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Beyond the Central Bank Independence Veil:

New Evidence

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Beyond the Central Bank Independence Veil: New Evidence

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Abstract

This paper employs a new and comprehensive database of central bank institutional design to reassess the role of the independence of these public administrations in influencing the macroeconomic performance of countries, before and after the Global Financial Crisis. Using new dynamic indices, the empirical investigation takes into account the evolution of the level of independence in 65 countries over the period 1972-2014. Going beyond the standard correlation between central bank independence and inflation, we confirm the importance of the independence of these public administrations. Importantly we show that the degree of central bank independence is an endogenous variable and stress the relevance of economic and political drivers in shaping the incentives of governments to maintain or reform the governance of these public administrations.

Keywords: Central Bank Independence, Global Financial Crisis, Macroeconomic Performance, Monetary Policy, Populism, Political Economy, Public Administration.

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1   Introduction

Over the past four decades, central banks around the world have progressively gained independence from their governments (de Haan et al., 2018; Masciandaro and Romelli 2018). Such a phenomenon has been in line with a worldwide trend to delegate policy responsibilities to independent regulatory public administrations (Majone, 1997; Gilardi, 2005; Jordana et al., 2011).

Until the Global Financial Crisis, the concept of central bank independence (hereafter CBI) was supported by a broad consensus and it had become one of the benchmarks to evaluate the effectiveness of monetary policy authorities all around the world (Cecchetti, 2013; Bayoumi et al., 2014; Goodhart and Lastra, 2017; Issing, 2018). The theoretical bottom line is well known (Cecchetti, 2013; Eijffinger and Masciandaro, 2014): incumbent governments tend to use monetary tools with a short sighted perspective to smooth different kind of macroeconomic shocks (Sargent and Wallace, 1981; Barro and Gordon, 1983). However, the more the markets are efficient, the greater the risk that such policies only produce distortions. In such a context, the rules of the game between policymakers and central bankers become fundamental (Kydland, F.E. and Prescott, 1977; Barro and Gordon, 1983; Backus and Driffill, 1985; Rogoff, 1985; Lohmann, 1992, Persson and Tabellini, 1993; McCallum, 1995; Franzesese, 1999). Consequently, the role of the central banks as veto players that strengthen the effectiveness of monetary policy gained momentum in the design of these public organizations.

Yet, the optimal institutional arrangement for monetary authorities as *independent* central banks has been severely questioned following the Global Financial Crisis. As a matter of fact, since the aftermath of the Crisis it is possible to highlight a second wave of studies devoted to the design of these public organizations (see Figure 1). Recently, the

concept of CBI has been revitalized not only in academia, but also in politics and in the media, and the consensus that surrounded the granting of central bank independence has been challenged (Alesina and Stella, 2010; Cecchetti, 2013; Stiglitz, 2013; Bayoumi et al., 2014; Ball et. al., 2016; Issing, 2018; Rodrik, 2018).

[Insert Figure 1 about here]

The triggers of the critical reconsideration of central bank independence have both economic and political drivers. On the one hand, the reason is mainly due to the increased economic and political importance that central banks of advanced economies have experienced since the beginning of the Great Crisis (Buiter, 2014). Supervisory and regulatory functions have been piled up in these public administration, increasing the relationships between banking, fiscal and monetary policies (Bayoumi et al., 2014; de Haan and Eijffinger, 2017; Masciandaro and Romelli, 2017). The lines between the role of central bank liquidity management and the government support for the solvency of banking and financial institutions have been blurred out, triggering, inevitably, a general debate on the shape of these public organizations (Nier, 2009; Bean, 2011; Cecchetti et al., 2011; Ingves, 2011; Reis, 2013).[3] In the same vein, an important question becomes whether the policy blurring effect has made the pendulum swing. So far, comparative analyses did not reach a consensus (Bodea and Hicks, 2015; de Haan et al., 2018; Masciandaro and Romelli, 2018).

On the other hand, it has been argued that the rise of populism might twist the consensus that surrounded the concept of central bank independence from the late 1980s to the Global Financial Crisis (Buiter, 2014; de Haan and Eijffinger, 2017; Goodhart and Lastra, 2017; Rajan, 2017). After a first wave of left-wing populism in Latin America, a second wave of

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[3] See also Bordo and Siklos (2017) for an historical perspective and Cukierman (2008), Cukierman (2013), Cecchetti (2013), Taylor (2013), Issing (2013), Buiter (2014), Sims (2016) and Blinder et al. (2017) for an overview on the features of CBI.

right-wing populism gained ground in many European countries and the United States (Acemoglu et al., 2013). These movements might have already influenced or are going to influence, directly or indirectly, the design and the implementation of different economic policies around the world (Dovis et al., 2016; Aggeborn and Persson, 2017; Rodrik, 2017).

The academic literature that have analyzed the economics impact of populism, suggests that populist policies present solutions which are welfare enhancing for a majority of the population only the short run. While, in the long run, these policies are costly for the entire population (Sachs, 1989; Dornbush and Edwards, 1991; Acemoglu et al., 2013; Chesterley and Roberti, 2016).[4] Since the crisis, central bankers have become a natural target for populist movements.[5] In this context, the rise of populism might put under threat one the pillars of today's central banking, i.e. central bank independence and monetary policies aimed at guaranteeing price stability.

Therefore, nowadays a redux on the CBI issue seems particularly relevant. How does the institutional design of central banks impact the conduct of monetary policy? Can we still consider an independent central banker a "free lunch" veto player that can improve economic performances? With this paper, we seek to improve the literature on central bank independence in various aspects. First, following a recent body of literature in economics and political science, we collect qualitative information on the independence of a public agency and convert them into a metrics that allows us to evaluate how these institutional features influence economic performances. It is worth noting however that our study is genuinely positive, acknowledging how a normative translation of such frameworks are likely to imply a series of potential drawbacks that can characterized the systems of governance by targets (Bevan and Hood, 2006).

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[4] Populist movement share three main starting points: 1) they claim to be on the side of people against the elites; 2) they pander the people's fear and enthusiasm; and 3) they promote policies disregarding its future consequences (Guiso et al., 2017).
[5] "With their PhDs, exclusive jargon, and secretive meetings in far-flung places like Basel and Jackson Hole, central bankers are the quintessential rootless global elite that populist nationalist love to hate" (Rajan, 2017).

