CENTRAL BANK INDEPENDENCE AND INFLATION: THE CASE OF COLOMBIA. 1924-1998

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ABSTRACT

This paper evaluates the link between central bank independence and inflation for the case of Colombia. It develops a theoretical framework concerning central bank independence and inflation. It concludes that central bank independence is an important feature for reducing inflation and partially solving the problem of time inconsistency, assuming the existence of a monetary dominant regime Central bank independence has led to a reduction in inflation and its variability in Colombia. However, the results for inflation in the last period have not been so impressive. The paper suggests alternative explanations for this result. Real independence of the Colombian central bank may be lower than its formal independence. Also, other factors besides central bank behaviour may account for higher-than-expected inflation rates in Colombia, particularly the existence of an externally financed fiscal deficit.

Key words: Institutions, central bank, inflation
JEL classification: E31, E42, E58, E61, E63

I. INTRODUCTION

There is an extensive body of literature concerning central bank independence. Interest in the subject has increased as a result of a worldwide acceleration of inflation. Issing (1993) points out how during the 70´s inflation levels for OECD countries were twice as high as they were in the 60's.

The objective of this paper is to quantify central bank independence in Colombia and to evaluate its effects in terms of reducing inflation.

This paper answers 3 questions: Is it important for an economy to have an independent central bank? Can we measure central bank independence in Colombia for the last 70 years? Has it contributed to the reduction of inflation?

II. ECONOMIC THEORY ABOUT CENTRAL BANK INDEPENDENCE AND INFLATION

According to the literature there are three answers to the question of why central bank independence results in lower inflation:

1.   Public Choice theory argues that a dependent central bank is more frequently under the spell of political influences. Governments usually prefer "easy money" policies rather than aggravating their budgetary position by monetary tightening.[1]

2.   Sargent and Wallace (1981) put forward the second argument. They distinguish between a fiscal dominant regime in which monetary authorities cannot influence the size of the budget deficit and money supply becomes endogenous, and the monetary dominant regime. In the latter, fiscal authorities will be forced to reduce the deficit. The more independent the central bank is, the less monetary authorities can be forced to finance deficits by creating money.

3.   The third argument is based on the time inconsistency problem. It starts by saying that the main cause of inflation is the rapid growth of money supply. One of the reasons for this growth in recent years is the existing trade-off between output and inflation. This implies an incentive for the government to increase money supply when looking for an increase in output. Kydland and Prescott (1977) took ideas from game theory to describe the problem of time inconsistency. It arises when an economic agent, like the government, has an incentive to promise to take some action *ex ante*, but takes some other action *ex post*, even without any other information that might lead it to alter its plans. As a result, the decisions of the economic agents depend not only on past policy decisions or on the current state but also on the expectations of future policy actions. Consequently, unexpected changes in economic institutions or their policies with respect to prices tend to change agents' actions, leading to the problem of time inconsistency.[2]

Barro and Gordon (1983b) concluded that the best solution is to commit monetary policy to certain policy rules. Unfortunately, commitment is not an easy task[3] and requires the design of a "Commitment Technology".[4] One alternative is to build a reputation for low inflation, in which case the gains[5] from generating higher than expected inflation,

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1   Buchanan and Wagner (1977) say that "it is scarcely to be expected that persons who are chosen as monetary decision makers will be the sort that are likely to take policy stances sharply contrary to those desired by their political associates ..."

2   Kydland and Prescott (1977) even recommend institutional arrangements, which make it difficult and time consuming to change the policy rules. They showed how discretionary policy gives rise to high inflation.

3   Romer (1996) points out a normative and a positive problem. The first one says that rules cannot account for completely unexpected circumstances, the second one says that it is possible to have cases in which under no commitment rules there is low inflation, so there must be other ways to alleviate the dynamic inconsistency problem without involving binding commitments.

4   Barro and Gordon (1983) add "If commitment were feasible through legal arrangements or other procedures, the countercyclical aspect of monetary policy would disappear and everyone would be better off"

5   Barro and Gordon (1983) mention the gains from creating surprise inflation. They include expansions of the economic activity, and reductions of government liabilities.

will compensate the losses implicit in this policy.[6] The second alternative is delegation, which will be the main concern of this paper. As an example Rogoff (1985) recommends the appointment of a central banker who will place a large but finite weight on inflation relative to employment stabilisation. There are two other mechanisms to avoid the inflationary bias: punishment equilibrium and incentive contracts.[7]

Following Romer (1996) and Bean (1997) it is possible to prove the advantages of delegation (central bank independence) with respect to a discretionary monetary policy when reducing inflation. Consider an economy subject to external supply shocks that occur after private expectations are formed but just before the establishment of monetary policy. The government needs to minimise a welfare loss function depending on the deviations from targeted growths of output and inflation. The timing is as follows:

1.   The regime is set up.

2.   The public form their expectations.

3.   The shock occurs

4.   The government sees the shocks.

5.   The government decides whether reneging or not on the regime set up before.

Equation (1) represents the output – inflation trade-off of the economy subject to external random shocks. Equation (2) represents the Government Welfare Loss Function, which includes the inflation and the stabilisation target.

$$Y_t = \alpha.(\pi_t - E_{t-1} \pi_t) + \varepsilon_t \tag{1}$$

Y_t = Log Output at period t

π_t = Inflation at period t

$E_{t-1} \pi_t$ = Expected inflation at period t-1

ε_t = Identically and Independently distributed error at period t with mean 0 and variance σ^2

$$L_t = \pi_t^2 + \lambda (Y_t - Y^*)^2 \tag{2}$$

Using equation (1), assuming rational expectations and minimising equation (2)[8], we obtain the optimal inflation rate under discretion (3), which also defines the expected losses under a policy of discretion (4).[9]

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6   This alternative works given three conditions: An infinite horizon, no changes in the trade off between inflation and output and full information.

