

# Price stability and central bank independence: Discipline, credibility and democratic institutions.

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## Abstract

In the last twenty years many countries have reformed their central bank legislation by giving the bank more independence in monetary policy. A key assumption behind these law changes is that central bank independence (CBI) is an effective means of ensuring price stability. Yet the existing empirical evidence for an association between CBI and inflation has provided mixed results with the association being particularly weak in developing countries. We re-examine the relationship between central bank independence and price stability using a more encompassing theoretical approach and a new yearly data set for CBI from 1973 to present. Our theory traces the sources of the inflationary phenomenon and distinguishes the role of simply printing less money (discipline effect) from the public belief about what the monetary authority is likely to do (credibility effect). We further argue that democracies and dictatorships differ significantly in their application of the rule of law and the process of law change, depending on two measurable characteristics: the presence of relevant political opposition and the freedom to criticize the government in power. A first implication is that in democracies the central bank can be more conservative and this is reflected directly in lower rates of growth for the money supply. A second implication is that, addition to being directly more disciplinarian, a central bank whose credibility is enhanced by the configuration of democratic political institutions is also likely to insure a more robust money demand by reducing inflation expectations, and therefore leading to lower inflation.

## **1. Introduction**

Since the recent worldwide economic crisis, central bank independence has once again become a topical issue. Jens Weidmann, the president of the Deutsche Bundesbank, recently defended the European Union's lack of reflationary policy by stressing the need for central bank credibility: "Delivering on its primary goal to maintain price stability is the prerequisite for safeguarding the most precious resource a central bank can command: credibility."<sup>1</sup> The European Union also refused to discuss a bailout package for Hungary until the Hungarian government restored the central bank's independence to community standards. On the other hand, after a couple of decades of moderate deflation, politicians in Japan have started to question the Bank of Japan's independence and its cautious approach to monetary policy, debating whether politicians need to take a more active role in monetary policy. The assumption underlying these views is that central bank independence is an effective means of ensuring price stability. Is that the case, however?

Historically, stable prices have not been easy to accomplish. Across time periods and structural characteristics of economies, developed and developing nations alike have struggled to restore confidence in their currencies. Examples stretch from the US in the 1970s, Western European countries (except Germany) in the 1970s and 1980s, Latin American countries post WWII and in the 1970s and 1980s, and former communist countries in the 1990s. Delegating monetary policy to an independent central bank has been a key institutional mechanism argued to help achieve low inflation (Rogoff 1985) and bank independence has seen a world wide increase starting in the 1990s (Cukierman et al. 2002, Arnone et al. 2007, Jacome and Vasquez 2008, Crowe and Meade 2008, Bodea forthcoming).

Despite this trend to make central banks more independent, there have been few attempts to examine whether these reforms have contributed to price stability and, if so, how. Existing studies focus on a single region (Cukierman et al. 2002, Arnone et al. 2007, Jacome and Vasquez 2008,

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<sup>1</sup> *Financial Times* May 8, 2012, p. 11.

Bodea forthcoming) or two points in time (Crowe and Meade 2008). We update the Cukierman, Webb, and Neyapti (1992) index of central bank independence to cover yearly data for more than 80 countries from the end of the Bretton Woods system until the present day. We explore whether the effects of CBI on money growth rates and inflation are conditional on a country's level of democracy and test plausible causal mechanisms that may explain the effect.

We argue that democracies and dictatorships differ significantly in their application of the rule of law, with implications for the binding effect of the central bank law both on government behavior and public expectations. Democracies lead in de facto enforcement of the law due to stronger ex-post constraints and greater transparency regarding the actions of the government. This allows the central bank to use monetary policy instruments in a conservative fashion. The same mechanisms are likely to increase the credibility of the central bank's policy because changes to the law to reduce independence are less likely to occur when there are multiple veto players and when the press can report freely on the positions of the government, the opposition, the central bank and key constituencies. Following, we expect two distinct effects. First, delegation of monetary policy to an independent central bank in democracies allows the bank to actually behave in a conservative fashion and this is reflected directly in lower rates of growth of the money supply. Besides being directly more disciplinarian, a central bank whose credibility is enhanced by the configuration of political institutions is also likely to insure a more robust money demand by reducing inflation expectations, which therefore leads to lower inflation above and beyond the reductions in the supply of money.

Our results broadly conform to our expectations, especially in the case of control of the money supply. There is a strong interactive effect between central bank independence and democracy and its mechanisms in controlling the money supply. Independent central banks have a stronger negative effect in democracies and when there are multiple checks and balances or freedom of the press. The results are less clear for inflation. While the marginal effect of independence is negative and significant for democracies and for strong democratic mechanisms, the effect gets weaker in more

democratic countries and those with stronger checks and balances. This suggests either that there are political processes in democracies with competing effects on inflation expectations or that we do not capture accurately the institutions that condition the expectational effect of central bank independence. That is, too many checks and balances in a country may lead to policy deadlock in areas other than monetary policy which may increase inflation expectations. One such example may be delays in stabilization policy when there are multiple veto points. Another explanation is that, perhaps, rather than the current configuration of political forces, it is the public's expectation of changes in the constraints facing the government that enhances the conditioning effect of central bank independence.

Our paper contributes directly to the literature linking central bank independence to price stability. More so than in previous research, our theory accurately reflects the sources of the inflationary phenomenon and distinguishes the role of simply printing less money (discipline effects) from the public belief about what the monetary authority is likely to do (credibility effect). We also explain how democratic institutions are likely to condition both of these channels. Very importantly, we test our hypotheses with author-coded data on yearly changes to central bank independence laws. This data structure allows identifying more precisely the relationship between price stability and the central bank than the period averages that are prevalent in previous research.

The paper proceeds as follows: Section 2 offers a background on the literature and presents our theory. Section 3 discusses data and variables. Section 4 shows the results. Section 5 concludes.

## **2. Background and theory**

There have been a huge number of central bank reforms in the last twenty years. With the publication of academic studies showing a correlation between central bank independence and lower inflation in developed countries, governments have rushed to give their central banks more autonomy. Figure 1 compares central bank independence in 1980 and 2008, using a score on the Cukierman et al. (1994) index of .4 or above as the independence cutoff. As the figure shows, while

governments in a few large countries, notably, Brazil, India, and Australia, have retained control over the central banks, countries in most regions have made their banks more independent. The only region where there has been little change is Africa. The graph shows a rush towards greater independence, but have these changes actually had an effect on price stability?

[Figure 1 about here]

Theoretically a key reason that central bank independence keeps inflation in check is that delegation reduces the risk of time inconsistency in monetary policy (Kydland and Prescott 1977 and Barro and Gordon 1983). Time inconsistency emerges because governments have incentives to generate economic growth through surprise inflation and therefore their own announcements and commitments about price stability have little credibility. Independent central bankers, on the other hand, are argued to take a policy view beyond the political cycle, and to be, on average, more concerned about the risks to price stability than elected politicians (Rogoff 1985, Lohmann 1992). Lohmann (1998) suggests that independent central banks can be expected to reduce inflation even if governments have low inflation preferences. In her argument, the temptation to create inflation surprises exists even for such governments and the role of the central bank remains to insure consistency between ex ante and ex post inflation preferences.

Time inconsistency approaches, however, have been critiqued by central bankers who suggest that the logic is unlikely to hold in developed countries (Blinder 1998). Also, more recent explanations for monetary policy delegation to independent central banks point to information asymmetries between ministers and backbench legislators and coalition partners (Bernhard 1998); diverse political coalitions (Crowe 2008); more checks and balances (Moser 1999); federal systems and party veto players (Hallerberg 2002); the presence of powerful coalitions in favor of price stability (Goodman 1991); or a more transparent political system (Broz 2002).

Reflecting the potentially multiple causal arguments for delegation of monetary policy, the empirical evidence for an association between central bank independence and inflation has provided

mixed results with a particularly weak relationship in developing countries.<sup>2</sup> The early work on the topic shows a strong negative relationship between inflation and central bank independence in developed countries (Grilli et al. 1991, Cukierman et al. 1992, Alesina and Summers 1993). This relationship has been shown to lack robustness in later work (de Haan and Kooi 2000, Daunfeldt and de Luna 2008, Jacome and Vasquez 2008). On the other hand, in a recent study Crowe and Meade account for country heterogeneity and potential endogeneity of central bank independence and find a robust negative relationship across developed and developing countries (Crowe and Meade 2008). The same negative result is shown to hold in post-communist countries (Loungani and Sheets 1997, Cukierman et al. 2002).

A key reason why an independent institution with a mandate for maintaining price stability fails to deliver lower inflation is political interference from the principal that delegated monetary policy in the first place. Monetary policy has distributional effects and is an important tool for influencing the economy in the short run during the electoral season. Therefore, delegation is a costly option that is continuously fought in the political arena. Politicians may try to take advantage of the ambiguity of laws in order to influence the bank. Early on in the CBI literature, Cukierman et al. (1992) point out the issue and write that “first, the laws are incomplete in that they cannot specify explicitly the limits of authority between the central bank and the political authorities under all contingencies. These voids are filled by tradition at best and by power politics at worst. Second, even when the law is quite explicit, actual practice may deviate from it” (p. 355).

