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**BREAKING CREDIBILITY IN MONETARY POLICY:
THE ROLE OF POLITICS
IN THE STABILITY OF THE CENTRAL BANKER**

BY

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Abstract*

This paper studies the relationship between the hazard rate of the exit of a president of a central bank and a measure of credibility in monetary policy. The expected hazard rate of exit is estimated as a function of legal and political variables. The measure of credibility is the expected probability of a disinflation beginning when inflation is rising. For a sample of 22 Latin American and G7 countries, I find a negative relationship between the hazard rate of exit and the measure of credibility. This provides evidence of the expected relationship between independence and credibility not found in previous cross country studies. Using the executive's party ideology as a measure of aversion to inflation, there was no evidence that this relationship is different for countries where the government is identified as more conservative. However, when a president of the central bank appointed by a conservative government is in office, a rise in the probability of a disinflation beginning when inflation was rising was found. The results show that legal independence after controlling for the hazard rate of the president's exit is not associated with credibility gains.

Keywords: credibility, central bank independence, central bankers

JEL Classification: E50, E58

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1. Introduction

It is widely accepted that central bank independence is a useful institutional arrangement in achieving price stability. In fact, during the 1980s and 1990s, countries around the world undertook important changes in central bank legislation that increased central banks' autonomy in the design of monetary policy.¹ These changes were partially justified by the belief that, when the government does not control the money supply, it cannot precipitously undertake inflationary policies. Furthermore, if monetary policy is managed by an independent conservative central bank, the nominal contracts are set in accordance with the expectations of conservative actions from this authority, consequently generating lower inflation levels. From this standpoint, it is clear that central bank independence affects the inflation level through its impact on the expectations of private agents.²

In the empirical literature, there has been great interest in the relationship between independence measures and inflation levels. Those studies have consistently shown a negative relationship between these variables.³ However, few studies have focused on showing evidence of the existence of a relationship between independence and the credibility of monetary policy directly, and those that do, find results that conflict with the predictions made by the theory. Fischer (1996) and Posen (1998) estimated the effect of legal independence over the sacrifice ratios during disinflations for OECD countries in the 1950-1989 period, finding that a cost of disinflation was greater for countries with greater legal independence. If monetary policy is tighter than expected, a recession takes place, indicating that when credibility is low and expectations differ markedly from the policy actions, greater sacrifice ratios would be observed after a change towards a tighter monetary policy. The fact that central bank independence was positively associated with the sacrifice ratios did not support the idea that greater credibility was attained by the presence of a more independent monetary authority. In line with that finding, Posen (1998) showed that there was not a significant positive relationship between the indexes of independence and measures of nominal rigidities. In this case, greater nominal rigidities could be

¹ Examples in Latin America of reform to central bank charts during this period are: Chile 1989, El Salvador 1991, Argentina 1992 and 2002, Colombia 1992, Nicaragua 1992 and 1999, Venezuela 1992 and 2001, Ecuador 1992 and 1998, Peru 1993, Mexico 1993, Bolivia 1995, Costa Rica 1995, Uruguay 1995, Paraguay 1995, Honduras 1996 and 2004 and Guyana 1998.

² This is not the only channel by which independence affects inflation. By avoiding direct loans from the central bank to the government, the monetary supply is changed, affecting inflation results.

³ Eijffinger and de Hann (1996) provide a list of relevant studies for different periods and countries.

associated with greater credibility because the public, facing the stable and predictable inflation environment resulting from independence, would choose to lower their menu costs by increasing the terms of their nominal contracts. Finally, Boschen and Weise (2001) found no significant relationship between legal independence measures and the probability of the start of a disinflation when inflation was rising for a sample of 19 OECD countries for the period 1960-1993.

As we have seen, the studies that deal with the association of independence and monetary policy credibility do not make use of measures of independence not based on legal central bank statutes or country constitutions. For this reason, they are subject to well-known criticism that could explain some of the odd results found. This criticism can be summarized in two observations. First, there is no clear consensus about what central bank independence exactly means, which brings a broad range of possible definitions and different criteria included in each measure of legal independence (see Mangano, 1998). Second, the legal measures based on the central bank statutes or constitutions could not capture *de facto* independence in countries where these measures are not properly enforced. Therefore, new empirical studies of the effect of institutional arrangements of the central bank and its impact on monetary policy outcomes should attempt to identify central bankers' incentives for maintaining conservative policies towards inflation besides those that exist in central banks' statutory mandates (Mangano, 1998).

This paper's aim is to establish whether there is evidence of an existing relationship between certain aspects of *de facto* central bank independence and the credibility of monetary policy. More exactly, this paper estimates the effect of variables that capture some of central bankers' incentives to be conservative in regard to expectations of changes in monetary policy. For this purpose, a new indicator that contains some of the elements of independence is proposed, based on the political influence that the government has over the central bank through the appointment of its members and the duration of their terms. This indicator is the probability of exit of a central bank governor (more exactly, the hazard rate), calculated as a function of political and legal variables. This measure captures the central banker's incentive to take a conservative approach toward inflation because it is directly related to the expected length of the head of the central bank's term and also to the executive's political influence on chances of the central banker's reappointment.

Two theoretical models support the choice of this variable. In a model where one central banker has complete control over monetary results, Cukierman (1994) shows that the greater the probability of exit of a central banker, the greater his chosen inflation is. This is explained by the fact that the cost of expansive monetary policies in each period is reflected in the expectation of inflation in the future. In this way, a central banker who knows that his permanence is not guaranteed will give a lesser value to the future cost of his current policies when choosing his optimal level of inflation. The model of Eslava (2007) reaches similar results in a setting of monetary policies taken by a committee. In general, the greater the probability of a member of the committee exiting office (keeping the number of members constant), the greater the probability of a member voting for high inflation. If a greater fraction of members of the committee leaves office each period, the public will face a greater uncertainty about the policies taken by the next committee and, as a result, past inflation will not provide much information to the public about the commitment of the central bank to fight inflation. This fact creates an incentive for the central bankers not to build an anti-inflation reputation in the first place.