Zooming on the degree of central bank independence, we then employ this new index of CBI to re-examination the CBI-inflation nexus and offer two new contributions to this literature. On the one hand, traditional approaches to investigating this relationship consider central bank independence as an effective device to minimize inflation risks and, therefore, generally treat it as an exogenous variable. However, recent research argues that, while public administrations 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). We follow a similar approach by considering an endogenous index of central bank independence which can potentially be explained by the political or economic characteristics of a country. While some recent research has explicitly considered the endogeneity of CBI, it generally does not provide very strong instruments for the level of independence (Crowe and Meade, 2008; Jacome and Vazquez, 2008). The construction of a dynamic index such as the one proposed in this paper can overcome many of the challenges faced by previous research and enable the construction of a reliable instrument of CBI. Using this index, we provide a detailed description of the evolution of central bank independence for a set of 65 countries during the period 1972-2014 and document some important trends in central bank design over the past four decades. At the same time it is worth noting that our methodology could be potentially applied to analyze the independence of other public agencies.

Then through our novel instrument, we perform new empirical analyses of the well-known nexus between CBI and inflation, documenting a negative and causal relationship between the institutional variable and the macroeconomic performance in a set of 65 heterogeneous countries over the period 1972-2014. Further and more importantly we show that the CBI is an endogenous variable,

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The paper is organized as follows. Section 2 discusses the new dynamic index of CBI. Section 3 and 4 use this index and present some descriptive statistics and analyze the evolution of CBI over the last four decades. Section 5 proposes a reinvestigation of the CBI-inflation nexus, discovering that CBI still matters and, even more importantly, that it is an endogenous variable. Section 6 concludes.

2   Measuring Central Bank Independence

A large literature has studied the link between central bank independence and macroeconomic performances. 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. Following the development of these measures of central bank independence, an extensive empirical literature has tested the effectiveness of CBI in lowering inflation. Overall, there is a large support for a negative correlation between CBI indices and inflation (Alesina, 1988; Grilli et al., 1991; Cukierman et al., 1992; Alesina and Summers, 1993; Masciandaro and Spinelli, 1994; Siklos, 2008).[6]

Nonetheless, conflicting views still exist. One set of concerns regards the heterogeneity of the link between CBI and inflation across countries or when different control variables are included. Cargill (1995) shows that the relationship is not robust in a sample of industrialized countries. Evidence from developing countries is also mixed. For example,

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[6] 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.

Cukierman et al. (2002) analyze 26 former socialist economies and find that CBI is unrelated to inflation during the early stages of liberalization, but the link becomes significant when countries become more liberalized. The negative correlation between central bank independence and inflation appears also sensible to various controls. For example, Campillo and Miron (1997) and Oatley (1999) show that CBI has no effect on inflation when they control for the degree of openness, political instability or historical levels of debt and inflation.[7]

A limitation of previous studies has been the lack of a comprehensive database on central bank institutional design that allows to track the evolution of CBI over time. In this paper we overcome this issue by employing a dynamic index of CBI constructed by Romelli (2018) for a sample of 65 countries during the period 1972-2014. Romelli (2018) constructs a new index of central bank independence and updates previous indices such as the ones proposed by Grilli et al. (1991) (GMT) and Cukierman et al. (1992) (CWN). The main advantage of these new indices is their dynamic aspect. Previous research generally evaluates the degree of CBI of a country at a particular point in time (see Acemoglu et al., 2008), or by focusing on a specific index (see Bodea and Hicks, 2015). This limits our understanding of how central bank design has evolved over time and how it may have impacted the dynamics of certain macroeconomic variables. The dynamic indexes in Romelli (2018) are evaluated in every year in which the central bank legislation has been amended and recomputed whenever a legislative reform induced a change in central bank independence.

Now, in order to propose a redux of such metrics, we have to start discussing the two most commonly employed indices of central bank independence developed by Grilli et al.

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[7] However, these findings themselves may not be robust as shown in Brumm (2000), who points out significant measurement errors in Campillo and Miron (1997) and confirms the strong negative correlation between inflation and central bank independence.

(1991) and Cukierman et al. (1992), as well as the newly developed index of CBI proposed in Romelli (2018).

2.1 The Grilli, Masciandaro, and Tabellini (1991) and the The Cukierman, Webb, and Neyapti (1992) Indices

Grilli et al. (1991) construct a composite index of CBI (hereafter, GMT) through a comprehensive codification of central bank legislations for a group of 18 advanced economies as of 1989.[8] The GMT index is calculated as the sum of central banks' fulfillment of 15 criteria and ranges from zero (least independent) to 16 (most independent). Importantly, this index allows the identification of a political and an economic independence index.

The other classical measure of CBI has been developed by Cukierman (1992) and Cukierman et al. (1992) (henceforth, CWN), who investigate the degree of *de jure* independence for 68 countries during the period 1950-1989, therefore including a large number of developing and emerging economies. The CWN index, which varies from 0 to 1 (lowest and highest levels of independence, respectively), is calculated as the sum of central bank's fulfillment of 16 criteria which are grouped under four main headings: 1) central bank governor; 2) policy formulation; 3) objectives of the central bank; and 4) limitations on central bank lending to the government.

While the GMT index is based on a binary code assigned to each one of its criteria and its overall value is given by the sum of every single criteria, the CWN index requires a series of furthers steps for its computation. First of all, every question analyzed for the construction of the index is coded from 0 to 1, with lower values indicating a lower

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[8] Parkin and Bade (1982) propose a first measure of CBI, by answering three criteria on whether: 1) the government or the central bank is the final monetary policy authority, 2) any government officials are members of the central bank board, and 3) the government appoints all or only some of the board members.

independence level and higher values signaling a higher degree of independence. Then the sixteen criteria are aggregated into eight different groups and the obtained values are summed up to obtain a single index that ranges from zero (no independence) to one (maximal independence). Starting from these eight aggregated variables, the authors develop two indices of CBI. Cukierman (1992) introduces the LVAU measure, obtained as an unweighted average of the eight aggregated variables, while Cukierman et al. (1992) develop the LVAW measure, suggesting different weights for the various aggregations.