In fact, many economists have argued that political interference in developing countries is so severe that the legal independence of the central bank is not a good indicator of its autonomy. Because governments do not respect the rule of law as much as in developed countries, they argue, the legal independence does not measure a central bank’s true independence. Instead, turnover of

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<sup>2</sup> Survey work of the empirical results in the literature includes Eijffinger and de Haan (1996), Berger et al. (2001), Hayo and Hefeker (2002), Arnone et al. (2007).

central bank governors has been argued to be better measure of a bank's autonomy in developing countries.<sup>3</sup> Political interference has been an issue even for the Bundesbank, the most acclaimed independent central bank after the Second World War. For example, Lohmann (1998) duly notes that the "behavioral independence of the German central bank fluctuates over time with the party control of federalist veto points" (p. 401). Also, Berger (1997) shows that after the 1957 central bank law passed, the Bundesbank was an active player in the political system, trying to consolidate its conservative reputation and engaging in the public debate on the sources of inflation.

The implication from this discussion is that de jure and de facto central bank independence may vary significantly. However, while the incentives to renege or otherwise subvert the delegation contract certainly exist everywhere, the political economy literature suggests that the configuration of political institutions influences significantly the extent to which delegation is enforceable (Franzese 1999, Broz 2002, Keefer and Stasavage 2002, 2003, Moser 1999, Acemoglu et al. 2008, Hielscher and Markwardt 2012). This literature is rich and brings a series of important insights. Franzese (1999) shows that the effect of central bank independence on inflation is conditional on features of the political economy environment in which banks carry out monetary policy, including government partisanship and labor market organization. Broz (2002) argues that central banks are an opaque commitment mechanism and, therefore, political system transparency prevalent in democracies allows central banks to become credible and reduce inflation expectations. Keefer and Stasavage (2002, 2003) demonstrate that the credibility of monetary policy delegation is enhanced by the presence of multiple veto players with distinct preferences.<sup>4</sup> Similarly, other work shows that strong

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<sup>3</sup> To capture de facto bank independence Cukierman et al. (1992) and the economics literature look at central bank governor's tenure or surveys of experts. Neither of these solutions is unproblematic, however. Long governor tenures may be a result of both autonomy and the lack of it, and surveys are limited to small samples and are difficult to build retroactively. Other work derives de facto bank independence from the behavior of monetary aggregates during election cycles (Alpana and Honig 2010).

<sup>4</sup> Acemoglu et al. (2008) show a non-linear conditional effect with central bank reforms leading to more independence lower inflation the most in countries with intermediate levels of political constraints. Their argument is that central bank independence is likely to have the highest effect when the distortions introduced by the political

institutional checks and balances (Moser 1999, Hayo and Voigt 2008) or the quality of political institutions (Hielscher and Markwardt 2012) condition central bank independence in generating low inflation.

While these explanations all point to the importance of political institutions, they highlight different aspects that make it difficult to distinguish their inter-relatedness and therefore their causal effects. Our argument is simple and provides a unifying approach to previous research: Democracies and dictatorships differ significantly in their enforcement of the rule of law and the process of law amendment, with implications for the effect of the central bank law on restraining government behavior and anchoring public expectations. More specifically, democracies lead autocracies in the application of the rule of law due to stronger ex-post constraints and greater transparency regarding the actions of the government. In addition, the same mechanisms are likely to increase the credibility of the central bank's policy because threats to amend the law and actual changes to the law to reduce independence are less likely to occur when there are multiple veto players and when the press can report freely on government action and central bank reaction. These advantages of democracies are likely to have two distinct effects. First, delegation of monetary policy to an independent central bank in democracies allows the bank to be more conservative and this is reflected directly in lower rates of growth for the money supply. In addition to being directly more disciplinarian, a central bank whose credibility is enhanced by the configuration of political institutions is also likely to ensure a more robust money demand by reducing inflation expectations, therefore leading to lower inflation. Below we detail our argument and link it to extant research.

Olson (1993) argues that democracies and autocracies differ in the rights afforded to individuals and this reverberates into differences in the system of courts, the independence of the judiciary, and respect for the law as well as stronger property rights. At the most basic level, then, in democracies

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system are at medium level. At low level of distortions, CBI has little additional impact, whereas when distortions are too high, CBI is an insufficient reform.

the prevalence of the rule of law generates confidence in contract enforcement more broadly and, especially, when the government is a party to the contract, as is the case with the central bank law. In democracies, a government realizes that its tenure in office depends in part on the perception that it is playing by the rules. Excessive violations may lead to removal from office. Several factors increase the likelihood that a democracy will be more prone to follow the rule of law than autocracies: a relevant political opposition and the freedom to criticize the government in power.

A first measurable characteristic that helps democracies lead autocracies in the enforcement of the law is the presence of “leading rivals of the administration in power” (Olson 1993, p. 572). Very directly, the political opposition has an interest in seeing that the law granting independence to the central bank is enforced because such independence denies the incumbent the opportunistic use of monetary policy. Indeed, Keefer and Stasavage (2003) show that in a system with two or more veto players there is a low probability that the central bank will be overridden in any of its decisions. In addition, coalition partners in the executive, back-bench legislators and the opposition have an interest in the enforcement of the central bank law and a de facto independent bank because such a bank solves the problem of asymmetric information available to the government about its policy choices by providing balanced information (Bernhard 1998). Furthermore, if the opposition represents a constituency that prefers low inflation, it has an additional interest in seeing that the government complies with the law of the central bank and keeps policy close to its conservative preferences. Thus, the presence of a strong opposition will allow the central bank greater leeway in conducting policy and we would expect a stronger relationship between CBI and control of the money supply and price stability.

Second, enforcement of the central bank law is helped by the fact that in democracies individuals as well as the key contenders to power have significant freedom of speech and the press is free to report on the government’s actions. Central banks often lack a high degree of transparency with respect to internal decision making and it is difficult to determine directly their “true” independence

(Broz 2002, Bodea 2010). However, freedom of speech allows the opposition to blow the whistle on government transgressions against the independence of the central bank. It also allows the bank to minimize transgressions against the law by using the media to publicize conflicts with the government, attribute the sources of the inflationary phenomenon to expansionary fiscal policy and consolidate and expand a constituency in favor of price stability (Goodman 1991, Berger 1997, Bernhard 1998). Ultimately, freedom of speech allows voters to be better informed and eventually punish at the ballot box government transgressions against the law, including central bank law.<sup>5</sup> Both the presence of an opposition and a free press, therefore, make the central bank law more enforceable by making it more difficult for a government to interfere with the central bank.

The direct consequence of a central bank law that has a de facto bite is that the bank is more disciplinarian and actually able to use the instruments of monetary policy to achieve the legal mandate in the delegation contract, most prominently low inflation. Depending on the particular central bank, this means an independent setting of the key interest rates at which the central bank lends directly to financial institutions, an independent determination of the quantity of government securities to be sold or bought on secondary markets or an independent determination of the reserve ratios that commercial banks need to set aside against deposits. Changes in monetary policy instruments affect directly the amount of liquidity available in the financial system and the supply of money. Therefore, countries with independent central banks and institutional configurations that guarantee the rule of law will have lower rates of growth of the money supply, reflecting the preference of the central bank for price stability.<sup>6</sup>

Following, what are then the consequences of central bank independence for inflation? Inflation is a result of money supply increases which in the longer run are not matched by a large enough

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<sup>5</sup> For example, Leeson (2008) finds significant evidence that media freedom is linked to citizen political knowledge and apathy or involvement in politics.

<sup>6</sup> Clark and Hallerberg (2000) use rates of growth of the money supply to test the existence of electoral cycles in monetary policy contingent on the status of the central bank, the exchange rate regime and the international mobility of capital.

public desire to hold on to cash balances. While money supply is directly affected by central bank action, an independent central bank is also likely to affect money demand.<sup>7</sup> That is, an independent central bank that is credibly conservative insures a more robust money demand and this reduces the inflationary effects of any given monetary expansion (Stockman 1996, Ghosh et al. 1997 and Levy-Yeyaty and Sturzenegger 2001). This means a moderation of broad public inflation expectations and, in particular, of the inflation expectations included in negotiated wage contracts. The result of this moderation is that workers are likely to renounce frequent renegotiation of contracts and forego demands of indexation to past inflation and that the broad public wants to hold relatively more of the money controlled by a trusted central bank. How much the public trusts the central bank will depend on how likely a government is to abruptly change the status of the central bank. If the central bank law is likely to change, workers will be more likely to frequently renegotiate contracts in anticipation of increasing inflation.

What are the circumstances that help the central bank moderate inflation expectations? We suggest that the same institutional mechanisms that insure the application of the rule of law are also likely to lead to an expectation that the law will not change randomly, within short time spans and without a proper public debate. In particular, the veto player literature stemming from the original work of Tsebelis (1995) argues that a larger number of relevant veto points (with distinct preferences) increases policy stability.<sup>8</sup> Central bank independence which is granted through regular legislation cannot then be amended in a sweeping manner when the political system has many

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<sup>7</sup> It is worth stressing here the point that while central bank actions have a relatively direct effect on money supply, the bank has only an imperfect control of inflation. This is particularly the case in developing countries, where central banks still have an imperfect understanding of the transmission mechanism of domestic monetary policy, money demand functions are unstable and inflation forecasting models remain inaccurate (IMF 2006). Inflation expectations are also likely to be driven by the fiscal behavior of the government (Ardagna et al. 2004).

