policy influences prices and economic activity. To this end, the period 1985–95 is analysed on the basis of quarterly data using a combination of VARs and error correction models. Given the lack of information about the underlying structural model for the transmission mechanism in that period, the study starts from a VAR to obtain a first approximation of the way in which the variables are interrelated and to determine which of them are indeed relevant for the analysis. Once some evidence has been obtained about the relationships between the variables, an error correction model is formulated for inflation, aimed at capturing both the direct and indirect effects of monetary policy on prices.

On the basis of the estimated results, the implications for the conduct of monetary and exchange rate policies are analysed and a number of recommendations are made for managing monetary policy.

### (i) Model variables

Given the estimation techniques employed, each of the variables used in the models was, as a first step, analysed in order to determine whether the series have unit roots. The variables and their corresponding definitions are as follows:

|               |   |
|---------------|---|
| <i>IPCP:</i>  | Consumer price index of the metropolitan area of Caracas. |
| <i>PIB:</i>   | Gross domestic product in constant prices.                |
| <i>CRTBC:</i> | Bank credit to the private sector.                        |
| <i>TIA:</i>   | Interest rate on loans.                                   |
| <i>M1:</i>    | Currency plus chequing deposits.                          |



- GAP: Output gap defined as the residuals of the regression of economic activity on both a linear and a quadratic trend. This variable is viewed as a proxy for excess demand in the economy.
- XPTBC: Value of oil exports in real terms, which represents a wealth effect in consumption and investment decisions.
- SAL: Nominal private sector wages.

Unlike in other Latin American economies, it has been difficult to find a well-behaved inflation equation in which the exchange rate plays a significant role by itself in Venezuela. This may be explained by two factors. First, the exchange rate has been fixed for most of the sample period, with a number of discrete devaluations depending on the balance-of-payments position. Domestic disequilibria therefore showed up in other variables; as soon as they became unsustainable, a devaluation took place. Secondly, as a consequence of the State monopoly of oil revenues, exchange rate depreciation improves the fiscal balance in domestic currency, inducing monetary expansion. Hence, this implicit financial mechanism reduces the explanatory power of the exchange rate in the inflation equation, transferring its influence to the domestic fiscal deficit and the monetary aggregates.

The results of the Dickey-Fuller test shown in Table 2 point to the presence of a stochastic trend in the logarithms of the time series, except for GAP, which is stationary.<sup>3</sup> Once the relevant series are differentiated, the test indicates that the variables become stationary.

Once the integration order of the variables is determined, a set of models seeking to explain the target variables of the monetary policy can be formulated in order to establish how central bank action can influence those variables.

### *(ii) The general model*

In order to study how monetary policy is transmitted to inflation and economic activity, an unrestricted VAR model including a set of variables that are supposed to interact with the final variables (inflation (*DLIPCP*))

<sup>3</sup> The following notation is used for the variables: *L* before a variable indicates logarithm; *D* means first difference. Consequently, *DL* denotes the first difference of the logarithm of the variable, that is, an approximation of the measurement of the growth rate of the variable.

Table 2  
**Results of the Dickey-Fuller test**

|                          | Observed<br>value | Critical<br>value<br>(95%) | DF test   | Observed<br>value | Critical<br>value<br>(95%) | DF test   | Integra-<br>tion<br>order |
|--------------------------|-------------------|----------------------------|-----------|-------------------|----------------------------|-----------|---------------------------|
| <i>LIPCP</i> . . . . .   | -1.7              | -3.5                       | ADF(1), t | -3.84             | -3.5                       | DF, t     | I(1)                      |
| <i>LPIB</i> . . . . .    | -3.1              | -3.5                       | ADF(5), t | -2.81             | -2.9                       | ADF(4)    | I(1)                      |
| <i>LCRTBC</i> . . . . .  | -2.5              | -3.5                       | ADF(1), t | -9.93             | -2.9                       | DF        | I(1)                      |
| <i>TIA</i> . . . . .     | -3.2              | -3.5                       | ADF(2), t | -6.31             | -2.9                       | DF        | I(1)                      |
| <i>LM1</i> . . . . .     | -0.5              | -3.5                       | ADF(6), t | -3.35             | -2.9                       | ADF(4)    | I(1)                      |
| <i>GAP</i> . . . . .     | -3.4              | -2.9                       | ADF(4)    |                   |                            |           | I(0)                      |
| <i>LXPTBC*</i> . . . . . | -4.5              | -3.5                       | DF, t     | -6.43             | -2.9                       | ADF(2), t | I(1)                      |
| <i>LSAL</i> . . . . .    | -2.6              | -3.5                       | ADF(2), t | -7.44             | -3.5                       | ADF(1), t | I(1)                      |