7   The second one was developed by Walsh (1995).

8   For this part see the Mathematical Appendix.

9   This policy is followed when no "Commitment Technology" is available.

$$\pi_t^d = \alpha.\lambda Y^* - \alpha.\lambda\varepsilon_t \,/\, (1+\alpha.^2\lambda) \tag{3}$$

$$E_{t-1} L_t^d = \lambda \left\{ (1+\alpha.^2\lambda)Y^{*2} + \sigma^2/\,(1+\alpha.^2\lambda) \right\} \tag{4}$$

Even though the best alternative for the government would be to follow the inflation given by equation (5) (inflation under commitment), this inflation is not seen by the public since the random shock is not observable by them. This alternative is not applicable in practice because people would not be able to monitor it. The last choice is to follow a rule of no inflation (e.g. Inflation=0% (10), Expected Inflation=0%), which will give expected losses shown in equation (6).

$$\pi_t^c = \alpha.\lambda\varepsilon_t \,/\, (1+\alpha.^2\lambda) \tag{5}$$

$$E_{t-1} L_t^r = \lambda \left\{ Y^{*2} + \sigma^2 \right\} \tag{6}$$

Hence, comparing the two applicable alternatives with the expected losses (expected losses under a discretionary regime and expected losses under a rule of zero inflation), the government will prefer discretion instead of following the rule of zero inflation when:

$$Y^* < \sigma^2/\,(1+\alpha.^2\lambda) \;^{10}$$

However, if the government appoints a central bank (delegation) that cares a less than infinite amount about inflation, the new loss function will be given by (7) based on which, if we follow the same procedure as explained before, we obtain an inflation given by (8).

$$L_t^{CB} = \pi_t^2 + \mu(Y_t - Y^*)^2 \tag{7}$$

Assume $\mu < \lambda$, therefore the central bank is less concerned than the government about the stabilisation target.

$$\pi_t^{CB} = \alpha.\mu Y^* - \alpha.\mu\varepsilon_t \,/\, (1+\alpha.^2\lambda) \tag{8}$$

As we saw, commitment is impossible to attain, so we should compare the result of inflation under delegation (8) with the inflation under a discretionary regime (3), being:

$$\mu < \lambda \;^{11}$$

It is clear that the central bank will get a better result in terms of inflation. Finally, based on equation (9), it is easy to conclude that μ must lie between 0 an λ.

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10 When this inequality holds there is an incentive for the government to follow a discretionary policy and therefore have inflation higher than 0%. That means an inflationary bias and consequently Time Inconsistency appears.

11 Where μ and λ represent the emphasis given by the Central Bank and the Government to the stabilisation target against the inflation target.

Expected Losses under Delegation to a Central Bank

$$E_{t-1} L_t^{CB} = (\lambda + \alpha^2 \mu^2) Y^{*2} + (\lambda + \alpha^2 \mu^2) \sigma^2 / (1 + \alpha^2 \mu) \} \qquad (9)$$

Taking the first derivative of (9) with respect to μ,

$$\partial E_{t-1} L_t^{CB} / \partial \mu = 2\mu\alpha^2 Y^{*2} + 2\alpha^2(\mu - \lambda)\sigma^2 / (1 + \alpha^2 \mu)^3$$

Calculating $\partial E_{t-1} L_t^{CB} / \partial \mu$ either when $\mu = 0$ (central bank is not concerned about stabilisation) or when $\mu = \lambda$ (central bank is as concerned as the government about stabilisation), we can obtain the following results:

$$\partial E_{t-1} L_t^{CB} / \partial \mu \big|_{\mu=0} = -2\alpha^2 \lambda \sigma^2 < 0$$

$$\partial E_{t-1} L_t^{CB} / \partial \mu \big|_{\mu=\lambda} = -2\alpha^2 \lambda \sigma^2 / (1 + \alpha^2 \mu)^3 > 0$$

In the first case the derivative is decreasing and in the other case it is increasing, therefore the optimal point should be between these two points, implying the importance of a conservative central bank.[12]

III. MEASURING CENTRAL BANK INDEPENDENCE: THE CASE OF COLOMBIA 1923-1998

a. Indices of central bank independence

The first attempt to calculate an index of central bank independence was done by Bade and Parkin (1982). However, several single and multi-country cases studies were done in the 70's and 80s. Bade and Parkin constructed a (1-4) scale for twelve countries based on "political independence" of the central bank. The index focused on three features:

1. The relationship between central banks and government in the formulation of monetary policy.

2. The procedures for appointing the board of the central bank.

3. The financial and budgetary relations between the central bank and the government.

Their conclusion was that central banks with a higher degree of independence deliver a lower rate of inflation. Appendix (Table 1) summarises their criteria.

Alesina (1988) added more countries and went beyond this first attempt by relating political independence to the institutional relationship between the central bank and the executive. He also concluded that there is an inverse relationship between central

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12 Walsh (1995) says that Waller (1992) proves that under non-homogeneous preferences in the economy as the ones used by Rogoff (1985) it may not always be optimal to appoint a conservative central banker.

bank independence and the average inflation rate.[13] Grilli, Masciandaro and Tabellini (1991) developed an index for eighteen industrial countries focusing on the political and economic independence of the central bank. Their political criteria was determined by:

1.   The relationship between central banks and governments in the formulation of monetary policy.

2.   The procedures for appointing the central bank board of directors.

3.   The responsibility of the central bank with respect to monetary policy.

Appendix (Table 2) summarises their questions.[14] They also calculated an economic index of central bank independence. It described two main issues: the influence of the government in determining how much to borrow from the central bank and the nature of monetary instruments under the control of the central bank. Appendix (Table 3) presents the main questions.

