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The Measurement of Central Bank Autonomy: Survey of Models, Indicators, and Empirical Evidence

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**The Measurement of Central Bank Autonomy:
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Abstract

This paper presents a survey of the literature on the measurement of central bank autonomy. We distinguish inputs that constitute the building blocks in the literature, and the literature that builds on them. Issues including sensitivity analysis, robustness, and endogeneity are discussed. The review shows that empirical evidence regarding the beneficial effects of central bank autonomy is substantial, although some technical issues still remain for further research. In particular, central bank autonomy raises the issue of subjecting the monetary authorities to democratic control; this calls for additional research on the linkages between central bank autonomy and accountability and transparency. Additional empirical analysis on the relationship between the financial strength of the central bank and its de facto autonomy, and between its autonomy and financial stability, would also be desirable.

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I. Introduction to Indicators of Central Bank Autonomy

The empirical justification for Central Bank (CB) autonomy is based on studies demonstrating, at least for the industrial countries, that such autonomy is a "free lunch." On average, countries with significant monetary autonomy have been able to achieve lower average inflation; cushion the impact of political cycles on economic cycles, enhance financial system stability, and boost fiscal discipline without any real additional costs or sacrifices in terms of output volatility or reduced economic growth. Many of the empirical studies on the relationship between CB autonomy and inflation have shown that there is a robust negative correlation between the two variables. In initial studies, this result was based on research conducted on industrial countries, most of which showed a strong negative relationship linking average inflation or changes in inflation and CB autonomy.[2] The indices used to proxy CB autonomy were mainly based CB law analysis. The most widely known and frequently used indices are those discussed in Bade and Parkin (1977); Alesina (1988, 1989); Grilli, Masciandaro, and Tabellini (1991); Cukierman (1992); and Eijffinger and Schaling (1993). We refer to these measures as the "base indicators" of de jure CB autonomy.

More recent studies test the robustness of the statistical relationship between the distribution of inflation, growth and CB autonomy. These studies have used different measures of autonomy, different time and cross-country samples, and additional determinants (such as political instability, trade openness, exchange regulations, per capita income, education levels, and proxies for the labor market structure) to explain geographic differences in inflation and growth levels. Although most of these studies suggest that the relationship between CB autonomy and inflation is clear and robust, there are several conflicting viewpoints. In particular, the studies of Cargill (1995), Jenkins (1996), Fuhrer (1997), and Campillo and Miron (1997) arrive at different conclusions:[3]

- Cargill (1995) finds that the statistical associations are not robust even among industrial countries when the sample of countries and time horizon are changed.

- Jenkins (1996) incorporates additional variables to measure CB autonomy, including the turnover rate of CB governors, a dummy variable for the regulation burden of the CB, and another one for membership in the European Monetary System (EMS), and takes into account an index reflecting the corporate structure of the labor market. Jenkins argues that adding this last variable eliminates the significance of the statistical relationship between CB autonomy and inflation.

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[2] Grilli, Masciandaro, and Tabellini (1991), Cukierman (1992), and Alesina and Summers (1993), among the "base" indicators. Hereinafter, Grilli, Masciandaro, and Tabellini (1991) will be referred to as GMT (1991).

[3] All of these studies, however, use the Cukierman (1992) LVAU-LVAW legal index that was shown to have the lowest correlation to inflation.

- Campillo and Miron (1997) show that CB autonomy has no effect on inflation when control variables relating to the degree of openness in the business environment and of political instability, and a country's inflation and debt history are introduced.

It has also been difficult to find a correlation between CB autonomy and long-term growth. Many studies have concluded that neither long-term output growth nor its variability is correlated to the degree of CB autonomy, at least for the more developed countries. Certain authors have argued, however, that disinflation costs grow as CB autonomy grows. For example, the paper by Debelle and Fischer (1995) shows that the sacrifice ratio in Germany was generally higher than in the United States despite the fact that the Bundesbank comes across as more independent than the U.S. Federal Reserve System.

Although the vast majority of the initial studies on the macroeconomic effects of CB autonomy focused on the experience of industrial countries, Cukierman (1992) and Cukierman and Webb (1995) are two worthy examples of a more global approach to the issue. In such works, the study of developing countries generally gave better results when conducted on the basis of de facto autonomy indicators.[4] In particular, the studies of Cukierman (1992); Cukierman, Webb, and Neyapti (1992); and Cukierman and Webb (1995) show that the average and variance of inflation rates in developing countries are negatively correlated to the de facto degree of CB autonomy, when such "empirical" independence is proxied using, for example, the average turnover rate of CB governors.[5] These studies suggest that there is a positive correlation between economic growth and de facto CB autonomy indicators based on an analysis of the turnover rate of governors (Cukierman, 1992; and Cukierman, Webb, and Neyapti, 1992) or the degree to which their tenure is vulnerable to major political transitions (Cukierman and Webb, 1995).

There has been little focus, instead, on the analysis of the costs of deflation tied to CB autonomy in developing countries. According to Wagner (1999), although de jure CB autonomy is the first necessary step for such countries to build actual independence, any such changeover is liable to generate enormous costs. According to Wagner, when CB autonomy is threatened by the dominant role of politicians or the halfhearted implementation of reforms needed to make the transition to a market economy, then such autonomy is liable to remain little more than symbolic (or possibly even counterproductive).

Finally, Mangano (1998) shows that all legal indicators are heavily dependent not merely upon the criteria contained in the index but also upon the assessments of laws regarding each individual criterion, and the way in which these assessments are combined, including the weights assigned to each criterion. The criticism of the consistency of autonomy indices by Mangano (1998) and Forder (1998a), of the robustness of results by Campillo and Miron (1997), and of the direction of the causality of the relationship by Forder (1998b), raises the

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[4] Cukierman (1992) finds no correlation between de jure CB autonomy and inflation in developing countries.

[5] In contrast, however, this measure appears to hold no significance for developed countries.

question of whether the previously mentioned empirical regularities between CB autonomy, inflation, growth, and costs of deflation are isolated cases.

The remainder of the paper is organized as follows: Section II surveys base indicators of de jure and de facto CB autonomy; Section III surveys the subsequent literature and empirical studies on the base indicators by following Berger, de Haan, and Eijffinger (2000); and Section IV offers concluding remarks.

II.   BASE INDICATORS OF DE JURE AUTONOMY

The indicators of CB autonomy developed by Bade and Parkin (1977), Alesina (1988, 1989), GMT (1991), Cukierman (1992), Alesina and Summers (1993), Eijffinger and Schaling (1993), and Cukierman and Webb (1995) have been chosen as base indices because they constitute the body of research that forms the basis of, or the inspiration for, most recent empirical works. They represent the most diversified methodological source in this field; and offer nine indices in all; three of them serve as a de facto measure of CB autonomy, and the remaining indices serve as more or less detailed de jure indices.

A.   First Indicator of De Jure Central Bank Autonomy: Bade and Parkin (1977)

Indicator of CB autonomy

Bade and Parkin (1977) marks the first attempt to construct an indicator for CB autonomy. The paper professes to be a preliminary investigation of the relationships between general monetary policy characteristics and the laws that define the powers of CBs. This is an empirical study that compares the monetary experience of twelve industrial countries (Australia, Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, and the United Kingdom) during the period 1951–75, on the basis of an analysis of the provisions of CB laws on three areas[6]:

- CB primary objective. This criterion considers if the law establishes price stability as the sole and primary objective of the CB, or if it is accompanied by other macroeconomic objectives. Price stability as primary and only CB objective is considered a requirement to ensure CB autonomy.

- CB Board. A supplemental provision to the first criterion requires the CB to represent the final monetary policymaking authority, and the absence of government representatives on the CB's Board.

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[6] In order to minimize the arbitrary nature of combining the three attributes in the indicator, an equal weight is given to each of the attributes. This is the same method used by GMT (1991) and by Alesina and Summers (1993), who, in turn, compute an arithmetic mean of the indices of Bade and Parkin and GMT.

- Appointment of CB senior management. Finally, the CBs score an additional point if the appointments of CB senior management assigned to the government are less than half of the total.

Through these criteria the authors can identify eight different types of monetary institutions, and show that four of these structures are empty in the sample selected. Bade and Parkin indicate that when the government is responsible for formulating monetary policy, the CB is generally not allowed to independently appoint more than one member out of 15 on the board. The authors then start by excluding two of the eight possible CB types, i.e., those that simultaneously possess the following characteristics: (i) the CB is not the "ultimate" policy-making authority; there is at least one government official on the board, and at least half the appointments of senior management are made outside the influence of the executive branch; or (ii), still in an environment in which goals are not set independently, there are no members of government on the board, and most board members are appointed independently. To justify the other two exclusions, Bade and Parkin point out that, among the twelve countries, no CB that can be defined as "autonomous" from the standpoint of objectives, has even one member appointed directly or indirectly by the government, and, thus, another two composite types of CBs should be eliminated, that is those in which: (iii) the CB, while able to set objectives independently, still has at least one government official in its decision-making body and independently appoints more than half of its members; or (iv) possesses the first two characteristics but happens to lack the latter prerogative. The four remaining types of CBs are ranked from one (minimum autonomy) to four (maximum autonomy), based on the number of satisfied criteria.

Empirical evidence

The empirical findings of Bade and Parkin regarding evidence between CB autonomy and macroeconomic performance are as follows:[7]

- Inflation performance. There is weak evidence suggesting that the pursuit of a policy of price stability as the sole final policy objective is associated with achieving a lower level of average inflation, compared to cases in which this objective does not exist in legal provisions or is not the sole objective.[8]

- Monetary policy variability. CBs with some autonomy in terms of policymaking and board appointments are shown to guarantee a lower level of inflation, but not necessarily a low degree of variability in monetary policy,[9] and monetary policy variability does not show a clear association with any of the CB groups.

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[7] See Appendix Table 2 for detailed results.

[8] The weakness of this result is probably due to the fact that only The Netherlands' CB shows the first criterion.

[9] This refers to the variability some of the most autonomous CBs showed in their monetary operations, in terms of higher coefficients of variation in monetary base growth and in the exchange rate (Appendix Table 1).

- Appointment of senior management. Monetary policy-making does not seem to differ significantly among independent CBs and CBs dominated by governments when, in the first case, senior management is appointed by the executive branch.

B.   Alesina's Political Response (1988, 1989)

Indicator of CB autonomy

Alesina (1988 and 1989) extends Bade and Parkin's 1985 work,[10] combining political cycles theory and theories on rational expectations. He finds that there is a negative relationship between the degree of autonomy of CBs and the average level of inflation. The author uses Bade and Parkin's index to link the level of a country's political instability to its macroeconomic results, and, thanks to Fair (1980) and Masciandaro and Tabellini (1988), he extends the sample to five more countries: New Zealand, Spain, Denmark, Norway, and Finland. Appendix Table 2 summarizes Alesina's results for the 17 countries over the time horizon of 1973-1986, and the results of Bade and Parkin for their sample of 12 countries.[11]

Empirical evidence

Alesina (1988) examines how the degree of CB autonomy affects the magnitude of political influence on the economy and monetary policy.[12] An independent CB is able to reduce fluctuations in monetary policy brought about by the election cycle, and, as indicated by Rogoff (1985), an inflation-averse CB can help to reduce the inflationary bias. Alesina argues that the creation of an autonomous CB is associated with lower levels of inflation, and reduces politically induced volatility in monetary policy and inflation. Countries that are shown to have the most autonomous CBs (Japan, United States, Germany and Switzerland) have four of the six lowest rates of inflation, while the less autonomous CBs are associated with the highest inflation rates. Alesina points out that this apparent correlation does not necessarily constitute a causal relationship. In fact, the observed relationship may reflect the fact that a more pronounced aversion to inflation is more likely to result in a consensus in favor of establishing an autonomous CB.

Alesina also considers the size of the public sector, measured as the level of government spending as a percentage of GNP, and he points to a possible correlation between this variable and the rate of inflation. Such an assessment is based on the assumption that the highest levels of government spending should require higher levels of seignorage

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[10] This, in turn, represents an update to the original study of 1977.

[11] The only difference between Alesina's assessments and those of Bade and Parkin (1985) concerns the Bank of Italy, which, after attaining a greater degree of economic autonomy following the "divorce" from the Treasury in 1981, Alesina ranks with a score of 1.5 instead of 2.

[12] See Appendix Table 3 for detailed results.

(Appendix Table 3). The author argues, however, that this correlation is not clear, since neither Belgium, nor the Netherlands, nor Germany seem to support this argument.

The final question that Alesina asks is whether the establishment of an autonomous CB can reduce fluctuations in monetary policy caused by the political cycle.[13] To answer the question, the author uses the example of Germany, the United States, and the United Kingdom, since these countries experienced a change in direction in their governments at the beginning of the 1980s. By comparing annual inflation under the various administrations, Alesina provides convincing evidence. On the one hand, in the United Kingdom, whose CB was relatively dependent, monetary policy followed a rather "partisan" path during the transition period. On the other hand, in Germany, where the CB was much more autonomous, the volatility of monetary policy, as expressed by the difference in the average inflation rate posted during lelftist and more conservative governments, was less pronounced. The intermediate case is that of the United States, where the effect of the change in government on inflation performance was in between the two extremes above in keeping with the level of autonomy of the Federal Reserve.

C. Autonomy in Objectives and Instruments: Grilli, Masciandaro, and Tabellini (1991)

Indicator of CB autonomy

Grilli, Masciandaro, and Tabellini-GMT (1991) compares the monetary regimes of 18 OECD countries in the postwar years (1950–1989), focusing on political features—autonomy in setting objectives—and economic and financial features.[14] Similarly to Bade and Parkin (1977, 1985) and Alesina (1988, 1989), the authors confirm that the countries in which the CB is more autonomous have a lower—or less variable—level of inflation. By defining political autonomy as the ability of the CB to select the final objectives of monetary policy, GMT examine three areas: (i) the procedures regarding the appointment of the CB board; (ii) the legal relationships that link the CB to the government in the formulation of monetary policy; and (iii) the CB's formal responsibilities (in the form of policy objectives) concerning monetary policy. Based on legal information available for each area, the authors create a *political autonomy index*.[15] Since the index rises with the increase in autonomy in the selection of objectives, it ultimately serves as an index of growing credibility in the CB's ability to autonomously pursue a low inflation objective. GMT add the values obtained by each CB, thus following the same path taken by Bade and Parkin.

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[13] See Appendix Table 4 for detailed results.

[14] OECD countries are: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Greece, Ireland, Italy, Japan, New Zealand, the Netherlands, Portugal, Spain, the United Kingdom, Switzerland, and the United States.

[15] See Appendix III for a description of the indicator variables considered by GMT, and Appendix Table 5 for detailed results on the political independence index.

Regarding *economic autonomy,* the index is stated to be an indicator of autonomy in the selection of instruments.[16] It aims at describing: (i) the government's influence in determining the credit available from the CB; and (ii) the nature of monetary instruments over which monetary authorities have full control. When the executive branch is able to influence the quantity and terms of credit available from the CB, it is also able (at least in the short term) to influence the creation of base money. The aggregation of the variables is simply additive, as for the political index.

In conclusion, the authors indicate that the correlation between the political autonomy index and the economic autonomy index is not always positive; thus, a ranking that includes only one of the two dimensions of autonomy might be misleading. Therefore, the authors calculate a combined indicator of CB autonomy, as the sum of the two sub-indices.

Empirical evidence

The authors rank the various countries based on the differing degrees of autonomy with regard to political and economic autonomy and obtain four country groups (Figure 1):

- Group 1.The Netherlands, Germany, Switzerland, Canada, and the United States have CBs with the greatest degree of autonomy in regard to both aspects.

- Group 2. The Bank of Italy enjoys a good degree of political autonomy, but is not very autonomous from the standpoint of selecting instruments.

- Group 3. Greece, Spain, Portugal, and New Zealand have less autonomous CBs from both points of view.

- Group 4. Ireland, Denmark, Austria, Australia, France, the United Kingdom, Japan, and Belgium are shown to have CBs with a good degree of economic autonomy, albeit limited autonomy from the standpoint of objectives.

When comparing the various groups, the authors note that three of the four countries that have less autonomous CBs (Greece, Portugal, and Spain) have also exhibited highly unstable political systems and risky public debt policies. They are also the countries that have made the greatest use of seignorage. Other countries may have had unstable political systems over the period under review (Austria, Belgium, Ireland, Italy, and the Netherlands). However, they still have relatively autonomous CBs (at least on one of the dimensions), and the use of seignorage since the end of World War II seems to be small (with the exception of Ireland and Italy).

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[16] See Grilli, Masciandaro, and Tabellini (1991), p. 368; Appendix III for a description of the indicator variables considered by GMT, and Appendix Table 6 for detailed results on the economic autonomy index.

Figure 1. Grilli Masciandaro, and Tabellini: Dispersion of Political and Economic Autonomy
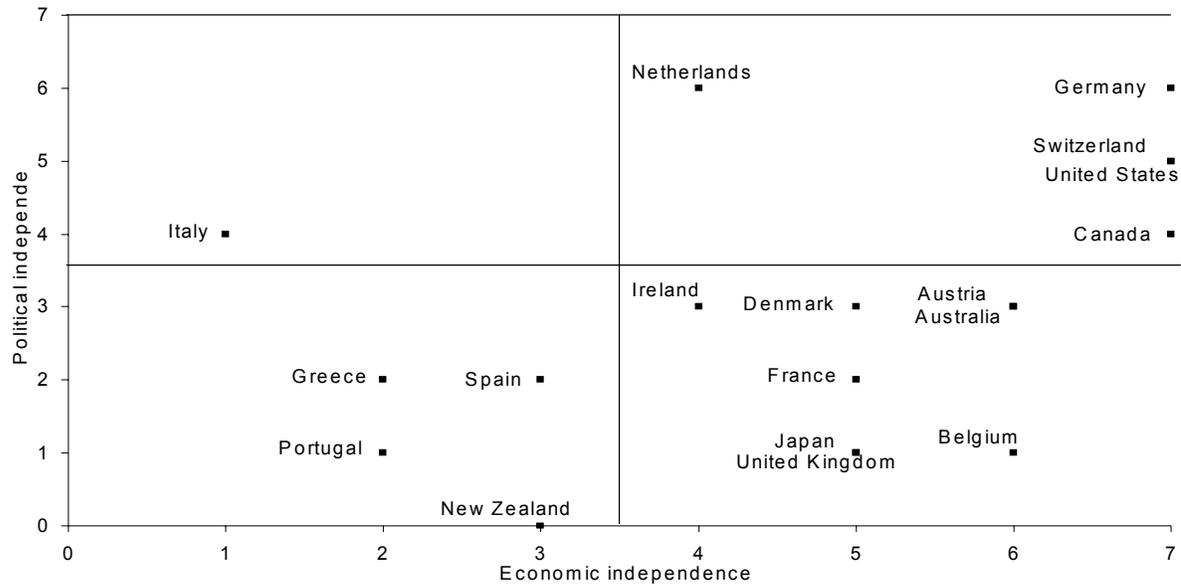
Source: Grilli, Masciandaro, and Tabellini (1991).

The authors argue that these stylized facts suggest that the establishment of an autonomous CB could have provided benefits in terms of monetary stability and low inflation, even in the presence of political incentives toward less orthodox fiscal policies. By dividing the time horizon into four sub periods (1950–1959, 1960–1969, 1970–1979, and 1980–1989) and regressing inflation data on the two autonomy indices, the authors show that the coefficients for the both indicators always have the expected negative relationship. The economic autonomy index is statistically significant during periods of widespread inflation (as in the last two decades); while the autonomy index for objectives (political autonomy) is significant only for the 1970s. These results hold good for the average inflation rate for the entire period of 1950–1989.

GMT also conclude that CB reforms brought positive results through their impact on policy credibility and the incentives they had on governments' behavior, consistently with Bade and Parkin, and Alesina. In order to determine whether CB autonomy can influence the likelihood of Treasuries adopting unsustainable debt policies, the authors regress primary deficits on the combined autonomy indicator and on three other variables that define countries' political environment (frequency of government changes, frequency of government changes from one political alignment to another, and the percentage of governments supported by a single party majority). They conclude that the autonomy index generally has a negative—and statistically insignificant—coefficient.

Finally, the authors found no systematic effect between the CB autonomy and real growth. Similar results can be obtained by dividing the period under review into four sub periods and

adding the political instability variables indicated above as regressors. Replacing the growth rate with the unemployment rate, the authors find that an autonomous CB not only leads to a lower level of inflation but does not involve sacrifices in terms of macroeconomic performance. It constitutes what is commonly referred to as a "free lunch."

D. Two of the Most Widely Used Indicators: Cukierman (1992)

Indicator of central bank autonomy

Cukierman is the first author to point out that there can be a wide gap between formal autonomy and the real autonomy of CBs. The autonomy of a CB is certainly affected by the degree of de jure autonomy, but it is also determined by a host of other factors such as informal arrangements or actual practices, the quality of the research at the CB, and the personalities of key staff at the CB, the treasury or the ministry of finance. Cukierman points out the great difficulty in coding these elements so as to derive empirical measurements of autonomy. He stresses that the already significant degree of subjectivity in the selection of legal variables makes these (legal and practical) measurements highly arbitrary. According to the author, the joint use of legal variables and those variables that cover more widespread informal practices, by partially offsetting the subjectivity of both approaches, provides very useful results for assessing actual CB autonomy.

Cukierman (1992) provides three indicators of CB autonomy, of which two (the LVAU-LVAW and TOR indices) have been widely cited and used in subsequent literature. The first of these (LVAU-LVAW),[17] which has been calculated for some 70 countries, is characterized as a strictly legal index. Although it only gives a partial assessment of actual CB autonomy, it is still a useful and comprehensive index. It is made up of some 16 variables that provide a detailed picture of the legal structure under which the various CBs operate.[18] Cukierman points out that, among the seven countries with the highest autonomy score, four are OECD countries, while of the lowest seven, six are developing countries. The average level of autonomy for the entire sample (0.33) is not far from that for developed countries alone (0.31), although there is a greater concentration of OECD countries in the top 10 percent of the distribution, while the bottom 10 percent is dominated by less-developed countries. It should be noted that the ranking obtained with the LVAU depicts a level of autonomy similar to the ranking obtained with the LVAW.

With his second indicator (turnover rate of CB governors—TOR), a de facto autonomy index which is calculated for 58 countries, Cukierman tries to identify actual deviations from the law. This is a simple and easy to calculate indicator, which is valid in a variety of circumstances. Nevertheless, Cukierman cautions that a low TOR could be mistakenly

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[17] LVAU is a simple legal index, while LVAW is a weighted index. The weights used for calculating the LVAW are presented in Appendix I.

