

Monetary policy transmission: the Colombian case

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Introduction

This paper seeks to present the Colombian experience regarding the transmission of monetary policy. The first part provides a general overview of the institutions and operating procedures which have been established in Colombia and of the financial markets in which monetary policy is implemented. The second part of the paper will focus on the basic empirical relationships between the instruments of monetary policy and its effects. The third part of the paper takes a preliminary look at micro data at the firm level.

1. The context: institutions, instruments and markets

(i) The central bank

Monetary and exchange rate policy in Colombia is implemented by an independent central bank, the Banco de la República, which functions in the context of simple yet rapidly evolving financial markets. The Bank was made independent by the 1991 Constitution, while the legislation implementing this constitutional principle was signed into law in 1992.

The Bank's governing body is the Board of Directors (Junta Directiva), which is made up of seven members: the Minister of Finance, the Governor (Gerente General) and five full-time members, two of whom are appointed by each succeeding government. It is worthwhile mentioning that these five members have no direct involvement in the

* The author wishes to thank Andres Arias and Andres Carvajal for assistance with the econometric estimations. Also, the paper benefited greatly from the sharp, detailed and constructive comments on the part of BIS staff. I learnt much in the seminar and wish to express my gratitude to its organisers and fellow participants for an enlightening and very enjoyable event. All opinions, errors and omissions are my own responsibility.

administrative nor technical departments of the Bank.¹ Currently, the seven members of the Board of Directors are all economists with links to one of the two political parties (liberal and conservative) which have dominated the country for the last century. All the members hold graduate degrees from foreign universities (and in two cases, doctorates) and most have served in prominent government positions, including ministries, at one time or another during the last 25 years. This underscores the fact that the Board, and as a consequence the Bank itself, is a technically oriented body, at least by Colombian standards, which at the same time has important roots in the tradition of policy-making prevalent in the country.

The staff in charge of drawing up proposals for the Board's consideration and of implementing Board decisions currently comprises 118 members, divided into a research department and a monetary operations department, the latter also in charge of managing foreign reserves and monitoring banking sector developments. Senior members of the staff hold regular formal meetings with the Board of Directors in the context of several committees. First, a weekly organising committee meets on the Monday following each session of the Board to draw up the agenda for work on topics where future decision-making is required. This work is itself discussed in technical sessions which are scheduled at least once a week. The second type of regular meeting between the Board and the technical staff is a weekly committee on exchange and open market operations. At this meeting the staff present the basic data on financial market developments: monetary aggregates, interest rates, the foreign exchange market and the financial sector balance sheet. This committee is not a decision-making entity; when decisions on short-term policy are needed, the Board has to formally delegate the relevant authority. Finally, there is a monthly committee dealing with international reserves.

Board meetings usually begin with a discussion on the current state of the money and foreign exchange markets and later turn to particular topics. The discussion of each topic centres on a staff paper, occasionally supplemented by a formal written commentary by one or more Directors. These papers will usually have been discussed beforehand in the technical sessions held during the week.

¹ They are, however, responsible for the setting of general administrative policy, as opposed to day-to-day functions.

Table 1
Board Resolutions by subject

	1995	%	1996	%
Reserve requirements	4	13.8	10	34.5
Exchange regime	14	48.3	15	51.7
Interest rates	6	20.7	1	3.5
Discount policy	3	10.3	1	3.5
Other matters	2	6.9	2	6.9
Total	29	100.0	29	100.0

The Board of Directors is responsible for fulfilling the duties which the Constitution and the Law entrust to the Bank, namely to “*defend the purchasing power*” of domestic currency and to preserve the stability of the financial system. This responsibility is assigned along with that for several (interrelated) policy instruments: the nominal exchange rate regime, open market operations, discount windows and reserve requirements. Though assigned the role of lender of last resort, the Bank is not the supervisor of banking sector activity; this function is performed by the Superintendency of Banks, which is a government agency.

The Board holds weekly meetings each Friday morning and sets policy by means of Resolutions which are usually made public the following Monday. In 1996 the Board issued 29 Resolutions, as many as in 1995. Table 1 provides a breakdown of these Resolutions by subject.

As can be seen from Table 1, during the last two years the Board has devoted 74% of all Resolutions to issues regarding reserve requirements and the exchange rate regime. One reason is that Colombia has a complex system of exchange controls, which were put in place in the context of the surge in capital inflows experienced since the early 1990s, and most of the Board Resolutions in this area have been aimed at clarifying particular issues or changing some of the basic underlying parameters. Moreover, during the period under review the Board has set itself the goal of gradually simplifying the initially complicated arrangements regarding reserve requirements.

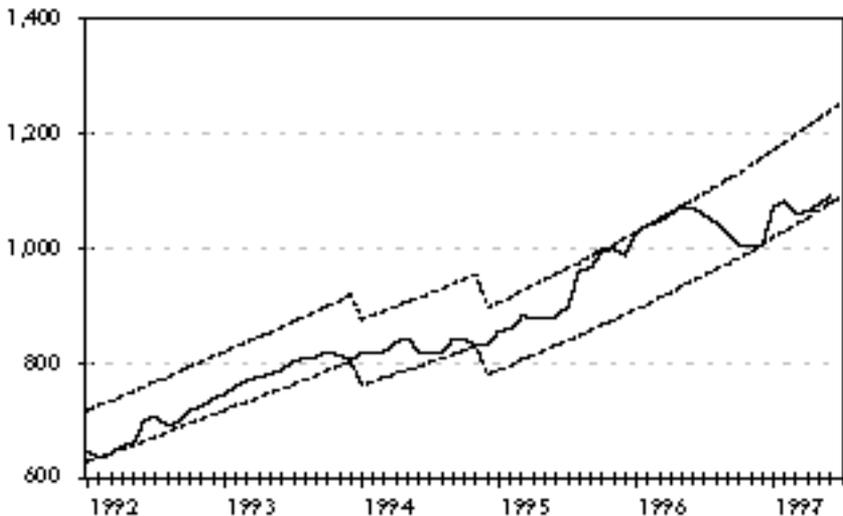
(ii) The instruments of policy

The Colombian exchange rate regime is built upon a dollar-based target zone or band which was introduced in 1994. Before that a crawling-peg

regime had been in operation. Between 1991 and 1994, however, a system which can be thought of as a band was put in place: the central bank issued dollar-denominated debt with a one-year maturity instead of high-powered money in exchange for foreign currency. The holder of this paper could redeem it at a 12.5% discount over the “official” exchange rate or sell it in the market. The exchange rate (pesos per dollar), of course, was established in the market for these bonds and hovered anywhere between the so called “official” exchange rate and a level 12.5% below it. Graph 1 shows the evolution of the exchange rate and of the bands, including the 1991–94 transitional implicit band just described.

