

Central Bank Independence and Economic Performance

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Abstract

This paper examines the influence that several factors may have on the relationship between legal Central Bank Independence (CBI), on the one hand, and the inflation and real GDP growth on the other. Using multivariate regression analysis for 39 OECD during the two periods, 1991-1998 and 1999-2006, we show that even if we include several control variables in the regression, the negative relationship between CBI and inflation, and the lack of relationship between CBI and the variability of real GDP growth remaining were unaffected. Also, we decompose the index of CBI into its four components and we examine whether they matter for inflation, for real GDP growth and for the sacrifice ratio.

Keywords: central bank independence, inflation, real output growth, ordinary least squares estimation.

1. Introduction

The issue of Central Bank Independence (CBI) has been debated extensively by economists and policy makers during the past three decades. These debates, triggered essentially by the high inflation episodes in the 1970s and 80s, led to dramatic changes in monetary policy frameworks across several countries which essentially boosted the degree of independence of the Central Banks (CBs). Behind these reforms has been the realisation that more independent CBs can deliver lower inflation in the medium to longer term. Important changes were introduced in several European countries, but also in New Zealand, Canada, and Sweden. A notable example has been the granting of independence to the Bank of England by the incoming Labour government more than 10 years ago. As it was noted by Cukierman (1994), more independence allows CBs to focus more efficiently on key policy objective, such as that of price stability, without undue political interference.

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As mentioned by Hasse (1990), CBI is related to three key issues: personnel independence, financial independence and independence in the formulation and implementation of monetary policy. Personnel independence refers to the influence the government has in appointment procedures within the Bank. Of course, it is not realistic to completely prohibit government influence in key appointments in the CB, especially for the Governor. However, the degree of this influence depends on other several criteria, including for example government representation in the executive board of the CB. Financial independence refers to the ability of the CB to fulfil its tasks independently of government bodies and financial assistance and the prohibition of direct credit facilities to the public sector. Policy independence refers to the formal responsibility given to the CB to design and execute the monetary policy. DeBelle and Fischer (1995) and Fischer (1995) argue that it may be useful to decompose the policy independence to goal independence and instrument independence. The CB enjoys instrument independence if it has all instruments in hand to perform in an independent manner all its duties while goal independence refers to the ability to set its own policy objectives (e.g., the precise inflation target etc).

The empirical literature on CBI is focused on the question whether actually there exists a negative relationship between CBI and the rate of inflation (for surveys, see Eijffinger and De Haan 1996; Berger et al. 2001). Several studies conclude that, among industrial countries, legal independence is negatively related to inflation.¹ Also, some of these studies report that the GDP growth rate, the employment level and sacrifice ratios are not significantly related to legal independence in any way. Thus, based on these findings, they conclude that, regarding the industrial countries, CBI provides a free lunch, meaning that on the one hand it leads to lower inflation and on the other hand does not interfere (negatively) with the economic performance.

Cukierman (1992) and Bouwman et al. (2005) point out, however, that in general one of the problems empirical studies face is that legal indicators of CBI are often incomplete and unreliable because laws do not explicitly specify the limits of authority between CBs and governments. Thus, the actual degree of CBI may not be well measured by legal independence indicators. Even when the laws are relatively explicit, a CB by its nature interacts with other groups in the economy and this often leads to informal

¹ Legal independence is a proxy for the actual independence, given that there is sufficient implementation of the law in the country under consideration.

agreements. As a result, legal independence may deviate from actual independence.

In this paper we extend the CBI indices of Cukierman (1992) for a longer period and also examine several factors that may influence the relationship between the degree of CBI on the one hand and the inflation rate, and variability of real GDP on the other hand. The extension of CBI indices has become possible as a result of new CB laws which have been enacted over the last few years in several countries. These update allows us to review, using latest data, the relationship between CBI indices and key macroeconomic variables on interest. We use a sample of 39 developed and developing countries (27 European Union (EU) countries, USA, Canada, Australia, Korea, Japan, New Zealand, Israel, Turkey, Switzerland, Norway, Island and Mexico) for the period 1991-2006.

The paper is organized as follows. Section 2 describes the methods used in the literature to measure actual and legal independence. Section 3 discusses the empirical literature and presents our results. In Section 4, we discuss the policy implications and offer some concluding remarks.

2. Measuring Central Bank Independence: Legal and actual independence indices

The legal CBI indices have been constructed by several authors, including Alesina (1988; 1989), Cukierman (1992), Cukierman et al. (1992), Eijffinger and Schaling (1993) and Grilli et al. (1991). These indices are based on CB's legislation during the decade of 1980 and are focused on the level of independence that legislators meant to confer on the CB. The higher is the score for the index, the higher is the CBI. The indicators of Alesina (ALES) and Eijffinger-Schaling (ES) vary between 1 and 4, and between 1 and 5, respectively. In particular, as Eijffinger and De Haan (1996) mention, the original attempt of Bade and Parkin (1982) to codify the legal CBI has been extended by Alesina (1988; 1989). This index takes into account whether the CB has final authority concerning monetary policy, whether government officials have a lace in the governing board of the CB, and whether more than half of the board members are appointed by the government. In addition, Eijffinger and Schaling (1993) constructed an index based on who has the final authority for the monetary policy, the absence or presence of a government official on the board of CB, and the ratio of government made board appointees.

The Grilli et al. (GMT) index is the sum of the indices for political and economic independence of CB and the maximum total sum is 13. The political independence index is focused on the appointment procedures for

board members, the length of members' term to office, and the existence of legislation concerning the monetary stability. In general, the total index, which describes the legal independence, is the sum of both political and economic independence indices.

Cukierman (1992) and Cukierman et al. (1992) constructed CBI indices which were aggregated from sixteen characteristics of CB charters grouped into four clusters: (a) the appointment, dismissal, and the long term of office of the governor of CB, (b) the resolution of conflicts between the government and the CB and the participation of the CB in the budget process, (c) the objectives of the CB, and (d) the limitations on the ability of the CB to lend to the public sector (restrictions concerning the volume, maturity, interest rates and the conditions and conditions regarding the direct advances and securitized lending from the CB to the public sector). Furthermore, 16 variables were built by these four categories which were coded on a scale between 0 (lowest level of independence) and 1 (highest level of independence). Then, the 16 variables were aggregated into eight variables and the only difference between two indices is that the Cukierman's index (CUK) is the unweighted mean of the eight variables while the index of Cukierman et al. (CWN) is the weighted mean of the eight variables.

In order to extend and update the earlier work on Central Bank Independence, this section expands the CBI indices of Cukierman (1992) for the period 1991-2006. Our contribution to the existing literature is that we are going to provide it with independence indices which will be based on the new CB laws and on the codification system in Cukierman (1992, Chapter 19).^{2, 3, 4} The analysis covers many EU countries as well as Cyprus and Greece.

² The reason for that choice is that the CUK index, in contrast to the other CBI indices, has a broader score range for each factor that it measures (the measurement range is between 0 and 1), that is its values are continuous in the range between 0 and 1. Hence, the measure of independence is more detailed and comprehensive. In addition, the CUK index is an unweighted version of the 16 characteristics, but Cukierman et al. (1992) present a weighted index of the same characteristics. The CUK index was based on the CB laws during the 1980s. We extended this index according to the renewal of the CB legislation and this took place separately for both periods.

³ Following Cukierman (1992), the legal variables were coded separately for each decade. Since CB legislation changes relatively slowly, the codes are, in many cases, identical across periods. However this process includes important legislative changes for several countries. The coding was done according to the legislation that was in effect during at least half of the decade, whenever a change occurred within a decade. Thus, the coding procedure took place since we first selected the CB laws from all countries separately and then basing them on Cukierman (1992) methodology, measured the CBI.

⁴ The methodology used to measure legal independence is described in the Appendix.