<sup>8</sup> Beyond the credibility of the central bank, there is evidence that inflation is influenced by the independent status on the central bank conditional on the institutions organizing the labor market (Hall and Franzese 1998, Iversen 1998).

different actors who can veto a policy proposal.<sup>9</sup> Very directly, Keefer and Stasavage (2003) show that in the presence of multiple veto players, central bank independence always lowers inflation expectations.<sup>10</sup>

Freedom of speech and a free media is also likely to contribute to higher legislative predictability. In the first place, a free media is likely to present to the public competing views of any proposed changes to the central bank law. Even in countries with legislative majorities for the executive, the due process is likely longer when different views on the central bank can be expressed and different public constituencies need to be convinced that law changes act in their favor. Thus, even if law changes pass the legislature, the freedom of the media can at least postpone or prevent changes driven by very short term interests. In addition, as mentioned earlier, the central bank itself can use the public arena to make the case for its independence. Moreover, media freedom allows the expression of dissenting opinion from the political opposition and conservative circles, including the banking industry or the financial press.

The role of both factors (veto players and freedom of the media) is well illustrated in the example of the 1957 change in the law of the Bundesbank, the central bank of the then Federal Republic of Germany. Goodman (1991) writes that “many members of the CDU government were intent upon making the Bundesbank more responsive to government preferences, and after the 1957 elections they arguably had the votes to do so”. Despite the dominance of the CDU in the Bundestag, two key factors contributed to the preservation (in large part) of the independence of Germany’s central bank

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<sup>9</sup> E.g., with high political constraints Henisz (2004) shows policy stability for a range of fiscal policy indicators; Hallerberg and Basinger (1998) show stability of tax policy.

<sup>10</sup> We believe that this result comes both from increased credibility of central bank action (the central bank is able to act according to its conservative inflation preferences when there are multiple veto players), but also from an implied stability in the law and the nature of the delegation contract which is assumed not to change for the duration of the negotiated wage contracts. In the Keefer and Stasavage (2003) model inflation results only from changes in public expectations about the interaction between an independent central bank and one agenda setting veto player and a second non-agenda setting veto player. Walsh (1998), e.g., has a more complex models showing that inflation results both from money growth rates and inflation expectations used in negotiated wage contracts. The long-run relationship between M1 and the consumer prices in U.S. data is found in Robert Lucas’ seminal work (Lucas 1980). Recent empirical work also finds the relationship between money growth and inflation in a global sample of countries (McCandless and Weber 2005).

as it transitioned from the system of the Land Central Banks (Bank deutscher Lander) established by the Allied Powers in 1948 to the modern Deutsche Bundesbank. One important factor was the institution of German federalism and the veto power of the upper chamber of parliament, the Bundesrat, which represents the states (Lohman 1998). This veto point was meaningful because the Social Democratic Party (SPD) controlled several of the state governments and the CDU was split internally, including along regional lines, on the issue of making the central bank more dependent on the central (federal) government. As a result, the negotiations for the passage of the 1957 law lasted for several years. This prolonged negotiation also allowed the central bank to express its own opinions and forge its own position on price stability and the contribution of government policies to the inflation phenomenon. Goodman (1991) cites a German central banker as saying that “we have established such credibility that anytime there is a conflict with the government, at least 70 percent of the financial writers in the country would be on our side” (p. 339). Also, Berger (1997) notes the very public presence in the media of the German central bank in 1955-1957, before the federal elections and while the central bank law was being considered for amendment. The central bank not only made the case against fiscal deficits in the run-up to the 1957 elections but also forged alliances with conservative government ministers and contributed actively to plans for a federal level stabilization program.

Following our discussion, we test two hypotheses:

*Hypothesis 1 (discipline): Rates of money growth are lower when the central bank is independent and the country is a democracy, when there are multiple veto players and the country has a free press. (H1)*

*Hypothesis 2 (credibility): Inflation is lower when the central bank is independent and the country is a democracy, when there are multiple veto players and the country has a free press. (H2)*

### **3. Data, operationalization and methods**

We test the arguments of the paper with two dependent variables: the change in M2 and the inflation rate. The first of our primary dependent variables is the yearly percentage change in M2, an intermediate monetary aggregate that includes the currency in circulation and very short term deposits.<sup>11</sup> Here, we limit the sample to observations where the change in M2 is less than 150%. There are 74 observations where the change in M2 is greater than 150%. Often, scholars will take the log of variables to control for outlying values. We use the log of change in M2 and the log of inflation as robustness checks as logged values have their own issues. The log of negative values and of 0 are undefined so we lose observations where the money supply contracts or where a country experiences deflation. In our sample, there are 81 cases with a negative value for change in M2, so the number of observations is very similar if we use the logged value and if we restrict the sample to changes of less than 150%. The observations that are dropped in the two cases are different—in the logged case, it is small values and in the non-lagged case, large values—which should increase confidence in our results if they point in the same direction.

M2 data comes from two different sources. While the World Bank's World Development Indicators (WDI) has M2 in local currency units, it is missing data for all euro area countries before they adopted the euro. The IMF's International Financial Statistics has pre-Euro data so we used it as the primary source for change in M2. It is missing some data for Russia, Bulgaria, Turkmenistan, and Mongolia. Because these countries are included in the WDI, we fill in missing IFS M2 data with WDI data. This replacement fills in an additional 41 observations.

Our inflation rate measure is the change in the consumer price index. Because large values of inflation are sample outliers, we use only observations where the inflation rate for the year is less

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<sup>11</sup> In principle, narrow money or M1 data would be more appropriate for our tests because the central bank has better control on these quantities. However, the WDI and IMF's IFS have too much missing data for these narrower definitions of monetary aggregates. See also Clark and Hallerberg (2000) on this issue.

than 150%. There are 82 observations where inflation exceeded 150%.<sup>12</sup> When we use the logged inflation rate as the dependent variable in the robustness section, we lose 25 observations where inflation was less than or equal to 0. Inflation data comes from the WDI. The WDI is missing data for a few countries in our sample: Nicaragua, Guyana, Turkmenistan, Uzbekistan, Germany before reunification, the UK before 1989, and Chile. For Germany and Chile we use data from the OECD. Inflation data for Nicaragua for the years 1973 to 2000 are from the IMF's International Financial Statistics. The UK only started collecting CPI data in 1989. Before then, it collected price data using a different format that was not comparable to the other EU countries. Neither the OECD nor the IFS has additional data for the UK or the other countries in our sample.

### *Independent variables*

The key independent variable in this paper is the level of central bank independence in a country, based on the Cukierman et al. (1992) index (CWN). Despite the popularity of the central bank independence measures, there have been few attempts to code independence annually and identify directly the year of reforms or much effort to extend the CWN coding to cover the reforms of the last twenty years, beyond a handful of countries. Our data does exactly this. The original Cukierman et al. data cover 72 countries for 4 time periods (1950-59, 1960-72, 1973-79, and 1980-1989). Cukierman et al. (2002) and Bodea (forthcoming) extend the coverage to the central banks of Eastern and Central European countries from 1990 to 2002. Jacome and Vazquez (2008) code 24 Latin American and Caribbean countries for 1989 to 2002. Crowe and Meade (2008) cover 69 countries at a two points in time (the 1980s and 2003). We have updated the scores for 81 countries and the European Central Bank to cover the period 1973 to 2010. (A list of the countries covered can be found in Appendix 1.)

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<sup>12</sup> This is also done because expectations about monetary policy become unanchored in high inflation environments (Ghosh et al. 1997, Levy-Yeyaty and Sturzenegger 2001).

The CBI scores are based on a weighted calculation of 16 indicators in 4 categories regarding the Chief Executive Officer, Policy Formation, Objectives, and Limitations on Lending to the Government.<sup>13</sup> The indicators cover such areas as: who appoints the Governor of the Bank, how long is the Governor's appointment, who formulates monetary policy, does the central bank have the stated objective of price stability, and does the central bank set the terms of lending to the government. For each indicator, possible scores run in intervals from 0 to 1 with the intervals depending on the number of categories. For example, there are five categories in the central bank governor's term of office indicator: 0=under four years or at the discretion of the appointer; .25=4 year appointment; 0.50=5 years; 0.75=6 to 8 years; 1=more than 8 years. Scores from the individual indicators are then aggregated into their broader categories. The weights listed in the Appendix were applied to each of the aggregate scores and then the totals were summed.<sup>14</sup> The overall CWN scores range from a possible 0 to a possible 1, with 1 representing the most independent central bank.

Our main measure for democracy is the Polity2 score from the Polity IV database. The Polity 2 score is constructed by subtracting a country's autocracy score from its democracy score. Both the democracy and autocracy scores range from 0 to 10 so the Polity 2 score ranges from -10 to 10. We add 10 to the Polity 2 score to convert the range to a scale of 0 to 20. We supplement the Polity 2 score with Freedom House data. This measure is the average of a country's political rights and civil liberties score. Originally, the lower the Freedom House score, the more democratic the country. We reverse the scale so that a value of 7 is most democratic and a value of 1 is least democratic.

In this paper, our argument is that certain features of democracy give an independent central bank more autonomy in controlling the money supply and fighting inflation. We include several different variables to determine whether the presence of checks and balances or freedom of the press increases

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<sup>13</sup> A list of all of the indicators and their weight are listed in the Appendix.