In addition to this exchange rate commitment, the Board establishes bands for the money supply and for overnight interest rates. These three commitments obviously are not necessarily mutually consistent under many circumstances. Thus, an implicit hierarchy has been established with regard to the exit clauses to the system. Briefly, it can be said that during the last two years the Bank has given substantial weight to the exchange rate target and has, therefore, defended the band despite the fact that the money supply has not always evolved according to targets. A perception

Graph 1
Exchange rate band – January 1992–July 1997



that money demand might have been shifting led the Board to allow these departures from stated objectives. Moreover, the stability of the overnight interest rate has been an increasingly important goal of policy.

Operationally, the system is set up as follows. The Board defines an exchange rate zone, usually at the end of the year for the following year and in the context of a global discussion on economic policy with the Government. The first explicit band was implemented in January 1994 and its level was changed in December of that year (down by 5%) in the context of strong appreciation forces. The second change was implemented in January 1996 when the slope shifted from 11.5 to 13.5%, while the central parity was maintained. The third change became effective in January 1997, with the slope again changing from 13.5 to 15%.

The Bank acts at the margins; buying foreign exchange in the strong part of the band and selling in the weak part. During 1996 it has acted at both ends of the band, given the great volatility of the nominal exchange rate (see Graph 1). In addition to this form of intervention, the Bank also has the ability to intervene within the margins and has done so on some occasions, especially in 1996. The stated purpose of these intra-marginal interventions is to reduce volatility, and the rules governing these actions are designed with that goal in mind. For example, there is an explicit limit on the resources which traders can commit in intra-marginal interventions. There is also a rule which defines the precise exchange rate spread, between a moving average of the latest transactions and the marginal rate occurring in real time, which may trigger intervention.

The second market in which the Bank acts is the overnight money market. In this case, the Bank has established an interest rate band and commits itself to issuing one-day debt at the lower end of the band or, in the opposite upper case, offering one to seven-day liquidity through reverse repo operations on certain pre-defined assets.

The foreign exchange market is an interbank market in Colombia, owing to the nature of the relevant legislation. During the last three years, it has evolved as shown in Table 2.

Two salient pieces of information emerge from the data. First, relative to the stock of international reserves (US\$ 8.5 billion), the size of the market is comparatively small (less than 3% in the highest individual daily case). Secondly, the market experienced a sharp increase in size during 1995, but flattened out in 1996.

Table 2
Average daily transactions: foreign exchange market
 In millions of US\$

	1994	1995	1996
Q1	38.0	96.5	115.9
Q2	41.0	106.2	120.5
Q3	50.4	138.7	121.2
Q4	61.3	117.8	127.6

The money market has developed as shown in Table 3. The size of daily transactions in the money market is a relatively stable proportion of the monetary base and is also relatively small. For example, in dollar terms and at current levels, with the nominal exchange rate at around pesos 1,000 to the US dollar, the daily money market is roughly equivalent to US\$ 240 million, or 0.2% of GDP.

Bonds are issued by the government and by the private sector, with financial entities a major supplier.

The equity market in Colombia is one of the most underdeveloped in the world. Recently, Demirgüç-Kunt and Levine (1996) compiled and examined stock market developments in 41 countries during the 1986–93 period. The indicators show that Colombia's is among the least developed markets in all categories relating to size and dynamics, namely in terms of the capitalisation ratio (38th), value traded (40th), number of listed companies (40th) and turnover (38th).

Table 3
Average daily transactions: money market
 In billions of US\$ and as a % of the monetary base

	Size (US\$)	% of M0
1995 Q4	205.4	3.7
1996 Q1	254.4	4.3
1996 Q2	251.5	4.3
1996 Q3	219.5	3.8
1996 Q4	238.1	4.1

2. Empirical aspects of the transmission process: the macro level

In the context of the simple yet rapidly evolving financial markets of Colombia, a detailed conventional analysis of the transmission process is difficult. In this section we seek to present basic macroeconomic data relating to the period 1980–96.

The precise identification of monetary policy is not a simple task, given that the authorities have pursued different objectives during the 1980–96 period. We can, however, provide a global view of the topic.

Our point of departure is given by the fact that the stance of economic policy in Colombia has been defined in the context of a global objective which has been to maintain moderate inflation, in the 20–30% range. Hypotheses regarding the internal logic behind this scheme have been advanced elsewhere.² For present purposes, it is sufficient to state the fact that the Colombian authorities can be adequately viewed as implementing a strategy that allows to keep the rate of inflation within the aforementioned band, while several real variables behave in a very stable fashion. Higher inflation taxes are traded off against lower volatility, with the financial sector acting as a fundamental component of the distribution of these resources. Indeed, Colombian macroeconomic volatility is comparable to that of the OECD countries.

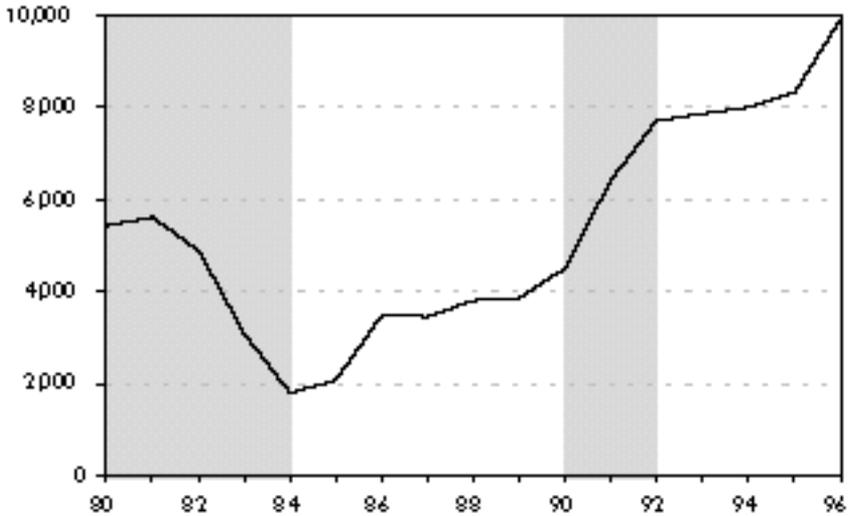
The instruments of policy have been utilised within the constraints imposed by this general objective and by the presence of external shocks.