[18] See Appendix I for a description of Cukierman's LVAU and LVAW indices, and Appendix Table 7 for the list of the variables and the score allocated to each of them.

perceived as a sign of autonomy in the case of a CB that is relatively subordinate to the executive branch and, consequently, tends to leave its position unchanged for a long period. However, the TOR is still a useful indicator based on the assumption that—at least above a certain threshold—a higher TOR does point to lower CB autonomy. In particular, in the event of a high TOR, the term in office of the governor may be shorter than the average term of a government, which dissuades the CB from taking a long term view of monetary policy.

The author notes that it is unlikely that the TOR indicator would have a practical meaning for more-developed countries. The ranking calculated by Cukierman shows TORs in developing countries covering a much broader range of values than in OECD countries (where values are all below 0.20 turnovers per annum), suggesting that this is not a reliable indicators for OECD countries. However, in developing countries, where practices that deviate from legal norms are more common than in industrial countries, the TOR may be a good reflection of CB autonomy. TOR values range from a minimum of 0.03 (which corresponds to an average term in office for the governor of some 33 years) to a maximum of 0.93 (which corresponds to an average term in office of just 13 months).

The last of the three indicators (QVAU and QVAW)[19] reported in Cukierman (1992) is constructed on the basis of responses given to a questionnaire by qualified personnel at 24 CBs. The questionnaire explores various aspects of CB autonomy. It serves as an indicator of de facto autonomy, since the questions focus on CB practices. The questions not only investigate the legal aspects of CB autonomy and the de jure objectives of monetary policy (for which a partial overlap with legal indices is permissible) but most importantly, focus on the instruments that are under the control of the CB and the practices that are followed when they differ from the law. The two indices show a high correlation coefficient of 0.99. Appendix Table 8 summarizes the nine relevant variables and the corresponding scores for Cukierman's indicator of de facto CB autonomy.

Empirical evidence

Cukierman's main findings regarding measures of CB autonomy are as follows:

- De jure autonomy (as proxied by the LVAU–LVAW) is more closely related to actual autonomy (as indicated by the QVAU–QVAW) in developed than in developing countries, confirming a closer adhesion of practices to the laws in these countries.

- The TOR and the de jure indicators seem to proxy different dimensions of CB autonomy, given the weak link between the former indicator and the LVAU-LVAW.

- Regarding the effects of de jure autonomy on inflation, Cukierman finds that the overall contribution of individual groups of legal variables to inflation in the entire

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[19]QVAU is a simple de facto index, while QVAW is a weighted index. The weights used for calculating the QVAW are presented in Appendix II.

sample is not statistically significant. This is also true when TOR is added to the regression, although the improvement in results leads one to believe that the latter captures significant de facto autonomy factors.

- By regressing inflation against the TOR for the entire group of countries, the expected negative relationship is only significant above a certain turnover threshold.

- Finally the TOR is a measure that best approximates the actual autonomy of less-developed countries. By splitting the sample countries in two subgroups by income level, the author finds that the index has a negative coefficient that is not significant for industrial countries, the opposite of what occurs for developing countries.

Regarding the impact of CB autonomy on inflation performance, Cukierman's main findings are as follows:

- The regression of inflation on the LVAW and on a measure that captures compliance with the law with respect to the term of office of governors (the comp measure)[20] shows that both have the anticipated negative sign, but only the comp is statistically significant for the entire sample. When only developed countries are considered, the opposite occurs: the effect of the comp measure is practically nil and the LVAW exhibits a significantly negative coefficient. This confirms the hypothesis that de facto measures would be better proxies for CB autonomy in less developed countries.

- The regression of inflation on the QVAU and QVAW indicators shows on the one hand that most of the questionnaire variables have the negative expected sign, and that the most significant are those referring to the presence of intermediate targets and the limitation of credit to the government, while the overall contribution of the index to explaining inflation performance is low. Furthermore, adding the LVAW measure of autonomy does not provide much additional information, while adding the TOR measure does. This shows that, at least for the countries in the sample and limited to the 1980s, all the variables for explaining inflation are those contained in the answers to the questionnaire and in the TOR.

E. Aggregation of Two Legal Measures: Alesina and Summers (1993)

Indicator of CB autonomy

In a 1993 work, Alesina and Summers construct a new CB autonomy index covering both political and economic areas. The indicator is based on Bade and Parkin (1985), which was expanded by Alesina (1988, 1989), and on GMT (1991). The methodology consists in calculating an index constructed as the arithmetic mean of the combined GMT index

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[20] The *comp* variable is defined as the relationship between the average actual term of office and the legal term.

(political plus economic autonomy), and Alesina index (Appendix Table 9).[21] The index is then compared to macroeconomic measures, such as inflation, real GDP growth rates and per capita GDP, unemployment rates, and real interest rates, for the 1955–1988 period.

Empirical evidence

The authors identify a nearly perfect negative correlation between CB autonomy and both the average and variance of inflation. The relationship between CB autonomy and the average (and variance) of GDP growth is not very clear.[22] The analysis of unemployment rate trends provides the same results, and the same can be concluded for the relationship between CB autonomy and real interest rate movements. However, in line with expectations a clearly negative relationship is observed between CB autonomy and interest rate variability.

F. A New Legal Indicator: Eijffinger and Schaling (1993)

Indicator of CB autonomy

In keeping with GMT (1991), Eijffinger and Schaling choose to identify the degree of political autonomy with the ability to select final objectives in an autonomous manner. Three areas are considered: (i) the procedures for appointing CB boards; (ii) the relationship between the CB and government in formulating monetary policy objectives; and (iii) the CB's monetary policy objectives it is required to pursue. The index is then developed on the basis of these areas using three criteria. The aggregate index (or CB's policy type) is the sum of the values obtained for each variable plus one:[23]

- CBs with ultimate authority for monetary policy are awarded with two points. If this authority is shared with the government, the CB is awarded with a single point. Finally, if only the government has this authority, the CB gets zero points.

- Whether government officials (with or without voting rights) are on the CB's board;

- Whether the appointment of more than half of those on the board is under the control of the executive branch.[24]

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[21]To review the conversion in detail, see the aggregation method section of the Alesina and Summers (1993) index in the Summary Table of Base indicators of de jure autonomy, in Appendix I.

[22] The authors note that Switzerland reports growth rates that are lower and more variable than the average, while Germany and the United States have good growth performance.

[23] The value of the index is augmented by one to allow a ranking of policy types starting from 1 (instead of 0).

[24] See Appendix Table 10. The sum of the first two variables and the third variable taken alone mimic, respectively, the second and third criteria of the first generation index of Bade and Parkin. The first 4 of the 12 possible combinations are excluded in the first instance, since they represent policy types that were found to be non-existent by Bade and Parkin. In addition, on the basis of the analysis of CB laws, the authors also exclude

Departing from Bade and Parkin index and GMT, Eijffinger and Schaling opt for using different weights when aggregating the index. When a CB has total authority in designing its objectives, it gets two points, thus the criterion concerned has a weight of two-fourths of the overall index. Thus, Eijffinger and Schaling differ from GMT who award an equal score to a CB which is able to select its final objectives (sixth attribute in GMT) and whose primary objective is not monetary stability (seventh attribute in GMT), and a CB that is not able to select its final objectives, but whose primary objective is monetary stability.

G. Political Vulnerability of Central Banks: Cukierman and Webb (1995)

Indicator of CB autonomy

The index developed by Cukierman and Web in 1995 is primarily aimed at understanding differences in inflationary trends among developing countries. The study is motivated by the fact that, as we noted in regard to the TOR, legal autonomy indices overlook deviations from the law, which presumably are more common in developing countries. An index of CB vulnerability to political instability is created by developing and refining Cukierman's TOR; it is measured as the CB governor's propensity to leave office in periods following a government transition or significant political change.[25] The new measure of vulnerability, which considers TOR only near a political change, makes it possible to distinguish strictly political turnover from the normal turnover of politically stable periods.[26]

Political transitions are categorized into four types, each of which characterized by a growing level of instability. These are as follows: *(i)* change in the head of government that does not lead to change in government parties (low instability); *(ii)* non-violent change in the party or parties in government without a change in the form of government (medium instability); *(iii)* irregular transitions from one authoritarian regime to another without changes in the fundamental rules of government—a coup—; and *(iv)* change in the government regime, such as a coup detrimental to democratic government or a return of democracy (high instability). Each group of countries in each sub period is then divided into countries that have maintained a democratic regime throughout the time horizon, countries which have maintained an authoritarian form of government, and countries where the two regimes have alternated ("mixed" regimes).

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three categories of CBs of the twin authority type. In fact, there are *(i)* no CBs that have partial policy authority and, at the same time, have a government representative on the board, and *(ii)* no twin authority structures in which members of the board are mostly appointed without government involvement.

[25] Political instability (as considered by Cukierman and Webb) has more to do with changes in fundamental attitudes in economic policy, than with mere shifts between political parties that would share good levels of consensus over the economic policy action.

[26] The data cover the period 1950–1989, with two sub-periods: Bretton Woods period (1950–1971); flexible exchange rates period (1972–1989). Sixty seven countries are analyzed: 20 OECD and 47 developing countries.

Cukierman and Webb define an indicator of political vulnerability for CBs by estimating the monthly probability of a change in the head of the CB, starting from the date of a political change (Appendix Table 11). They found that, as expected, this probability decreases with the number of months from the political transition. The authors define politically motivated changes in CB governor as those occurring within 6 months of a political transition. They find that they occur more than twice as often within 6 months than within 10 months. The authors then define the indicator of political vulnerability (also called the VUL) as follows, where (where $i = 1, 6$).

$V(i) \equiv$ Nb. of governors' turnovers within i months from political transition/Nb. of political transitions

The overall average is 0.24, meaning that nearly a quarter of all political transition events were followed by a turnover of the CB governor within six months, although the vulnerability is over three times more pronounced in developing countries. In addition, among the latter countries, those that experienced transition from democratic to authoritarian regimes and vice versa (high instability) exhibit more vulnerable CBs.[27]

Finally, the authors present two sets of regressions to identify relationships among different indicators, and between the political vulnerability index and type of political transitions. The results are as follows:

- In the first set of regressions the indicators show no correlation. The authors compare four different CB autonomy indicators: the legal autonomy index of Cukierman, Webb and Neyapti (1992),[28] the TOR, the vulnerability index discussed above, and the complement to the latter, i.e., the nonpolitical turnover rate of CB governors (see Appendix Table13). Most indicators exhibit no mutual correlation, even though the overall TOR is highly correlated to the two measures derived from it.

- The second set of regressions highlight that the CB political vulnerability is more pronounced in less developed countries and after major political transitions. The authors estimate the correlation between political vulnerability indices and the various types of political transition, in addition to a dummy variable for purely authoritarian regimes and another one for developing countries. The latter dummy has a significantly positive impact on the vulnerability index calculated over a six-month time horizon. None of the political change indicators has a statistically significant effect. Low and medium-level political changes have no effect on vulnerability, while high-level changes exhibit a positive, but not statistically significant, coefficient. However, CB vulnerability (over a period of six months) depends on the type of

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[27] See results in Appendix Table 12.

[28] This indicator was developed in the same manner as Cukierman's (1992) LVAU-LVAW.

political change.[29] The highest degree of CB vulnerability is associated with high-level political transitions, which occur only in developing countries. In developing economies, irregular transitions from one authoritarian regime to another without changes in fundamental rules of government have an impact on CB vulnerability that is nearly twice as great as changes on a more modest scale. This effect is generaly associated with alternating authoritarian and democratic regimes.

Empirical evidence

Cukierman and Webb (1995) expands on Cukierman (1992) and seeks to assess the relationship between inflation (and its variability), CB political vulnerability, the nonpolitical turnover rate of the governor, and the various types of political instability.[30]

- Results are very similar for vulnerability measures at one and six months, although vulnerability within the first month seems the most decisive. CB political vulnerability as well as nonpolitical TOR has a significantly positive impact on the inflation rate and its variability;

- High-level political instability contributes to increased inflation variability, while low political instability contributes only marginally to an increase in average inflation;

- Instability categorized as medium-level, i.e., the normal turnover of parties in a democratic context, has no real effect on inflation;

- The low significance of the dummy variable, which incorporates countries with authoritarian regimes over the entire period considered, suggests that once CB and political instability variables are considered, the distinction of this type of regime does not help to explain the differences in inflation performance; and

- Once TOR is broken down into its two components and the various types of political instability are considered, the distinction between developing and industrial countries no longer explains the differences in inflation performance. Hence, the differences in CB vulnerability to political instability, in the nonpolitical TOR, and in the degree of political instability fully account for higher inflation in developing countries.

Regarding real performance, the authors show that greater CB political dependence tends to retard growth. They assess whether CB autonomy has a significant impact on growth, once

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[29] Appendix Table 14 shows the value of vulnerability indices grouped by type of political transition and economic group. In the category of developing countries some 61 percent of major political transitions were followed by a replacement of CB leadership within six months. It can easily be seen that there is generally little difference in vulnerability to low- and medium-level changes in each country grouping. However, such changes are twice as common in developing countries.

[30] Cukierman (1992) finds significantly positive relation between inflation and TOR in developing countries.

the contribution of other determining variables is defined (i.e., initial GDP, initial primary and secondary school enrollment rates, and 10-year rates of change in the terms of trade). Contrary to expectations, the nonpolitical TOR of CB governors has a marginally significant positive sign. However, by removing Brazil, Korea, and Botswana (which have demonstrated solid growth rates despite high levels of political and nonpolitical TOR), a negative, statistically significant sign is obtained for the political vulnerability index within six months, suggesting that greater CB political dependence tends to retard growth.

Finally, the authors find that the TOR increases the variability of real interest rates. Both the nonpolitical TOR and the political vulnerability index increase the variability of real interest rates, while the legal index has little significance. However, with regard to the average level of real interest rates, the political vulnerability index exhibits a significantly negative sign, which probably reflects the higher implicit inflation tax in countries with politically dependent CBs.

III. SUBSEQUENT LITERATURE AND EMPIRICAL STUDIES ON BASE INDICATORS

As we have seen in the previous section, the base indicators literature found strong empirical evidence supporting the hypothesis that CB autonomy reduces the average rate and variability of inflation. Cukierman (1994) summarized these findings as follows:

- Among industrial countries, de jure autonomy turns out to be negatively correlated to inflation and its variability. On the other hand, de facto indices—in particular, the CB governor turnover rate—do not exhibit any correlation to inflation;

- Among industrial countries, de jure autonomy indicators are not significantly correlated to economic growth;

- Among emerging economies and developing countries, legal indicators have no significant relationship with inflation, while de facto measures such as TOR do; and

- Among developing countries and emerging markets, TOR is correlated with growth, but legal indices are not.

From 1994 to the present, a number of studies have challenged the theoretical foundations of CB autonomy and related empirical evidence, as follows:

- Several authors consider Rogoff's (1985) idea of reducing the inflationary bias by delegating monetary policy to an autonomous and conservative CB to be too simplistic. They have also criticized Walsh (1995) "incentive compatible contracts" solution, which has been shown to be isomorphic to the Svensson (1997) "Inflation Targeting" approach. Others have searched for criteria that are more conclusive in explaining the differences in the inflation rates of various economies;

- In models such as Barro and Gordon (1983) inflation results from the CB's inability to credibly commit not to attempt to correct structural inefficiencies in the economy

such as inflexible nominal wages or distortionary tax action. Certain authors have attempted to make these structural imperfections endogenous in order to deepen the analysis, for example, of the interaction between CBs conservatism and various degrees of the centralization of wage bargaining;

- There is a sizable body of literature that investigates the problems related to the robustness of CB autonomy and sensitivity of conclusions;

- Several authors argue that there are significant differences among measures of autonomy, and they exhibit interpretation gaps. Throughout the literature, there is a widespread conviction that legal indicators are at times redundant and incomplete. Hence, many authors believe that one should use more than one index even though the usefulness of legal indicators is not questioned. The correlation between inflation and CB autonomy could be explained by other factors that drive the two variables;[31]

- Other authors argue that the relationships shown in the base indicators literature may differ depending on countries or the period used, or may be sensitive to control variables. For example, the results obtained under fixed exchange rate regimes will presumably differ from those obtained during periods of flexible exchange rates. Thus, the exchange rate regime could be a good control variable; and

- Some authors explore the relationship between autonomy, credibility, and the costs of deflation.

A. Theoretical and Empirical Clarifications on Central Bank Autonomy

In much of the literature regarding CB autonomy, there is frequently little distinction between the concept of independence and the concept of conservatism. As already discussed, most legal indicators assign CBs a higher value when price stability is one of the CB's main objectives, even though this intuitively indicates less autonomy in terms of objectives. This is because in the theoretical setup, both autonomy and conservatism are important for the definition of inflation performance.[32] In particular, the objective of de Haan and Kooi (1997) is to assess whether the concept of conservatism (the governor's aversion to inflation) or autonomy (of the CB from the government's influence) is more important as key factor of a good CB autonomy measure.

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[31] For example, Posen (1993, 1995) suggests that both CB autonomy and inflation can be jointly accounted for on the basis of a third determining factor, which he defines as the financial sector's actual aversion to inflation. However, most empirical studies reject this assertion.

[32] If the CB has the same aversion to inflation as the government, its level of autonomy would not matter. Vice versa, if a CB was dependent on the executive branch, a higher degree of conservatism would have no effect.

De Haan and Kooi (1997)

According to de Haan and Kooi (1997) CB autonomy refers to three areas in which the government's influence must be eliminated or at least restricted. These are: (i) the autonomy of board members and the governor; (ii) financial autonomy and; (iii) the CB's autonomy over monetary policy. The first of the three largely refers to de jure appointment autonomy, and thus, includes criteria such as the government's representation on the board, appointment procedures, and terms of office and dismissal procedures. The second area concerns how easy it is for the government to obtain direct or indirect CB funding. The last area gives the CB room for maneuver in formulating and implementing monetary policy.

Following Debelle and Fischer (1995) and GMT (1991), the authors distinguish the two concepts of autonomy with respect to objectives, and autonomy with respect to instruments. With regard to autonomy of objectives, it is necessary to verify the variety of issues over which the CB has discretion, and whether price stability represents the main objective of monetary policy.[33,34] It is no accident that the indices by GMT (1991) and Cukierman (1992) assign higher values the more stringent the price stability objective. Autonomy with respect to instruments proxies the freedom of the CB to use whatever means necessary to achieve its objectives.

The goal of the study is to find a measure capable of distinguishing the concepts of conservatism and autonomy. By breaking down two de jure autonomy indicators (GMT and Cukierman), the authors can identify a measure proxying the conservative bias woven into the law and a proper measure of autonomy. The procedure for breaking down the indicators is based on the assumption that while the degree of an individual's conservatism cannot be objectively determined in practice, the degree of conservatism required by law can be measured in the form of the commitment to the price stability objective. Following this line of thinking, the two indicators are broken down by isolating that degree of conservatism from other components that approximate respectively the autonomy of the personnel, financial autonomy and the CB's autonomy in policy.[35]

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[33] These two components are (at least partially) negatively correlated since a greater focus of monetary policy on the specific objective of nominal stability implies less autonomy in terms of objectives.

[34] A significant practical assumption is based on the fact that CBs whose sole objective is price stability are considered more independent since the level of priority given to this objective reflects the level of conservatism provided by law (see Cukierman (1992)).

[35] With regard to Cukierman's LVAU (Appendix Table 7) all the (*CEO*) variables are retained for the personnel's autonomy measure; the (*PF*) ones, with the exception of the role of the CB in the formulation of the government budget, are retained for autonomy with respect to instruments; the (*OBJ*) one is retained for the degree of conservatism required by law; the (*LL*) ones, with the exception of variables *ltype* and *lprm*, are retained to provide a measure of financial autonomy. The breakdown follows the same four criteria in the case of the GMT index: the first five points of the GMT policy autonomy index contribute to determining the autonomy of CB's personnel; the sixth and eighth points of the GMT policy autonomy index proxy autonomy with respect to instruments; the degree of conservatism is isolated in the seventh point; and the level of financial autonomy is built on the first five points of GMT economic index.

Similarly to Debelle and Fischer (1995), the regressions calculated by the authors generally show that instruments independence matters for inflation performance while conservativeness and other aspects of CB independence are less important. The results of regressions of these new measures on the average level of inflation in 21 OECD countries from 1972-1989 show that the coefficient on the autonomy index for monetary policy instruments is always significantly different from zero, which is not the case for the conservatism measure. The latter is never significantly different from zero for Cukierman's LVAU, and it loses its significance in the GMT index as soon as the indication of autonomy with respect to instruments is included. In addition, the calculations show that not even the autonomy of CB members is significant for explaining average inflation. Regressions of the same measures on the variability of inflation show quite similar results; the indicator showing the greatest relationship with the dependent variable is autonomy with respect to instruments. Regarding variability in growth performance, no significant coefficient is found.[36]

Banaian, Burdekin, and Willett (1995 and 1998)

Banaian, Burdekin, and Willet also look at the components of the Cukierman legal index (1992) to determine how strongly each of these is related to inflation performance. In a 1998 study, the authors observe that, despite the great uniformity the results express, there is a considerable difference in the ways in which de jure CB autonomy is defined and categorized. According to the authors, the problem lies in the relatively non theoretical way in which the various indices are constructed. In a 1995 study, the authors had argued that economic theory suggested the need to give greater weight to attributes that describe the formal powers of the CB over monetary policy formulation rather than the provisions with regard to the limitation imposed on CB credit to the government. The authors highlight, for example, that Cukierman's (1992) scheme was constructed in such a way as to attribute to the restrictions on CB's participation in the primary market for public debt more than three times the weight attached to the ability of formulating an autonomous monetary policy. GMT (1991) overlooked this fundamental aspect by giving the same weight to all fifteen variables. The empirical results Banaian, Burdekin, and Willet obtained led them to argue that among industrial countries inflation can be predicted more accurately using a simple policy autonomy index based on the CB's freedom from government interference in monetary policy formulation rather than using other more complex indices. In particular, using a sample of 21 OECD countries between 1971 and 1988, Banaian, Burdekin, and Willett (1995) obtain values with little significance for the LVAU and TOR indices of Cukierman (1992) and for the GMT index (1991) once a dummy variable on policy autonomy (i.e., the inability of the government to override monetary policy decisions) is included. In other

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[36] Kilponen (1999) uses a similar procedure on Cukierman's index. While his results confirm the positive effect of CB instruments autonomy on inflation performance as in de Haan and Kooi (1997), the author finds that the degree of conservativeness conferred to the CB by the law impacts on wage growth.

words, in the absence of policy autonomy as defined above, the beneficial effects attributed to the other characteristics considered by Cukierman and GMT are seriously compromised.