<sup>14</sup> If the legislation does not cover one of the indicators, it is not coded as 0. Instead, "the weights of the missing variables are allocated proportionally to the remaining variables within the subgroup" (Cukierman, Webb, and Neyapti 1992, p. 12).

the effectiveness of an independent central bank. The first measure is the executive constraints components of the Polity 2 score. This variable measures “the extent of institutionalized constraints on the decision-making powers of chief executives, whether individuals or collectivities”.<sup>15</sup> Scores on the variable range from 1 where there are no limits to an executive’s power to 7 where other political actors are as equally strong or stronger than the executive. We expect that stronger constraints on the executive should make the central bank more effective. Our second measure is the checks variable from the Database of Political Institutions which measures the checks and balances in the political system. As with executive constraints, the more checks, or places in the political system where legislation can be blocked, the higher the value of the variable.<sup>16</sup> Our final measure of checks and balances is Henisz’s (2002) political constraints variable (polcon iii). This measure ranges from 0 to 1 and quantifies the feasibility of policy change by tracking the number of independent veto players and their distribution of preferences in the executive and upper and lower legislative chambers. Again, a higher score represents stronger constraints. To measure media freedom, we use Freedom House’s Freedom of the Press measure. It takes on three possible values. If the press is not free, a country receives a 0; a country with a partially free press receives a 1; and a country with a completely free press receives a 2. For this measure we code any missing data as showing a not free press.

In addition, our models include a number of other relevant variables. All models include both the lagged logged value of GDP (in constant dollars) and lagged trade openness (imports plus exports divided by GDP). The inflation models also include the lagged change in the GDP deflator for the world to control for systemic trends in inflation over time. All three of these variables are from the

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<sup>15</sup> Marshall, Jagers, and Gurr (<http://www.systemicpeace.org/inscr/p4manualv2010.pdf>) , p. 24.

<sup>16</sup> We use the log of the checks variable. Checks equal 1 if the country does not hold competitive elections. For countries with competitive elections: Add 1 for the chief executive; increment by 1 if the opposition controls the legislature; in presidential systems add 1 for each chamber of legislature unless the president’s party has a majority in the lower house and a closed list system is in effect; in parliamentary systems increment by one for each party in the government coalition that is needed to maintain a majority; in parliamentary systems add one for each party in the government that has a position on economic issues closer to the largest opposition party than to the party of the executive; in parliamentary systems subtract 1 for prime minister’s party if there is a closed rule in place.

WDI. A country's exchange rate regime may also affect the inflation rate. To control for this, we include a dummy variable for a fixed exchange rate regime based on Ilzetzki, Reinhart, and Rogoff's coding of the IMF's official classification. We code an observation as having a fixed regime if it is coded as 1 under the IMF's coarse coding.<sup>17</sup> All other values are considered non-fixed regimes. We also use a lagged indicator of a country's fiscal balance. This is the budget deficit/surplus relative to GDP (IMF IFS, EBRD transitional reports, OECD statistics, Brender & Drazen 2005 and Hyde & O'Mahoney 2010). Finally we include an indicator variable for presidential and legislative election years.<sup>18</sup>

#### **4. Results and discussion**

For the main models, we use panel-corrected standard errors with the lagged dependent variable. Panel corrected standard errors correct for heteroskedasticity within panels and contemporaneous correlation across panels. The lagged dependent variable controls for the backwards indexation of inflation and potentially serially correlated error terms (Beck and Katz 1995). For the inflation models, we also include the lag of the change in M2, as M2 is more directly under the control of the central bank than is inflation. In this fashion, we control for the direct, disciplinarian effect of central bank on inflation, so the coefficient on the central bank independence index reflects an additional credibility effect via a more robust money demand and anchored inflation expectations. As robustness checks, we also present results from models with country fixed effects and decade dummies. Although there were a significant number of central bank reforms during our sample period, not all countries changed their central bank laws. When country fixed effects are included, observations from these countries will not be used in estimating the effect of CBI.

In Table 1, we examine whether democracy and democratic mechanisms affect a central bank's control of the money supply. In Model 1 we include a country's Polity score and its central bank

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<sup>17</sup> The four types of regimes are "no separate legal tender," "pre-announced peg or currency board arrangement," "pre-announced horizontal band that is narrower than or equal to +/-2%" and "de facto peg."

<sup>18</sup> Hein Goemans (2011): <http://www.rochester.edu/college/faculty/hgoemans/data.htm>

independence level separately. Central bank independence by itself does not significantly affect the growth rate of M2, while the Polity score does have a negative and statistically significant effect. Most of the insignificance of CBI is driven by non-OECD countries. When we run the model separately on OECD and non-OECD countries, we find a negative and statistically significant effect of CBI in OECD countries but no effect in non-OECD countries. Similarly, if the dependent variable is the log of M2, CBI has a marginally significant impact on the full sample and a strongly significant effect in OECD countries, but no effect in non-OECD countries. These results conform to previous studies which find a stronger effect of CBI in OECD than non-OECD countries. All of the control variables behave as expected. Greater openness and a fixed exchange rate system both decrease the rate of growth of M2, as does a legislative election.

[Table 1 about here]

Model 2 introduces the interaction between the central bank independence index and Polity democracy score. In order to make the coefficients on the interaction variables easier to interpret, we center the Polity scores by subtracting the mean Polity score for the sample from each value of Polity.<sup>19</sup> This does not change the substantive impact of the variables or the interactions nor does it reduce multicollinearity since it is only an algebraic transformation of the data (Brambor, Clark, and Golder 2005). All that centering does is to change the interpretation of the CBI coefficient. With uncentered data, the coefficient is the effect of a one-unit change in CBI when Polity is equal to 0 while with the centered data, the coefficient is the effect when Polity is at its mean. The mean transformed Polity score in the data is about 15, one point below the standard cutoff of 16 for a democracy. In Model 3, we replace the Polity variable with the transformed Freedom House variable, center it, and interact it with CBI.

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<sup>19</sup> Other works that have centered variables for an interaction include Rudolph (2011, AJPS), Dragojlovic (2011, Political Psychology), Mulligan (2011, Political Psychology), Young (2005, JoP).

Also, because the effect of an interaction can vary at different levels of the interacted variables, we graph the marginal effect of CBI (and the 95% confidence interval) as Polity or Freedom House varies in Figures 2 and 3. The graphs show that the results conform to our expectations; the marginal effect of CBI is downward sloping but is only significant at some levels of democracy. At low levels of Polity, the marginal effect of CBI is positive and significant. For most of the middle range of Polity, the marginal effect is insignificant. It only is negative and significant at Polity scores of 17 and higher. Similarly, the marginal effect of CBI is negative and significant only when the Freedom House score is equal to 6 or 7. So, as expected, central bank independence only affects control of the money supply in democracies.

[Figures 2 and 3 about here]

What aspect of democracy allows an independent central bank to have de facto control the money supply? Models 4 through 7 explore this question by interacting CBI with the different operationalizations of democratic mechanisms. Model 4 includes executive constraints (*xconst*) from Polity; Model 5 includes the log of the checks score from the Database of Political Institutions; Model 6 includes Henisz's *polconiii* measure and the final column includes a measure of the freedom of the press from Freedom House. In all models, the democratic mechanism variables are centered around their mean. The marginal effect of CBI at different levels of each of the democratic mechanisms is shown in Figure 4.

[Figure 4 about here]

Again, the results conform to expectations. With the exception of the checks variable, the slope of the marginal effect is downward. For all four variables, the marginal effect of CBI, when significant, is negative. That is, a one-unit change in CBI decreases change in M2. CBI has a significant effect on change in M2 at the highest levels of *xconst*, *polconiii*, and press freedom. *Checks* has a significant effect for logged values of about 1.5 and smaller, corresponding to a value of about 5 on the non-logged measure. Overall, then, the effect of central bank independence on

change in M2 is stronger when there are stronger checks and balances or freedom of the press. The presence of more veto players or a free press allows a central bank to more strongly control the money supply. When the potential for political interference is greater or when the press cannot report on a government's actions, the central bank is more constrained in its policy-making and more subject to the whims of politicians. Does the same situation apply to control of inflation?

We repeat the same empirical modeling exercise for inflation in Table 2 and Figures 5, 6 and 7. In all the models, we include both the lagged inflation rate and the lagged change in the money supply which is more directly under the control of the central bank (we drop this variable in the robustness checks). Including the lagged change in the money supply also allows us to control for the direct, disciplinarian effect of the central bank and focus on the non-technical, expectational effect of a central bank on inflation.

[Table 2 about here]

As shown in Model 1, CBI does have an independent effect on inflation. Greater central bank independence leads to lower inflation, even controlling for the lagged change in M2. More democratic countries also have lower inflation. All of the other control variables behave as expected. Surprisingly, if we run the analysis separately for OECD and non-OECD countries, we do not obtain a significant effect of CBI on inflation in either subsample. It could be the case that, as Blinder argues, the time inconsistency problem is not as severe in developed countries. CBI does have a negative and significant effect on inflation when we use the log of inflation as the dependent variable. It has a weakly significant negative effect in non-OECD countries as well but no effect in OECD countries.

Theoretical expectations lead us to test whether the effect of CBI is conditional on democracy and democratic mechanisms. As in the case of the money growth rate models, the marginal effect of CBI is significant at higher levels of Polity (see Figure 5). However, the marginal effect line is upward sloping, suggesting that the effect of CBI gets closer to 0 at higher values of Polity. This

result is important, suggesting either that political processes in democracies have competing effects on inflation expectations or that our measures do not capture accurately the institutions that condition the effect of central bank independence. Still, the evidence strongly suggests that CBI does not have a significant effect on inflation in autocracies.

