

Central bank independence and its relationship to inflation

Helder Ferreira de Mendonça

This paper builds on earlier studies of central bank independence (CBI), making a comparison of the rankings of central banks for 15 countries through three different indices. The analysis reveals that there is no shared concept of CBI and that the indices are a measure of the inflation bias. The Brazilian case is used as an example, with the objective of examining the impact on inflation of an increase in independence over time, as measured by Cukierman's index. The findings indicate that CBI is a consequence of the conduct of monetary policy and that it is not an adequate framework for developing credibility.

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I

Introduction

Nowadays, central bank independence (CBI) is considered one of the main conditions for assuring low and stable inflation. This view is largely a consequence of the dissemination of the well-known empirical evidence that there is a negative correlation between inflation and CBI. Although the majority of empirical studies support this conclusion, the reliability and usefulness of CBI indices and the robustness of the previous studies have been questioned, especially since 1995.¹

In the same vein as the current literature on CBI, this paper analyses two major points. First, it discusses the quality of independence indices by comparing the three most popular independence measures in the literature, constructed by Alesina and Summers (1993), Cukierman, Webb and Neyapti (1992), and Grilli, Masciandaro and Tabellini (1991). Forder's suggestion (Forder, 1999) that one can hardly view the advocates of different concepts as supporting the same legislative policy proposals would confirm that there is no shared concept of what constitutes statutory independence.² Second, this paper points to a potential problem of endogeneity in the CBI indices. Both CBI and inflation may be related to a third factor, such as a society's aversion to inflation. Without controlling for the third factor, the relationship between CBI and inflation may be spurious (Posen, 1993). The present paper reiterates this criticism, arguing that CBI indices measure the degree of inflation bias in the economy and are therefore, by definition, negatively correlated with inflation. Further, it is observed that if CBI includes the issue of whether or not price stability is the main objective of the central bank, this may, in principle, lead to reverse causality, especially if the analysis is put in a time series perspective.

The analysis of a particular country is important for the literature concerning CBI because the majority of the empirical literature is a result of cross-sectional comparisons of economic outcomes. Thus, there is a

difficulty in evaluating the effects of institutional changes within a given country (Hutchison and Walsh, 1998). One way to determine whether the effort and the success of an economy in the quest for price stability is related to an increased degree of CBI is the selection of a country that has had success in reducing inflation. In this sense, a study of countries such as Australia, Canada, Finland, New Zealand, Sweden and the United Kingdom could be profitable. It takes less effort, however, to stabilize inflation in these economies than in developing countries. Furthermore, the literature concerning CBI indicates that in industrial countries, independence is systematically and inversely correlated to inflation. Thus, it is very probable that the selection of one of these industrialized countries will indicate a relationship between price stability and an increase in the degree of independence. In order to attempt to eliminate the possible tendency of bias in the analysis, the selection of a developing country is recommended. With this objective, Brazil was chosen for a case study.

In summary, this paper builds on earlier analyses of CBI, making a comparison of the rankings of central banks for 15 countries through three different indices. This study reveals that there is no shared concept of CBI, and that the indices are a measure of the inflation bias. Furthermore, with the objective of verifying the impact on inflation of an increase in independence over time, measured by Cukierman's index, the Brazilian case is used as an example.

This paper is organized as follows. Section II assesses previous empirical results reported in the literature. The third section analyses the quality of independence indices by comparing three measures. Section IV discusses the endogeneity of the CBI indices. Section V analyses the impact of CBI, the turnover of central bank governors and the interest rate on inflation in the Brazilian case. The final section offers some concluding comments.

¹ Berger, de Haan and Eijffinger (2001) list 35 papers (after 1995) that record a change in the empirical evidence on the consequences of CBI.

² The analysis, relative to the first point in this paper, is an upgrade in relation to the intuitive analysis offered by Forder (1999).

II

The origin of CBI measures: a brief review

The empirical analysis that supports the thesis of CBI is based on a negative correlation among several proxies for independent central banks and inflation.³ Several studies show a strong correlation between a higher degree of legal independence and a lower inflation rate for industrialized countries.

The main relationships found in the literature between CBI and the performance of the economy can be summarized in the following ways: (i) in industrial economies, legal independence and inflation have a strong negative correlation; (ii) in developing countries, there is no evident relationship between legal central bank independence and inflation; (iii) there is a positive correlation between political vulnerability of the central bank and the rate (or variation) of inflation; (iv) countries where the monetary authorities have announced their goals have been presenting lower inflation rates; (v) the legal CBI does not have a correlation with the real growth average;⁴ and (vi) central banks with a higher degree of autonomy do not finance deficits.⁵

One of the main problems in the analysis of the CBI proposal refers to the difficulty in evaluating the possible effects on the economy of an increased independence. In the search for a solution to this problem, two types of independence indices are used in the analysis: (i) legal independence indices, which denote the relationship between monetary policy and the laws that establish and define the power of the central banks; and (ii) the independence indices achieved by questionnaires (real independence indices)

that are based on judgements concerning the behaviour of the central bank.

The literature on independence recognizes that legal independence is a basic prerequisite to isolating the central bank from the influence of the political authorities. Thus, at first, the existence of legal independence is necessary in order to create an appropriate institutional environment capable of creating conditions so that a higher independence is attained by real independence indices.

The empirical analysis concerning the independence proposition was put in the spotlight between the second half of the 1980s and the beginning of the 1990s. The first authors who developed an index based on legal attributes for central banks were Bade and Parkin (1985) and Alesina (1989). These indices mainly take into account: (i) which authority controls the monetary policy; (ii) the presence or absence of government employees on the board of the central bank; and (iii) whether the government appoints the majority of the board members of the central bank.

In the 1990s, Grilli, Masciandaro and Tabellini (1991) elaborated a two-part index that was applied to the majority of the industrialized countries. The first part dealt with the independence of bank policies (existence of a procedure for appointing the board of the bank, and also the duration of their mandate and the presence of guidelines that incorporate the goal of monetary stability. The second referred to economic independence (existence of a maximum level, established by law, that the central bank may lend to the government, and whether the central bank is responsible for the supervision of the bank system).⁶

Following the same model developed by their predecessors, Eijffinger and Schalling (1993) built an index that encompasses: "(i) formal responsibility of CBs with regard to monetary policy; (ii) the relationship between the CB and government/parliament in the formulation of monetary policy; (iii) the procedures for the appointment of the board of a central bank" (Eijffinger and van Keulen, 1995, p. 51) The main difference in comparison to the previous cases is the

³ Several papers discuss this result, see Cukierman (1992); Cukierman, Webb and Neyapti (1992); Alesina and Summers (1993); Eijffinger and Schalling (1993); Posen (1993); Eijffinger and van Keulen (1995).

⁴ Although the empirical evidence in the literature does not support the idea that CBI improves economic growth, there are two points that do not eliminate this possibility: (i) the behaviour of an CBI is more predictable because it is less vulnerable to political pressure, and thus it helps to improve economic stability and the planning capacity of private agents; and (ii) an CBI decreases the costs for society because it reduces inflation volatility and therefore uncertainty about inflationary behaviour.

⁵ This point is associated with the observation that an CBI does not use the inflation tax, and thus it is independent from the fiscal authority.

