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Long run inflation: persistence and central bank independence*

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Abstract

This paper provides novel evidence of the long-run effects of central bank independence on inflation. We show that improvements in central bank independence have a much larger impact on inflation in the long run compared to the short run. Contrary to most of the previous literature, our results also show that the long-run effects of central bank independence on inflation are larger in developing countries. We find similar effects using linear and instrumental variable local projection methods. Finally, we show that central bank independence also reduces inflation persistence, reinforcing the effectiveness of monetary policy.

Keywords: central bank design, central bank independence, inflation, persistence.
JEL classification: E5, E31, E52, E58.

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1 Introduction

Central bank independence has recently re-emerged as a major concern within political economy discussions. Following the era that Mervyn King, former governor of the Bank of England, termed as the "nice" (non-inflationary consistently expansionary) years King (2003), characterized by the Great Moderation, many economies are now experiencing high levels of inflation volatility (Schnabel, 2022). In such a dynamic environment, the role of effective monetary policies becomes even more crucial.

A broad consensus has emerged among policymakers, academics, and experts worldwide that effective monetary policies played a key role in fostering the Great Moderation. Yet, doubts about the benefits of an independent central bank have emerged. In recent years, prominent politicians have voiced concerns about the role of independent central banks and proposed reviewing or even curtailing their independence (CNBC, 2022). In 2018, then-President Donald Trump openly criticized the Federal Reserve's four interest rate hikes, expressing dissatisfaction with the central bank's monetary policy (Binder, 2021). Following his re-election in November 2024, President-elect Trump has remained vague about the extent of coordination between the presidency and the central bank, having previously suggested that the president should have a consultative role in the Federal Reserve's decisions. (NewYorkTimes, 2024)[1]. Similarly, some European leaders expressed concerns over the European Central Bank's rapid interest rate increases in 2022 and its potential impact on economic growth (Politico, 2022)[2], while some have even proposed legislation giving governments the power to make senior appointments at central banks (Reuters, 2024). On the other hand, academics and central bankers alike continue to uphold central bank independence as a fundamental pillar of sound economic policy-making (Rajan, 2016; Rogoff, 2021; Haldane, 2020; Jordan, 2022; Plosser, 2022; Powell, 2023).

There are sound theoretical reasons to believe that an independent central bank can achieve superior outcomes than a monetary authority under the complete control of the government (see Barro and Gordon, 1983, among many others). However, the empirical

[1] Drechsel (2024) shows that the extent of personal interaction between the president and the chair of the FED can "strongly and persistently raise inflation".

[2] Sanna Marin, Finland's former prime minister, was among the first European leaders to reopen this debate. In early October 2022, various newspapers reported the news about her retweet of an article followed by the quote: "There is something seriously wrong with the prevailing ideas of monetary policy when central banks protect their credibility by driving economies into recession" Financial Times (2022).

literature on the effects of central bank independence on inflation provides conflicting evidence. In a comprehensive review of this literature, Masciandaro et al. (2020) highlight the diversity of empirical approaches adopted and concludes that a consensus has yet to be reached regarding the impact of central bank independence on multiple macroeconomic variables, including inflation.

While the literature on the effects of central bank independence on inflation is extensive, there has been surprisingly little interest in investigating the long-run impacts of central bank reform on inflation dynamics. Most studies either ignore inflation dynamics in their examined specifications or, when including lagged inflation values, they do so with the purpose of improving the model fit rather than analyzing the dynamic effects of central bank independence on inflation. This paper aims to address this gap in the literature.

Our focus on inflation dynamics is motivated by the persistent nature of the inflationary process and the influential role that beliefs and expectations play in shaping monetary policy. From an economic perspective, the effects of a successful structural reform are expected to be long-lasting. A government's *de jure* commitment to refrain from intervening in monetary policy is expected to progressively enhance central bank credibility over time through accumulated experience and consistent policy adherence. Importantly, agents' assimilation of the central bank's anti-inflationary measures into their expectations would be a gradual process, as it would take time to assess the credibility of a reform.[3] As we show in our analysis, countries that are perceived to be less developed and whose central bank is less credible seem to obtain greater benefits from central bank reforms in the long run.

From a statistical perspective, the expected long-term impact of a shock to a persistent process is positively correlated with the degree of the process's persistence. The higher the persistence, the greater the long-term effect of the shock. Notably, the high persistence of inflation justifies our focus on the long-run effects of reforms, which contrasts with the predominant attention given to its short-run effects in most of the literature on the topic.[4]

Our empirical strategy estimates the long-run effects of changes in central bank in-

[3] Cukierman and Meltzer (1986) define credibility in terms of the speed at which the public recognizes changes in the objectives of the policymaker, though in their setting the policymaker reveals his preferences through monetary policy control rather than by declaring a new policy framework. In the case of *de-jure* independence, there is uncertainty about the significance of the declaration, so the slower dynamics of partial gains in credibility would lead to a long-run effect that is higher than the short-run impact.

[4] See Fuhrer (2010) for a comprehensive review of the concept of inflation persistence in macroeconomic theory and empirics.

dependence on inflation by employing both a dynamic panel model and local projections. Unlike the conventional static analyses commonly used in the literature, our dynamic panel modelling approach accounts for inflation persistence while explicitly incorporating it into the estimation of central bank independence's long-run effects on inflation.

Our study uses the central bank independence index introduced in Romelli (2022) and updated in (Romelli, 2024), a *de-jure* index of central bank independence based on the codification of the central bank legislation of 155 countries between 1972 and 2023. This comprehensive index allows us to investigate the dynamic effects of central bank independence on inflation for a large set of countries. In our baseline specification, we use a conventional dynamic panel model able to account for the dynamics of inflation.[5] Furthermore, using the local projection methodology established by Jordà (2005), we also employ a direct estimation method to quantify the long-run effects of central bank independence on inflation. Finally, we address potential endogeneity concerns associated with structural reforms by employing an instrumental variable local projections (IV-LP) approach, allowing for a more robust estimation of dynamic causal effects while mitigating bias from endogenous regressors.

To preview our results, we find that an advanced economy moving from the first to the fourth quartile of the index of central bank independence would experience a long-run reduction of annual inflation of approximately 3.7 percentage points. However, this effect is considerably larger for developing countries, with an average decrease in annual inflation of around 10.3 percentage points. By analyzing inflation's impulse response functions to changes in central bank independence, we find that the effects of central bank reforms take time to materialize. Overall, our results indicate that it is developing economies that primarily benefit from improvements in central bank independence.

Our study contributes to two strands of the literature: the one on institutional reforms and the one on the link between central bank independence and inflation. As observed by Acemoglu et al. (2008), central bank independence is a narrow reform, targeting a distinct objective - inflation. Our focus on the long-run effects of central bank reforms on inflation highlights the dynamic effects of institutional changes, which can be driven by a multitude of political and economic factors (Masciandaro and Romelli, 2015; Romelli, 2022).

[5]This modelling approach has been used extensively in the literature on structural changes (see Acemoglu et al., 2019, on the effects of democratizations on GDP per capita).

We also contribute to the literature on central bank independence in several ways. First, we quantify the long-run effect of central bank reforms on inflation for a large set of countries. Indeed, given the persistent nature of inflation (Fuhrer, 2010), one could expect that the effects of a reform in central bank independence may unfold over time, particularly in contexts in which the central bank's credibility is initially lacking. Second, we apply an instrumental variables estimation to account for the endogeneity of central bank reform. Finally, our study also presents suggestive evidence that central bank independence lowers inflation persistence.

The rest of the paper is organized as follows. The section 2 briefly reviews the literature. In section 3 we describe our data, while section 4 presents the empirical strategies employed in the paper. Section 5 presents the results and section 6 concludes.

