Regulatory reforms and central bank independence

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Abstract

This paper extends the most commonly used indices of central bank independence by (i) capturing the changes in central bank legislative reforms over time and (ii) including a larger set of characteristics that influence the degree of central bank independence. I propose a dynamic central bank independence index that tracks the evolution of the full set of central bank legislative reforms for a sample of 50 countries during 1972-2014. I then employ this index to investigate the determinants of central bank reforms over times. I find that the likelihood of reforming central bank legislation is mainly driven by an international pressure to reform, such as IMF loan programs or the policy changes required to join a monetary union. I also show that central bank independence evolves endogenously as a response to country-specific politico-economic conditions such as unemployment rates or political stability.

Keywords: Central banks, central bank independence, central bank governance, legislative reforms.

1 Introduction

Over the last thirty years, the mandate of central banks around the world has been progressively narrowed to the goal of price stability. This convergence was prompted by the chronic inflation that characterized most advanced economies in the 1970-80s and independent central banks anchored to an inflation target seemed to be the optimal institutional arrangement to the problem of inflation. However, the 2008-09 global financial crisis reopened the debate on central bank design (Alesina and Stella, 2010). Events that unfolded during this recent crisis, have brought attention to the idea that conventional monetary policy aimed only at price stability may, in fact, increase financial instability.[1] As a result, a wave of reforms concerning

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[1]See, for example, Brunnermeier and Sannikov (2012); Cukierman (2013).

the involvement of central banks in banking and financial supervision followed (for example in UK (2012), Hungary (2013), Russia (2013) and Euro area members (2014)). Central banks are now perceived as public policy institutions with the goal to promote monetary *and* financial stability, a double mandate that might bring a new form of time inconsistency problem (Ueda and Valencia, 2014). Consequently, a growing literature is concerned with understanding if new institutional arrangements are needed for central banks (Issing, 2013; Taylor, 2013).

This paper tries to understand why and how central bank reforms, such as the ones that followed the recent crisis, come about. My objective is twofold. First, I aim at building the first comprehensive survey of central bank legislative reforms for a set of 50 countries during the period 1972-2014. Second, I investigate how these changes in central bank legislation can arise endogenously as a result of country-specific characteristics and/or an international pressure to reform.

A large literature in central banking has investigated the link between inflation rates and central bank independence (Parkin and Bade, 1982; Alesina, 1988; Grilli et al., 1991; Cukierman et al., 1992; Alesina and Summers, 1993). Overall, while most of this research supports a negative correlation between the two, conflicting views on the effectiveness of central bank independence to lower inflation rates still exist (Posen, 1995; Campillo and Miron, 1997). These are generally linked to the sample of countries examined and, in particular, to the fact that central bank independence (CBI) indices are computed at specific points in time (Acemoglu et al., 2008). In this paper, I go beyond the static measures of central bank independence by extending the current CBI indices to capture the evolution of central bank reforms over time. I propose a dynamic index of central bank independence based on the ones developed by Grilli et al. (1991) and Cukierman et al. (1992). However, given that the role of central banks has evolved considerably since the early 90s, when these indices have been created, this new CBI index extends previous ones with several elements that crucially affect the conduct of monetary policy such as central bank accountability and financial autonomy.

The second contribution of this paper refers to the treatment of CBI. Mainstream literature considers central bank independence as an effective device to minimize inflation risks and, therefore, generally treats it as an exogenous variable. However, recent research argues that, while political institutions such as central banks determine the choice of economic policies, they themselves evolve in response to changing political and economic conditions (Hayo and Hefeker, 2002; Aghion et al., 2004; Masciandaro and Passarelli, 2013). I follow a similar approach by considering an endogenous index of central bank independence which can potentially be explained by the legal, political or economic characteristics of a country. The novel dynamic CBI index developed in this paper allows me to capture these directions of causality.

This paper, therefore, goes beyond explaining the established negative relationship between inflation and central bank independence by understanding what triggers central bank regulatory reforms, in particular in times of low and stable inflation. To that end, I first investigate the drivers behind central bank legislative reforms over the last four decades. I relate an index that measures the change in the level of CBI over time to a set of international and domestic factors in a panel of 50 advanced and developing economies. I find that countries are more likely to reform their central bank legislation if they are characterized by a lower degree of independence or are under international pressures to reform such as receiving an IMF loan and becoming a member of a currency union. My second empirical strategy tries to shed a new light on the endogenous determination of the level of central bank independence. Results show that past unemployment rates and political stability have a strong influence on the level of legal central bank independence.

The paper is organized as follows. Section 2 reviews previous literature on central bank independence. Section 3 discusses the methodology followed in building the extended central bank independence index. In Section 4 I discuss the empirical strategies followed and the data. Section 5 presents the main results, while Section 6 concludes.

2 Literature on Central Bank independence

Theoretically, the concept of central bank independence (CBI) is rooted in the time inconsistency problem put forward first by Kydland and Prescott (1977) and formalized in Rogoff (1985) who first suggested the delegation of monetary policy to institutions (central banks) that have a clear objective of price stability. Since then central bank independence has not only shaped the design of central banks over the last three decades, but also created avenues for investigating how independent central banks behave and affect macroeconomic indicators such as inflation rates.

A large literature has studied the link between central bank independence and macroeconomic performance. A first step in this endeavor is the identification of measures able to capture the degree of central bank independence from the government. Parkin and Bade (1982); Alesina (1988); Grilli et al. (1991); Cukierman et al. (1992) are among the first to propose indices aimed at capturing the degree of central bank independence. These indices focus on the statutes of central banks to capture in the most objective way the degree of independence of the central bank. They consider three crucial characteristics such as the appointment of central bankers, the presence of a clear objective function, the amount of power the government has on the central bank, including its ability to borrow from it.

Following the development of these measures of central bank independence an extensive empirical literature tested the effectiveness of CBI in lowering inflation rates. Overall, early literature such as Alesina (1988) or Grilli et al. (1991) supports a negative and statistically significant correlation between CBI indices and inflation.[2] Nonetheless, conflicting views still exist.

One set of concerns regards the heterogeneity of the link between CBI and inflation across different samples of countries or when different control variables are included. Cargill (1995) shows that the negative relationship between CBI and inflation is not robust in a sample of industrialized countries. Evidence from developing countries is also mixed. For example, Lybek (1999) looks at Baltic and ex-Soviet Union states and shows that central banks characterized by a higher degree of autonomy and accountability do not only enjoy lower inflation rates, but also a higher average real growth, after the initial period of reforms. Similarly, Cukierman et al. (2002) analyze 26 central banks in Former Socialist Economies. However, they find that CBI is unrelated to inflation during the early stages of liberalization of countries' economies, but the link becomes significant when countries become more liberalized. These findings suggest that the reduction of inflation and the consequent negative relationship with CBI indices might also be connected to the implementation of other sound economic policies together with the CB legislative reforms. This is also confirmed in Jacome and Vazquez (2008) for a sample of Latin American and Caribbean countries.

Evidence against a negative correlation between central bank independence and inflation is also found when controlling for different country characteristics. For example, Campillo and Miron (1997) and Oatley (1999) show that CBI has no effect on inflation when they include different sets of control variables such as the degree of openness, political instability or historical levels of debt and inflation. However, these findings themselves may not be robust as shown in Brumm (2000), who points out significant measurement errors in Campillo and Miron (1997) in particular and confirms the strong negative correlation between inflation and central bank independence.