More specifically, we extend the existing indices taking into account the upgraded CBs laws so that they characterize the legal CBI from the beginning of 1990 up to today because the existing legal CBI indices covered the period up to early 1990s. We use data for the periods 1991-1998 and 1999-2006.⁵ We divided the whole period because during the period 1999-2006 it started the implementation of the new regime concerning the European Central Bank (ECB), which took over responsibility for the conduct of monetary policy in the euro zone and its institutional process started with the Maastricht agreement for the European System of Central Banks (ESCBs). Due to the prerequisite for the national CBs to participate in the ESCBs to achieve their legal and institutional independence, we considered that for the 12 countries of the European Monetary Union (EMU) there is only the ECB (we include it in our sample and as concerns the variables we take into account their aggregated euro zone values) for the period 1999-2006. Thus, the number of countries is reduced to 28 from the initial 39, which we took into account during the period 1991-1998.

Furthermore, following De Haan (1995), we decomposed the independence measure of Cukierman (1992) into four components which are: (a) independence with respect to personnel (Per), (b) independence with respect to instruments to conduct monetary policy (Instr), (c) goals independence (Goal), and (d) financial independence (Fin).⁶

Table 1 shows our estimates for legal CBI and its four components for all countries during both periods. A comparison between the indices of independence developed in this paper and the original estimates of Cukierman (1992) (see Appendix for details) shows that the CBI indices of all EU-15 member-countries, except for Greece, Portugal and Netherlands, increased over the 1991-1998 period.⁷ As concerns the new EU member-states, a comparison cannot be made as Cukierman's (1992) study did not cover these countries, with the exception of Malta, Romania and Hungary. All the remaining countries, except for Israel, Mexico, Turkey and

⁵ We constructed two new CBI indices for each country, one for the period 1991-1998 and one for the period 1999-2006.

⁶ The decomposition of total CBI index was done as follows. The proxy for personnel independence is the sum of all variables in the first cluster of variables as distinguished by Cukierman (1992) and the proxy for instrument independence is the sum of all variables in the second cluster of variables. The third proxy concerning goal independence is the score for the third cluster and financial independence is the sum of eight variables in the fourth cluster, as discerned by Cukierman (1992).

⁷ EMU member-states plus Denmark, Sweden and the U.K..

Switzerland, experienced an improvement in their CBI indices between the decade of 1980 and 1991-1998 periods.

More specifically, as is also shown in Figure 1, during the period 1991-1998 almost all EMU member-states have high levels of CBI, which range from 0.25 to 0.70 (France, Finland and Germany have the highest CBI indices with 0.70, 0.68 and 0.66 respectively). As concerns the 10 new EU member-states, Table 1 and Figure 1 show that the values for their indices of independence range in low levels, from 0.16 (Poland) to 0.34 (Malta).⁸ This is due to the fact that, on the one hand, the EMU member-countries started a fundamental process of change in the structure of their economies and CBs after the Maastricht Treaty agreement (February 1992) which enacted irreversibly towards European single currency, while on the other hand, the ten new EU member-states moved to changes in their economies after the Luxembourg Summit of December 1997.

The CBs of Mexico and Israel have the lowest indices of independence with 0.18 and 0.22 respectively, as they were under the control of their governments. Also, during the period 1999-2006, as expected, all the 10 new EU member-states showed higher CBI indices than those during the period 1991-1998., which ranged between 0.29 and 0.63. Furthermore, these indices of independence during the period 1999-2006 were very close to the CBI indices of EMU member states during the period 1991-1998. Only Romania and Turkey had CBI indices of 0.24 and 0.22 respectively during the period 1999-2006, while Bulgaria had an index of independence of 0.30. Regarding Cyprus, we did not measure the CBI index because the official CB Law was enacted in 2002. During the period 1999-2006 its index of independence was 0.49, one of the highest indices among new EU member-states in that period. In addition, it is evident from Table 1 that the ECB is indeed very independent, having an index of 0.92, as is also documented by Alesina (1989), Cukierman (1992), Eijffinger and Schaling (1993), Bade & Parkin (1982) and Grilli et al. (1991).

We should mention that, during both periods, the objectives index has small variability (its standard deviation is 0.181 for the period 1991-1998 and 0.143 for the period 1999-2006). As a result, the variability of aggregate independence index is based on the variability of the remaining three components, personnel independence, instrument independence and financial independence.

⁸ Slovenia, Slovakia, Cyprus, Czech, Malta, Latvia, Lithuania, Poland, Hungary and Estonia.

TABLE 1

The Cukierman's Central Bank Independence Index and its four components

	CUK 91-98	CUK 99-06	91-98				99-06			
			Per	Instr	Goal	Fin	Per	Instr	Goal	Fin
Australia	0.62	0.64	2.83	1.07	0.60	4.67	3.33	1.07	0.60	4.67
Austria	0.59	-	2.58	1.60	0.60	4.66	-	-	-	-
Belgium	0.61	-	2.83	1.40	0.60	4.67	-	-	-	-
Bulgaria	0.13	0.30	0.67	0.53	0.40	0.58	1.33	0.93	0.60	1.24
Canada	0.67	0.69	3.33	0.93	0.80	5.34	3.33	0.93	0.80	5.00
Cyprus	-	0.49	-	-	-	-	1.33	2.00	0.60	2.66
Czech	0.23	0.56	1.33	0.53	0.40	0.91	2.33	1.60	0.60	3.67
Denmark	0.47	0.57	1.08	1.00	0.60	3.24	2.08	1.67	0.60	3.57
Estonia	0.18	0.40	1.17	0.33	0.40	0.33	1.33	1.60	0.40	1.91
Finland	0.68	-	3.75	1.60	0.60	4.33	-	-	-	-
France	0.70	-	3.00	1.60	0.80	4.00	-	-	-	-
Germany	0.66	-	2.75	1.67	1.00	4.59	-	-	-	-
Greece	0.25	-	0.83	0.53	0.60	0.99	-	-	-	-
Hungary	0.19	0.30	0.83	0.33	0.40	0.66	1.42	0.33	0.60	1.32
Iceland	0.36	0.39	3.08	0.53	0.40	1.91	2.92	1.07	0.40	2.25
Ireland	0.41	-	2.58	0.60	0.80	2.07	-	-	-	-
Israel	0.22	0.42	1.33	0.87	0.40	0.99	2.58	1.27	0.60	2.58
Italy	0.35	-	2.58	0.93	0.60	1.32	-	-	-	-
Japan	0.71	0.77	3.58	0.67	0.60	4.67	3.58	0.67	0.60	5.67
Korea	0.30	0.52	2.33	0.33	0.60	1.32	2.17	1.27	0.60	3.01
Latvia	0.20	0.38	1.08	0.87	0.80	0.25	1.92	1.60	0.80	1.24
Lithuania	0.17	0.63	0.83	0.33	0.40	0.66	2.17	1.60	0.80	3.34
Luxembourg	0.44	-	2.83	0.73	0.60	3.08	-	-	-	-
Malta	0.34	0.55	2.17	1.20	0.40	2.58	2.42	1.60	0.60	4.67
Mexico	0.18	0.28	1.58	0.53	0.00	0.91	2.17	0.73	0.40	1.25
Netherlands	0.38	-	2.17	0.53	0.60	2.00	-	-	-	-
New Zealand	0.71	0.73	3.08	1.67	0.60	4.34	3.08	1.67	0.60	4.67
Norway	0.43	0.48	2.33	1.07	0.60	2.99	2.33	1.07	0.60	3.66
Poland	0.16	0.37	0.58	0.33	0.40	0.66	1.58	0.33	0.40	3.25
Portugal	0.32	-	0.92	0.93	0.60	2.32	-	-	-	-
Romania	0.09	0.24	0.58	0.33	0.40	0.00	1.42	0.93	0.40	0.33

(Table 1 continues on next page)

TABLE 1 (continued)