Unlike for the rates of growth of M2, there is less evidence that the combination of democratic mechanisms and CBI has a stronger effect on inflation via an expectational channel. As shown in Figure 6, the slope of the marginal effect of CBI is upward sloping for all interaction effects. In other words, the effect of CBI does not get stronger with stronger checks and balances or greater freedom of the press; it gets weaker. Indeed, at higher levels of checks, the effect of CBI is not different from zero.

What explains the difference in the M2 and inflation results? First, as we've noted, the money supply is more directly under the control of the central bank than is inflation. Thus, we would expect a stronger effect of CBI when the central bank has a stronger assurance that politicians will not interfere. Inflation depends on factors beyond the control of the central bank. Too many checks and balances in a country may lead to stasis in policy (other than monetary policy) which leads to expectations of higher inflation. One example may be delays in stabilization policy when there are multiple veto points. Another explanation is that, perhaps, expectations of changes in the constraints that the government faces are a more accurate measure of factors that condition the effect of central bank independence on inflation via an expectational channel.

#### *Robustness of results*

In addition to our main models, we perform a series of additional tests to ensure that our findings are robust to the inclusion of other variables and to alternative specifications of the dependent variables. Table 3 shows the results of the models including the interaction between Polity and CBI using different regression techniques. To save space, we only report only the coefficient for Polity, CBI, and their interaction. The first 4 columns have change in M2 as the dependent variable while the last

five columns have inflation. Models 1 and 5 include country fixed effects to capture the within country effect of central bank independence and the models 2 and 6 include country fixed effects with 5-year period dummy variables. Model 7 shows the results when the lagged change in M2 is excluded from the inflation model. The other models aggregate the data to different levels. We perform the aggregation for two reasons. First, for some countries, the central bank independence index and the democracy scores do not have much time variation. Second, much of previous research uses aggregated data or even cross-section data, so we look into replicating the data structure of earlier work. Models 3 and 8 aggregate the data to 7 roughly half decade time periods (1972-1975, 1976-1980, 1981-1985, 1986-1990, 1991-1995, 1996-2000, 2001-2008). Finally, Models 4 and 9 do the same for overall cross-section averages.

Our theoretical expectations obtain for both fixed effects models. The results also do not change when the lagged change in M2 is excluded. We do not get the same results when we aggregate the data to either 5-year periods or to a cross-section. The marginal effect of CBI is downward sloping but is insignificant for all values of Polity in all cases. Given the number of central bank reforms that have occurred across the countries in our data, it is possible that aggregating the data is affecting the results. That is, by aggregating the data, we are averaging inflation and the scores of central banks pre- and post-reform.

[Table 3 about here]

Additionally, we run the models from Tables 1 and 2 with additional control variables and different dependent variables. We do not show the results here; but they are available upon request. First, we ran the interaction models separately on OECD and non-OECD countries. Surprisingly, the findings hold more strongly for the non-OECD countries than for OECD countries, perhaps because there is not much variation in many of the democratic mechanisms for OECD countries.

We next include a number of additional political and economic controls to see if the results change. The main thrust of the findings remains intact though the specific value of the democratic

mechanisms at which CBI becomes significant varies slightly. First, membership in the European Union may affect a country's inflation rate, even if they do not adopt the Euro. Even prior to the adoption of the Euro, many EU countries tied the value of the currency to the German Deutschmark. Also, prior to adopting the Euro, countries have to achieve certain economic standards, including a minimum level of central bank independence. These factors may cause EU countries to have lower inflation rates controlling for the level of CBI. When an EU dummy variable is included, it has a negative and significant coefficient, but it does not affect our other results.

A country's growth rate may also affect the inflation rate, so we include the change in real GDP in addition to logged GDP. Again, there is no effect on our results. The slope of the CBI's marginal effect is now negative for inflation, but again is significant only at higher values of Polity. Some scholars have suggested that a country's electoral system or a government's ideology may affect the results. We include dummy variables for whether a country has a proportional representation electoral system and a series of dummy variables indicating whether the government is controlled by a right, left, or center party. The coefficient on PR is positive and significant across the models while the dummy variables for ideology are almost always insignificant. Again, our results are not affected.

Political instability may also lead to higher inflation. We include three variables from the Banks Cross-national Time-series data to control for instability. When riots, anti-government demonstrations, and strikes are included in the models, the results do not change. Only the strikes variable has a consistently significant (and positive) effect on inflation or change in M2. Again, the slope of the marginal effect of CBI on inflation as Polity varies becomes negative, but there are no other changes. Finally, the effect of political polarization is difficult to predict. Greater polarization may cause gridlock in the government which may give the central bank more freedom to act and therefore lead to lower inflation. On the other hand, greater polarization may lead to greater policy uncertainty which may increase inflation. We find little effect for polarization and our results do not change.

As discussed above, an alternative way to account for extreme values of the dependent variable is to log it. When we include the logged change in M2 as our dependent variable, the only difference is that the marginal effect of CBI crosses 0 at a lower value of Polity (around 13 rather than 17) and the effect is not significant at low levels of Polity. We use two alternative measures of inflation. In addition to taking the log of inflation, we also include the change in the GDP deflator. Again, we limit the sample to countries with a change in the GDP deflator of less than 150%. Interestingly, the effect of CBI on inflation more closely matches our expectations when either the log of inflation or the GDP deflator is used. In both cases, the marginal effect of CBI as Polity varies is downward sloping and significant at higher levels of Polity. Moreover, the marginal effect of CBI is downward sloping for both *polconiii* and *press* when we use the log of inflation and is downward sloping for all mechanisms except the log of checks when we use the GDP deflator. Our results, therefore, do not depend on our measure of the dependent variable or to the independent variables included.

## **5. Conclusion**

The recent worldwide economic crisis has once again brought central banks and central bank independence to the forefront of news. In the 1990s and 2000s, central banks across the world received greater autonomy from the government. Some independent central banks are using their mandate to achieve price stability to limit the effect of stimulus packages, frustrating politicians in some countries. Whether these banks have been successful at achieving their goal of greater price stability since the reforms has been underexplored.

In this paper, we examined whether central bank independence has more of an effect when a country has institutional mechanisms that limit political interference in a central bank's activities. Institutions such as checks and balances or freedom of the press allow the political opposition and the central bank to highlight and resist attempts by the government to sway the central bank. This should have two consequences on economic performance. First, by limiting interference, these institutions allow a central bank to fulfill its mandate more effectively. The central bank will have stronger

control over the money supply and act in a more disciplined manner, leading to lower rates of money growth. We find strong support for this part of our argument. An independent central bank resists growth in the money supply at higher levels of democracy, when there are checks and balances in place, or when there is freedom of the press.

At the same time, if the public believes that the central bank is free from political interference, it will also lower inflationary expectations, leading to greater price stability. We find mixed evidence for this part of the argument. Although the effect of CBI is significant at higher levels of democracy and democratic mechanisms, the effect does not grow stronger.

One reason for CBI may not have as strong an influence on inflation as democratic mechanisms grow stronger is the increasingly important role of external actors such as the EU or the IMF. As shown in the recent case of Hungary and Serbia, both of these actors can have a strong influence on a country's monetary policy. The Hungarian and Serbian governments in 2011 and 2012, respectively, had threatened to remove a great deal of the central bank's autonomy. Despite protests from the central bank governor, Serbia's government followed through on its threat. Hungary still needed economic assistance from the EU and IMF and both actors refused to negotiate until the government promised to respect the central bank's independence. Hungary did back down. These examples suggest that external actors can protect a bank's independence and are an area for future research.