\* Although the Dickey-Fuller test suggests that this variable is I(0), the analysis of the autocorrelation function and the visual inspection of the series suggest the need to take first differences to achieve stationarity.

and GDP) is estimated. Thus the model incorporates alternative monetary aggregates (M1, M2 or high-powered money), the interest rate on loans (*DTIA*) and a variable measuring the volume of credit to the private sector (*DLCRTBC*). It is worth emphasizing that the money aggregate that showed the best result was M1. The explanatory power of both M2 or the monetary base was poor.

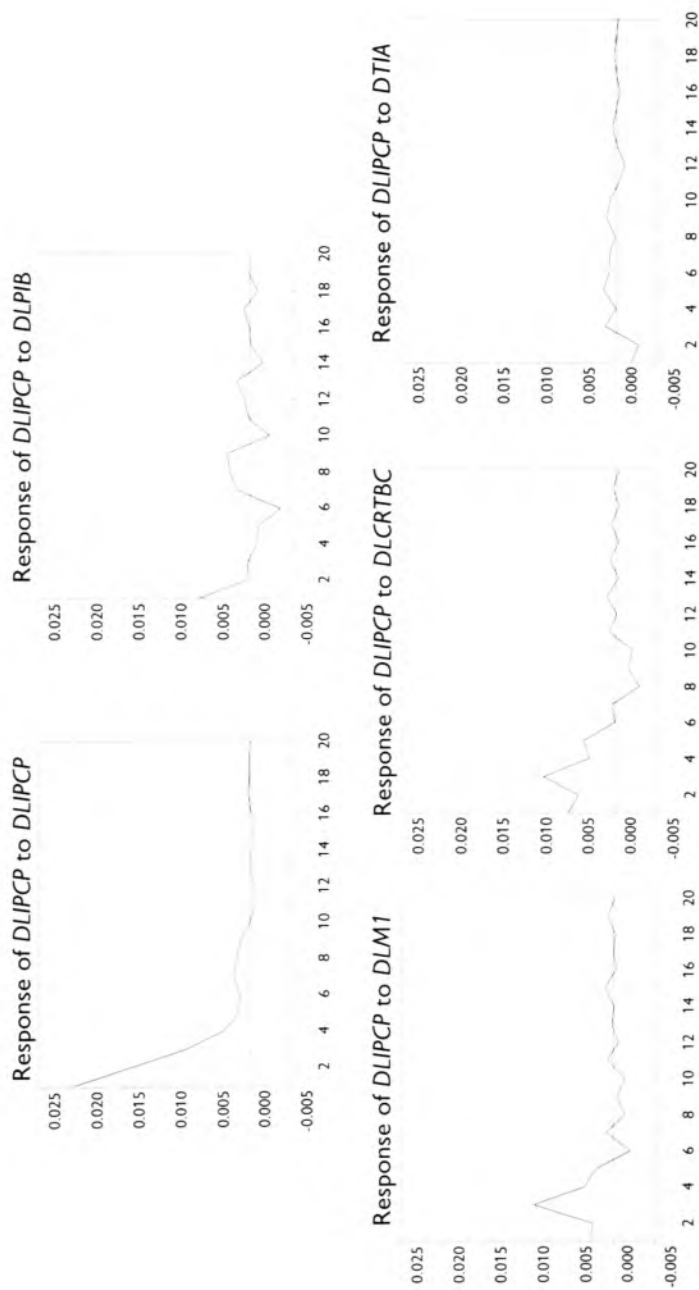
The formulation of an unrestricted VAR reflects the lack of information about the underlying structural model linking the variables mentioned above.<sup>4</sup> This type of model therefore provides an intuitive view of the way in which the relevant variables are interrelated in a given economic process.