Eijffinger and Shaling (1993b) produced another index based on the ability of the central bank to choose the final goals of monetary policy. They focused on the procedures for appointing the board of directors of the central bank, the relationship between the central bank and the government in the formulation of monetary policy and the formal responsabilities of the central bank with respect to monetary policy. Appendix (Table 4) summarises the possible types of central banks. This one is similar to the Bade-Parkin index except that it does not weight the first attribute (Bank Final Policy Authority) equally with the other ones. It considers three scenarios: when the bank is the only final authority in monetary policy (b); when the government is the only final authority (g); or when both share this task (b/g).[15]

Finally, Cukierman (1992b) developed measures of legal independence for a wider range of countries covering the period 1950-1989. He used four criteria:

1.   The procedures for appointment, dismissal and term of the office of the bank´s Chief Executive Officer.

2.   Policy formulation, including how to solve conflicts between the executive branch and participation of the central bank in the budget process.

3.   The objectives of the central bank.

4.   Limitations on the ability of the central bank to lend to the public sector.

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13 Schaling (1995) criticises this criterion saying it is internally inconsistent and is not useful as an index of central bank independence. It will not be used in this paper.

14 Alesina and Summers (1993) have an index which is an average of the Bade and Parkin and the Grilli Masciandaro and Tabellini index. Their results are consistent with the ones obtained with previous indices.

15 Shaling (1995) calculates a relationship between the following indexes: Eijffinger- Shaling (ES), Bade Parkin (BP) and the political index of Grilli, Masciadaro and Tabellini (GMT). The relation is ES-GMT=(ES-BP)+(BP-GMT)

Appendix (Table 5) summarises the points assigned in each case and the way to weight each answer. In addition Cukierman, Webb and Neyapti (1992) developed an index using the turnover rate of central bank governors as a measure of central bank independence (assuming that a more rapid turnover means a lower level of independence). In both cases they found evidence that legal independence is an important and statistically significant determinant of price stability among industrial countries but not among developing countries. However, using the turnover index they found it was an approximate measure of central bank independence in developing countries.

Cukierman, Webb and Nayapti (1992) and Pal (1993) proved how the relation between legal indexes of central bank independence and inflation in developing countries could fail due to a clear difference between real independence and legal independence[16]. In order to test this hypothesis, it used data developed by The Economist Intelligence Unit for the period 1990 to 1996 and completed the analysis developed by Cukierman (1992b) and Siklos(1994). It also used indices of central bank independence for the 80's obtained by Cukierman and the new indices obtained by Siklos (1994) for South American countries in the 90's. These include changes in central bank independence in sample countries starting in the early 90s. Finally, this paper used a new index for Colombia. A cross-country regression analysis was developed relating central bank independence and average inflation.[17] The results provide evidence that these indices cannot explain the reduction in inflation in these countries. The scatter plot did not show any clear relationship.

b. Describing central bank independence in Colombia. 1924-1998

Walsh (1996) points out that the traditional way of measuring central bank independence (i.e. cross-country correlations) cannot control for country-specific fixed effects that may be related both to central bank structure and to economic outcomes. He concludes that this separation is critical to draw conclusions about the desirability of central banking reforms aimed at increasing independence. The solution is to have data from periods with different central bank structures. The case of Colombia allows us to define 4 different periods of central bank independence. Meisel (1996) identifies them according to the legislation as:

1923-1951: The Central Bank of Colombia was founded in 1923. It was designed by Edwin Kemmerer (Professor at Princeton), following the model of the Federal Reserve in the United States. The Bank was granted a monopoly of issue for twenty years with the notes being convertible into gold. Its notes became legal tender. Its main objective was to preserve price stability by maintaining the gold standard. Its

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16 Siklos (1994) thinks also that legal indexes when aggregating too many features of central bank legislation, can add very little to understand the problem. Bananian (**1995**) proves that by using only one part of the index it can perform better than by using the detailed index.

17 It used the index of inflation developed by Cukierman (1992b) which is D= inflation/(1-inflation).

shareholders were the government, private domestic banks, foreign commercial banks and the general public. All of them were represented on the board, which had 9 members, of which only 3 represented the government. The central bank also became subject to a limit on the amount it could lend to the government (30% of its capital). Monetary policy was endogenous and prices were determined by the relationship with other countries during this period. In addition, Colombia kept the gold standard and a fixed exchange rate, except for the period 1933-1935. The bank could receive deposits from commercial banks. The result was a bank with mixed ownership (government, private banks and public), with relative autonomy and an orthodox monetary policy.

1951-1963: This period starts with two problems: political turmoil and a huge amount of foreign reserves which had increased prices via monetarisation. In addition, commercial banks with representation in the Central Bank board kept fixed discount rates and stimulated the private sector to increase its debts to the Central Bank. Rising inflation and fixed exchange rates generated profits for them. In 1951 there was a reform in the Central Bank charter, intended to involve the bank in the promotion of economic development via the granting of subsidised loans. This charter stated that the board of the Central Bank, with the favourable vote of the Finance Minister (who was appointed to this board) could approve modifications in monetary policy. The result was a loose monetary policy and an appreciation in the real exchange rate, which afterwards yielded a massive devaluation of the currency. This characterises the heterodoxy of the Central Bank for this period.

1963-1991: In 1963, following the example set by other countries in Latin America, a monetary board, the Junta Monetaria, was created. It was made the supreme authority on monetary policy and the external value of the currency. Its members were the governor of the central bank and three government ministers. In 1973 the central bank was nationalised but the Junta Monetaria kept its strength. The result for this period is a heterodox and dependent central bank.