In a 1998 article, the authors analyze the components of Cukierman's (1992) legal index in order to isolate the various attributes from the implicit weight assigned to them. Analyzing fifteen out of the sixteen variables, the authors conclude that most of the attributes have a non-significant or positive, rather than negative, relationship with the average level of inflation. This could mean either that there is no truly relevant attribute for explaining inflation within the Cukierman index or that certain attributes are relevant but were improperly coded by the author. Thus, the result suggests at least a certain caution in using Cukierman's (1992) legal index as a measure of CB autonomy. According to the authors, several of the problems discovered in Cukierman's index can be attributed to a faulty approach in categorizing the various degrees of formal autonomy, in particular the attribute that pertains to autonomy in monetary policy formulation. The absence of significance for this attribute is the least reassuring sign for the authors. A further disturbing fact is that the CBs of Austria, Nicaragua and Romania, the only ones to obtain the maximum ranking, are considered more independent than the Bundesbank for this attribute.

McCallum (1995)

As we already pointed out, there has been some criticism of the link between the theoretical foundations (Rogoff 1985) and the measurements of CB autonomy, and of the the contractual solutions to the time inconsistency problem given by Walsh (1995) and Svensson (1997). One of the most cited criticisms is the one provided in 1995 by Bennet McCallum, who points out two misleading interpretations of the positive literature on the foundations of the concept of autonomy. The first criticism concerns the assumption that if the monetary authority is not forced to behave otherwise, it will opt for suboptimal discretionary equilibrium. Certainly, he notes, there is no pre commitment capable of ensuring the future behavior of the CB under all possible circumstances. However, there is no barrier either, that would prevent the CB from implementing optimal policies. The CB must recognize that benefits for the economy would be achieved sooner and more completely by abstaining from inconsistent policies. Another way of looking at this issue is to recognize that there is no required trade-off between commitment and flexibility (as argued by Lohmann, 1992, and Debelle and Fischer, 1995) when faced with the occurrence of unusually large shocks: in such cases, even a vigorous response does not necessarily imply inappropriate trends in the inflation rate.

McCallum (1995) also criticizes Persson and Tabellini (1993), and Walsh (1995) regarding the contractual solution to the problem of time inconsistency. McCallum argues that the incentive structure proposed by Walsh (1995) cannot solve the problem of the time inconsistency of discretionary monetary policy, but merely transfer it to the authority to which the CB is accountable to. A government that must enforce the contract, and nevertheless suffers from the same (if not bigger) incentives to violate it, represents an evident inconsistency. McCallulm argues that placing the contract at a higher legal level does not solve the problem. One example is the United States, where the constitution provides for a metal-based monetary structure, which, has not formally existed since 1971, and ceased to

exist de facto even earlier. McCallum doesn't deny the utility of such incentives but argues that they cannot influence the source of the inconsistent behavior.

B. Endogenizing the Inflation Bias

Inflationary bias has to do with the temptation for policymakers to accept an inflation rate above its optimal level to boost growth.[37] While there is broad agreement that monetary policy is not a first-best choice for correcting labor market ineddiciences, it is not clear how these inefficiencies interact with monetary policy. Several studies attempt to endogenize inflationary bias by introducing the behavior of inflation-averse unions. Since those who bargain over wages are averse to inflation, they will moderate their demands. This modeling assumption undermines previous results, in particular Rogoff (1985), that an inflation-averse CB helps reduce the inflationary bias. According to that new line of research, a not too conservative CB can achieve low inflation because such a behavior is more likely to reduce wage increases demands.

Cukierman and Lippi (1999)

An example of this second best theory is offered by Cukierman and Lippi (1999). They provide empirical evidence of the joint effect of CB autonomy and centralized wage bargaining on macroeconomic performance. The inclusion of a sufficient inflation aversion component in unions' behavior leads to a convex/"hump-shaped" relation between inflation and unemployment on one side, and the degree of centralization of wage bargaining on the other. This relationship is the consequence of two opposite effects of centralization: on one hand it reduces competition in the labor market; on the other hand, it increases the extent to to which each union internalizes the inflationary consequences of its wage claims.

- At low levels of concentration unions are too small to internalize the effects of increasing wage claims on inflation and a free-riding effect prevails; therefore an increase in wage bargaining centralization, by reducing competition results in a rise in real wages, inflation and unemployment.

- However, as unions become large enough to appreciate the consequences of their claims on aggregate inflation, this effect is offset because fewer unions leads to higher inflationary fears on the part of unions. This effect reduces wage demands; hence, inflation and unemployment decline.

Thereafter, the authors suggest a number of channels through which the degree of CB autonomy and its relationship with the level of labor market centralization affects the performance achieved by the labor market. They argue that in a system with a limited number of unions, a study of the effects of various levels of centralization of wage

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[37] The phenomenon of inflationary bias is generally defined as a problem of distorting taxation or a failure of the labor market. Both deficiencies are exogenous to monetary policy.

negotiations should take into account the type of monetary regime. They argue that the convex relationship between unemployment (inflation) and wage bargaining centralization is stronger at a low level of CB autonomy and when unions are sufficiently averse to inflation. This convex relationship gradually weakens as the degree of CB autonomy increases. The main implication is that in countries in which there is a high level of CB autonomy, labor market decentralization (i.e., a high number of unions) is capable of reducing real wages, inflation and unemployment.

Cukierman and Lippi asses also the relationship between CB autonomy and unemployment, and they identify two transmission channels. First, if unions are averse to inflation, they argue that the degree of CB autonomy can affect the perception of unions regarding the inflationary consequences of their individual actions. Thus, at sufficiently high levels of centralization, a more conservative CB leads to more aggressive wage negotiations and therefore higher unemployment. Secondly, they argue that if there are several unions and some degree of substitutability between the labor they offer, there is a second, more strictly competitive effect that works regardless of the unions' aversion to inflation. A less inflation-averse CB leads a union to perceive any increase in individual real wage as more costly in terms of competitiveness (i.e. in terms of nominal wage relative to the competing union). The effect moderates wage demands (and holds down unemployment) compared to a situation in which salaries are indexed, while this perceived reduced competitiveness decreases as CB conservativeness increases. Both relationships disappear when a wage negotiation structure is atomized at the firm level. Hence, in the presence of sufficiently concentrated unions that perceive the effects of their wage claims, the Cukierman and Lippi (1999) model suggests that a higher degree of conservativeness at the CB produces a higher level of unemployment, by relaxing unions' fears with respect to inflation and competitiveness.

Empirical research on these issues is based on an analysis of data from nineteen OECD economies for the period 1980–1994. The authors find a clear convex relationship between unemployment (inflation) and the bargaining centralization in the labor market for low levels of CB autonomy; the relationship disappears as the degree of CB autonomy grows. The authors show that previous studies, such as OECD (1997) did not find a convex relationship because they had omitted CB autonomy as a control variable in exploring the relationship between labor market structure and macroeconomic performance. The authors also show that the inflation reducing impact that CB autonomy brings about is stronger at intermediate levels of union centralization, while there is a significantly positive effect of CB autonomy on unemployment for low levels of wage bargaining centralization.

Franzese (1999)

In its study Franzese provides a politically oriented view that combines, among other, CB autonomy and union concentration models. According to this author, the concentration and coordination of wage negotiations have opposite influence on the anti-inflationary impact of CB independence. On one side the power of labor unions, when the wage bargaining process is concentrated, lowers the natural rate of employment and therefore increases discretionary inflation. Coordinated bargaining on the other hand, by internalizing the real costs of excessive wage claims, increases the natural rate of employment and reduces discretionary

inflation. As a consequence CB independence lowers inflation more in the former case (greater unions' power) and less in the latter (greater coordination). The study considers that CB autonomy is a matter of nuances: it can neither be absolute, nor completely absent. Therefore, monetary policy—hence inflation—is always partially controlled by the CB and unions. Therefore, Franzese argues that the macroeconomic effects of CB autonomy and union's behavior should be analyzed simultaneously. More generally, the author emphasizes that the inflationary impact of institutional and economic settings is not constant: any factor influencing unions, the government or the CB's policy decisions, changes the impact that the autonomy of the CB has on inflation. Conversely, CB autonomy changes the inflationary impact of each of the factors. For instance, beyond the above mentioned case of wage bargaining concentration and coordination, the authors argues that CB independence should reduce inflation more when the government is leftist or there is higher inflation abroad than when the government is conservative or the inflation abroad is lower. Conversely, greater CB independence reduces inflationary differences between the above polar cases.

C. Robustness of Autonomy Measures

The following paragraphs review research work that explores the robustness of CB autonomy measures. We have noted that it is difficult to construct a consistent CB autonomy measure that is unbiased. In particular, even subtle differences in defining a variable, especially within the legal indicators, can generate enormous discrepancies in results. Furthermore, the possibility of comparing quantitative responses and the substitutability of analogous measures are seriously compromised considering that the areas subject to the authors' discretion involve the selection of relevant criteria as well as their interpretation and the aggregation method.

Mangano (1998)

Mangano explores interpretative and methodological discrepancies in measurements of CB autonomy and their impact on the credibility of resulting empirical results. Looking at the most widely used indicators (i.e., the de jure GMT autonomy index, and the legal LVAU index of Cukierman—1992), the author uncovers the existence of a significant "interpretation spread"[38] equal to an average of 30 percent of the legislation reviewed. He also points to so-called "criteria spread"[39] that indicates that 40 percent of the variables contemplated by GMT are not present in Cukierman's paper, while in the opposite case the proportion rises to 45 percent. Finally, he discovers a negligible "weighting spread".[40]

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[38] An interpretation spread indicates the subjective spread among researchers in reading laws and thus in interpreting the same criterion when it is included in an index of CB autonomy.

[39] The criteria spread is the way in which the personal preferences of the researcher influence the selection of criteria to be included in the index, and it is logically situated at a higher level than the first spread.

[40] The weighting spread is defined as the way in which the selection of the weights related to each criterion included in the index influences its final value.

Mangano's work results in a ranking of existing indicators of CB autonomy. He notes that most of the recent empirical studies using more than one index or combinations of different indices, generally obtain results that agree with theory, but argues that it is not acceptable to merge indicators that suffer from subjective spreads. Accordingly, the author chooses to make a direct comparison of the rankings expressed by the measures rather than comparing absolute values. Looking at the 12 OECD economies that are common to the samples in the six indicators he compares (see Appendix Tables 15 and 16), Magnano finds that there is little correlation among the rankings.

Mangano then uses the rankings as explanatory variables for several dependent variables for macroeconomic performance, including the average inflation rate, GDP growth rate, and their variability. With respect to inflation, the signs of the coefficients of the rankings are generally consistent with the anticipated negative relationship. However, it is not reassuring that only in the case of the GMT and Alesina indices is this coefficient significantly different from zero. He reaches similar conclusions regarding the variability of inflation, for which all coefficients have the anticipated sign, but only in one case this coefficient is significant. The results on growth are even less impressive: contrary to expectations, CB autonomy seems to have a negative effect on growth, although the results are not significant. Finally, Mangano does not find any significant relationship between the rankings assigned to the various CBs and the variability of GDP growth. Even if Mangano does not question the quality of the measures, he argues that the different measures of CB autonomy capture different aspects of the status of a CB, thus reducing the possibility of making meaningful comparisons of the empirical results.

Forder (1999)

Forder (1999) compares several autonomy indicators with a view to identify a good proxy measure of CB autonomy.[41] The author accepts that selecting an appropriate measure for CB autonomy inevitably involves arbitrary decisions, but also acknowledges that the results obtained indicate that CB autonomy lowers inflation and its variability. With those assumptions as background, Forder's goal is to challenge the view that measurement problems are minor, and to raise doubts regarding the concordance of results. Forder believes that measurement problems and the dichotomy between de jure and de facto autonomy are still too large to consider the results to be truly significant and persuasive.

Forder first discusses the possibility of misrepresenting the main autonomy hypothesis of the monetary institution. He argues that the indicators of CB autonomy are nothing more than formal tests, since they identify a measure that is already actually negatively correlated to inflation, and that their authors are overly hasty in attributing to them the capacity to approximate the degree of CB autonomy. Indeed, none of the authors he reviews offer a test of the independence hypothesis, but only more or less plausible proxies of CB autonomy

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[41] Folder analyzes Alesina (1988, 1989), GMT (1991), Cukierman, and Cukierman, Webb, and Neyapti (1992).

which are tied to inflation performance. Forder admits that all the studies provide reasonable measures, but there is no objective basis for making a selection among them. The fact that, except for the cases of Germany and Switzerland, the various studies do not succeed in reaching a reasonable consensus, confirms Forder's insights.

In conclusion, Forder argues that although it is possible to talk about "degrees of autonomy" on a theoretical level, there is no correlation among different indices that indicates empirical agreement in this regard. It is assumed that the various indicators approximate the same group of fundamental characteristics, but it is still not possible to measure them. Forder concludes that the assumption that there is a correlation between low levels of inflation and CB autonomy could indeed prove to be correct, but the literature has still not been able to offer an empirical concept of independence that would allow an effective test of this assumption.

Eijffinger, Van Rooij, and Schaling (1996)

Eijffinger, Van Rooij, and Schaling (1996) estimate a monetary policy reaction function for 10 OECD countries,[42] and analyze the response of money market interest rates to inflation, growth, and the current account surplus. The authors search an empirical measure of CB autonomy by estimating reaction functions, so that the differences in CB autonomy can be seen as different structural pressures for an increase or decrease in money market rates. The reaction functions show a trend toward rising interest rates as a common reaction to inflation and economic growth. But, contrary to expectations, it appears that the intensity of the response is higher in response to growth than it is to inflation. By then ranking countries in decreasing order with respect to the new empirical autonomy variable (from the CB that has the strongest reaction as reflected in the increase in interest rates, through to the CB with the weakest reaction), the authors obtain a ranking with the CBs of Germany and the Netherlands at the top, the Italian and British banks at the bottom, and the rest in between. After comparing the rankings obtained by their own and other indicators, the authors argue that most of the legal measures coincide rather well with their new autonomy index (Appendix Table 17). This close relationship is confirmed by the correlations between the legal measures and the new empirical index of autonomy.

D. Causality of Hypotheses on Central Bank Autonomy

Posen (1993, 1995)

Posen (1993, 1995) argues that the strength of the financial sector's opposition to inflation could determine both the degree of CB autonomy and the level of inflation. The correlation between inflation and CB autonomy could run in either direction, or could alternatively be explained by a third factor such as the culture and tradition of monetary stability in a country.

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[42] Australia, Canada, France, Germany, Japan, Italy, the Netherlands, Switzerland, United Kingdom, and United States.

According to Posen, CB autonomy is not always a valid institutional recommendation, and instead may result as a "Pareto inefficient" selection (even though it increases the relative level of welfare), since it was demonstrated (the author cites Debelle and Fischer, 1995 and Walsh, 1994) that the costs of deflation tend to rise with an autonomous CB. In addition, as argued by Cukierman (1992), in developing economies differences in the legal autonomy of CBs are not able to predict inflation rates. In practice, CB autonomy entails significant redistributive consequences, so there is no reason to believe that such an arrangement is always optimal. The author argues that the preference for price stability, which the CB's conservatism should embody, needs significant political support. The only economic sector able to provide such support is the financial sector, since it sees autonomy as the only way to achieve nominal stability in the long run. Accordingly, it is very likely that changes in a country's financial or political systems will also have an effect on the CB's ability to maintain price stability.

Posen suggests that monetary policy decisions may embody the responses expected by those political entities that have the power to determine the CB's autonomy and powers. The financial sector is in a dominant position since it represents the greatest source of information, advisory services and assessments for both the government and CB, regarding monetary policy. Posen quotes a sentence supporting his argument, taken from a 1993 parliamentary debate on the reform of the American federal monetary system: "If one's goal is to minimize inflation, Fed officials reason, then a sure way to achieve that goal is to have private bankers—who are among the world's fiercest inflation hawks—appoint the regional bank presidents."

Posen proposes an indicator of financial opposition to inflation (FOI). In order to elaborate the FOI, Posen answers two questions:

- What factor determines the financial sector's differing degree of unity in its opposition? Posen argues that the larger the number of financial enterprises that share the same positions, the lower the cost of pursuing a joint objective. This implies that financial sectors with a "universal" banking system should have a more unambiguous feeling of aversion toward inflation, and the same should be true where the CB has no banking supervision responsibilities; and

- What is it that makes the financial sector stronger in one country compared to others? Posen assumes that for a less fragmented political system (as measured by the number of political parties), the financial sector's opposition to inflation should be stronger, and that the same can be said for a decentralized administrative system where national issues (such as monetary policy) hold relatively greater importance.

Posen's FOI is made of 4 components. The first one has a positive value when banks are authorized to operate in at least two of the following markets: the financial intermediation market, insurance market and commercial credit market. The second component has a full value when banking supervision is not under the control of the CB, and a partial value when this responsibility is shared between the CB and another agency. The third component approximates the existence of a federal administrative system. The fourth component

(probability that two members of parliament selected randomly during the same legislative period belong to two different political parties) serves as an indicator of party system fragmentation. The first 3 components should increase FOI; the last should reduce it.

Posen's empirical work, which is based on a sample of 32 countries (of which 17 are OECD countries) with low and moderate inflation for the period 1960—1989, seeks to assess the ability of FOI to explain differences in the degrees of CB autonomy and inflation.[43] Analyzing international differences over FOI and its components, the inflation rates, and the level of CB autonomy (as proxied by Cukierman's LVAU), Posen finds a positive relationship between CB autonomy and FOI and a negative relationship between average inflation and FOI. By then regressing Cukierman's LVAU on FOI and its four components, he shows that the FOI, as well as its components with the exception of the one regarding the CB's supervisory power, exhibits a highly significant positive coefficient. Another set of regressions, in which inflation is the dependent variable, exhibits significant coefficients with the expected (negative) sign for FOI and for two of its four components (CB supervisory power and the existence of a federal administration). Furthermore, Cukierman's LVAU never exhibits statistically significant coefficients as long as the FOI variable is present. These results are not unique to OECD countries, even though they are stronger for them. In summary, Posen's work shows clear empirical evidence supporting a causal relationship between a high degree of FOI on the one hand, and a greater degree of CB autonomy and a lower inflation rate on the other hand.

Several authors have challenged Posen's results, and did not find empirical evidence regarding the role of the FOI in explaining the various states of CB autonomy or inflation performance. De Haan and van't Hag (1995) criticized the empirical results of Posen on OECD economies by arguing that results can be confirmed only if Cukierman's LVAU is used. Similarly, neither Campillo and Miron (1997), nor Temple (1998), nor de Haan and Kooi (2000) and Sturm and de Haan (2001) find evidence supporting the hypothesis that the financial sector's opposition to inflation plays a decisive role in explaining the differences in inflation or the degrees of CB autonomy.

Crosby (1998)

Crosby (1998) suggests that countries that experience less variability in output should establish CB autonomy more quickly. According to Rogoff (1985), the highest cost of an autonomous CB is identifiable in the increase in output variability caused by the governments' loss of control over discretionary and stabilizing monetary policy. Assuming an opposite causal relationship to Rogoff's, Crosby suggests that countries experiencing low levels of output variability should establish an autonomous CB more quickly. Crosby argues that the higher the inflationary bias, the less attractive the decision for discretionary monetary policy. Similarly, however, if the real shocks to the economy are widespread, discretion is

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[43] A higher level of FOI should lead to a greater degree of CB autonomy, and on average inflation should also be lower when FOI is widespread.

desirable since reducing output variability would be beneficial. As a consequence, it may be more likely that countries affected by real shocks of a lower magnitude or with a lower frequency, will opt for CB autonomy.

Crosby tests for the hypothesis that the differing variability of real shocks in different countries could explain the various degrees of CB autonomy. The study uses a sample of 44 industrial and developing countries for the period 1962-1991. It is based on Cukierman's LVAU indicator and data for the variance of the terms of trade for each country, with the addition of a variable for measuring political stability (defined as the degree of polarization of the political system), which, according to Alesina and Gatti (1995), should increase the variability of output and inflation.

Crosby finds that CB autonomy is a negative function of the magnitude of real shocks for the entire sample, but not for the sub-group of developing countries. On the other hand, there is no evidence that the degree of political stability determines the degree of CB autonomy. However, this does not repudiate the hypothesis of Alesina and Gatti (1995), which argued that the direction of causality moves from autonomy to the reduction in fluctuations brought about by politically instability. Crosby cites Posen (1995) and his argument that CB autonomy could be regarded as endogenous and may depend on the support for such autonomy within the financial sector. Crosby argues that if the assumption of endogeneity is correct, the empirical correlation between inflation and output variability on the one hand, and CB autonomy, on the other hand, should not only imply causality moving from autonomy to inflation and output, but also in the opposite direction. Thus, the new hypothesis proposed by Crosby, which is empirically confirmed at least for more advanced countries, suggests that reforms in economic structures that can influence inflation and output variability should also change the degree of desirability for more or less autonomous CB. Finally, Crosby did not find evidence of the opposite effect, contrary to Rogoff (1985). An explanation could be that delays in monetary policy transmission to the real economy make monetary policy unsuitable for reducing output variability. Crosby brings us back to GMT's claim that CB autonomy can reduce inflation with no costs for growth or output variability.

Stella (1997 and 2003)

Stella is one of the few researchers who have analyzed the role central bank capital and financial autonomy on its performance. In the event of limited financial autonomy, the central bank may face great difficulties in achieving its medium term policy objectives. Moreover, the potential losses attached to the conduct of monetary policy, requiring continuous transfer of funds from the government, may undermine CB autonomy. Several authors have argued that, despite losses, the central bank always return to posting profits in the long run, regardless of starting levels of operating costs and capital. The central bank could operate with no capital as long as demand for base money is maintained.

Stella (1997), however, shows that a weak balance sheet that leads to repeated losses may force the central bank to abandon the goal of price stability. It may also result in a decline in operational autonomy, and lead to the imposition of inefficient restrictions on the financial sector so as to achieve the objectives of monetary policy. If demand for base money does not

rise, the central bank may be forced to: (i) issue accelerating interest bearing debt which would further reduce its discounted economic capital; (ii) condition its ability to pursue its objectives to continuous financial infusions of capital by the treasury; (iii) impose high non-remunerated reserve requirements (i.e. repressing the financial system); (iv) lower interest rates to levels which would not be consistent with macroeconomic stability. Thus, financial strength and autonomy are necessary preconditions for central bank operational independence, and the achieving without financial repression. Furthermore, Stella (2003) points to the positive relationship between central bank financial weakness and high inflation rates. Bindseil et al. (2004) propose various explanations for this empirical finding, one of which derives from eventual large monetization of government's budget deficits at negligible interest rates. This is an evident signal of a lack of CB autonomy from the government.