2 Literature review

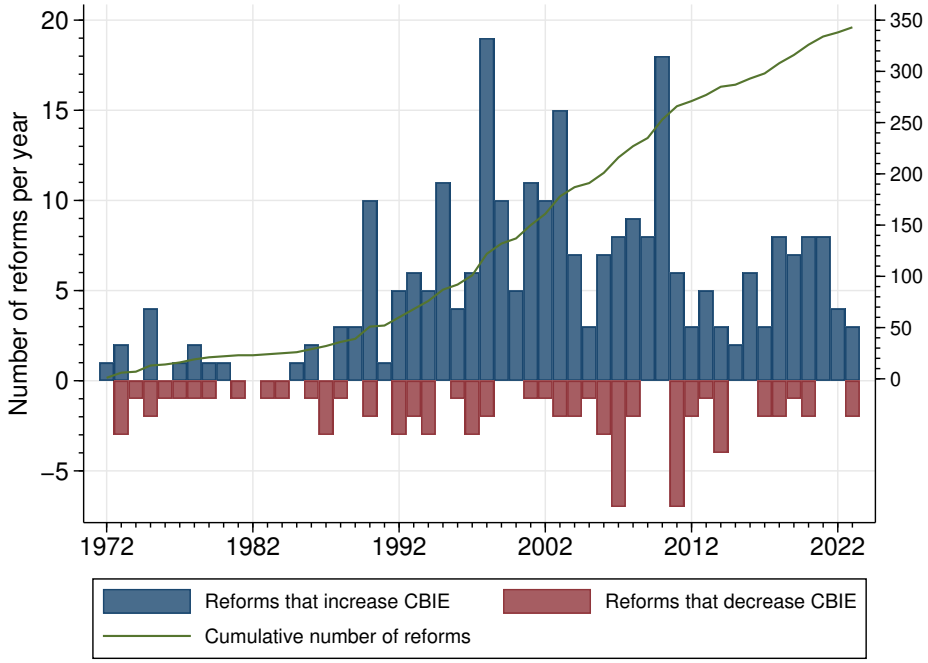
As the literature on the relationship between central bank independence (CBI, henceforth) and inflation is extensive, a comprehensive review is beyond the scope of this paper. Thus, this section offers a concise overview of the methodological evolution of this literature and its findings.[6]

The modern empirical literature on CBI starts in the early 1990s when the first indices of *de-jure* CBI were proposed by Grilli et al. (1991) and Cukierman et al. (1992). These indices were obtained by codifying central banks' legislation at distant points in time. However, their lack of temporal variability had the inevitable consequence that early empirical investigations on the effects of CBI on inflation or other macroeconomic variables were based on cross-sectional analyses. Although the results were generally in favour of the adoption of central bank reforms aimed at increasing central bank independence (Alesina and Summers, 1993), concerns about the well-known limitations of cross-country regressions remained unanswered.

Amidst the strength of the empirical evidence at the time, central bank independence emerged as an appealing policy solution to some of the macroeconomic policy challenges

[6]For a meta-regression analysis of the studies examining the relationship between inflation and central bank independence, see Klomp and De Haan (2010). Additionally, an overview of the empirical analysis examining the correlation between central bank independence, inflation, and other macroeconomic variables is provided by Masciandaro et al. (2020).

Figure 1: Central Bank legislative reforms (1972-2023)



Note: The figure shows the frequency of reforms that increased/decreased the CBIE index and the cumulative number of reforms in central bank independence between 1972 and 2023. Source: Authors based on Romelli (2024).

identified by the rational expectations revolution of the 1970s. The notion of central bank independence, coupled with the "more conservative than the median voter" central banker by Rogoff (1985), offered a natural answer to the time inconsistency problem identified by Kydland and Prescott (1977) and Barro and Gordon (1983). Within the strategic interaction described by Sargent and Wallace (1981), delegating monetary policy to an independent central bank emerged as a plausible avenue for conflict resolution.

As Figure 1 illustrates, the trend toward greater central bank independence in economic policymaking began in the late 1980s. This evolution in central bank institutional design had the advantageous effect of enabling the use of panel data methods to analyze the relationship between central bank independence and macroeconomic variables. Over the past two decades, a new generation of scholars has developed dynamic indices of central bank independence (CBI), significantly expanding the number of countries analyzed in their empirical research. These studies have largely confirmed a negative *short-run* relationship between central bank independence and inflation, particularly in advanced economies. (see Polillo and Guillén, 2005; Crowe and Meade, 2008; Jacome and Vazquez, 2008; Arnone

and Romelli, 2013; Bodea and Hicks, 2015b; Garriga and Rodriguez, 2020; Jacome and Pienknagura, 2022). Our paper complements this still-growing literature by providing evidence of the *long-run* effects of central bank independence on inflation.

Central bank independence, as a transformative monetary policy framework, is closely linked to the extensive literature on the credibility of disinflation processes. The concept of partially credible disinflation can be traced back to seminal works such as Cukierman and Meltzer (1986), where credibility is defined as the "speed with which the public recognises changes in the objective function of the policymaker". More recently, researchers have analysed the relationship between central bank credibility and its persistent effects on inflation (see Erceg and Levin, 2003; Rudd and Whelan, 2003; Bordo and Siklos, 2015, among others). These studies link the monetary policy regime of a country with its disinflation process. Our paper also contributes to this strand of literature.

Finally, this paper also engages with the extensive yet inconclusive literature on the effects of monetary policy regimes on inflation persistence.[7] By the early 2000s, as the dis-inflationary process was increasingly evident, the "good luck vs. good policy" debate surrounding the origins of the Great Moderation also encompassed the issue of inflation persistence. Major contributions in this literature like Benati (2008), Benati and Surico (2008), and O'Reilly and Whelan (2005) did not reach a consensus on the effects of monetary policy on the persistence of inflation. By the end of the 2010s, with the flattening of Phillips curve and the growing insensitivity of inflation to its own lags, researchers concluded that inflation was predominantly forward-looking and well anchored (see for example Blanchard, 2018).[8] The resurgence of inflation between 2022 and 2023 has renewed the urgency of understanding the determinants of inflation persistence. Our paper pro-

[7]The literature on inflation persistence differs from the broader one on long-term persistence in development. Two main strands of research have progressively emerged in this latter literature. The first emphasizes that institutions established through natural experiments in otherwise similar geographical environments tend to endure over time (Acemoglu et al., 2021; Banerjee and Iyer, 2005). The second highlights the role of culture in persistence by examining cultural variations within historical contexts that share a common institutional framework (Putnam et al., 1994; Guiso et al., 2016). More recently, these approaches have been integrated to explain persistence by exploring the interactions between institutions and culture and their impact on economic and social outcomes (Greif and Tabellini, 2010; Persson and Tabellini, 2021; Bisin et al., 2024).

[8]The policy conclusion of Blanchard (2018) that "given the evidence [..] on stickiness of inflation expectations [..] there is a strong case, although not an overwhelming case, to allow US output to exceed the potential for some time, so as to reintegrate some of the workers who left the labour force during the last ten years" echos the concerns of Pivetta and Reis (2007) that "detecting whether persistence has recently fallen is key in assessing the likelihood of recidivism by the central bank".

vides some evidence suggesting that central bank independence can also reduce inflation persistence.

3 Data and descriptive statistics

This section describes the data used in the analysis. The index of central bank independence used in the paper is presented in Section 3.1. Section 3.2 discusses our dependent variable, i.e. inflation, while Section 3.3 describes the additional control variables used in the analysis.

3.1 Index of central bank independence

As highlighted in Arnone and Romelli (2013), legal indices of central bank independence (CBI) are suitable measures for analyzing the relationship between CBI and inflation for three key reasons. First, the mere adoption of a legal statute aimed at ensuring central bank independence can help anchor inflationary expectations within the economy (Polillo and Guillén, 2005). Second, legal indices focus on specific provisions outlined in central bank legislation, reducing the potential for bias stemming from subjective interpretations. Finally, because de facto indices of central bank independence often rely on the turnover rate of central bank governors, they overlook the broader institutional features of a country's monetary policy framework.