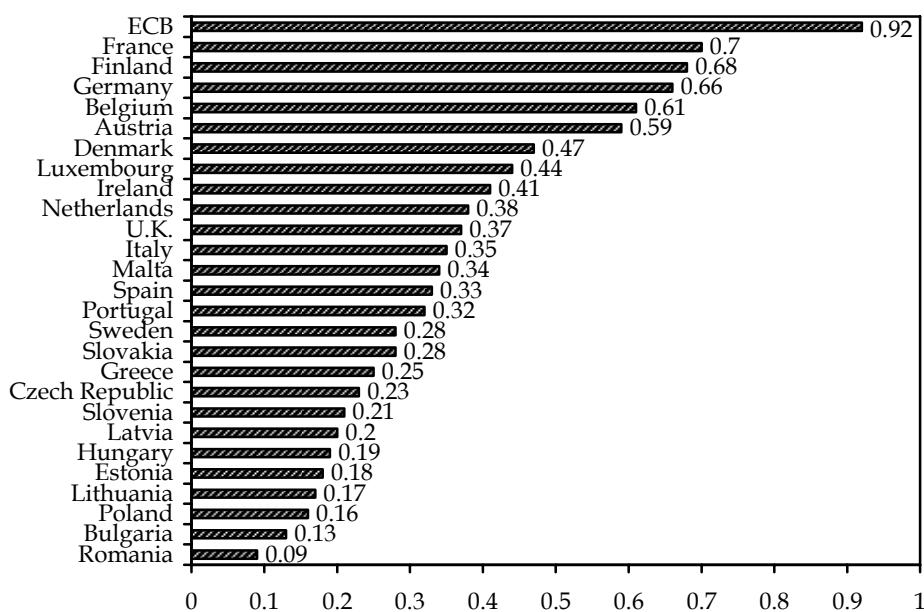
	CUK		91-98				99-06			
	91-98	99-06	Per	Instr	Goal	Fin	Per	Instr	Goal	Fin
Slovakia	0.28	0.29	1.42	2.00	0.40	0.66	1.67	2.00	0.40	0.66
Slovenia	0.21	0.32	1.17	0.67	0.60	0.58	1.83	1.27	0.60	0.91
Spain	0.33	-	1.83	0.73	0.60	2.24	-	-	-	-
Sweden	0.28	0.56	2.42	0.00	0.20	2.90	2.42	1.07	0.60	4.67
Switzerland	0.55	0.72	1.50	0.60	0.60	2.58	2.92	0.93	0.80	5.00
Turkey	0.11	0.22	0.83	0.53	0.40	0.33	1.83	0.93	0.40	1.25
U.K.	0.37	0.58	2.83	0.73	0.60	1.66	2.83	0.73	0.80	3.34
U.S.A.	0.52	0.54	2.33	0.20	0.40	3.91	2.67	0.40	0.40	3.91
EMU	-	0.92	-	-	-	-	4.00	2.00	0.80	7.00
Average	0.379	0.495	1.972	0.817	0.537	2.261	2.321	1.188	0.586	3.096
St. Deviation	0.193	0.178	0.940	0.482	0.181	1.619	0.733	0.490	0.143	1.705

Note: The CUK index was based on the CBs legislation as shown in Appendix by using the methodology of Cukierman (1992).

Sources: Cukierman (1992) and author's calculations.

FIGURE 1

Comparison of CBI indexes between ECB and EU member-states: 1991-1998

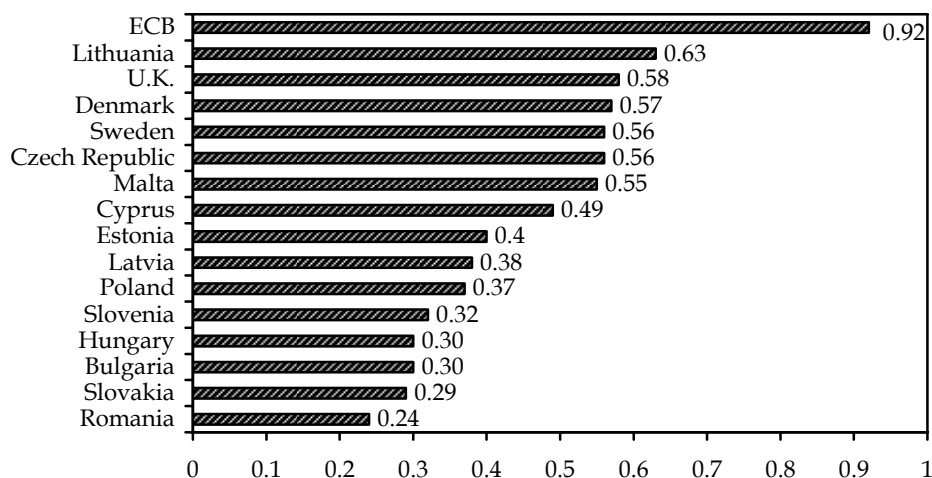


Note: The independence index of ECB (0.92) concerns the 1999-2006 period.

Source: Author's calculations.

FIGURE 2

Comparison of CBI indexes between ECB and EU member-states: 1999-2006



Source: Author's calculations.

3. Does independence matter for macroeconomic stability?

As concerns the empirical literature, the results regarding the effects of independence are not clear enough. A large number of studies deal with the relationship of inflation and variability of real output with the CBI index.

Most of the studies, by using several indices for CBI, arrive at the conclusion that the independence is negatively related with the mean inflation rate (Bade and Parkin 1982; Crilli et al. 1991; Banaian et al. 1983 and Cukierman et al. 1992). The independence also seems to lead to lower variability of inflation rate, while in many studies it appears to be related with real variables, such as mean GDP growth rate or variability of that (Alesina and Summers 1993; Cukierman et al. 1993 and Eijffinger and De Haan 1996).

In particular, Alesina and Summers (1993), by using the index of Bade and Parkin (1978) and adding four more countries (Denmark, New Zealand, Norway and Spain), found a clear negative relationship between independence and inflation. In addition, Bleaney (1996), taking account a sample of 17 OECD countries, argued that not only is the degree of independence negatively related with the inflation but also has no effect on the unemployment. Eijffinger et al. (1997) use panel methodology for 10 industrial countries for the period 1977-1990, and moreover, consider current and past values of inflation and also the growth rates as independent variables. They find that CBI does not have a negative influence on the mean GDP growth rate of the countries examined.

Cukierman et al. (1993) also did not find any effect of independence on output growth, even when they took into account other structural factors that may influence the growth rate. Such factors were the initial level of GDP, the human capital reserve (measured approximately as the ratio of registers in primary and secondary education) and the trade flows.

In contrast, Hall and Franzese (1998), Fuhrer (1997), Fuijki (1996) and Demertzis (2004), point out that CBI reduces inflation but at the same time it increases the variability of the output, while some other studies mention a positive relationship between independence and real output growth. De Long and Summers (1992), for example, have found that a positive relationship exists between the degree of independence and the GDP per capita for a sample of industrial countries. Cukierman et al. (1993), despite not finding a significant relationship between independence and GDP growth for the industrial countries, do however find a positive relationship for the developing countries when the frequency that Central Bankers change is used as a variable for measuring the independence.

In general, the empirical studies face several problems (Zervoyianni et al. 2006). One of these is that the construction of independence indices is based on the legal independence of CBs while the degree of real independence would describe more effectively the real situation of CBs. Another problem is that the empirical studies do not show whether there is causality between independence and inflation. This means that inflation can perhaps be explained by other factors other than CBI.