(i) Preliminary discussion

The sample period 1980–96 can be divided into three distinct sub-periods, according to the nature of external factors. First, from 1980 to 1984 there is a substantial loss of reserves stemming from the defence of an overvalued exchange rate in the context of a reduction of capital inflows and sizable fiscal pressures. In 1985 an adjustment package is implemented, by means of which the fiscal deficit is drastically reduced and the nominal exchange rate devalued by 50%. The stock of international reserves increases and stabilises until 1990. The third period begins in 1990 and is associated with substantial capital inflows. The authorities

² See Carrasquilla (1995).

Graph 2
Net international reserves
 In millions of US dollars



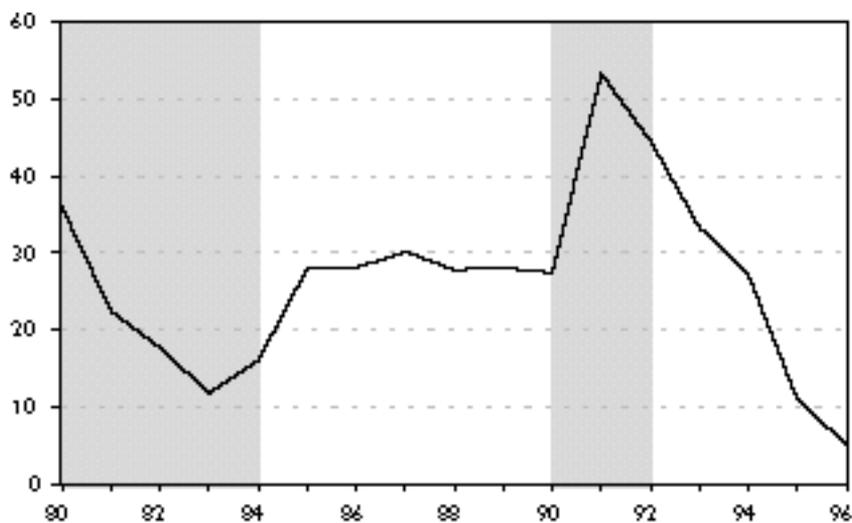
decided to defend the nominal exchange rate and thus implement expansionary monetary policies, at least until 1994. Since then, efforts have been aimed at regaining control of monetary and credit aggregates.

The sequence can be graphically illustrated. Graph 2 shows the evolution of the stock of international reserves between 1980 and 1996, where the aforementioned sub-periods are indicated by means of shading. The pattern outlined above emerges with some clarity.

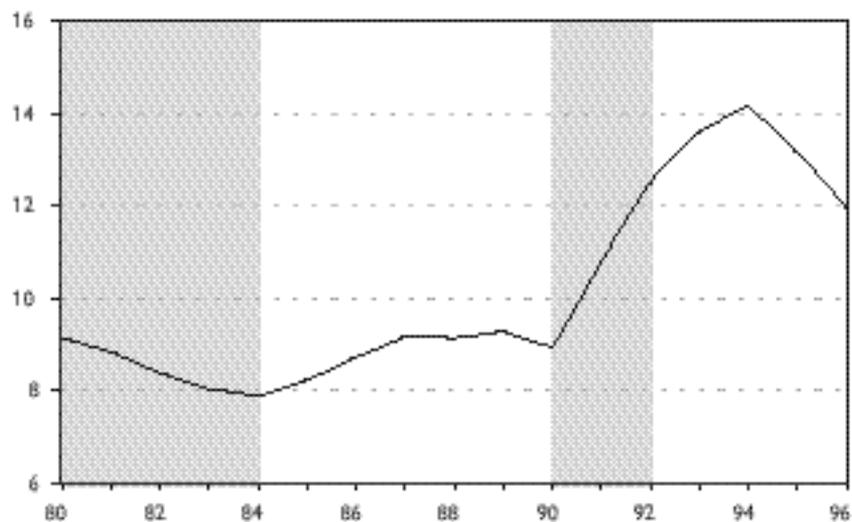
Graphs 3 and 4 show the rate of growth of the monetary base.³ It is clear that the policy decisions are reflected in the dynamics of high-powered money. In the first subperiod the economy experiences a sharp reduction of the money supply, as agents perceive the exchange rate overvaluation and recompose portfolios away from domestic money, while the authorities insist on a strong currency. In the second sub-period (1990–92) the economy witnesses an increase in the money supply.

³ Cecchetti (1995) suggests that the monetary base is the adequate measure of money for these studies.