The effect of shorter terms of central bankers over the expectations of higher inflation can also be affected by the preferences of the executive towards inflation. If a central banker is interested in staying in charge of monetary policy and the executive defines his reelection chances, greater probability of exit implies a greater incentive to follow the executive's preferred policies. Eslava (2007) finds that under a government averse to inflation, the effect of the probability of exit of a member of a central bank on the probability of voting for high inflation remains to be positive but its magnitude becomes smaller. This paper also studies the relationship between the preferences of the executive and the expected changes in monetary policy that this theoretical result supports.

The effects of longer terms in central banker's periods in office and political influence on the central bank have already been studied in the empirical literature by indicators such as the turnover rate of heads of central banks in Cukierman, Webb and Neyapti (1992) or the political vulnerability index in Cukierman and Webb (1995). However, none of these measures were used in studies finding their relationship with the private agent's expectations of changes in monetary policy. As Posen (1998) points out, if independent central banks are indeed more credible, not only should inflation levels be low where they operate, but there should also be systematic

differences in how expectations of monetary policies are formed by the public. This study tests if these differences are in fact present.

In this paper, the probability of the beginning of a disinflation initiated by a central bank in periods when a disinflation is considered necessary (periods of rising inflation or periods that preceded one of them) was used as a measure of credibility in a central bank's commitment to achieve low inflation. Using a sample of 22 countries of the G7 and Latin America for the years 1975-2003 under moderate inflation scenarios,⁴ I find that while legal independence measures are not related positively to a greater probability of the beginning of a disinflation, a lower probability of exit of a central bank governor is. Using the executive's party ideological orientation as a measure of preferences towards inflation, I find no evidence that the effect of a greater probability of the exit of a central banker on the measure of credibility is different depending on the current executive's inflation preferences. However, I find that in periods when a governor of the central bank appointed during an inflation-averse government is in charge, there is a greater probability of a disinflationary policy.

This paper is divided into five sections. In Section 2, I discuss the empirical strategy. Section 3 provides a description of the data used in the study. Section 4 presents the main results and Section 5 concludes.

2. Empirical Strategy

The empirical strategy follows Boschen and Weise (2001), by using a measure of credibility estimated as the probability of the start of a successful disinflation induced by the central bank. In their study, the authors estimate a model that uses as a dependent variable a dummy indicator of the start of a disinflation. As these authors explain, the monetary authority in each period needs to decide whether to start a disinflation policy. Not doing so in periods of high and rising inflation could be interpreted as a lack of commitment to fighting inflation.⁵ In this way, the probability of the start of a disinflation assigned by the public in a period of rising inflation, or in

⁴ As noted by Hofstetter (2005), hyperinflations have not been a problem in the last 10 years and most of the central bankers in charge of defining monetary policy are likely to face moderate inflation scenarios.

⁵ This approach follows the idea of models inspired by Backus and Driffill (1985) where, by taking hard measures against inflation, credibility is built, signaling aversion to inflation. However, as is found in Drazen and Masson (1994), inflation-averse agents under certain circumstances might not find it optimal to take action against inflation at each moment in time because in the future they could be forced to take them back. To account for the Drazen and Masson (1994) finding in the empirical exercise, it would be required to identify the episodes in which the policy-

one when the public expects it to rise, becomes a measure of ex ante credibility in the commitment of the central bank to keep low price levels.

Based on the above discussion, the equation that allows the identification of the relationship between the credibility of monetary policy and the variables of interest that capture the incentives of a central banker to be conservative towards inflation is:

$$\begin{aligned} \Pr(Des_{i,t} = 1) \\ = F(\alpha_1 Ps_{i,t} + \alpha_2 pre_e_{i,t} \times Ps_{i,t} + \alpha_3 IB_{i,t} + \alpha_4 pre_p_{i,t} + \alpha_5 pre_e_{i,t} + X_{i,t}\beta) \end{aligned} \quad (1)$$

where $Ps_{i,t}$ is the probability of exit of the president of the central bank;⁶ $pre_e_{i,t}$ is an indicator of the extent to which the government is inflation-averse; $IB_{i,t}$ is a measure of legal central bank independence that does not include aspects related to the appointment of the president of the central bank; $pre_p_{i,t}$ is a measure of the extent to which the central banker is inflation-averse; and $X_{i,t}$ includes control variables. i denotes the country, t denotes the year and $F(.)$ is a cumulative logistic distribution function.

Following the explanation of the dependent variable, t will be restricted to periods when one of the following two conditions is met: i) Inflation is rising in that period or ii) inflation starts rising (during the next period the first difference of the inflation series will be positive). $Des_{i,t}$ takes a value of 1 when a disinflation initiated by the central bank's policies starts and 0 otherwise. The restrictions on t for the estimation of (1) define a set of periods where a disinflation can be considered necessary. In those periods, the public has information that makes them predict worse results of inflation. If this is so, a credibly central bank committed to fighting inflation will be expected to make changes in the way monetary policy is being carried out.

The disinflations used to define the dependent variables in the estimation of (1) are those identified by Hofstetter (2005) and three additional ones (Colombia 1997, Chile 1990 and

maker, by taking action against inflation, might have to take them back in the future. This would imply formulating very subjective criteria to select such disinflation episodes.

⁶ Lack of information about other members of the central bank does not allow me to use their probability of exit. Furthermore, using the probability of exit of the central bank's governor (also referred to here as president) is justified by his greater relative power when making decisions within the board. This greater power comes from agenda-setting abilities and the power of appointing other bank officials, among other reasons (see Chappell, McGregor and Vermilyea 2003)

Honduras 1995).⁷ Following Hofstetter, a disinflation occurs when at least one of the following four criteria is met: (i) The peak is 35 percent or less;⁸ (ii) the inflation rate drops 1.5 or more from the peak to the trough; (iii) inflation falls one fourth or more from the level at the beginning of the disinflation; and (iv) based on historical research, it is established whether a disinflationary policy was indeed pursued by the monetary authority. The first requirement is due to the interest in exploring the determinants of the credibility of monetary policy under moderate inflation periods. In order to give the interpretation of a measure of credibility to the predicted probability of model (1), it is important to include criterion (iv). Otherwise, some disinflation caused by supply shocks could be misinterpreted as an attempt by the monetary authority to reduce price levels.