In this paper, we use the Central Bank Independence - Extended (CBIE) index introduced in Romelli (2022) and updated in Romelli (2024). This index covers a sample of 155 countries from 1972 to 2023.[9] This index uses the classical indices of CBI, namely the Grilli et al. (1991, GMT, hereafter) and Cukierman et al. (1992, CWN, hereafter) indices, to develop a new and comprehensive index of central bank independence that covers a wider range of central bank characteristics. By incorporating the characteristics of *both* the GMT and CWN indices, the CBIE index overcomes 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). In addition to incorporating these two established indices, this index introduces novel criteria aimed at

[9]See Appendix Table A for the full set of countries and information on data availability.

Table 1: Summary statistics on the evolution of the CBIE index

Period	# of Countries	# of Reforms	# of Reversals	Mean	Min	Max
			Full sample			
1972-1979	93	11	10	0.486	0.122	0.746
1980-1989	110	10	8	0.491	0.098	0.746
1990-1999	149	77	16	0.536	0.142	0.929
2000-2009	155	83	19	0.626	0.142	0.929
2010-2017	155	129	35	0.647	0.142	0.929
2018-2023	155	38	7	0.687	0.265	0.912
			Advanced economies			
1972-1979	25	4	3	0.479	0.179	0.746
1980-1989	26	5	1	0.486	0.147	0.746
1990-1999	34	33	2	0.574	0.147	0.929
2000-2009	34	23	3	0.743	0.366	0.929
2010-2017	34	28	11	0.753	0.366	0.929
2018-2023	34	4	2	0.769	0.366	0.912
			Developing countries			
1972-1979	68	7	7	0.489	0.122	0.66
1980-1989	84	5	7	0.492	0.098	0.729
1990-1999	115	44	14	0.524	0.142	0.899
2000-2009	121	60	16	0.593	0.142	0.899
2010-2017	121	101	24	0.617	0.142	0.899
2018-2023	121	34	5	0.664	0.265	0.899

Note: Table provides summary statistics for the CBIE index of central bank independence. The sample of Advanced economies includes all OECD member countries in 2023. The sample of Developing countries includes all non-OECD member countries in 2023.

capturing good practices in central bank financial independence and accountability. The information collected is used to build a new index of central bank independence which ranges from 0 (no independence) to 1 (full independence).[10]

Using this dynamic index, we are able to implement the most extensive analysis of the long-run effects of central bank independence on inflation. By examining the period from 1972 to 2023, we capture key central bank reforms following the collapse of the Bretton Woods system, the full spectrum of reforms implemented by European countries before and after the creation of the euro, the policy changes introduced in response to the 2008-09 Global Financial Crisis, as well as the reforms adopted during and after the COVID-19 pandemic.

Table 1 provides an overview of the evolution of the CBIE index over the decades,

[10]See Appendix B for the coding rules used for the creation of the CBIE index.

Table 2: Inflation summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
All countries	5141	7.907	11.669	-43.266	99.196
Advanced economies	1466	4.344	4.922	-11.873	43.6
Developing countries	3675	9.328	13.181	-43.266	99.196
Pre-reform	2803	10.153	13.814	-41.188	99.196
Post-reform	2338	5.213	7.572	-43.266	90.13

Note: Table provides summary statistics for normalized inflation. The pre-reform group includes all years before the adoption of the largest reforms in CBI. The post-reform sample refers to all the years following the reform that brought the highest change in a country's degree of CBI. Countries that never reformed their central bank legislation are included in the pre-reform sample.

highlighting a significant increase in average central bank independence (CBI) levels. The index has risen by more than 50 percent from the 1970s to the present day. Examining the extensive array of reforms in central bank design adopted from 1972 to 2023, our analysis identifies 348 reforms that increased central bank independence (CBI) and 95 reversals. A notable pattern emerges when comparing advanced economies and developing countries: 62% of reforms in advanced economies occurred until 2009, whereas more than half of the institutional changes adopted by developing countries took place since 2010.

3.2 Inflation

Our dependent variable is the level of inflation, calculated as the annual percentage change in the consumer price index, obtained from the IMF - International Financial Statistics (Code: PCPI_IX). Consistent with Cukierman (1992) and many others in the literature on the CBI-inflation nexus, we re-scale inflation using the formula:

$$\pi_{c,t} = \frac{inflation_{c,t}}{1 + inflation_{c,t}},$$

where $inflation_{c,t}$ denotes the annual percentage change in the consumer price index for country c in year t. This transformation alleviates the problem of very high inflation rates having disproportionate effects on our analysis.

Table 2 presents descriptive statistics for inflation for the full sample of countries, as

well as for the sub-samples of advanced economies and developing countries. This table, also reports the descriptive statistics for inflation obtained by splitting the sample between pre and post-reform periods. The t-statistic of a t-test on the equality of means between pre and post-reform periods for inflation is t = 18.96 (p-value<0.001), indicating that the post-reform sample is characterized by a lower inflation level.

3.3 Additional control variables

The additional control variables in our analysis are designed to account for potential confounding effects. We categorize these controls into three broad groups: business cycle, economic openness, and level of development and institutional framework.[11]

In all our estimations, we control for the business cycle by including a measure of the output gap, proxied by deviations of real GDP from its Hodrick-Prescott trend. Additionally, we include the public debt-to-GDP ratio as an indicator of the government's fiscal stance and its associated inflation risks.

The exposure of an economy to external competition and international price developments is an equally important determinant of inflation (Romer, 1993). Following standard practice in the literature, we control for a country's trade openness, measured as the ratio of total imports and exports to GDP. Finally, we include an exchange rate regime dummy variable, which equals 1 for years when a currency peg is in effect in a given country.

The level of economic development and the quality of a country's institutional framework play a crucial role in shaping its inflationary environment. Acemoglu et al. (2008) analyze the relationship between political institutions and central bank independence (see also Bodea and Hicks, 2015a). To capture these influences, we include the electoral democracy index as a measure of institutional quality, along with a country's GDP per capita as a broader indicator of economic development.[12]

[11] The data source and definitions for all the variables used in the paper are provided in Appendix Table C, while Appendix Table C.2 provides some summary statistics.

[12] The electoral democracy index reflects the extent to which political leaders are elected through comprehensive voting rights in free and fair elections, while also ensuring freedoms of association and expression. We use this index as an alternative to the widely used Polity index, as it provides coverage up to 2023, whereas the latest update of the Polity index only extends to 2018. The two measures are highly correlated, with a correlation coefficient of 0.90.

4 Empirical strategy

In this section, we provide details of the empirical strategies we apply. The dynamic panel models discussed in Section 4.1 enable the estimation of the long-run effects of CBI on inflation using an inflation dynamics modeling approach. In Section 4.2, we introduce our second strategy, which uses the local projection method proposed by Jordà (2005), while Section 4.3 discusses the instrumental variable local projections approach.

4.1 Dynamic panel models

The first model we use to estimate the effects of CBI on inflation is a dynamic (linear) panel model for inflation with country and time-fixed effects and an auto-regressive process for the inflation dynamics.[13]

Specifically, we estimate the following dynamic panel model:

$$\pi_{c,t} = \beta_1 CBI_{c,t-1} + \sum_{i=1}^{p} \gamma_i \pi_{c,t-i} + \Theta' X_{c,t} + \alpha_c + \delta_t + \varepsilon_t \tag{1}$$

where $\pi_{c,t}$ is the level of inflation in country c at time t, CBI is the index of central bank independence in country c at time *t-1*. $X_{c,t}$ is a vector of control variables. Country-specific intercepts, α_c, absorb the impact of any time-invariant country characteristics.[14] The full set of time-fixed effects is captured by δ_t. Our specification also includes p lags of inflation to control for its dynamics, while the error term ε_t captures all other time-varying unobservable shocks to the inflation process.[15] To account for cross-sectional dependence we estimate Driscoll and Kraay (1998) errors.

Economically, the identifying assumption implies that conditional on the lags of inflation, the country-fixed effects, and the other controls, countries that reformed their central

[13] A fixed effects/within estimator is appropriate in this case given that the within-country standard deviation of inflation is 62% larger than the between countries one, i.e. 6.06% versus 9.87%. Appendix D provides a detailed description of the specification search for the dynamic panel models we used.