⁶ CB supervision of the bank system is associated with the effort to guarantee price stability.

extent of the central bank's responsibility for monetary policy. In this last index, enhanced importance is attached to the laws that give the central bank exclusive control over monetary policy.

Cukierman, Webb and Neyapti (1992) elaborated one of the best-known methodologies for the measurement of CBI.⁷ This index was built on 16 basic legal features of central banks, divided into the following four groups (Cukierman, 1996): (i) the appointment, dismissal, and legal duration of the mandate of the main executive (usually the president); (ii) the institutional location of the final responsibility for monetary policy and the procedures for the

resolution of conflicts between the government and the central bank; (iii) the importance of the stability of prices in comparison to other objectives (such as high levels of employment or financial stability); and (iv) the constraints on the government with regard to taking loans from the central bank (market or subsidized rate) or on the central bank with regard to lending to a third party.

After the above-mentioned studies, several papers were developed with the objective of disaggregating indicators into their various components, in order to determine which aspects of independence affect the inflation performance.⁸

III

Is there any convergence among CBI indices?

One relevant point is to verify that the independence indices treat the same object in the CBI empirical literature, since the indices were created for the measurement of independence. If the concept of independence differs from index to index, this means that there is no homogeneous concept of independence. Under the hypothesis that the indices are based on different concepts of independence, the analysis of the linkages between the degree of independence and several elements in the economy (interest rate, output, inflation, etc.) may reveal different effects on the same object and may therefore lead to inconclusive results for the empirical analysis. This observation is mentioned as one of the main weaknesses of the empirical analysis concerning independence.

Forder (1999, pp. 35-36) notes the following: *"The failure to agree on a measure of independence makes impossible any test of the effects of independence. It is important to recognize exactly what the point is. It is not the foolish one that different authors use different approaches to measure independence and so cannot be said to be talking about the same thing. The problem is not the different approaches to measurement, but rather the different resultant measures. (...) The claim of these studies [measurement of independence] is that they show a general tendency for lower inflation to be*

associated with greater independence. And indeed this claim could even be correct, but what the literature has not succeeded in doing is offering an empirical concept of independence that allows the claim to be tested."

In order to determine whether the indices reveal a homogeneous concept of independence, a correlation analysis with different independence measurements was made. For this purpose, three indices that are frequently used in the empirical studies of CBI (Alesina-Summers (AS), Cukierman-Webb-Neyapti (CWN) and Grilli-Masciandaro-Tabellini (GMT)) were chosen. The study focused on 15 industrialized countries and was divided into two parts.⁹ The first analysed the independence indices, while the second analysed the independence ranking of the countries according to these indices. This division matters because the divergence between the three resulting rankings reveals inconsistencies in the measurement of independence (table 1, columns B).

Table 1 lists each country's values for CBI and its ranking for each above-mentioned index. Furthermore, sample summary statistics for each of the three scales

⁷ That research resulted in an index of legal independence for all the industrialized countries and for 50 developing countries (period 1950-1989).

⁸ See, Fuhner (1997); Forder (1999); de Haan and Kooi (2000); Brumm (2000); Berger, de Haan and Eijffinger (2001) and Farvaque (2002). For the purposes of this paper, it is not necessary to use the "new indices" of CBI.

⁹ The justification for the use of industrialized countries in the analysis is that there is no evidence that central bank independence is associated with low inflation in emerging economies. Evidence that supports this affirmation is present in Cukierman, Webb and Neyapti (1992).

TABLE 1

Industrialized countries (15 countries): indices and rankings of CBI

Countries	Alesina and Summers (AS)		Cukierman, Webb and Neyapti (CWN)		Grilli, Masciandaro and Tabellini (GMT)	
	Index (A)	Ranking (B)	Index (A)	Ranking (B)	Index (A)	Ranking (B)
Germany	4	1	0.69	1	13	1
Australia	2	4	0.36	6	9	4
Belgium	2	4	0.17	13	7	6
Canada	2.5	3	0.45	5	11	3
Denmark	2.5	3	0.5	3	8	5
Spain	1.5	6	0.23	11	5	8
France	2	4	0.24	10	7	6
Italy	1.75	5	0.25	9	5	8
Japan	2.5	3	0.18	12	6	7
Norway	2	4	0.17	13	-	-
New Zealand	1	7	0.24	10	3	9
United Kingdom	2	4	0.27	8	6	7
Sweden	2	4	0.29	7	-	-
United States	3.5	2	0.48	4	12	2
Switzerland	4	1	0.64	2	12	2
Mean	2.35	-	0.34	-	8	-
Std. Dev.	0.84	-	0.16	-	3.04	-
Minimum	1	-	0.17	-	3	-
Maximum	4	-	0.69	-	13	-

Source: Author's estimates, on the basis of Alesina and Summers (1993); Cukierman, Webb, and Neyapti (1992); and Grilli, Masciandaro and Tabellini (1991).

are listed. This analytical framework is justified by the fact that an analysis based only on the first part does not allow for a qualitative assessment. An indication that this perspective deserves attention is the finding presented in table 2 that the CBI rankings obtained by each methodology differ considerably among themselves. This observation is valid especially for the countries where the measure of independence is not high.

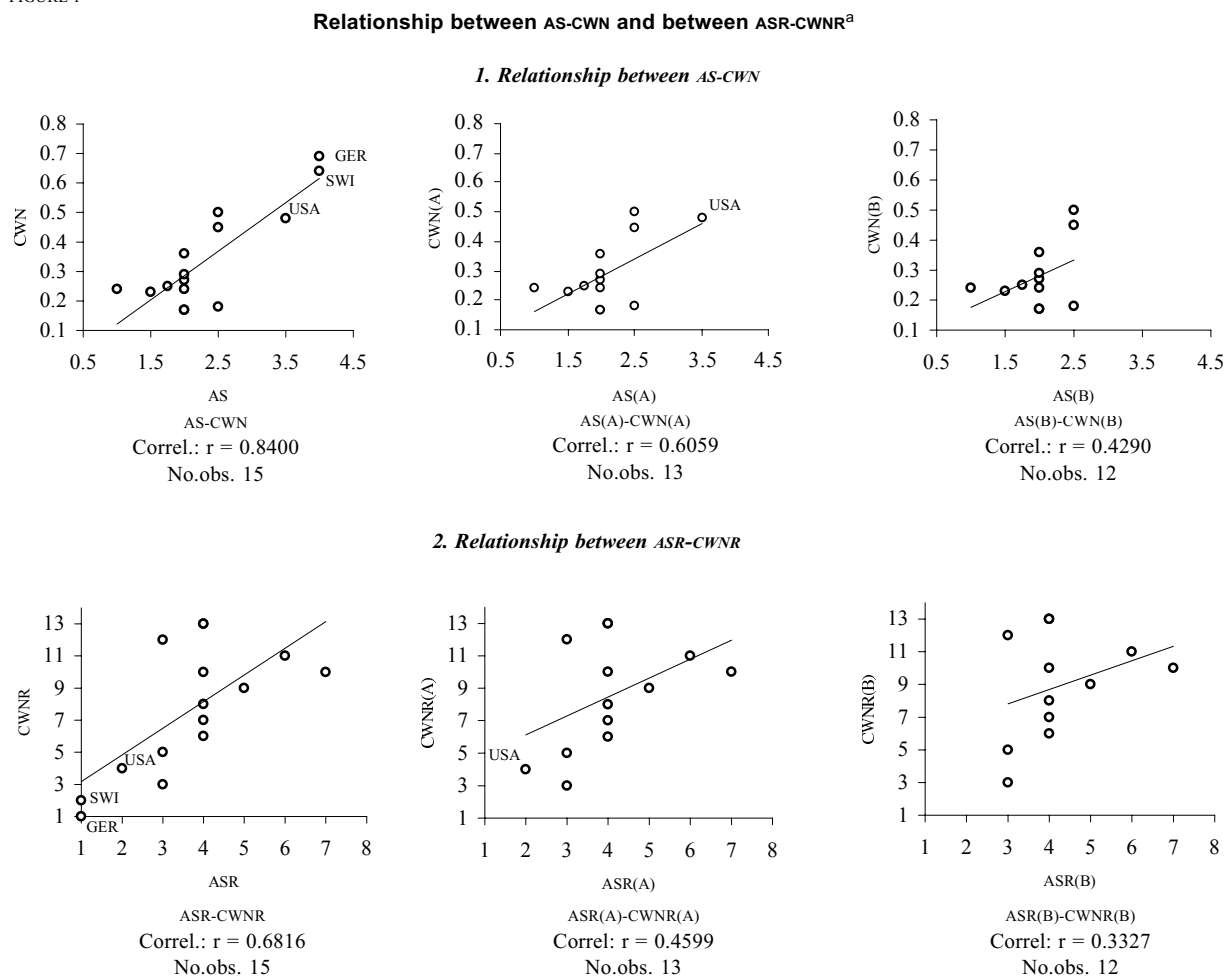
The data presented in table 1 allowed for the elaboration of figures 1, 2 and 3. The first section of each graph exhibits the relationship between indices, while the second section shows the relationship between rankings from indices (denoted by "R"). In other words, figure 1 presents the relationship between the AS and CWN indices, and between the ASR and CWNR rankings; figure 2 shows the relationship between the AS and GMT indicators and between the ASR and GMTR rankings; and figure 3 presents the relationship between the CWN and GMT indices and between the CWNR and GMTR rankings. The use of the ranking of the countries is justified by the fact that the correlation tests among the independence indices are not capable of capturing the essence of the analysis proposed. The correlation tests