The effect of the probability of exit of the governor $Ps_{i,t}$ on the probability that the disinflation starts is expected to be negative due to the results of the models of Cukierman (1994) and Eslava (2007). Shorter expected periods for the governors, reflected in high probabilities of exit, are related to less incentive to vote for low inflation because it is harder to build a reputation for the bank when there is uncertainty regarding the preferences and actions of future governors. This happens regardless of the government's preferences. However, in the event of having an inflation-averse government, the incentives to follow the executive's preferences make it more likely for a banker to vote for low inflation. Given that estimating $Ps_{i,t}$ it is found that executive-branch elections increase the probability of exit of the central banker, $Ps_{i,t}$ captures the power of the executive in removing a central banker from office. This explains why we expect to find a positive coefficient for the interaction of the measure of the government's aversion to inflation $pre_e_{i,t}$ and the probability of exit of the central bank's president. In this case, the more inflation-averse the government is, the less negative the effect of $Ps_{i,t}$ over the credibility measure becomes.

The variable that represents the preferences of the government towards inflation $pre_e_{i,t}$, is the political orientation of the government's party in i in period t . Greater

⁷ The three additional disinflations are included in the sample because by 2004 the inflation levels of these countries are such that if that year their disinflations ended, all the four criteria used in Hofstetter (2005) to identify them would be met.

values are given to more conservative executives. Hibbs (1977) and Alesina (1988) point out that right-wing governments are prone to choosing less inflation over less unemployment when facing this short-run trade-off. It is clear that this indicator has limitations reflecting the true preferences of the executive towards inflation. However, among other indicators this one has the advantage of being an exogenous variable in the estimation of (1).

The influence of the executive over the decisions of the central bank does not come exclusively from the incentive that a banker has in following the views of the current government to remain in his office. The executive's power of appointment also gives him the opportunity to include someone close to his preferences on the committee. This is consistent with models like Waller (1989) in which the preferences of the central banker are given by the preferences of the government that appointed him. $pre_p_{i,t}$ is the political orientation of the government's party in office when the central banker in charge in i in period t was appointed. Greater values are given to more conservative executives, implying that a positive coefficient of this variable in (1) is expected. $pre_p_{i,t}$ could also be interpreted as the banker's preference indicator.

$IB_{i,t}$ is created using some of the same components as the indexes of legal central bank independence. In general, this variable captures legal measures concerned with: the central bank's ability to select its instruments, conflict resolution mechanisms with the executive, the primary objective of the bank, direct participation of members of the government in central bank's committee, term length of other members of the central bank committee and government participation in their appointments. This variable is included in the estimation of (1) because it provides information on some important aspects of the independence of the central bank not included in the variable of the probability of exit of the central bank's president.⁹ This variable is expected to have a positive coefficient, given that a greater value of the index is associated with greater independence.

$IB_{i,t}$ will be treated as an exogenous variable. As Keefer and Stasavage (2003) point out, most governments inherit central bank legislation approved by past administrations whose

⁸ In Hofstetter's paper, the peaks of disinflation should not be higher than 30 percent. The results presented also hold for that limit. However, given that no disinflation was found in the range of 30 to 35 percent, the limit of 35 percent was chosen to increase the size of the sample used in estimations.

⁹ The probability of exit of the central bank's president and the legal independence index are not significantly related as shown by simple correlations over the samples used in estimations of (1).

relative aversion to inflation is not related to the current economic situation but driven by ideological preferences. Chile during the Pinochet era, United States in 1913 and the German central bank after World War II are presented as examples of situations where governments ideologically opposed to high inflations changed the legislation granting more independence to the central bank. By doing this, these governments tried to avoid the control of the money supply by their political opponents in the future. Having a government highly opposed to inflation in the past will be considered exogenous to the current credibility of monetary policy for this sample, where moderate levels of inflation are present.

The vector $X_{i,t}$ includes variables known in the literature to be factors affecting inflation. One of these variables is an indicator of trade openness, following the idea that trade, and more generally globalization, are important in determining inflation performance (see Rogoff, 2003). $X_{i,t}$ also includes fiscal indicators. It is expected that having high deficits and debt accumulation will have a negative effect on the probability that stabilizations will succeed (Hammann and Pratti, 2002). Other variables in $X_{i,t}$ include inflation levels for world food and oil prices, incorporated into the model to capture supply shocks that affect the success of a disinflation in the sample countries, as found by Hofstetter (2005).

A final control variable is a measure of political polarization. It is expected that a greater polarization will decrease the likelihood of a reform (or change in policy) taking place (see Alesina and Drazen 1991). In a country with greater political polarization, where it is perceived that the disinflation will bring a political cost (because of the redistribution of income among groups produced by inflation seigniorage), the different political groups will delay the stabilization, waiting for their opponents to bear its political cost when they assume power. As a proxy of political stability $X_{i,t}$ includes the years in which the present political system has been in power. This variable is included in the model for being found significant in estimations that try to explain stabilizations from high rates of inflation.

Sources and exact definitions for the control variables used in the estimation of equation of (1) can be found in Table 1.

2.1. Estimating the Probability of the Exit from Office of a Central Bank Governor

The variable $Ps_{i,t}$, which is not observed, is estimated by:¹⁰

$$h(S_{j,i,t} / Z_{i,t}, T_j) = f(Z_{i,t}, T_j) \quad (2)$$

where $S_{j,i,t}$ is a dichotomous variable that takes the value of 1 when banker j in country i in period t leaves office and 0 otherwise. $h(S_{j,i,t} / Z_{i,t}, T_j)$ is the hazard rate of exit of a central banker leaving office. In this case, it is the probability of j exiting in i in period t conditional on the time he has been in office T_j and other political, legal and economic variables included in $Z_{i,t}$. $f(\cdot)$ is the inverse of a cloglog transformation used to model a random continuous event (the length of a central banker's period) with discrete time data (survival times are grouped into discrete intervals of one year where it is observed whether the president remains in charge or not).¹¹