The empirical analysis, based on the estimate of a VAR with three lags,<sup>5</sup> reveals that the effects of changes in the monetary and credit variables are not very relevant in explaining the behaviour of either inflation or GDP, according to the impulse response functions and the variance decomposition of the forecast error. In fact, Graph 1 shows that the main impact on inflation derives from its own lags and that the effect lasts for approximately four quarters. Similarly, the variance decomposition for a

<sup>4</sup> This methodology has been used in other studies analysing the transmission mechanism (see Buttiglione and Ferri (1994), Fernández and Mendoza (1994) and Vargas (1995)).

<sup>5</sup> The lag structure was determined according to the Akaike and Schwartz criteria.

Graph 1  
Inflation: impulse response functions\*



\* Response to a one-standard deviation innovation.

Table 3  
**Variance decomposition of the inflation error forecast**  
 In percentages

| Quarters     | <i>DLIPCP</i> | <i>DLPIB</i> | <i>DLCRTBC</i> | <i>DTIA</i> | <i>DLM1</i> |
|--------------|---------------|--------------|----------------|-------------|-------------|
| 1 . . . . .  | 85.59         | 6.67         | 5.82           | 0.65        | 1.26        |
| 2 . . . . .  | 85.88         | 4.56         | 6.46           | 1.45        | 1.65        |
| 3 . . . . .  | 72.48         | 3.54         | 12.40          | 1.29        | 10.29       |
| 4 . . . . .  | 71.22         | 3.50         | 12.91          | 1.25        | 11.11       |
| 8 . . . . .  | 67.52         | 5.38         | 14.18          | 1.49        | 11.42       |
| 12 . . . . . | 65.92         | 6.45         | 14.50          | 1.72        | 11.41       |
| 20 . . . . . | 65.26         | 6.99         | 14.57          | 1.75        | 11.43       |

Order: *DTIA*, *DLCRTBC*, *DLM1*, *DLPIB*, *DLIPCP*.

forecast horizon of 20 quarters shows that 65% of the forecast error is explained by the inflation lags (Table 3). These findings are consistent with the results of other studies of inflation in Venezuela (Guerra and Sánchez (1996) and Montiel (1994)). It should be stressed that, even though shocks on M1 and bank credit seem to go in the right direction, only the latter has a certain significance for inflation according to the variance decomposition.

With regard to output, the results of the unrestricted VAR for GDP show the lack of significance of the variables of the system according to the impulse response functions shown in Graph 2.

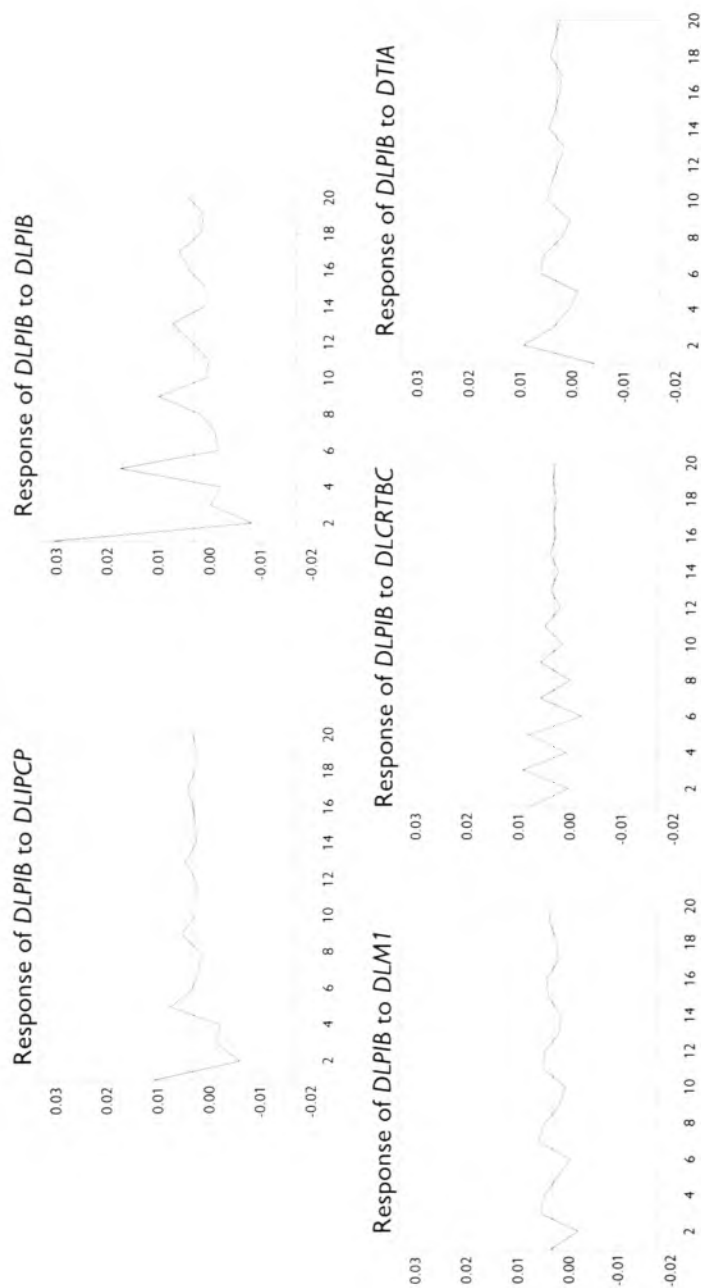
Two interpretations are possible in explaining this result. First, fluctuations in GDP may originate in supply factors not incorporated in the model. Secondly, the specification cannot capture the incidence of the explanatory variables on the demand components of GDP. This latter aspect is related to the effect of some variables on consumption and private investment, which cannot necessarily be captured when aggregate GDP is taken as the dependent variable.