Ize (2005)

Giving an empirical dimension to Stella's argument and building on the fact that inflation and interest rates control has proven costly for many CB in recent years, Ize (2005) approaches the problem of defining a CB's need for capital within a deterministic net worth approach. The author builds a measure of CB "core capital", defined as the minimum amount of capital needed to maintain a credible inflation target[44], and then uses this measure to show how a number of loss making and/or negative capital CB indeed needed capital injection from national treasuries. Ize's result[45] is that in many low and middle-income countries a substantially positive core capital is needed to allow for a target of low inflation to be credible. This opens to the question of what should be the desirable level of "fiscal" effort on monetary and financial stability services, which is clearly a negative issue for CB operational (and objectives) independence.

As Ize argues CB balance sheets may erode under the pressure of costly domestic liabilities, as the CB attempts to sterilize capital inflows to offset exchange rate appreciations, but they could also reflect poorly performing domestic assets, resulting from large credits to government or failing banks. This second scenario could entail an expensive vicious cycle in which the fiscal excesses of governments, increasingly priced into the capital of the CB, could be rolled-over until a new CB capital injection becomes unavoidable, thus causing an excessive one-off fiscal effort. This suggests how the lack of CB financial strength can also have sizable distortionary impacts).

E. Robustness and Sensitivity of Results, and Search for New Measures

A number of recent empirical works go beyond simple linear regressions to include additional control variables. In addition to the previously cited Jenkins (1996), they include

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[44] In this framework core capital is defined as a function of the (projections of) operating expenditures of a CB and the carrying cost of its international reserves while core profits and core inflation are defined as the profits a CB would obtain, and the minimum rate of inflation it would need to target, in the absence of capital.

[45] With data for operational expenditures and excess international reserves pooled from a sample of countries.

Campillo and Miron (1997), Fry (1998), Akhand (1998), Sikken and de Haan (1998), Oatley (1999), Lybek (1999), de Haan and Kooi (2000), Sturm and de Haan (2001), and Arnone, Laurens and Segalotto (2006).

Campillo and Miron (1997)

Campillo and Miron argue that previous analyses of the differences in countries inflation performances overlooked key factors that could reasonably be considered significant empirical determinants of this performance. In addition to taking into account the degree of CB autonomy, the level of trade openness, political instability and the income level, the authors consider, in particular, past inflation performance, and the level of taxation.[46] The results of the authors' empirical tests are as follows[47]:

The authors produced empirical evidence indicating that the institutional characteristics of monetary policy, and especially CB autonomy and the foreign exchange regime, have no importance by themselves with respect to inflation performance. The variables that seem to play key roles are the degree of trade openness, debt as a percentage of GDP, the level of the inflation tax, political instability, and the level of income. Previous inflation experience, especially in developed countries, also has a positive effect on inflation.

Brumm has challenged Campillo and Miron's view of an empirical uncoupling between CB independence and inflation, arguing that their estimation technique did not account for the measurement error that inevitably lies in a complex measure as the LVAW. Brumm (2000, 2002) argue that: (i) the use of legal proxies for CB autonomy as a substitute for actual independence is dubious; (ii) directly substituting a measured proxy for a latent theoretical construct in a regression equation may yield undesirable consequences. By employing an alternative technique (the analysis of covariance structures instead of OLS regressions) and adding Cukierman's TOR and Cukierman and Webb's vulnerability indicator, Brumm shows that strong negative correlation between CB independence and inflation is restored. Further, Brumm argues that Posen (1993, 1995) results as well as those of Posen (1998) may be questionable on the same grounds.

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[46] Previous inflation performance is considered to account for the fact that countries which in a history of high inflation were able to learn their lesson, and are less inclined to face a recurrence of similar episodes. The rationale for considering the level of taxation is that countries where government spending is high on average would be expected to show high levels of taxation, and the inflation tax is more substantial the less governments are able to maintain high levels of conventional taxation and the more inelastic the demand for money.

[47] The sample on which the empirical study is based consists of 62 countries (the countries for which Cukierman, Webb, and Neyapti construct their LVAW measure) and the time horizon covers the period 1973–1994. The sample is then further modified to exclude countries where average inflation is over 100 percent or 50 percent, and to distinguish the most developed countries.

Fry (1998)

Fry explores the relationships between CB autonomy in developing countries and the level of fiscal dominance. Fry's methodology consists in ranking countries on the basis of two sets of potential discriminating variables (indicators of CB independence on one hand, fiscal and macro performance indicators on the other) and then estimating a system of monetary policy reaction functions (one for each country) in which the change in domestic credit to the private sector is a function of current and lagged change in net domestic credit to the government (beyond current and lagged change in net foreign assets of the banking system, and the current and lagged gap between domestic inflation and inflation in the industrial countries). Within the estimated reaction function the sum of the coefficients of the contemporaneous and lagged credit to the public sector represent the actual measure of CB independence. Hence, Fry's CB autonomy index based on the ability of the CB to neutralize (by reducing the amount of credit available to the private sector) the effects on money supply of lending to the government. He argues that the government can be financed in four broadly defined methods: borrowing from the CB at no cost (inflation tax); obtaining financing at below-market rates and forcing commercial banks to absorb the securities issued (financial repression); obtaining financing abroad in foreign currencies or at market rates in the private sector.[48] Fry's "fiscal dominance hypothesis of CB autonomy" implies that greater reliance on the inflation tax and financial repression is associated with a lower degree of CB autonomy. Thus, the size of government deficits and methods by which it is financed jointly determine the degree of actual CB autonomy in a developing country.

Fry first estimates neutralization coefficients by selecting the country sample through three different measures of CB autonomy: a 1996 Bank of England (BoE) questionnaire, Cukierman's LVAU de jure index and TOR de facto index. The results are as follows:

- With regard to the BoE questionnaire, the results are anomalous. CBs that consider themselves less autonomous neutralize some 49 percent of any increase in credit to the government within two years, while more autonomous CBs do not neutralize them at all;

- With regard to CB autonomy according to Cukierman's the de jure index, although the less autonomous CBs show smaller delayed neutralization coefficients than more autonomous ones, neither of the two groups seems to have a significant degree of actual autonomy based on the sum of current and delayed neutralization coefficients; and

- With regard to the index of de facto CB autonomy, contrary to expectations, CBs with the lowest TOR exhibit high, positive neutralization coefficients.

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[48] Fry points that that the typical OECD country finances about 50 percent of its deficits through market rate resources from the private sector, against 8 percent in developing countries.

Therefore, Fry argues that the CBs that are defined as autonomous have little or no autonomy in practice. This first set of results seems to suggest that coded measures of CB independence provide little information about how independently CBs actually behave in developing countries.

Second, Fry tests his fiscal dominance hypothesis of CB autonomy by estimating neutralization coefficients when the country sample is selected on the basis of three fiscal attributes: average government deficit as a percentage of GDP, change in the amount of reserve money as a percentage of GDP, and ratio of bank reserves to deposits to capture the degree of financial repression. Fry's results indicate that: (i) CBs in countries with low government deficits have much higher neutralization coefficients; (ii) CBs in countries that rely less on seignorage have high neutralization coefficients, while in those countries where seignorage is high, no neutralization takes place; and (iii) countries whose banking systems have a lower ratio of reserves to deposits show higher neutralization coefficients, whereas CBs in countries with high reserves to deposits ratios do not neutralize at all.

All there results are consistent with Fry's hypothesis that the degree of CB autonomy in developing countries is determined by the size of the government deficit and the way in which this deficit is financed. By measuring CB autonomy as the degree in which the CB neutralizes the effects on money supply of an increase in the government credit demands, Fry's research shows that larger deficits and greater government's reliance on the domestic baking sector are associated with a lower degree of sterilization. The author stresses that this result may also reflect the fact that a CB that enjoys instruments autonomy is able to bring about some degree of fiscal discipline after neutralizing (in a painful manner for the private sector), for a certain number of periods, the increased financial requirements of governments.

Finally, the author estimates neutralization coefficients by selecting the countries based on the level of inflation and economic growth. Fry finds that (i) countries with the lowest levels of inflation have more autonomous CBs in practice, as expected; and (ii) by ranking countries on the basis of growth, those with higher growth rates show the highest sterilization coefficient.

Fry's valuable contribution can be summarized as follows:

• Fry's estimates indicate consistent cross-country differences in the tendency of CBs to neutralize increased credit demands by the central government (Fry's proxy for actual CB independence in developing countries) when countries are ranked on the basis of fiscal, growth and inflation attributes. A higher actual level of CB independence is found to be associated with lower fiscal deficits, lower tendency to use seigniorage and financial repression on the part of the government, but also higher growth and lower inflation. However, these differences either disappear or become inconsistent when countries are ranked based on the autonomy measures referenced. Higher levels of CB independence as codified by these measures do not correspond to higher levels of neutralization in monetary policy reaction functions

and the author concludes that the former are not a good measure of actual CB autonomy in a developing country;

- Fry argues that the reaction functions show that large government deficits and greater reliance on the inflation tax and on financial repression are associated with a lower degree of neutralization of increased CB credit to the government. Since the measure of autonomy that Fry considers is the degree of neutralization, he argues that empirical analysis confirms his initial hypothesis, that the degree of CB autonomy in developing countries is determined by the size of the government deficit and the way in which this deficit is financed; and

- Fry argues that countries that have monetary institutions with the highest degree of autonomy have the highest growth rates. This could imply that the fiscal factors or characteristics of a country or its executive branch end up influencing both growth and CB autonomy. But it could also mean that a competent and effective monetary policy fosters both growth and CB independence in a developing country.

Akhand (1998)

Akhand investigates the robustness of the empirical relationship linking growth to CB autonomy as proxied by several indicators. The author points to the lack of empirical studies supporting the hypothesis of a relationship between growth and the degree of CB autonomy. As we have seen, GMT (1991) and Alesina and Summers (1993) find no such relationship. Most likely, this is due to the fact that among OECD countries there is not sufficient variability in the dependent variable (the growth rate) or the explanatory variable being studied (the level of CB autonomy). Akhand specifically refers to Cukierman, Kalaitzidakis, Summers, and Webb (1993) as the article that inspired his study. Akhand argues that this article is missing a systematic study of robustness for the relationship between growth and CB autonomy. To this end, the author uses the robustness test of Levine and Renelt (1992) on four measures of CB autonomy: the LVAW, the TOR of Cukierman (1992), the nonpolitical turnover of CB governors (NOR) and the CB political vulnerability index (VUL) of Cukierman and Webb (1995).[49]

Akhand confirms that the legal index and the indices that are more closely tied to actual practice cover different aspects of the characteristics of monetary institutions. His results indicate that there is a negative relationship between growth and de facto CB autonomy, but none of the autonomy indices he uses show statistically significant coefficients in the base regressions. He concludes that he was unable to find a robust relationship with growth for any of the four CB autonomy indices, and that the result of Cukierman, Kalaitzidakis, Summers, and Webb (1993) of a negative relationship between growth and TOR is probably due to the exclusion of the robust explanatory variable relating to the rate of investment as a percentage of GDP.

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[49] The sample is made up of some 62 countries in the time interval from 1960 to 1989.

Sikken and de Haan (1998)

Sikken and de Haan investigate whether, in developing countries, there is a relationship between CB autonomy on the one hand, and the measure of fiscal deficits and degrees of monetization of deficits, on the other hand.[50] The authors make reference to several theoretical references and they indicate four possible channels through which government debt can lead to money creation and inflation:

- Government pressures to stabilize interest rates. If it is true that an increase in government debt leads to upward pressures on interest rates, the CB may be forced to absorb part of government debt to stabilize interest rates;

- Time inconsistency in relation to monetary policy. This has to do with the ability to reduce government debt through capital gains that would result from a level of inflation exceeding the inflation-related premium in interest rates;

- Optimum level of seignorage. This channel represents the amount of resources that the government may obtain through base money growth. In developing countries the tax base tends to be low. Therefore, seignorage plays a larger role, although beyond a certain limit inflationary expectations reduce the tax base at a faster pace than that of monetary expansion; and

- Fiscal dominance hypothesis. According to Sargent and Wallace (1981), if fiscal policy dominates over monetary policy, it is likely that money supply will become endogenous to the government's fiscal behavior. This occurs when the ability to absorb debt is saturated, and the CB has to purchase the remaining debt.[51]

The authors explore the relationship between the government budget deficit and the level of CB autonomy. Following de Haan and Sturm (1992), they regress the average budget surplus on different measures of CB autonomy.[52] The results indicate that none of these measures have a statistically significant coefficient. Thus, it does not seem possible to argue that in developing countries CB autonomy has a motivating effect on the government to reduce spending, or that none of the indices used is suitable for this purpose.

With regard to debt monetization, the authors regress money growth on current and past values of government surpluses. If it is true that a government deficit has a long-term effect on money growth, the coefficients corresponding to budget surpluses should be negative. The results indicate that 18 of the 30 countries confirm the prediction, and 6 of these do so in a

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[50] GMT (1991) argued that there was little relationship in industrial countries (see Appendix Tables 20 and 21).

[51] See Fry (1998).

[52] Countries are those in Cukierman and Webb (1995) reduced from 45 to 30 countries due to data availability. CB autonomy measures used are Cukierman's LVAW and TOR, Cukierman and Webb's VUL, and the LL heading in Cukierman's LVAU–LVAW index that approximates legal lending limitations on the CB.

significant manner. However, in many countries government deficits have no major impact on money growth. The authors argue that this result is in line with previous studies regarding the monetization of debt in developing countries.

They also regress the growth rate of CB net credits to the government on its fiscal performance. Time series-regressions results indicate that in 26 out of 30 countries, a negative relationship exists, and in 12 cases the coefficient of the budget surplus is marginally significant. In order to compare these results with the level of CB autonomy, the authors perform second stage cross-section regressions using the coefficients estimated in these time series as dependent variables, and the various CB autonomy measures as explanatory variables. The results suggest, as expected, that an autonomous CB provides less monetary financing to the government through direct loans. However, significant coefficients are found only for the two de facto autonomy measures, confirming that legal indicators are poor proxies of CB autonomy in developing countries.

Oatley (1999)

Oatley investigates the robustness of the relationships found in previous research through the analysis of eight indicators of CB autonomy and how the results behave when a broader group of control variables is included.[53] The objective is to add control variables which, at least theoretically, have a clear relationship with inflation, including the degree of trade openness; fiscal policy; the characteristics of labor markets; and several other variables which have received little attention in previous studies, including employment and the macroeconomic preferences of various political groups. He argues that previous studies rely at most on 4 indicators of CB autonomy,[54] and he includes 8 indicators in his study: Cukierman's LVAW and TOR; GMT's three indices (political autonomy, economic autonomy, and the combination of these two); Alesinas'(1988, 1989) index and two variants of the latter – one that presents a dummy variable for each level of autonomy identified by Alesina, and another consisting of a single dummy variable that distinguishes between high and low levels of CB autonomy. Three measures are used to approximate the labor market structure: an index for union centralization (Cameron, 1984), an indicator of union density (Visser, 1991), and a multiplicative variable of these two. With regard to the measurement of policy preferences, Oatley opts for a measure on a five-point scale, which rises with the percentage of progressive representatives on the council of ministers. In addition, Oatley adds the government budget situation, the degree of openness of the economic system and unemployment level as control variables.

Contrary to Campillo and Miron (1997), Oatley does not find a strong relation of inflation with some economic variables, such as the government budget situation or for the degree of

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[53] The sample is made up of 10 OECD countries (Australia, Belgium, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, and the United Kingdom), and the period covered is 21 years from 1970 to 1990.

[54] See Cukierman (1992); Banaian, Burdekin, and Willett (1995); Eijffinger, Van Rooij, and Schaling (1997); Akhand (1998); Fry (1998).

openness of the economy. By contrast, the variable covering the unemployment level exhibits a higher correlation to inflation. The coefficients are generally stable and statistically significant for all eight models, and the signs are negative as expected.

Like for unemployment, Oatley reaches positive conclusions with regard to the measures of labor market organization and the political variables. Two of the three variables proxying the structure of the labor market (union density and the multiplication union centralization) have significant and stable coefficients. However, even though the signs are in agreement with Calmfors and Driffill (1988), the magnitude of the interactive variable is too weak to attribute to it a conclusive negative effect on inflation. On the other hand, the coefficients of the variable reflecting the government's political orientation are generally stable and statistically significant. Oatley concludes that autonomy indices produced so far provide results that fall short of expectations. In fact, neither the more complex legal index (LVAW), nor the TOR, nor the three indices of GMT (1991) provides satisfactory results from the standpoint of the significance of the coefficients. Of the eight indices that are considered, it is the three simplest ones that exhibit statistically significant coefficients with the correct sign.

De Haan and Kooi (2000)

De Haan and Kooi use Cukierman's TOR to construct a new dataset of CB governor turnover.[55] They calculate simple regressions between the changes in the price level and the CB governor turnover rate and find a positive and statistically significant relationship for the sample of countries they consider as well as for sample of countries used by Cukierman (1992). However, the result seems to be heavily affected by several observations: once high inflation countries are removed from the sample, the authors do not find a significant relationship.

Following Campillo and Miron (1997), Haan and Kooi then attempt to verify the robustness of results by adding, one by one, several control variables that the formers found to be significant, including political instability (defined as the total number of irregular government transitions in the decade); the degree of openness in the economy (the total of imports and exports as a percentage of GDP); the logarithm of per capita GDP in 1980; and, public debt as a percentage of GDP in 1980. As a result, in most of the regressions, the coefficient of the new indicator remains significantly positive in relation to inflation contrary to what was observed by Campillo and Miron. The discrepancy is likely due to the fact that Campillo and Miron used Cukierman's legal indicator LVAW, which has limited value for developing countries. However, this result no long holds when high inflation countries are excluded.

With regard to the variability of inflation, the authors calculate several simple regressions between the standard deviation of changes in price levels and the TOR. The relationship between CB autonomy and the variability of inflation is negative and statistically significant although to a lesser degree than the relationship observed with average inflation. However,

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[55] The study considers 82 developing countries between 1980 and 1989.

this conclusion is also shown to be valid only for high inflation countries. The authors stress that even when it is assumed that the order of causality does not move from CB autonomy to inflation or vice versa, but that both variables are affected by the Posen's (1995) FOI, the results would not change. By following Sikken and de Haan (1998), the authors calculate the existence of any associations between government budget surpluses and the TOR, and do not find a significant relationship between these two variables.

By following the sensitivity analysis of Levine and Renelt (1992), the authors develop a growth equation. The independent variables are: a vector of explanatory variables that demonstrate some degree of robustness in explaining the differences in growth rates (the logarithm of initial product, the average investment ratio over GDP, and primary and secondary enrollment ratios in 1980), the TOR and an additional vector of explanatory variables, which, according to theory, affect growth (average population, the ratio of government spending to GDP and the average rate of imports and exports as a percentage of GDP). The coefficients of the variables of the first vector are significantly different from zero, but by adding the TOR, sensitivity analysis indicates that there is not a robust relationship between growth and TOR, contrary to what was argued by Cukierman et al. (1993), but in accord with Akhand (1998).

Sturm and de Haan (2001)

Sturm and de Haan analyze the relationship between TOR and inflation rates by constructing a new sample that is nearly twice the size of Cukierman's (1992) sample. The sample is based on data from some 97 developing countries and also includes data from the 1990s. Following Cukierman (1992) and de Haan e Kooi (2000), the authors use as a dependent variable the percentage rate of change in price level, and the TOR in a multivariate model by adding as control variables the degree of openness to trade within the economy, a political instability variable, the logarithm of per capita GDP, a dummy variable for the case of a fixed exchange rate and the ratio of government debt to GDP. In order to compare results to those of Cukierman (1992), the time sample is divided into two sub periods, from 1980 to 1989 and from 1990 to 1998.

Sturm and de Haan find results that are highly consistent with previous studies. With regard to bivariate regressions, the coefficient of TOR is highly significant for both sub periods, and has the anticipated positive sign (a higher TOR results in higher inflation). However, as already observed by de Haan and Kooi (2000), the result is significant only if high-inflation countries are included. Moving then to a multivariate analysis, the coefficient of TOR based on the broader sample is not significantly different from zero. However, by applying Cukierman's sample, the result improves slightly: the variables that exhibit statistically significant coefficients are instead the degree of openness in the economy, the exchange rate and the ratio of debt to GDP, and as in the case of bivariate regressions, the result obtained remains significant only if countries with high inflation are included.

Lybek (1999)

Lybek uses a new indicator to measure the degree of legal autonomy and accountability of fifteen CBs in the Baltic countries, Russia, and other countries of the former Soviet bloc at the end of 1997. The indicator assesses some 21 legal attributes including: (i) monetary policy targets (regarding price stability); and (ii) the supervision of the banking sector. In the policy autonomy area, the author considers (iii) autonomy with respect to instruments and objectives; (iv) autonomy in exchange rate policy; (v) the coordination between fiscal and monetary policy; and (vi) the resolution of conflicts between the government and CB. In the area of policy autonomy, the index assesses regulations regarding: (vii) the appointment of the governor; (viii) the term of office; and (ix) the regulations for the dismissal of the governor; (x) the representation of the government on the CB's board; (xi) the appointment of board members; (xii) the term of their office; and (xiii) dismissals. Regarding CB economic autonomy, the following items are considered: (xiv) limitations on loans made to the government; (xv) interest rates applied to such loans; (xvi) required collaterals; laws governing (xvii) the quasi fiscal activities of the CB; (xviii) monetary policy instruments; and (xix) cases of insolvency. Finally, in the area of transparency and CB's accountability, the following items are analyzed: (xx) the publication of bulletins; and (xxi) CB auditing authorities. The attributes are added with an equal weighting (the maximum score is 21).

Lybek looks for several empirical parallels between his index and changes in macroeconomic performance in the years (1995-1997), that followed the introduction of these countries' own currency.[56] Lybek's main findings are as follows:

- The degree of legal autonomy and accountability expressed by the indicator is –as expected- strongly negatively correlated to average inflation, and this correlation remains valid when expanding and contracting the time horizon;

- A strong positive correlation is shown between the indicator and the average annual growth rate of real GDP, even though this correlation deteriorates by expanding and contracting the sample period, and disappears when taking into account per capita real GDP adjusted for purchasing power; and

- No relation is found between macroeconomic performance (inflation and growth) in these countries and de facto degree of CB autonomy as proxied by the TOR.

Lybek then asks whether causality moves from CB autonomy to inflation and growth performance or whether it was the decisive political will to achieve reforms in those years that had a positive impact on all three variables. In partial confirmation of this viewpoint,

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[56] The countries started a gradual reform process at the beginning of the 1990s. They adopted new CB laws between 1992 and 1995, and introduced their currency, for most of them, towards the end of 1993. Most prices were deregulated in the years that immediately followed, excess liquidity inherited from the previous regime, the need to continue subsidizing inefficient production sectors, and the problems of inter-regional trade, led to inflationary pressures and output decline.