The predicted discrete hazard rate that comes from this model will be used as $Ps_{i,t}$ in the estimation of equation (1).¹² Instead of using this probability, one could think of using a dummy variable for the event of a president exiting office. However, this brings two problems. First, such a variable could be potentially endogenous by the impact of the credibility of the central bank on the appointment of its members. Specifically, lacking credibility in the central bank could be a reason for removing from office the head of this institution. Second, this measure will not capture the political influence of the government in the appointment procedure. Our measure

¹⁰ Recently Dreher, de Haan and Sturm (2006) estimated a similar equation to find the determinants of the exit of a central banker in 173 countries for the period 1973-2004. My estimation differs in two important aspects. The estimation method used by Dreher et al. (2006) is a conditional fixed effect Logit that takes as the individual panel variable the country and not the president. Under this method, it is only possible to calculate the prediction of the probability of exit conditional on the fact that the country did not experience another central banker's replacement in any other period. This goes against the evidence showed in Table 1. Dreher et al. (2006) include the time that the president has been in office as a percentage of their legal time. In this paper's estimation, we are interested in differentiating the effect of the legal and observed time apart from each other. Other variables included in his estimations present very similar results to the ones in this paper.

¹¹ The cloglog model is the most extensively used in the literature (Jenkins, 2004, p. 41). Other models like the logistic could be used in this setting (Sueyoshi 1995). However, to follow this approach, one needs to assume that the duration of the event in each interval follows a loglogistic distribution. The choice of $f(\cdot)$ is consistent with a duration model that follows the assumption of a proportional hazard (the hazard rate has a form in which the base hazard multiplies a function of the independent variables)

¹² Notice that there are years in which a country can have more than one president of the central bank. For these periods $Ps_{i,t}$ is the average of the hazard rates predicted by each of the central bankers in that country.

of $Ps_{i,t}$ addresses both issues. It is estimated with exogenous variables for equation (1), and captures the influence that the government has over the central bank by including political variables that account for the relative power of the government in the $Z_{i,t}$ vector.

The set of variables included in $Z_{i,t}$ cannot be related to the error of equation (1). $Z_{i,t}$ includes: Executive election year dummy, checks and balances in the political system, democracy indicator, a dummy that takes the value of 1 if there is a legal provision for the governor to be elected for a period longer than five years and 0 otherwise, and a dummy variable that takes the value of 1 if the head of the executive appoints the president of the central bank and 0 otherwise. $Z_{i,t}$ also includes the log of the time that the governor has been in office. This is done in order to capture the duration dependence that the event of exiting office could have. The variables included in the vector $Z_{i,t}$ affect the credibility that the public has in monetary policy only through the changes in the head of the central bank and its implied term length.

The dummy indicator of the executive election included in $Z_{i,t}$ can be positively associated with the probability of a central bank governor leaving office for two reasons (not always independent from each other). The timing of the end of the president's period can coincide with the end of the term of the central bank governor or because there is an actual influence of the executive over the head of the central bank. Table 2 shows that most central bank presidents elected for periods longer than five years (as specified in their central banks statutes) end their terms prematurely. This confirms that provisions for having longer terms in office for the governor are not generally carried out in practice. This is why finding a significant and positive relationship between the executive elections and changes in the presidency of the central bank could be seen as evidence of government interference with its independence. By including a dummy of the executive's election, the government's influence will be captured in the prediction made by model (2).

Keefer and Stasavage (2003) present a model in which political interference of the government with the central bank is less likely when there are multiple veto players. Therefore, we expect that a greater level of checks and balances (measured as the number of veto players) would decrease the probability that the public gives to a central bank governor's leaving office. However, this association is significant only if the executive has power over the appointing and

removing process of the members of the central bank. If the central bank is effectively protected by the law from executive interference, after controlling for legal independence, a greater level of checks and balances should have no effect on the expectations of changes in the head of the central bank.

3. Data

The estimations of equation (1) take a sample with a maximum of 22 countries¹³ from Latin America and G7 countries for the period 1975-2003. Table 3 and Table 4 present the list of variables included in each set of regressors used estimating equation (1) and their summary statistics for the sample used in the results.

After applying the criteria to identify the disinflations to the inflation series used in Hofstetter (2005),¹⁴ the same disinflations from that paper for the period 1973-2000 were identified. For the period 2000-2003 not covered by the Hofstetter sample, seven more disinflations were identified. Out of this group, two disinflations were eliminated after reviewing the historical records of their central banks: Venezuela 2003 (an expansive monetary policy was in place during the period) and Bolivia 2000 (import prices fell as a result of devaluation from countries that exported to Bolivia, along with expansive monetary policies). The average inflation for the complete sample used in the regressions is 8.89 percent, and that present at the beginning of the disinflations group is 13.34 percent. This shows that the sample includes periods where a disinflation is necessary not only because it is rising or is expected to rise, but also because the level of inflation is moderately high.

The estimations of (1) and (2) use legal variables taken from a desegregation of the updated independence index created by Grilli, Masciandaro and Tabellini (1991). The updates for the Latin American countries were taken from Jácome and Vázquez (2005) and for the G7 countries from Arnone, Laurens and Segalotto (2006). The specific economic and political factors evaluated in the index are summarized in Table 1.

The variable that identifies the government's party ideology towards economic policy used in the definition of $pre_p_{i,t}$ and $pre_e_{i,t}$ is taken from the Database of Political

¹³ Some estimations include fewer countries depending on the technique used.

¹⁴ The inflation series is the moving average of a quarterly inflation series of eight quarters. In this way, inflation in t is the average of the inflation of the four quarters of that year plus the first two of next year and the last two of the preceding one.

Institutions of the World Bank (Beck et al., 2001). These variables take the value of 1 if the party is identified as a right-wing party, 0 if it is a center party and -1 if it belongs to the left. The identification was done by the authors based on party description, party name, and cross-checking with Huber and Inglehart (1995). Also, if there was evidence that the executive deviated from the party's orientation, the executive's orientation was recorded instead for this variable.