[14] A large political economy literature has tried to explain how the political characteristics of different societies lead to different institutional arrangements. However, for the purpose of our analysis, the country-specific intercepts best capture the idea outlined by Eijffinger and de Haan (1996), i.e. that "every society gets the central bank it deserves".

[15] The inclusion of lags of the dependent variable in a model with fixed effects mechanically introduces correlation between the demeaned regressor and the demeaned error term which leads to Nickell's 1981 bias. Therefore the results of our dynamic panel model with fixed effects have an asymptotic bias of order 1/T. In our data the average country is observed for 44 years, so the resulting bias is trivially small, see Judson and Owen (1999) and Beck and Katz (2011).

bank design were not in a different trend with respect to countries that did not reform.

For our model we therefore assume that countries that reform their central bank did not have a different inflation experience in the run-up to the reform (controlled for by the lags of inflation included in the specification), given other long-run characteristics captured by the country fixed effects (and other controls as the case might be).

Formally, the identifying assumption of sequential exogeneity implies that the level of CBI and past inflation are orthogonal to contemporaneous and future shocks to inflation and that inflation shocks themselves are serially uncorrelated:

$$E[\varepsilon_{c,t} \mid \pi_c^{1:(t-1)}, CBI_c^{1:T}, \alpha_c, \delta_t] = 0, \ \forall c, t > t_0.$$

The inclusion of a sufficient number of lags of inflation is required to eliminate the serial correlation of the residuals and to assure the stationarity of the inflation process.

Under these assumptions, modeling inflation dynamics allows us to estimate both the short-run, or "on-impact", effect of a central bank design reform and its long-run effects.[16] A dynamic panel model with auto-regressive inflation dynamics such as ours fully characterises the time trajectory of the effects of CBI on inflation. In other words, under the assumption that the model is correctly specified, i.e. that its lag structure adequately captures the dynamics of inflation, and that all relevant confounding factors are accounted for, the time pattern of the effects of central bank reform on inflation is derived by extrapolating the linear inflation process into the future.

For a dynamic model with an estimated persistence of the inflation process equal to $\omega = \sum_{c=1}^{p} \gamma_c$, a shock to CBI has a short-run effect on inflation equal to β_1 at time t. But the effect of the change in CBI continues to influence inflation through the lags of inflation in subsequent periods, i.e. $\beta_1\alpha$ in $t+1$, $\beta_1\alpha^2$ in $t+2$, and so on. The cumulative long-run effect is therefore the sum of these effects, i.e. a geometric series $\beta_1 \sum_{c=1}^{\infty} \gamma_c$ that converges to the standard formula:

$$\frac{\beta_1}{1 - \sum_{c=1}^{p} \gamma_c}, \tag{2}$$

as long as $|\sum_{c=1}^{p} \gamma_c| < 1$.

As a consequence, the persistence of inflation determines the difference between the

[16] It is well known that adding lags of inflation greatly improves the accuracy of the estimates of inflation models, see for example Fuhrer (2010).

short-run and the long-run effects of CBI on inflation, with this gap increasing with the persistence of the series. For a highly persistent series such as inflation, the long-run effect can be considerably larger than the short-run effect. As inflation persistence varies with the credibility and transparency of monetary policy regimes (Erceg and Levin, 2003; Rudd and Whelan, 2003), countries characterised by lower credibility of their central bank might experience a larger reduction in their inflation persistence following a reform in central bank design, maximizing, therefore, the benefits of a reform. The relationship between the dynamic behaviour of inflation and the effects of central bank reforms is the core insight of our dynamic panel approach.

4.2 Local projections

Our second strategy to estimate the long-run effects of CBI is through a direct estimation approach using Jordà's 2005 local projections. This method directly estimates the effect of central bank reforms on inflation across multiple horizon dates: outcomes at horizon *t+h* are projected onto values at *t=-1*. In our application, we specifically estimate the following set of equations:

$$y_{c,t+h} = \alpha_c^h + \Lambda^h CBI_{c,t-1} + \beta_{1h} \sum_{l=1}^{l=4} \pi_{c,t-l} + \beta_{2h}' X_{c,t} + \varepsilon_{c,t+h} \tag{3}$$

where $h = 1, .., 10$ is the forecast horizon and $y_{c,t+h}$ is the cumulative change of 100 times the log of the consumer price index (CPI) in country c between year *t+h* and year *t-1*. The maintained identifying assumption is sequential exogeneity, consistent with the dynamic panel models. As before, *CBI* represents the central bank independence index for country c at time *t-1*. We also include four lags of inflation and the vector $X_{c,t}$ of control variables used in the dynamic panel model, while error term $\varepsilon_{c,t+h}$ captures all other time-varying unobservable shocks to the inflation process. As in the dynamic panel models, we address cross-sectional dependence by estimating Driscoll and Kraay (1998) standard errors. The set of *h=10* coefficients, Λ^h, traces the effects of central bank independence on the cumulative change in inflation over the forecasting horizon.

4.3 Instrumental variables local projections

Finally, we introduce our last empirical strategy: an instrumental variables estimator designed to address the potential endogeneity of central bank reforms. Romelli (2022) shows that past levels of central bank independence, regional convergence, and external pressures — such as securing an IMF loan — are key drivers of changes in central bank design. We therefore instrument a country's level of central bank independence using its lagged level, a regional convergence measure defined as the 75th percentile of the CBI distribution within the region in a given year (excluding the country itself), and a dummy variable indicating whether the country was part of an IMF programme in the previous two years. Regional peer countries are identified using the classification in Acemoglu et al. (2019). In the estimates of the first stage regressions reported in Appendix Table G.9 we show that our instruments is indeed correlated with the level of CBI. In our specifications, we include the same set of time-varying control variables used in both the dynamic panel and linear local projections estimations.

5 Results

This section presents the results of our analysis of the relationship between inflation and central bank independence. Section 5.1 provides the estimates from the dynamic panel models and the corresponding dynamic panel impulse response functions (DP-IRFs) for inflation. Next, we present the results obtained using local projection methods, including both the linear and instrumental variable approaches, in Section 5.2. Finally, Section 5.3 provides suggestive evidence on the impact of central bank independence on inflation persistence.

5.1 Dynamic panel models

This section presents the analysis using the dynamic panel framework. In Columns (1) and (2) of Table 3, we present the results run on the full sample of countries, while the estimations run on the sub-samples of advanced and developing countries are presented in

Columns (3)-(4) and (5)-(6), respectively.[17]

Table 3: Dynamic effects of CBI, baseline results

	All countries		Advanced countries		Developing countries	
	(1)	(2)	(3)	(4)	(5)	(6)
CBI_{t-1}	-4.709**	-4.665**	-2.046**	-2.391**	-7.521**	-6.163**
	(1.660)	(1.552)	(0.543)	(0.655)	(2.657)	(2.424)
$Inflation_{t-1}$	0.500**	0.490**	0.568**	0.547**	0.498**	0.489**
	(0.067)	(0.068)	(0.069)	(0.072)	(0.067)	(0.067)
$Inflation_{t-2}$	0.051	0.050	-0.014	-0.016	0.055	0.054
	(0.048)	(0.048)	(0.070)	(0.072)	(0.047)	(0.047)
$Inflation_{t-3}$	0.090**	0.088**	0.132**	0.131**	0.084**	0.083**
	(0.040)	(0.039)	(0.054)	(0.054)	(0.040)	(0.040)
$Inflation_{t-4}$	0.012	0.010	-0.022	-0.013	0.013	0.012
	(0.029)	(0.029)	(0.029)	(0.026)	(0.030)	(0.030)
Output gap		-8.445*		12.809**		-8.814*
		(4.557)		(3.632)		(5.109)
Debt to GDP		1.829**		-0.453		2.399**
		(0.676)		(0.370)		(0.869)
Exchange rate regime		-0.927**		-0.087		-0.983**
		(0.309)		(0.199)		(0.447)
Openness to trade		0.005		0.007		0.004
		(0.005)		(0.005)		(0.007)
Log of GDP per capita		-0.007		-0.001		-0.012
		(0.007)		(0.007)		(0.008)
Electoral democracy index		-1.672		-1.532		-0.986
		(1.522)		(1.058)		(2.024)
Effect after 10 years	-12.866**	-12.339**	-5.816**	-6.538**	-20.474**	-16.289**
	(4.401)	(3.981)	(1.641)	(1.790)	(7.151)	(6.349)
Long-run effect of CB reform	-13.562**	-12.906**	-6.074**	-6.817**	-21.553**	-17.038**
	(4.682)	(4.211)	(1.781)	(1.925)	(7.619)	(6.700)
Persistence of Inflation process	0.653**	0.639**	0.663**	0.649**	0.651**	0.638**
	(0.047)	(0.050)	(0.055)	(0.058)	(0.049)	(0.051)
Sample inflation mean	19.372	19.372	4.861	4.861	25.161	25.161
Observations	5141	5141	1466	1466	3675	3675
Countries in sample	134	134	33	33	101	101