Given the unsatisfactory results in the estimation of GDP, a different variable was specified as a proxy for economic activity. In the previous models, domestic aggregate demand was used in an attempt to account for the expansionary impact of increased spending on prices. However, the results were not encouraging, perhaps because in given phases of the economic cycle the level of spending was far below potential output.

In the light of these considerations and the assumption that the demand variables might influence the deviations of economic activity from

Graph 2

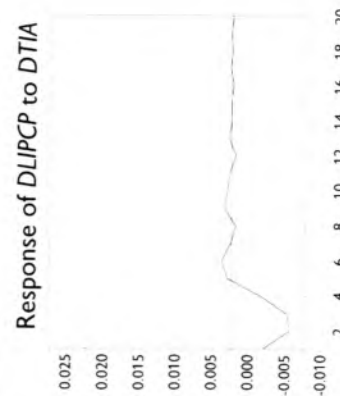
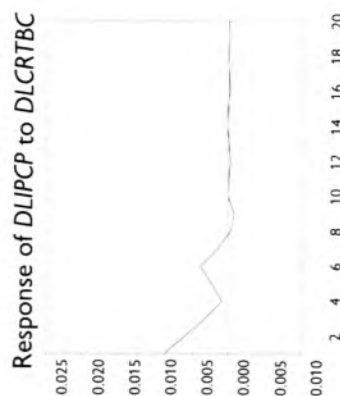
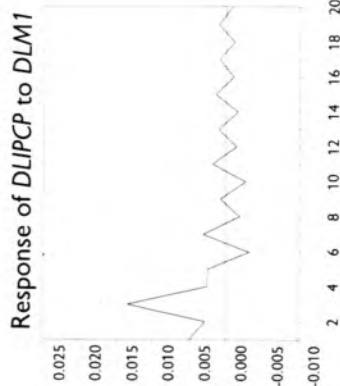
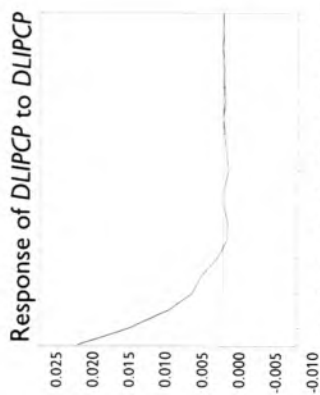
# **GDP: impulse response functions\***



\* Response to a one-standard deviation innovation.

Graph 3

# Inflation: impulse response functions using $GAP^*$



\* Response to a one-standard deviation innovation.

trend, the *GAP* variable was constructed using the residuals of a regression of GDP on a linear and a quadratic trend.<sup>6</sup> It should be pointed out that the trend in this variable is consistent with the Venezuelan business cycle.

In addition, given that *GAP* can be interpreted as the excess demand for goods, its explanatory power is superior to GDP since the observed levels of GDP only represent equilibrium values which may be insufficient to put pressure on prices if their level is below full-employment output.