The baseline construction of the CWN is also employed in Jacome and Vazquez (2008) who propose an extension of the LVAW index, by introducing some modifications to the subcategories of this index and incorporating an additional category on central bank accountability. Similarly, Dincer and Eichengreen (2014) augment the LVAU and LVAW indices by adding additional aspects of central bank independence such as a measure of limits on the reappointment of the central bank governor, measures of provisions affecting the (re)appointment of other board members similar to those of the governor, restrictions on government representation on the board and intervention of the government in exchange rate policy formulation.

2.2 The Extended Central Bank Independence (ECBI) Index

Using the GMT and CWN indices as a starting point, Romelli (2018) develops a new and comprehensive index of central bank independence that covers a wider range of central bank characteristics. This new index, called the Extended Central Bank Independence (ECBI) Index, provides, in its most disaggregated format, information on 42 criteria of central bank institutional design.

The extended index incorporates the characteristics of *both* the GMT and CWN indices. This aggregation aims to overcome the main criticism of these classical measures

of CBI,

i.e. the fact that 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-known indices, the ECBI index also includes new criteria able to capture good practices in central bank financial independence and accountability. Table 1 presents the summary of the characteristics collected in the GMT and CWN indices, as well as, in the ECBI index.

[Insert Table 1 about here]

3   The Evolution of Central Bank Independence

This section presents some characteristics and descriptive statistics of the dynamic indices of CBI employed in this paper, focusing mainly on the ECBI index, which is the most comprehensive one. It includes a breakdown of the average CBI score in its six dimensions and discusses how this new index relates to the classical measures of central bank independence. The data employed covers a set of 65 countries over the period 1972-2014. The list of countries and information on data availability are presented in Appendix Table A1. This table also classifies countries according to their geo-political areas. The sample includes 23 OECD countries, 18 Eastern European countries, 10 African and Middle-Eastern countries, 8 Southern and Eastern Asian countries and 6 Latin-American countries.

[Insert Figure 2 about here]

Figure 2 shows the average degree of independence assigned to the different dimensions on the ECBI index in 2014 for the whole sample of countries. This figure indicates that there is quite little variation in the average value of independence across dimensions. Interestingly, the two dimensions omitted in both the GMT and CWN indices, i.e. financial independence and accountability, appear to be quite relevant in central bank statutes. In particular, the characteristics related to reporting and accountability are associated with the highest average value of independence. Looking now at the dimensions with the lowest degree of independence, we can find the ones related to central bank governance and monetary policy. Given these similar levels of average independence along the different dimensions, the rest of the analysis focuses on the aggregated index of independence. This also allows for a comparison with previous studies, most of which investigate the link between CBI and macroeconomic outcomes by looking at the overall level of independence.

[Insert Figure 3 about here]

Apart from the extended set of central bank characteristics, another important innovation of the ECBI index is its dynamic nature, that allows us to track the evolution of central bank independence over time. This also improves previous approaches of assessing the changes in the degree of central bank independence that recomputed the level of CBI at two different, usually distant moments in time (Arnone et al., 2009). By computing the level of independence after each central bank legislative reform, we can draw a complete picture of how central bank institutional design has evolved over time. Figure 3 shows the evolution of the average values of the ECBI index across different regions. In line with Arnone et al. (2009), we find that

the average degree of CBI has sharply increased especially after the late 1980s. However, notable cross-country differences persist. On average, the degree of CBI across all regions moved from 0.42 during the 1970s to 0.72 today. Looking at the evolution across different samples, we find that central banks in more advanced economies (OECD geo-political area) are the ones that have improved the most their independence during the last 4 decades. However, former socialist economies (Eastern European region) are the ones characterized by the highest average degree of CBI in 2014. This is also consistent with the findings of Arnone et al. (2009), who suggest that their proximity to the European Union, together with the process of establishing the euro zone, have strengthened their incentives for introducing autonomous central banks.

Interestingly, central banks in Africa and the Middle East, Latin-America and South-East Asia are now characterized by a similar average degree of independence. However, their evolution over time has been different. The African and Middle Eastern countries kept their central bank institutional setting unchanged between 1972 and the beginning of the 2000s and introduced marginal reforms afterwards. In the case of the Latin-American countries, most of the improvements in CBI happened in the second half of the 1980s and the first half of the 1990s, with the independence of the central bank in some of these countries being subsequently reduced in 2012.

Table 2 presents the pair-wise correlations between the ECBI index and the most commonly used measures of CBI, i.e. the Grilli et al. (1991), Cukierman (1992), and Cukierman et al. (1992) indices. Overall there is a strong positive correlation between all measures.

[Insert Table 2 about here]

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4 CBI before and after the Great Crisis

This section uses the newly created index of CBI to briefly evaluate the evolution of CBI over the past decades.

[Insert Figure 4 about here]

Figure 4 highlights several important trends. Prior to the 2008 Crisis a clear trend towards an increase in the level of CBI is evident. The most striking feature is present in the early 1990s where, together with a spike in the average inflation rate, we see a significant rise in the level of CBI. This coincides with the break-up of the USSR, which resulted in the inclusion in the sample of several economies experiencing high inflation and which implemented significant reforms in their monetary policy institutions throughout this period. The period also coincides with the European Union integration process and the creation of the ECB that required members to implement legislative reforms aimed at assigning their central banks a level of independence similar to the one of the Bundesbank, the highest at the time. Further, in this period the establishment of an independent central bank became an external prerequisite to maintain or gain access in the financial markets.

From this point on, a transition to a period of more stable and low inflation followed. This, as clearly depicted in Figure 4, corresponded to a levelling in the degree of CBI. Furthermore, a clear stabilization in the level of CBI is noticeable following the 2008 Crisis.[9]

5 The CBI-inflation nexus: a new investigation

Finally, this section uses the newly created index of CBI to re-investigate the classical

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[9] See also de Haan and Eijffinger (2017) on the possibility that the trend towards greater CBI may be reversed after the Crisis.

CBI-inflation nexus. It also checks the robustness of these results using other common measures of central bank independence but recomputed dynamically using the new database on central bank design developed in Romelli (2018).