Note: The dependent variable is the normalised level of inflation. CBI is the Central Bank Independence - Extended index. *Output gap* is the deviation of real GDP from the Hodrick-Prescott filter. *Debt to GDP* is the Debt to GPD ratio of a country. *Exchange rate regime* is a dummy equal to one for countries adopting a fixed exchange rate regime. *Openness to trade* is the degree of trade openness of a country measured as the ratio of imports plus exports over GDP. *Log of GDP per capita* is the logarithm of the level of GDP per capita of a country. *Electoral democracy index* is the index of electoral democracy. All models include country and year fixed effect. Driscoll and Kraay (1998) standard errors in parentheses. ***/**/* denote significance at 1, 5 and 10 percent levels, respectively.

Columns (1), (3) and (5) present the estimates of the effect of CBI on inflation taking into account the inflation dynamics only. Our preferred specification for capturing the dynamic process of inflation includes four lags of inflation.[18] The estimates of the short-

[17]Countries are classified as advanced or developing according to the OECD classification. Appendix Table A.1 provides the complete list of countries included in our sample, along with their respective developmental group classifications.

[18]In Appendix E, we discuss the selection of the lag length used to identify the preferred specification.

run effects of the lag of the CBI index on inflation in columns (1), (3) and (5) show that higher central bank independence has a negative and statistically significant association with inflation.

The magnitude of the coefficients suggests that the negative effects of CBI on inflation are primarily driven by developing countries. This indicates that developing countries benefit the most from reforms in central bank design, experiencing stronger reductions in inflation as a result of increased central bank independence. Earlier studies on the CBI-inflation nexus found that *de jure* measures of CBI were negatively associated with inflation among advanced economies, but this was not the case for developing countries. At the same time, the studies focusing on *de facto* measures of CBI, i.e. the turnover rate of central bank governors, suggested a negative relation between CBI and inflation for all countries, irrespective of their level of development (see Klomp and De Haan, 2010, for a meta-regression analysis on this earlier literature). However, more recent papers have shown that CBI is negatively associated with inflation also among developing countries (Dincer and Eichengreen, 2014; Garriga and Rodriguez, 2020) and less so among advanced economies, especially when we focus on the post-2000 period (Balls et al., 2018; Haldane, 2020; Ioannidou et al., 2023). One of the possible explanations for the difference in the results between earlier and more recent literature relates to the timing of reforms across countries. As shown in Table 1, most central bank reforms in advanced economies occurred before 2010, whereas in developing countries, the majority of such reforms were implemented after 2010. In addition, the beneficial effects of central bank reforms may materialize immediately in some countries, while in others — particularly those with lower initial levels of central bank independence and credibility — it may take longer to build trust and shape firms' and consumers' expectations. This consideration motivates our decision to examine both the short-run and long-run effects of central bank reforms on inflation.

Looking at the estimates of persistence specifically, in each column we present the estimates of the auto-regressive coefficients of inflation up to four lags, as well as the sum of these coefficients (marked as *Persistence of Inflation process*). Across all estimations, we find that inflation behaves as a persistent but stationary process, with the sum of all lagged coefficients typically ranging between 0.63 and 0.66. This value is consistently and

significantly less than one, satisfying the necessary condition for the convergence of an infinite series of effects.[19]

Given the dynamic structure of our model, we also calculate the long-run effects of CBI on inflation. In each column, we report two long-run effects: (i) the cumulative impact of a reform on inflation after 10 years (*Effect after 10 years*) and (ii) the cumulative long-run effect (*Long-run effect of CB reform*), calculated according to equation (2). As expected for a persistent process like inflation, the reported long-run effects are significantly larger than the short-run ones. In addition, the similar magnitudes of these two effects suggest that it may take approximately 10 years for countries to fully realize the benefits of central bank design reforms.

In columns (2), (4), and (6) of Table 3, our estimates also included a set of control variables normally used in the literature (see Arnone and Romelli, 2013, among others). To account for short-run business cycle effects, we first include a measure of the output gap, consistent with a standard Phillips curve framework, along with the debt-to-GDP ratio. Additionally, we consider structural features of the economy, such as trade openness, measured as the share of imports plus exports relative to GDP, and a dummy variable indicating the adoption of a fixed exchange rate regime. Finally, we include a measure of the quality of democracy in the country, i.e. the Electoral democracy index, and a broader index of the economic development of countries proxied by the logarithm of per capita GDP.[20]

Our baseline results are robust to the inclusion of these control variables as both the short-run and the long-run negative effects of CBI on inflation are confirmed for the full sample and for the two sub-samples of advanced and developing countries. The evidence presented in this table gives us some comfort in the specification of our inflation model and that the conditional independence assumption is not violated.

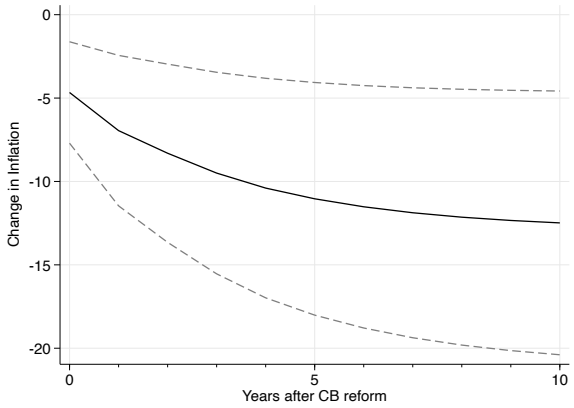
The economic significance of the long-run effect of CBI on inflation is illustrated as follows: a country moving from the first quartile (CBI score of 0.25) to the fourth quartile

[19]The inclusion of lagged values of inflation also helps address the "reversion to the mean" problem in the identification of the treatment effects of changes in the monetary policy framework most prominently remarked by Ball and Sheridan (2004) in the case of inflation targeting regimes.

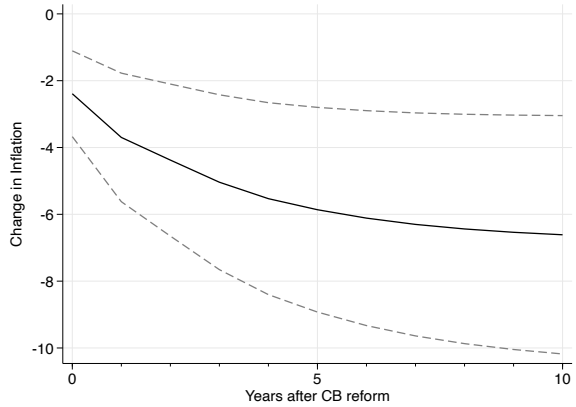
[20]In columns (2), (4), and (6) of Table 3, we present the saturated specification with all control variables, while Appendix Tables F.4, F.5 and F.6 present the specifications in which each control is added independently.