Lybek argues that his new indicator is positively correlated with an index constructed by the European Bank for Reconstruction and Development (EBRD) in 1997, to measure progress in trade reforms, reforms in the financial sector, and in the commercial deregulation of emerging markets with respect to the standards of advanced market economies. Taking this into account, it is still appropriate to look at political will and CB autonomy as complementary causes of inflation performance.

Arnone, Laurens, and Segalotto (2006)

Arnone, Laurens and Segalotto (2006) present an update of the Grilli-Masciandaro-Tabellini (GMT) index of CB autonomy, based on central bank legislation as of end-2003. The index is applied to a set of OECD and developing countries, and emerging market economies. For a smaller set of countries, the paper presents a reconstruction of the GMT index based on Cukierman (1992) and it assess changes in CB autonomy between 1992 and 2003.

Overall, the picture provided by the autonomy measures presented in this paper confirms a sharp move towards greater CB autonomy in OECD countries. A preliminary comparison of the data in GMT (1991) against the current data for the same group of OECD countries shows substantial changes in terms of both economic and political autonomy. In most cases, these changes are attributable to the implementation of the ESCB model to those central banks that had showed the lowest levels of autonomy in the earlier evaluation by GMT. Three features of the ESCB standard have played a leading role: the adoption of price stability as the sole objective of monetary policy; the insulation of the central bank from political interference; and the prohibition for the central banks to provide direct credit to governments. Progress in OECD countries is not confined within the boundaries of the euro area. The data also show significant progress—particularly in economic autonomy—for the other central banks belonging to the ESCB and for the extra-European banks that initially did not enjoy much autonomy. In sum, all the 2003 scores for the OECD countries have improved when compared to the results of GMT (1991).

Similar trends can be observed in emerging economies and developing countries. Some of these countries have reached levels of autonomy that compare well with those observed in OECD countries using the GMT methodology. Using data from Cukierman's (1992) legal measure, we could track the evolution of legislation in these countries as well. The results point to significant progress, since on average the measure for both political and economic autonomy doubled during the period under review.

It appears that in a number of emerging markets and developing countries, CB autonomy gained momentum in the course of the last decade. This has been accomplished through a consistent political will and a strong interest in central bank reform, leading to rapid progress both in terms of policy and instrument autonomy. These developments were underpinned by the growing consensus among developed and developing countries about the benefits for overall economic performance to be expected from assigning price stability as the primary objective of the central bank, and limiting the scope for the monetization of public deficits. As a consequence, today we can see an approximately equal distribution of autonomy among countries, irrespective of the level of economic development.

The analysis suggests a three-stage modernization process. Such a process, which can be observed in all three categories of countries, has involved moving from a basic stage in which the foundations are laid for basic de jure autonomy (i.e., price stability as the objective of monetary policy; clauses to protect the central bank from political interferences). A second stage involves the development of an autonomous operating capacity. The final stage involves further expansion of political autonomy in terms of both policy formulation and the appointment of senior management.

F. Autonomy, Credibility, and Costs of Deflation

This section reviews research work on the relationships between CB autonomy and credibility. CB autonomy and conservatism are often considered the best way for enhancing CB credibility which, in turn, should help reduce the costs of deflation due to more rapid adjustment of individual expectations in such an environment.

Blinder (1999)

Blinder asks why credibility is deemed important and what the ideal tools are for its establishment. The study relies on questionnaire to 84 CBs from industrial and emerging countries and to 53 macroeconomic and monetary economy researchers and scholars affiliated with the National Bureau of Economic Research (NBER). Such a process makes it possible to assess which theoretical propositions have been most successful according to those involved in the practice of central banking, and which are the main differences between the academics' and central bankers' visions. The questionnaire begins with the following two general questions: (i) How important is credibility for a CB? and (ii) How closely are the concepts of credibility and dedication to price stability related? As shown in Appendix Table 20, among CBs there is a consensus on the importance of credibility, a view which is not fully shared by economists. With regard to the second question, CB governors gave average responses which showed greater confidence than scholars did in identifying aversion to inflation as the main component of credibility.

The questionnaire gives also interviewees seven possible reasons why credibility should be considered an important element in "making monetary policy," and the interviewees are asked to rank them (Appendix Table 21). For all seven possible reasons, the CBs provided assessments which on average were higher than those provided by scholars. In addition the rankings expressed by the two groups diverge when the first two possible reasons (it makes deflation less costly, and it keeps inflation low) are excluded:

- Central bankers generally accept that credibility improves the short-term tradeoff between inflation and unemployment (it makes deflation less costly). The scholars also give credit to this hypothesis even though on average they seem more skeptical, and the dispersion for this response is the highest of the seven;

- The second reason offered (it keeps inflation low) is closely tied to the credibility hypothesis contained in the first. It obtained the highest degree of consensus;[57]

- The third reason expresses the possibility that greater credibility gives the CB more tactical and strategic flexibility by mitigating fears that a change in strategy could mean that the fight against inflation is being abandoned. The CBs liked this idea almost as much as the second reason, while scholars seemed reserved, although they considered it the third most important reason;

- The fourth proposal assumes that a more credible CB should be able to serve as lender of last resort during a financial crisis or a bank run without generating fears in the public, and thus without raising inflation expectations. CBs rank this hypothesis higher than scholars. However, it is surprising that this idea is only the sixth most important for CBs, while it is in fourth place for scholars;

- The fifth hypothesis refers to a short-term intervention to protect the exchange rate in the event of a speculative attack and assumes that a CB that has greater credibility may more rapidly deter these episodes. CBs seem to be in agreement on average, while economists express doubts, giving it a much lower score on average;

- The sixth hypothesis refers to the importance of credibility for openness and transparency, which the author interprets as complete harmony between declarations and intents. CBs agree on average, but scholars are more skeptical, reflecting the weight they attribute to secrecy for monetary policy; and

- The seventh hypothesis (to gain consensus over CB autonomy) is ranked fourth by CBs and last by economists, perhaps because the public may support the idea of an autonomous CB even if the monetary authority has little credibility.

The final part of the questionnaire aims at comparing viewpoints about how to best create and maintain CB credibility. Interestingly, both groups rank equally the seven proposed considerations (Appendix Table 22):

- The best way to achieve credibility is to establish a tradition of honesty. While Blinder considers that agreement among CB governors was to be expected, he considers the broad agreement among scholars to be unexpected considering the lower weight attributed by them to theoretically more attractive solutions, such as CB autonomy or optimal contracts;

- However, CB autonomy is ranked second. The consensus seems that an autonomous CB can be less credible than a more dependent institution that has managed to establish a solid, valued tradition;

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[57] The credibility hypothesis is defined as the hypothesis that greater credibility reduces the costs of deflation.

- An history of fight against inflation is ranked third, confirming the view that a tradition of honesty does more to increase credibility than one of inflation aversion;

- Blinder expresses some surprise to the fact that transparency, as a way to create and maintain credibility, is ranked fourth, as this would go against a view that some secrecy may help ensure that credibility is not to be affected by a change in strategy;

- Surprisingly, government's fiscal discipline is only ranked fifth. This result may well reflect progress made in enhancing fiscal discipline in the most recent period; and

- The last two ways to create and maintain credibility refer to the CB's pre-commitment to a fixed rule and the personal incentives included in the optimal contracts proposed by Walsh (1995) and Svensson (1997). As could be expected, central bankers express a low score with regard to the pre-commitment to a fixed rule, given that they probably rank highly their own capacity to conduct monetary policy. However, it is surprising that the scholars attribute an even lower score. With regard to personal incentives, Blinder refers to an answer stating that that the loss of reputation is already an effective mechanism for creating credibility, even in the absence of a personal incentive. Here also, the even lower assessment expressed by the scholars may be considered somewhat at odds with the widely cited theory.

Posen (1998)

Posen looks for empirical evidence of the "credibility bonus" that a commitment to price stability should theoretically entail if a CB is conservative and autonomous. The article investigates the public and private sectors' behavior in a sample of OECD countries by looking for changes in credibility, which is proxied by the deflationary capability of the CB.[58] The author first provides several theoretical predictions regarding the impact of greater CB autonomy on deflationary processes and wage negotiations:

(i)   The announcement of a credible deflationary policy should lead to good inflation performance with limited output or employment costs. Thus, the risk of a recession should be limited to the case in which money growth is lower than what was predicted by the public. By reducing the gap between expectations and actual outcomes, a more credible monetary policy should therefore imply lower costs of deflation, all other conditions being equal;

(ii)   If we assume that the public (in an environment with little inflation and limited uncertainty over future inflation) prefers to enter into contracts for a longer period, a monetary regime that offers greater credibility in terms of price stability should encourage greater rigidity in nominal wages.

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[58]Seventeen countries are considered for the period 1950-1989.

(iii)   As a result, Posen argues that higher inflation (hence lower CB autonomy at the beginning of a deflation episode), should ensure lower costs during that process; and

(iv)   It is likely that in an environment of perfect credibility, the period required for the deflation process is significantly shorter since credibility should reduce the degree of stickiness in the reduction of nominal compensation.[59]

Posen shows a good relationship between all 4 predictions and Cukierman's LVAU indicator of CB autonomy:

- The first of the four empirical predictions (more credibility lowers the cost of deflation) is analyzed by regressing the costs of deflation[60] on the LVAU index, the duration of the episode, the total change in inflation, and a measure of nominal wage rigidity. The result do not support the prediction, which is therefore, rejected;[61]

- Regarding the second prediction (credibility leads to rigidity in nominal wages), Posen regresses two measures of nominal wage rigidity[62] on the LVAU index. The results are inconsistent with expectations. However, neither of the two measures of nominal wage rigidity have a statistically significant relationship with CB autonomy. Thus, negotiating behavior seems to be partially invariant with respect to the monetary environment, and therefore the positive relationship between CB autonomy and the costs of deflation does not seem to depend on that particular channel;

- The third prediction (low CB autonomy at the beginning of the deflation episode leads to lower costs during deflation) is addressed using a set of regressions of the sacrifice ratio, and by replacing CB autonomy with the level of inflation at the beginning of each episode of deflation. This variable does not exhibit significant coefficients. The author concludes that there is no evidence confirming that a less inflationary environment leads to greater nominal rigidity, and therefore that the negative relationship between CB autonomy and inflation does not seem to have the desired effect when the increase in credibility is the source of price stability; and

- With regard to the fourth prediction (perfect credibility would reduce the duration of a deflation process), two measures are regressed that approximate the speed of the

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[59] The first and last of the theoretical predictions are necessary conditions supporting the hypothesis that CB autonomy increases monetary policy credibility. Rejection of the second and third predictions ultimately lead to denying that the credibility bonus is sufficiently large to influence the public's negotiating behavior.

[60] The cost of deflation is proxied by the total annual increase in the unemployment rate from the beginning of the deflationary maneuver divided by the corresponding reduction in inflation (so-called sacrifice ratio).

[61] As further proof, Posen cites Ball and others (1988) who regress the estimated tradeoff between output and inflation on CB autonomy and two wage rigidity measures. He finds that the coefficient of the variable regarding CB autonomy has a negative sign.

[62] Rigidity index of Grubb, Jackman, and Layard (1983) and Bruno and Sachs (1985) complementary measure.

deflationary episode: the number of quarters the episode lasts and the number of percentage points of inflation eliminated during the episode in relation to the length of the episode. Posen finds that the coefficient of CB autonomy has a small negative sign and is significant in only one of the regressions.

Posen also assesses what should be the effects of an increase in CB autonomy on the government's behavior. The laws that ensure CB autonomy should increase the CB's ability to resist debt monetization, protect the governor's position once appointed, and ensure the priority of price stability as the objective of monetary policy. Two additional predictions are proposed to reflect these considerations:

(v)   all other conditions being equal, where CB autonomy is greater, the government's recourse to seignorage should be lower; and

(vi)   there should be less economic policy manipulation for electoral purposes.

Posen does not find empirical evidence supporting these last two predictions. Regarding prediction (v), the regression of seignorage[63] on CB independence, on an indicator of political differentiation within the government and on a political instability indicator exhibits a negative sign for CB autonomy only in the 1960s, and the coefficient is not statistically significant. Therefore, Posen rejects the prediction. Regarding prediction (vi), Posen finds no evidence of the influence of CB autonomy on the trends of political business cycles.

In summary, Posen does not find empirical evidence supporting the hypothesis that the channel through which CB autonomy leads to a situation of low inflation is brought about by an increase in credibility. In other words, deflation is more costly and lasts longer in countries with relatively autonomous CBs. Similarly, countries with autonomous CBs do not exhibit either nominal wage and price rigidities or less government debt monetization and less manipulation of macroeconomic policies for election purposes. According to Posen, two questions result from these considerations, which he attempts to answer:

- Why doesn't CB autonomy increase the credibility of a deflationary policy? He argues that it is unlikely that the legal indicators used could capture the entire spectrum of a CB's actual discretion; other factors may influence its actual autonomy;

- Why is there a negative correlation between inflation and CB autonomy? He argues that if there are no fiscal restrictions on the government, it will be impossible to make a tight money policy credible in the long run, and CB autonomy does not seem to prevent recourse to seignorage or monetary expansion in pre-electoral periods. However, if a CB is autonomous from the executive branch, neither of the two will be interested in implementing expansionary policies, and thus the commitment should be

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[63] Seignorage is defined as the rate of increase of the monetary base divided by total government revenues.

credible. Therefore, the lack of a private sector reaction to CB autonomy can be seen as a reaction to unchanged behavior in the public sector.

Cukierman (2002)

Cukierman (2002) seeks to provide a conceptual review of the relationship between the level of CB autonomy and the greater sacrifice in employment during deflationary periods. Posen (1998) showed that the sacrifice ratio is higher in OECD countries that exhibit greater CB autonomy. Gartner (1995) and Fischer (1996) reach a similar conclusion, while Debelle and Fischer (1994) note that during the deflationary period that followed the oil shocks, the employment sacrifice was greater in Germany than in the United States. Cukierman argues that there is not necessarily a negative relationship between the sacrifice ratio and social wellfare.[64] On the contrary, there is a credibility bonus: the higher the level of CB autonomy (and thus, the better its reputation), the higher the expected value of social welfare. In other words, social welfare is a growing and monotonic function of autonomy and reputation (which is assumed to be positive in relation to autonomy). This result is obtained regardless of the size of the sacrifice ratio and the sign of its relationship with CB autonomy. Thus, although it is empirically true that countries with greater CB autonomy incur in higher increase in unemployment during deflationary periods, one cannot infer that it is not desirable to increase CB autonomy since it increases expected social welfare monotonically. That conclusion explains why the sacrifice ratio is a rather poor measure for analyzing the long-term desirability of CB autonomy.

Fuhrer (1997)

Further objective is to reassess previous assertions about CB autonomy and inflation. Fischer (1996) states that "effective CBs must be independent from undue political interference, and they would do well to target the rate of inflation directly". Fuhrer examines the empirical evidence to support these assertions. After reporting several previous theoretical solutions to the problem of inflationary bias (Rogoff—1985, McCallum—1995 and Walsh—1995), Fuhrer suggests that the CB's autonomy and credibility are inescapable ingredients in any resolution of this issue. However, he also notes that there is an alternative solution, which consists in pegging the exchange rate to a currency whose CB is independent.

The author stresses that the major macroeconomic developments of the beginning of the 1980s, occurred without any formal obligation for monetary authorities. Several countries between the 1980s and 1990s began reviewing their legislation in response to the concept of inflationary bias and time inconsistency, with a view to ensure that price stability would be the primary and often only objective, of monetary policy. However, the author stresses that

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[64] Cukierman argues that the relationship between sacrifice ratios and welfare is not monotonic for at least two reasons. First, if we focus only on deflationary periods, we lose sight of the fact that a higher sacrifice ratio also implies greater output performance during expansionary periods. Second, for the same reason, temporary employment-related costs tend to obscure the long term benefits derived from price stability.

the "major deflation" that occurred at the beginning of the 1980s was brought about by monetary authorities in the United States, United Kingdom, Germany, and France without any formal obligation to do so, and it occurred without either changes in their degree of autonomy, or the formalization of strict rules, or the announcement of an explicit inflationary target. In essence, the authorities' will, which was probably accompanied by public support, was sufficient to bring about those changes. Thus, credibility (defined as the behavior which is sufficiently systematic and permanent to generate a public perception that this is the norm) seems to be the determining factor for successful deflation. If a CB earns this credibility bonus through its actions, it is unlikely that the announcement of new monetary policy rules or new inflationary objectives would serve as an effective substitute.[65] However, Fuhrer (as in the case of Debelle and Fischer – 1994) acknowledges that the empirical evidence contradicts the existence of a credibility bonus in case of deflation.[66]

Fuhrer also moves to past empirical studies in an attempt to reconfirm that CB autonomy is a key ingredient for successful monetary policy. He initially reports the results obtained by Alesina and Summers (1993), indicating the strong negative correlation between the degree of CB autonomy and inflationary levels. Then, he regresses the data on inflation found by these authors on Cukierman's LVAU. Fuhrer finds that the strong negative correlation weakens and becomes statistically less significant. Then, by using a broader sample of countries divided into geographic areas, and measuring CB autonomy using the Cukierman's LVAU, Fuhrer conclude that for the sub-group of OECD countries, the relationship is weaker and less significant than the relationship observed by Alesina and Summers (1993). For Latin American, Asian, and sub-Saharan African countries this correlation is not statistically significant, and it is positive, rather than negative, in the two former cases.

Fuhrer then attempts to infer conclusions on the possible existence of a credibility bonus. For that, he measures the level of correlation among Cukierman's LVAU and Ball's (1994) sacrifice ratio for the Alesina and Summers'(1993) sample of 16 OECD countries. The results indicate that the correlation between CB autonomy and the sacrifice ratio is significantly positive primarily due to the values obtained in Germany and the United States. According to Fuhrer, it is these two CBs that contradict the hypothesis of a credibility bonus. To check the robustness of this result, Fuhrer expands the number of countries and scope of his analysis, including data on inflation, unemployment, real growth, the 10-year average LVAU, short-term interest rates, deficits as a percentage of GDP and a variable that measures exchange rates in various European countries against the deutschemark. As a result of these additional variables, Fuhrer reaches the following conclusions:

- Regarding inflation, none of the regressions on the entire sample of 70 countries exhibits any significant correlation with the degree of CB autonomy;

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[65] See Blinder (1999).

[66] See also Posen (1998), Cukierman (2002), and Debelle (1996).

- The only negative relationship is confirmed to be the one observed for the sample of Alesina and Summers (1993), in simple bivariate regressions;

- The coefficient of CB autonomy with respect to inflation also loses significance for OECD countries, although the explanatory power of the regressions is good;

- Regarding the variability of inflation, the only specification for which Fuhrer finds a significant correlation between this and the degree of CB autonomy is in the simple bivariate regressions on the sample of Alesina and Summers (1993); and said correlation vanishes as supplementary variables are added; and

- When the dependent variable is the real growth rate or unemployment rate, Fuhrer's calculations contradict the "free lunch" hypothesis. The only statistically significant correlations suggest a negative relationship between CB autonomy and real growth and a positive relationship with unemployment.

In summary, Fuhrer's calculations generate considerable doubts over the robustness of the correlation between CB autonomy, inflation level and variability, real growth or unemployment. In general, the inflation-related benefits attributed to CB autonomy are found only in bivariate regressions. Once several supplementary attributes of international differences are included, the correlation disappears. These conclusions are still distorted by the fact that the author uses a legal indicator of autonomy such as Cukierman's LVAU for a sample which included a number of developing countries.

IV. CONCLUDING REMARKS

The empirical results in the base literature on CB autonomy were brilliantly summarized by Cukierman (1994) as follows:

- Among industrial countries, there is a strong negative relationship between de jure CB autonomy and inflation, while the same measures of autonomy exhibit no correlation to real macroeconomic performance. This may be because growth has underlying causes that are too complex and varied for a regression on a measure of CB autonomy to provide significant results;

- De facto CB autonomy do not seem to have any significance in explaining economic performance in developed countries, since in those countries the transparency of monetary decisions is high and practices adhere more closely to the law. However, measures of de facto autonomy have proved to be useful for analyzing inflation performance in emerging and developing countries; and

- In the case of less developed countries, de facto measures of CB autonomy prove to be good proxies in explaining growth performance, even when additional control variables are added.

The study of de jure CB autonomy by Bade and Parkin (1977), which later served as a reference for subsequent research, finds that establishing price stability as the primary objective of monetary policy is associated with lower levels of inflation. It shows that CBs that have a certain degree of autonomy are able to ensure lower inflation, although not necessarily lower variability of monetary policies.

Alesina (1988 and 1989) argues that there is an inverse relationship between the degree of CB autonomy and average inflation. By comparing average inflation under various governments, he notes that where a CB is autonomous, monetary policy has, in general, followed the course of political cycles more closely. Moving to a more in-depth analysis of CB autonomy, such as that of Grilli, Masciandaro, and Tabellini, the result does not change: it appears that an autonomous CB brings about low levels of inflation, and although it does not eliminate government deficits problems, CB autonomy does not seem to have costs in terms of slower growth or greater output variability.

Cukerman's (1992) LVAU and LVAW indicators show that the contribution of legal autonomy to inflation is negative and statistically significant for developed countries, but not for developing countries. Although the general contribution of the single groups of variables in explaining inflation is not significant, and separating industrial from developing countries does not result in an increase in significance, this value is higher in industrial countries.

Finally, among de jure measures, the indicator by Alesina and Summers, which combines two of the previous measures of autonomy, shows results that are consistent with the general trend reported by previous measures of de jure CB autonomy. Although the authors find a strong negative correlation between CB autonomy and inflation (both with regard to average levels and variability), there is no clear relationship between CB autonomy and the average and variance of GDP growth. The analysis of unemployment rate behavior shows similar results, while negative long-term effects are observed with regard to the relationship CB autonomy and the variability of real interest rates.

In view of the low reliability of de jure measures of autonomy for developing countries, the literature relies on measures for these countries that approximate de facto autonomy. Cukierman proposes proxying actual autonomy using the average frequency of CB governor turnover (TOR) and finds that, at least above a certain threshold, TOR is positively related to average inflation and its coefficient is statistically significant for only the subgroup of developing countries. Cukierman develops two other de facto autonomy indices (QVAU and QVAW) and finds that most of their variables have the expected negative sign, with the most significant measures being those concerning the presence of intermediate monetary policy objectives and those concerning limitations to CB credit to the government. The index's overall contribution to explaining inflation performance is not very significant, however, and this leads the author to favor the use of the simpler TOR measure.