The dataset used in the estimation of equation (2) includes information for 234 central bank governors with their dates of entry and exit from office from 23 Latin American and G7 countries during 1975-2003. This dataset is an updated version of the one used in Cukierman and Webb (1995).¹⁵

The checks and balances variable was taken from the Database of Political Institutions of the World Bank by Beck et al. (2001). This variable counts the number of veto players and captures the differences in the distribution of power between presidential and parliamentary systems (see Keefer, 2005, for a more detailed description). The regressions for equation (2) use the log of this variable, since at lower levels of checks and balances the effect of more veto players on the distribution of political power is stronger than for a large number of veto players.

Finally, as an indicator of democracy in the estimation of (2) the "Polity" indicator was used. This variable is taken from the Polity IV project and takes values from -10 to 10, 10 being strongly democratic and -10 strongly autocratic (see Marshal and Jagers 2002 for detailed description).

Table 5 presents summary statistics for the variables used in the estimations of equation (2).

4. Results

4.1. Effect of Political Variables on the Probability of the Exit of the Governor of the Central Bank

Table 6 shows marginal effects estimated from equation (2). One of the main findings is that the hazard rate of a central bank president's exit is positively associated with executive elections. There is a 6-10 percent increment in the probability of a central banker leaving office in years in which the head of the executive is elected. The dummy variable, which takes the value of 1 whenever there is a legal provision indicating that the term of the governor must be longer than

five years, is always significant and has the expected negative sign. On the other hand, direct participation by the executive in the governor's appointment process does not seem to have an effect on the probability of a replacement.

It is important to note that the democracy level only has a negative significant effect on the probability of a governor's leaving office if the models do not include a measure of the distribution of political power, such as the measure of checks and balances. Once this variable is accounted for in specification 3, the democracy level loses relevance. This suggests that the negative effect that democracy previously displayed was explained by the better distribution of political power that a higher democracy level implies.

Figure 1 shows the predicted hazard rate for each year that the governor remains in his position in a country where a certain banker's term is longer than five years and where the executive does not appoint the governor. Two lines are included, one representing the predicted hazard rate in an executive election year and the other one the predicted hazard rate in a year with no election. As the figure shows, a governor who has been in office for five years has a probability of exiting the central bank close to 50 percent in an election year and 32 percent in any other year. As expected, the probability of a central bank's president exiting office increases with the time in which he has been in office.

Finding significant differences in the value of the predicted probability of a governor leaving office whenever there are executive elections and with greater checks and balances, after controlling for legal independence, is considered evidence of the existence of the executive's political influence over the central bank. Similar results were found in Cukierman and Webb (1995), who found that the replacement of a central bank governor was more likely during the first six months after a political transition than after ten months or more. Their sample consisted of 67 industrial and developing economies from 1950 to 1989. Dreher, de Haan and Sturm (2006) found that a decrease in the number of veto players and changes in the government were also related positively to the probability of a central bank's president's exit for a sample of 137 countries in the years 1970-2004.

¹⁵ The new data were provided by Professor J. de Haan or taken from the "Europa World Yearbook" and central banks' web sites.

The results of Table 6 remain unchanged if non-parametric modeling is used for the time dependence in the hazard rate, and also if a different updated measure of legal independence (the updated Cukierman Index) is included in the model.¹⁶

4.2. Legal Independence, Probability of a Governor's Exit, Preferences of the Executive and Credibility of Monetary Policy

Table 7 shows the marginal effects calculated from the estimation of equation (1). Marginal effects for the control variables are not reported. The sample used, as explained above, takes only periods where inflation is rising or periods that precede them, all for inflation levels not higher than 35 percent. The marginal effects are calculated for a scenario in which the executive belongs to a party located at the center of the political spectrum and whose values for the continuous variables are at the sample's average. Each column in Table 7 represents a different regression that includes the set of controls specified at the rows of the bottom of the table.

The main result shown in Table 7 is that greater probabilities of exit for the central bank's president are negatively related to the probability of a disinflation starting. From the results presented in column 3, it is shown that a 10 percent increase in the hazard rate of a central banker leaving office is associated with a fall in the probability of a disinflation starting at about 7 percent ($0.1 * -0.73 = -0.073$). This result is consistent across different sets of controls that include political, fiscal and external determinants of disinflations.

The marginal effect of the legal index of independence that does not include independence aspects related to the president is consistently negative across specifications. This indicates that our credibility measure does not show an improvement in countries for which their central bank's statutes grant them more independence. Fischer (1996) and Posen (1998) reached similar results in models where the dependent variable was the sacrifice ratios of disinflation episodes. This allowed Posen to reject the hypothesis in which greater independence reduced the cost of a disinflation caused by the greater credibility that this institutional arrangement provided, even for OECD countries in which greater compliance with statutes is likely to be assumed.

To establish if the hazard rate was capturing the effect that the legal independence measure related to the president of the central bank would have by itself, a new estimation of

¹⁶ Results are available upon request.

equation (1) was carried out using only the complete legal independence index. The results from this model showed that the index coefficient still presented the “wrong” sign. Furthermore, a new estimation of (1) in which I separated each component of the legal index used in the hazard estimation (the ones related exclusively to the president of the central bank) was done without finding any of the coefficients of these variables significant.¹⁷

Columns 5, 6, and 7 present the results that include the variables of the political ideology of the executive’s party. The marginal effect of the interaction between the ideology of the party of the current head of the executive and the hazard of exit of the central banker allow us to test the hypothesis that central bankers have an incentive to follow the executive’s preferences. Given that the ideology measure takes a greater value for parties at the right of the political spectrum, the effect of the hazard rate over the probability of a start of a disinflation should be smaller in magnitude for such governments. However, this does not appear to be the case; the marginal effect is not significant in any of the specifications tested.¹⁸

Finally, it is found that if the current president of the bank was appointed by a more conservative executive, the probability of a disinflation increases. This effect is significant for specifications 5 and 6. Finding that the influence of the executive over the central bank is given by the appointment of someone close to the preferences of the government and not by the influence of the current government over the central bank is consistent with the findings of Chappell et al. (2003) for the United States¹⁹ and Berger (1999) in Germany.

The concern about the results presented so far is that the models are not controlling for effects fixed in time that vary only in the country dimension. In fact, even the legal measures of independence present a temporal variation thanks to the reforms of the central bank charters that some countries experienced in the sample period.²⁰ The need to include country effects in the specifications was tested for each of the specifications presented in Table 8.