5.1 Baseline estimations

The baseline estimation follows closely the analysis presented in Jacome and Vazquez (2008) and Arnone and Romelli (2013). However, given that the set of countries analyzed now includes both advanced economies and emerging markets, characterized therefore by very different price dynamics, we standardize inflation rates as follows: $\pi_{it}/(1 + \pi_{it})$. This standardization reduces the risk of assigning a too high weight to outliers, such as episodes of hyperinflation (see also Cukierman, 1992).

The first step consists in reassessing the CBI-inflation link in a classical framework that relates the level of inflation to previous values of central bank independence. Drawing on the large literature of CBI, this simple test is augmented with a set of variables that have been largely found to impact the relationship between CBI and inflation. This set of controls includes (i) a *Financial Crises* dummy to isolate the possible inflationary effects associated with financial distress especially in emerging economies; (ii) a measure of the degree of *Openness to Trade* in line with Campillo and Miron (1997); (iii) an *Exchange Rate Regime* dummy to capture countries which have adopted a fixed exchange rate regime; (iv) an *OECD Member* dummy to account for the level of development of the country since OECD members are generally more industrialized and advanced economies and (v) the average level of *World Inflation* to capture inflationary trends and the effect of the decreasing average inflation rate during the great moderation period (see also Jacome and Vazquez, 2008).

Following Jacome and Vazquez (2008), initial estimations were performed using OLS and with fixed-effects at the country level. However, given the heteroskedasticity across panels and the autocorrelation across observations present in the data, the preferred estimations use Feasible Generalized Least Squares (FGLS) allowing for heteroskedasticity across countries and a common AR(1) error process.

[Insert Table 3 about here]

Table 3 presents the results obtained using the FGLS estimations. In particular, Column (1) shows the estimations using the ECBI measure of independence, while Columns (2) to (7) present the estimates pertaining to the alternative measures of independence recomputed dynamically. The coefficients of the different indices of CBI are generally similar and negatively related to inflation at a 1% level. This confirms the results in Arnone and Romelli (2013) that countries characterized by higher independence of their central bank also experience lower inflation rates.

Looking at the additional set of control variables, results suggest that banking crises are associated with higher inflation, since the liquidity assistance to troubled banks might create inflationary pressures. The degree of openness to trade is only marginally significant for the ECBI and the CWNE index, while, as expected, more industrialized economies (OECD member countries) are associated with lower inflation. Finally, the positive and statistically significant relationship between the dependent variable and world inflation indicates that inflationary trends worldwide have an influential effect on the inflation rate of the analyzed countries.

While this simple test confirms the negative correlation between inflation and central bank independence it does not, however, imply a causal link. A recent literature on

endogenous political institutions argues that central bank independence is not imposed "exogenously", but evolves in response to changing political, social or economic factors. For example, Aghion et al. (2004) consider the case of the German Bundesbank whose statute was modified in 1957 as a result of a strong public aversion towards inflation after periods of hyperinflation in Germany. They argue that, often, central banks have been made more independent, to "insulate" monetary policy in periods of high inflation. Posen (1995) also 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 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 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 and Romelli, 2015). The 2008-09 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.

All these arguments suggest that the level of central bank independence evolves endogenously as a response to a set of social, economic and political factors. The dynamic nature of the new index of CBI proposed in this paper can overcome many of the challenges of previous research and provide a reliable instrument of central bank independence.

5.2 CBI-inflation nexus with endogeneity

To account for the possible endogeneity of the degree of central bank independence, we re-estimate the results presented in Table 3 using an instrumental variable approach. In particular, the degree of central bank independence is instrumented by: i) its lagged value, to account for a time dependence of CBI; ii) the lagged level of the unemployment rate, to control for the short-run trade-off between inflation and unemployment;[10] iii) an indicator of government stability, since we can expect that more stable governments are more likely to adopt reforms, including granting more independence to the monetary policy

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[10] Looking at the link between unemployment and CBI, for example, Eijffinger and Schaling (1995) show that a higher natural rate of unemployment is associated with a higher degree of central bank independence.

authority; iv) the level of GDP per capita; and v) a dummy variable for currency unions, which in this sample assumes the value one for the Euro zone countries characterized by a similar degree of central bank independence. The results of the first stage estimation are not reported, but suggest that all the instruments except the government stability one are appropriate, with coefficients significant at the 1% level.

Table 4 presents the results obtained by implementing an instrumental variable estimation for fixed-effects panel data.[11] Importantly, the Hausman test statistic suggests the rejection of the null hypothesis that the endogenous regressor can be treated as exogenous, confirming that the degree of central bank independence is indeed an endogenous variable in this analysis.

Column (1) shows the estimations using the instrumented ECBI index, while Columns (2) to (7) look at the instrumented alternative measures of independence. These results confirm the negative and statistically significant (at 1% level) relationship between inflation and the different indices of CBI. More importantly, the point estimates of the instrumented level of CBI are almost twice as big as the estimated coefficients of CBI in Table 3, suggesting an even stronger effect of central bank independence on inflation rates. Furthermore, the results in Table 4 also suggest an important effect of periods of financial distress and inflationary trends around the world. Moreover, now, also the level of openness to trade and the type exchange rate regime of the country are more precisely estimated.

[Insert Table 4 about here]

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[11] The Hausman specification test always rejected the null hypothesis of equality between the coefficients of the random and the fixed-effects models in all specification, suggesting therefore that the fixed effect model is more reasonable.

The robustness of these results is tested using the Limited Information Maximum Likelihood (LIML) estimation technique. This estimation is more robust in the presence of weak instruments. The results obtained using this alternative technique are presented in Appendix Table A2 and are qualitatively similar.

How to interpret these results? The intuition is quite simple: the endogeneity nature of CBI that we observed in the data cannot be explained by the existence of a superior setting for delegating powers to central banks, i.e. the optimal CBI doesn't exist. In this context, the different arguments supporting increases or decreases of the degree of CBI are likely to be weighted differently by the incumbent government that – from time to time and country by country – will modify the design and governance of these public administrations.

6 Conclusions

The impact of central bank institutional design on real economic outcomes received large attention over the last three decades. It has been claimed that more than 9000 works have been devoted to the role of CBI in influencing economic outcomes (Vuletin and Zhu, 2011). Moreover, in the aftermath of the 2008-09 Global Financial Crisis, the debate on the optimal design of monetary policy authorities has seen a further revived interest. In general, the debate on the nexus between the independence of public agencies and their performances has been particularly vivid both in economics and political science.