Graph 3 presents the impulse response functions of an unrestricted VAR where *GAP* was substituted for GDP. The results validate the hypothesis of an inertial component of inflation. Nevertheless, the incorporation of *GAP* provides information on the impact of excess demand on the inflation process. Indeed, an innovation in this variable brings about a price change of the same sign as the shock, and the impact reaches a peak in the third quarter. At that point, it starts to decline until vanishing in the fifth quarter.

The contribution of *GAP* to the explanation of the forecast error of inflation is around 16%, which confirms its importance in the generation of inflation dynamics. M1 also makes an important contribution of approximately 19%. The influence of other variables is marginal as shown in Table 4. It should be noted that under this new specification the contribution of inflation to its own explanation is approximately 44%. Although

Table 4  
**Variance decomposition of the inflation error forecast using  
*GAP***  
In percentages

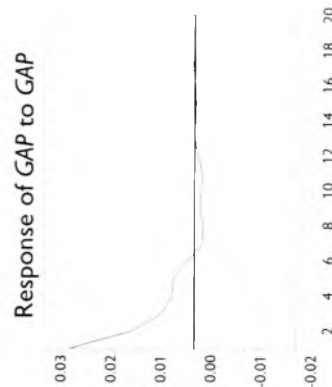
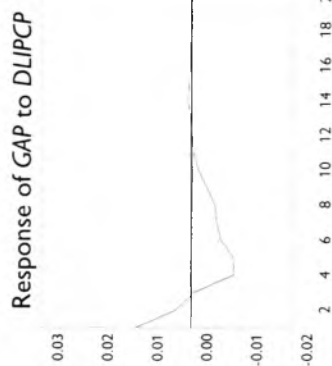
| Quarters     | <i>DLIPCP</i> | <i>GAP</i> | <i>DLCRTBC</i> | <i>DTIA</i> | <i>DLMI</i> |
|--------------|---------------|------------|----------------|-------------|-------------|
| 1 . . . . .  | 66.40         | 13.50      | 12.71          | 3.34        | 4.04        |
| 2 . . . . .  | 61.60         | 13.58      | 12.13          | 9.16        | 3.54        |
| 3 . . . . .  | 48.70         | 13.65      | 9.50           | 11.27       | 16.88       |
| 4 . . . . .  | 46.99         | 16.02      | 8.95           | 11.73       | 16.31       |
| 8 . . . . .  | 44.96         | 16.25      | 10.03          | 11.22       | 17.53       |
| 12 . . . . . | 44.48         | 16.09      | 9.96           | 11.20       | 18.26       |
| 20 . . . . . | 44.14         | 15.96      | 9.89           | 11.14       | 18.87       |

Order: *DTIA*, *DLCRTBC*, *DLMI*, *GAP*, *DLIPCP*.

<sup>6</sup> This approach is also followed in Fernández and Mendoza (1994) and Walsh (1986).

Graph 4

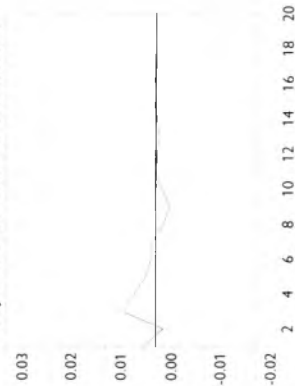
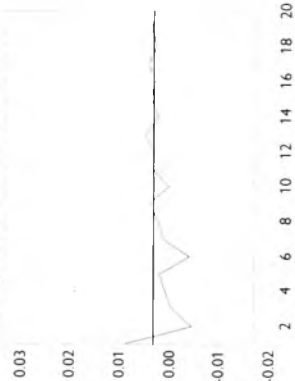
**GAP: impulse response functions\***



**Response of GAP to DLM1**

**Response of GAP to DLCRTBC**

**Response of GAP to DTIA**



\* Response to a one-standard deviation innovation.



still high, this nevertheless represents an important decrease compared with the previous model.

As far as *GAP* is concerned, its own history is of greatest importance, since an excess demand shock has an impact on itself which lasts for approximately four quarters, and its contribution to the forecast error is about 50%. The impact of the other variables would not appear to be significant, and their sign runs contrary to expectations. Moreover, the individual contribution of those variables to the forecast error of *GAP* (with the exception of inflation) is significant. These results are shown below in Table 5 and Graph 4.