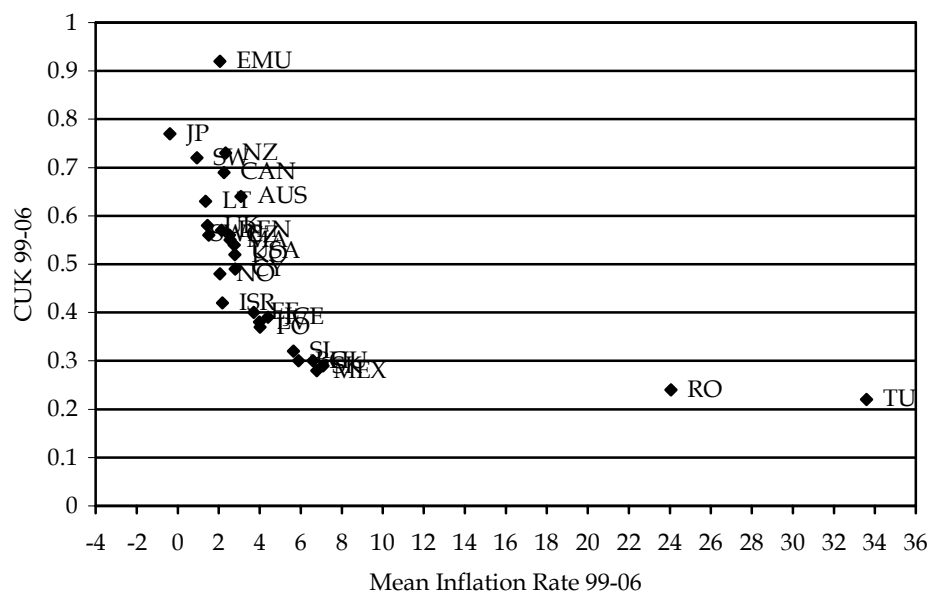
In addition, various authors examined whether CBI really influence inflation once other factors were taken into account. Thus, according to Zervoyianni et al. (2006), it is argued that while the degree of CBI increases the total variability of the business cycle thus incurring no significant social cost. This may not show in the empirical results due to, for example, the use of the appropriate fiscal policy. Campillo and Miron (1997) found that the CBI does not lead to lower inflation once factors such as fiscal policy are held constant. However, using a similar model to that of Campillo and Miron, Brumm (2000) arrived at the conclusion that even though the CBI indices were not significantly associated with inflation, the variables turnover rate of CB governors and the degree of changing the political regimes within a country constructed by Cukierman and Webb (1995), were significantly related to inflation.

The existing literature also deals with the 'political factors' that influence the relationship between inflation and CBI, especially with the issue of political instability. There is no specific definition of the term 'political instability' which has been used in the empirical studies. Cukierman (1994), for example, examined the effect of two indices of political

instability, (a) party political instability, and (b) regime political instability. The party political instability index is related to the frequency that a change in government takes place in which a right-wing government is replaced by a left-wing government, or vice versa. When the party political instability is high, the party, which is in government, realizes that in the following elections it may lose its power. Also, the governing party facing the probability that the opposing party may use monetary policy in order to manage the budget deficit, prefers to delegate monetary policy to the CB. Thus, Cukierman (1994, p.65) points out that there is a positive relationship between party political instability and CBI, "provided political polarization is sufficiently large". De Haan and Van 't Hag (1995) tested Cukierman's hypothesis for three different indices of CBI (two of Cukierman and one of Grilli, Masciandaro and Tabellini) for the period 1970-1980 using data from industrial countries. They used the degree of substantial political changes occurred in the governments (that is, when another party or coalition undertakes the governance) as an index of political instability. For that index, all three indices did not show a significant relationship.

Based on the independence indices produced in this paper a number of these propositions were tested. Figures 3 and 4 describe the data during the 1999-2006 period and Table 2 gives a brief description of econometric results.

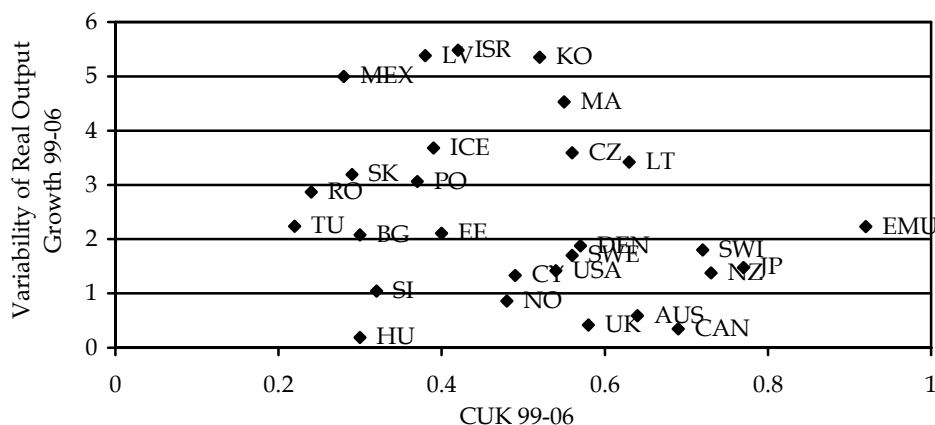
FIGURE 3
CBI indexes and mean inflation rates for 1999-2006 period



Source: Author's calculations.

FIGURE 4

CBI indexes and variability of real output growth for 1999-2006 period



Source: Author's calculations.

TABLE 2

Econometric results

	Mean Inflation Rate 91-98	Mean Inflation Rate 99-06	Variability of Real Output Growth 91-98	Variability of Real Output Growth 99-06
CBI	Negative, significant	Negative, significant	Not significant	Not significant
Per	Negative, significant	Not significant	Not significant	Not significant
Fin	Not significant	Negative, significant	Not significant	Not significant
Inst	Not significant	Not significant	Not significant	Not significant
Qual	Negative, significant	Negative, significant	Not significant	Negative, significant
PS	Negative, significant	Not significant	Not significant	Not significant
Open	Negative, significant	Not significant	Not significant	Not significant
BDS	-	Not significant	Positive, significant	-
ER	-	Not significant	-	-

Note: see Appendix for the definition of explanatory variables

Firstly, we examine the relationship between Central Bank Independence and inflation. The econometric results based on cross-country regression

(see Appendix for details) show a strong negative relationship between independence and inflation. Therefore the results are consistent with other studies which conclude that the political independent CBs achieve lower inflation than CBs in which this independence is absent (Banaian et al. 1983; Alesina 1988; Grilli et al. 1991; Cukierman et al. 1992; Bleaney 1996).

In what follows, the results show that, even if we include all the control variables, the CBI coefficient remains statistical significant and negative. In particular, the inclusion of the control variables in our model helped us to arrive at the conclusion that there is a strong indication that countries whose CBs are more independent tend to have lower inflation during 1991-1998 and 1999-2006 periods. Quality of government and political stability are the only control variables that influence statistically significantly the inflation. As expected, both variables have a negative influence on inflation. The explanation is that when there is quality of government or political stability the prevailing regime can be assumed to have long run tenure. Thus, under this regime, there is a more credible economic policy which in general aims at implementing the announced policies regarding the price level or the achievement of other macroeconomic objectives.

De Haan and Siermann (1994) and Cukierman and Webb (1995) also report similar findings concerning the effects of political stability on inflation. The results of these studies imply that inflation and political instability are positively related, and even if some measures of political instability are included in the regression, indicators for CBI, such as the turnover rate of CB governors or the political vulnerability of the CB, remain significantly related to inflation. Also, we find that the degree of openness is negatively associated with the inflation during the 1991-1998 period. This result is in line with the empirical finding of Romer (1993), which concludes that there is a strong and robust negative link between openness and inflation since he included several indicators of political stability and CBI, which have been found to be important determinants of inflation.

Also, Romer (1993: 871) argued that "if the openness-inflation relationship arises from the dynamic inconsistency of discretionary monetary policy, the relationship should be weaker in countries that are more stable politically and have more independent central banks, since one would expect these countries to have had more success in overcoming the dynamic inconsistency problem". Similarly, Al-Marhubi and Willett (1995) employed an indicator for openness and once again the coefficient of CBI index remained significant and negative.

Furthermore, as concerns the contribution of each component of aggregate CBI index on inflation (see Appendix for details), we arrive at the conclusion that only independence with respect to personnel matters for inflation performance during 1991-1998 and only financial independence matters for inflation performance during 1999-2006. Regarding the 1991-1998 period, the other two components of the CBI index are negatively associated with inflation but this relationship is not statistically significant. Thus, only the personnel independence reveals the same behaviour across the inflation with that of the CBI index.