A second set of difficulties in assessing the impact of central bank independence concerns the way in which CBI indices are built. It might be the case that *de jure* measures do not represent actual central bank independence, in particular in developing countries where written rules are often circumvented by *de facto* procedures. Cukierman et al. (1992) build a measure of *de facto* independence as the turnover rate of the central bank governor and find that for developing countries, the link between CBI and inflation still holds when we look at *de*

[2]See Eijffinger and de Haan (1996); Arnone et al. (2006); Cukierman (2008); Klomp and de Haan (2010) for extensive literature reviews on the relationship between CBI indices and inflation.

facto measures of independence. However, using an updated measure of the rate of turnover on recent data, Crowe and Meade (2007) cannot find any meaningful statistical relationship. They conclude that this is due to the very low correlation between *de jure* measures of CBI and the turnover rate which might, in fact, capture different dynamics. At the same time, *de jure* indices themselves seem quite subjective since Mangano (1998) points out that the two most common measures of CBI, Grilli et al. (1991) (GMT) and Cukierman et al. (1992) (CWN) capture quite different information. For example, 40 percent of the points collected by the GMT index are not present in the CWN one. Acemoglu et al. (2008) circumvent this problem by constructing a simple dummy variable which captures the year of major reforms leading to increases in CBI. Their approach highlights the tendency of more recent studies to capture the changes in central bank legislations over time (see also, Crowe and Meade, 2008).

Finally, disregarding the robustness of the negative correlation between CBI and inflation, a more recent stream of the literature discusses the issue of causality and looks at the endogenous evolution of central banks. A typical example of an endogenous creation of central banks is represented by the German Bundesbank whose statute has been modified in 1957 as a result of a strong public aversion towards inflation after periods of hyperinflation in Germany (Alesina and Summers, 1993). Thus, it might be the case that CBI is not imposed "exogenously", but evolves in response to changing political, social or economic factors.[3]

Posen (1995) discusses these issues of causality between CBI and inflation by suggesting that the different levels of CBI reflect differences in countries' financial opposition to inflation. He argues that CBI lead to a reduction of inflation in OECD countries because in these countries a large part of the population actually prefers low and stable inflation. Other cultural characteristics are discussed in de Jong (2002), who finds that the distribution of power in the society and the degree of uncertainty avoidance might also explain differences in CBI. Political systems can be an equally important factor influencing a country's degree of central bank independence. For example, Moser (1999) finds that legal independence is significantly higher in OECD countries with legislative processes characterized by extensive checks and balances. Keefer and Stasavage (2003) look at the *de facto* CBI and show that the monetary policy credibility (lower governor turnover) is enhanced by the presence of multiple veto players in the government. In Alesina and Stella (2010) the fractionalization of the party system might make the delegation of monetary policy to independent experts more cumbersome given the conflicts among groups. Finally, Cukierman and Webb (1995) also find a certain level of endogeneity of the *de facto* index of CBI, by showing that the probability

[3]A more general literature on "endogenous political institutions" makes a similar argument. For example, Aghion et al. (2004) consider the case of the Bundesbank to stress the fact that, often, central banks have been made more independent, to "insulate" monetary policy in periods of high inflation.

of a change of the central bank governor is more than two times higher in periods within six months after a political transition.

These empirical findings on the endogeneity of CBI are, nonetheless, limited to small samples and sensitive to the choice of CBI indices (see de Haan and van't Hag, 1995, for a critical assessment). Yet, the need to study the determinants of central bank independence is greater in periods in which the design of central banks is put into question (Masciandaro, 2013). The 2007-09 financial crisis has brought into question many of the established facts about monetary policy and its institutions (Alesina and Stella, 2010). For example, Masciandaro and Passarelli (2013) explain the recent developments in central banking by focusing on a political economy model of bailouts. They argue that the distribution of financial wealth among individuals might represent one of the drivers of the decision of a country to maintain or reform its central bank regime.

By proposing a more comprehensive index of central bank independence, this paper tries to overcome some of the limitations of previous research. I build a new index of CBI that extends both the Grilli et al. (1991) and Cukierman et al. (1992) indices of *de jure* independence for a large sample of 50 countries. This index also goes beyond the static measures of central bank independence generally employed in the literature by tracking the evolution of reforms over several decades. The main advantage of employing dynamic CBI indexes is the ability to perform a more rigorous test of the endogenous evolution of central bank independence.

3 Indices of Central Bank Independence

This section describes the new index on central bank legislation proposed in this paper. I also provide an overview of the extensive survey of central bank statutes for a sample of 50 countries over the period 1972-2014 and descriptive statistics.

3.1 Measures of CBI

This paper presents a new and comprehensive database comprising a wide range of central banks' characteristics based on their charters. The survey answers to over 140 questions on the following areas of central bank institutional design: a) monetary policy, b) governance, c) banking and financial supervision, d) financial independence, e) accountability, and f) transparency.[4] The collected information provides a unique data source for updating and extending the literature on central bank independence indices for a sample of 50 countries during 1972-2014.

[4]The full set of questions is available upon request.

Classical measures of the degree of central bank independence are build using two different methodologies: i) *de jure*, and ii) *de facto* measures of independence. The first consists in the codification of central banks' statutes to obtain information concerning, among the others, the objective function of the central bank, the procedures for the appointment of the governor and of other board members, as well as the authority responsible for monetary policy and the procedures for the resolution of conflicts between the central bank and the government. *De facto* indices, on the other hand, associate the independence of central banks to the autonomy of its governor, i.e. a higher turnover rate of the central bank governors is associated to a lower independence of the central bank. *De facto* indices, however, are know to suffer from important limitations such as the fact that the reasons behind the dismissal of the governor are not considered or the fact that they focus on the governor only and overlook the entire board of directors (see, among others Dreher et al., 2008; Arnone and Romelli, 2013). I thus focus my analysis on *de jure* CBI indices.

The most extensively used indices of legal independence are those of Grilli et al. (1991) (GMT) and Cukierman et al. (1992) (CWN). Thus, as a first step in my analysis, I compute the dynamics of these indices by tracking the evolution of the reforms that modify the degree of CBI over the period 1972-2014. I then extend these two indices along several lines and propose a new dynamic index of CBI, which I call the extended CBI index (ECBI). This extended index incorporates the characteristics of *both* the CWN and GMT indices. This overcomes an important criticism of these classical CBI indexes since only nine characteristics are common to both indices, out of a respective total of 15 in GMT and 16 in CWN (see Mangano, 1998). Apart from integrating these two well-know indices, the ECBI also incorporates new aspects that capture good practices in central bank accountability and financial independence. Table 1 presents the summary of the characteristics collected in the CWN and GMT indices, as well as, in the extended ECBI index. The structure and different scores assigned in the ECBI index are summarized in Appendix Table A2.

The most important innovation of the ECBI index is represented by the introduction of two criteria on accountability and financial autonomy. Previous literature has argued that central bank accountability nowadays goes in tandem with central bank independence (Jacome and Vazquez, 2008). The first point on accountability (Central Bank reporting) clarifies the legal provisions that require central banks to report, on a regular basis, the fulfillment of their policy targets. The second one concerns the publication of the financial statements and the maximum level of independence is reached when the central bank financial statements are published on a regular basis, following international accounting standards, as well as when these are certified by an independent auditor. The financial autonomy criterion concerns the

Table 1: Institutional characteristics of CBI indices

Criteria	GMT	CWN	ECBI
Political Independence			
Governor and Central Bank Board			
Who appoints the Governor	*	*	*
Term of office of Governor	*	*	*
Dismissal of Governor		*	*
Governor allowed to hold another office in government		*	*
Who appoints the Board Members	*		*
Term of office of Board Members	*		*
Dismissal of Board Members			*
Government representatives in the Board	*		*
Policy Formulation			
Who Formulates Monetary Policy	*	*	*
Final Authority in Monetary Policy	*	*	*
Objectives			
Central Bank's Statutory Goals	*	*	*
Economic Independence			
Lending to the Government			
Direct credit: Not Automatic	*	*	*
Direct credit: Interest Rates	*	*	*
Direct credit: Maturity of Loans	*	*	*
Direct credit: Type of Limit	*	*	*
Who decides financing conditions to Government		*	*
Prohibition from buying Government securities in Primary Market	*	*	*
Instruments and Supervision			
Who fixes key Policy Rates	*		*
Banking Sector Supervision	*		*
Accountability			
Central Bank Reporting			*
Central Bank Financial Statements			*
Financial Autonomy			
Budget Approval			*
Profits Distribution			*

Notes: GMT = Grilli et al. (1991); CWN = Cukierman et al. (1992); ECBI = Extended CBI Index

identification of the authority that determines and approves the central bank's budget, as well as the requirements for profits allocations. These last two features are of particular interest during crises periods, when, as it happened following the global financial crises of 2007-09, the total amount of central banks assets increase exponentially. In this context, the presence of limits on the determination of the central banks' budget and on the distribution of their net profits, may limit their capacity to implement their monetary policy. Regarding profits allocation, in particular, Reis (2013) discusses the fact that, under fiscal stress, governments will always be tempted to demand the central bank to generate more profits and transfer them to the Treasury.