Graph 3
Nominal growth of the monetary base
In percentages



Graph 4
Real monetary base
Index



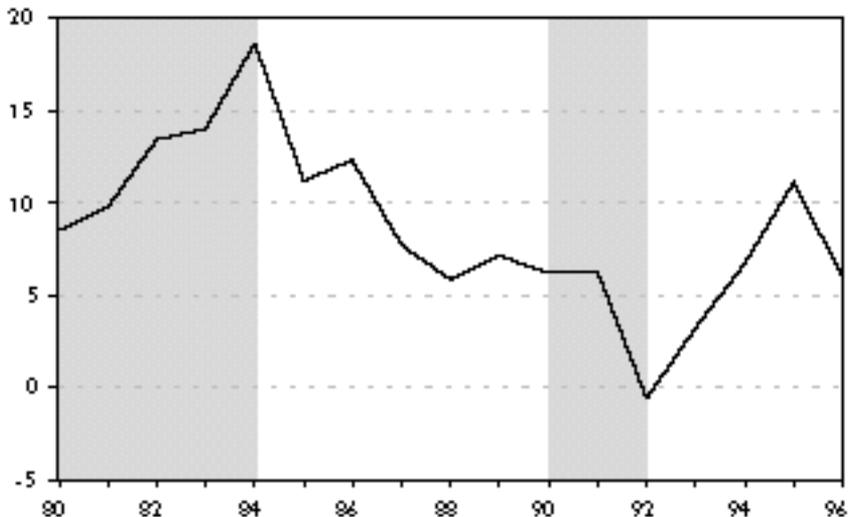
In terms of the analysis of the transmission process, the Colombian experience is interesting in that it contains a substantial monetary contraction (1981–84) and a major monetary expansion (1990–92). Moreover, the former occurs in the context of financial markets which are regulated, while the latter occurs in the context of liberalisation efforts.

In both cases, the process reflects policy decisions regarding capital flows. In the first case the policy stance is characterised by the decision to maintain an appreciated exchange rate, and in the second the stance is characterised by the decision to defend a depreciated exchange rate.

(ii) A graphical exploration of specific channels

The general outcome of these policy decisions can be explored using the following information set. Graph 5 shows the behaviour of the real (ex post) 90-day deposit interest rate. The 90-day market has been the most active for deposit-taking in Colombia. We concentrate on the two episodes outlined above; the contraction of 1980–84 is associated with a

Graph 5
Real (ex post) deposit interest rate
 In percentages



sharp increase in domestic interest rates, while the expansion of 1990–92 is associated with a steep fall. Moreover, the tightening of monetary policy, which is clear from 1994 onwards, is associated with interest rate increases and sharp drops in money growth, with relatively stable foreign exchange reserves.

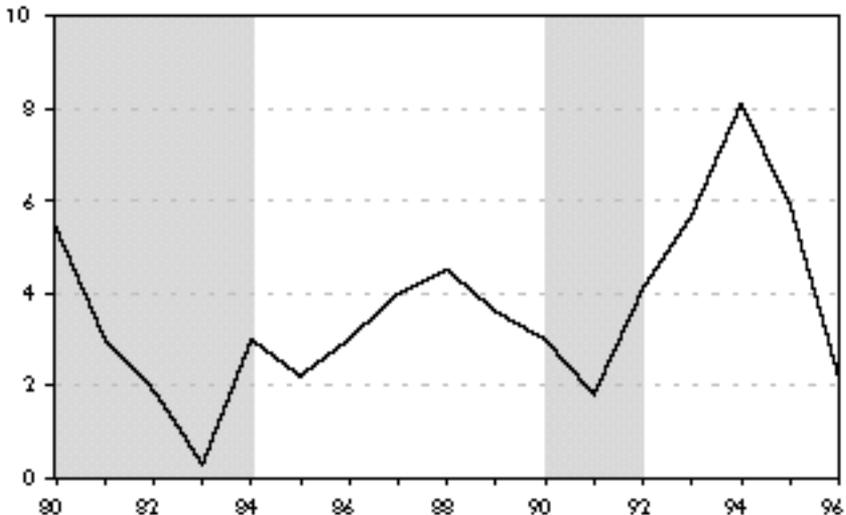
Mishkin (1995) has recently put forward a very simple, yet adequate, framework which allows a discussion of the different channels through which monetary policy may affect output in the short run. The first channel is the traditional interest rate channel which can be represented as follows:

$$\nabla M \rightarrow \Delta i \rightarrow \left\{ \begin{array}{l} \nabla I \\ \nabla C \end{array} \right\} \rightarrow \nabla Y$$

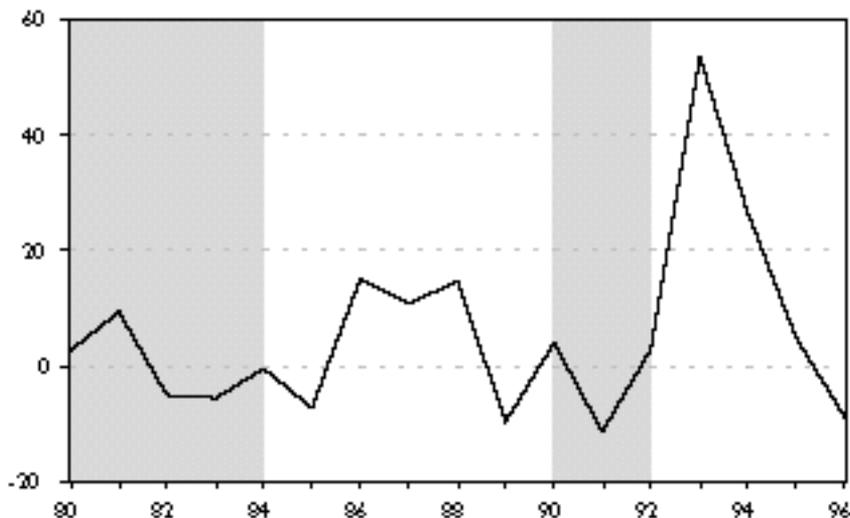
A monetary contraction increases the nominal interest rate (liquidity effect). This in turn decreases both consumption and investment and leads to a fall in output.