1991-1998: In the late 80s the Colombian economy started a process of modernisation and openness. Following similar experiences in Latin America, the new Colombian constitution introduced the idea of a central bank responsible only for price stability and maintaining the purchasing power of the currency. Seven members make up the Board of Directors, one of whom is the Minister of Finance. The President nominates the other members. He is not allowed to nominate more than two per term. In addition, any loan to the government requires the unanimous approval of the board. We could characterise this period as an orthodox and independent central bank

c.   Measuring central bank independence in Colombia. 1924-1998

Central bank independence for each period can be measured using the indexes given in part a). The charters for each period were checked and the Bade and Parkin, Grilli, Eijffinger and Cukierman procedures were applied. Tables 6, 7, 8, 9 and 10 summarise the results.

TABLE 6
Results of applying Bade-Parkin index to the Colombian case 1923-1998

Period of Time	Bank is Final Policy Authority	No Government Oficial on Bank Board	Some Board Appointments Independent from Government	CBI Index
1923-1951	*1)	—2)	*	2
1951-1963	—	—	*	1 3)
1963-1991	—	—	—	0
1991-1998	*	—	*	2

1) Meisel (1990) points out that the main policy of the central bank was to direct monetary policy, being the final authority. However for Bade and Parkin this kind of central bank does not exist for their sample.
2) The government takes part because it is shareholder of the new central bank. However it only appoints 3 of the 9 members of the board.
3) In this period the monetary policy is not the only main policy of the central bank, since it has a pro-development policy.

TABLE 7
Results of applying Grilli, Masciandaro and Tabellini political index to the Colombian case 1923-1998

(Answers to Appendix (Table 2))									
Period	1	2	3	4	5	6	7	8	CBI Index
1923-1951	*	—	—	—	—	*	*	—	3 1)
1951-1963	*	—	—	—	—	—	—	—	1 2)
1963-1991	—	—	—	—	—	—	—	—	0
1991-1998	*	—	—	—	—	*	*	—	3 3)

1) The governor is elected by the board. This board was elected for a period of one year and with a majority, could define monetary policy.
2) The power of the central bank is lessened and is not clear in cases of conflict.
3) The governor is nominated by the board, and the central bank recovers its strength in cases where there are conflicts in monetary policy.

TABLE 8
Results of applying Eijffinger- Shaling index to the Colombian case 1923-1998

Period of Time	Bank is Final Policy Authority	No Government Oficial on Bank Board	Some Board Appointments Independent from Government	CBI Index
1923-1951	**(b)	—	*	3
1951-1963	*(b/g)	—	*	2
1963-1991	—	—	—	0
1991-1998	**(b)	—	*	3 [1]

1) In this case the central bank is the authority in monetary policy. In addition, even though the President elects two of the members of the central bank, they do not represent more than 11/21 of the Board.

TABLE 9
Results of applying Cukierman index to the Colombian case 1923-1998

Concept (See Appendix Table 5)	1923-1951	1951-1963	1963-1991	1991-1998
1.a	0	0	0	0.25
1.b	1	1	0.75	1
1.c	0.67	0.67	0.83	0.83
1.d	1	1	0	1
2.a	1	0.67	0	1
2.b	1	0.8	0.2	0.8
2.c	0	0	0	0
3	1	0.4	0	0.8
4.a.	0.67	0.33	0	0
4.b	0.67	0.67	0.67	0
4.c	1	1	0.33	1
4.d	0	0	0	1
4.e	0.67	0.67	0.67	1
4.f	1	1	0.67	0
4.g	0.25	0.25	0.25	0.25
4.h	0	0	0	0
CBI INDEX	0.699	0.5315	0.27 [1]	0.54525 [2]

1) The index for this period is calculated by Cukierman (1992b)
2) The index for this period is calculated by the General Secretary of the Colombian Central Bank and included in Junguito (1993)

TABLE 10
Results of applying Grilli, Mascianaro and Tabellini economic index to the Colombian case 1923-1998
(Answers to Appendix (Table 3))

Period	1	2	3	4	5	6	7	CBI Index
1923-1951	*	—	*	*	—	*	**	6 [1]
1951-1963	—	—	—	*	—	—	**	3 [2]
1963-1991	—	—	—	—	—	—	**	2 [3]
1991-1998	*	—	—	—	—	*	**	4 [4]

1) The central bank was not entrusted with the supervision. According to Kalnims (1963) it was entrusted to define the discount rate. Finally, it had the opportunity to give direct credit to the government but according to Ibañez (1990) with restrictions in quantities and time.
2) The change introduced in this period according to Kalnims (1963) allowed the government to establish interest rates, terms, period and amounts (because it only needed the favourable vote of the Finance Minister) for credits to the private sector. In addition the new rules included the ability of the government to have automatic resources up to a certain amount and with a fixed rate. The central bank could participate in the primary market in order to sell government liabilities.
3) The central bank lost its independence and its role, becoming only executor of the policies defined by the government.
4) The central bank, according to Gaviria (1991) can intervene in the secondary market negotiating public debt. Junguito (1993) points out that the ability of the central bank to intervene by buying public debt titles in the market implies a loophole in the legislation against price stability. Finally he also thinks that establishing unanimity when giving money to the government, avoids the need to have precise limits.

The first period had the highest level of legal independence while the third one is the one with the lowest level of independence. The fourth period has also an important level of central bank independence. Finally the turnover rates of the central bank Governor for the periods considered were also measured (table 11). This table can explain that in the second period the legal level of independence did not result in real independence due to a large turnover rate in the board of directors. However, the index by itself is not conclusive for the Colombian case.