among indices only relate the values of the coefficients, without qualifying the relations among the points.

Based on the finding that there is almost a total coincidence between the first and second places resulting from each index for countries with higher independence, and the observation made by Forder (1999, p. 33) that "[c]learly, the apparent similarity of measures of independence depends on agreement that the central banks of Germany and Switzerland are highly independent", the analysis of each relationship follows three steps. The first column of graphs uses all countries in the sample; the second column excludes Germany and Switzerland (case denoted by "A"—countries that were classified as having a higher independence) from the sample; and the third column excludes also the United States of America (case denoted by "B"—occupying the second place in the ranking—see table 1).¹⁰

¹⁰ The United States Federal Reserve System, the Deutsche Bundesbank and the Swiss National Bank are excluded from the sample because they are usually highlighted in the literature as an independence paradigm.

FIGURE 1



Source: Prepared by the author on the basis of table 1.

^a See explanation of abbreviations in table 1 and in the two paragraphs preceding figure 1.

The graphs in figures 1, 2 and 3 show that the correlation among rankings is lower than the correlation among indices. Moreover, the exclusion of Germany, Switzerland, and the United States from the sample contributes to the reduction of the correlation between measures of independence. Thus, there is an indication that the divergence of rankings and the exclusion of the aforementioned three countries from the sample can weaken the relationship among independence measurements. Nonetheless, the figures generally illustrate the existence of a significant and positive correlation among the three indices (excluding the relationship between AS-CWN and ASR-CWNR).

To ascertain if the results of the correlations are consistent, the following equation was regressed (OLS

method) to analyse the relationship among the independence indices:

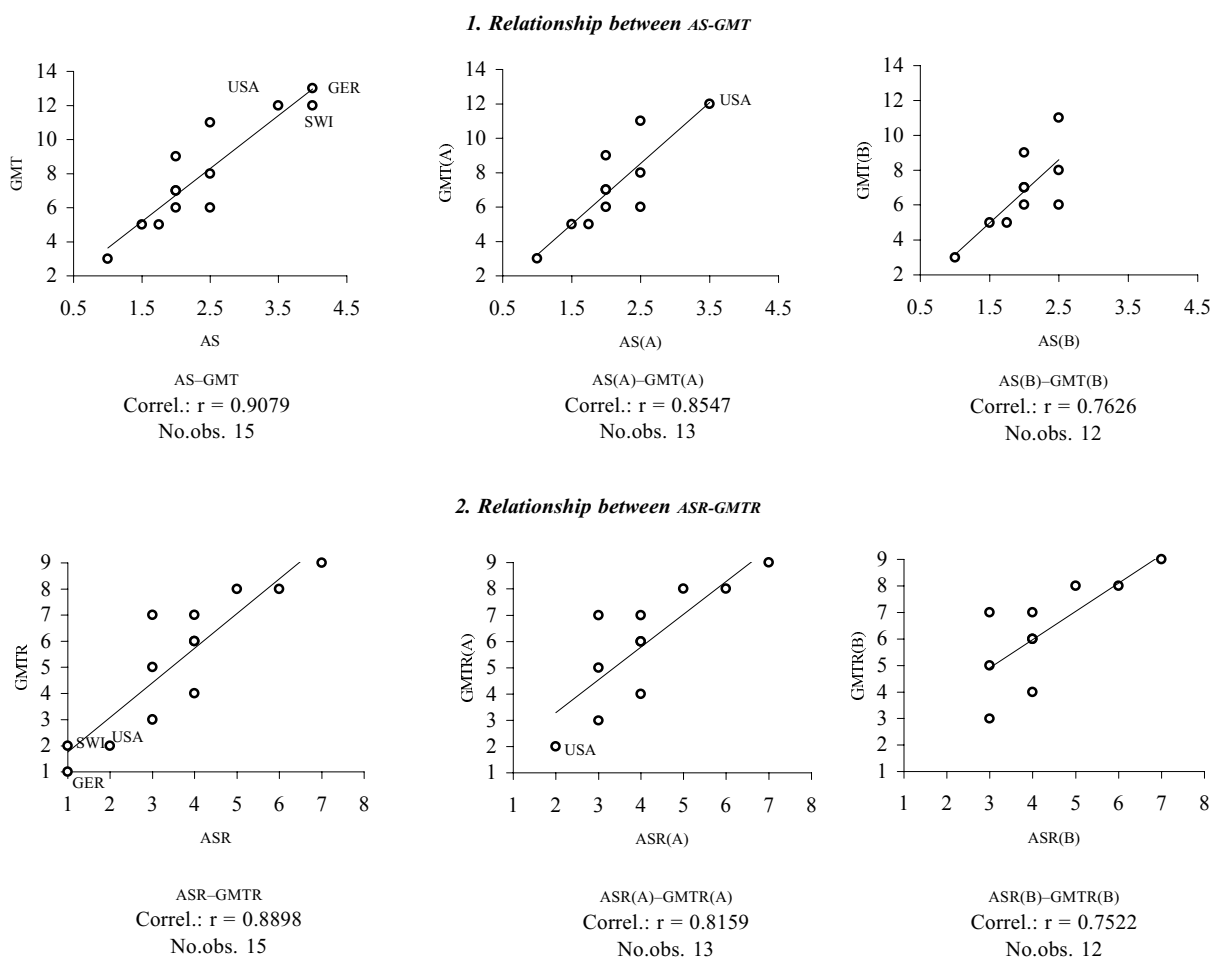
$$\text{CBI index} = \alpha_0 + \alpha_1 \text{CBI index}^* \quad (1)$$

where α_0 is a constant and CBI index* denotes a different independence index than that used on the left side of the equation.