This paper contributes to this debate by using dynamic indices of central bank independence which allow for a new and more precise theoretical and empirical re-investigation on this topic. We provide a detailed description on the evolution of central bank independence for a set of 65 countries during the period 1972-2014 and document some important trends in central bank design over the past four decades. Finally, we

reinvestigate the CBI-inflation nexus. We go beyond the simple negative correlation between CBI and inflation by employing an instrumental variable approach where the level of CBI is instrumented by a set of politico-economic factors.

Our results highlighted the endogeneity of the CBI feature, i.e. the level of central bank independence depends on the political and economic drivers that shape the incentives of the government in charge that – time to time and country by country – maintains or reforms the governance setting of such important public agency.

More generally, the methodology employed in this paper can be used for the analysis of other independent regulatory agencies. It is a matter of fact that the decisions to delegate powers to independent regulatory agencies has characterized the last four decades, and that the academic literature has been investigating both the drivers and the effects of such institutional design. These investigations are based on institutional metrics that can be used both as independent or dependent variables, but also as additional control variables. By checking the nature and the robustness of these indicators, it will be possible to improve the overall quality of this research topic.

Needless to say, the above discussion zoomed on a specific institutional quality, i.e. agency independence, but the same methodology could be fruitfully applied in analyzing other features such as accountability or transparency or in exploring the differences between the nature - de jure or de facto – of institutional characteristics of a public agency.

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Figure 1: Research and policy articles with a title containing the word "Central Bank Independence" (1991-2015)

Central Bank Independence: Articles and Papers

Notes: Figure 1 presents the evolution of the number of academic papers and research published with a title containing the words "Central Bank Independence", between 1991 and 2015. Data obtained from SSRN and JSTOR. Source: Masciandaro and Romelli (2018).

Table 1: Institutional characteristics of CBI indices (Part A)

Criteria	GMT	CWN	ECBI
Governor and Central Bank Board			
Who appoints the governor	*	*	*
Term of office of governor	*	*	*
Reappointment option for governor			*
Dismissal of governor		*	*
Governor allowed to hold another office in government		*	*
Qualification requirements for governor			*
Who appoints the board members	*		*
Term of office of board members	*		*
Reappointment option for board members			*
Dismissal of board members			*
Board Members allowed to hold another office in government			*
Qualification requirements for board members			*
Staggering term of office for board members			*
Government representatives in the board	*		*
Monetary Policy and Conflicts Resolution			
Who formulates monetary policy	*	*	*
Central bank responsible to fix key policy rates	*		*
Banking sector supervision	*		*
Central bank role in government's budget and/or debt	*		*
Final authority in monetary policy	*	*	*
Objectives			
Central bank's statutory goals	*	*	*
Lending to the Government			
Direct credit: not automatic	*	*	*
Direct credit: market of lending		*	*
Who decides financing conditions to government		*	*
Beneficiaries of central bank lending		*	*
Direct credit: type of limit	*	*	*
Direct credit: maturity of loans	*	*	*
Direct credit: interest rates	*	*	*
Prohibition from buying government securities in primary market	*	*	*

Note: GMT = Grilli et al. (1991), CWN = Cukierman et al. (1992) and ECBI = Extended CBI

Index.

Table 1: Institutional characteristics of CBI indices (Part B)

Criteria	GMT	CWN	ECBI
Financial Independence			
Payment of the initial capital of the central bank			*
Authorized capital of the central bank			*
Central bank financial autonomy			*
Arrangements for automatic recapitalization			*
Transfers of money from the treasury			*
Central bank approves its annual budget			*
Central bank adopt its annual balance sheet			*
Auditing agency			*
Allocation of the net profits			*
Allocation of profits to the general reserve fund			*
Partial payments of dividends before the end of the fiscal year			*
Unrealized profits included in the calculation of distributable profits			*
Central Bank Reporting and Accountability			
Central bank reporting			*
Central bank financial statements			*

Note: GMT = Grilli et al. (1991), CWN = Cukierman et al. (1992) and ECBI = Extended CBI Index.

Figure 2: Degree of independence by dimension
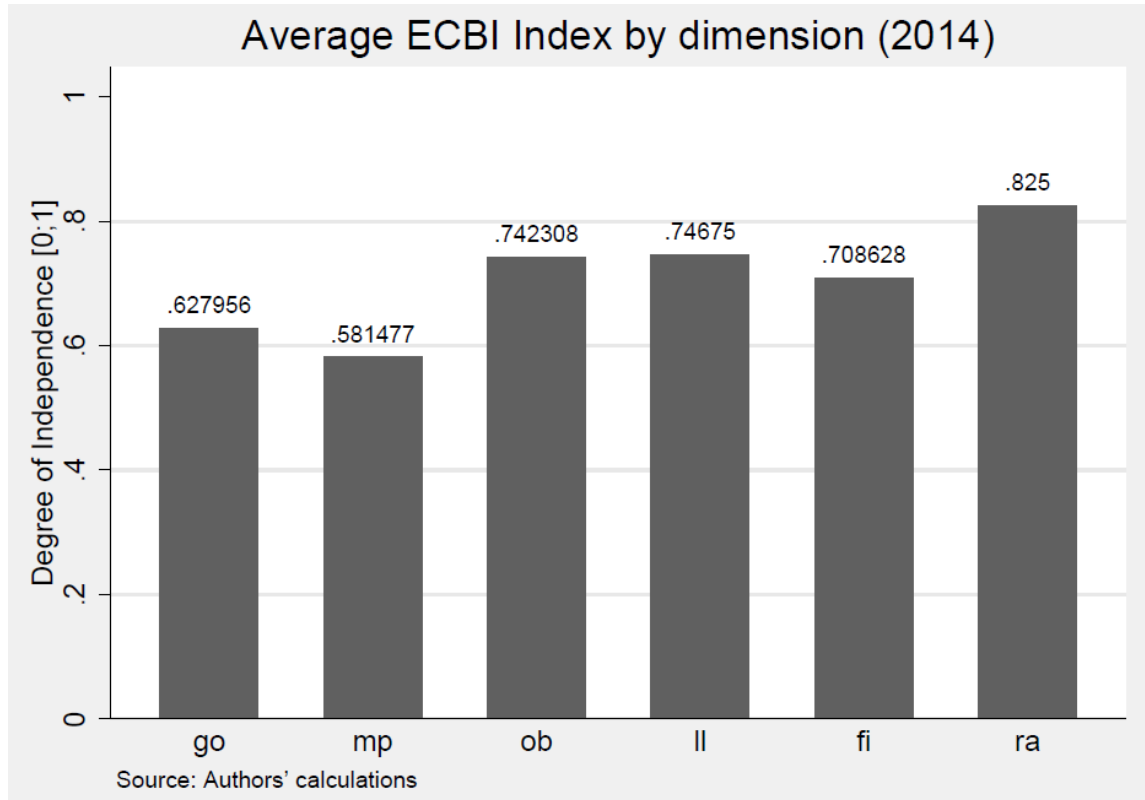
Each bar indicates the average value of independence of the different dimensions of the ECBI index in 2014. *go*: governor and central bank board. *mp*: monetary policy and conflict resolution. *ob*: monetary policy objectives. *ll*: limitations on lending to the government. fi: central bank finances. Finally, *ra*: reporting and accountability.