From the existing empirical studies only two have tried to differentiate between the various aspects of CBI. Debelle and Fischer (1995) decomposed the Grilli et al. (1991) index into independence with respect to goals, personnel and instruments. They found that the instrument independence was not significantly associated with the inflation performance, while the independence with respect to personnel and goals was negatively and significantly related to inflation. Similarly, De Haan (1995) decomposed the legal CBI index of Cukierman (1992) and examined the relationship of its components to inflation. Using pooled time-series and cross-sectional data for 21 industrial countries, he concluded that only instrument independence is negatively related to inflation. Thus, as concerns the significance of personnel independence, our results are similar to the findings of Debelle and Fischer (1995) but are opposed to the conclusions of De Haan (1995).

Secondly, we examine the relationship between Central Bank Independence and variability of real output growth. Following most of the models related to the CBI issue (for example, see Rogoff 1985; Eijffinger and Schaling 1993), when the CB assigns a relatively higher weight on price stability, the output variability is higher than the CB which also fights for the economic stability. However, as pointed out by Alesina and Summers (1993), an independent CB, while fighting for the price stability and trying to have the inflation control, will not follow a 'stop-and-go' policy in which case the fluctuations in real output may be smaller. Also, Eijffinger et al. (1997), Eijffinger and Schaling (1993) and De Haan and Sturm (1994) concluded that the CBI does not have a significantly negative influence on the mean rate of increase of the GDP. Our econometric results based on cross-country regression (see Appendix for details) show that there is no evidence at best that variability of real GDP growth is related to CBI during the 1991-1998 and 1999-2006 periods. Thus, we conclude that independence does not contribute to explaining the behaviour of variability of real GDP growth. Moreover, the existence of a non significant relationship between CBI and variability of real GDP growth is confirmed in the studies of Alesina and Summers (1993), Cukierman et al. (1993) and

Eijffinger and De Haan (1996). Also, this result is not consistent with Alesina and Gatti (1995) as they concluded that the statistical significance of independence was influenced when they included political stability in the model, which related significantly to the variability of real output growth. In addition, our result is not in line with the studies of Hall and Franzese (1998), Fuhrer (1997), Fuijki (1996), Demertzis et al. (1998) and Demertzis (2004) which argue that not only does the independence reduce inflation but also increases the variability of real GDP. Also, we arrive at the same conclusion with Bleaney (1996) as he implies that independent CBs despite reducing the average inflation, do not influence the unemployment rate. In addition, we find that the higher the variability of budget deficit/surplus is, the higher is the variability of real output growth during 1991-1998 period. In addition, as concerns the 1999-2006 period, quality of government does matter for variability of real output growth as there is an indication that countries whose governments are more qualitative tend to have lower variability of real output growth. A possible explanation is that when the quality of government is high the economy is governed by political stability and there is a more credible fiscal authority, which pursues to implement fiscal policies and taxes. Thus, the governments manage to fulfil their targets easier and this leads them to lower variability of macroeconomic variables in real economy.

As regards the contribution of each component of aggregate CBI index on output variability (see Appendix for details), we conclude that there is no evidence that some of the independence components are associated with the variability of real output growth during the 1991-1998 and 1999-2006 periods.

4. Some conclusions and policy implications

This paper examines the robustness of the relationship between CBI, on the one hand, and inflation, real GDP growth on the other hand, using the method of ordinary least squares analysis. Our results reveal that countries with more independent CBs have lower inflation over both periods and even if some control variables are included in the regression, the coefficient of CBI remains significant. Quality of government is inversely related to inflation over both periods, but political stability is negatively associated with inflation only over the period 1991-1998. The latter result is consistent with De Haan and Siermann (1994) and Cukierman and Webb (1995), who show that even if political stability is included in the regression, indicators for CBI, such as the turnover rate of CB governors or the political vulnerability of the CB, remain significantly related to inflation. During 1991-1998, we arrived at the conclusion that there is a significant and

negative link between inflation and the degree of openness. This result confirms the finding of Romer (1993), according to which there is a strong and robust relationship between openness and inflation. Concerning the components of independence index, our results reveal that personnel independence and financial independence matter for inflation over the periods 1991-1998 and 1999-2006 respectively. The former result is with Debelle and Fischer (1995), finding that the independence with respect to personnel and goals was negatively and significantly related to inflation.

Our results regarding the relationship between variability of real GDP growth and CBI, revealed that there was no statistical link between these variables over both periods. In other words, independence does not contribute to explaining the behaviour of real GDP growth. This result is in line with the studies of Alesina and Summers (1993), Cukierman et al. (1993) and Eijffinger and De Haan (1996) which pointed out the existence of a non significant relationship between CBI and variability of GDP growth. Also, during 1999-2006, we arrived at the conclusion that there was a significantly negative relationship between the variability of budget deficit/surplus and the variability of real GDP growth. Only quality of government mattered for variability of real GDP growth over 1999-2006, as there was evidence for the existence of a negative relationship between these two variables. In addition, there was weak evidence that any of the components of independence index were significantly related to variability of real output growth over both periods.

The concept of CBI has become increasingly recognised in monetary theory and policy. It is often argued that a high degree of CBI, together with the mandate that the bank aims for price stability, are the key devices for maintaining that stability. And as Table 1 indicates, many countries increased the independence of their CBs during the period 1999-2006.

The independence of CBs has been proposed as a solution to the problem of dynamic inconsistency problem. Policy decisions that are optimal *ex ante* are not necessarily optimal *ex post* when the particular policy has to be adopted. For example, in the case of monetary policy, the government at the end of period $t-1$ announces a policy of zero inflation from period t , which is the best choice at this particular time. However, when the government has to implement the zero-inflation policy, this choice is no longer optimal. Once the private sector has adjusted their inflationary expectations to the zero-inflation level, the government's best choice is to expand the money supply so as to reduce unemployment beyond its natural-rate level. Sooner or later the private sector realizes that, as a result of the government's actions, there will be a tendency for prices to rise and revises upwards their expectations of inflation. This leads to an 'inflation

bias', namely higher average inflation in the long run with no benefit in terms of reduced unemployment.

CB independence implies that monetary policy is assigned to a CB whose board is not influenced by elected governments. Being politically autonomous, an independent CB will have no incentive to expand the money supply in order to reduce unemployment, and will therefore concentrate on the objective of maintaining price stability. The independence of the ECB has been advocated along these lines. With its board of directors consisting of technocrats whose main aim is the regulation of monetary aggregates and the control of inflation, the ECB's policies are not subject to the time inconsistency problem. Indeed, inflation throughout the eurozone has been kept low and stable since 1999, at an average level of 2.06%, something consistent with the ECB's money-supply growth target of 4.5%. Also, in the case of Greece, the decision to become a eurozone member and the implementation of procedures that led to the independence of CB of Greece, were followed by a significant reduction in the inflation rate from 7.8% in 1996 to 3.7% in 2001 when the euro started to circulate in Greece. As far as Cyprus is concerned, it became a eurozone member only very recently (January 2008) and any general conclusions regarding the impact of CB independence on its economy are too early to be drawn.

This solution works well in normal circumstances, i.e. during periods in which economies are not confronted with significant stochastic shocks, namely unexpected events which, although may reverse themselves fully in the long run, can cause large fluctuations in output and employment in the short run. In the presence of such shocks, CBI increases the impact of the shocks on the real economy. In particular, if an adverse stochastic shock reduces aggregate demand and employment, an independent CB will not react by expanding the money supply or reducing interest rates as an elected government would do. The end result with an independent CB will therefore be deeper recession for the local economy (Acemoglu et al., 2008).