¹⁷ Results available upon request.

¹⁸ The marginal effect of the interaction and its standard error were calculated following Chunrong and Norton (2003). The marginal effect of the hazard rate under a left-wing government is subtracted from the marginal effect of the hazard under a conservative government and the standard error of the difference is calculated with the delta method.

¹⁹ A governor appointed by a Democratic administration prefers a funds rate 19 points lower on average than a governor appointed by a Republican administration, and a member of the FOMC (Federal Open Market Committee) prefers a funds rate 18 points lower when the chief of the executive is a Democrat. However, the statistical evidence for the second result was not as consistent and precise as the first one.

²⁰ Six countries in the sample used in the final regressions have legal indexes that changed at some point in the period studied.

First, a likelihood ratio test was carried out to test whether the share of the variance of the specific error of the country in the total variance was statistically different from zero for the Logit random effects models. The hypothesis was not rejected for any of the specifications at the conventional levels giving support for the pooled models. In the same way, a Hausman test was performed comparing the coefficients of the conditional fixed effects model with the ones from the pooled Logit (efficient under the null hypothesis given the results of the likelihood ratio tests), finding evidence in favor of the pooled model in each specification.²¹

Even though the tests confirmed the election of a pooled Logit, as a robustness check the results of the conditional fixed effects models are presented in Table 8. The results show the estimated coefficient for the variables of interest and not their marginal effects. This is a shortcoming of the conditional Logit fixed effect estimator proposed by Chamberlain (1980). This estimator uses a likelihood function that eliminates the coefficients associated with each individual in the panel, which implies that marginal effects cannot be calculated without making the assumption that these parameters are zero.

In Table 8 it is shown that the sign and the significance of the coefficient of the hazard rate of exit of the central bank president are consistent with the results obtained from the pooled Logit models. This does not occur with the significance of the legal measures. In fact, there is no specification where the legal measures were significantly associated with the probability of a start of a disinflation. A similar result was found by Boschen and Weise (2001) in a sample of 19 OECD countries in the 1960-1993 period. In their results, the legal independence index did not seem to have any effect on the probability of a start of a disinflation. For columns 5 and 6, it is seen that the significance at conventional levels is a loss for the coefficient of the ideology of the president of the central bank, but it is maintained at the 10 percent level for the specification in column 7. This could be explained by the loss of observations due to the estimation technique. The conditional fixed effects Logit requires each country to have at least one period where the dependent variable takes the value of 1 and one period with a value of 0. This condition was not met by some of the countries in the original sample, and eight of them were as a result eliminated, decreasing the sample size from 156 to 131 in specifications 1, 2, 3 and 4, and from 130 to 106 in specifications 5, 6 and 7.

²¹ Results available upon request.

4.3. Robustness

A potential concern with the results of Table 7 and Table 8 is the definition of the periods included in the sample. For the results presented in these tables, only periods where the inflation was rising or when the inflation was going to rise in the following period were included. It could be argued that in periods where the public has not observed a rise in inflation, there is no need for a disinflation to start. This is why all the specifications were estimated over a sample that only included periods of rising inflation. The sign and significance of the coefficient of the hazard remained in all specifications but that in column 7. The positive and significant association of the ideology of the party of the executive that appointed the governor was maintained for specifications 5 and 6.

Finally, all the models were re-estimated using an updated Cukierman Index (Cukierman, Webb and Neyapti, 1992) instead of the Grilli, Masciandaro and Tabellini measure. This could be relevant, given the differences presented in both measures caused by the subjectivity of the criteria included in the definition of independence used in them (Mangano 1998). Once again, the results for the legal measures remain unchanged and the negative association of the probability of exit and the probability of the start of a disinflation was still present.

5. Concluding Remarks

In this study, it was found that a greater probability of the exit of a president of the central bank is related negatively to the expectations of the monetary authority changing its current policies towards a tougher stance against inflation. On the other hand, legal independence indicators that did not include aspects related to the president of the central bank did not affect credibility in monetary policy. These results suggest that the expected hazard of exit is a measure that captures key aspects of independence that the legal indicators could not account for. This explains why the expected relationship between credibility and independence was found in this paper, while previous studies presented the opposite relationship. These key aspects are related to the political environment, specifically, to the distribution of power within each country, as was seen with the determinants of the probability of exit of a central banker.

In addition to these results, it was found that the preferences of the government towards inflation through its influence over the appointment of central bankers affected the credibility in the commitment of the bank to anti-inflation policies. Conservative governments present at the time of the appointment of the head of the central bank seemed to improve the credibility of the monetary authority. On the other hand, the preferences of the current government (if different from the one that appointed the governor) did not seem to have an effect on the expectations of changes to monetary policy directly or through its influence over the central banker in place. This evidence does not support the idea of central bankers trying to follow governments' preferred policies for reelection purposes or other reasons. However, an alternative explanation could be that our indicators of preferences are really not good enough to capture the effective relative aversion to inflation.

As highlighted by Posen (1998), it remains to be answered what channel explains the negative relation between legal independence indexes and inflation documented extensively elsewhere. On the basis of the results included in this paper and those in Posen's work, the empirical evidence gathered so far does not support the hypothesis that increased credibility causes the negative relationship between those variables.

This study is an attempt to estimate at the aggregate level how factors that affect the incentives of the central bankers are regarded as important in the expectations of the public of monetary policy. This goes along with the idea that actions of central bankers cannot be considered as given by their perceived type; instead, factors that influence their incentives should be taken into consideration. Here I have focused on only two of those factors: the expected term length of the head of the central bank (measured by the probability of exit) and its relation with the government's political influence and preferences. However, many other considerations involving central bankers' behavioral considerations and their effects on policy remain untested empirically. Of particular interest are i) the size of the central bank's committees and ii) the public's ability to evaluate central banker's individual performance in those committees. As discussed by Sibert (2005), these two variables are important in defining the degree of polarization of their members' views and the individual effort exerted by each member in a committee. Groups with too many members increase the chances of social loafing, and in committees where the public monitors their members the incentive to follow popular policies increases. Also, Eslava (2007) shows that increasing the size of the committee (keeping the

fraction of members elected by the government fixed) increases the probability of voting for high inflation. Future research needs to be done in order to test the validity of such predictions, given their importance in understanding the effect of institutional arrangement of the central bank on final monetary policy results and expectations about them.