Table 5  
**Variance decomposition of the *GAP* error forecast**  
In percentages

| Quarters     | <i>DLIPCP</i> | <i>GAP</i> | <i>DLCRTBC</i> | <i>DTIA</i> | <i>DLMI</i> |
|--------------|---------------|------------|----------------|-------------|-------------|
| 1 . . . . .  | 13.16         | 64.71      | 0.64           | 18.23       | 3.25        |
| 2 . . . . .  | 11.38         | 64.95      | 0.73           | 15.21       | 7.73        |
| 3 . . . . .  | 10.30         | 61.83      | 3.64           | 16.27       | 7.95        |
| 4 . . . . .  | 14.56         | 58.13      | 4.60           | 15.02       | 7.68        |
| 8 . . . . .  | 21.26         | 50.62      | 4.30           | 13.82       | 9.99        |
| 12 . . . . . | 21.47         | 49.82      | 4.75           | 13.62       | 10.35       |
| 20 . . . . . | 21.40         | 49.57      | 4.78           | 13.60       | 10.65       |

Order: *DTIA*, *DLCRTBC*, *DLMI*, *DLIPCP*, *GAP*.

### *(iii) Inflation as a target variable of monetary policy*

Although studies of the transmission mechanism usually consider the effects on both prices and economic activity, this analysis concentrates on the impact of the monetary variables on price changes. In particular, the importance of monetary and financial variables is analysed in the data generating process that determines inflation.

Once evidence about the relevant variables in the inflation dynamics has been obtained, the next step involves formulating a better specified model that takes into account the short and long-run relationships between the variables. The long-run relationship is estimated on the basis of a cointegrating vector between the consumer prices index (*IPCP*) and *M1*. The results are shown below.

$$LIPCP = 1.25 LM1.$$

| Null<br>r=0 | Alternative<br>r>1 | Statistic<br>18.51 | 95 % critical value<br>15.41 | 90 % critical value<br>13.33 |
|-------------|--------------------|--------------------|------------------------------|------------------------------|
|-------------|--------------------|--------------------|------------------------------|------------------------------|

Some other variables were taken into account in the long-run relationship, such as *GAP* and *TIA*. However, as in previous studies about Venezuelan inflation, the only relevant variable was the stock of money.

An error correction model was then formulated incorporating the short-run dynamics through inflation's own lags and current and lagged values of *GAP*, the rate of change of wages and *M1*. In addition, the long-run relationship was included through the residuals of the cointegrating vector (*MCE*).<sup>7</sup>

The lag structure for the formulation of the general model was determined on the basis of the Akaike and Schwarz criteria. The results for the reduced fourth-order VAR model are shown below.

$$\begin{aligned}
 DLIPCP = & -0.324 + 0.666 DLIPCP(-1) - 0.206 DLIPCP(-2) \\
 & (-1.668) \quad (6.666) \quad (-1.561) \\
 & -0.25581 DLIPCP(-3) + 0.30722 DLIPCP(-4) - 0.15346 GAP(-1) \\
 & (-2.035) \quad (2.736) \quad (1.523) \\
 & + 0.310 GAP(-2) + 0.143 DLMI + 0.154 DLSAL(-1) + 0.079 DLSAL(-4) \\
 & (3.462) \quad (3.360) \quad (3.235) \quad (1.609) \\
 & - 0.0322 MCE(-1) + 0.135 D89Q1 - 0.099 D88Q1 \\
 & (-1.78) \quad (5.332) \quad (-4.188)
 \end{aligned}$$

t-statistics in parentheses.

$R^2=0.858$ ;  $R^2(\text{adjusted})=0.792$ .

Serial correlation test (LM1):  $F(1,25)=0.55607$ ; [0.465].

Serial correlation test (LM4):  $F(4,22)=0.30524$ ; [0.871].

Functional form test (Ramsey's reset):  $F(1,25)=3.4219$ ; [0.076].

Normality of errors test (Bera-Jarque):  $\text{Chi-SQ}(2)=1.5037$ ; [0.471].

Heteroskedasticity test:  $F(1,37)=1.3593$ ; [0.244].

p-values are shown in brackets.