An example is the current situation in the European and global economies. The financial crisis, which started in 2007 and was culminated in September 2008, has been accompanied by a synchronized slowdown of economic activity in all economies. The deceleration of economic activity in the global economy is considered by many as equally severe as that in the 1930s as it is characterized by a low level of consumer and business confidence, a reduction in world trade and high uncertainty in the markets. This situation requires not only the adoption of bank support schemes, but also the implementation of macroeconomic policies to help revive aggregate demand, and, in particular, investment spending, so as to

contain the adverse effects of the financial crisis on the real economy and promote economic growth.

Over the last six months, the ECB, along with other CBs and governments, has reacted to the financial crisis by implementing policies aimed at repairing banks' assets and encourage the provision of credit to the EU economies. Many, however, argue (Di Noia & Micossi (2009), Masciandaro (2009)) that the ECB has lagged behind the economic crisis, because its independence implies that its main objective should be price stability and preservation of price stability requires high interest rates and a strict inflation target and thus a strict money-supply growth target. That is, the ECB failed to respond promptly to the financial crisis and the actions taken were not sufficient to help alleviate the pressures on the real economy of the EU member states. In particular, the priority of monetary policy since the start of the financial crisis should have been to stimulate investment and ensure high growth, something requiring low real interest rates. However, it was only in October 2008, when the ECB announced a cut in its key policy rates by 50 basis points.

Recognizing that the extent of its policy-rates cut was not enough to contribute to a revival of economic activity, the ECB proceeded to announce another 50 basis point cut in November. And it had to wait to see a large drop in inflation before it decided to reduce its policy rates by a further 75 basis point in December, by which time a revival of consumer and business confidence had become much more difficult. Thus, the focus of ECB on inflation has rendered it less flexible to react more quickly to the events which were unfolding internationally, especially when compared with the Federal Reserve.

This is rather over simplistic, however, mainly if one takes into account the fact that at the same time as the financial crisis was unfolding, the ECB was also faced with the oil and commodity price shock, which complicated enormously policy making. It is true though that the focus on inflation put enormous pressure on the ECB to keep a tight stance to pin down inflation expectations and avoid second round effects, and it is therefore also logical to claim with hindsight that the ECB could have reversed its stance earlier. However, in real time policymakers need to take bold decisions and overall the analysis seems to confirm that the ECB's response was appropriate. What is crucial, however, from the point of view of this paper is the fact that the ECB performed its role without political interventions, and it is therefore clear that CBI ensured that at least on the inflation front things did not escalate, otherwise we would be facing a similar hyperinflation environment as in the 1970s.

What should be done? As many argue (Geraats et al. (2008), Goodhart (2008)), given that there are increasing risks that the EU countries will face a prolonged period of deceleration in economic activity, real interest rates need to be lowered to their lowest possible level. Since the risk of inflation in the EU is very low, it may be necessary for the ECB to make clear that its key policy rates, which affect short-term nominal interest rates in the financial markets, will stay low for an extended period of time, thus providing a signal for further monetary easing. On the other hand, as many academic and policymakers point out, if the ECB wishes to contribute enough to stimulating spending and investment, it should create higher inflation expectations in order to reduce real interest rates. This requires the ECB to raise its inflation-rate target, say to 2-2.5%, and thus announce a corresponding increase in its medium-term money-supply growth target. Some economists (see e.g. Buitert & Sibert (2007)) go even further in arguing that to ensure the revival of spending and investment, more dynamic measures are required on the part of the ECB. For example, the ECB could consider the possibility of explicitly announcing its intention to encourage growth and take coordinated actions along with national governments on this front.

This however would imply a change in the ECB's priorities and in its degree of independence. As Krugman (2009) notes, the reason that the ECB has been less active than the Federal Reserve of the US and has avoided to take dynamic measures to increase market confidence is that, unlike the Federal Reserve, it lacks the support of a strong national government. The FED can be more daring than the ECB, because the US government has shown to the markets that it is ready to accept the costs of any risky decision by the FED and that it will back it up even if it fails to resolve all the problems created by the financial crisis. The ECB, because it is politically independent, cannot count on a similar backing. Indeed, in the current period of economic crisis, the EU appears to be structurally weak and the independence of the ECB is not as desirable as it was some years ago.

But the adoption of a single currency in Europe eliminated the exchange-rate risk during the financial crisis. Having a single currency automatically implies having a single exchange rate and thus also a single exchange rate policy. Prior to their adoption of the euro, countries like Italy, Greece or Spain simply devalued their currencies in troublesome times and lowered their interest rates to increase the export opportunities for their economies. As members of the euro zone today, however, this option is no longer available because of stringent budget rules in place to ensure the common currency's stability. For example, Iceland saw the collapse of its currency and its banking system and, following Lane (2008), its future strategy

should be membership of the EU and, once the Maastricht criteria are fulfilled, entry into the euro area.

Besides CBI, there are also other options aimed at achieving stable prices. One solution is to influence the incentives of the monetary authorities by imposing a contract on the central banker that would force it to pay a pecuniary penalty if monetary policy is used against unemployment over and above its use for price stabilization. (See e.g. Hayo & Hefeker (2002)). Such a contract however needs full information about the preferences of the central banker if it is to allow correction for the marginal incentive to create surprise inflation. Also, as for example Obstfeld & Rogoff (1996) note, it would be difficult to define which shocks are within the scope of stabilization policy and which are not.

Another solution is to assign to the Central Bank an inflation target (see e.g. Hayo & Hefeker (2002) for a discussion). The UK, New Zealand, Sweden, Switzerland, Australia, Israel and Canada have adopted this solution, which often is considered as the opposite of independence. Over the short to medium run, in this regime the government either assigns a target to the Central Bank for the inflation rate, or the government and the Central Bank 'negotiate' a target. When the Central Bank does not meet the target it has to justify its failure, like is the case of the contract, and the governor of the Central Bank may even risk losing his job as a penalty. Hence, a low and stable inflation rate is sought by holding the Central Bank responsible for a too high inflation rate. The case of New Zealand implies that there is often high discretion concerning the interpretation of violation of such a contract. For example, the Governor of New Zealand's CB was not removed from office for missing the target.

Finally, there is the old monetarist approach of fully constraining CBs by a constitutional monetary policy rule. In such a case CB discretion is reduced to the choice of instruments to achieve the goals set in a monetary-policy rule. For instance, a specific money-supply growth value of, say, 4.5% may constitute a rule (see e.g. Hetzel (1997)).

Appendix

A.1. The methodology for independence measure

The individual components of legal CBI, according to Cukierman (1992), are aggregated in two steps. First, the original data on the 16 legal variables are aggregated into eight legal variables as follows. The four variables regarding the appointment and term of office of governor of the CB are aggregating into a single variable which is the mean of the four components. The three variables concerning policy formulation are aggregated into a single variable by computing a weighted

mean of the variables in that group, with weights of 0.5 for the resolution of conflict, 0.25 for who formulates monetary policy, and 0.25 for active role of CB in formulating the government budget. The objectives variable is considered separately. The first four variables which are related to limits on lending are treated separately while the last four variables in the group are averaged with equal weights into a single variable. This procedure provides one summary legal variable for each of the first three groups and five variables for the limitations on lending group. Second, the eight legal variables are averaged with equal weights into a single index for each country and period. Thus, this index describes the legal CBI following the codification system of Cukierman (1992).

A.2. Original Cukierman CBI indices for 1980-1989 period

Country	CUK
Australia	0.31
Austria	0.58
Belgium	0.19
France	0.28
Germany	0.66
Denmark	0.47
Switzerland	0.68
Greece	0.51
U.K.	0.31
U.S.A.	0.51
Japan	0.16
Ireland	0.39
Island	0.36
Spain	0.21
Italy	0.22
Canada	0.46
New Zealand	0.27
Norway	0.14
Netherlands	0.42
Portugal	0.41
Sweden	0.27
Finland	0.27

Source: Cukierman (1992).