Table 2: Cross-correlation between measures of CBI

Variables	ECBI	GMT	LVAU	LVAW
ECBI	1			
GMT	0.8762	1		
LVAU	0.9190	0.8774	1	
LVAW	0.9437	0.8998	0.9901	1

Note: ECBI = Extended CBI Index; GMT = Grilli et al. (1991); LVAU = Cukierman (1992); LVAW = Cukierman et al. (1992).

Figure 3: Average degree of ECBI across regions
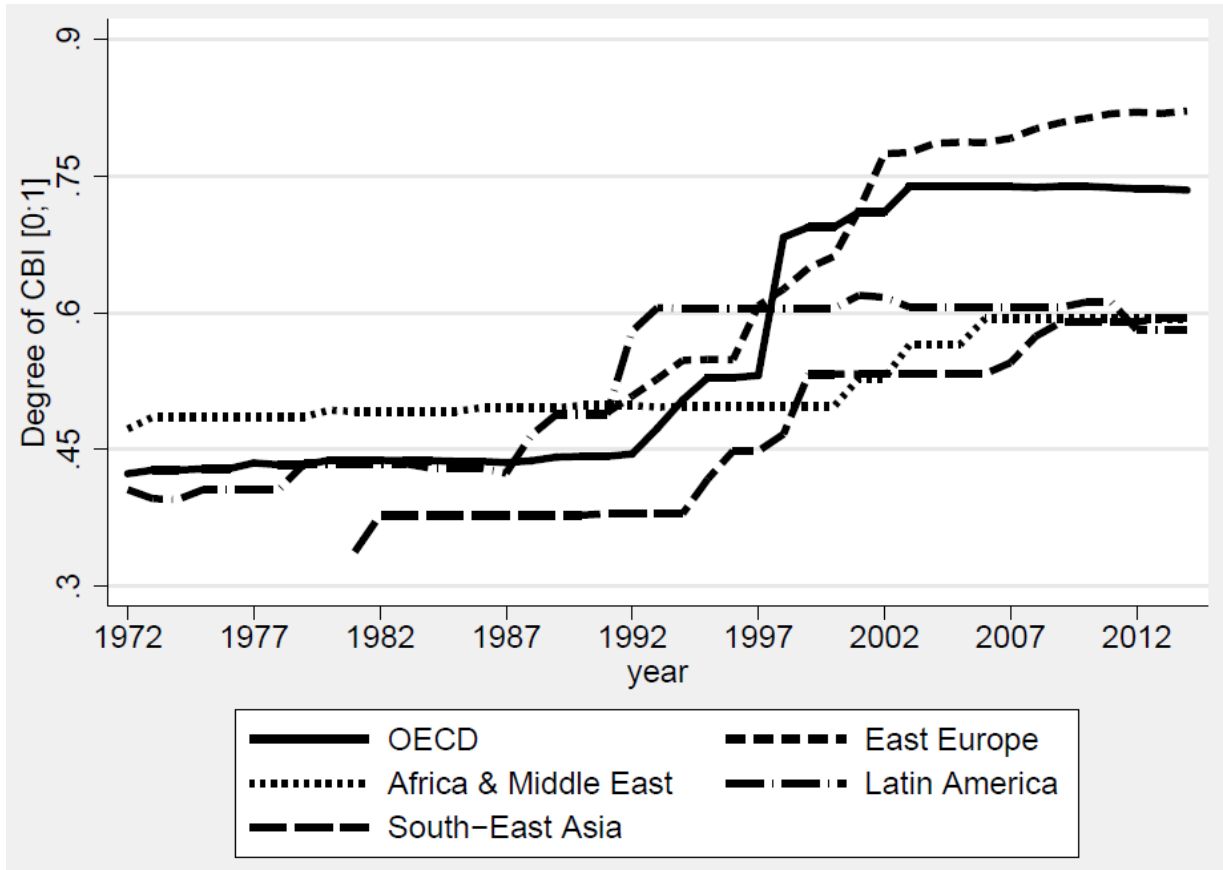
[Add discussion here]