Following the same framework as that used in the correlation analysis, table 2 summarizes the regression results. Table 2 is divided into six boxes. The first box shows the estimates for the relationship between CWN and AS indices (first row), CWN(A) and AS(A) (excluding Germany and Switzerland - second row), and CWN(B) and AS(B) (excluding Germany, Switzerland, and the United States - third row). The second box shows the

FIGURE 2

Relationship between AS-GMT and between ASR-GTMR^a



Source: Prepared by the author on the basis of table 1.

^a See explanation of abbreviations in table 1 and in the two paragraphs preceding figure 1.

estimates for the relationship between the rankings from CWN and AS (respectively CWN_R and AS_R) and follows the same framework as in the first box. The idea of the first box is repeated in the third to sixth boxes.

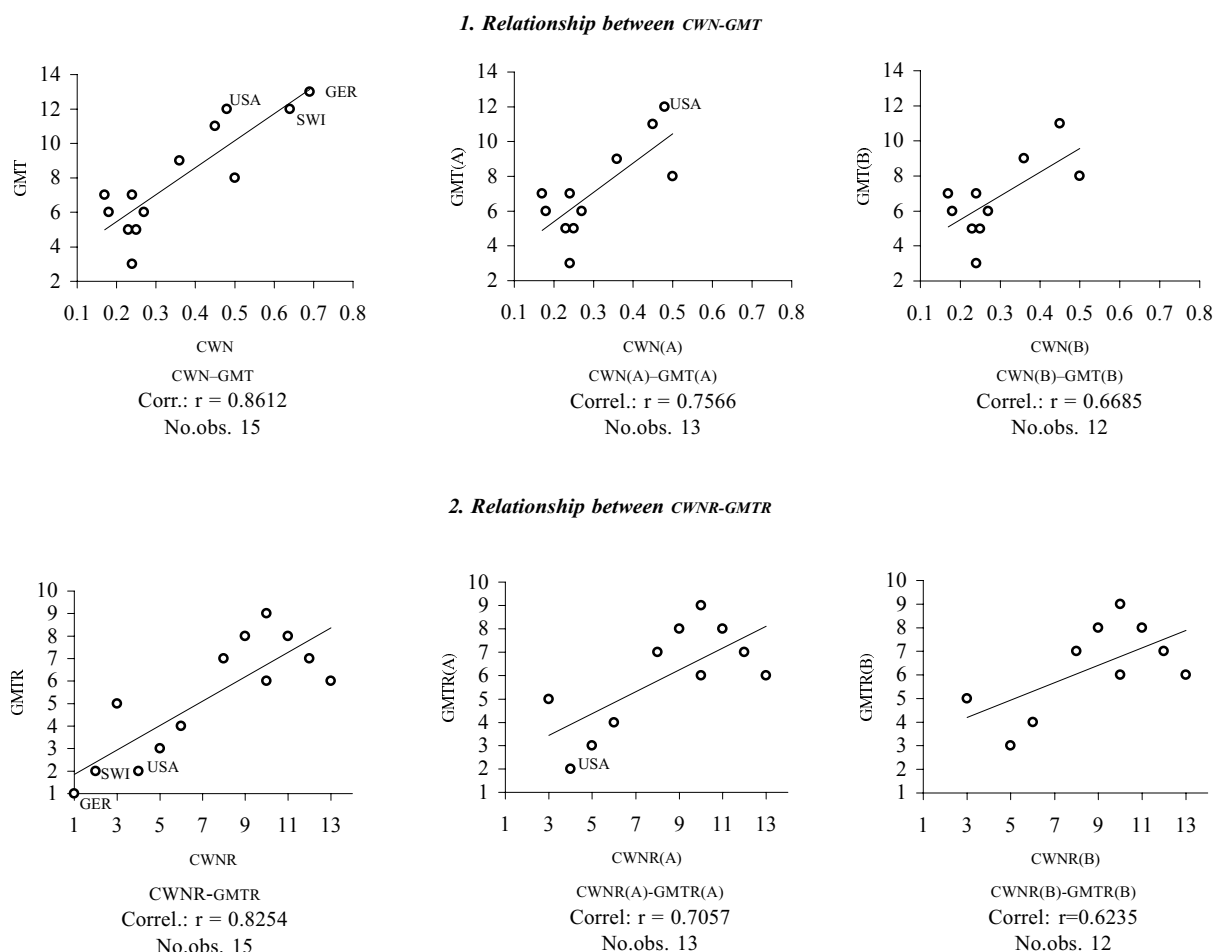
On the basis of these estimates, the idea is to verify if the constant (α_0) is significant and thus denotes a strong disagreement between indices; or if, on the contrary, the relationship between each pair of indices is strong (captured by parameter α_1 in equation 1), confirming the homogeneity of the indices. The first row in the first, third and fifth boxes (table 2) indicates that the t-values of the indices are significantly different from zero at a 99% confidence level and the average R^2 (adjusted) is 0.736. Therefore, these results (strong

statistical association among indices) confirm the expectation, in theory, that the indices reflect a homogeneous concept of independence. The same idea can be applied for the first row in the second, fourth and sixth boxes (analysis of rankings), although the average R^2 is less than in the previous case (0.616).

Despite these results, when Germany and Switzerland are removed from the sample, the situation changes considerably. The empirical results presented in table 2 for the relationship among indices (second row of first, third and fifth boxes) and for the relationship among rankings from indices (second row of second, fourth and sixth boxes) reveal that the t-statistic values remain significant. Except for CWN(A)-

FIGURE 3

Relationship between CWN-GMT and between CWN-R-GMTR^a



Source: Prepared by the author on the basis of table 1.

^a See explanation of abbreviations in table 1 and in the two paragraphs preceding figure 1.

AS(A) and CWN-R(A)-ASR(A), all values are significant at the 1% level, although R² decreases substantially. For the first case (analysis of indices), the average R² corresponds to 0.512, while for the second case (analysis of rankings), the average R² is 0.404. These results suggest that the exclusion of the above-mentioned countries from the sample weakens the statistic association among independence indices.

The exclusion of the United States together with Germany and Switzerland from the sample confirms the tendency noted above. The third row in each box in table 2 reveals that the significance of the t-values of

the indices reduces the confidence level (except for GMT(B)-AS(B) and GMTR(B)-ASR(B)) and the t-values of the constant become significant in half of the cases. The most relevant result is the analysis of the R², whose average value for indices is 0.336, and for ranking 0.282. Therefore, the result shows that the analysis, when focused on all countries in the sample, is misleading. When Germany, Switzerland and the United States (countries that represent the example of independence) are omitted from the analysis, the result appears to negate the existence of a relationship among the measurements of independence.