The ECBI also expands the GMT political independence index by collecting additional information for the dismissal of the Governor and other board members, as well as by identifying if the Governor is legally allowed to hold other offices in the government. Moreover, their economic independence index is augmented by including information on the authority responsible for setting the financial conditions on lending to the Government. Finally, it should be also noticed that, the index takes values between zero and one, with larger values indicating an higher degree CBI, while the GMT index assign zero or one point for each one of the 16

criteria specified.

While for most of the 23 criteria analyzed in the ECBI index, I follow the codification implemented by Cukierman et al. (1992), I depart from their methodology in several ways. First, I collect information on the appointment, terms of office and dismissal of the rest of the board members. Second, in line with GMT, I identify if Government's representatives are legally required to become board members. Finally, I assess whether the central bank is the authority responsible for fixing the policy rates in the country and if this institution is also involved in the supervision of the banking sector in the country.

3.2 Central Bank legislative reforms

I focus my analysis on the post Bretton Woods period (1972-2014). This time span allows the identification of all the reforms adopted by central banks in advanced economies after Bretton Woods, the full set of reforms implemented by European countries before and after the creation of the euro, as well as the reforms adopted by many Former Socialist Economies after the fall of the USSR.

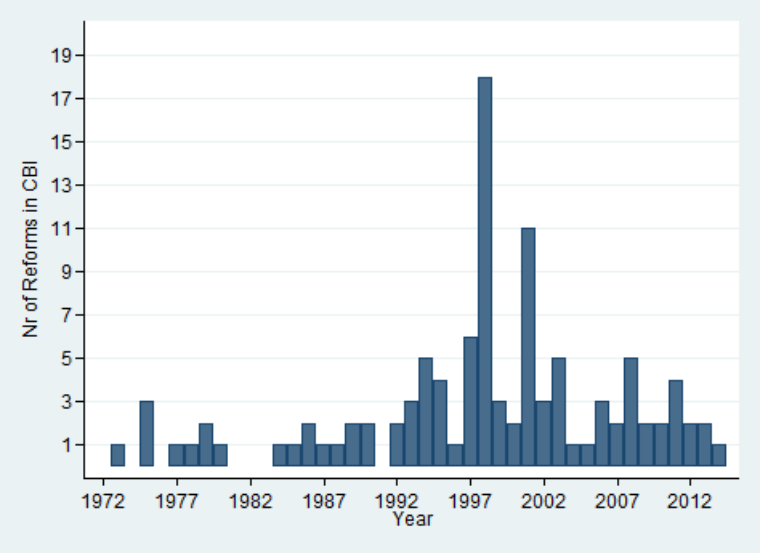
Over this four decades period, I identified 751 central bank legislative changes, out of which 447 are documented by statutes or reprints of the central bank charters and 304 are legislative amendments.[5] Over the analyzed period, countries have modified, on average, their legislation about 15 times.

I build dynamic central bank independence indices by recomputing the ECBI, GMT and CWN indices at each date when a legislative change took place. These new indices will thus identify the full set of central bank legislative reforms that modified the degree of central bank independence in the analyzed countries, during 1972-2014. Out of the 751 legislative changes identified, 107 of them had an actual impact on the degree of CBI. Figure 1 provides an idea on the distribution of central bank legislative reforms over time. Interestingly, after 1992, every year has been characterized by the implementation of at least an effective reform. This finding confirms the popular belief that the spread of the literature on central bank independence might have partially stimulated the reform process. Clearly, the highest number of changes in CBI have been implemented in 1998, year in which the 11 countries that initially joined the euro, moved from having 11 national banks to a unique authority, the European Central Bank (ECB). However, the process of reforms in CBI did not end with the creation of the ECB, but continued over the 2000s and finally a new impetus for reforms started after the 2007-09 financial crisis.

Figure 2 presents the trend in adopting reforms by plotting the actual level of CBI (proxied

[5]The full list of the analyzed documents is available upon request.

Figure 1: CB Legislative reforms (1972-2014)



by the ECBI) in each country between 1960 and 2014. Comparing the GMT and the CWN indices of CBI in 1992 versus 2003, Arnone et al. (2009) document a significant increase in CBI, in particular for developing countries. This trend towards an higher degree of CBI over time is also clear in Figure 2.

Figure 2: Evolution of Central Bank Independence (1960-2014)

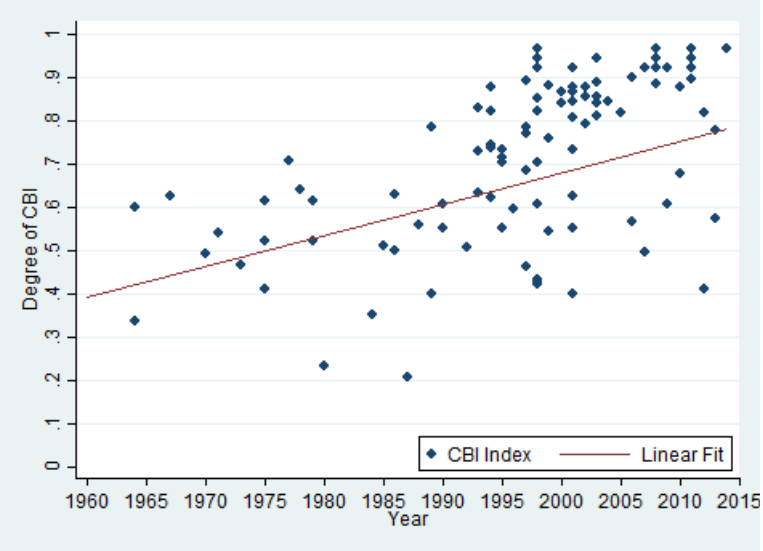


Table 2 looks in more detail at the evolution of the three indices of central bank independence. It shows a clear increase in the mean level of CBI in all three measures, which almost doubled between the 1970s and nowadays. It also clearly stresses the higher number of reforms captured by the enhanced ECBI index proposed in this paper. Finally, Table 2 also points out a key difference between the dynamic indices of independence proposed in this paper and