(CBI score of 0.75) of the CBI index would experience a long-run annual inflation reduction of approximately 7.6 percentage points. However, the effect is substantially larger for developing countries, with an average reduction in inflation of approximately 10.2 percentage points per year. In contrast, for advanced economies, the corresponding reduction in inflation is much smaller, averaging around 3.7 percentage points per year.[21]

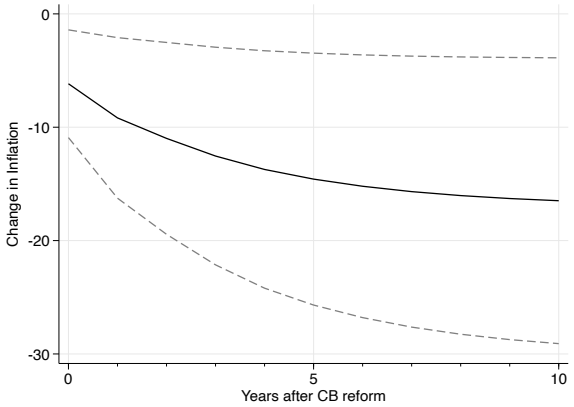
Figure 2: Dynamic effects of CBI on inflation



(a) All countries



(b) Advanced economies



(c) Developing countries

Note: The figure shows the impulse response function of inflation from the dynamic panel model estimations in Table 3, Columns (2), (4) and (6), respectively.

The time path of the effects of central bank reforms on inflation for the saturated specifications presented in Columns (2), (4), and (6), along with the corresponding 95%

[21] For this calculation, we use the coefficients from the saturated models in columns (2), (4), and (6), along with the corresponding average inflation rates reported at the bottom of each column. Since our models are estimated using a normalized inflation value, we follow the approach in previous studies (Acemoglu et al., 2008; Jacome and Vazquez, 2008) and compute the estimated effects by multiplying the coefficients by $(1+\pi)^2$, where π represents the average inflation rate in each sample.

confidence intervals, are shown in Figure 2a for the full sample, Figure 2b for advanced economies, and Figure 2c for developing countries. As shown in Table 3, the graphs illustrate not only the immediate negative effect of central bank reforms on inflation but also the substantially larger reduction in inflation over longer horizons.

5.1.1 Robustness and additional controls

Given that institutional reforms often occur in the aftermath of currency, financial, or political crises (Gokmen et al., 2021), we introduce a set of crisis-related controls in Table 4. Specifically, we test whether our results are robust to the inclusion of controls for banking, currency, and sovereign debt crises. We further include the Chinn and Ito (2008) index of capital account openness to account for policy decisions that may influence the central bank's ability to manage inflation. Additionally, we introduce an index of political instability and a dummy variable capturing the transition of former Soviet economies and their satellite countries. The results presented in Table 4 remain qualitatively consistent with our baseline findings, with the coefficients of the additional controls showing the expected theoretical signs when statistically significant.

A potential challenge to our results lies in the presence of inflation trends. Table 5 presents various model specifications that implement different approaches to controlling for these trends. In columns (1), (4) and (7) we introduce a linear time trend for the full set of countries as well as the sub-sample of advanced economies and developing countries, while in columns (2), (5) and (8) we control for both a linear and a quadratic time trend. The results in these columns suggest that both the short- and long-run effects of CBI on inflation are primarily driven by the sample of developing countries. The negative and statistically significant coefficient for the time trend variable aligns with existing evidence indicating that, since the onset of the Great Moderation, most countries worldwide have experienced a gradual decline in inflation. Finally, in columns (3), (6) and (9), we control for the average level of inflation in any given year. Our conclusions remain robust to this alternative control variable.

In Table 6, we restrict the estimation sample to ensure that our results are not driven by a specific group of countries. In particular, in column (1) we exclude from our sample all countries part of a currency union, in column (2) we exclude all hyperinflation years, i.e.

Table 4: Dynamic effect of CBI, additional controls

	All countries (1)	Advanced countries (2)	Developing countries (3)
CBI_{t-1}	-2.966**	-1.843**	-6.461**
	(1.466)	(0.683)	(2.448)
Banking crisis	-0.280	-0.122	-0.164
	(0.489)	(0.217)	(0.701)
Currency crisis	6.825**	2.057**	7.123**
	(1.697)	(0.585)	(1.772)
Sovereign debt crisis	-1.351		-1.674
	(2.296)		(2.396)
Chinn-Ito index	-0.861**	-0.317**	-1.097**
	(0.183)	(0.119)	(0.232)
Transition economies	-0.334	-0.114	-0.523
	(0.835)	(0.934)	(0.981)
Government $crisis_{t-1}$	1.196**	0.102	1.829**
	(0.361)	(0.120)	(0.522)
Baseline controls	Yes	Yes	Yes
Effect after 10 years	-7.480**	-5.111**	-16.047**
	(3.565)	(1.963)	(6.161)
Long-run effect of CB reform	-7.736**	-5.292**	-16.574**
	(3.674)	(2.071)	(6.401)
Persistence of Inflation process	0.617**	0.652**	0.610**
	(0.049)	(0.060)	(0.051)
Sample inflation mean	21.767	5.216	28.271
Observations	4229	1193	3036
Countries in sample	124	31	93

Note: The dependent variable is the normalised level of inflation. Baseline controls include: four lags of inflation, Output gap, Debt to GDP, Exchange rate regime, Openness to trade, Log of GDP per capita, and the Electoral democracy index. *Banking*, *Currency*, *Sovereign debt* and *Government* crisis are crises dummies. We exclude sovereign debt crises from the estimation of the advanced economies model, as there are only two occurrences among these countries—specifically in Greece and Cyprus. *Chinn-Ito index* is the Chinn and Ito (2008) index of financial openness. *Transition economies* are dummies that indicate the years of transition to market economies for post-Soviet states and satellites. All models include country and year fixed effect. Driscoll and Kraay (1998) standard errors in parentheses. ***/**/* denote significance at 1, 5 and 10 percent levels, respectively.

those episodes in which the annual change in inflation is higher than 50%, while in columns (3) we exclude all countries which have experienced, at least once an hyperinflation episode over the period of our analysis. In column (4) we exclude former transition countries and in column (5) we exclude all Western European countries.[22] Again our main conclusions remain robust.

[22] Appendix Tables F.7 and F.8 present the results obtained on the subsamples of advanced economies and developing countries, respectively.

Table 5: Dynamic effect of CBI, time controls and trends, all countries

	All countries			Advanced countries			Developing countries		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CBI_{t-1}	-4.505**	-4.865**	-5.206**	-2.141**	-2.072**	-3.147**	-5.542**	-6.510**	-5.923**
	(1.427)	(1.552)	(1.350)	(0.853)	(0.750)	(0.848)	(2.217)	(2.399)	(2.197)
Time trend	-0.036	-0.283**		-0.031	-0.243**		-0.027	-0.318**	
	(0.033)	(0.082)		(0.021)	(0.056)		(0.039)	(0.112)	
Quadratic time trend		0.004**			0.004**			0.005**	
		(0.002)			(0.001)			(0.002)	
World Inflation			0.008**			-0.003**			0.013**
			(0.003)			(0.001)			(0.004)
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Effect after 10 years	-11.346**	-12.400**	-13.119**	-6.414**	-5.553**	-9.431**	-13.735**	-16.385**	-14.582**
	(3.573)	(3.912)	(3.344)	(2.557)	(1.948)	(2.324)	(5.431)	(6.033)	(5.341)
Long-run effect of CB reform	-11.679**	-12.849**	-13.495**	-6.653**	-5.760**	-9.774**	-14.116**	-16.954**	-14.959**
	(3.744)	(4.123)	(3.517)	(2.757)	(2.066)	(2.557)	(5.615)	(6.321)	(5.510)
Persistence of Inflation process	0.614**	0.621**	0.614**	0.678**	0.640**	0.678**	0.607**	0.616**	0.604**
	(0.051)	(0.050)	(0.051)	(0.056)	(0.060)	(0.056)	(0.053)	(0.052)	(0.053)
Sample inflation mean	19.372	19.372	19.372	4.861	4.861	4.861	25.161	25.161	25.161
Observations	5141	5141	5141	1466	1466	1466	3675	3675	3675
Countries in sample	134	134	134	33	33	33	101	101	101

Note: The dependent variable is the normalised level of inflation. Baseline controls include: four lags of inflation, Output gap, Debt to GDP, Exchange rate regime, Openness to trade, Log of GDP per capita, and the Electoral democracy index. All models include country and year-fixed effects, except in columns (3), (6), and (9) when the world inflation is included instead of year-fixed effects. Driscoll and Kraay (1998) standard errors in parentheses. ***/**/* denote significance at 1, 5 and 10 percent levels, respectively.