TABLE 2

OLS estimates of CBI indices and ranking

<i>Dependent variable: CWN</i>					
Constant	t-stat.	AS	t-stat.	Adjus. R ²	No. obs.
-0.042	-0.575	0.164	5.582 ^a	0.683	15
<i>Dependent variable: CWN(A)</i>					
Constant	t-stat.	AS(A)	t-stat.	Adjus. R ²	No. obs.
0.045	0.440	0.119	2.526 ^b	0.310	13
<i>Dependent variable: CWN(B)</i>					
Constant	t-stat.	AS(B)	t-stat.	Adjus. R ²	No. obs.
0.070	0.493	0.106	1.502 ^c	0.102	12
<i>Dependent variable: CWNR</i>					
Constant	t-stat.	ASR	t-stat.	Adjus. R ²	No. obs.
1.511	0.765	1.661	3.359 ^a	0.423	15
<i>Dependent variable: CWNR(A)</i>					
Constant	t-stat.	ASR(A)	t-stat.	Adjus. R ²	No. obs.
3.772	1.298	1.169	1.718 ^c	0.140	13
<i>Dependent variable: CWNR(B)</i>					
Constant	t-stat.	ASR(B)	t-stat.	Adjus. R ²	No. obs.
5.190	1.498 ^c	0.877	1.116	0.022	12
<i>Dependent variable: GMT</i>					
Constant	t-stat.	AS	t-stat.	Adjus. R ²	No. obs.
0.512	0.461	3.115	7.181 ^c	0.808	15
<i>Dependent variable: GMT(A)</i>					
Constant	t-stat.	AS(A)	t-stat.	Adjus. R ²	No. obs.
-0.305	-0.193	3.542	4.939 ^a	0.701	13
<i>Dependent variable: GMT(B)</i>					
Constant	t-stat.	AS(B)	t-stat.	Adjus. R ²	No. obs.
-0.432	-0.197	3.611	3.335 ^a	0.529	12
<i>Dependent variable: GMTR</i>					
Constant	t-stat.	ASR	t-stat.	Adjus. R ²	No. obs.
0.438	0.535	1.326	6.466 ^a	0.773	15
<i>Dependent variable: GMTR(A)</i>					
Constant	t-stat.	ASR(A)	t-stat.	Adjus. R ²	No. obs.
0.804	0.632	1.248	4.233 ^a	0.629	13
<i>Dependent variable: GMTR(B)</i>					
Constant	t-stat.	ASR(B)	t-stat.	Adjus. R ²	No. obs.
1.733	1.175	1.062	3.229 ^a	0.512	12
<i>Dependent variable: GMT</i>					
Constant	t-stat.	CWN	t-stat.	Adjus. R ²	No. obs.
2.345	2.115 ^b	15.642	5.620 ^a	0.718	15
<i>Dependent variable: GMT(A)</i>					
Constant	t-stat.	CWN(A)	t-stat.	Adjus. R ²	No. obs.
2.027	1.278	16.826	3.471 ^a	0.525	13
<i>Dependent variable: GMT(B)</i>					
Constant	t-stat.	CWN(B)	t-stat.	Adjus. R ²	No. obs.
2.775	1.688 ^c	13.582	2.543 ^b	0.378	12
<i>Dependent variable: GMTR</i>					
Constant	t-stat.	CWNR	t-stat.	Adjus. R ²	No. obs.
1.306	1.426	0.543	4.850 ^a	0.652	15
<i>Dependent variable: GMTR(A)</i>					
Constant	t-stat.	CWNR(A)	t-stat.	Adjus. R ²	No. obs.
2.054	1.486	0.466	2.988 ^a	0.442	13
<i>Dependent variable: GMTR(B)</i>					
Constant	t-stat.	CWNR(B)	t-stat.	Adjus. R ²	No. obs.
3.098	2.060 ^b	0.368	2.255 ^b	0.312	12

Source: Prepared by the author on the basis of estimates made from data contained in table 1.

^a Significant at the 1 percent level.

^b Significant at the 5 percent level.

^c Significant at the 10 percent level.

IV

The “endogenous character” of the indices

Since measures of CBI pay special attention to the inflationary bias, these indices are indissolubly linked to inflation. In other words, if a central bank is strongly (or weakly) contrary to the inflationary bias, it is seen to have a high (or low) independence, and thus a negative correlation between CBI and inflation is found. To put it another way, “... *measures of independence are only acceptable if one already agrees with the theoretical principles on which the thesis of correlation between independence and price stability is based. Of course, if one defends the assignment of highest priority to price stability as a measure of independence and then correlates this measure of independence with price stability, one should not be surprised to find some correlation*” (Carvalho, 1995/96, p. 169-170).

Therefore, with the objective of showing the inherent tendency of a high negative correlation between central bank independence and inflation in questionnaires devised to measure the degree of CBI, table 3 lists the most frequently asked questions. The main objective is to identify, in each question, some common characteristics that could reveal a prior intention to confirm the negative correlation.

The questions in table 3 can be divided into three groups: (i) questions 1, 2, 3 (present in all the indices under consideration) and 7 have the objective of identifying the possible influence of government over operational decisions of the central bank; (ii) questions 4 and 5 try to reveal the capacity of the central bank to neutralize the pressures from the government; and (iii)

question 6 verifies if the central bank is committed to the quest for price stability or is concerned with other objectives (for example, employment level).

Despite the above-mentioned differences, the main point is the existence of one feature that is common to all the questions: they were created with the objective of evaluating the possible inflationary bias associated with the conduct of monetary policy. Herein lies the main element for an external critique. Since the questions were created to evaluate the effect of the largest degree of independence on inflation, there is an implicit bias present. Consequently, the degree of independence obtained by these indices has a tendency to reveal a negative correlation between higher independence and inflation.

The corollary of the above observation is that these indices are not useful as an instrument capable of demonstrating the effects of an increase in independence on inflation. Since a low degree of independence denotes, to a great extent, the presence of an inflationary bias in the conduct of monetary policy, and since the evaluation of this bias depends on the observation of the inflation, the measure of independence is ultimately a consequence of the observed inflation. Furthermore, an internal critique can be made on the basis of the observation that an increase in independence today does not mean an immediate fall in the inflation rate, because the central bank’s credibility in reducing the inflation is not automatic. In other words, the degree of independence in one period

TABLE 3

Most frequently asked questions for the measurement of CBI

	BP	A	GMT	ES	CWN
1. Does the central bank have the final responsibility for monetary policy?	X	X	X	X	X
2. Are there any government appointed representatives on the board of the central bank?	X	X	X	X	X
3. Are any appointments to the board outside government control?	X	X	X	X	X
4. Is there a limit on government loans from the central bank?		X	X		X
5. Are there legal provisions that strengthen the bank’s position in cases of conflict with the government?			X		X
6. What is the importance of price stability in relation to other objectives?			X		X
7. What is the duration of the legal mandate of the president of the central bank?			X		X

Source: Compiled by the author on the basis of: BP = Bade and Parkin (1985); A = Alesina (1989); GMT = Grilli, Masciandaro and Tabellini (1991). ES = Eijffinger and Schalling (1993); CWN = Cukierman, Webb and Neyapti (1992).

cannot be held responsible for the average inflation in that period.