Table 2: Evolution of central bank independence indices

Decade	# of Ctys	ECBI				GMT				CWN			
		# of Ref	*Mean*	*Min*	*Max*	*# of Ref*	*Mean*	*Min*	*Max*	*# of Ref*	*Mean*	*Min*	*Max*
1972-1979	28	8 *(3 ; 5)*	0.490	0.201	0.783	6 *(3 ; 3)*	0.401	0.125	0.750	8 *(2 ; 6)*	0.390	0.090	0.735
1980-1989	30	9 *(2 ; 7)*	0.503	0.206	0.783	6 *(2 ; 4)*	0.411	0.063	0.750	7 *(0 ; 7)*	0.412	0.135	0.799
1990-1999	49	42 *(3 ; 39)*	0.594	0.206	0.963	37 *(3 ; 34)*	0.528	0.063	1	37 *(2 ; 35)*	0.533	0.135	0.979
2000-2009	50	31 *(2 ; 29)*	0.755	0.387	0.963	26 *(2 ; 24)*	0.720	0.125	1	24 *(1 ; 23)*	0.746	0.193	0.979
2010-2014	50	11 *(5 ; 6)*	0.777	0.399	0.963	8 *(4 ; 4)*	0.744	0.125	1	5 *(0 ; 5)*	0.774	0.193	0.979

Notes: ECBI = Extended CBI Index; GMT = Grilli et al. (1991); CWN = Cukierman et al. (1992).
All indices goes from [0 ; 1]. Number of Negative and Posivive changes in CBI into parentheses (N ; P).

previous attempts to look at changes in CBI such as Acemoglu et al. (2008). Acemoglu et al. (2008) builds a dummy variable that captures reforms in CBI by simply looking at the CWN index computed at different points in time. They identify 40 major central bank reforms for a sample of 52 countries over 1972-2005. This approach, however, overlooks the fact that significant changes in CBI may have occurred between the dates at which the CBI indexes are computed. Indeed, by looking at the actual legislative changes, I identify more than 100 reforms that modify the degree of CBI in my sample of 50 countries. This shows that CBI indices are rather dynamic over time and that countries reform their central bank legislation quite often. This motivates my main empirical investigation in which I try to understand the triggers behind these many reforms.

4 Empirical strategies and data

I follow two empirical strategies to investigate the determinants of reforms in central bank legislation as well as the level of CBI. First, I look at the role of country-specific characteristics, international factors or financial crises on the probability of legislative reforms that modify the degree of central bank independence, by estimating the following model:

$$Prob(e_{it} = 1) = F(\phi_t^{Crises}\beta_C + \phi_t^{Intern}\beta_I + \phi_t^{Pol}\beta_P + \phi_t^{Econ}\beta_E), \quad (1)$$

where e_{it} is a reform dummy variable that takes the value 1 if country i is experiencing a reform in year t; ϕ_t^{Crises} is the vector of crises variables; ϕ_t^{Intern} is the vector of international variables; ϕ_t^{Pol} is a vector of political economy characteristics; and ϕ_t^{Econ} is the vector of economic variables. The choice of these explanatory variables is discussed below. The appropriate methodology to estimate Equation (1) is determined by the distribution of the cumulative distribution function, $F(\cdot)$. Since episodes of reform occur irregularly (95% of the sample

is zeros), $F(\cdot)$ is asymmetric. Therefore, I estimate Equation (1) using the complementary logarithmic (or cloglog) framework, which assumes that $F(\cdot)$ is the cumulative distribution function (cdf) of the extreme value distribution. In other words, this estimation strategy assumes that:

$$F(z) = 1 - exp[-exp(z)]. \tag{2}$$

The reform dummy is created by identifying the year in which the degree of CBI has been modified. As mentioned in Section 3, over the period considered, 107 reforms changed the degree of CBI of at least one of the indices used in this paper. More specifically, the ECBI index has been modified 101 times, 83 times the GMT, while the CWN one has been amended in 81 cases. The difference in the number of changes adduced to the ECBI index with respect to the CWN one are mainly driven by the fact that the latter index does not capture information on the central bank involvement in banking supervision. Consequently, the CWN index is not influenced by the legislative reforms implemented after 2008 that assigned or increased the central banks' supervisory power for the conduct of prudential banking supervision.

The second methodological approach looks at the endogenous determination of central bank independence. The theoretical arguments reviewed in Section 2 argued that central bank institutional design is not "exogenous", but can evolve as a response to politico-economic factors. The dynamic central bank independence indices constructed in this paper can allow to test this endogeneity hypothesis in a rigorous way. To do so, I estimate the following panel model:

$$CBI_{i,t} = \alpha_0 + \alpha_1 CBI_{i,t-1} + \alpha_2 \Upsilon_{i,t} + \alpha_3 \Gamma_i + \epsilon_{i,t}, \tag{3}$$

where $CBI_{i,t}$ is an index of *de jure* CBI of country i in year t, $CBI_{i,t-1}$ is the lagged level of CBI and $\Upsilon_{i,t}$ and Γ_i are vectors of country politico-economic characteristics which includes: unemployment rates, measures of political stability, real GDP per capita, and dummies for currency union membership, common law system and inflation targeting regime.

4.1 Explanatory variables

The choice of explanatory variables reflects the theoretical and empirical literature reviewed in Section 2. To explain why countries reform their central bank legislation, I consider four sets of explanatory variables: a) crisis episodes, b) international factors, c) political-economic elements, and d) economic development. It is often stated that "it takes a crisis to reform" (Masciandaro et al., 2008). Thus, in the wake of crises, governments might modify the degree

of independence of the central bank. For example, especially following the 2007-09 financial crisis, many governments have assigned (removed) the supervision of the banking sector to (from) the central bank. Accordingly, I introduce a financial crisis dummy that takes the value 1 if a country experienced a systemic banking crisis in the last two years. Apart from financial sector crises, episodes of high inflation are of particular importance in explaining the probability of reforms in central banking. I thus include a dummy variable that captures the presence of an inflation crisis in the country, i.e. annual inflation rates higher than 40% in the previous period (see Reinhart and Rogoff, 2004). It can be expected that governments, after periods of high inflation, will try to stabilize the inflation expectations by assigning more independence to the monetary policy institution.

An international pressure to reform could also explain why countries reform their central bank legislation. I consider two proxies for such international conditions: IMF loan programs and membership to a currency union. The International Monetary Fund clearly states that an IMF loan provides a cushion that eases the adjustment policies and reforms that a country must make to correct its balance of payments problems and restore conditions for strong economic growth. Given that central bank independence has often been considered as a *free lunch* among these reforms, one might expect improvements in CBI as one of the conditions imposed for obtaining such loans (see Grilli et al., 1991; Gutierrez, 2003, among others). The second variable of international pressure is represented by a currency union dummy variable, that assumes value 1 if the country is member of a currency union. Given the sample of countries analyzed the Euro area is the only currency union captured by this variable. Prior to joining the European Monetary Union and adopting the euro, countries are required to grant more independence to their central bank. After a country becomes part of the Euro area, its monetary policy institution is the European Central Bank, that has been created following the best practices in central bank independence.

Studies on political economy and central bank independence have shown that the degree of *de facto* central bank independence is effectively influenced by political cycles (see Cukierman and Webb, 1995). The idea behind these studies is that less independent central banks might experience higher turnover rates of the central bank governor just after government changes. However, these studies disregard the fact that the terms of office of the central bank governor might overlap with the one of the government. The motivation for including government changes rests in the fact that changes in the political orientation of the government might stimulate the implementation of reforms. For example, only 4 days after the start of Tony Blair's mandate, on May 6 1997, the new Chancellor of the Exchequer of Great Britain, Gordon Brown, announced the intention of the government to implement the "most radical

internal reform to the Bank of England since it was established in 1694". Thus, a dummy variable capturing changes in the political orientation of the government in the last two years is expected to positively impact the probability of central bank reforms. Following previous research such as Masciandaro et al. (2008) I also consider the legal origin hypothesis (La Porta et al., 1999). Countries' legal origins, i.e. common, civil or socialist law have been related to several institutional development such as the evolution of financial sector development. Masciandaro et al. (2008) further argue that the common law countries have a more market friendly environment which might explain the assignment of financial supervision to an authority different from the central bank. However, their results provide little evidence suporting this hypothesis. Regarding the probability of reforming the legislation of the central bank, one can also argue that common law systems, which rely less on legislative processes or regulations issued by the executive branch, are less likely to reform their level of CBI.