Is there an interest rate channel in Colombia? Graph 6 shows the rate of growth of private sector consumption. As can be seen, there is a

Graph 6
Real growth of private consumption
 In percentages



Graph 7
Nominal growth of private investment
 In percentages

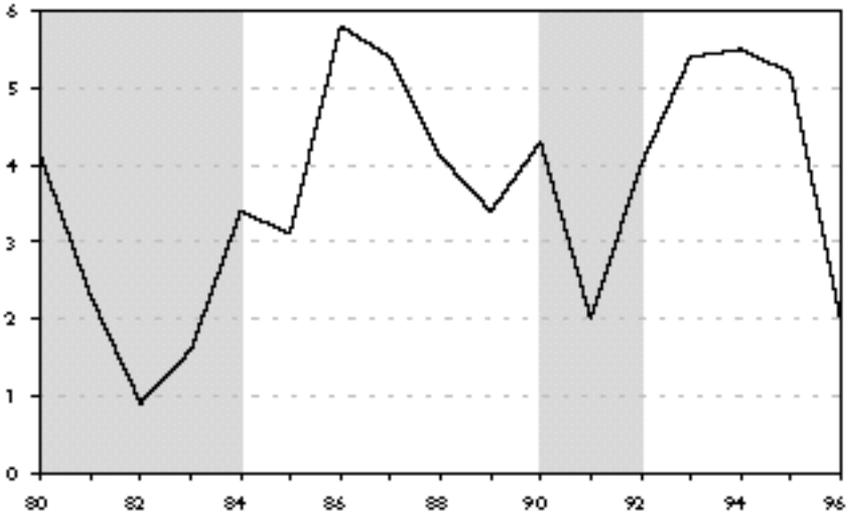


substantial fall in this rate from 1980 until 1983, a period of marked monetary contraction and interest rate increases. In the case of the monetary expansion of 1990–92, there is also a shift in the behaviour of private consumption, although the rate of growth accelerates belatedly, from near the beginning of 1992. There seems to be a lag in the response of this variable to the monetary policy shock. A similar response can be observed in the case of private investment, which is shown in Graph 7. Finally, Graph 8 shows the behaviour of the rate of growth of real output.

The data seem consistent with the existence of this basic interest rate channel, and also with the fact that it acts through both private consumption and private investment. A very basic caveat is in order. We have stated the idea that the two monetary policy decisions have much to do with exchange rate considerations in the context of important shifts in capital flows. These decisions are, in this sense, endogenous to choices which were made with respect to the exchange rate regime.

In other words, it could be argued that monetary developments have to do with a fixed exchange rate system in which money is endogenous. Our point is, first, that neither the nominal exchange rate nor the rate of

Graph 8
Real GDP growth rate
In percentages

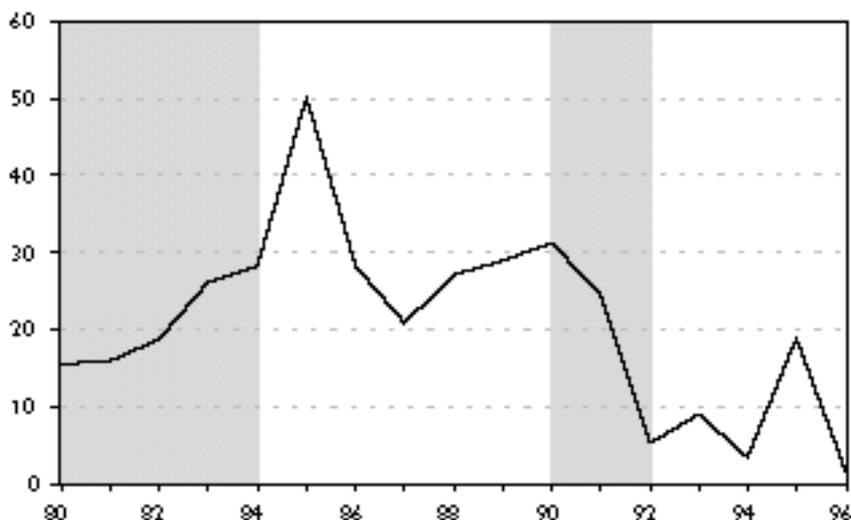


devaluation has been fixed, as can be seen from Graph 9. Secondly, even if the argument were true, the decision to fix the nominal exchange rate, in the context of important developments in the determinants of the real exchange rate, is itself an exogenous choice of monetary policy. In 1980–84 the choice was contractionary, as the determinants of the real exchange rate implied a depreciation, and in 1990–92 it was expansionary, as they implied an appreciation.

The second mechanism is linked to the credit channel. According to this view, the traditional interest rate channel is not sufficient to explain several stylised facts.⁴ In order to account for these facts, which include issues of timing and of size of the responses of private spending to monetary policy, it has proved useful to broaden the analysis and include the banking sector and the peculiarities which it implies. A monetary shock affects the availability of loanable resources on the liabilities side of the

⁴ See Bernanke and Gertler (1995). The most important limitation, according to the authors, is given by the size of the effects: small changes in short-term interest rates imply investment and consumption responses which are larger than those found in the estimation of the traditional behavioural equations.

Graph 9
Nominal exchange rate devaluation
 In percentages



banking sector's balance sheet. An expansion, for example, increases these funds and induces lending on the part of banks both directly and indirectly, by altering the perceived costs of informational asymmetries.

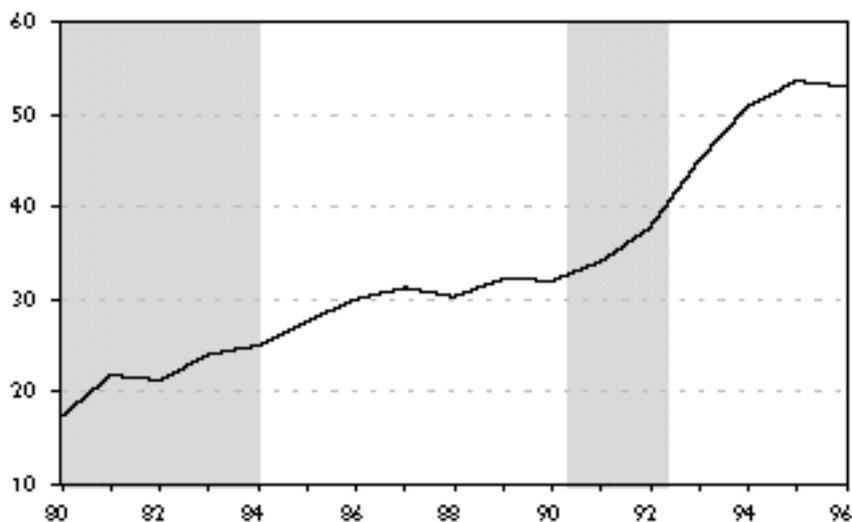
Again using the simple scheme of Mishkin (1995), the credit channel operates as follows:

$$\nabla M \rightarrow \nabla \text{Deposits} \rightarrow \nabla \text{Loans} \rightarrow \text{Firm problems} \rightarrow \nabla \text{Loans} \rightarrow \left\{ \frac{\nabla I}{\nabla C} \right\} \rightarrow \nabla Y \left\{ \frac{P}{Y_R} \right\}$$