An endogenous feature is therefore observed in the indices. When the economy presents a low inflation level, there is a tendency for indices to reveal a high level of independence, while if the inflation rate is high, the same indices exhibit a low degree of independence. Hence, it is the level of inflation of an economy that determines the degree of independence and not the opposite. Based on an econometric analysis, Posen

(1993) offered evidence that supports this result. He verified that in countries where the public interest has anti-inflation motivations, institutions are being built to sustain this aversion. On the other hand, in countries where there is an acceptance of inflation, such institutions are not developed. Besides, Posen showed the existence of a clear causal relationship between anti-inflationary interests and independence, and did not find a relationship between high independence and a low inflation rate.

V

Turnover rate, CBI index, inflation and interest rate in Brazil

In order to illustrate the analysis made in the previous section, a study of the Brazilian economy was carried out. Brazil was selected because of its success in attaining price stability since the middle of the 1990s. Between 1986 and 1993, Brazil adopted several economic plans in an attempt to stabilize inflation (Cruzado, Bresser, Verão, Collor I and Collor II), all of which failed. Success in the control of inflation came only after the introduction of the Real Plan, a stabilization programme divided into three steps: (i) budgetary equilibrium; (ii) introduction of a new stable unit of account to align the most important relative prices in the economy; and (iii) the conversion of this unit (URV – unit of real value) to the new currency of this country (the real) with the parity semi-fixed with the dollar. With the introduction of the Real Plan, the new monetary unit (the real) was guaranteed to have a level of international reserves equal to the volume in circulation. In addition, currency issues were limited by law, in accordance with the government's intention to indicate to the agents that such issues were not necessary.

With the recovery of political stability after the impeachment of President Fernando Collor de Mello, an economic stabilization programme, adopted in the second half of 1993 under the direction of the then Minister Fernando Henrique Cardoso, was introduced. During that period a national consensus was built around the idea that budgetary equilibrium was a prerequisite to economic stabilization. In addition, the exchange market was liberalized and the external debt

with the Paris Club was renegotiated. The main idea was to gain the public's confidence in the stabilization programme in order to increase its chances of success.

Under the presidency of Fernando Henrique Cardoso, the third phase of the Real Plan was concluded in July 1994. The result was a substantial decrease in inflation. In spite of the success in the control of inflation, the cost of a tight monetary policy was not negligible. In an attempt to control the pressure on consumption due to the fall in inflation tax, the Central Bank of Brazil (CBB) adopted a high interest rate strategy. As a result, after the positive initial impact of this fall in inflation on the real sector, three basic problems appeared in mid-1995: (i) fiscal – the high interest rate increased the debt/GDP ratio; (ii) economic growth and unemployment – the high interest rate strategy attracted speculative capital and reduced the interest in productive activities, and thus increased the unemployment rate; and (iii) external account – high interest rates contributed to an appreciation in the exchange rate and led to a persistent deficit in current transactions.

The above-mentioned strategy remained in place until June 1999. At that time, owing to a change in the exchange rate, the National Monetary Council decided on inflation targeting as the new monetary policy for Brazil. Before this, two different targeting frameworks had been used during the Real Plan: exchange rates and monetary aggregates. The main motivation for introducing inflation targeting was the expectation that the use of this strategy could eliminate the inflation

that resulted from supply shocks. It was expected that the use of this monetary regime would neutralize the pressure on prices stemming from the sharp currency devaluation in January 1999, and would restore inflation control.

In an attempt to demonstrate the endogenous character of the independence index in relation to the conduct of monetary policy, and thus the spurious effect of CBI on inflation, Cukierman's methodology (1992) was used. In this framework, it was expected that CBI would help to reduce/stabilize inflation. The justification was that in Brazil, since 1994, the main objective of monetary policy has been price stability, and therefore the degree of CBI must have increased considerably after that year.

It must be remembered that the analysis of the independence of the monetary authority cannot be seen only from the legal side. Based on the above-mentioned methodology, an estimate was made of the degree of independence of the Central Bank of Brazil (CBB) for the period 1980-2002 (table 4). As expected, the outcome shows that 1994 was the year that presented the highest increase in CBB independence (about 48%) between 1980 and 2002. Therefore, it can be affirmed that the increase in CBB independence was accentuated after the introduction of the Real Plan.

The main arguments for the increase in CBB independence after the introduction of the Real Plan can be divided into five points:

(i) Use of a crawling peg for the exchange rate, a strategy that was considered the main instrument for maintaining price stability after the introduction of the Real Plan. This framework was seen as useful in impeding the acceleration of inflation by constraining the prices of tradable domestic goods; attenuating the inertial inflation that fed wages and prices of non-tradable goods; and contributing to the convergence of inflationary expectations, based on the inflation of the anchor country. In addition, this mechanism created an

automatic adjustment of the money supply, reducing the problem of dynamic inconsistency in monetary policy.

(ii) Reduction of seignorage, an important indicator of the level of independence because it reveals the financing of the budget deficit through the money issued (denotes the presence of fiscal dominance).¹¹ Thus, a higher seignorage would be associated with a lower degree of independence; while lower seignorage would mean constraints in financing the government, and thus would indicate higher independence. Seignorage reached its highest level in 1990 (5% of GDP) and after 1995 the level remained under 0.01%.

(iii) Use of intermediate policy targets, that is, quarterly quantitative targets for a monetary base. In accordance with Act No. 9,069 of June 1995, the targets for monetary growth ceased to be determined by law, and CBB became responsible for these targets.¹² As can be observed in table 5, there was a growth in the fulfilment of the CBB monetary targets (from the last quarter of 1995 the outcomes are found within the expected range). As the rule followed by CBB was not violated, the inflationary bias was reduced, giving more credibility to the institution as a guarantor of monetary discipline and thereby impeding an increase in inflation. Despite this observation, CBB recognized that monetary policy execution required strict compliance with monetary programming in order to guarantee that the fundamental goals of the Real Plan, namely economic growth with declining inflation, would be attained.

(iv) Use of inflation targeting, which increases the level of transparency and puts limits on inflation, and thus binds the inflation variability. The consequence of this framework is the reduction of inflationary bias, and thus an increase in CBI. With the flexible exchange rate introduced in January of 1999, the adoption of inflation targeting in June of the same year represented an arrangement that assured the influence of the central bank on the control of inflation.

TABLE 4

Estimates of CBB independence

Period	1980/85	1986/89	1990/93	1994/96	1997/99	2000/02
Degree of independence ^a	0.25	0.35	0.46	0.68	0.71	0.76

Source: Estimates on the basis of the methodology of Cukierman, Webb and Neyapti (1992).

^a Degree of independence ranges from 0 to 1.

¹¹ According to Fry (1998), the size of the deficit and the way in which it is financed determine the level of independence of central banks in the developing countries.

¹² Empirical evidence suggests that over periods of five or more years the growth in money is a major determinant of inflation (see, for example Leeper and Roush, 2003).