The last de facto indicator analyzed among the base contributions is the index of CB vulnerability to political instability proposed by Cukierman and Webb (1995) as a substitute for the TOR during periods of political transitions. The measure has a significantly positive

impact on inflation's level and variability, and it appears that the differences in the political and nonpolitical TOR, together with the various degrees of political instability, can explain the highest inflation rates reported, on average, by developing countries, as well as differing growth performances and interest rates variability.

As a follow up to base indicators, many authors have studied CB autonomy and its measurement, contributing to an already large body of literature:

- Several authors, such as McCallum, have branded as too simplistic Rogoff's proposal of reducing inflationary bias by merely delegating monetary policy to an autonomous and conservative CB. They also criticized the solutions proposed using incentive-compatible contracts for CBs, since such mechanisms would simply redistribute the time-inconsistency problem but not solve it;

- Others authors, such as Banaian, Burdekin, and Willett, have turned their attention to searching for the single criterion, among those contained in various measures of autonomy, that have the best performances in explaining differences in inflation performance. The authors show that a simple dummy variable based on the government's inability to override policy decisions made by the CB is statistically more significant in explaining inflation than more complex measures of autonomy (i.e., TOR, LVAU, and the GMT indices); and

- Other authors, such as Cukierman and Lippi, have attempted to endogenize the structural imperfections of economies in order to better assess the determinants of inflationary biases, in particular by studying the interaction between CB conservatism and various degrees of centralization in wage bargaining. The authors confirm that there is a convex relationship between the unemployment rate or inflation and the centralization of wage bargaining. This relationship is valid only at low levels of CB autonomy, however. In addition, the inflation-reducing impact that monetary policy autonomy brings about is greater at intermediate levels of union centralization, while there is a significantly positive effect of CB autonomy on unemployment for low levels of centralization in wage bargaining.

There is also a group of authors who make alternative hypotheses regarding the direction of causality in empirical relationships, and others who investigate the robustness and sensitivity of previous empirical results:

- Posen argues that CB autonomy does not affect inflation if the calculations include his measure of the financial sector's opposition to inflation (FOI) as an additional variable. According to Posen, FOI is theoretically able to increase CB autonomy and, at the same time, significantly reduce inflationary bias without the need to assume any direct causal relationship between these two variables. Although his assertion is widely criticized, Posen argues that there is a significant causal relationship between a high FOI, higher CB autonomy, and lower inflation, with the relationship moving in that order;

- Regarding the robustness of previous empirical findings, Campillo and Miron show that CB autonomy cannot explain inflation when several additional control variables are added, such as the degree of openness of the economy, the ratio of debt to GDP, political instability, the level of income, or previous inflation experience. These variables are more significant than CB autonomy in explaining inflation;

- Oatley achieves a significant result by showing that the assumed negative relations between CB autonomy and inflation resists to the inclusion of a set of economic and political-institutional control variables. Contrary to what was observed by Campillo and Miron, neither the government's budget situation nor the degree of openness of the economy exhibits a strong relationship to inflation; whereas unemployment, the structure of the labor market, and the government's political preferences provide good results. Oatley also argues that five out of the eight most complex indices of CB autonomy that he has analyzed fail to capture the assumed relationship with inflation, while the three simplest indices perform better;

- Sturm and de Haan calculate the TORs for a new sample of 97 developing countries, in order to substantiate Cukierman's conclusions on de facto autonomy. They show that once some control variables are included, the TOR coefficient is not very significant. The authors also observe the TOR coefficient is significant only when high-inflation countries are included, as in de Haan and Kooi (2000); and

- Stella and Ize have analyzed the role of CB capital and financial autonomy on its performance. This is a promising area in which more empirical research is warranted to assess the relationship linking financial strength and the level of autonomy.

In exploring the relationship between autonomy, credibility, and the costs of disinflation, we again cited Posen (1998). Looking for the actual existence of a credibility bonus, which (if the monetary authority is independent and conservative) makes deflationary policies less costly, Posen investigates the behavior of the public and private sectors in a sample of Organization for Economic Cooperation and Development (OECD) countries by looking for changes in credibility consistent with common measures of autonomy. He could not find evidence, however, that greater CB autonomy and conservatism lead to significantly lower costs of deflation.

Finally, Mangano (1998) offer the most outstanding analysis of the reliability and comparability of different CB autonomy measures. Mangano uncovers nonnegligible criteria and interpretation spreads between the de jure GMT and LVAU indices, and low correlation coefficients between the CB rankings obtained with these and other four autonomy measures. This line of research is aimed not so much at establishing which the best measure for proxying CB autonomy is, but rather at suggesting that a good analysis should rely on a set of measure rather than on a single index. Mangano's results caution from the potential abuse of CB autonomy indicators if they were deemed to be interchangeable.

In conclusion, the evidence on the beneficial effects of CB autonomy is more than substantial, but some technical issues remain for further research. In particular, CB autonomy

raises the issue of subjecting it to democratic control. This requires additional research on the linkages between CB autonomy and accountability and transparency. Furthermore, so far, the literature has focused on the relationship between CB autonomy and price stability, plus a few other real sector indicators, but limited attention has been given to the relationships between CB autonomy and financial stability. Further research in this area would be useful. Further empirical analysis on the relationship between the financial strength of the central bank and its de facto autonomy would also be desirable.

Appendixes

I. Statistical Tables

Table A1. Bade and Parkin Ranking

Final Authority/ Appointment of Senior Management	Country	Percentage Change in Exchange Rate	Annual Growth in Money Supply		Annual Growth in Monetary Base	
			Standard Deviation	Variation Coefficient	Standard Deviation	Variation Coefficient
Government/ Government	Netherlands	33.44 (3)	4.62 (7)	55.1 (6)	3.99 (3)	61.67 (2)
	Australia	16.96 (7)	6.22 (11)	107.8 (12)	10.78 (11)	144.12 (12)
	Belgium	26.43 (4)	1.75 (1)	47.5 (5)	3.67 (2)	81.19 (6)
	Canada	3.39 (8)	5.49 (10)	89.4 (10)	5.26 (5)	76.23 (5)
	France	-22.47 (11)	4.02 (4)	36.7 (3)	8.69 (10)	115.10 (11)
	Japan	17.81 (6)	7.43 (12)	41.5 (4)	7.78 (9)	48.47 (1)
	Italy	-4.45 (10)	4.17 (5)	29.1 (1)	12.40 (12)	86.11 (7)
	United Kingdom	-26.05 (12)	4.82 (9)	103.4 (11)	7.60 (8)	109.67 (10)
	Sweden	19.74 (5)	4.27 (6)	60.2 (8)	6.89 (7)	106.33 (9)
CB/ government	United States	0.00 (9) cash on hand	2.15 (2)	55.4 (7)	3.23 (1)	91.24 (8)
CB/ government and others	Germany	41.35 (1)	3.20 (3)	33.6 (2)	6.79 (6)	75.70 (4)
	Switzerland	40.97 (2)	4.65 (8)	65.5 (9)	4.80 (4)	69.46 (3)

Source: Bade and Parkin (1977).

Table A2. Results of Alesina and Bade and Parkin

Country	Average Inflation	Bade and Parkin (1977) Autonomy Index	Bade and Parkin (1985) Autonomy Index	Alesina Autonomy Index (1988, 1989)
Italy	13.7	1	2	1/2
Spain	13.6	-	-	1
New Zealand	12.0	-	-	1
United Kingdom	10.7	1	2	2
Finland	9.8	-	-	2
Australia	9.7	1	1	1
France	9.2	1	2	2
Denmark	8.8	-	-	2
Sweden	8.7	1	2	2
Norway	8.4	-	-	2
Canada	7.8	1	2	2
Belgium	6.9	1	2	2
United States	6.9	3	3	3
Japan	6.4	1	3	3
Netherlands	5.5	2	2	2
Switzerland	4.1	4	4	4
Germany	4.1	4	4	4

Source: Alesina (1989), Bade and Parkin (1977), Eijffinger and Schaling (1993).

Table A3. Alesina: CB Autonomy, Inflation, and Government Spending

Country	Degree of Autonomy of CB (1)	Average Inflation Rate (2)	Rate of Government Spending as a Percentage of GNP (3)
Italy	1/2	16.1	35.6
Spain	1	15.2	26.2
New Zealand	1	12.7	36.4
United Kingdom	2	12.3	37.3
Australia	1	10.5	28.4
France	2	10.2	39.1
Sweden	2	9.8	38.3
Denmark	2	9.1	39.7
Norway	2	8.8	38.3
Canada	2	8.1	23.1
United States	3	7.2	21.7
Belgium	2	6.8	36.0
Netherlands	2	5.8	35.4
Japan	3	5.0	16.2
Germany	4	4.1	29.3
Switzerland	4	4.0	9.0

Source: Alesina (1988).

Table A4. Alesina: Inflation Rates and Political Transitions

Country	(a)	(b)	Difference (a)–(b)	Bade and Parkin (1985) Autonomy Index
Germany	Social Democrats (1975–82)	Christian Democrats (1983–85)		
	4.3	2.5	1.8	4
United Kingdom	Labor Party (1975–79)	Conservative Party (1980–85)		
	16.3	9.0	7.3	2
United States	Carter (1977–80)	Reagan (1981–85)		
	8.0	5.4	2.6	3

Source: Alesina (1988).

Table A5. GMT: Political Autonomy Index

Country	Appointment				Relationships with Government		Charters		Political Autonomy Index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Australia		1					1	1	3
Austria						1	1	1	3
Belgium				1					1
Canada	1	1					1	1	4
Denmark		1				1	1		3
France		1		1					2
Germany		1		1	1	1	1	1	6
Japan							1		1
Greece			1					1	2
Ireland		1				1	1		3
Italy	1	1	1		1				4
New Zealand									0
Netherlands		1		1	1	1	1	1	6
Portugal					1				1
United Kingdom					1				1
Spain				1	1				2
United States				1	1	1	1	1	5
Switzerland		1			1	1	1	1	5

Source: Grilli, Masciandaro, and Tabellini (1991).

Appendix Table A6. GMT: Economic Autonomy Index

Country	Monetary Financing of Public Deficits					Monetary Instruments		Economic Autonomy Index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Australia	1	1	1	1	1	1		6
Austria			1	1	1	1	2	6
Belgium		1		1	1	1	2	6
Canada	1	1	1	1		1	2	7
Denmark		1			1	1	2	5
France				1	1	1	2	5
Germany	1	1	1	1	1	1	1	7
Japan	1		1		1	1	1	5
Greece			1			1		2
Ireland		1	1	1		1		4
Italy			1					1
New Zealand			1	1		1		3
Netherlands			1	1	1	1		4
Portugal			1			1		2
United Kingdom	1	1	1	1		1		5
Spain			1	1			1	3
United States	1	1	1	1	1	1	1	7
Switzerland		1	1	1	1	1	2	7

Source: Grilli, Masciandaro, and Tabellini (1991).

Table A7. Variables of Cukiermann Legal LVAU–LVAW Indices

Variable	Definition of Variable	Sub-Variables	Score (Higher for Greater CB Autonomy)
CEO			
Too (term of office of CEO)	Term of office of governor or president in years	1. *too* ≥ 8	1
		2. $8 > too \geq 6$	0.75
		3. *too* = 5	0.50
		4. *too* = 4	0.25
		5. *too* < 4	0
App (Who appoints of the CEO?)	Entity delegated to appoint governor or president	1. Appointment delegated to board of CB	1
		2. Appointment delegated to body made up of members of executive branch, parliament and the board of the CB	0.75
		3. Appointment delegated to parliament or legislative branch	0.50
		4. Appointment delegated to government	0.25
		5. Appointment by decision of one or two members of the executive branch (e.g., prime minister or finance minister)	0
Diss (Provisions for dismissal of CEO)	Provisions for dismissal of governor or president	1. No provisions	1
		2. Dismissal possible only for nonpolitical reasons (e.g., incompetence or violation of the law)	0.83
		3. Dismissal possible at discretion of CB board	0.67
		4. Dismissal for political reasons at discretion of legislative branch	0.50
		5. Unconditional dismissal at discretion of legislative branch	0.33
		6. Dismissal for political reasons at discretion of executive branch	0.17
		7. Unconditional dismissal at discretion of executive branch	0
Off (Is CEO allowed to hold another office?)	Ability of governor or president to hold another office	1. Governor legally prohibited from any other government office	1
		2. Governor not allowed to hold any other government office unless authorized by the executive branch	0.50
		3. No legal prohibition for the governor to hold other offices	0
PF			
Monpol (Who formulates monetary policy?)	Entity responsible for formulating monetary policy	1. Only the CB has authority to formulate monetary policy	1
		2. CB participates in formulating monetary policy with government	0.66
		3. CB participates in formulating monetary policy on consulting basis	0.33
		4. Only the government has authority to formulate monetary policy	0
Conf: (Government directives and resolution of conflicts)	Government directives and conflict resolution	1. CB has ultimate authority on matters explicitly defined by law as its objectives	1
		2. Government has ultimate authority only on policy matters not explicitly defined as objectives of CB, or in the event of internal conflict within CB	0.8
		3. In case of conflict, the final decision lies with a body comprising members of the CB, the legislative branch, and the executive branch	0.6
		4. The legislative branch has ultimate authority in policy matters	0.4
		5. The executive branch has ultimate authority in policy matters, but is subject to possible opposition by the CB	0.2
		6. The executive branch has unconditional ultimate authority	0
Adv (Is CB given active role in formulation of government's budget?)	Does CB have a role in formulating the government budget?	1. Yes	1
		2. No	0
OBJ			

Variable	Definition of Variable	Sub-Variables	Score (Higher for Greater CB Autonomy)
Obj *(objectives of the CB)*	Objectives of CB	1. Price stability is cited as the only or primary objective, and in the event of a conflict with the government, the CB has ultimate authority to pursue the necessary policies to achieve that objective	1
		2. Price stability is cited as the only objective	0.8
		3. Price stability is only one of the objectives; the other objectives do not conflict with the primary objective (e.g., banking system stability)	0.6
		4. Price stability is only one of the objectives; the other objectives potentially conflict with the primary objective (e.g., full employment)	0.4
		5. CB charter does not mention objectives	0.2
		6. CB charter mentions certain objectives, but not price stability	0
LL			
Lla *(Limitation on advances)*	Limitations on advances to the government	1. Advances to the government are prohibited	1
		2. Advances possible but limited in absolute terms or subject to other types of limitations (e.g., up to 15 % of government revenues)	0.66
		3. Advances possible and subject to more generous limits (e.g., over 15 % of government revenues or defined as fraction of expenditures)	0.33
		4. There are no legal limitations on advances; their amount is periodically negotiated between the CB and the government	0
Lls *(Limitation on securitized lending)*	Limitations on secured loans to the government	Same distinctions as for limitations on advances	
Ldec *(Who decides control of terms of lending?)*	Who has the authority to control terms and conditions (maturity, interest rate and amount) of loans to the government?	1. CB controls the terms and conditions of loans	1
		2. The terms and conditions are specified by law, or the law gives the CB the authority to establish these limits	0.66
		3. The law leaves the decision of the terms and conditions of the loan open to negotiation between the executive branch and CB	0.33
		4. The executive branch imposes loan terms on the CB	0
Lwidth: *(How wide is the circle of potential borrowers from CB?)*	Who has access to loans made by the CB?	1. Only the central government may obtain a loan at the CB	1
		2. The central government, local governments and all other political sub-divisions may obtain loans at the CB	0.66
		3. In addition to the entities mentioned in paragraph 2, public enterprises have access to CB loans	0.33
		4. The CB may make loans to the private sector in addition to the entities mentioned in paragraph 3	0
Ltype *(Type of limit when limits exist)*	Types of limitations on loans, where limits exist	1. Limit on loan amount is prescribed in absolute terms	1
		2. Limit on loan amount is prescribed in terms of capital or other liabilities of the CB	0.66
		3. Limit on amount prescribed in terms of % of government revenues	0.33
		4. Limit on amount prescribed in terms of % of government expenses	0
Lmat *(Maturity of loans)*	Maturity of possible loans	1. Loan maturity limited to six months	1
		2. Loan maturity limited to one year	0.66
		3. Loan maturity limited to over one year	0.33
		4. No legal limit on loan maturities	0
Lint *(Restrictions on interest rates)*	Limitations on interest rates applicable to loans by CB	1. Loans are possible only at market rates	1
		2. Minimum level applies to the interest rate paid by the government	0.75
		3. A ceiling applies to interest rates paid by the government	0.50
		4. No explicit legal provisions on interest applied to CB loans.	0.25
		5. Law does not provide for government to pay interest on CB loans.	0
Lprm *(Prohibition onlending in primary market)*	Prohibitions on lending on the primary market	1. CB prohibited from underwriting public debt on the primary market	1
		2. CB may underwrite public debt securities on the primary market	0

Source: Cukierman (1992).

Table A8. Variables for Determining Cukierman's QVAU-QVAW

Variable	Definition of Variable	Sub-Variables	Score (Higher Score Means Greater Autonomy)
Qto (tenure overlap with political authority)	Overlap of tenure of governor and board with government	Limited overlap	1
		Some overlap	0.5
		Substantial overlap	0
Qll limitations on lending in practice)	Practical limitations to loans made by CB	The assessment was made by questionnaire respondents on the basis of a four-level scale (where 1 is assigned to the strictest limitations)	1
			0.66
			0.33
			0
Qrc resolution of conflicts)	Resolution of conflicts between CB and government	In certain instances there is clear evidence of resolution in favor of the CB	1
		Everything not covered by the first and third choices	0.5
		Clear evidence that conflicts are resolved in the government's favor in all instances	0
Qbcb (who determines CB budget?)	Who determines the CB budget?	Mostly the CB	1
		Partly by CB, partly by executive branch/ parliament	0.5
		Mostly the executive branch or parliament	0
Qsp)who determines salaries of high CB officials and allocation of CB profits?)	Who is in charge of determining compensation of CB officials and allocation of profits? (if identity of individual not given response codified for individual that determines compensation)	Mostly the CB or the law	1
		Partly by the CB and partly by the executive branch or parliament	0.5
		Mostly the executive branch or parliament	0
Qst are there quantitative money stock targets?)	Does the CB have monetary targets, and to what extent does it comply with them in practice?	Targets exist and followed in practice	1
		Targets exist and followed to some extent in practice	0.66
		Targets exist but rarely followed in practice	0.33
		There are no quantitative targets	0
Qirt (are there formal or informal interest rates targets?)	Does the CB also have informal interest rate targets?	No	1
		Yes	0
Qpps (what is priority assigned to price stability?)	What priority is assigned in practice to the price stability target?	The price stability target is given the highest priority	1
		Fixed exchange rate is given the highest priority	0.66
		Both price and exchange rate stability are among monetary policy targets, but are not highest priority	0.33
		No mention of the above two targets	0
Qsc(does CB function as a development bank-grants credits at subsidy rates?)	Is CB required to provide loans at subsidy rates thus acting as development bank?	No	1
		Sometimes	0.66
		Yes	0.33
		The CB is heavily involved in providing loan subsidies to both the public and private sectors	0

Source: Cukierman (1992).

Table A9. Alesina and Summers Autonomy Index

Country	Alesina Index (1988)	Grilli, Masciandaro, and Tabellini (GMT) Index (1991)	Conversion of the GMT Index (1991) to Alesina Scale (1988)	Average of Alesina (1988) and Converted GMT Index (1991)
Australia	1	9	3	2
Belgium	2	7	2	2
Canada	2	11	3	2.5
Denmark	2	8	3	2.5
France	2	7	2	2
Germany	4	13	4	4
Japan	3	6	2	2.5
Italy	1.5	5	2	1.75
Norway	2	-	-	2
New Zealand	1	3	1	1
Netherlands	2	10	3	2.5
United Kingdom	2	6	2	2
Spain	1	5	2	1.5
United States	3	12	4	3.5
Sweden	2	-	-	2
Switzerland	4	12	4	4

Source: Alesina and Summers (1993).

Table A10. Eijffinger and Schaling Policy Types

CB Ultimate Policy Authority (1)		No Government Representatives on CB Board (2)	Over One-Half of Appointments of Senior Management Made Alone by Government (3)	Potential CB Type	Type of CB Exists in Sample	CB Policy Type
g	0	0	1	(a)	no	-
g	0	1	1	(b)	no	-
b	2	0	1	(c)	no	-
b	2	0	0	(d)	no	-
b/g	1	0	0	(e)	no	-
b/g	1	1	1	(f)	no	-
b/g	1	0	1	(g)	no	-
g	0	0	0	(h)	yes	1 (Australia, Canada)
g	0	1	0	(i)	yes	2 (France, Italy, U.K., Sweden)
b/g	1	1	0	(j)	yes	3 (Belgium, Japan, U.S.
b	2	1	0	(k)	yes	4 (Netherlands)
b	2	1	1	(l)	yes	5 (Germany, Switzerland)

Source: Eijffinger and Schaling (1993).

Table. A11. Cukierman and Webb: Frequency of Changes in Head of CB at Various Intervals

Economic Group Considered	Number of Countries	Time Interval (Number of Months from a PoliticalTransition)				
		0–1	2–3	4–6	7–9	10 or more
Total sample	67	0.063	0.026	0.025	0.013	0.015
All industrial economies	24	0.008	0.013	0.013	0.003	0.009
Only democratic economies	18	0.020	0.009	0.015	0.002	0.009
Mixed economies	2	0.060	0.000	0.000	0.024	0.013
All developing economies	47	0.096	0.041	0.034	0.022	0.018
Only authoritarian economies	9	0.046	0.016	0.065	0.011	0.025
Only democratic economies	16	0.089	0.017	0.006	0.025	0.015
Mixed economies	22	0.105	0.053	0.038	0.023	0.019

Source: Cukierman and Webb (1995).

Appendix Table A12. Cukierman and Webb: Central Bank Political Vulnerability

Economic Group Considered	Vulnerability		Annual Frequency of Political Changes
	Within Six Months	Within One Month	
Total sample	0.24	0.12	0.27
Industrial countries	0.10	0.05	0.32
Developing countries	0.35	0.18	0.24
Industrial countries			
Only democratic economies	0.10	0.04	0.32
Mixed economies	0.12	0.12	0.33
Developing countries			
Only authoritarian economies	0.22	0.17	0.14
Only democratic economies	0.30	0.09	0.18
Mixed economies	0.39	0.20	0.30

Source: Cukierman and Webb (1995).

Table A13. Cukierman and Webb: Correlation Between Various Autonomy Indicators

Indicator	Legal CB Autonomy Index	Total TOR	Vulnerability Index	Frequency of Political Changes
Total TOR	-0.05			
Vulnerability index	-0.11	0.78		
Frequency of political transitions	-0.05	0.06	-0.11	
Nonpolitical turnover at CB	-0.02	0.88	0.60	-0.21

Source: Cukierman and Webb (1995).