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Tables and Figures

Figure 1.

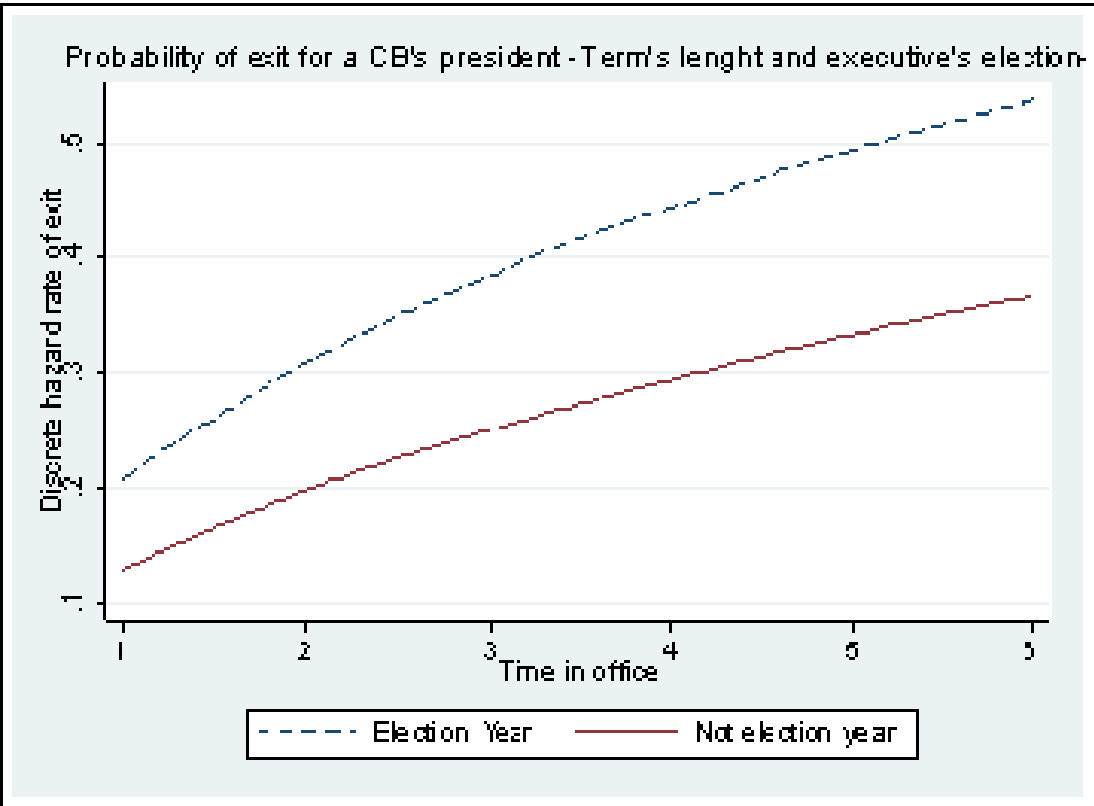


Table 1.**Variable definitions**

Years to most recent change in political regime	The change in political regime is defined as a change in the democracy level of three or more units in three years or less. Details Marshall and Jagers (2002)
Central government's debt	From Jaimovich and Panizza (2006)
Executive election	Takes the value of 1 if there is an executive election in that year an 0 otherwise. Database of Political Institutions. Beck et al. (2001). Details see Keefer (2005)
Gov. doesn't appoint the central bank president	Takes the value of 1 if the government is involved in the appointment of the president of the central bank and 0 otherwise. This is a component of the Grilli, Masciandaro and Tabellini (1991) index The aspects included are: i) Other committee members are appointed without government intervention, ii) Committee members's term longer than five years, iii) Participation of government in the committee, iv) Executive's approval of monetary policy is not required, v) Objective of the central bank, vi) Legal protection from Executive's involvement, vii) There is no automatic access for credit from the central bank to the government, viii) Loans to the government from the central bank are given at market rates, ix) Credit is given to the government in a limited and temporary basis, x) Central bank does not participate in primary market for public debt, xi) Discount rate is set by the central bank and xii) Central bank doesn't oversees the financial sector. The index comes from Grilli, Masciandaro and Tabellini (1991) and updates from Arnone et al.(2006) and Jacome et al.(2005)
Legal independence IB_{it}	
Inflation international food prices %	Annual change of food price index. International Financial Statistics IMF.
Inflation oil prices %	Annual change of price of West Texas Oil. Federal Reserve Economic Data.
Checks and balances	Log of number of veto players. Database of Political Institutions, Beck et al. (2001) details see Keefer (2005)
Democracy level	Takes values between 10 and -10. 10 very Democratic, -10 very autocratic. Taken from Polity IV, Project Integrated Network fro Societal Conflict Research Program (INSCR), Center for International Development and Conflict Management (CIDCM), University of Maryland, College Park. Details see Marshall and Jagers (2002)
Political polarization	Is the maximum difference between the chief executive's party's ideology and the values of the three largest government parties and the largest opposition party's ideology. Database of Political Institutions, Beck et al. (2001) details see Keefer (2005)
President exits office $S_{j,i,t}$	Takes the value of 1 if the president of the central bank leaves office and 0 otherwise. Data on the years of entry and exit for the presidents of central banks was taken from Cukierman and Webb (1995) and updated with data provided by J. de Haan, Europa World Yearbook and central bank's websites.
Seigniorage	Change in monetary reserves following Aisen and Veiga (2006). International Financial Statistics . IMF
Legal term > 5 years	Takes the value of 1 if the central bank's statutes say that the legal term of the president must be 5 years or more and 0 otherwise. This is a component of the Grilli, Masciandaro and Tabellini (1991) index and updates from Arnone et al.(2006) and Jacome et al.(2005)

Table 2.