TABLE 11
Results of applying Cukierman turnover rate of the central bank governor index to the Colombian case 1923-1998

Period	1923-1949	1950-1963	1963-1991	1991-1998
Proxy CBI	0.11	0.29	0.14	0.14

d. Inflation and central bank independence in Colombia. 1924-1998

As Cukierman (1997) proves, there is a negative relationship between the mean and variance of inflation and the legal independence measures[18]. In the case of Colombia the lowest levels of central bank independence are associated with higher level of inflation and higher variability with only two exceptions (Table 12).

In terms of level of inflation, it increased for the second and third period (the ones with the lower level of central bank independence), but it has not decreased for the last period (1991-1998) which has a clearly independent bank[19]. Results suggest that the first period is the one with the highest variability of inflation in spite of its high level of central bank independence. This can be explained as a result of the economic crisis in 1929, which yielded negative growth in prices altering the trend. Excluding the effect of this period (1929-1932), we can obtain a coefficient of variation of 76%, which is less than the one registered for the next period. Therefore, the introduction of central bank independence reduced the variability of inflation. In the third period the variability is even lower than in the first period. This fact could be explained as a result of a trade-off between the public and private sector described by Carrasquilla (1996) according to which there was a tacit agreement to reduce inflation variability. Finally, the variability for the last period is the smallest in the Colombian history of inflation but the level of inflation is not the expected one.[20] Some reasons will be given in the following section to explain this fact.

TABLE 12
Mean and standard deviation of inflation in each of the periods
of the central bank history of Colombia[1]

Period	1923-1949 [1]	1950-1963	1963-1991	1991-1998
Mean	8.85	9.06	20.12	21.7
Standard deviation	6.78	7.58	7.39	3.3
Coefficient of variation	76.6%	83.7%	38%	15.2%

1) Series obtained from the Central Bank of Colombia. "Revista del Banco de la República".
Several numbers

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18 Grilli, Masciandaro and Tabellini (1991), Cukierman (1992b), Alesina and Summers (1993) and Debelle and Fischer (1994) developed similar procedures for developed countries finding similar results.

19 Femández R. (1997) points out this result as an unsatisfactory result. He explains it saying that the economy is not prepared to pay a rapid reduction on inflation.

20 Eijffinger (1996) following Alesina (1988), Havrislesky (1987) and Tabellini (1989), states that if monetary authorities are dominated by elected politicians inflation variability may be high. With the new constitution Colombia has avoided this problem for the Central Bank governor, therefore this could be one of the reasons explaining low variability in the last 8 years.

e. Explaining inflation and central bank independence in Colombia. 1970-1998

The following hypothesis is put forward to explain why the evidence and the theory do not agree for the Colombian case for the last period 1991 to 1998:

1. Swinborne and Castello Branco (1991), Mass (1995), Eijffinger and Shaling (1996b) call our attention to the reliability of the empirical results obtained by the inverse relationship between central bank independence indices and inflation. They think that these studies, when correlating indices and macro variables, are sensitive to numerical values of indices. To avoid this problem for the last period, this paper will evaluate the response of the money market rate with respect to inflation, current account surplus and fiscal deficit with respect to growth [21]. The model proposed by Eijffinger and Shaling (1996b)[22] was used with time series from 1970 until 1996[23] and covering two periods (1972-1990) and (1991-1996). A Chow Test of structural change in 1990 was applied.[24] The results obtained were[25]:

$$\Delta MMR_t = 2.55 + 0.243.D1\pi_t{}^{26} + 1.32DFG_{t-2} - 0.35.CASG_t$$

$$** \qquad\qquad ** \qquad\qquad ** \qquad\qquad **$$

$$R^2 \text{Adjusted} = 0.49$$

$$**\text{Significant with } 10\% \text{ level}$$

The results, although not conclusive in terms of fully explaining the reaction function, show a structural change. The Chow Test is accepted with 10% of significance. Therefore this result confirms the existence of a structural change in the monetary policy in 1990 using different procedures than the traditional indices of the central bank independence approach. However the results cannot explain why it has not been sufficiently efficient in the reduction of inflation.

2. Swinborn and Castello-Branco (1991) argue that central bank independence is not real when the central bank has multiple macroeconomic objectives such as price

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21 Following Eijffinger (1993), in order to use OLS one must assume the error term to be independently and identically distributed random variable with mean zero and variance δ^2. In addition the error term is independent of the regressors. When the F and t statistics are used the error term is assumed to be normally distributed.

22 They follow the procedure developed by Koskela and Viren (1991). There are other procedures applied in a similar fashion. Syklos (1994) developed this procedure for South American countries, using money growth as the dependent variable and he did not find any conclusive result for Colombia. However, the criticism of this procedure invokes problems of simultaneity and instability. Johnson and Syklos (1994) review the econometric problems and propose a more structural approach allowing for the possibility that temporal instability is a feature of the data. Cukierman (1997) says that evidence using this procedure is scarce and confused.

23 Data is obtained from different numbers of the central bank statistics magazine "Revista del Banco de la Republica".

24 According to Greene (1997) this test is very useful when having data series not long enough to estimate them separately for a structural change.

25 For the description of the variables, see the Mathematical Appendix (Letter S).

26 The first difference is used so as to avoid non-stationarity with this variable.

stability, growth, employment and balance of payments. They also point out that intervention in both money and foreign exchange markets can be used to achieve either exchange rate or monetary policy goals. If the central bank is keeping price stability, the government must be prepared to give up other exchange rate objectives. Exchange rate policy is under the control of the central bank in Colombia. However, even in the case of conflict with monetary policy, price stability has not been attained first. In the face of large foreign capital inflows the central bank has kept low interest rates levels, perhaps avoiding future additional capital inflows but also generating excessive demand and leading to inflation. In this way they avoid conflicts with the government in terms of not promoting conditions for growth.[27]

3. Canzoneri (1996) proves that a central bank is functionally independent if it is operating in a monetary dominant regime, in which the central bank can control the price level directly. But in a fiscal dominant regime the central bank loses control of the price level to the swings in fiscal policy. During the last three years the fiscal deficit has increased significantly[28]. This situation, as pointed out by Mass (1995) can lead the government to engage in games of "chicken" whereby one's actions are undertaken to force actions or provoke reactions by other.[29] This can lessen the degree of independence of the central bank. Additionally, if the government is financed by external capital the last explanation is again reinforced.[30] Herrera (1997) points out that the government is leading the country to "Ponzi Games". The growth of internal and external debt was between 1994 and 1996 of 9,5%, while real interest rates were 8% and the growth of the economy 4%. Therefore the condition of stability of debt is not fulfilled and central bank independence is not a sufficient policy to reduce inflation.