Some striking features can be observed. First, the large inertial component, which is characteristic of countries with persistent inflation rates, can be seen. Secondly, the role of the output gap is evident, the global effect of which has a positive impact on prices. Finally, wages have a positive effect, reflecting the impact of cost push factors on inflation.

<sup>7</sup> The p-value of the *MCE* term is 8.7%, which is a reasonable level of significance.

As regards the monetary aggregate, it is clear that its influence on inflation is contemporaneous, although the size of the coefficient (0.143) is too small to support a monetarist explanation of inflation in the short run. However, it is possible to implement an anti-inflationary policy based on the control of the monetary aggregates even in the short term. The link between prices and money in the long term is captured by the cointegrating vector, which supports a speed of adjustment towards long-term equilibrium of approximately 3%.

Note that two dummy variables (*D89Q1* and *D88Q1*) needed to be incorporated to capture the effects of the introduction of the adjustment programme in the first quarter of 1989 and the deflation in March 1988.

In addition to the direct channels of monetary policy influence observed in the previous equation, it is important to analyse the indirect effects which occur via the impact of monetary policy on the output gap. An equation was therefore specified that could determine the impact of the real interest rate (*TIAR*) and of bank credit to the private sector on excess demand. The equation also assumed a close relationship between *GAP* and its historical levels, as well as between *GAP* and the development of oil exports which represent a wealth effect given the importance of oil for the Venezuelan economy.

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$$\begin{aligned}
 \text{GAP} = & 0.142 + 0.936 \text{ GAP}(-1) - 0.195 \text{ GAP}(-3) - 0.0012 \text{ DTIAR} \\
 & (1.923) \quad 0.943) \quad (-2.254) \quad (-2.296) \\
 & + 0.0012 \text{ DTIAR}(-1) - 0.0009 \text{ DTIAR}(-3) + 0.162 \text{ DLCRTBC}(-2) \\
 & (2.477) \quad (-1.800) \quad (4.1694) \\
 & + 0.175 \text{ DLXPTBC} + 0.052 \text{ D89Q1} \text{ 89Q3} + 0.046 \text{ D92Q4} \\
 & (4.999) \quad (3.429) \quad (2.551) \\
 & - 0.0357 \text{ S1} + 0.046 \text{ S2} + 0.009 \text{ S3} \\
 & (-4.124) \quad (4.084) \quad (0.974)
 \end{aligned}$$


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t-statistics in parentheses.

$R^2=0.929$ ;  $R^2(\text{adjusted})=0.901$ .

Serial correlation test (LM1):  $F(1,30)=0.0016$ ; [0.968].

Serial correlation test (LM4):  $F(4,27)=0.8333$ ; [0.516].

Functional form test (Ramsey's reset):  $F(1,30)=1.1925$ ; [0.284].

Normality of errors test (Bera-Jarque):  $\text{Chi-SQ}(2)=0.76893$ ; [0.681].

Heteroskedasticity test  $F(1,37)=0.0096$ ; [0.922].

p-values are shown in brackets.

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The global effect of the real interest rate indicates a negative relationship between this variable and excess demand. It could be basically attributed to the stimulus that is exerted by negative real rates of interest on private consumption and some types of investment in Venezuela. The direct effect of bank credit to the private sector on the output gap can be seen as the manifestation of a natural expansionary effect resulting from the greater availability of bank credit.

Note that the variables  $D89Q1$   $89Q3$  and  $D92Q4$  are dummy variables to take into account the implementation of the adjustment programme (1989) and the political shock hitting the economy at the end of 1992.  $S1$ ,  $S2$  and  $S3$  are seasonal dummies.

### **3. Conclusions and implications for monetary policy**

The results obtained allow the identification of a multi-variable process in the generation of the inflation dynamics. On this basis, it can be derived that the greatest contribution that the central bank could make to inflation-fighting would be to control the pace of  $M1$ , given both its contemporaneous effect on prices and the long-term link between prices and money.

However, the inertial component of inflation also suggests that a policy aimed at disinflating the economy must give serious consideration to the role of expectations, the degree of indexation and the credibility of economic policy.

According to the model estimates, the implementation of monetary policy should take into account two relationships. The first is the cointegration observed between prices and money ( $M1$ ). This result is important for the general orientation of monetary policy, but it contributes very little to the definition of short-term policy rules. The second relationship, that between inflation and its determinants, should therefore be considered when specifying policy actions. In particular, the results suggest that money has a contemporaneous influence on prices through its impact on interest rates, and in turn on aggregate demand.