Table 6: Dynamic effect of CBI, sample exclusions - all countries

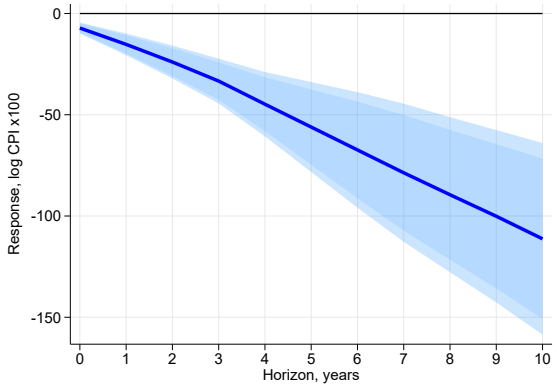
	No Currency unions	No hyperinflation years	No hyperinflation countries	No Transition	No Western Europe
	(1)	(2)	(3)	(4)	(5)
CBI_{t-1}	-9.303**	-3.926**	-3.268**	-4.622**	-6.208**
	(1.996)	(1.206)	(1.390)	(1.570)	(2.307)
Effect after 10 years	-25.537**	-5.413**	-4.695**	-12.477**	-16.276**
	(5.728)	(1.626)	(1.778)	(4.156)	(6.000)
Long-run effect of CB reform	-26.592**	-5.418**	-4.731**	-13.196**	-16.974**
	(6.270)	(1.629)	(1.785)	(4.475)	(6.318)
Persistence of Inflation process	0.650**	0.275**	0.309**	0.650**	0.634**
	(0.049)	(0.038)	(0.091)	(0.054)	(0.051)
Sample inflation mean	22.934	7.430	5.905	18.998	22.661
Observations	4178	4970	3060	4977	4172
Countries in sample	121	134	77	134	114

Note: The dependent variable is the normalised level of inflation. Baseline controls included: four lags of inflation, Output gap, Debt to GDP, Exchange rate regime, Openness to trade, Log of GDP per capita and the Electoral democracy index. All models include country and year fixed effect. In column (1) currency union countries are excluded. In column (2), years with hyperinflation are excluded. In column (3), countries that have experienced hyper-inflationary episodes are excluded. In column (4), former transition countries are excluded. In column (5), Western European countries are excluded. Hyperinflation is defined as a period with annual inflation of more than 50%. Driscoll and Kraay (1998) standard errors in parentheses. ***/**/* denote significance at 1, 5 and 10 percent levels, respectively.

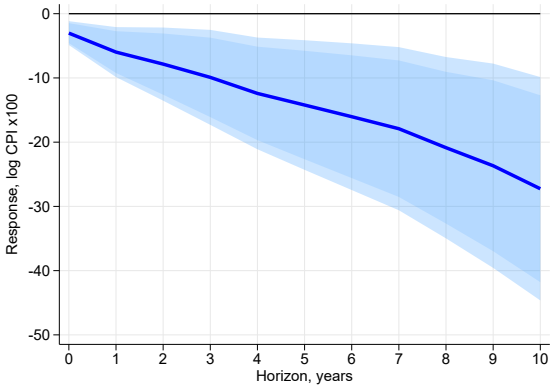
5.2 Local projections

This section presents the results of our local projection estimations. We begin by reporting the findings from a linear OLS estimation of the long-run effects of CBI on inflation. Next, we apply an instrumental variable local projections analysis.

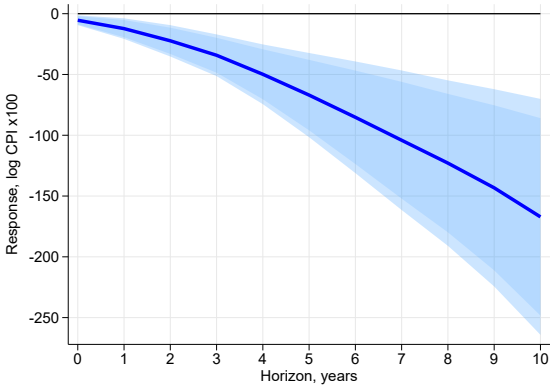
Figure 3: Local projections of CBI on inflation



(a) All countries



(b) Advanced economies



(c) Developing countries

Note: Local projections of the cumulative change of 100 times the log of the consumer price index (CPI) on the CBI index. We use four lags of CPI inflation, Output gap, Debt to GDP, Exchange rate regime, Openness to trade, Log of GDP per capita and the Electoral democracy index as controls. The solid line is the point estimate and the dark and light-shaded areas are 90% and 95% confidence bands, respectively. Country fixed effects included. Driscoll and Kraay (1998) standard errors.

5.2.1 Linear local projections estimates

Figure 3a presents the estimated effects of CBI on inflation to horizons up to ten years and the corresponding 90 and 95% confidence intervals for the full sample of countries, while Figures 3b and 3c focus on the sub-samples of advanced economies and developing countries, respectively. Consistent with the estimations conducted for the dynamic panel model, we include four lags of CPI inflation, the central bank independence index, baseline control variables from our dynamic panel models, and country-fixed effects.[23]

[23] As is standard practice in local projection methods, we do not include year fixed effects. We experimented with incorporating a common linear time trend, but the results remained consistent with those

The direct estimation of the long-run effects of CBI using this method reinforces the insights from the dynamic panel model discussed in the previous section. The estimated effects are of comparable magnitude, with the influence of CBI on inflation intensifying over time. Notably, the divergence between advanced and developing economies becomes more pronounced under this direct estimation approach.

These findings strengthen our confidence that the dynamic panel model accurately captures the dynamic effects of CBI on inflation, especially in the context of developing countries.

5.2.2 Instrumental variable local projections estimates

Figure 4a presents the estimated effects of CBI on inflation to horizons up to ten years and the corresponding 90 and 95% confidence intervals for the full sample of countries, while Figures 4b and 4c focus on the sub-samples of advanced economies and developing countries, respectively. In our estimations, we include the same set of control variables as in our baseline local projection estimation described above.

Our IV estimates are if anything larger than the corresponding LP-OLS estimates in the previous section for the full sample of countries and the group of developing countries.[24] The results obtained for developing countries are noteworthy, as the instruments we use might be particularly relevant for this group. Overall, our IV estimates confirm our baseline result for a significant and long-lasting effect of central bank independence on inflation, particularly among developing countries.

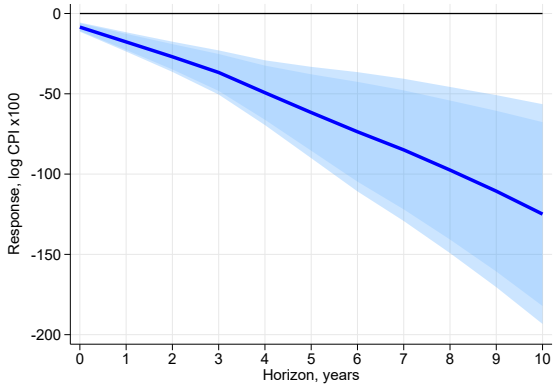
5.3 Inflation Persistence

In this final section, we estimate the effect of central bank independence on inflation persistence. Since our baseline dynamic panel models rely on inflation dynamics to estimate the long-run effects of CBI on inflation, we now explore a potential mechanism underlying this relationship — the influence of CBI on inflation persistence. Following the relevant literature Dincer and Eichengreen (2008); Siklos (2008); Willard (2012), we estimate the following model:

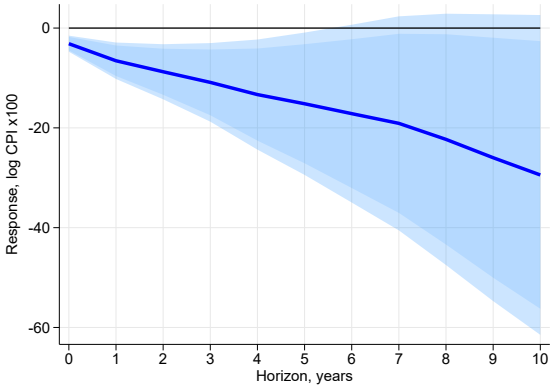
presented here.