4. Issing (1993) points out that central bank independence has to be treated according to experience as a necessary but not sufficient condition to ensure the maintenance of the value of the money. It is impossible to believe that transferring this task to an independent institution will immediately reduce the effects of excessive demands. Therefore, other external problems such as the changes in climate or political instability could be also reasons for the higher levels of inflation.

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27 Junguito (1993) points out that it is not clear if the policy of interest rates has been used to avoid capital inflows and reduce inflation or to promote growth even accepting higher levels of inflation. Using a model of Giavazzi and Pagano, Junguito and Vargas (1997) conclude that having an independent central bank is advantageous if it has responsability for both the monetary and the exchange rate policy.

28 Ocampo, former Minister of Finance in Colombia (1997) concludes that the government deficit continues increasing and that it is a structural problem, which requires even legal transformations. Similar remarks come from Herrera (1997) and Caballero (1998). The former also says that the fiscal deficit is pressing an appreciation of the currency.

29 Alesina (1988) proves that this kind of game leads to suboptimal outcomes. He describes a situation where the government pursues an expansionary policy to test how the central bank is going to persist with an unaccomodative monetary stance. The central bank responds with a restrictive monetary policy to force the government to change it's policy.

30 Junguito (1995) says that when the government can finance its deficit with external resources, although the central bank can compensate the fiscal situation with monetary and exchange rate policies, its action could be costly. The success depends on its ability to influence government fiscal behaviour.

IV. CONCLUSIONS

This paper has considered the topic of central bank independence for the case of Colombia. It initially developed a theoretical framework concerning central bank independence and inflation. The paper concluded that central bank independence is an important feature for reducing inflation and partially solving the problem of time inconsistency, assuming the existence of a monetary dominant regime.

Colombia had an initial experience with an independent central bank from 1923 to 1950. After this, due to changes in the legislation, Colombia followed the path of a central bank dependant on the government (1951-1991). In 1991, as the economy was being opened up, Colombia changed its constitution and now has one of the most independent central banks in the world, according to the legal indices proposed by theory.

This paper found that central bank independence has led to a reduction in inflation and its variability. However, the results for inflation in the last period have not been so impressive. Given the lack of information available to develop more complex procedures some alternative hypothesis for this situation was given:

1. The legal level of independence according to the new legislation is different to the real level of independence.

2. The central bank, being responsible for the exchange rate since 1991, faces a dilemma: To keep low interest rates and avoid co-ordination problems with the government in terms of growth policy or increase interest rates to restrict monetary growth.

3. The central bank is facing an increasing amount of capital inflows that threaten price stability. Additionally, the government faces an increasing fiscal deficit, financed either with external credit or with privatisations. This also threatens price stability[31].

4. This is the result of sharing multiple macroeconomic objectives, which in the case of Colombia, has determined that real central bank independence is less than legal independence for the last 8 years. This could explain the apparent flaw in the theory of the relationship between central bank independence and reduction in inflation.

5. Colombia needs to control its structural fiscal deficit. Otherwise it could end in a Fiscal Dominant regime, which according to theory, could lead to higher levels of inflation even under tightening monetary policy. As Sargent and Wallace (1981) pointed out, tight money lowers current inflation at the expense of bringing nearer the day when debt credibility collapses and more rapid inflation appears.

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31   Mass (1995) has an interesting proposal. It consists of an Independent Fiscal Board , analogous to an independent Central Bank. It could determine the size of the budget deficit while the government decides the composition of revenues and expenditures. This reduces the discretion of the government in fiscal policy. He thinks that it is more likely to force discipline on fiscal policy directly rather than indirectly through monetary policy. Debelle and Fischer (1994) show inflation tends to be higher when the fiscal authority makes its decision before the Central Bank.

APPENDIX

TABLE 1 Bade – Parkin criteria of central bank independence					
BANK IS FINAL POLICY AUTHORITY	NO GOVERNMENT OFICIAL ON BANK BOARD	SOME BOARD APPOINTMENTS INDEPENDENT OF GOVERNMENT¹	POTENTIAL CENTRAL BANK TYPE²	EXISTS	TYPE
—	—	*	(A)	NO	—
—	*	*	(B)	NO	—
*	—	*	(C)	NO	—
*	—	—	(D)	NO	—
—	—	—	(E)	YES	1
—	*	—	(F)	YES	2
*	*	—	(G)	YES	3
*	*	*	(H)	YES	4

1. Operationalized as *proportion of members* not appointed directly or indirectly by the government. It has to be ≥ 11/21.
2. Only the last four types of central bank exist. Type 4 Central Banks are more independent than Type 1.

TABLE 2 Political independence of central bank by Grilli, Masciandro and Tabellini
1. Is the governor not appointed by the government?
2. Is the governor appointed for more than five years?
3. Are all board members not appointed by the government?³
4. Is the board appointed for more than five years?
5. Is there no mandatory participation of a government representative in the board?
6. Is there no government approval of monetary policy required?⁴
7. Are there any statutory requirements that the bank pursues monetary stability as one of its goals?
8. Are there legal provisions that strengthen the bank's position in the case of conflicts with the government?