In order to identify the specific transmission mechanism and to derive some policy implications, the impact of  $M1$  on prices can be split into two related effects:

*(a) The direct impact of M1 on inflation*

An expansion in the money stock (M1) results in an increase of aggregate demand via an excess of real balances which produces a decline in real interest rates causing higher levels of consumption and investment and, as a result, inflation pressure.

In the short term, however, this effect is not fully transmitted to prices although the cointegrating vector suggests a close relationship between the path of prices and the quantity of money. The result is consistent with the nominal character of both variables. While this does not imply that there are no other determinants of the price level in the long term, it suggests that during the period under review the quantity of money has been the time series that was fundamentally related to the price trend.

*(b) The indirect effect via the impact of the real interest rate on the output gap*

In addition to the direct effect of M1 on inflation, there is an indirect component which operates via the effect of the real interest rate on the output gap. One explanation for this indirect channel is that changes in the real interest rate modify the cyclical position of the economy, exacerbating or dampening inflation pressures. In other words, this indirect effect captures the extent to which excess demand, due to a fall in interest rates, endures.

*Implications of selecting the money supply as an intermediate target of monetary policy*

Setting targets for M1 implies the selection of an exchange rate regime that offers the authorities some scope for controlling the stock of money. It is clear that a flexible exchange rate system is the most appropriate choice given that it affords better monetary control and that exchange rate changes would tend to reflect economic fundamentals and stochastic shocks to the demand for money. Another argument for choosing M1 as the intermediate target of monetary policy is the selection of the operational variable. In this context, the actions of the central bank must be targeted at controlling domestic credit to the private sector, given that the external component of the money base is determined by the choice of the exchange rate regime and that the financing needs of the public sector cannot be met by the central bank according to its legal code. In

addition, in order to determine the efficiency of the Bank's policy actions on the intermediate variable, the high degree of endogeneity of money creation within the banking sector must be taken into consideration, given the interaction between the commercial banks' portfolio decisions and the public sector's financing needs.<sup>8</sup>

The actions of the monetary authorities aimed at managing domestic credit to the private sector should be based on open market operations, since these are the natural instrument of monetary policy. However, as these operations have been carried out during the last few years by issuing central bank bonds, additional monetary expansion has been caused when the bonds reached maturity. Given this restriction, one strategy for the Bank to use in order to improve its intervention in the monetary market would be to perform open market operations using assets other than its own liabilities. This would not involve future monetary expansion, nor would it give rise to expectations of insolvency on the part of the monetary authorities.

#### *Suggestions for monetary policy implementation*

In order to improve the efficiency of monetary policy, to gain credibility and to have a positive impact on expectations, a number of operating criteria could be suggested to support policy decisions. First, it is recommended that money supply targets are determined not in terms of absolute levels, but rather in terms of a range which allows for random shocks beyond the control of the monetary authorities. Once a range for M1 has been defined, the Bank should make it public and monitor it on a regular basis.

When M1 moves out of the estimated range, the monetary authorities must provide a convincing explanation for the deviations, so that its commitment to controlling inflation is reinforced.

The information provided by the Bank on prices and monetary aggregates should be of sufficient quality to ensure that economic agents form appropriate expectations about the monetary authorities' final objective. This approach has been used in various countries (see Ammer and Freeman (1994)) and has strengthened the credibility of the monetary authorities in their pursuit of an anti-inflation policy.

<sup>8</sup> Only a passing reference can be made here to the complexity of the relationship between the operational and intermediate variables. A more detailed analysis must be the subject of another study.

An effective method of showing the monetary authorities' commitment is the publication of special inflation bulletins containing a careful analysis of the evolution of prices, price forecasts and the policy measures taken by central bank. In this way, the monetary authorities will gain credibility, at the same time as shaping the economic agents' expectations.

Finally, it is important to build a set of economic indicators which permit an ongoing evaluation of the various transmission mechanisms. These statistics would allow the policy-makers to analyse current economic conditions and identify the presence, nature and transitory character of price shocks. These indicators could be issued in conjunction with the announcement of inflation and money supply targets.

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