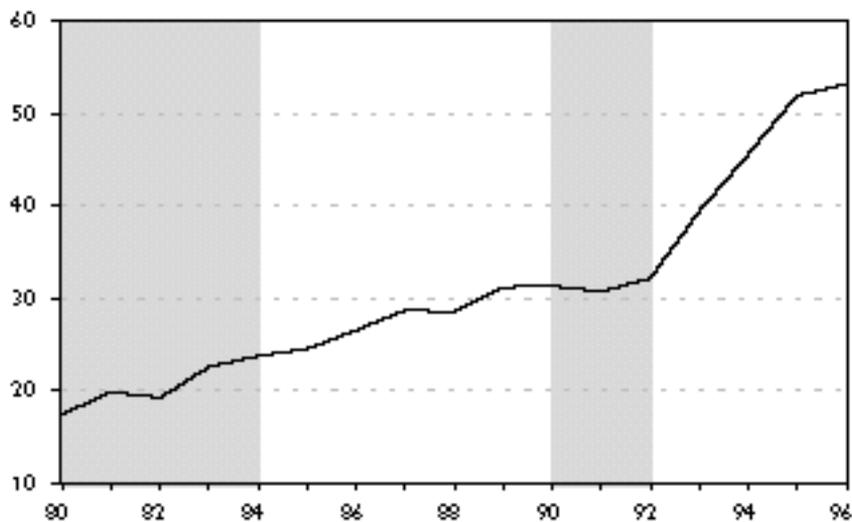
A contraction in high-powered money reduces deposits or, in an inflationary context, their rate of growth. A banking sector balance sheet constraint limits the ability to lend and thus creates cash-flow and other problems at the firm (and household) level. Perception of these problems further complicates the supply of funds on the part of banks. Thus, expenditure is credit-constrained and output falls.

Is this mechanism relevant in Colombia? Let us look at the basic data. First, we continue to associate the 1980–84 period with a contraction and the 1990–92 period with an expansion. Graph 10 shows the evolution of real deposits in the financial system. No particularly strong effect

Graph 10
Real deposits in the banking sector
Index



Graph 11
Real loans outstanding
Index



can be clearly perceived in the contraction of 1980–84. On the other hand, it is very clear that the expansion of 1990–92 did imply a lagged response, which is particularly strong in 1994.

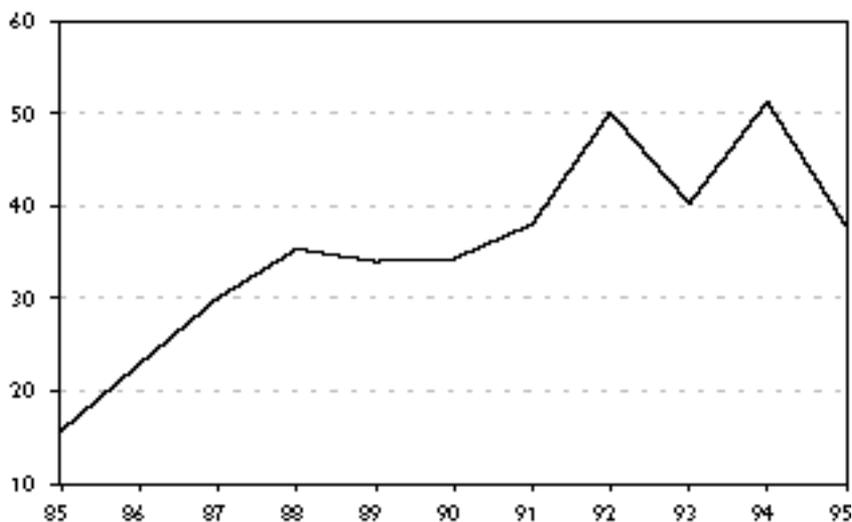
Financial sector loans outstanding are shown in Graph 11. Once more, there is a very different response to policy in 1980–84 compared with 1990–92. In the former case, the contraction did not limit banking sector lending, while in the latter the (lagged) response is very clear.

There are two possible explanations to the stylised fact. First, it could be true that there is a structural asymmetry between the effects of a monetary contraction and those of an expansion. McKinnon and Pill (1996), for example, have argued that informational imperfections could lead economies involved in a credible liberalisation process to what they call an “over-borrowing syndrome”, in which banks overextend themselves. This type of imperfection emerges within the financial sector, and is crucially linked to excessively optimistic expectations on the part of agents, including the financial sector itself, domestic residents in general, international investors and policy-makers. In the initial phase of liberalisation, improved economic performance is indeed observed, as are large capital inflows. Part of this improvement turns out to be unsustainable, as debt levels rise beyond what is strictly feasible. Moreover, the phenomenon does not occur in the context of a contractionary environment.

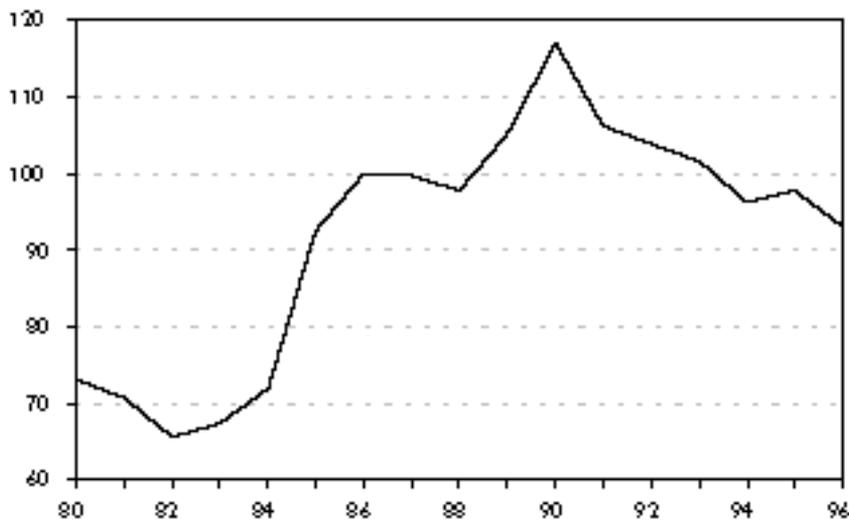
Secondly, the difference could be explained by the degree to which financial markets have developed. A monetary contraction, in the context of systems endowed with high levels of government involvement in the market-place and thus high degrees of moral hazard, might not lead bankers to implement the same type of behavioural adjustments as would be the case in a more liberal environment, in which risks are not transferred elsewhere. A banking crisis, in this sense, could well emerge as a consequence of a failure on the part of bankers, lacking adequate incentives, to perceive and respond to monetary policy decisions. This hypothesis implies that in the context of a high degree of moral hazard and other imperfections the credit channel might not operate as efficiently as in normal market circumstances, given the banking system’s inability to adequately process information stemming from the monetary authorities.