Turning to economic variables, I control for the level of GDP per capita as a proxy for the level of development. The impact of this variable is a priori ambiguous. Similarly, I control for the degree of internationalization of a country proxied by the KOF Index of Globalization, as well as, a measure of financial sector development and liberalization captured by the index of financial reforms developed by Abiad et al. (2008). As discussed in Section 2, previous findings such as Cukierman et al. (2002) suggest that the negative relationship between CBI and inflation is connected to the implementation of other sound economic policies together with the CB legislative reforms. Thus countries with a higher index of globalization or financial reforms might also be more likely to reform their level of CBI.

In the second empirical strategy, I look at the determinants of the actual level of central bank independence. Given the evolution of CBI indices towards higher levels of independence as depicted in Figure 2, I expect previous levels of CBI to positively impact the current one. The long run trade off between the inflation and unemployment level is well established in economic literature. The literature on central bank independence has also tried to identify a link between unemployment and CBI. For example, Eijffinger and Schaling (1995) suggest that an higher natural rate of unemployment is associated with an higher degree of central bank independence. The logic behind this idea is that countries characterized by high unemployment have a greater inflationary risk. Thus, the credibility cost for the government will be higher in these countries and this will provide a good incentive to assign an higher degree of independence to the central bank. Accordingly, I include the lagged level of unemployment rates in the estimations. Similarly, the degree of political stability can influence the level of CBI. I proxy government stability following Kaufmann et al.'s (2010) index of political stability and absence of violence that reflects the perception of the likelihood that the government

will be destabilized. We can expect that more stable governments are more likely to adopt reforms, including granting more independence to the monetary policy authority. Another variable that can influence the level of CBI is the adoption of an inflation targeting (IT) regime. At first sight the impact of this variable is less obvious. IT adopting countries should generally be characterized by higher levels of independence if one only looks at the objective of price stability. However, adopting an inflation targeting might be consider an alternative to increasing the *de jure* level of independence, and so, could be negatively correlated to the level of CBI. Finally, I also include some of the explanatory variables used to explain the probability of reforms such as the level of GDP per capita, the currency union and common law dummies. I describe in more detail the definition of all these variables and sources of data in Appendix Table A3.

5 Main results

I start with the results on the drivers of the likelihood that a country implements reforms that modify the degree of central bank independence. Table 3 presents the cloglog estimation in Equation (1).

CBI is measured by the ECBI index in columns 1–3, the GMT Index in columns 4–6 and the CWN index in columns 7–9. Columns (1), (4) and (7) present the baseline regression for each of the three indices. I find a strong negative correlation between the lagged level of CBI and the likelihood of reforms which is present across all specifications. This shows that countries characterized by a lower CBI in the previous period are more likely to reform their central bank legislations. This result confirms the intuition in Figure 2 which suggested a trend towards higher levels of independence through time. Next, legislative changes are more likely to happen in countries that have been assisted by an IMF loan program in the last 2 years. This is expected since the IMF is know to provide technical assistance to borrowing countries in order to help them adopt the best standard in central bank institutional design (Lybek, 1999). By the same logic, countries that have received an IMF assistance will have an higher probability to implement reforms that improve their CBI. A similar argument in Gutierrez (2003), discusses how in Latin America central bank legislative reforms were often one of the conditions imposed by international financial institutions, such as the IMF and the World Bank, for the disbursement of loans to the country.

The results also confirm the positive relationship between the probability of reforms and the currency union dummy. This is expected since countries that join a currency union like the Euro area also undergo significant reforms in their central bank legislation. Finally, I find

that countries in a Common Law system are characterized by a lower probability of reforming their *de jure* level of central bank independence.

In columns (2), (5) and (8), I introduce an index of financial reforms. Results confirm the fact that countries characterized by an higher degree of financial development have an higher probability to reform their central bank institutional design. However, this index is available for a limited number of countries and its data coverage ends in 2005. With the introduction of the financial reforms index, the dummy variable for IMF loan programs loose its significance. This result could be driven by the fact that most of the countries that received IMF loans during the analyzed period were developing countries and the financial reform index is not available for most of them. I also find that the inflation crisis dummy is significant and positively related with the likelihood of reforming the central bank legislation in this extended specification. This means that countries that experienced high inflation in the previous period are more likely to reform. Interestingly, the financial crisis dummy is not significant in any specification.

Finally, in columns (3), (6) and (9) I replace the index of financial development with the KOF index of globalization available for a bigger set of countries. The obtained results are similar to the ones reported in columns (1), (4) and (7). Moreover, more globalized economies are found to have an higher probability of reforming their central bank independence.

Table 3: Drivers of CB legislative reforms

Dependent variable: CBI Reform dummy									
	ECBI			GMT			CWN		
Explanatory variables:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
L.CBI	-2.50727***	-4.12027***	-3.24138***	-1.58380***	-2.75552***	-2.32372***	-3.13597***	-4.69251***	-4.35898***
	(0.685)	(0.798)	(0.703)	(0.530)	(0.645)	(0.580)	(0.631)	(0.780)	(0.692)
L.Inflation Crises	0.53561	1.10465**	0.83567**	0.58510	1.18378**	0.81922*	0.37787	0.89479*	0.65542
	(0.367)	(0.432)	(0.405)	(0.401)	(0.480)	(0.431)	(0.415)	(0.470)	(0.454)
L.Crises	-0.13417	0.42717	-0.17906	-0.03222	0.44700	-0.10342	-0.19912	0.11276	-0.24797
	(0.399)	(0.442)	(0.401)	(0.431)	(0.496)	(0.433)	(0.468)	(0.517)	(0.465)
IMF Programs (2y)	0.72527**	0.75020*	0.95143***	0.85508**	0.82432*	1.27707***	0.66015*	0.50293	1.06457**
	(0.319)	(0.443)	(0.350)	(0.338)	(0.493)	(0.377)	(0.379)	(0.482)	(0.428)
Currency Union	1.61387***	1.80727***	1.56153***	1.21620***	1.35910***	1.14719***	2.21446***	2.36310***	2.18627***
	(0.377)	(0.443)	(0.384)	(0.358)	(0.444)	(0.368)	(0.450)	(0.487)	(0.449)
Government change (2y)	0.20785	0.13599	0.18768	0.18314	0.00600	0.15929	-0.08615	-0.01547	-0.11198
	(0.279)	(0.318)	(0.278)	(0.313)	(0.375)	(0.312)	(0.343)	(0.362)	(0.338)
L.Real GDP per capita	-0.00001	-0.00002	-0.00001	0.00001	-0.00001	-0.00001	-0.00001	-0.00005**	-0.00004**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Common Law	-0.79158**	-1.20043***	-0.96438***	-0.69077**	-1.14640***	-0.90872***	-1.19553***	-1.93403***	-1.62830***
	(0.341)	(0.459)	(0.365)	(0.297)	(0.413)	(0.325)	(0.439)	(0.564)	(0.484)
L.Financial Reform Index		0.16815***			0.18499***			0.20823***	
		(0.038)			(0.042)			(0.045)	
L.KOF Globalization Index			0.03391***			0.03615***			0.05354***
			(0.012)			(0.012)			(0.015)
Constant	-1.47370***	-2.70618***	-3.17438***	-2.59544***	-4.34788***	-4.56332***	-1.35284***	-2.83879***	-3.93935***
	(0.447)	(0.664)	(0.818)	(0.337)	(0.682)	(0.789)	(0.426)	(0.683)	(0.929)
Observations	1,323	961	1,306	1,323	961	1,306	1,323	961	1,306
Nr of countries	44	37	44	44	37	44	44	37	44
LR chi^2/Wald chi^2	37.04	51.38	47.32	29.73	44.74	39.46	43.01	55.59	59.08