3. This question is comparable with the third Bade Parkin criteria.
4. This question is comparable with the first criteria of Bade-Parkin

TABLE 3
Economic independence of central bank by Grilli, Masciandro and Tabellini[5]

1. Is the direct credit facility not automatic?

2. Is the direct credit facility subject to a market interest rate?

3. Is the direct credit facility temporary?

4. Is the direct credit facility subject to a limited amount?

5. Is the Central Bank not participating in the primary market for public debt?

6. Is the Discount rate set by the Central Bank

7. Is Banking Supervision not entrusted to the Central Bank?

5. In this index each topic counts for one point.

TABLE 4
Eijffinger – Shaling political criteria of central bank independence

BANK IS FINAL POLICY AUTHORITY	NO GOVERNMENT OFICIAL ON BANK BOARD	SOME BOARD APPOINTMENTS INDEPENDENT OF GOVERNMENT	POTENTIAL CENTRAL BANK TYPE	EXISTS	TYPE
—(g)	——	*	(A)	NO	—
—(g)	*	*	(B)	NO	—
**(b)	——	*	(C)	NO	—
**(b)	——	——	(D)	NO	—
*(b/g)	——	——	(E)	YES	—
*(b/g)	*	*	(F)	YES	—
*(b/g)	——	*	(G)	YES	—
—(g)	——	——	(H)	YES	1
—(g)	*	——	(I)	YES	2
*(b/g)	*	——	(J)	YES	3
**(b)	*	——	(K)	YES	4
**(b)	*	*	(L)	YES	5

TABLE 5
Cukierman legal measure of central bank independence

VARIABLE NUMBER	DESCRIPTION OF THE VARIABLE	WEIGHT	NUMERAL CODING
1.	Chief Executive Officer (CEO)	0.2	
	a. Term of office		1.00
	Over 8 years		0.75
	6 to 8 years		0.50
	5 years		0.25
	b. Who appoints CEO ?		
	Board of Central Bank		1.00
	Council of Members from the Central		
	Bank, legislature and executive		0.75
	Legislature		0.50
	Executive branch collectively		0.25
	One or two members of the executive		
	branch		0.00
	c. Dismissal		
	No provision for dismissal		1.00
	Only for reasons not related to Monetary Policy		0.83
	At the discretion of the Central Bank Board		0.67
	At legislature's discretion		0.50
	Unconditional dismissal possible at legislature's		
	discretion		0.33
	At executive's discretion		0.17
	Unconditional dismissal possible at executive's		
	discretion		0.00
	d. May CEO hold other offices in the government?		
	No		1.00
	Only with permission of the executive		0.50
	No rule against CEO holding another office		0.00
2.	Policy Formation	0.15	
	a. Who formulates the monetary policy?		
	Bank Alone		1.00
	Bank participates with government		0.67
	Bank Advises government		0.33
	Bank has no say		0.00
	b. Resolution of conflict		
	Bank has the final authority on issues that are		
	clearly defined in the law as its objectives		1.00
	Government has priority or final word		
	only on policy issues that have not		

(Continued Table 5)

VARIABLE NUMBER	DESCRIPTION OF THE VARIABLE	WEIGHT	NUMERAL CODING
	been clearly defined as the bank's goals or in case of conflict within the bank A council of the Central Bank, executive branch and legislative branch makes the final decision		0.80
	in case of conflict		0.60
	Legislature has the final word on policy issues		0.40
	Executive branch has the final word on policy issues subject to due process and possible protest by the bank		0.20
	Unconditional priority of executive branch in policy decisions		0.00
	c. Role in the government's budgetary process		
	Central Bank Active		1.00
	Central Bank has no influence	.	0.00
	At the discretion of the Central Bank Board		0.67
	At legislature´s discretion		0.50
	Unconditional dismissal possible at legislature's discretion		0.33
	At executive's discretion		0.17
	Unconditional dismissal possible at executive's discretion		0.00
3.	Objectives	0.15	
	Price Stability is the only major goal, and the Central Bank has the final word in favour of price stability in case of a conflict with other government goals		1.00
	Price stability is the only goal		0.80
	Price stability is one goal, with other compatible objectives		0.60
	Price stability is one goal, with potentially conflicting goals		0.40
	No objectives stated in the bank charter		0.20
	Stated goals do not include price stability		0.00
4.	Limitations on Lending to the government		
	a. Advances (Limitations on nonsecuritized lending)	0.15	
	No advances permitted		1.00
	Advances permitted but with strict limits		0.67
	Advances permitted, with loose limits		0.33
	No legal limits on lending		0.00

(Continues)

(Continued Table 5)

VARIABLE NUMBER	DESCRIPTION OF THE VARIABLE	WEIGHT	NUMERAL CODING
	b. Securitized Lending	0.10	
	Not permitted		1.00
	Permitted but with strict limits		0.67
	Permitted, with loose limits		0.33
	No legal limits on lending		0.00
	c. Terms of Lending	0.10	
	Controlled by the bank		1.00
	Specified by the bank charter		0.67
	Agreed between the central		
	bank and executive Branch		0.33
	Decided by the executive branch alone		0.00
	d. Potential borrowers from the bank	0.05	
	Only the central Government		1.00
	All levels of government		
	(state as well as Central)		0.67
	Those mentioned above and public		
	Enterprises		0.33
	Public and Private Sector		0.00
	e. The limits on central bank lending are		
	determined by	0.025	
	Currency amounts		1.00
	Central Bank demand liabilities or capital		0.67
	Government revenue		0.33
	Expenditures		0.00
	f. Maturity of loans	0.025	
	Within 6 months		1.00
	Within 1 year		0.67
	More than one year		0.33
	No mention of maturity in the law		0.00
	f. Interest rates on loans must be	0.025	
	Above minimum rates		1.00
	At market rates		0.75
	Below maximum rates		0.50
	Interest rate is not mentioned		0.25
	No interest on government		
	borrowing from the central bank		0.00
	g. Is the Central Bank prohibited		
	from buying or selling government		
	securities in the primary market?	0.025	
	Yes		1.00
	No		0.00