TABLE 5

Brazil: Monetary program - 1995/1999
(R\$ billion)

Quarter	Restricted base		M1		Expanded base		M4	
	Estimated	Confirmed	Estimated	Confirmed	Estimated	Confirmed	Estimated	Confirmed
1st/95	17.7 - 18.1	15.7	20.4 - 21.4	18.1	81.0 - 90.0	80.3	176.0 - 188.0	188.2
2nd/95	14.9 - 17.4	14.7	17.7 - 20.7	17.7	84.1 - 85.5	83.8	200.4 - 203.6	199.7
3rd/95	15.1 - 18.3	15.0	18.2 - 21.8	19.2	87.9 - 94.0	106.6	207.5 - 222.1	229.9
4th/95	18.6 - 23.1	20.7	22.4 - 27.8	26.6	111.0 - 122.7	122.3	233.4 - 258.6	251.2
1st/96	17.0 - 19.9	18.0	21.2 - 24.8	23.4	122.0 - 143.2	137.7	234.8 - 275.7	265.3
2nd/96	16.8 - 19.7	17.4	19.7 - 26.6	24.0	134.4 - 157.8	157.4	252.3 - 296.1	280.2
3rd/96	16.6 - 19.5	17.2	23.2 - 27.2	24.3	154.2 - 181.1	165.1	276.1 - 324.1	297.6
4th/96	20.6 - 24.2	20.1	28.6 - 33.6	29.0	159.4 - 187.1	184.1	289.0 - 339.2	322.1
1st/97	23.3 - 27.3	24.7	33.2 - 39.0	36.9	191.5 - 224.8	193.7	323.9 - 380.2	336.4
2nd/97	24.0 - 28.1	24.7	35.1 - 41.2	36.8	220.3 - 258.7	203.2	337.5 - 396.2	351.3
3rd/97	22.7 - 26.7	26.2	33.8 - 39.7	38.8	225.8 - 265.1	224.0	340.4 - 399.6	373.8
4th/97	31.7 - 37.2	32.3	48.6 - 57.1	45.6	257.7 - 302.5	280.1	371.4 - 436.0	392.8
1st/98	25.1 - 29.4	30.9	36.1 - 42.4	41.5	313.9 - 368.5	310.7	406.6 - 477.3	416.9
2nd/98	30.2 - 35.5	33.1	37.9 - 44.5	42.4	320.4 - 376.1	340.0	405.8 - 476.3	431.1
3rd/98	31.0 - 36.4	34.6	39.4 - 46.3	43.4	346.6 - 406.9	322.2	415.8 - 488.1	423.5
4th/98	34.6 - 40.7	39.9	45.0 - 52.8	49.0	347.7 - 408.2	352.3	435.1 - 510.7	453.4
1st/99	35.4 - 41.6	37.6	46.0 - 54.0	46.6	353.0 - 414.4	388.0	436.7 - 512.6	477.4

Source: Central Bank of Brazil.

(v) Reduction in the turnover of CB governors (table 6). Cukierman, Webb and Neyapti (1992) highlighted that in developing countries the frequency of turnover of the chief executive officer of the CB is a good proxy for CBI because it is strongly and positively associated with inflation. The idea behind this indicator is that a more rapid turnover presumably creates more dependence on the part of the CB, probably as a result of political pressures.

Table 6 shows the turnover of CBB governors for the period between March 1979 and December 2002. It can be seen that the turnover has been decreasing since 1985. The lowest turnover ratio was during the tenure of President Fernando Henrique Cardoso, when there was a decrease of 56% compared with the previous period.

1. Empirical Results

After identifying the main reasons for the increase in the degree of independence of CBB after the introduction of the Real Plan, it is important to analyse whether the increase in independence was responsible for the control of inflation. With this objective, a vector autoregression analysis (VAR) was applied, using the following annual data for the period 1980-2002: the transformed inflation rate (INFD is the inflation variable transformed in order to reduce heteroskedasticity of the

TABLE 6

Brazil: turnover of central bank governors

Presidents of Brazil	Period	Turnover ratio ^a
João Batista Figueiredo	15/03/1979 - 15/03/1985	0.67
José Sarney	15/03/1985 - 15/03/1990	1.20
Fernando Collor	15/03/1990 - 29/12/1992	1.07
Itamar Franco	29/12/1992 - 01/01/1995	1.00
Fernando Henrique Cardoso	01/01/1995 - 01/01/1999	0.75
Fernando Henrique Cardoso	01/01/1999 - 01/12/2002	0.33

Source: Estimates on the basis of the methodology of Cukierman, Webb and Neyapti (1992).

^a Turnover ratio is the frequency of turnover of the chief executive officer of the CB during the President's tenure.

error),¹³ the turnover of the CBB governors (TOR); the CBB independence (CBBI);¹⁴ and the modified Selic interest rate (INTD).¹⁵ The last variable was included in the VAR because it is now widely accepted that the Brazilian monetary policy operates through setting a

¹³ Inflation is measured by the extended national consumer price index (IPCA); it covers a sample of families with personal income between 1 and 40 minimum wages and has a broad geographical basis. INFD is the year's inflation rate divided by one plus the inflation rate.

¹⁴ CBI index is the actual degree of independence weighted, based on Cukierman's methodology (1992).

¹⁵ Interest rate for overnight interbank loans collateralized by government bonds registered with and traded on the Special System of Clearance and Custody (Selic). INTD is the Selic divided by one plus the Selic.

key interest rate. The VAR is used because the theoretical analyses concerning CBI are not developed enough (in particular for developing countries) to provide a dynamic specification that identifies all relationships among the variables in analysis.

It is first necessary to verify if the above-mentioned series have a unit root. The unit root tests (Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP)) denote the acceptance of the null hypothesis (nonstationary series) for the original values of these series. On the other hand, for the case of first difference, the null hypothesis is rejected at the 1% significance level, and thus the series are stationary (table 7).

Before applying the cointegration test to the series in analysis, the lag orders were determined by means of Akaike (AIC), Schwarz (SIC) and Hannan-Quinn information criteria (HQ). Owing to the presence of an outlier in the inflation rate which occurred after the introduction of the Real Plan, it was decided to place a dummy variable to capture the outlier effect. It is important to emphasize that the critical values of the cointegration tests are no longer completely valid when the model has deterministic variables other than the intercept and trend. It is observed that both models (with

or without constant) and the outcome of the criteria used denote 1 lag for the VAR (table 8).

The cointegration test proposed by Johansen (1991, LR test statistic), based on the significance of the estimated eigenvalues, indicates that the trace statistic rejects the no-cointegration hypothesis at the 1% significance level (table 9), but not the hypothesis that there is more than one cointegration relation.¹⁶

The cointegration test indicates, therefore, that there is a long-run equilibrium among variables considered in VAR. The cointegrating vectors (β), normalized for the variable INFD, as well as the adjustment coefficients (α) are reproduced in table 10. All components of the cointegrating vector are significant at the 1% level, except for TOR, which is significant at the 10% level. Furthermore, all variables presented the expected indication: increases in the CBI and interest rate lead to a reduction in inflation, while an increase in turnover of CB governors exerts the opposite effect.

¹⁶ The specification selected has only the intercept within the cointegration vector.

TABLE 7

Brazil: Unit root tests (Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP))^a

Series	Lag	ADF test	Lag	PP test
CBBI	0	-2.9531	8	-2.8512
Δ CBBI	0	-5.3460 ^b	9	-6.0578 ^b
INFD	0	-2.9753	1	-2.9422
Δ INFD	0	-6.6553 ^b	1	-6.6935 ^b
INTD	0	-2.0287	4	-2.0168
Δ INTD	0	-3.5621 ^b	4	-3.5010 ^b
TOR	0	-0.6510	1	-0.6571
Δ TOR	0	-3.9390 ^b	0	-3.9390 ^b

Source: Prepared by the author.