A.3. The CBs' legislation

Country	Legislation
Australia	Reserve Bank Act 1959, as amended in 2001
Austria	Federal Act on the Austrian National Bank, 1984, as amended in 1998, 2001
Belgium	Law on the National Bank of Belgium, 1948, as amended in May 1995, February 1998, August 2002
Bulgaria	Law on the Bulgarian National Bank, 1991, as amended in 1997
Canada	Bank of Canada Act, 1985, as amended in 1997 and 2001
Cyprus	Law on the Central Bank of Cyprus, 2002
Czech Republic	Act on the Czech National Bank, December 1992, as amended in 2002
Denmark	The National Bank of Denmark Act, April 1969, as amended in 1988, 2002
Estonia	Law on the Central Bank of the Republic of Estonia, May 1993, as amended in 1994; Law on changing the Law of the Central Bank of the Republic of Estonia, June 1998
Finland	Act on the Bank of Finland, 1991
France	Act on the Bank of France, August 1993
Germany	Sixth Act Amending the Bundesbank Act, October 1992
Greece	Law on the Bank of Greece, October 1927, as amended in May 1998, June 2000
Hungary	Act LX of 1991 on the National Bank of Hungary, 1991; Act LVIII of 2001 on the National Bank of Hungary, 2001
Iceland	Act on the Central Bank of Iceland, 1986, as amended in 2001
Ireland	Act on the Central Bank of Ireland, July 1989, as amended in 1995, 1998
Israel	Bank of Israel Law, 1954, as amended in 1981, 1985, 1998, 2002
Italy	1936 Banking Law of Bank of Italy, as amended by consolidated Law on Banking 1993
Japan	Bank of Japan Act, May 1942; Bank of Japan Act, June 1997
Korea	The Bank of Korea Act, 1962; The Bank of Korea Act, 1997
Latvia	Law on the Bank of Latvia, May , 1992, as amended in 1997, 2002, 2005
Lithuania	Law on the Bank of Lithuania, December 1994, as amended in March 2001
Luxembourg	Law on Central Bank of Luxembourg, 1992
Malta	Act XIV and XXVI of 1994 on the Central Bank of Malta; Act XVII of 2002 on the Central Bank of Malta, Act III of 2004, Acts I, IV of 2007
Mexico	Law on the Bank of Mexico, 1984, as amended in 1998
Netherlands	Act on the Netherlands Bank, 1991, Bank Act 1998
New Zealand	Reserve Bank of New Zealand Act, 1989; Reserve Bank of New Zealand Amendment Act, 1995, Reserve Bank of New Zealand Amendment Act, 2003

(continues on next page)

The CBs' legislation (continued)

Country	Legislation
Norway	Act on the Central Bank of Norway, September 1985, as amended in 1999
Poland	Act on the National Bank of Poland, 1991, as amended in 1997
Portugal	Law on Bank of Portugal, November 1975, as amended in 1992
Romania	Law on the Statute of the National Bank of Romania, 1991, as amended in 1998, June 2004
Slovakia	Act on the National Bank of Slovakia, 1992, as amended in 2001, 2005
Slovenia	The Act of Bank of Slovenia, 1991, as amended in 2002
Spain	Law on the Bank of Spain, June 1994
Sweden	The Sveriges Riskbank Act, 1988, as amended in 1999
Switzerland	Federal Act on the Swiss National Bank, 1978, Federal Act October 1989, Federal Act March 1995
Turkey	The Law on the Central Bank of the Republic of Turkey, 1970, as amended in 1990, 1994, 2001, 2005
U.K.	Bank of England Act 1946, as amended in 1993, 1998
U.S.A.	Federal Reserve Act, 1988, as amended in 2000
E.M.U.	Treaty on the European Union, 1992, including Protocol on the Statute of the European System of Central Banks and of the European Central Bank, 1992

Sources: www.rba.gov.au; www.oenb.at; www.bnb.be; www.bnb.bg; www.bankofcanada.ca; www.centralbank.gov.cy; www.cnb.cz; www.nationalbanken.dk/dnuk/specialdocuments.nsf; www.bankofestonia.info; www.ecb.int; www.bof.fi; www.banque-france.fr; www.bundesbank.de; www.bankofgreece.gr; www.mnb.hu; www.sedlabanki.is; www.centralbank.ie; www.bankisrael.gov.il; www.bancaditalia.it; www.boj.or.jp/en/index.htm; www.bok.or.kr/eng/index.jsp; www.bank.lv; www.lbank.lt; www.bcl.lu; www.centralbankmalta.org; www.banxico.org.mx; www.dnb.nl; www.rbnz.govt.nz; www.norges-bank.no; www.nbp.pl; www.bportugal.pt; www.bnro.ro/def_en.htm; www.nbs.sk; www.bsi.si; www.bde.es; www.riksbank.com; www.snb.ch; www.tcmb.gov.tr; www.bankofengland.co.uk; www.federalreserve.gov; www.newyorkfed.org.

A.4. Empirical Results

A substantial disadvantage of many empirical studies, which study the relationship between the degree of independence and the inflation and variability of real output, is that they do not take into account other variables which once are held constant, they show that CBI plays no role in determining inflation outcomes (see Campillo and Miron 1997; Melitz 1997). For this reason and following Cukierman (1994) and Haggard et al. (1991), which mention the term 'political instability' trying to examine how several political factors influence the CBI, we add similar variables such as 'quality of government' (QUAL) and 'political stability' (PS). Also, we examine several other factors, such as the variability of nominal exchange rates (ER) (we use the variance of nominal exchange rates for each period), and the unions' aggressiveness (WORK) (number of employees that participate in strikes per 1000 employees, average for each period). Following Campillo and Miron (1997), we examine the degree of openness (OPEN) (sum of imports and exports as percentage

of GDP, average for each period). According to Campillo and Miron (1997), regardless of the CB conservativeness, the degree of openness influences positively the inflation. In attempt to study the influence of fiscal policy interventions on the relationship between CBI and dependent variables, we use the deficit/surplus of the budget (BDS) (we take into account the percentage of GDP and we use the variance in each period). In addition, in order to examine other factors (control variables) that influence the relationship between the CBI index and the inflation and variability of real output growth, we use multivariate regressions with dependent variables the mean inflation rate and the variance of real GDP growth rate and independent variables, the CBI index and several other factors that may influence the above relationships. We have used the OLS (ordinary least squares) method for all regressions for both periods 1991-1998 and 1999-2006. It should be mentioned that we did not include Cyprus, Mexico, Hungary, Latvia and Lithuania as concerns the variance of nominal exchange rates for the period 1991-1998, while for the same variable we excluded Lithuania and New Zealand for the period 1999-2006, because their variances were extremely high (outliers) and they would bias our results. In addition, due to the possibility of our results being biased, we do not take into account Luxembourg as concerns the degree of openness for the period 1991-1998.