## Figures and Tables

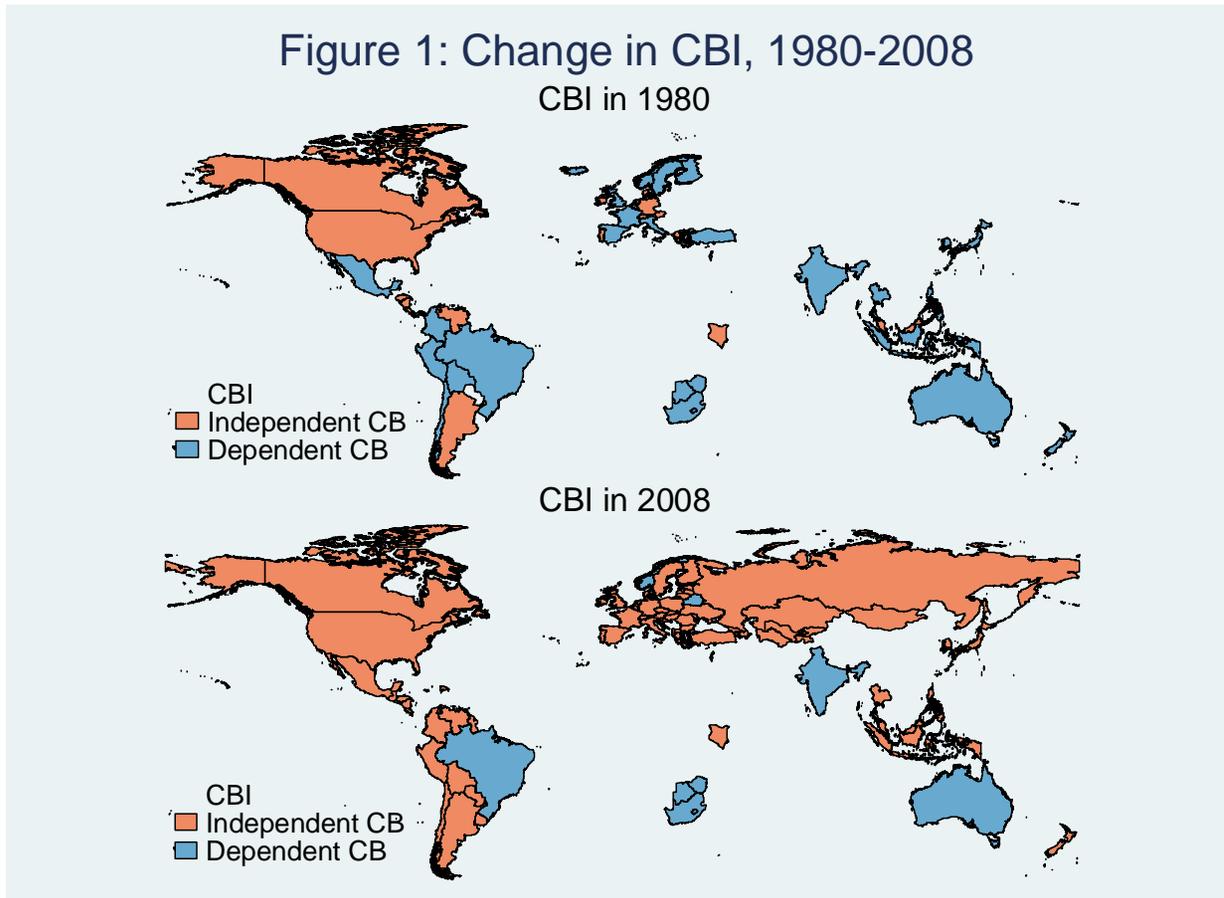


Table 1: Effect of CBI on M2 contingent on democratic mechanisms?

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
CBI	-3.016 (2.565)	-0.350 (3.044)	-4.792 (2.918)	-2.084 (2.865)	-8.812*** (2.636)	-5.508** (2.640)	-5.911* (3.192)
Polity2	-0.923*** (0.115)	-0.252 (0.270)					
CBI * Polity2		-1.754*** (0.678)					
Freedom House			-2.119*** (0.800)				
CBI * FH			-3.384* (1.863)				
XConst				-1.691** (0.861)			
CBI * XConst				-2.899 (2.140)			
Log checks					-7.762*** (2.632)		
CBI * Log checks					6.365 (5.775)		
Polcon						-19.563*** (6.770)	
CBI * Polcon						-6.552 (14.693)	
Freedom of Press							-5.048*** (1.889)
CBI * Press							-3.522 (3.723)
Lag change in M2	0.096*** (0.014)	0.096*** (0.014)	0.094*** (0.014)	0.094*** (0.014)	0.114*** (0.015)	0.097*** (0.015)	0.094*** (0.015)
Lag log GDP	-1.961*** (0.341)	-1.826*** (0.351)	-1.716*** (0.330)	-2.004*** (0.341)	-2.587*** (0.319)	-2.367*** (0.322)	-2.139*** (0.361)
Lag openness	-0.069*** (0.014)	-0.069*** (0.015)	-0.064*** (0.015)	-0.070*** (0.014)	-0.070*** (0.016)	-0.071*** (0.015)	-0.069*** (0.017)
De jure XR	-2.968** (1.171)	-2.745** (1.210)	-2.184* (1.252)	-2.960** (1.192)	-3.308*** (1.205)	-3.023** (1.273)	-2.978** (1.472)
Lag Fiscal balance	-0.049 (0.101)	-0.015 (0.104)	0.017 (0.100)	-0.033 (0.104)	-0.108 (0.105)	-0.093 (0.102)	-0.068 (0.108)
Pres. election	1.458 (1.967)	1.597 (1.938)	1.309 (1.837)	1.713 (1.965)	1.103 (2.036)	1.572 (1.892)	1.940 (2.122)
Legis. election	-2.465** (1.003)	-2.422** (0.986)	-2.141** (0.964)	-2.466** (1.006)	-2.768** (1.080)	-2.621** (1.034)	-3.151*** (1.146)
_cons	75.373*** (9.679)	71.205*** (10.031)	69.891*** (9.707)	76.280*** (9.679)	93.014*** (9.262)	86.732*** (9.398)	80.631*** (10.695)
N	1691	1691	1717	1672	1604	1715	1432
Countries	78	78	79	78	79	79	79
R2	0.249	0.254	0.259	0.254	0.239	0.238	0.252

Notes: \* Significant at .10; \*\* Significant at .05; \*\*\* Significant at .01. Values of change in M2 greater than 150% are dropped.