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Results regarding the endogenous determinants of the level of CBI are presented in Table 4. Columns (1), (4) and (7) present panel estimations for each of the three indices for the full sample of countries. The coefficient of the lagged value of the central bank independence indices is always statistically significant at 1%, and its coefficient estimates range from 0.82 to 0.89. This shows an extremely high correlation between the actual level of CBI and its lagged value. Next, the coefficients of unemployment rate and political stability are always significant and positive. Thus, in line with previous studies such as Cukierman (1994), these results suggest that governments in countries experiencing high unemployment rates will have an higher incentive to introduce inflationary surprises. Since the public is well aware of this, the benefit for granting an higher CBI will be higher for these countries. The positive correlation between political stability and legal CBI is also confirmed in Cukierman and Webb (1995) who look at the turnover rate of the central bank governor and find that the independence of the central bank is lower during political changes. I also find evidence that countries members of the Euro area currency union enjoy a greater degree of independence. Indeed, since its creation, the ECB has been characterized by one of the highest degree of legal independence. Similar to the previous specification, the legal origin of countries seems to matter and the negative relationship between the Common law dummy and CBI suggests that countries in Common Law jurisdictions have a lower degree of independence. Interestingly, the inflation targeting indicator is not statistically different from zero in most cases. This result implies that countries that adopt an inflation targeting regime are not necessarily characterized by an higher degree of independence or, on the opposite, such regime could potentially be an alternative way in which countries assume the independence of their monetary policy authorities.

Finally, I find that less developed countries (lower GDP per capita) enjoy an higher degree of CBI. Previous research also suggests that the level of CBI might differ according to countries' level of development (see Cukierman et al., 1992, among others). I thus expand the analysis by splitting the sample according to their level of development. In columns (2), (5) and (8) I replicate the estimations for a restricted sample of OECD members states, while in columns (3), (6) and (9) I provide estimates for the sample of non-OECD countries. Overall, the estimations run on industrialized economies appear in line with the one found for the full sample. The exception, of course, is the level of real GDP per capita variable which looses its significance. This might also be driven by the fact that OECD countries are characterized by smaller differences in terms of GDP per capita. Regarding the sample of non-OECD, results are qualitatively the same, if not stronger for some variables such as the impact of political stability.

Table 4: Endogeneity of CBI

	ECBI			GMT			CWN		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Full sample	OECD	Non OECD	Full sample	OECD	Non OECD	Full sample	OECD	Non OECD
L.CBI	0.83717***	0.82181***	0.87695***	0.88783***	0.88687***	0.89492***	0.87997***	0.88832***	0.85861***
	(0.014)	(0.018)	(0.023)	(0.012)	(0.015)	(0.021)	(0.013)	(0.015)	(0.024)
L.Unemployment	0.00189***	0.00172**	0.00152**	0.00181***	0.00154*	0.00154**	0.00135**	0.00161*	0.00139*
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
L.Political Stability	0.01202***	0.00778*	0.02006***	0.01508***	0.01447**	0.02350***	0.01060**	0.01046*	0.01951**
	(0.003)	(0.004)	(0.006)	(0.004)	(0.006)	(0.007)	(0.005)	(0.006)	(0.008)
L.Real GDPcap	-0.00001**	-0.00001	-0.00001*	-0.00001**	-0.00001	-0.00001***	-0.00001***	-0.00001	-0.00001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Currency Union	0.04543***	0.05218***		0.03933***	0.04141***		0.03647***	0.04003***	
	(0.005)	(0.007)		(0.006)	(0.008)		(0.007)	(0.009)	
Common Law	-0.02698***	-0.03340***	-0.01769**	-0.02799***	-0.03301***	-0.01937**	-0.02865***	-0.03545***	-0.02225**
	(0.005)	(0.007)	(0.007)	(0.006)	(0.008)	(0.009)	(0.006)	(0.009)	(0.011)
IT Regime	0.00281	0.00810	0.00521	0.00642	0.01301*	-0.00686	-0.00030	0.00909	0.00873
	(0.004)	(0.006)	(0.016)	(0.005)	(0.007)	(0.019)	(0.006)	(0.007)	(0.024)
Constant	0.10856***	0.11504***	0.08786***	0.06935***	0.06126***	0.07690***	0.09149***	0.07113***	0.11224***
	(0.010)	(0.014)	(0.016)	(0.009)	(0.014)	(0.015)	(0.011)	(0.015)	(0.019)
Observations	834	543	291	834	543	291	834	543	291
Nr of countries	50	32	18	50	32	18	50	32	18

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

5.1 Robustness checks

I check the robustness of my results along several lines. First, regarding the analysis of reforms in CBI, I consider alternative definitions of the main explanatory variables used. I replace the dummy variable that captures changes in the government in the last two years, with another proxy for political stability developed in Powell and Thyne (2011), who build a dummy variable indicating if a country has been characterized by a *coup d'état*. I control if a coup d'état episode which occurred in the last one, two or five years impacts the probability of reforms. De Haan and Siermann (1996) find that among measures of political instability, only the number of coups affects the *de facto* measure of CBI in a sample of developing countries. I however find no impact of this alternative measure of political stability.[6] This result might be driven by the small number of *coup d'état* episodes in my sample.

I also consider alternative specifications for inflation. I control for the occurrence of an inflation crisis not just in the year prior to the reform, but also in the past 2 and 5 years, respectively. I also replace the inflation crisis dummy with other measures such as: a) the difference between the inflation rate of the country and the average inflation rate of in the entire sample in the previous year and b) the mean and variance of inflation in the last 2 and 5 years. Results allowing for all these robustness checks are qualitatively the same.

Finally, I check the robustness of the determinants of the level of CBI by considering alternative measures of political economy. Moser (1999) argue that granting independence via a statute is only credible for legislative systems with at least two heterogeneous decision-making bodies both of which have veto rights (for example bicameral systems). He finds this claim to be empirically valid: the legal independence of central banks is significantly higher in OECD countries in which legislative processes are characterized by extensive checks and balances. Similarly, Alesina and Stella (2010) suggest that countries with a high fractionalization of party systems may have a hard time granting independence to the monetary policy authority given the conflicts of interest among groups. I thus re-estimate Equation 3 by including these alternative measures: checks and balances, the degree of fractionalization and the political polarization. The last variable captures the distance in economic orientation between the executive party and the four principle parties of the legislature. All variables come from the 2012 update of the Database of Political Institutions developed by Keefer and Stasavage (2003). Results are presented in Appendix Table A4. For the sample of OECD countries all measures are statistically significant and positive. Thus, a higher extent of checks and balances, as well as more fractionalized and polarized systems are all associated with a higher

[6]Results for most of the robustness checks performed are not presented but available upon request.

level of central bank independence. These results are also present in the full and non-OECD countries samples, with the exception of the fractionalization index which loses significance.

6 Concluding remarks

This paper updates and extends the most common indices on central bank independence for a set of 50 countries during the period 1972-2014. This comprehensive survey of central bank reforms shows that countries change the institutional setting of their central bank quite often. I find 751 changes in legislation out of which 107 reforms that modified the degree of CBI. Countries also seem to increase their level of central bank independence through time and have undertaken many reforms following the global financial crisis in 2007-09. The new index of central bank independence I propose takes account of these recent changes in central bank statutes and extends previous indexes by incorporating new information on accountability and financial independence of central banks.