In the case of Colombia both factors are relevant. First, the lack of adjustment to the significant contraction of 1980–84, which is shown in the data, is a major explanation of the banking sector crisis which clearly surfaced in 1985 and ultimately required heavy government involvement

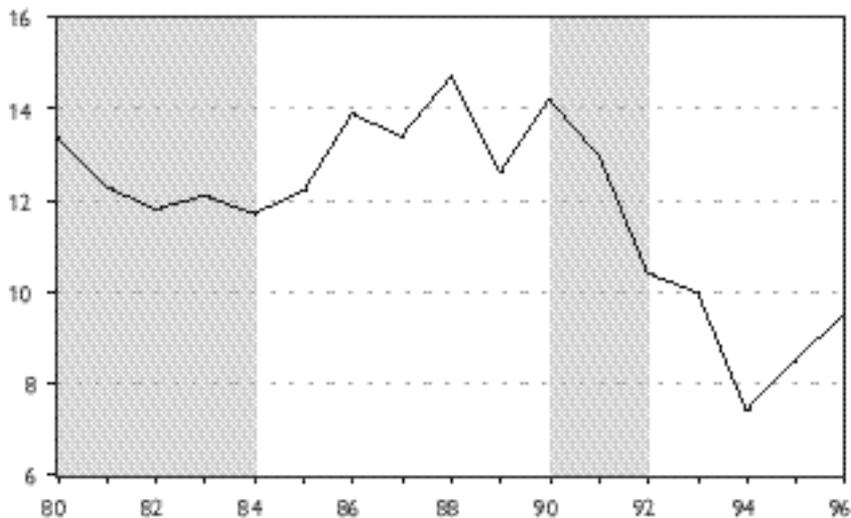
Graph 12
Asset price inflation
In percentages



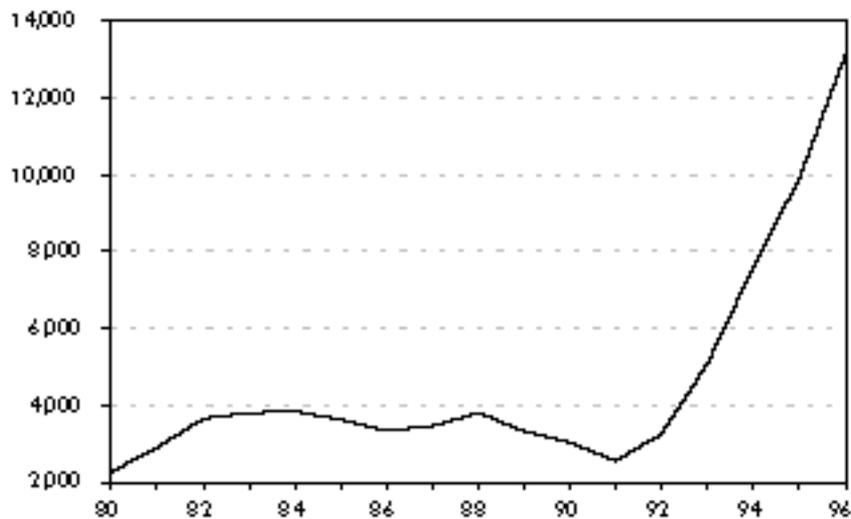
Graph 13
Real exchange rate
Index, 1985 = 100



Graph 14
Private gross saving rate
 As a percentage of GDP



Graph 15
Stock of private external debt
 In millions of US dollars



for its resolution.⁵ It is thus clear that the perverse incentives facing bankers could well be a reason why the credit channel did not operate.

Secondly, in the 1990–92 expansion, there is some evidence that processes of the type described by McKinnon and Pill did in fact occur. Among these, it is appropriate to highlight substantial asset price inflation (Graph 12), real exchange rate appreciation (Graph 13), a sizable fall in private savings rates (Graph 14), and a rapid increase in private sector external indebtedness (Graph 15).

(iii) VAR results

In order to examine more formally the hypotheses outlined above, we constructed a conventional VAR model in which attempts were made to derive results with all the relevant variables discussed in the previous section. The technical details are contained in an appendix. Our results are consistent, robustly, with the following three basic findings:

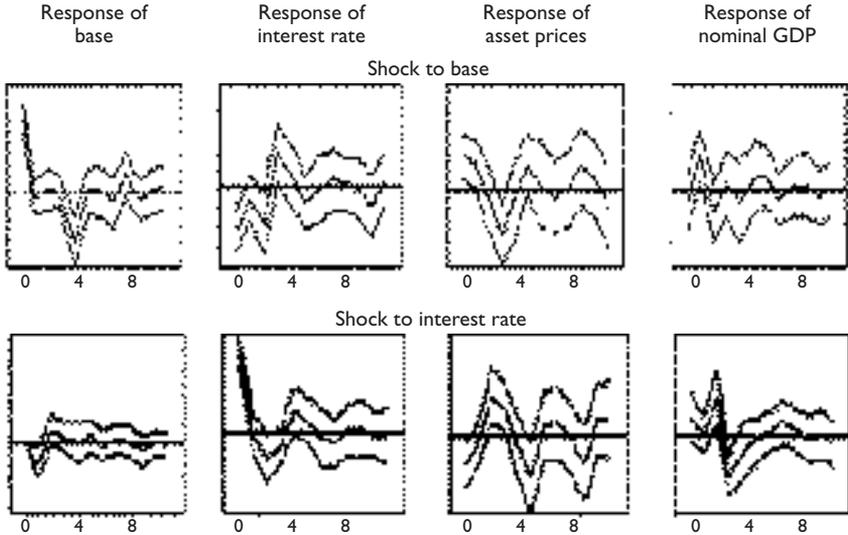
1. There is a liquidity effect which stems from monetary policy. As can be seen from the upper panel of Graph 16, an expansion of the monetary base implies a reduction in the relevant (90-day) interest rate. This liquidity effect is significantly less than zero during the three quarters which follow the initial shock.