Figure 2: Marginal Effect of CBI on M2 as Polity varies

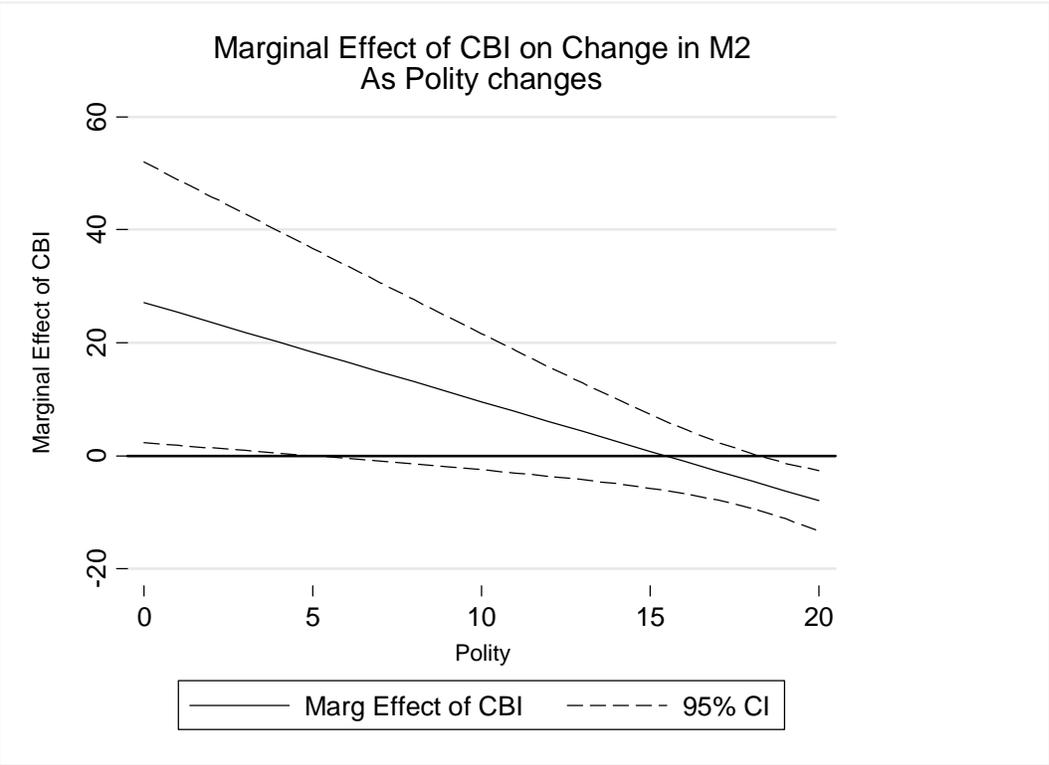


Figure 3: Marginal Effect of CBI on M2 as Freedom House varies

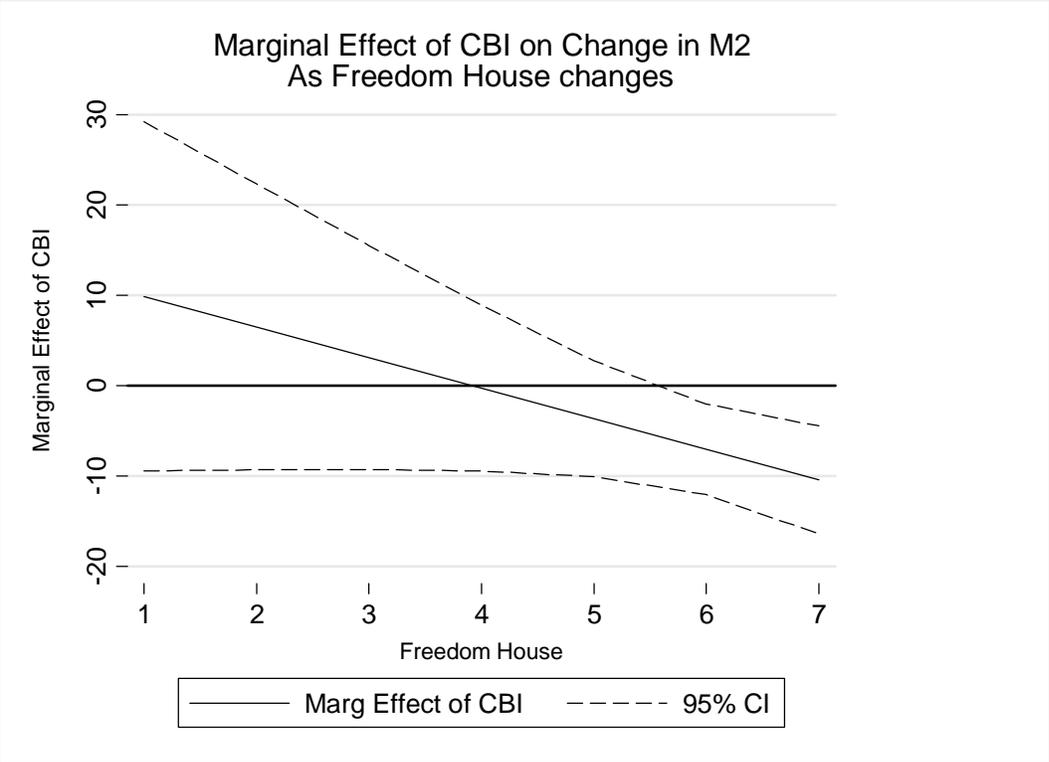


Figure 4: Marginal Effect of CBI on M2 as Democratic mechanisms vary

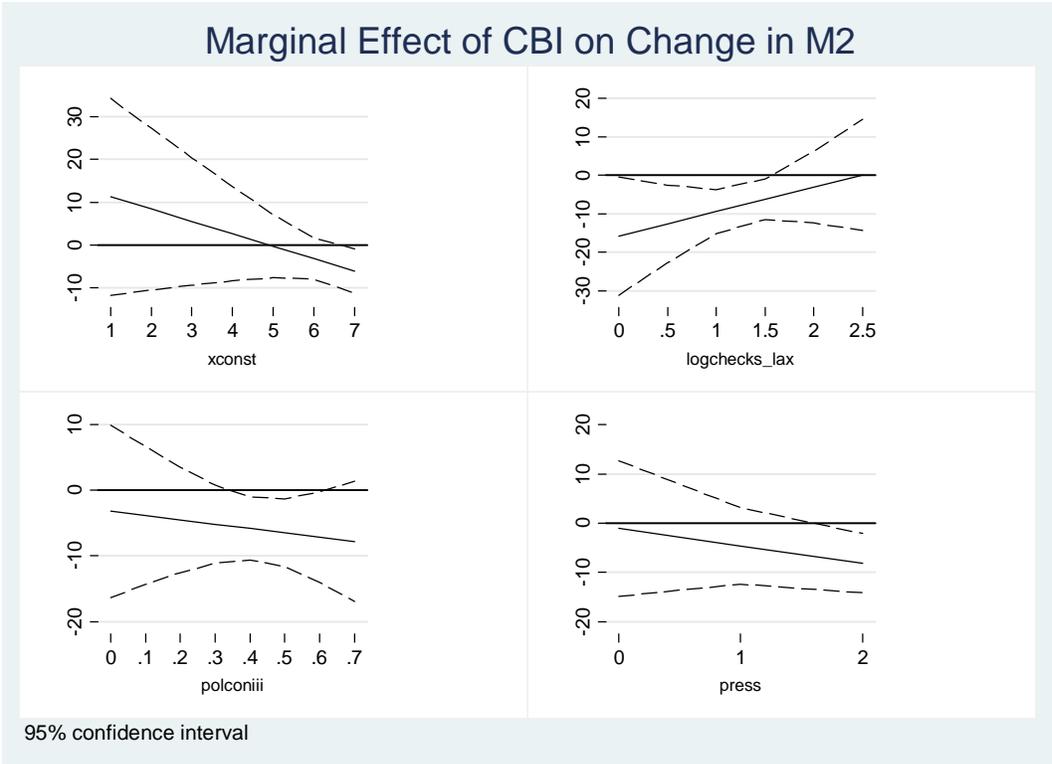


Table 2: Effect of CBI on inflation contingent on democratic mechanisms?

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
CBI	-7.550*** (2.054)	-7.811*** (2.466)	-12.393*** (3.392)	-8.826*** (2.477)	-10.720*** (2.258)	-8.974*** (2.194)	-7.858*** (2.415)
Polity2	-0.367*** (0.083)	-0.430* (0.224)					
CBI * Polity2		0.164 (0.533)					
Freedom House			1.658 (1.157)				
CBI * FH			-2.533 (1.889)				
XConst				-1.751*** (0.675)			
CBI * XConst				1.794 (1.610)			
Log checks					-7.080*** (1.898)		
CBI * Log checks					13.089*** (4.418)		
Polcon						-15.146** (5.904)	
CBI * Polcon						7.210 (11.485)	
Freedom of Press							-3.598** (1.623)
CBI * Press							2.262 (3.053)
Lag inflation	-0.067*** (0.017)	-0.067*** (0.017)	-0.061*** (0.017)	-0.067*** (0.017)	-0.069*** (0.018)	-0.067*** (0.017)	-0.076*** (0.020)
Lag change in M2	0.222*** (0.032)	0.222*** (0.032)	0.202*** (0.030)	0.222*** (0.032)	0.226*** (0.032)	0.223*** (0.032)	0.234*** (0.037)
Lag log GDP	-1.342*** (0.322)	-1.354*** (0.316)	0.416 (0.359)	-1.399*** (0.307)	-1.671*** (0.317)	-1.479*** (0.314)	-1.433*** (0.336)
Lag openness	-0.067*** (0.014)	-0.067*** (0.014)	-0.044*** (0.015)	-0.067*** (0.014)	-0.067*** (0.015)	-0.065*** (0.015)	-0.067*** (0.016)
De jure XR	-4.281*** (1.159)	-4.300*** (1.151)	-6.736*** (1.603)	-4.368*** (1.155)	-4.854*** (1.229)	-4.754*** (1.210)	-3.740*** (1.393)
Fiscal balance	-0.484*** (0.085)	-0.487*** (0.087)	-0.797*** (0.131)	-0.489*** (0.087)	-0.487*** (0.083)	-0.493*** (0.085)	-0.417*** (0.084)
Pres. election	2.298 (1.620)	2.286 (1.621)	1.862 (1.817)	2.570 (1.631)	2.676 (1.685)	2.183 (1.563)	2.552 (1.810)
Legis. election	-1.235 (0.880)	-1.239 (0.881)	-1.552 (1.410)	-1.334 (0.886)	-1.334 (0.895)	-1.000 (0.868)	-1.204 (0.965)
Lag world inflation	0.722*** (0.171)	0.721*** (0.171)	1.428*** (0.311)	0.698*** (0.175)	0.825*** (0.180)	0.765*** (0.178)	1.292*** (0.212)
_cons	46.101*** (9.449)	46.495*** (9.265)	3.508 (10.107)	48.120*** (8.991)	54.910*** (9.460)	49.882*** (9.270)	44.832*** (9.958)
N	1646	1646	1090	1627	1567	1670	1403
Countries	77	77	57	77	78	78	78
R2	0.286	0.286	0.283	0.286	0.289	0.294	0.297

Notes: \* Significant at .10; \*\* Significant at .05; \*\*\* Significant at .01. Values of inflation greater than 150% are dropped.