^a ADF test: number of lags based on Schwarz criterion; PP test: lag based on Newey-West criterion using Bartlett kernel. For CBBI, INFD and INTD constant and linear trends were applied. For Δ CBBI constant was applied. For other series, no-constant specification or time trend was used.

^b Denotes rejection of the null of a unit root at the 1% significance level.

TABLE 8

Brazil: VAR lag order selection criteria

Lag	With constant			Without constant		
	AIC	SIC	HQ	AIC	SIC	HQ
0	-10.35247	-10.10378	-10.29850			
1	-15.76519 ^a	-14.27302 ^a	-15.44135 ^a	-14.85520 ^a	-13.61172 ^a	-14.58533 ^a
2	-15.59074	-12.85509	-14.99703	-14.38647	-11.89952	-13.84674

Source: Author's estimates on the basis of Akaike (AIC), Schwarz (SIC) and Hannan-Quinn information criteria (HQ).

^a Denotes rejection of the hypothesis at the 1% level.

TABLE 9

Brazil: Johansen's cointegration test

Hypothesized no. of CE(s)	Eigenvalue	Trace statistic	5% critical value	1% critical value
R = 0 ^a	0.867686	78.41756	68.52	76.07
R ≤ 1	0.568159	33.92080	47.21	54.46
R ≤ 2	0.352939	15.44743	29.68	35.65

Source: Estimates calculated by the author using the Johansen cointegration test.

^a Denotes rejection of the hypothesis at the 1% level. Trace test indicates 1 cointegrating equation at 1% level.

TABLE 10

Brazil: Cointegrating vectors and adjustment parameters

Series	β	α
INFD	1.000000	-0.055467
CBBI	-1.294171	-0.016736
INTD	-16.33198	0.026754
TOR	0.269904	0.426996
Constant	15.50979	

Source: Author's estimates.

TABLE 11

Brazil: weak exogeneity test^a

Series	χ^2	P-Value
CBI	1.638928	0.2005
DINT	1.493454	0.2217
ROT	0.214067	0.6436

Source: Author's estimates.

^a Dependent variable: INFD.

Table 11 shows the χ^2 (Wald) statistics for the joint significance of each of the other lagged endogenous variables in equation INFD in the VAR model. The weak exogeneity test performed for the variables denotes that the variables under consideration can be treated as exogenous. Thus, it is correct to estimate a model for INFD. It is worth stressing that the values of the coefficients of the cointegrating vector should not be interpreted directly as a measure of the impact of the innovations of each variable isolated from the rest because these coefficients do not take into account the relationships between the variables expressed in the VAR model (Lütkepohl, 1991).

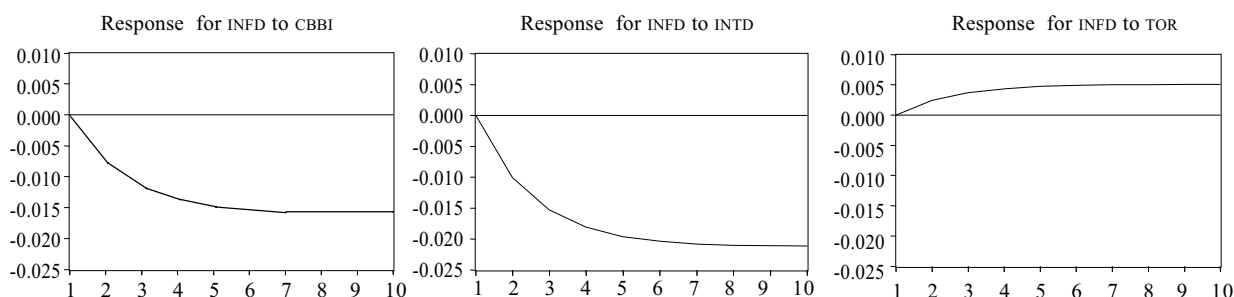
Figure 4 shows the impacts on the INFD due to the increase in the standard deviation in the innovations of the other variables.

The variables were ordered in different ways for the analysis of the impulse response function, but the results did not change significantly. It is shown that a positive shock in the CBBI and in the interest rate reduces inflation permanently. On the other hand, a positive shock in the turnover of CBB governors contributes to an increase in the inflation rate. In other words, the results suggest that a mix of an increase in CBI and in the interest rate with a decrease in turnover of CB governors should be a good framework for reducing inflation.

The results above need to be clarified. Albeit the empirical data denote that an increase in CBBI and TOR contributes to reducing inflation, in fact both variables depend on the macroeconomic environment. As pointed out in section IV, Cukierman's index is a consequence of the success of monetary policy in the control of

FIGURE 4

Brazil: impulse response functions



Source: Prepared by the author.

inflation. In this sense, the results found from a CBI index with an economy whose main monetary policy objective is the quest for price stability are not surprising.

One important lesson extracted from the analysis in this section is that it does not matter which country (developing or industrialized) is considered in CBI studies. The endogenous character of the indices

reflects a conservative monetary policy (aversion to inflation) and, as a consequence, results in an increase in CBI. Therefore, if a country changes the conduct of its monetary policy against inflation, the effect is an increase in CBI, thereby offering fallacious evidence that the independence helps to control inflation.

VI

Conclusion

The empirical evidence suggests that when countries that have been historically successful in fighting inflation are eliminated from the sample, it becomes difficult to define a reasonable independence ranking for central banks. Thus, an analysis that considers a set of countries, but omits Germany, Switzerland and the United States, may produce results that are quite the opposite of those which CBI enthusiasts might hope for. Further, the disagreement among the rankings by indices reveals the subjective nature of the measurement of independence.

The empirical results for the Brazilian economy are in accordance with the standard literature concerning CBI. The main point behind these outcomes is the credibility of the conduct of monetary policy. Blinder (2000) showed that, in the opinion of central bankers and economists, CBI is the most important criterion for establishing or maintaining credibility, provided there is a history of honesty. In fact, CBI is now understood as an operational independence, that is, entailing the freedom of the CB in the conduct of monetary policy in the quest for price stability. In spite of the importance of Blinder's observation, it needs to be treated with caution because it is based on simple opinions.

Brazil does not have a legally independent CB. Its success in controlling inflation is due to the fact that the CBB follows a set of criteria that represent a rule of thumb for monetary policy (such as using interest rates

as a tool, increasing transparency and focusing monetary policy on inflation). After the implementation of the Real Plan, the priority of monetary policy was the control of inflation. Due to this objective, CBB adopted a conservative monetary policy and used two different monetary regimes (crawling peg for the exchange rate in the period between July 1994 and January 1999, and, since June 1999, inflation targeting). It is worth stressing that the CBB is based on judgments concerning the behaviour of the CBB. Consequently, this indicator depends on the strategy adopted for the conduct of monetary policy.

A low and stable inflation depends on credibility, which is, in turn, endogenous to the public's perception concerning the accountability and the potential success of the CB in the conduct of monetary policy. Developing countries like Brazil that need to develop credibility must look for other frameworks, instead of accepting the presupposition that there is a vicious circle which includes inflation and a lack of CBI. The main point is that it is necessary to use a monetary strategy to achieve a historical success against inflation, and thereby develop credibility. Furthermore, since the main objective of governments is to maximize social welfare, and since the impact of monetary policy on the economy is not negligible, it becomes necessary for the monetary strategy adopted to take into account as well the possible effects of a tight monetary policy on fiscal equilibrium, economic growth and unemployment.

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