MATHEMATICAL APPENDIX

A. $Y_t = \alpha.(\pi_t - E_{t-1}\pi_t) + \varepsilon_t$

Y_t = Log Output at period t

π_t = Inflation at period t

$E_{t-1}\pi_t$ = Expected inflation at period t-1

ε_t = Identically and Independently distributed error at period t whit mean 0 and variance σ^2

B. $L_t = \pi_t^2 + \lambda\,(Y_t - Y^*)^2$

L_t = Loss Function of the Government

C.   Minimise $\pi_t^2 + \lambda\,((\alpha.(\pi_t - E_{t-1}\pi_t) + \varepsilon_t) - Y^*)^2$

$\{\pi_t\}$

D.   First Order Condition:

$(1+\lambda\alpha^2)\,\pi_t = \alpha.^2\lambda E_{t-1}\pi_t + \alpha.\lambda(Y^* - \varepsilon_t)$

E.   Obtaining Expectations over (D)

$E_{t-1}\pi_t = \alpha.\lambda Y^*$

F.   Assuming Rational Expectations we obtain **Inflation under Discretion** (Replacing (E) in (D))

$\pi_t^d = \alpha.\lambda Y^* - \alpha.\lambda\varepsilon_t / (1+\alpha.^2\lambda)$

G.   Losses when **Inflation under Discretion** - Replacing (F) and (E) into (A) and (B)

$L_t = \lambda\,\{\,(\varepsilon_t^2/(1+\alpha.^2\lambda))^2 - (2\varepsilon_t Y^*/ (1+\alpha.^2\lambda)) + Y^{*2}\,\}$

H.   Taking expectations of (G) we obtain the **Expected Losses under discretion**

$E_{t-1}L_t^d = \lambda\,\{\,(1+\alpha.^2\lambda)Y^{*2} + \sigma^2/ (1+\alpha.^2\lambda)\,\}$

I.   **Inflation under Commitment**

$\pi_t^c = \alpha.\lambda\varepsilon_t / (1+\alpha.^2\lambda)$

J.   **Inflation under following a rule of no inflation**

$$\pi_t^r = 0$$

K.   Losses when **Inflation under rule of no inflation** - Replacing (J) into (A) and (B)

$$L_t^r = \lambda \{ \varepsilon_t^2 - 2\varepsilon_t Y^* + Y^{*2} \}$$

L.   Taking expectations of (K) we obtain the **Expected inflation under rule of no inflation**

$$E_{t-1} L_t^r = \lambda \{ Y^{*2} + \sigma^2 \}$$

M.   New loss function for the Central Bank (Delegation)

$$L_t^{CB} = \pi_t^2 + \mu(Y_t - Y^*)^2$$

$$L_t^{CB} = \text{Loss Function of the Central Bank}$$

Assume $\mu < \lambda$, therefore the Central Bank is less concerned than the government about the stabilisation target.

N.   Minimise $\pi_t^2 + \mu ((\alpha.(\pi_t - E_{t-1} \pi_t) + \varepsilon_t) - Y^*)^2$

$$\{\pi_t\}$$

O.   First Order Condition:

$$(1 + \mu\alpha^2) \pi_t = \alpha^2 \mu E_{t-1} \pi_t + \alpha.\mu(Y^* - \varepsilon_t)$$

P.   Taking Expectations over (O)

$$E_{t-1} \pi_t = \alpha.\mu Y^*$$

Q.   Assuming Rational Expectations we obtain **Inflation under Delegation to the Central Bank** (Replacing (P) in (O))

$$\pi_t^{CB} = \alpha.\mu Y^* - \alpha.\mu\varepsilon_t / (1 + \alpha^2\lambda)$$

R.   **Expected Losses under Delegation under Central Bank**

$$E_{t-1} L_t^{CB} = (\lambda + \alpha^2\mu^2)Y^{*2} + (\lambda + \alpha^2\mu^2)\sigma^2 / (1 + \alpha^2\mu) \}$$

Taking first derivative of (R) with respect to μ,

$$\partial E_{t-1} L_t^{CB}/\partial\mu = 2\mu\alpha^2 Y^{*2} + 2\alpha^2(\mu - \lambda)\sigma^2 / (1 + \alpha^2\mu)^3$$

Calculating $\partial\,E_{t\text{-}1}\,L_t^{CB}/\partial\mu$ either when $\mu{=}0$ (Central bank is not concerned about stabilisation) or when $\mu{=}\lambda$ (Central Bank is as concerned as the government about stabilisation). We can obtain the following results:

$$\partial\,E_{t\text{-}1}\,L_t^{CB}/\partial\mu\,\Big|_{\mu=0} = -2\alpha^2\lambda\sigma^2 < 0$$

$$\partial\,E_{t\text{-}1}\,L_t^{CB}/\partial\mu\,\Big|_{\mu=\lambda} = -2\alpha^2\lambda\sigma^2/\,(1+\alpha^2\mu)^3 > 0$$

S.   Reaction Function

$$\Delta MMR_t = C + a.\pi_t + b.GDPG_t + c.CASG_t + CBI$$

ΔMMR_t = Variation of the Money Market Rate at period t

$GDPG_t$ = Growht of GDP at period t

$CASG_t$ = Relation of Current Account Balance with respect to GDP at period t

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