Figure 4: The evolution of the ECBI index and Inflation (1972-2014)
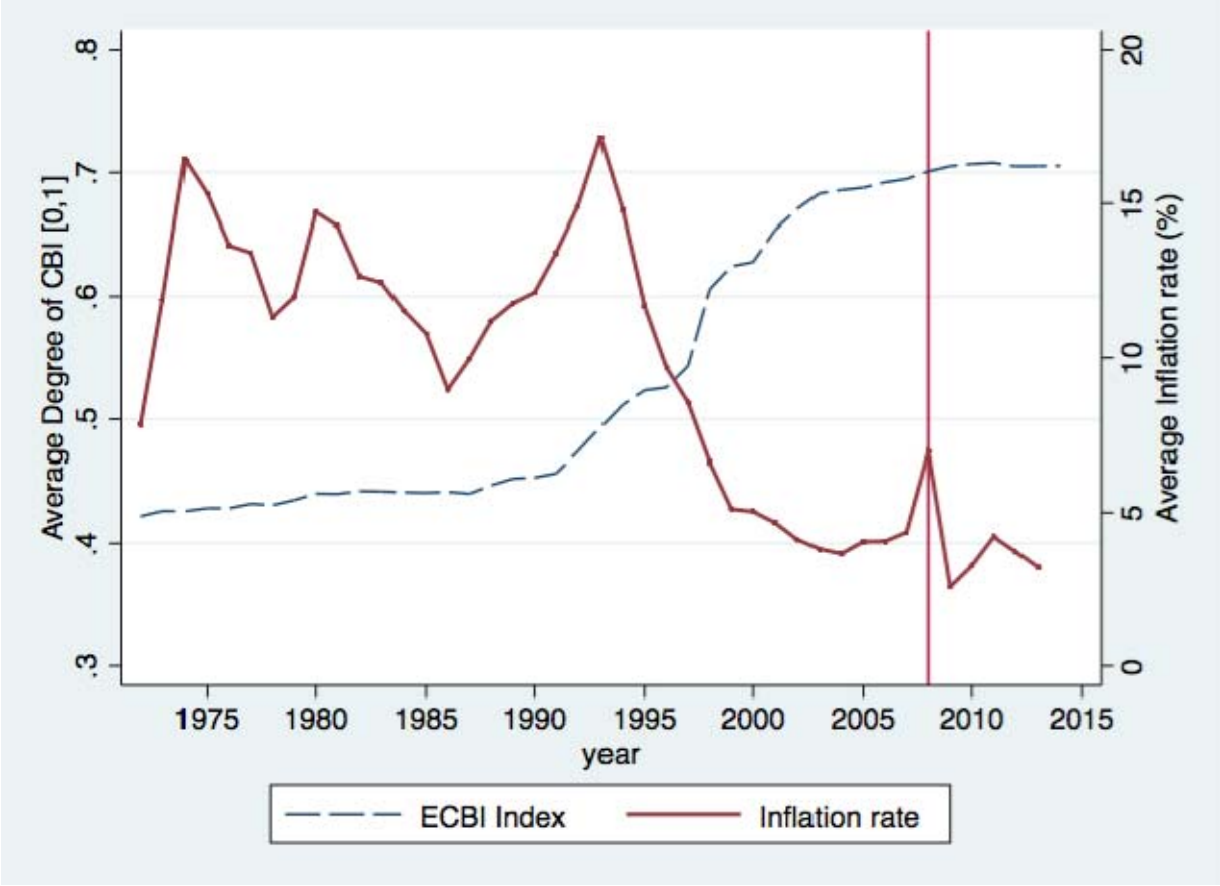
Notes: Figure 3 shows the evolution of the average ECBI index of central bank independence (left vertical axis) and inflation rate (right vertical axis) for the 65 analyzed countries, over the period 1972-2014.

Table 3: Panel regressions of inflation on CBI (FGLS)

CBI Indices:	ECBI	GMT	LVAU	LVAW	CWNE	CBIU	CBIW
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$CBI_{i,t}$	-0.0434***	-0.0308***	-0.0275***	-0.0293***	-0.0382***	-0.0293***	-0.0301***
	(0.010)	(0.008)	(0.007)	(0.007)	(0.008)	(0.007)	(0.007)
Financial Crises	0.0056*	0.0054*	0.0054*	0.0055*	0.0057*	0.0055*	0.0055*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Openness to Trade	0.0001*	0.0001	0.0001	0.0001	0.0001*	0.0001	0.0001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Exchange Rate Regime	-0.0026	-0.002	-0.0027	-0.0027	-0.0029	-0.0027	-0.0027
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
OECD Member	-0.0159**	-0.0157**	-0.0172**	-0.0170**	-0.0167**	-0.0167**	-0.0166**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
World Inflation	0.0012***	0.0013***	0.0013***	0.0013***	0.0012***	0.0013***	0.0013***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	1,729	1,729	1,729	1729	1729	1729	1,729
Number of countries	57	57	57	57	57	57	57

The dependent variable is inflation scaled as $\pi_{i,t}/(1 + \pi_{i,t})$. The coefficients were estimated using Feasible Generalized Least Squares, allowing for heteroscedasticity across countries and an AR(1) autocorrelation structure within countries. The main independent variables are the indices of CBI, measured alternatively by the ECBI, GMT (Grilli et al., 1991), LVAU (Cukierman, 1992), LVAW (Cukierman et al., 1992), CWNE (Jacome and Vazquez, 2008) and CBIU, CBIW (Dincer and Eichengreen, 2014) indices. Financial Crises is a dummy that takes the value one if a country is experiencing a systemic banking crisis in the current year. Openness to Trade is the ratio of the sum of exports and imports to GDP. Exchange Rate Regime is a dummy that takes value one is a country is adopting a fixed exchange rate regime. OECD Member is a dummy that takes the value one if the country is a member of the OECD. World Inflation is the average inflation rate in the world. Constant term and lagged inflation rate included but not reported.

Standard errors in parentheses. ***/**/* denotes significance at the 1%/5%/10%-percent level respectively.

Table 4: Panel regressions of inflation on CBI (IV)

CBI Indices:	ECBI	GMT	LVAU	LVAW	CWNE	CBIU	CBIW
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$CBI_{i,t}$	-0.0864***	-0.0667**	-0.0982***	-0.0893***	-0.0814***	-0.0952***	-0.0871***
	(0.030)	(0.029)	(0.021)	(0.022)	(0.026)	(0.022)	(0.022)
Financial Crises	0.0090**	0.0084*	0.0088*	0.0092**	0.0088**	0.0089**	0.0091**
	(0.004)	(0.005)	(0.005)	(0.005)	(0.004)	(0.005)	(0.004)
Openness to Trade	0.0005***	0.0004***	0.0005***	0.0005***	0.0005***	0.0005***	0.0005***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Exchange Rate Regime	-0.0152**	-0.0153**	-0.0120*	-0.0127**	-0.0144**	-0.0125**	-0.0130**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
OECD Member	-0.0101	-0.0142	-0.0075	-0.0109	-0.0112	-0.0074	-0.0107
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
World Inflation	0.0074***	0.0079***	0.0068***	0.0071***	0.0073***	0.0069***	0.0071***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	749	749	749	749	749	749	749
R-squared	0.381	0.377	0.375	0.378	0.381	0.377	0.379
Number of countries	56	56	56	56	56	56	56