Table A14. Cukierman and Webb: CB Political Vulnerability Within Six Months of Transition

Economic Group	Type of Political Transition			
	High-level	Type-2 Authoritarian	Medium-level	Low-level
Total sample	0.58	0.46	0.15	0.19
Industrial countries	0.00	-	0.11	0.08
Developing countries	0.61	0.46	0.24	0.26
Industrial countries				
Only democratic economies	-	-	0.11	0.08
Mixed economies	0.00	-	0.12	0.17
Developing countries				
Only authoritarian economies	-	0.20	-	0.23
Only democratic economies	-	-	0.24	0.25
Mixed economies	0.61	0.55	0.24	0.28

Source: Cukierman and Webb (1995). The values show political vulnerability within six months of the transition categorized by type of transition and applicable economic group

Table A15. CB Autonomy Indices: Comparison of Rankings

Country	GMT	LVAU	AL	ES	TOR	VUL
Belgium	7	11	5	5	6	4
Switzerland	2	1	1	1	6	8
Canada	4	4	5	12	3	1
Germany	1	2	1	1	3	11
Denmark	6	3	5	3	1	5
France	7	8	5	10	9	6
Japan	9	12	3	5	11	12
Netherlands	5	5	5	3	1	6
New Zealand	12	9	11	5	9	9
Spain	11	10	11	5	11	10
United Kingdom	9	6	5	10	3	1
United States	2	6	3	5	6	1

Note: AL denotes Alesina (1988, 1989); GMT denotes Grilli, Masciandaro, and Tabellini (1991); ES denotes Eijffinger and Schaling (1993).TOR and LVAU are from Cukierman (1992), VUL is from Cukierman and Webb (1995).
Source: Mangano (1998).

Appendix Table A16. Mangano: Partial Correlations Among Rankings

	GMT	LVAU	AL	ES	TOR	VUL
GMT	1.00	0.75	0.82	0.31	0.55	0.23
LVAU		1.00	0.52	0.27	0.73	0.21
AL			1.00	0.26	0.39	0.09
ES				1.00	0.09	-0.57
TOR					1.00	0.51
VUL						1.00

Source: Mangano (1998).

Table A17. Eijffinger, Van Rooij, and Schaling: Empirical Indices and Legal Indicators

Country	Ranking Based on Empirical Index	Eijffinger and Schaling (1993) (Scale 1 to 5)	Bade and Parkin (1988) (Scale 1 to 4)	Alesina (1988, 1989) (Scale 1 to 4)	GMT (1991) Political Index (Scale 0 to 8)	GMT (1991) Economic (Scale 0 to 8)
Germany	1	5	4	4	6	7
Netherlands	2	4	2	2	6	4
Canada	3	1	2	2	4	7
Japan	4	3	3	3	1	5
Switzerland	5	5	4	4	5	7
United States	6	3	3	3	5	7
France	7	2	2	2	2	5
Australia	8	1	1	1	3	6
Italy	9	2	2	1/2	4	1
United Kingdom	10	2	2	2	1	5

Source: Eijffinger, Van Rooij, and Schaling (1996).

Table A18. Sikken and de Haan: Relationship Between Autonomy and Government Funding

Study	Countries	Period	Relationship Between CB Autonomy and Size of Government Deficits	Relationship Between CB Autonomy and CB Loans to Government
Masciandaro and Tabellini (1988)	5 OECD countries	1970–89	Negative relationship (not measured statistically)	
Grilli, Masciandaro, and Tabellini (1991)	18 OECD countries	1950–89	Negative relationship (not significant)	
De Haan and Sturm (1992)	18 OECD countries	1961–87	Negative relationship	Negative relationship
			(Significance depends on measure of CB autonomy used)	
Cukierman (1992)	70 countries	1950–89		Significant negative relation (especially TOR)
Cukierman, Webb, and Neyapti (1992)	72 countries	1950–89		Significant negative relation (especially TOR)
Fry (1998)	70 developing countries	1972–95		No relationship with CB autonomy measures

Source: Sikken and de Haan (1998).

Table A19. Sikken and de Haan: Empirical Studies on Debt Monetization

Study	Countries	Period	Conclusions on Debt Monetization
Dornbush and Fischer (1981)	7 countries	1960–77	Significant effect only in 3 cases
Giannaros and Kolluri (1985)	10 industrial	1950–81	No evidence
Protopapadakis and Siegel (1987)	10 industrial	1952–83	No evidence
Demopoulus, Katsimbris & Miller (1987)	8 industrial	1961–80	Some evidence
Barnhart and Darrat (1988)	7 industrial	1960–84	No evidence
Burdekin and Laney (1988)	12 industrial	1960–83	Some evidence
De Haan and Zalhorst (1990)	17developing	1961–85	Limited evidence
Burdekin and Wohar (1990)	8 industrial	1962–85	Some evidence
Karras (1994)	32 countries	1949–89	No evidence
Brown and Yousefi (1996)	10developing	1950–89	No relation between deficit and inflation

Source: Sikken and de Haan (1998).

Table A20. Preliminary Questions in Blinder Questionnaire

(Q) Question	Answers and Scores	Average (84 CBs)	Average (53 economists)
Q1: How important is credibility for a CB?	1 = not important 2 = of little importance 3 = of average importance 4 = quite important 5 = extremely important	4.83	4.23
Q2: How are the concepts of credibility and dedication to price stability related?	1 = not related 2 = not very related 3 = related on average 4 = quite strongly related 5 = they are virtually the same concept	4.10	3.31

Source: Blinder (1999).

Table A21. Blinder: Reasons Why Credibility is Deemed Important

(Q) Question	84 CBs			53 Economists		
	Average	Standard Deviation	Ranking	Average	Standard Deviation	Ranking
Q3: it makes deflation less costly	4.13	0.78	2	3.83	1.12	2
Q4: it keeps inflation low	4.39	0.60	1	4.17	0.83	1
Q5: it allows for faster changes in operating strategy	4.38	0.54	5	3.97	1.03	3
Q6: it allows CB to be credible creditor of last resort during a financial crisis	4.12	0.77	6	3.74	1.07	4
Q7: to protect currency and/or exchange rate	4.29	0.70	3	3.47	1.04	5
Q8: for requirements of openness and transparency	4.00	0.84	7	3.30	1.07	6
Q9: to attain consent for CB autonomy	4.34	0.75	4	3.19	1.00	7

Source: Blinder (1999).

Table A22. Blinder: How to Create and Maintain Credibility

(Q) Question	84 CBs			53 economists		
	Average	Standard Deviation	Ranking	Average	Standard Deviation	Ranking
Q11: through CB autonomy	4.51	0.63	2	3.99	0.86	2
Q12: through transparency	4.13	0.71	4	3.44	1.18	4
Q13: through tradition of honesty	4.58	0.52	1	4.30	0.80	1
Q14: through tradition of fight against inflation	4.15	0.67	3	3.83	0.86	3
Q15: through enforcement of a law	2.89	1.01	6	2.32	1.06	6
Q16: through personal incentives	2.15	1.10	7	1.95	0.96	7
Q17: through low deficit/debt levels	3.92	0.93	5	3.27	1.14	5

Source: Blinder (1999).

Appendix II. Summary of Base Indicators of De Jure Autonomy

AUTHORS' NAMES	**Robin Bade, Michael Parkin (1977).**
TYPE	**Legal** indicator of **political** autonomy
SAMPLE DESCRIPTION	**Period**: 1951–1975. **Countries**: 12 OECD countries (Australia, Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Sweden, Switzerland, the United Kingdom, and the United States).
CHARACTERISTICS ANALYZED	(i) Legal policy objectives of CB; (ii) relationship between CB and government in the formulation of monetary policy; and (iii) procedures followed for appointing members of the board; financial and budgetary relationship between CB and the government.
INDICATOR VARIABLES	**(A) Legal policy objectives: (p)** the price stability objective is clearly codified as the sole CB objective [Netherlands]; **(p-u)** the price stability objective is accompanied by other macroeconomic objectives [Australia, Canada] or there are no explicit legal objectives (-) [Belgium, France, Germany, Italy, Japan, Sweden, Switzerland, the United Kingdom, and the United States]. **(B) Ultimate monetary policy authority: (g)** where CB authority is dominated by the government; **(b)** where the CB is the sole ultimate authority [only in the case of the United States, Germany and Switzerland. Also Canada before 1967]. **(C) Members of government or its representatives on the board**: number of ministers (or their representatives) on the board. [(1) for Australia and Canada; (2) for France and Japan; (0) for the other eight countries]. **(D) Percentage of senior managers appointed by the government**: There is a crucial distinction when the percentage of appointments assigned to the government is greater than or less than half the members; in most cases, senior managers are all appointed by the government (value of **1**). [The only exceptions are France (**14/15** appointed by government), Germany (**10/21**), and Switzerland (**5/8**)].
AGGREGATION METHOD D1	The authors categorize the 12 CBs into four groups from marginally independent CBs (**group 1**) to CBs with the greatest autonomy (**group 4**). The four variables considered would produce 24 possible combinations, and the 12 countries considered would end up having 12 different formulations. In order to group part of these under similar categories, the authors reduce the first variable **(A)** and group the second and third variables (**B and C**). **Legal policy objectives** fall from three to two: countries where there is no unambiguous price stability objective **(p-u)** are combined with countries where there are no specific objectives (-). A CB is considered the **ultimate authority of monetary policy** only if it satisfies requirement **(B)** (i.e., the CB is the only ultimate authority; case **b**), and there are **no members of government or their representatives on the board**. At the end of this process, the potential categories drop to eight, four of which remain empty in the sample considered. The four remaining categories are as follows: those belonging to **group 2** [**the Netherlands**] are CBs that have the **specific legal objective of price stability** (i.e., variable (A) = p), are **not** the sole **ultimate authority of monetary policy** (i.e., variable (B) = g) and over half of **senior managers are appointed by the government**. **Group 1** (the less independent CBs) [**Australia, Belgium, Canada, France, Italy, Japan, Sweden, and the United Kingdom**] includes CB's that do **not** have a **specific legal objective of price stability**, or this objective is ambiguous (i.e., variable (A) = p-u or (A) = -), that are **not** the sole **ultimate authority of monetary policy** (i.e., variable (B) = g, or in the case of Canada after 1967, (B) = b, but (C) does not equal 0), and more than half of **senior managers are appointed by the government**. The CBs in **group 3** [**the United States**] do **not** have a **specific legal objective of price stability** (as in the case of group 2), but have **ultimate monetary policy authority** (i.e., variable (B) = b and variable (C) = 0), and more than half the **senior managers are appointed by the government**. Finally, we have the last category (**group 4**) [**Germany and Switzerland**], where the law does not assign the CB the sole **legal objective of price stability**, but it is still seen as the undisputed **ultimate authority of monetary policy**, and less than half of **senior managers are appointed by the government**.

AUTHORS' NAMES	**Alberto Alesina (1988 – 1989).**

TYPE	**De jure** index of **political** and **economic** autonomy
SAMPLE DESCRIPTION	Same sample of CBs as Bade, Parkin (1977) with the addition of Denmark, Norway, New Zealand and Spain in Alesina (1988), and Finland in Alesina (1989). **Period**: 1973 – 1986. **Countries**: 17 OECD countries (Australia, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, New Zealand, the Netherlands, Norway, Spain, Sweden, Switzerland, the United Kingdom, and the United States)
CHARACTERISTICS ANALYZED	(i) Institutional and formal relationships between the CB and executive branch; (ii) relationships and informal contacts between the CB and members of government; (iii) financial and budgetary relationships between the CB and executive branch.
INDICATOR VARIABLES	The author states that he is directly referring to the expansion of Bade, Parkin (1977) found in Bade, Parkin (1985) and illustrates only the variables analyzed with respect to characteristic (**i**): **(A)** who appoints the CB governor and his term in office; **(B)** the existence of government representatives on the CB board; **(C)** any requirements for the approval of monetary policy by the government.
AGGREGATION METHOD D1	Consistency of the results with Bade, Parkin (1985) for the same period and sample (with the exception of Italy) suggests the same methodology for aggregating variables, i.e., the sum of values obtained by the CB for each variable. However, it is important to stress what Eijffinger and Schaling (1993) indicated regarding this indicator. First and foremost, the author (Alesina, 1988, p. 41) clearly acknowledges that the strictly political attributes appear more relevant for the purposes of his own research. Secondly, the score of **1/2** (1.5) assigned to the Bank of Italy (and the criticism made against Bade and Parking (1985) for not having duly considered the 1981 "divorce" of the Bank of Italy from the Treasury) indicates a different structure of weights used in the total, or perhaps even an internal inconsistency in the indicator given the movement of the Bank of Italy from **2** to **1/2** rather than to **3**. Only Italy has a score of **1/2**. At the same time **Australia, New Zealand and Spain** are classified with a score of **1**. The CB category with a score of **2** is made up of: **Belgium, Canada, Denmark, Finland, France, the Netherlands, Norway, Sweden, and the United Kingdom. Japan and the United States** have a score of **3**, while **Germany and Switzerland** were assigned a score of **4** (maximum autonomy).

AUTHORS' NAMES	**Vittorio Grilli, Donato Masciandaro, Guido Tabellini (1991).**
TYPE	**De jure** index of **political** autonomy; CB autonomy with respect to objectives.
SAMPLE DESCRIPTION	**Period**: 1960 – 1989. **Countries**: 18 OECD countries (Australia, Austria, Belgium, Canada, Denmark, France, Germany, Greece, Ireland, Italy, Japan, New Zealand, Netherlands, Portugal, Spain, Switzerland, the United Kingdom and the United States)
CHARACTERISTICS ANALYZED	(i) Procedures for appointment of board members; (ii) Relationships between CB boards and government in formulation of monetary policy; (iii) Formal monetary policy responsibilities of CB.
INDICATOR VARIABLES	**Appointments**: (**1**) governor not appointed by government; (**2**) governor appointed for more than five years; (**3**) board not appointed by government; (**4**) board appointed for more than five years. **Relationships with government**: (**5**) government representatives not required to participate in board; (**6**) government's approval not required for formulation of monetary policy. **Charters**: (**7**) there is a charter (or legal, or even constitutional) requirement that CB pursue monetary stability as one of its primary objectives; (**8**) there are legal provisions strengthening CB's position in the event of conflict with government. [There is an asterisk for items (**1**) to (**8**) if variable applies]
AGGREGATION METHOD D1	The authors believe they can reduce arbitrariness of the indicator by using a simple sum of values obtained (min = **0**, max = **8**). Overall "political autonomy" index grows as level of autonomy rises. **Australia**: score of **3** (variables **2, 7, and 8** apply); **Austria:** score of **3** (variables **6, 7 and 8**); **Belgium**, score of **1** (the only variable applicable is **4**); **Canada**, score of **4** (the variables applicable are **1, 2, 7, and 8**); **Denmark**, score of **3** (variables **2, 6, and 7**); **France** score of **2** (variables **2 and 4**); **Germany** score of **6** (variables **2, 4, 5, 6, 7, and 8**); **Japan** score of **1** (variable **7**); **Greece** score of **2** (characteristics **3 and 8**); **Ireland** score of **3** (the variables applicable are **2, 6, and 7**); **Italy** score of **4** (the variables applicable are **1, 2, 3, and 5**); **New Zealand** score of **0**; **Netherlands** score of **6** (variables **2, 4, 5, 6, 7, and 8**); **Portugal** score of **1** (variable **5**); **the United Kingdom** score of **1** (variable **5**); **Spain**, a score of **2** (variables **4 and 5**); **the United States**, a score of **5** (the variables applicable are **4, 5, 6, 7, and 8**); **Switzerland**, a score of **5** (the variables present are **2, 5, 6, 7, and 8**).

AUTHORS' NAMES	**Vittorio Grilli, Donato Masciandaro, Guido Tabellini (1991).**
TYPE	**De jure** index of **economic** autonomy. CB autonomy with respect to instruments.
SAMPLE DESCRIPTION	**Period and Countries**: same as political index.
CHARACTERISTICS ANALYZED	(i) Government influence in the determination of the amount of credit available at the CB; (ii) nature of monetary instruments under the control of the CB.
INDICATOR VARIABLES	**Monetary financing of public deficits**: (**1**) Direct credit not automatically extended; (**2**) Direct credit provided at market rates; (**3**) Direct credit is explicitly temporary; (**4**) Direct credit subject to limitations on amount; (**5**) CB does not participate in primary market for public debt securities. **Monetary policy instruments**: (**6**) discount rate set autonomously by the CB; (**7**) banking supervision not assigned to the CB (*); banking supervision not assigned only to the CB (**). [There is an asterisk for items (**1**) to (**6**) if the variable is applicable; one or two asterisks for item (**7**).]
AGGREGATION METHOD D1	Simple sum of values (asterisks) obtained (min = **0**, max = **8**). [The overall "economic autonomy" index grows as the level of autonomy rises.] **Australia**: score of **6** (variables **1, 2, 3, 4, 5, and 6**); for **Austria** score is **6** (variables **3, 4, 5, and 6** and double asterisk for **7**); **Belgium**, a score of **6** (variables **2, 4, 5, and 6** and a double asterisk for **7**); **Canada**, a score of **7** (variables **1, 2, 3, 4, and 6** and double asterisks for **7**); **Denmark** score of **5** (variables **2, 5, and 6** and two asterisks for **7**); **France** score of **5** (variables **4, 5. and 6** and double asterisks for **7**); **Germany** score of **7** (variables **1, 2, 3, 4, 5, and 6** and a single asterisk for **7**); **Japan**, a score of **5** (variables **1, 3, 5, and 6** and a single asterisk for **7**); **Greece**, a score of **2** (variables **4 and 6**); **Ireland**, a score of **4** (variables **2, 3, 4, and 6**); Italy, a score of **1** (the variable applicable is **4**); **New Zealand**, a score of **3** (variables **3, 4, and 6**); **Netherlands**, score of **4** (variables **3, 4, 5, and 6**); **Portugal**, a score of **2** (variables **4 and 6**); **the United Kingdom**, a total score of **5** (variables **1, 2, 3, 4, and 6**); **Spain**, a score of **3** (variables **3 and 4** and a single asterisk for **7**); **the United States**, a score of **7** (variables **1, 2, 3, 4, 5, and 6** and a single asterisk for **7**); **Switzerland**, a score of **7** (variables **2, 3, 4, 5, and 6** and a double asterisk for **7**).

AUTHORS' NAMES	**Alex Cukierman (1992).**
TYPE	**De jure** index of **political** and **economic** autonomy **Name of index: LVAU** (**simple** index) and **LVAW** (**weighted** index)
SAMPLE DESCRIPTION	The sample is extremely large from the standpoint of the number of countries analyzed and the periods covered. *It covers the period 1*950-1989*, divided into* four sub periods: 1950–1959, 1960–1971, 1972–79 and 1980–89*, corres*ponding to the dollar standard period, the period of dollar convertibility, the period of the two oil shocks and the deflation and debt crisis period. The sample of **countries** covered is among the largest including 21 OECD countries and 49 developing countries.
CHARACTERISTICS ANALYZED	(i) Variables concerning the appointment, dismissal and term in office of the CB governor or president; (ii) laws concerning the resolution of conflicts between the executive branch and CB, and the degree of CB participation in the formulation of monetary policy and the formation of the government budget; (iii) the final objectives of the CB covered in its charter; and (iv) laws that restrict the government's ability to obtain loans from the CB. The characteristics considered in this section are grouped under the following headings: **CEO** (*chief executive officer*), **PF** (*policy formulation*), **OBJ** (*final objectives*), **LL** (*limitation on lending*).
INDICATOR VARIABLES	The strength of the Cukierman indices lies in their unquestioned depth. Each of the four headings described above can be further broken down resulting in a total of 16 variables as follows: • **CEO** can be broken down into: (1) *too (term of office)*, the governor's term in office in years; (2) *app (appointment)*, the entity delegated to appoint the governor; (3) *diss (dismissal)*, legal provisions for the dismissal of the governor; (4) *off (other offices)*, the ability of the governor to hold other offices. • In turn, **PF** can be broken down into three variables: (1) *monpol (monetary policy)*, the entity formulating monetary policy; (2) *conf (conflicts)*, for government directives and conflict resolution; (3) *adv (advisory)*, analyzes whether the CB has an advisory role in the formulation

AUTHORS' NAMES	**Alex Cukierman (1992).**
	of the government budget.
	• **OBJ** is made up of one variable: (1) *obj (objectives)*, CB objectives.
	• **LL** is the category with the most variables (eight) due to often subtle differences, which in various countries define the spectrum of degrees of autonomy: (1) *lla (limitations on advances)*, limitations on advances to the government; (2) *lls (limitations on securitized lending)*, limitations on secured loans to the government; (3) *ldec (limitations on lending – who decides)*, i.e., who has the authority to control loan terms; (4) *lwidth (width of limitations on lending)*, i.e., the entities that have access to loans provided by the CB; (5) *ltype (type of limit)*, the type of credit limit, if any; (6) *lmat (maturity of loans)*, the maximum maturity of possible loans; (7) *lint (interest on loans)*, restrictions on rates applicable to CB loans; (8) *lprm (primary market lending)*, loan prohibitions through the primary market.
	Each of the 16 variables is coded using a standard scale that measures the degree of autonomy from 0 (minimum autonomy) to 1 (maximum autonomy). The number of levels presented for each variable depends on the specific nature of data for each individual legal characteristic. If n_j is the number of levels of legal variable j that can vary from a minimum of two to a maximum of seven, the scale [0, 1] is divided into $n_j - 1$ equal intervals providing n_j numerical values, or one for each level of autonomy.
AGGREGATION METHODS D1	Due to problems of availability of the large number of the postulated variables (due to the fact that laws do not provide sufficient information for coding all 16 variables in each country), Cukierman initially regroups them in order to form eight more comprehensive legal variables. The procedure followed calls for combining the four **CEO** subdivisions into a single variable called *ceo*, which is calculated by computing their arithmetic mean. The three subdivisions of the **PF** heading are combined under the notation of *pf* using a weighted average in which the weights are respectively 0.5 for *conf*, and 0.25 for *monpol* and *adv*. Finally, the last four variables of the heading **LL** (*ltype*, *lmat*, *lint*, *lprm*) are combined into the variable *lm* also using an arithmetic mean. The proposed combination produces a single variable for each of the first three headings (**CEO**, **PF** and **OBJ**) and some five legal variables for **LL**. Cukierman then proceeds to a second and final level of aggregation in order to obtain a single legal autonomy index by country and sub period. Two different indicators are calculated: a **simple** and **weighted** index.
	The **simple** index is constructed through the simple arithmetic mean of values obtained in each of the eight variables obtained at the first level of combination.
	In order to arrive at an index in **weighted** form, the weights, which the author insists are entirely subjective (Cukierman, 1992, p. 379) are organized as follows:

Aggregated legal variable	Weight assigned
Ceo (chief executive officer)	**0.20**
Pf (policy formulation)	**0.15**
Obj (objectives)	**0.15**
Lla (limitations on lending—advances)	**0.15**
Lls (limitations on lending—securitized)	**0.10**
Ldec (limitations on lending—who decides)	**0.10**
Lwidth (limitations on lending—width)	**0.05**
Lm (limitations on lending—miscellaneous)	**0.10**
	1

(row labels in left margin: LVAU, LVAW)

AUTHORS' NAMES	**Alberto Alesina, Lawrence H. Summers (1993).**
TYPE	**De jure** index of **policy** and **economic** autonomy

SAMPLE DESCRIPTION	The **period** covered by the sample runs from 1955 to 1988. The **countries** concerned are the same 16 OECD countries used by Alesina (1988) [Australia, Belgium, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, Norway, New Zealand, Spain, Sweden, Switzerland, United Kingdom, United States].
CHARACTERISTICS ANALYZED	The analysis is based on the joint characteristics of the indices of Alesina (1988, 1989) and Grilli, Masciandaro and Tabellini (1991).
INDICATOR VARIABLES	(1) The sum of values provided by the general index of Grilli, Masciandaro and Tabellini (1991) (i.e., the sum of the two political and economic autonomy indices), and (2) the values obtained through the Alesina (1988, 1989) indicator.
AGGREGATION METHOD D1	The index of Grilli, Masciandaro and Tabellini is converted into a scale of 1 to 4, like that of Alesina (1988), using the following procedure: for aggregate index values greater than 11 the score assigned is 4; for values between 7 and 11 the score is 3; if the value of the aggregate index of Grilli, Masciandaro and Tabellini is between 4 and 7 the new value is 2; and finally, for values less than 4 a score of 1 is assigned. The Alesina and Summers index is obtained using the arithmetic mean of the index of Grilli, Masciandaro, and Tabellini, converted as noted above, and the Alesina (1988, 1989) index.