2. There is also a temporary asset price response, which is positive.

3. We were unable to find a significant response of expenditure to the monetary shock, though the interest rate shock does seem to anticipate a temporary nominal GDP adjustment.

⁵ For a thorough discussion, see Montes-Negret (1996).

Graph 16
Impulse responses



3. Some basic micro level results

Systematic and comparable balance-sheet and earnings information at the firm level has been available since 1991. These data are gathered by the Superintendency of Industry, which is a government agency in charge of supervising the industrial sector. In this section we present the results of an analysis of the size effects present in this data set.

Our hypothesis stems from the type of issues raised, for example, by Bernanke and Gertler and has to do with the credit channel, in particular the differences between small and large firms in their adjustment to monetary policy shifts. Specifically, the question we had in mind was the possibility that smaller firms experience greater volatility of banking sector funds, while larger firms experience less volatility. Conceptually, this may arise because of the presence of scale economies in information gathering. In the face of a monetary contraction, banks may cease lending to smaller firms, where informational costs are high, before they cease lending to bigger firms, where they face smaller marginal costs of information and thus smaller risks of adverse selection.

To examine the issue, we randomly sampled 750 firms and examined their data for two of the five available years, one in which monetary conditions were relatively soft (1993) and another in which they were tighter (1995). In 1993 the ratio of total credit to GDP rose by 1.2 percentage points, while in 1995 it fell by 8 points. Real ex post 90-day deposit interest rates averaged 2.5% in 1993 and 10% in 1995.

After excluding firms whose reports were incomplete or presented inconsistencies, we chose the 100 largest and the 100 smallest firms in the sample, with size defined and ranked according to total capital outstanding.

Table 4 shows the implicit cost of external funds, measured as total financial outlays divided by total liabilities. The cost of funds is very similar when policy is expansionary. However, when policy is tightened, smaller firms experience a sharper increase in the cost of obtaining external funds than do large firms. There remains a question as to the availability of funds according to the stance of policy. A plausible presumption is that smaller firms are able to obtain proportionately more resources when policy is loose than when it is tight, relative to larger firms.

Table 4
Implicit cost of funds and monetary policy
In percentages

	Expansionary stance	Contractionary stance
Large firms	17.0	29.8
Small firms	16.2	34.0

Table 5 shows the growth in total liabilities according to the stance of monetary policy. There is a dramatic difference in the size of the adjustment experienced by small firms, relative to large firms.

Table 5
Growth of liabilities and monetary policy
In percentages

	Expansionary stance	Contractionary stance
Large firms	26.8	38.5
Small firms	138.4	29.4

Another point which has been raised has to do with the adjustment of inventories. The hypothesis is that larger firms do not cut production as much as smaller firms in the face of a contraction. Therefore, one should observe a greater build-up of inventories in larger firms than in smaller firms, as the former are able to fund these accumulations. Table 6 shows the rate of growth of inventory stocks in the two categories of firm.

Table 6
Real growth of inventories and monetary policy
 In percentages

	Expansionary stance	Contractionary stance
Large firms	- 4.0	4.0
Small firms	-15.0	2.9

The evidence is clear. Both categories of firm experience a reduction of inventories in the expansionary phase and an accumulation in the contractionary phase. The difference between large and small firms is, however, very limited in the latter scenario.

Appendix

In order to evaluate the transmission mechanisms of monetary policy at a macroeconomic level, we estimated a set of non-structural Vector Autoregression (VAR) models, including monetary policy variables and real sector variables, and made impulse-response functions accompanied by their respective confidence intervals (at a significance level of 90%).

The series used in the exercise were: nominal base, interest rate on three-month CDs, a series of asset prices,⁶ the real exchange rate, aggregate credit, nominal GDP, real GDP, sectoral GDP of construction, manufacture, agriculture, transportation and commerce, and some components of aggregate demand (fixed investment, private consumption and public consumption). All the series were taken on a quarterly basis.

To achieve some variance stabilisation, the series were log-transformed and, when it proved to be necessary, some of them were seasonally adjusted by the X11-ARIMA procedure (which models the deterministic seasonal components) in order to avoid spurious results. Then, with the application of the Hasza-Fuller test, we evaluated the existence of unit roots on the autoregressive polynomial, at the zero and the seasonal frequencies. All the series were differentiated as indicated by the previous test.

Once we got second-order stationary series, we used the Akaike Info Criterion to evaluate the optimal lag structure to be used in any VAR system. In this case, the considered Akaike always corresponded to the equation where the real sector variable appeared as endogenous. With the chosen lag structure, we estimated the non-structural VAR and then orthogonalised the residuals (by the Cholesky decomposition) considering an order of the variables such that the most exogenous variable was the monetary instrument (the monetary base and/or the interest rate), the transmission variable (asset prices, the real exchange rate and the credit aggregate)⁷ intermediated the process and, finally, the real sector variables (GDP, its sectoral components or the demand variables) were the most endogenous ones.

⁶ This series was taken from Carrasquilla et al. (1994). It is constructed as a weighted average of the share price index at the Bogotá Bourse and an index of housing prices.

⁷ A system that did not include any of these variables was intended to prove the existence of the traditional liquidity channel.

To conclude, the impulse-response analysis included confidence intervals (at 90% significance level) which were constructed by Montecarlo simulations implemented with the Monte Var procedure of the RATS System.

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