The dependent variable is inflation scaled as $\pi_{i,t}/(1 + \pi_{i,t})$. The coefficients were estimated using Feasible Generalized Least Squares, allowing for heteroscedasticity across countries and an AR(1) autocorrelation structure within countries. The main independent variables are the indices of CBI, measured alternatively by the ECBI, GMT (Grilli et al., 1991), LVAU (Cukierman, 1992), LVAW (Cukierman et al., 1992), CWNE (Jacome and Vazquez, 2008) and CBIU, CBIW (Dincer and Eichengreen, 2014) indices. Financial Crises is a dummy that takes the value one if a country is experiencing a systemic banking crisis in the current year. Openness to Trade is the ratio of the sum of exports and imports to GDP. Exchange Rate Regime is a dummy that takes value one is a country is adopting a fixed exchange rate regime. OECD Member is a dummy that takes the value one if the country is a member of the OECD. World Inflation is the average inflation rate in the world. Constant term and lagged inflation rate included but not reported.

Standard errors in parentheses. ***/**/* denotes significance at the 1%/5%/10%-percent level respectively.

Table A1: Analyzed countries

Country	Year	Region	Country	Year	Region
Afghanistan	2003	Africa & Middle East	Lithuania	1994	Eastern Europe
Albania	1992	Eastern Europe	Luxembourg	1983	OECD
Algeria	1962	Africa & Middle	Malaysia	1982	South-East Asia
Argentina	1935	Latin America	Malta	1994	Eastern Europe
Australia	1959	OECD	Mexico	1960	Latin America
Austria	1955	OECD	Mongolia	1996	South-East Asia
Bahrain	1973	Africa & Middle	Montenegro	2005	Eastern Europe
Belgium	1948	OECD	Morocco	1959	Africa & Middle
Bosnia and Herzegovina	1997	Eastern Europe	Netherlands	1948	OECD
Brazil	1964	Latin America	New Zealand	1933	OECD
Bulgaria	1991	Eastern Europe	Norway	1966	OECD
Canada	1954	OECD	Poland	1997	Eastern Europe
Chile	1953	Latin America	Portugal	1962	OECD
China	1995	South-East Asia	Qatar	1993	Africa & Middle
Croatia	1991	Eastern Europe	Romania	1991	Eastern Europe
Cyprus	1963	Eastern Europe	Russia	1992	Eastern Europe
Czech Republic	1991	Eastern Europe	Saudi Arabia	1957	Africa & Middle
Denmark	1942	OECD	Singapore	1991	South-East Asia
Estonia	1993	Eastern Europe	Slovakia	1992	Eastern Europe
Finland	1966	OECD	Slovenia	1991	Eastern Europe
France	1936	OECD	South Korea	1950	South-East Asia
Germany	1957	OECD	Spain	1962	OECD
Greece	1959	OECD	Sweden	1966	OECD
Hungary	1991	Eastern Europe	Switzerland	1953	OECD
Iceland	1966	OECD	Thailand	1942	South-East Asia
India	1934	South-East Asia	Trinidad and Tobago	1964	Latin America
Indonesia	1953	South-East Asia	Turkey	1970	Africa & Middle
Iran	1972	Africa & Middle	Ukraine	1991	Eastern Europe
Ireland	1942	OECD	United Arab	1980	Africa & Middle
Italy	1948	OECD	United Kingdom	1946	OECD
Japan	1957	OECD	United States of America	1951	OECD
Kuwait	1968	Africa & Middle	Venezuela	1939	Latin America
Latvia	1992	Eastern Europe			

Table A2: Panel regressions of inflation on CBI (IV with LIML)

CBI Indices:	ECBI	GMT	LVAU	LVAW	CWNE	CBIU	CBIW
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$CBI_{i,t}$	-0.0880***	-0.0685**	-0.1005***	-0.0911***	-0.0830***	-0.0974***	-0.0889***
	(0.030)	(0.030)	(0.021)	(0.023)	(0.027)	(0.022)	(0.023)
Financial Crises	0.0090**	0.0084*	0.0088*	0.0092**	0.0088**	0.0089**	0.0091**
	(0.004)	(0.005)	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)
Openness to Trade	0.0005***	0.0004***	0.0005***	0.0005***	0.0005***	0.0005***	0.0005***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Exchange Rate Regime	-0.0151**	-0.0152**	-0.0119*	-0.0126**	-0.0143**	-0.0125**	-0.0129**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
OECD Member	-0.01	-0.0142	-0.0073	-0.0107	-0.0111	-0.0072	-0.0105
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.016)	(0.015)
World Inflation	0.0073***	0.0078***	0.0068***	0.0071***	0.0073***	0.0069***	0.0071***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	749	749	749	749	749	749	749
R-squared	0.381	0.377	0.374	0.377	0.38	0.377	0.379
Number of countries	56	56	56	56	56	56	56

The dependent variable is inflation scaled as $\pi_{it}/(1 + \pi_{it})$. The coefficients were estimated using Feasible Generalized Least Squares, allowing for heteroscedasticity across countries and an AR(1) autocorrelation structure within countries. The main independent variables are the indices of CBI, measured alternatively by the ECBI, GMT (Grilli et al., 1991), LVAU (Cukierman, 1992), LVAW (Cukierman et al., 1992), CWNE (Jacome and Vazquez, 2008) and CBIU, CBIW (Dincer and Eichengreen, 2014) indices. Financial Crises is a dummy that takes the value one if a country is experiencing a systemic banking crisis in the current year. Openness to Trade is the ratio of the sum of exports and imports to GDP. Exchange Rate Regime is a dummy that takes value one is a country is adopting a fixed exchange rate regime. OECD Member is a dummy that takes the value one if the country is a member of the OECD. World Inflation is the average inflation rate in the world. Constant term and lagged inflation rate included but not reported.

Standard errors in parentheses. ***/**/* denotes significance at the 1%/5%/10%-percent level respectively.