The construction of dynamic indices of independence, allows me to investigate the drivers behind the many reforms central banks have implemented over the past four decades. Looking at a panel of 50 countries, I find that central bank legislative reforms are more likely to be implemented in economies characterized by a lower degree of independence. Thus, countries that reform their central banks are more likely to move towards higher levels of legal independence of their monetary policy institution. I also find evidence that the likelihood of reforms is influenced by international pressures to reform such receiving an IMF loan or becoming a member of a currency union. However, contrary to studies that document a positive link between electoral cycles and *de facto* measures of CBI, I find that the probability of reforms in *de jure* independence is not influenced by changes in the government. The data also suggests that changes in central bank legislation are more likely to happen in countries that are more financially developed and more globalized.

The second contribution of the paper rests in understanding the endogenous evolution of the level of CBI. While previous literature has recognized the fact that changes in central bank legislation may not, in fact, be "exogenous" to changes in politico-economic factors, there is very little empirical evidence of this issue. By employing dynamic indices of central bank independence, I can investigate their possible endogeneity in a more rigorous way. Results show that past unemployment rates and political stability have a strong influence on the level of legal central bank independence. Interestingly, despite popular belief, financial crises do not seem to explain the degree of central bank independence.

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Table A1: Analyzed Countries

Countries and year of first analyzed legislation			
Albania	1992	Luxembourg	1983
Australia	1959	Malta	1994
Austria	1955	Mexico	1960
Belgium	1948	Montenegro	2005
Bosnia and Herzegovina	1997	Netherlands	1948
Bulgaria	1991	New Zealand	1933
Canada	1954	Norway	1966
Chile	1953	Poland	1997
China	1995	Portugal	1962
Croatia	1991	Qatar	1993
Cyprus	1963	Romania	1991
Czech Republic	1991	Russia	1992
Denmark	1942	Saudi Arabia	1957
ECB	1997	Singapore	1991
Estonia	1993	Slovak Republic	1992
Finland	1966	Slovenia	1991
France	1936	Spain	1962
Germany	1957	Sweden	1966
Greece	1959	Switzerland	1953
Hungary	1991	Trinidad and Tobago	1964
Iceland	1966	Turkey	1970
Ireland	1942	Ukraine	1991
Italy	1948	United Arab Emirates	1980
Japan	1957	United Kingdom	1946
Latvia	1992	United States of America	1951
Lithuania	1994		

Table A2: Extended CBI index

Criteria	Coding
Political Independence	
Governor and Central Bank Board	
Who appoints the Governor	
Board of Central Bank	1.00
A council of the Central Bank Board, Executive branch, and Legislative branch / By Legislative branch on proposal by the Central Bank Board	0.75
By Legislative branch	0.50
By Executive branch collectively (e.g. council of ministers)	0.25
By one or more members of executive branch	0.00
Term of office of Governor	
More than 8 years	1.00
6 to 8 years	0.75
Equal to 5 years	0.50
Equal to 4 years	0.25
Less than 4 years or at the discretion of appointer (No limits or not mentioned)	0.00
Provisions for dismissal of Governor	
No provision for dismissal	1.00
Only for non-policy reasons (e.g., incapability, or violation of law)	0.83
At the discretion of Central Bank Board	0.67
For policy reasons at legislative branch's discretion	0.50
At legislative branch's discretion	0.33
For policy reasons at executive branch's discretion	0.17
At executive branch's discretion	0.00
May Governor hold other offices in Government	
Prohibited by law	1.00
Not allowed unless authorized by executive branch	0.50
No prohibition for holding another office	0.00
Who appoints the rest of the Board	
Board of Central Bank	1.00
A council of the Central Bank Board, Executive branch, and Legislative branch / By Legislative branch on proposal by the Central Bank Board	0.75
By Legislative branch	0.50
By Executive branch collectively (e.g. council of ministers)	0.25
By one or more members of executive branch	0.00
Term of office of the rest of the Board	
More than 8 years	1.00
6 to 8 years	0.75
Equal to 5 years	0.50
Equal to 4 years	0.25
Less than 4 years or at the discretion of appointer (No limits or not mentioned)	0.00
Provisions for dismissal of the rest of the Board	
No provision for dismissal	1.00
Only for non-policy reasons (e.g., incapability, or violation of law)	0.83
At the discretion of Central Bank Board	0.67
For policy reasons at legislative branch's discretion	0.50
At legislative branch's discretion	0.33
For policy reasons at executive branch's discretion	0.17
At executive branch's discretion	0.00
No mandatory participation of Government representatives in the Board	
Yes	1.00
No	0.00
Policy Formulation	
Who formulates monetary policy	
Central Bank alone	1.00
Central Bank participates, but has little influence	0.67
Central Bank only advises Government	0.30
Central Bank has no say	0.00
Who has final word in resolution of conflict	
The Central Bank, on issues clearly defined in the law as its objectives	1.00
Government, on policy issues not clearly defined as the Central Bank's goals or in case of conflict within the bank	0.80
A council of the Central Bank, executive branch, and legislative branch	0.60
The legislature, on policy issues	0.40
The executive branch on policy issues, subject to due process and possible protest by the bank	0.20
The executive branch has unconditional priority	0.00
Objectives	
Price stability objective	
Price stability is the single or primary objective	1.00
Price stability together with non-conflicting objectives but without priority	0.75

Table A2 Continued: Extended CBI index

Criteria		Coding
	Price stability plus others goals including stability of financial system that may conflict with the former, without priority	0.50
	Price stability together with objective of economic growth / economic development with no priority	0.25
	Objectives do not include price stability	0.00
Economic Independence		
Lending to the Government		
Limitations on advances		
	Advances to Government prohibited	1.00
	Advances permitted, but with strict limits (e.g., up to 15 percent of Government revenue)	0.67
	Advances permitted, and the limits are loose (e.g., over 15 percent of Government revenue)	0.33
	No legal limits on lending	0.00
Interest rates on advances		
	At market rates	1
	Interest rates not specified in law	0.50
	At below market rates	0.00
Maturity of advances		
	Within 6 months	1.00
	Within 1 year	0.67
	More than 1 year	0.33
	No mention of maturity in the law	0.00
Limits on central bank lending		
	As an absolute cash amount	1.00
	As a percentage of Central Bank capital or other liabilities	0.75
	As a percentage of Government revenues	0.50
	As a percentage of Government expenditure	0.25
	Fixed by agreement between the Central Bank and a member of the Executive Branch or no limits on lending	0.00
Who decides financing conditions to Government (maturity, interest, amount)		
	Central Bank defines terms and conditions	1.00
	Specified by the bank charter	0.67
	Agreed between the Central Bank and executive	0.33
	Decided by the executive branch alone	0.00
Central bank prohibited from buying or selling Government securities in the primary market		
	Yes	1.00
	No	0.00
Instruments and Supervision		
Is the Central Bank responsible for setting the policy rates		
	Yes	1.00
	No	0.00
Is there no responsibility of Central Bank for overseeing the banking sector		
	Banking supervision not entrusted to the Central Bank	1.00
	Banking supervision not entrusted to the Central Bank alone	0.50
	Banking supervision entrusted to the Central Bank alone	0.00
Accountability		
Central Bank reporting		
	Reports to executive branch and informs at least annually to Congress.	1.00
	Reports to the executive once a year and submits an annual report to Congress	0.75
	Annual report to the executive. Informs to the executive branch whenever fundamental disequilibria emerge, or reports through the media without specific periodicity.	0.50
	Issues annual report at specific time	0.25
	Distributes an annual report without establishing particular period of time	0.00
Central Bank financial statements		
	Discloses detailed financial statements at least once a year with a certification of an independent auditor	1.00
	Discloses consolidated financial statements at least once a year with seal of the Banking Superintendent or other public sector authority	0.75
	Discloses financial statements at least once a year, certified by an internal	0.50
	Publishes partial financial statements	0.25
	Does not publish financial statements or the law authorizes the central bank to deviate from international accounting standards	0.00
Financial Autonomy		
Central Bank has exclusive right to determine and approve its annual budget		
	Yes	1.00
	Ex-post approval by the Government	0.50
	No	0.00
Allocation of the net profits of the Central Bank		
	Prescribed by the Statute / Central Bank Charter	1.00
	Left to the discretion of the Central Bank	0.67
	A kind of negotiation between the Government and the Central Bank	0.33
	Left to the discretion of the Government	0.00