AUTHORS' NAMES	**Sylvester Eijffinger, Eric Schaling (1993).**
TYPE	**De jure** index of **policy** autonomy
SAMPLE DESCRIPTION	The **period** covered is for flexible exchange rates between 1972 and 1986. The sample of **countries** is the same as used by Bade and Parkin (1977): 12 OECD countries [Australia, Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, United Kingdom, and the United States].
CHARACTERISTICS ANALYZED	The authors refer directly to Grilli, Masciandaro, and Tabellini (1991) in the selection of characteristics, which are as follows: (i) Formal CB responsibilities based on policy objectives; (ii) relationships between CBs and governments; (iii) procedures for appointing CB boards.
INDICATOR VARIABLES	(1) **"Ultimate" monetary policy authority**: (b) held only by the CB (**); (b/g) not held exclusively by the CB (*); (g) held entirely by the government (-). (2) **Government officials on the board**: absence of government officials (with or without voting rights) on the board. (3) **Appointments to the board**: over half of board members are elected without government involvement. [There is an asterisk for items (2) and (3) if the variable is applicable; one or two asterisks for item (1).]
AGGREGATION METHOD D1	Simple sum of asterisks obtained + 1 (min = 1, max = 5). [The overall "policy autonomy" index grows as the level of autonomy rises.] Score of **1: Australia and Canada**; score of **2: France, Italy, the United Kingdom, and Sweden**; score of **3** for **Belgium, Japan, and the United States**; score of **4** for the **Netherlands**; score of **5** for **Germany and Switzerland**.

Appendix III. Summary of Base Indicators of De Facto Autonomy

AUTHORS' NAMES	**Alex Cukierman (1992).**
TYPE	De facto index of policy autonomy. Name of index: **TOR** (turnover rate of governors). **Policy** indicator
SAMPLE DESCRIPTION	**Period**: 1950–1989. **Countries**: 19 OECD countries and 39 less developed or developing countries.
CHARACTERISTICS ANALYZED	Cukierman uses a rather elementary formula for the CB governor turnover rate, largely on account of the absence of simple indicators that make it possible to measure the extent to which degree of actual CB autonomy diverges from the stylized autonomy encountered in the legal environments of the various countries. The author's opinion, which is frequently cited in the later literature, is that at least above a certain threshold, a more rapid CB governor turnover rate indicates a lower level of CB autonomy. This argument seems to primarily affect the sign of those cases concerning less developed countries where it is a safe assumption that practice may differ more frequently from the letter of the law.
INDICATOR VARIABLES	The **TOR variable** is **defined** as the **average annual number of turnovers at the head of the CB**. TOR run from a minimum of 0.03 (with average term in office of 33 years) for Ireland to a maximum of 0.93 annual turnovers (with an average term in office of 18 months) for Argentina. Confirming what was stated above regarding less developed countries, turnover rates in those countries are more dispersed than for OECD countries. While for OECD countries the range is from 0.03 for Iceland to 0.20 for Japan and Spain, more than half of less developed countries exceed this maximum, with the range varying from 0.13 for Malaysia to 0.93 for Argentina. A high turnover rate seems to point to low autonomy when the actual term in office of the CB governor is shorter than the actual term of the executive branch. If the average term of a governor is four years, the critical threshold of the turnover rate should be between 0.2 and 0.25.

AUTHORS' NAMES	**Alex Cukierman (1992).**
TYPE	Depiction of de facto autonomy through responses of qualified staff to a questionnaire sent to various CB. **Political** and **economic** indicator. **Name of index: QVAU (simple); QVAW (weighted)**.
SAMPLE DESCRIPTION	Twenty-four **countries** provided responses to the questionnaire, 10 of which were OECD countries. The implicit time frame of the questionnaire was 1980–1992.
CHARACTERISTICS ANALYZED	The questions asked in the questionnaire concern the following five issues: (i) legal aspects of CB autonomy; (ii) actual procedures followed when these differ from the legal norm; (iii) monetary policy instruments and institutional entities that control them; (iv) objectives and intermediate indicators; (v) final monetary policy objectives and their relative importance.
INDICATOR VARIABLES	The variables in question are: (1) *qto (tenure overlap with political authorities)*, consisting of the degree of overlap of the legal term in office of the government and CB. *Ceteris paribus*, if the legal term in office of the CB governor and board exceed that of government, the CB is considered more independent. (2) *Qll (limitations on lending in practice)*. This variable measures the actual magnitude of limitations on CB loans to government and the method in which the limitations are applied in practice. (3) *qrc (resolution of conflicts). This* variable measures the degree to which the resolution of conflicts is dealt with in practice to the CB advantage. (4) *qbcb (who determines the budget of the CB?)*. This question aims to determine the actual degree of CB autonomy in decisions concerning its budget. (5) *Qsp (who determines the salaries of high CB officials and the allocation of CB profits?)* aims to show who is charged with determining the compensation of CB officials and who decides on the allocation of profits. (6) *qst (are there quantitative money stock targets)*, i.e., does CB has quantitative monetary targets, and to what extent does it adhere to them in practice? In other words, is CB able to focus its efforts on price stability in a comparatively unrestricted manner? (7) *qirt (are there formal or informal interest rate targets?)* asks whether CB has formal or informal targets set in terms of interest rates, and which therefore preclude a portion of CB's freedom to pursue price stability. (8) *Qpps (what is the actual priority assigned to price stability?)*, i.e., what is the actual priority assigned to price stability. (9) *qsc (does the CB function as a development bank that grants credits at subsidy rates?)* measures degree to which the CB is required to provide loans at subsidy rates to both the private and public sectors.

AGGREGATION METHOD D1	As in the case of legal LVAU/LVAW, Cukierman follows two combination processes. On the first level, variables (4) and (5) are combined with equal weight into a single financial autonomy item, *qfi*. The same process is used for variables (6) and (7) to obtain the item *qit*, which summarizes both intermediate objectives. As for legal indicators, the second and final combination level is aimed at obtaining two alternative autonomy indices that reflect responses to the questionnaire.	
	In order to obtain the **simple** index (QVAU), Cukierman performs a simple arithmetic mean of the numeric values obtained for each of the seven variables left after the first aggregation process**.**	
QVAU QVAW	QVAW is obtained by using an average in which the same variables shown above have different weights; here again the author stresses the subjectivity in the selection of the latter (Cukierman, 1992, p. 389):	
	Combined variable	Weight assigned
	Qto (tenure overlap)	**0.10**
	Qll (limitation on lending)	**0.20**
	Qrc (resolution of conflicts)	**0.10**
	Qfi (financial autonomy)	**0.10**
	Qit (intermediate targets)	**0.15**
	Qpps (priority to price stability)	**0.15**
	Qsc (subsidized credits)	**0.20**
		1

AUTHORS' NAMES	**Alex Cukierman, Steven B. Webb (1995).**		
TYPE	De facto autonomy index formed as an index of CB vulnerability to political instability.		
SAMPLE DESCRIPTION	Sixty-seven **countries** (20 OECD countries and 47 developing economies), for the **period** 1950–89, sud-divided into two: Bretton Woods period (1950–71), and subsequent period (1972–89).		
CHARACTERISTICS ANALYZED	The article is a natural progression of Cukierman (1992) on TOR. It pushes the investigation to the next stage in an attempt to understand how political events are seen in relation to governor turnover rates at various CBs at different levels of development and in different regimes.		
INDICATOR VARIABLES	The frequency of CB management turnover is calculated over several time intervals while moving farther from a political transition. After empirically proving that changes in the direction of a CB, which can be defined as purely political, are those that occur within six months of the change of the executive branch, and after calculating the annual frequency of political changes in each country, Cukierman and Webb define their **indicator of CB vulnerability** to political instability as the percentage of political transitions in a country that were immediately followed by the replacement of the CB governor:		

$V(i) \equiv$ **Number of replacements of CB governor within *i* months of a political transition**

Number of political transitions

(where $i = 1, 6$).

The complement of this measure to the total turnover rate is clearly a **turnover rate** defined as **nonpolitical**. The following table provides an overall framework of the differences among economic groups, various political regimes and time intervals considered to be relevant.

Economic groups considered	Vulnerability		Annual Frequency of Political Changes
	Within Six Months	Within One Month	
Total sample	0.24	0.12	0.27
Industrial countries	0.10	0.05	0.32
Developing countries	0.35	0.18	0.24
Industrial countries			
Only democratic economies	0.10	0.04	0.32
Mixed economies	0.12	0.12	0.33
Developing countries			
Only authoritarian economies	0.22	0.17	0.14
Only democratic economies	0.30	0.09	0.18
Mixed economies	0.39	0.20	0.30

Appendix IV. Summary of Empirical Studies on De Jure Autonomy[67]

Study	Measures Used	Sample	Conclusions
Bade and Parkin (1977)	(BP) Index of policy autonomy	12 OECD countries 1951–1975	There is weak evidence that pursuing price stability as the only final policy objective is associated with achieving a lower level of inflation. It is shown that CBs that have a certain degree of autonomy are able to ensure a lower level of inflation, but not necessarily a low variability of monetary policy. In addition, the development of monetary policy does not seem to differ between independent CBs and those dominated by governments when all of CB management is appointed by the executive branch.
Alesina (1988, 1989)	(AL) Index of policy and economic autonomy	17 OECD countries 1973–86	Alesina's general considerations state that there is an inverse relationship between the degree of CB autonomy and average inflation, and they indicate a weak correlation between the level of government spending as a percentage of GDP and the inflation rate based on the assumption that higher levels of government spending require higher levels of seignorage. Finally, by comparing the average annual growth rate of inflation as a percentage of GDP under various administrations, Alesina argues that when the CB is dependent, monetary policy has followed a more political path.
Grilli, Masciandaro, and Tabellini (1991)	(GMTP) Index of CB policy autonomy (monetary policy objectives), (GMTE) index of CB economic autonomy (monetary policy instruments) and (GMT) general autonomy index (sum of the two indices)	18 OECD countries 1960–89	The authors argue that in general, an autonomous CB leads to low levels of inflation. At the same time, an independent CB does not avert government deficits. CB autonomy does not have a systematic impact on growth or the variability of real output.
Cukierman (1992)	(LVAU) Simple index of policy and economic autonomy, and (LVAW) the same index, but weighted	70 countries 1950–89	The overall contribution of individual groups of legal variables to the real currency depreciation rate in the entire sample is not statistically significant. By separating the two groups of countries, an increase in significance is not obtained even though this value is higher in industrial countries.\nIn developed countries, the combined index exhibits a significantly negative coefficient, which does not occur for the sub-group of developing countries.
Alesina and Summers (1993)	(AS) Index of policy and economic autonomy constructed as the average of the general index GMT and the index AL	Same sample of 16 OECD countries used by Alesina (1988) 1955–88	There is a nearly perfect negative correlation between CB autonomy and both average inflation and its variability. There is no clear relationship between CB autonomy and the average (variance) of GDP growth, and the analysis of the behavior of unemployment rates gives the same results. There are no long-term effects in the sample with respect to the relationship between CB autonomy and the level of real interest rates. However, the relationship is clearly negative if the variability of these rates is considered.

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[67] The observations found in baseline studies are indicated at the beginning of each table to allow for a quicker review of similarities and differences.

Study	Measures Used	Sample	Conclusions
Eijffinger and Schaling (1993)	(ES) Index of policy autonomy	Same sample of OECD countries as in Bade and Parkin (1977) 1972–86	The authors do not use their index to calculate the impact of CB autonomy on inflationary and macroeconomic performance but to review the verisimilitude of the AL and BP measures.
Posen (1995)	LVAU	32 countries 1960–89	CB autonomy proxied by LVAU does not influence inflation if its measure of "actual financial sector opposition to inflation" (FOI) is included as an additional explanatory variable. Posen emphasizes the existence of a causal relationship between a high degree of FOI, a higher level of CB autonomy and a lower average inflation rate that seems to move in this exact order.
Banaian, Burdekin and Willett (1995)	LVAU, TOR, GMT and their own index made up of a simple dummy variable	21 OECD countries 1971–88	The dummy variable (government's inability to circumvent CB policy decisions) is statistically significant together with two control variables (the deficit divided by GDP, and exchange volume divided by GDP) in explaining inflation, and provides better results than the other three indicators.
Fuhrer (1997)	LVAU and AS	70 countries 1950–89	No clear relationship between CB autonomy and the variable analyzed (inflation level and variability, growth, unemployment). The only significant relationship shows that growth and unemployment are negatively and positively correlated with CB autonomy. The statistical significance of the LVAU index with respect to inflation in bivariate regressions (Alesina and Summers – 1993) disappears once several independent variables are added.
De Haan and Kooi (1997)	Breakdown of GMT and LVAU into four measures: autonomy of CB board members; autonomy in instruments; CB financial autonomy; level of conservatism assigned by law to CB	21 OECD countries 1972–79 and 1980–89	The results indicate that CB autonomy with respect to monetary policy instruments has a considerable impact on the inflationary performance (and the variability of inflation) of several countries, while the degree of conservatism and other autonomy aspects have little or no influence. Neither autonomy nor the degree of conservatism exhibits any relationship with the variability of output.
Campillo and Miron (1997)	LVAW	62 countries 1973–94	CB autonomy proxied by the weighted LVAW index does not influence inflation when several new control variables are added. The additional independent variables concern: instances of time inconsistency other than CB dependence, fiscal aspects of optimal taxation, the degree of the financial sector's aversion to inflation (FOI) and previous inflationary experience. Of these variables, those that seem optimal for explaining differing inflationary performance are the degree of trade openness, the ratio of debt to GDP, the level of the inflation tax in relation to conventional taxes, political instability, the income level, and (at least partially) previous inflationary experience.
Banaian, Burdekin, and Willett (1998)	LVAU	27 countries 1980–89	The analysis of 15 of the 16 LVAU components leads the authors to the conclusion that most of them (and thus, the combined index as well) have a relationship that is not statistically significant and/or positive (rather than negative) with the average level of inflation.
Crosby (1998)	LVAU	44 countries 1962–91	Crosby argues that there is no empirical evidence of positive correlation between output variability and CB autonomy (contrary to Rogoff-1985): CB autonomy is endogenous to an economy's lower susceptibility to real shocks. Crosby regresses LVAU on the variance of exchange rates and finds weak evidence confirming this hypothesis. This is not seen sufficient to explain the above lack of

Study	Measures Used	Sample	Conclusions
			correlation, since delays in monetary policy transmission to the real economy make the latter useless for reducing output variability.
Mangano (1998)	LVAU, GMT, AL, ES, TOR and VUL	Same sample of 12 OECD countries for the six indicators 1980–89	When comparing GMT and LVAU, an interpretation spread of 30 percent is noted as well as a negligible weighting spread. When comparing the rankings obtained using all six indices, it is noted that the degree of correlation among them is weak. By regressing these rankings on several macroeconomic performance variables it is found that in the case of average inflation, only GMT and AL exhibit significantly negative coefficients. Only ES has a statistically significant coefficient for inflation variability. Contrary to predictions, signs for growth are negative but never significant, and no significant relationship is observed for output variability.
Posen (1998)	LVAU	17 OECD countries 1950–89	There is no evidence that a higher degree of CB autonomy (and of monetary policy credibility) implies lower costs of deflation by reducing the gap between inflationary expectations and reality. None of the measures of wage rigidity was shown to have a statistically significant relationship with CB autonomy. There is no evidence that higher inflation at the beginning of a deflation episode will ensure lower costs during the process. It does not seem that a greater CB autonomy significantly shortens the length of deflationary. There is no trace of the influence of CB autonomy on seignorage or the movements in economic and political cycles.
Cukierman and Webb (1999)	LVAU	19 OECD countries 1980–94	There is a complex relationship between unemployment (inflation) and wage negotiations centralization at low levels of CB autonomy. This relationship disappears as CB autonomy grows. In addition, the inflation-reducing impact that CB autonomy has on the economy is greater at intermediate levels of union centralization, while there is a significantly positive effect of CB autonomy on unemployment at low levels of centralized negotiations.
Lybek (1999)	A new legal indicator of CB autonomy and accountability, TOR and two indicators of reform progress	15 countries in the former ruble area 1995–97	The indicator is negatively correlated to inflation and positively to growth. TOR (used to proxy de facto autonomy) does not have any relationship with inflation or growth. No evidence that greater CB autonomy and accountability contributed to acceleration of reform process. Positive correlation between the index and the two indicators of progress in restructuring the economy suggests that strong desire to reform can be a complementary cause to CB autonomy in explaining economic reforms.
Franzese (1999)		18 OECD countries 1972–90	CB autonomy has greater anti-inflationary impact when the government is leftist, there is a high concentration of unions, the economy is closed, inflation abroad is high, the financial sector is restricted and there is little coordination in wage negotiations.
Oatley (1999)	LVAW, TOR, GMTP, GMTE, GMT, AL, and 2 simplifications of AL (dummy variable for each level of autonomy; dummy variable to split CB with high autonomy from others).	10 OECD countries 1970–90	The hypothesis that CB autonomy reduces inflation holds even when economic/political-institutional control variables are added. Contrary to Campillo and Miron (1997), neither the fiscal situation nor the openness of the economy exhibits a strong relationship with inflation, but unemployment, the structure of the labor market and the government's political preferences provide good results. Five of the eight (most complex) indices fail to capture the assumed relationship with inflation. The three simplest indices (in particular the dummy variable that divides CBs into two categories) are able to best explain international differences in inflation.

Appendix V. Summary of Empirical Studies on De Facto Autonomy[68]

Study	Measures used	Sample	Conclusions
Cukierman (1992)	TOR (turnover rate of CB governors).	58 countries 1950–1989	TOR negatively related to CB autonomy only above certain threshold, and its positive relationship with inflation is statistically significant only for the sub-group of developing countries.
Cukierman (1992)	(QVAU/QVAW) Simple/weighted indices of policy and economic autonomy based on a questionnaire	24 countries 1980–1989	Most variables in the questionnaire have the negative sign expected. The most statistically significant are those concerning the existence of intermediate monetary policy targets or loan limitations. Overall contribution of the index in explaining inflation not very significant.
Cukierman and Webb (1995)	(VUL) Index of CB vulnerability to political instability. (NOR) complementary measure for nonpolitical TOR of governors	67 countries 1950–1989	VUL and TOR have a significantly positive impact on inflation level and variability. Differences in VUL, NOR and the degree of political instability can be explained by higher the rates of inflation in developing countries. VUL has a negative and statistically significant impact on growth. VUL and NOR are positively related to variability of interest rates, but only VUL has a negative and significant sign.
Eijffinger, Van Rooij, & Schaling (1996)	Index based on money market rates and compared with legal indices: AL, GMT, ES, and Bade & Parkin	10 OECD countries 1977–1990	Index reflects differing pressures on money market rates and is obtained by estimating each country's individual effect within a function of the reaction of rates to inflation, growth and current account surpluses. Ranking of CB is obtained through the empirical measurement of autonomy coincides rather well with the legal measures considered.
Sikken and de Haan (1998)	LVAW, TOR, and VUL	30 developing countries 1950–1994	Regression of average surplus on measures of CB autonomy does not provide any significant result. Regression of money growth on fiscal deficits suggests that in most developing countries, deficits do not cause monetary expansions. Regression of the growth of CB lending to government shows that in most countries a negative relationship exists. Monetary accommodation of fiscal deficit is negatively and significantly correlated with CB autonomy only for VUL and TOR.
Fry (1998)	New index rising with increased CB sterilization of its credit to government. Index compared to LVAU, TOR, and an index based on questionnaire.	70 developing countries 1972–1995	Identifies differences in monetary policy reaction functions based fiscal, inflation and growth attributes of countries. Shows that large deficits and recourse to inflation tax and financial repression are associated with a lower degree of neutralization of increases in loans made by the CB to the government. The more autonomous CBs are found in countries that report higher growth rates.
Akhand (1998)	LVAW, TOR, VUL, and NOR	62 countries 1960–1989	Application of Levine and Renelt (1992) test of robustness to the relationship between growth and de facto CB autonomy. The results indicate a weak relationship between growth and CB autonomy.
De Haan and Kooi (2000)	TOR and new CB TOR measure based on information provided by IMF and CBs	82 developing countries 1980–1989	New TOR, as well as Cukierman's TOR explain inflation level and variability only for countries with high inflation. Posen's view that CB autonomy and inflation performance are caused by degree of "financial sector opposition to inflation" (FOI) is not supported. No evidence that CB autonomy is tied to growth in a robust manner.
Sturm and de Haan (2001)	TOR and their CB governor turnover rate developed on the basis of new sources	82 developing countries 1980–1998	Once control variables are added, TOR is almost never statistically significant. In keeping with de Haan and Kooi (2000), in regressions in which the coefficient of TOR is significant, this result remains valid only if the sample includes countries with high inflation.

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[68] The observations found in baseline studies are indicated at the beginning of each table to allow for a quicker review of similarities and differences.

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