Figure 5: Marginal Effect of CBI on Inflation as Polity varies

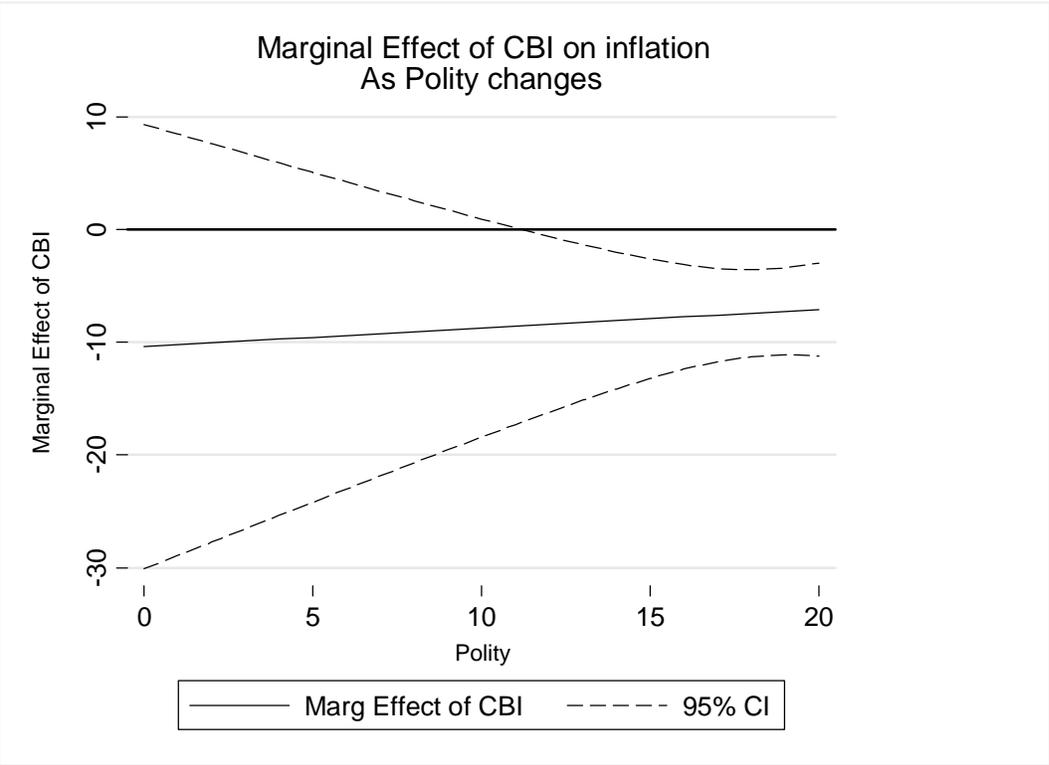


Figure 6: Marginal Effect of CBI on Inflation as Freedom House varies

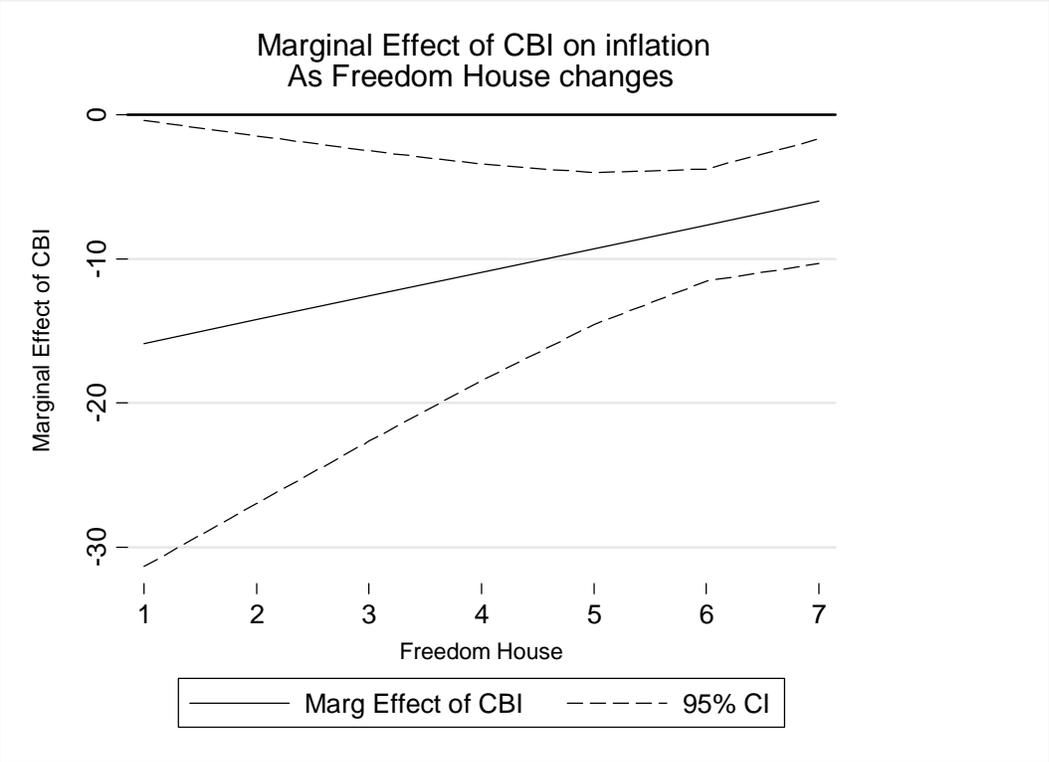


Figure 7: Marginal Effect of CBI on Inflation as Democratic mechanisms vary

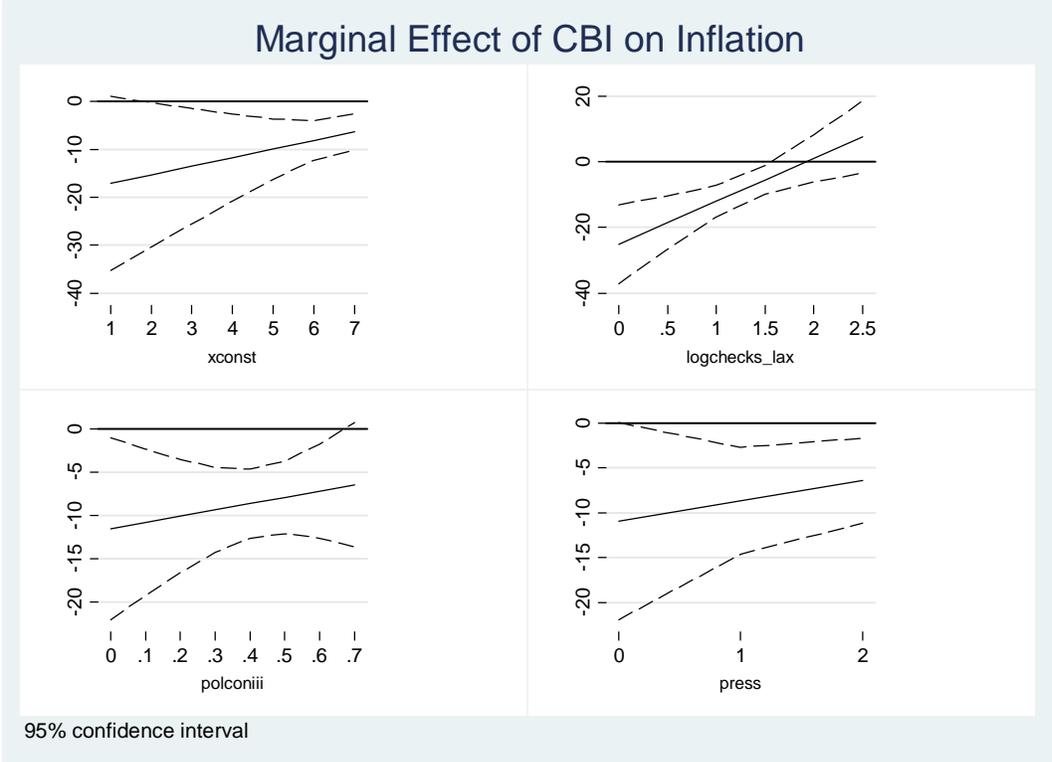


Table 3: Effect of CBI on change in M2: Robustness tests

	Change in M2				Inflation				
	Fixed effects	Fixed effects + Decade dummies	5-year Averages	Cross-section	Fixed effects	Decade dummies	No lagged change in M2	5-year Averages	Cross- section
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
CBI	-0.199** (0.093)	-0.092 (0.086)	6.974 (5.855)	29.258 (25.202)	-13.238* (7.901)	-6.109 (7.325)	-8.618*** (2.646)	7.404 (8.804)	49.618 (29.982)
Polity 2	0.006 (0.006)	0.004 (0.006)	-0.352 (0.527)	1.002 (3.114)	-0.072 (0.438)	-0.258 (0.438)	-0.480** (0.234)	0.375 (0.823)	0.476 (3.744)
CBI * Polity 2	-0.033** (0.013)	-0.029** (0.014)	-1.904 (1.378)	-4.044 (6.654)	-1.184 (1.033)	-0.624 (1.034)	0.093 (0.540)	-2.713 (2.356)	-4.603 (8.322)
N	1517	1507	311	69	1646	1646	1654	304	67
Countries	71	71			77	77	77		
R2	0.099	0.158	0.336	0.325	0.258	0.276	0.191	0.311	0.189

Notes: \* Significant at .10; \*\* Significant at .05; \*\*\* Significant at .01.

Dependent variable in Models 1 to 4 is change in M2 and in Models 5 to 9 is inflation. Models 1 and 5 include country fixed effects with standard errors clustered by country; Models 2 and 6 use fixed effects with decade dummies; Models 3, 4, 8, and 9 use OLS with robust standard errors; Model 7 uses panel corrected standard errors but does not include lagged change in M2.

## Appendix 1: Countries in the sample

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Albania	Greece	Paraguay
Argentina	Guatemala	Peru
Armenia	Guyana	Philippines
Australia	Honduras	Poland
Austria	Hungary	Portugal
Azerbaijan	Iceland	Romania
Belarus	India	Russia
Belgium	Indonesia	Singapore
Bolivia	Ireland	Slovakia
Botswana	Israel	Slovenia
Brazil	Italy	South Africa
Bulgaria	Jamaica	South Korea
Canada	Japan	Spain
Chile	Kazakhstan	Sweden
Colombia	Kenya	Switzerland
Costa Rica	Kyrgyz Republic	Tajikistan
Croatia	Latvia	Thailand
Czech Republic	Lithuania	Trinidad And Tobago
Denmark	Macedonia	Turkey
Dominican Republic	Malaysia	Turkmenistan
Ecuador	Mexico	Ukraine
El Salvador	Moldova	United Kingdom
Estonia	Mongolia	United States
Finland	Netherlands	Uruguay
France	New Zealand	Uzbekistan
Georgia	Nicaragua	Venezuela
Germany	Norway	Zimbabwe

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## **Appendix 2: Components of the Cukierman, Webb, and Neyapti index:**

### **Chief Executive Officer** (weight = .20)

- (a) Term of office (6 categories)
- (b) Who appoints CEO? (6 categories)
- (c) Dismissal (7 categories)
- (d) May CEO hold other offices in government (3 categories)

### **Policy Formation** (weight = .15)

- (a) Who formulates monetary policy? (4 categories)
- (b) Resolution of conflict (6 categories)
- (c) Role in government's budgetary process (2 categories)

### **Objectives** (weight = .15; 6 categories)

#### **Limitations on lending to the government**

##### *Part 1* (weight = .40)

- (a) Advances (weight = .15; 4 categories)
- (b) Securitized lending (weight = .10; 4 categories)
- (c) Terms of lending (weight = .10; 4 categories)
- (d) Potential borrowers from bank (weight = .05; 4 categories)

##### *Part 2* (weight = .10)

- (e) Limits on central bank lending determined by? (weight = .025; 4 categories)
- (f) Maturity of loans (weight = .025; 4 categories)
- (g) Interest rates on loans must be? (weight = .025; 5 categories)
- (h) Is central bank prohibited from buying or selling government securities in primary market? (weight = .025; 2 categories)

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