Table A3: Data sources

Variable	Definition	Data sources
	Dependent variables	
CBI Reforms	Dummy that signals whether a central bank legislative reform that modified ECBI, GMT or CWN have occurred or not in the current year.	Authors
Extended Index of Central Bank Independence (ECBI)	See description provided in Section 3.	Authors
Grilli et al. Index of Central Bank Independence (GMT)	The index is calculates as the sum of central bank's fulfillment of 15 criteria, 8 for political independence and 7 for operational independence. Political independence (GMTp) is defined as the ability of central bank to select the final objectives of monetary policy, based on the following eight criteria: (1) governor is appointed without government involvement; (2) governor is appointed for more than five years; (3) board of directors is appointed without government involvement; (4) board is appointed for more than five years; (5) there is no mandatory participation of government representative(s) in the board; (6) no government approval is required for formulation of monetary policy; (7) central bank is legally obliged to pursue monetary stability as one of its primary objectives; and (8) there are legal provisions that strengthen the central bank's position in the event of a conflict with the government. Economic independence (GMTo) is the central bank's operational independence based on seven criteria: (1) there is no automatic procedure for the government to obtain direct credit from the central bank; (2) when available, direct credit facilities are extended to the government at market interest rates; (3) this credit is temporary; (4) and for a limited amount; (5) the central bank does not participate in the primary market for public debt; (6) the central bank is responsible for setting the policy rate; and (7) the central bank has no responsibility for overseeing the banking sector (two points) or shares responsibility (one point).	Authors following Grilli et al. (1991)
Cukierman et al. Index of Central Bank Independence (CWN)	The index is calculates as the sum of central bank's fulfillment of 16 criteria which are grouped under four main headings: 1) Central Bank Governor: it contains proxies for (i) the length of the term of office of the governor; (ii) the entity delegated to appoint him/her; (iii) the provisions for his/her dismissal; (iv) and his/her ability to hold another office. 2) Policy Formulation: it contains proxies for (v) the entity responsible for formulating monetary policy; (vi) the rules concerning the resolution of conflicts between the central bank and the government; and (vii) the degree of the bank's participation in formulating the government budget. 3) Objectives of the central bank): it contains proxies for (viii) the provisions of charters regarding primary monetary objectives and the relative role of monetary stability. 4) Limitations on central bank lending to the government): it contains proxies for (ix) advances and (x) securitized lending; (xi) the authority that has control over the terms (maturity, interest rate and amount) of lending; (xii) the size of the circle of potential borrowers from the central bank; (xiii) the types of limitations on loans, where limits exist; (xiv) the maturity of possible loans; (xv) the limitations on interest rates applicable to these loans; (xvi) and prohibitions on central bank participation in the primary market for government securities.	Authors following Cukierman et al. (1992)
	Explanatory variables	
Inflation Crises	Dummy that signals whether an inflation crisis (inflation rate higher than 40%) has occurred or not.	Authors following Reinhart and Rogoff (2004)
Crises	Dummy that signals whether a systemic banking crisis have occurred up to two years before or not.	Masciandaro (2009); Laeven and Valencia (2013)
Unemployment	Unemployment rate.	World Bank (2014)
Currency Union	Dummy of countries member of a currency union. 1= Euro area member; 0 = non-Euro area member.	Authors
Real GDP per capita	GDP per capita at constant 2005 US$.	World Bank (2014)

Table A3 Continued: Data sources

Variable	Definition	Data sources
IT Regime	Dummy of countries adopting an inflation targeting (IT) regime: 1= IT regime is implemented in the country; 0 = IT regime is not implemented in the country.	Authors
Common Law	Dummy for Common Law legal roots: 1= Anglo-Saxon Law; 0 = non-Anglo-Saxon Law.	La Porta et al. (1999)
Financial Reform Index	The index is built following seven different dimensions of financial sector policy: 1) Credit controls and excessively high reserve requirements. 2) Interest rate controls. 3) Entry barriers. 4) State ownership in the banking sector. 5) Capital account restrictions. 6) Prudential regulations and supervision of the banking sector. Securities market policy.	Abiad et al. (2008)
KOF Globalization Index	The measure develops an index of globalization covering its three main dimensions: 1) Economic integration: (i) data on actual flows, and (ii) data on trade and capital restrictions. 2) Social globalization: (i) data on personal contact, and (ii) data on information flows. 3) Political integration.	Dreher (2006)
Government change (2y)	Dummy that signals whether the effective control of executive power has changed up to 2 years before or not.	Beck et al. (2001); Keefer and Stasavage (2003)
Political Stability	The index on Political Stability and Absence of Violence/Terrorism reflects perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism. Estimate of government stability ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance.	"The Worldwide Governance Indicators, 2013 Update" Kaufmann et al. (2010)
IMF Programs (2y)	Dummy that equals one if an IMF program has been in effect in the country in the last 2 years.	Authors following Dreher (2006)

Table A4: Robustness checks on the endogeneity of CBI

Dependent variable: ECBI									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Full sample			OECD			Non OECD	
L.ECBI	0.83387***	0.84928***	0.81695***	0.81737***	0.83665***	0.80291***	0.83630***	0.82972***	0.80437***
	(0.014)	(0.014)	(0.016)	(0.018)	(0.017)	(0.019)	(0.026)	(0.026)	(0.031)
L.Political stability	0.01097***	0.01160***	0.00821**	0.00639	0.00328	0.00390	0.01953***	0.02244***	0.01893***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.005)	(0.005)	(0.006)	(0.006)	(0.007)
L.Unemployment	0.00186***	0.00175***	0.00241***	0.00188***	0.00145**	0.00204***	0.00212***	0.00227***	0.00291***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
L.Real GDPcap	-0.00001**	-0.00001**	-0.00001**	-0.00001	-0.00001	-0.00001	-0.00001	-0.00001*	-0.00001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Currency Union	0.04371***	0.04196***	0.05018***	0.05220***	0.04886***	0.06292***	0.04903***	0.05327***	0.05452***
	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.008)	(0.016)	(0.016)	(0.018)
Common Law	-0.02599***	-0.02525***	-0.02647***	-0.03540***	-0.02441***	-0.03291***	-0.02225***	-0.02382***	-0.03119***
	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.009)
IT Regime	0.00021	0.00285	0.00252	0.00859	0.00896*	0.01443**	0.00386	0.01287	0.02577
	(0.004)	(0.004)	(0.005)	(0.006)	(0.005)	(0.006)	(0.017)	(0.017)	(0.051)
L.Checks and balances	0.00340***			0.00488***			0.00444**		
	(0.001)			(0.002)			(0.002)		
L.Fractionalization		-0.00001			0.05842**			-0.00001	
		(0.001)			(0.023)			(0.000)	
L.Polarization			0.00633***			0.00564**			0.01437***
			(0.002)			(0.003)			(0.005)
Constant	0.10025***	0.10131***	0.11327***	0.09827***	0.06877***	0.11503***	0.09470***	0.11397***	0.11748***
	(0.011)	(0.010)	(0.012)	(0.016)	(0.020)	(0.015)	(0.018)	(0.018)	(0.021)
Observations	817	814	720	543	538	498	274	276	222
Nr of countries	49	49	47	32	32	31	17	17	16

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10.