**Years in office for presidents of central banks in countries
where their legal terms are longer or equal to 5 years
LAC and G7 1972-2004**

<i>t</i>	Number of presidents that stay in office <i>t</i> years
1	10
2	14
3	13
4	5
5	6
<hr/>	
Total number of presidents appointed for more than 5 years	75
Presidents appointed for terms longer than 5 that didn't finish their period (% over presidents appointed for terms longer than 5 years)	64%

Notes: Author's calculations. Data comes from Cukierman et al. (1992), J.de Haan and central bank web sites.

Countries where bank statues dictate that its president should stay in office for more than 5 years are: Italia, Argentina (since 1993), México, Rep. Dominicana, France, Germany, Honduras (before 1997), Brazil, Venezuela (since 1993), Bolivia (since 1996), Canada.

Table 3.

**Other determinants of the probability of disinflation beginning.
(Control variables in credibility model)**

Political	1) Years to most recent change in political regime
	2) Political polarization
Fiscal	1) Seigniorage (% Central government's revenue)
	2) Central government's debt (% GDP)
External	1) Exports + Imports (% GDP)
	2) Inflation international food prices
	3) Inflation oil prices

Notes: Exact definition see table 1

Table 4.**Summary statistics for determinants of the probability of a disinflation beginning
G7 and LAC 1975-2003**

	Obs.	Mean	Std. Dev.	Count of 1's in dummy
Disinflation starts (Dep. Variable)	156	-	-	24
President's probability of exit	156	0.191	0.112	-
Legal independence (w/o President)	156	8.647	2.504	-
Years to most recent change in political regime	156	58.724	54.744	-
Political polarization	156	0.660	0.884	-
Central government's debt (% GDP)	156	50.636	40.943	-
Seigniorage (% Central government's revenue)	156	0.031	0.034	-
Inflation international food prices %	156	10.282	25.904	-
Inflation oil prices %	156	1.017	8.171	-
Exports + Imports (% GDP)	156	50.670	20.528	-

Table 5.**Summary statistics of political and legal determinants of the hazard
rate of exit of CB's presidents. LAC and G7 1972-2004**

	Obs.	Mean	Std. Dev.	Count of 1's in dummy
President exits office (Dep. Variable)	805	-	-	211
Executive election	805	-	-	142
Legal term > 5 years	805	-	-	272
Gov. doesn't appoint the central bank president	805	-	-	365
Democracy level	805	5.697	5.695	-
Checks and balances	805	1.053	0.594	-

Table 6.**Political and legal determinants of the hazard rate of exit
of central bank's presidents. LAC y G7 1975-2004**

	(1)	(2)	(3)
Executive election	0.060 * (0.033)	0.117 ** (0.056)	0.057 * (0.031)
Legal term > 5 years	-0.089 * (0.047)	-0.191 * (0.1)	-0.069 * (0.041)
Gov. doesn't appoint the central bank president	-0.026 (0.078)	0.006 (0.144)	-0.032 (0.076)
Democracy level	-	-0.015 ** (0.006)	0.002 (0.002)
Checks and balances	-	-	-0.076 ** (0.033)
Obs.	805	805	805

Notes. Marginal effects are calculated for a country in a year of elections, with legal term of less than 5 years, with a president not appointed by the executive, in his fourth year in office and with other continuous variables at the sample's mean

Estimation uses a cloglog model with a logarithmic baseline hazard.

Standard errors clustered at the governor's level in parenthesis. *** significant at 99%,

** at 95%, * at 90%. All control groups include country fixed effects

Table 7.

**Marginal effect in the probability of a disinflation beginning to changes of:
Probability of exit of the central bank president, legal independence and executive's preferences**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
President's probability of exit	-	-0.782 ** (0.312)	-0.730 *** (0.279)	-0.668 *** (0.215)	-1.093 *** (0.339)	-0.613 * (0.339)	-0.445 * (0.267)
Legal independence	-0.012 ** (0.006)	-0.023 *** (0.006)	-0.020 *** (0.006)	-0.015 ** (0.006)	-0.026 *** (0.007)	-0.024 *** (0.008)	-0.013 * (0.006)
Party's ideology of the executive when central bank's president appointed	-	-	-	-	0.045 * (0.026)	0.054 ** (0.027)	0.025 (0.031)
Party's ideology for the executive	-	-	-	-	-0.029 (0.042)	-0.073 (0.061)	0.000 (0.037)
Interaction marginal effect: Δ Prob. of exit of the central bank's president for governments from the right and left	-	-	-	-	0.380 (0.46)	0.754 (0.718)	-0.071 (0.414)
Political controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fiscal controls	Yes	-	Yes	Yes	-	Yes	Yes
External controls	Yes	-	-	Yes	-	-	Yes
Obs.	156	156	156	156	130	130	130

Notes. Marginal effects are calculated for a government in the center of the political spectrum and with all other continuous variables at the sample's mean.

Standard errors clustered at the country level in parenthesis *** significant at 99%, ** at 95% and * at 90%.

Control variables in each set are listed in table 3

Table 8.

**Effects over the probability of a disinflation beginning to changes of:
Probability of exit of the central bank president, legal independence and executive's preferences**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
President's probability of exit	-	-15.550 ** (6.815)	-13.730 ** (5.902)	-13.248 ** (6.698)	-25.841 ** (11.939)	-16.867 ** (8.308)	-17.756 (10.903)
Legal independence	-8.224 (894.469)	-5.146 (591.098)	-5.773 (863.89)	-5.879 (639.498)	-5.257 (456.633)	-5.393 (525.737)	-6.700 (597.023)
Party's ideology of the executive when central bank's president appointed	-	-	-	-	0.597 (0.638)	0.933 (0.687)	1.826 * (1.036)
Party's ideology for the executive	-	-	-	-	-0.479 (0.74)	-0.599 (0.805)	1.861 (1.141)
Prob. of exit of the central bank's president* Executive's ideology	-	-	-	-	3.973 (6.224)	2.363 (5.447)	-11.901 * (7.016)
Political controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fiscal controls	Yes	-	Yes	Yes	-	Yes	Yes
External controls	Yes	-	-	Yes	-	-	Yes
Obs.	131	131	131	131	106	106	106

Notes. These are coefficients of a conditional logit fixed effects models

Standard errors in parenthesis. ** significant at 95%, * at 90%

Control variables in each set are listed in table 3