TABLE A1
Inflation and independence index, 1991-1998

Dependent variable: mean inflation rate				
Ind. Var.	(1)	(2)	(3)	(4)
CUK	-0.807*** (0.247)	-0.290** (0.143)	-0.568** (0.237)	-0.972*** (0.294)
QUAL		-1.161** (0.589)		
PS			-0.131* (0.071)	
OPEN				-0.303* (0.176)
Constant	0.452*** (0.123)	1.256** (0.507)	0.454*** (0.120)	0.645*** (0.206)
# Observations	38	34	38	34
Adj-R ²	0.331	0.483	0.375	0.392
SEE	0.216	0.200	0.209	0.217
HET	11.980 (0.002)	23.453 (0.000)	11.000 (0.027)	11.420 (0.022)

Notes: The estimation method is ordinary least squares (OLS). *, ** and *** indicate significance at the 10%, 5% and 1% respectively. HET is White's (1980) test for general heteroskedasticity and if HET test statistic is significant at the 1 percent level, White's (1980) estimate of consistent standard errors are used. Standard errors are in parentheses. The empirical specification is:

$$CPI = a + bCUK + cK + \varepsilon, \text{ with } K = WORK, QUAL, PS, OPEN, BDS, ER. CPI \text{ is the mean inflation rate and } CUK \text{ is the legal CBI index of Cukierman (1992).}$$

TABLE A2
Inflation and components of independence index, 1991-1998

Dependent variable: mean inflation rate				
Ind. Var.	(1)	(2)	(3)	(4)
PER	-0.112** (0.051)	-0.077* (0.044)	-0.104* (0.060)	-0.096 (0.069)
FIN	-0.031 (0.023)	0.020 (0.025)	-0.004 (0.039)	-0.052 (0.043)
INST	-0.040 (0.048)	-0.078 (0.054)	-0.045 (0.083)	-0.032 (0.097)
QUAL		-1.217* (0.622)		
PS			-0.143** (0.068)	
OPEN				-0.226 (0.195)
Constant	0.471*** (0.139)	1.366** (0.547)	0.500*** (0.090)	0.578*** (0.126)
#Observations	38	34	38	34
Adj-R ²	0.305	0.486	0.369	0.318
SEE	0.220	0.199	0.210	0.230
HET	10.848 (0.093)	24.126 (0.002)	9.147 (0.330)	10.655 (0.222)

Notes: The estimation method is ordinary least squares (OLS). *, ** and *** indicate significance at the 10%, 5% and 1% respectively. HET is White's (1980) test for general heteroskedasticity and if HET test statistic is significant at the 1 percent level, White's (1980) estimate of consistent standard errors are used. Standard errors are in parentheses. The empirical specification is:

$$CPI = a + bPER + cINST + dGOAL + gFIN + hK + u .$$

TABLE A3
Inflation and independence index, 1999-2006

Dependent variable: mean inflation rate						
Ind. Var.	(1)	(2)	(3)	(4)	(5)	(6)
CUK	-0.235** (0.094)	-0.160** (0.065)	-0.177** (0.066)	-0.306** (0.122)	-0.214*** (0.069)	-0.163*** (0.045)
QUAL		-0.134* (0.074)				
PS			-0.034 (0.034)			
OPEN				-0.125 (0.079)		
BDS						0.000 (0.002)
ER					0.000 (0.000)	
Constant	0.166*** (0.055)	0.232*** (0.083)	0.161*** (0.045)	0.262** (0.102)	0.143*** (0.037)	0.126*** (0.027)
#Observations	28	28	28	24	23	26
Adj-R ²	0.325	0.368	0.380	0.416	0.254	0.307
SEE	0.058	0.056	0.056	0.058	0.057	0.037
HET	10.418 (0.005)	11.419 (0.022)	18.990 (0.001)	12.540 (0.014)	7.342 (0.119)	7.513 (0.111)

Note: For further comments see Table A1.

TABLE A4
Inflation and components of independence index, 1999-2006

Dependent variable: mean inflation rate				
Ind. Var.	(1)	(2)	(3)	(4)
PER	0.013 (0.029)	0.021 (0.028)	0.010 (0.015)	-0.001 (0.035)
FIN	-0.027** (0.012)	-0.019 (0.012)	-0.020** (0.007)	-0.029** (0.014)
INST	-0.015 (0.024)	-0.015 (0.024)	-0.009 (0.014)	0.010 (0.032)
QUAL		-0.166* (0.088)		
PS			-0.037 (0.039)	
OPEN				-0.149 (0.100)
Constant	0.120** (0.053)	0.206*** (0.068)	0.123*** (0.042)	0.205** (0.081)
#Observations	28	28	28	24
Adj-R ²	0.224	0.297	0.296	0.277
SEE	0.062	0.059	0.059	0.064
HET	5.389 (0.494)	8.651 (0.373)	18.046 (0.020)	7.192 (0.515)

Note: For further comments see Table A1.

TABLE A5

Variability of real output growth and index of independence, 1991-1998

Dependent variable: variance of real output growth						
Ind. Var.	(1)	(2)	(3)	(4)	(5)	(6)
CUK	-0.156 (0.106)	-0.046 (0.071)	-0.183 (0.113)	-0.197 (0.134)	-0.212 (0.187)	-0.041 (0.051)
WORK					0.000 (0.001)	
QUAL		-0.199 (0.253)				
PS			0.014 (0.015)			
OPEN				0.008 (0.070)		
BDS						0.003** (0.001)
Constant	0.124** (0.051)	0.249 (0.220)	0.124** (0.051)	0.139 (0.086)	0.156* (0.090)	0.049* (0.027)
#Observations	37	34	37	33	25	33
Adj-R ²	0.081	0.076	0.061	0.094	0.047	0.151
SEE	0.088	0.088	0.089	0.092	0.105	0.051
HET	8.099 (0.017)	13.150 (0.011)	10.512 (0.033)	7.877 (0.096)	9.516 (0.049)	7.135 (0.129)

Note: The empirical specification is: $RG = a + bCUK + cK + \varepsilon$. RG is the variability of real GDP growth. For further comments see Table A1.

TABLE A6

*Variability of real output growth rate and components of independence index,
1991-1998*

Dependent variable: variance of real output growth				
Ind. Var.	(1)	(2)	(3)	(4)
PER	0.010 (0.026)	0.016 (0.021)	0.009 (0.027)	0.023 (0.016)
FIN	-0.021 (0.016)	-0.008 (0.013)	-0.023 (0.018)	-0.022** (0.010)
INSTR	-0.017 (0.036)	-0.023 (0.030)	-0.016 (0.037)	0.022 (0.023)
QUAL		-0.227 (0.273)		
PS			0.012 (0.030)	
BDS				0.003*** (0.001)
Constant	0.106** (0.040)	0.262 (0.250)	0.103** (0.041)	0.019 (0.031)
#Observations	37	34	37	33
Adj-R ²	0.042	0.039	0.017	0.223
SEE	0.090	0.090	0.091	0.049
HET	8.819 (0.184)	16.210 (0.039)	9.351 (0.313)	18.022 (0.021)

Note: The empirical specification is: $RG = \alpha + bPER + cINSTR + dGOAL + gFIN + hK + u$.
For further comments see Table A2.

TABLE A7
Variability of real output growth and index of independence, 1999-2006

Dependent variable: variance of real output growth				
Ind. Var.	(1)	(2)	(3)	(4)
CUK	-0.024 (0.017)	0.006 (0.019)	-0.011 (0.019)	-0.006 (0.016)
QUAL		-0.055** (0.020)		
PS			-0.007 (0.005)	
OPEN				0.023 (0.015)
Constant	0.036*** (0.009)	0.063*** (0.013)	0.035*** (0.009)	0.014 (0.013)
#Observations	28	28	28	24
Adj-R ²	0.035	0.221	0.070	0.051
SEE	0.016	0.014	0.015	0.013
HET	2.698 (0.259)	5.221 (0.265)	2.963 (0.564)	2.997 (0.558)

Note: For further comments see Table A1 and Table A5.

TABLE A8
Variability of real output growth rate and components of independence index, 1991-1998

Dependent variable: variance of real output growth				
Ind. Var.	(1)	(2)	(3)	(4)
PER	0.005 (0.007)	0.008 (0.006)	0.004 (0.007)	0.002 (0.007)
FIN	-0.004 (0.003)	-0.002 (0.003)	-0.003 (0.003)	-0.002 (0.003)
INSTR	0.010 (0.006)	0.010* (0.005)	0.011* (0.006)	0.009 (0.007)
QUAL		-0.060*** (0.020)		
PS			-0.009 (0.005)	
OPEN				0.010 (0.020)
Constant	0.015 (0.013)	0.046*** (0.016)	0.016 (0.013)	0.007 (0.016)
#Observations	28	28	28	24
Adj-R ²	0.060	0.288	0.127	0.062
SEE	0.016	0.013	0.015	0.013
HET	3.820 (0.701)	11.177 (0.192)	4.061 (0.852)	4.137 (0.844)

Note: For further comments see Table A2 and Table A6.

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