[24] In Appendix Table G.9 we show that the instruments are not weak as indicated by the Kleibergen and Paap (2006) rk Wald F statistic which is systematically large across all estimated equations at all horizons.

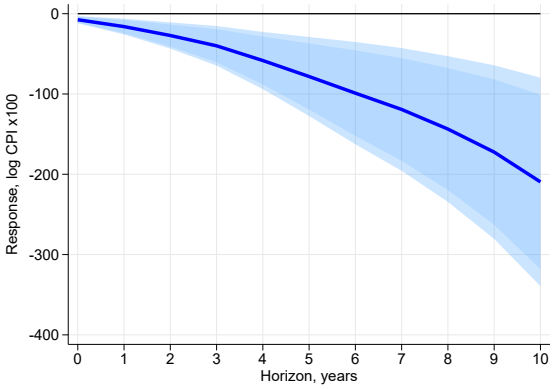
Figure 4: Instrumental variable local projections of CBI on inflation



(a) All countries



(b) Advanced economies



(c) Developing countries

Note: Instrumental variable local projections of the cumulative change of 100 times the log of the consumer price index (CPI) on the CBI index. The degree of central bank independence is instrumented using its lagged value, regional pressure and a variable taking value of 1 if an IMF program was in place in the country in the previous 2 year. We use four lags of CPI inflation, Output gap, Debt to GDP, Exchange rate regime, Openness to trade, Log of GDP per capita and the Electoral democracy index as controls. The solid line is the point estimate and the dark and light-shaded areas are 90% and 95% confidence bands, respectively. Country fixed effects included. Driscoll and Kraay (1998) standard errors.

$$\pi_{c,t} = \beta_0 + \beta_1 \pi_{c,t-1} + \beta_2 \text{CBI reform}_{c,t} + \beta_3 \text{CBI reform}_{c,t} \times \pi_{c,t-1} + \alpha_c + \varepsilon_t, \qquad (4)$$

In this model, $\pi_{c,t}$ represents the normalized measure of inflation in country c at time t. *CBI reform* is a dummy variable that takes the value of one from the year in which a reform to central bank design is implemented and the subsequent years. In this specification, β_1 is the reduced form estimate of the degree of inflation persistence for all the countries that

did not reform their central bank design, while $\beta_1 + \beta_2$ is the estimated persistence of reforming countries.

In Table 7 column (1), we begin by estimating a simple AR(1) process for inflation. In column (2), we include the CBI reform dummy and its interaction term with the first lag of inflation. The estimated coefficient of the CBI reform dummy is negative and statistically significant, indicating that reforms enhancing CBI help countries reduce their inflation levels. Similarly, the negative and significant coefficient of the interaction term suggests that central bank reforms also contribute to reducing inflation persistence. Columns (3) and (4) present the results separately for advanced economies and developing countries. These findings show that the negative impact of central bank reforms on inflation persistence is not confined to a specific group of countries. Our results suggest that CBI meaningfully influences inflation dynamics. We leave the broader implications of these findings as a subject for future research.

Table 7: Persistence

	All countries		Advanced countries	Developing countries
Inflation persistence	0.610***	0.646***	0.676***	0.643***
	(0.009)	(0.011)	(0.016)	(0.013)
CBI reform		-1.349***	-0.828***	-1.549***
		(0.331)	(0.228)	(0.457)
Inflation persistence x CBI reform		-0.224***	-0.242***	-0.220***
		(0.019)	(0.042)	(0.023)
Constant	3.172***	4.333***	2.023***	5.041***
	(0.134)	(0.231)	(0.162)	(0.315)
Observations	6778	6582	1529	5053
Countries	153	153	33	120

Note: The dependent variable is the level of normalized inflation. Inflation persistence is the measure of Inflation persistence extracted from an AR(1) process. CBI reform is a dummy that takes value equal to one from the year of the central bank reform onward. All models include country fixed effect.

6 Conclusion

In this paper, we examine the long-term effects of central bank independence on inflation. Using three distinct empirical strategies, we present plausibly causal evidence showing that greater CBI significantly reduces inflation in the long run.

Our findings highlight the crucial role of inflation dynamics in the disinflationary process triggered by central bank reforms, an area that has received limited attention in the

literature. We show that higher inflation persistence prolongs the adjustment process of inflation converging to its new target, consistent with arguments made by Ball (1995) and Fuhrer (2010). Furthermore, we provide evidence that central bank independence may also reduce inflation persistence, reinforcing the effectiveness of monetary policy.

Although we cannot claim that our results are symmetrical for countries experiencing reversals in central bank independence, we believe the evidence presented in this paper serves as a cautionary note against recent calls for increased governmental control over central banks. A reversal of the direct long-run effects documented here, or the more suggestive indirect effects on inflation persistence, would likely make the policy trade-offs faced by governments in a context of reduced central bank independence considerably less favourable.

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Online Appendix

A Countries

Table A.1: Analyzed countries

Countries, year of first analyzed legislation and development clusters					
Afghanistan	2003	Dev	Dominica	1983	Dev
Albania	1992	Dev	Dominican Republic	1959	Dev
Algeria	1962	Dev	Ecuador	1957	Dev
Angola	1997	Dev	Egypt	1957	Dev
Anguilla	1987	Dev	Equatorial Guinea	1972	Dev
Antigua and Barbuda	1983	Dev	Estonia	1993	Adv
Argentina	1935	Dev	Ethiopia	1994	Dev
Australia	1959	Adv	Finland	1966	Adv
Austria	1955	Adv	France	1936	Adv
Azerbaijan	1996	Dev	Gabon	1972	Dev
Bahrain	1973	Dev	Gambia	1971	Dev
Bangladesh	2003	Dev	Georgia	1995	Dev
Belarus	1990	Dev	Germany	1957	Adv
Belgium	1948	Adv	Ghana	1975	Dev
Benin	1956	Dev	Greece	1959	Adv
Bolivia	1945	Dev	Grenada	1983	Dev
Bosnia and Herzegovina	1997	Dev	Guatemala	1959	Dev
Botswana	1975	Dev	Guinea-Bissau	1956	Dev
Brazil	1964	Dev	Guinea	1994	Dev
Brunei	1984	Dev	Haiti	1979	Dev
Bulgaria	1991	Dev	Hungary	1991	Dev
Burkina Faso	1956	Dev	Iceland	1966	Adv
Burundi	1965	Dev	India	1934	Dev
Cambodia	1954	Dev	Indonesia	1953	Dev
Cameroon	1972	Dev	Iran	1972	Dev
Canada	1954	Adv	Iraq	1964	Dev
Central African Republic	1972	Dev	Ireland	1942	Adv
Chad	1972	Dev	Italy	1948	Adv
Chile	1953	Dev	Ivory Coast	1956	Dev
China	1995	Dev	Jamaica	1992	Dev
Colombia	1923	Dev	Japan	1957	Adv
Comoros	1987	Dev	Jordan	1971	Dev
Costa Rica	1953	Dev	Kazakhstan	1993	Dev
Croatia	1991	Dev	Kenya	1984	Dev
Cuba	1959	Dev	Kuwait	1968	Dev
Cyprus	1963	Adv	Kyrgyzstan	1992	Dev
Czech Republic	1991	Adv	Laos	1995	Dev
Democratic Rep. of the Congo	1993	Dev	Latvia	1992	Adv
Denmark	1942	Adv	Lebanon	1969	Dev

Note: The table reports information on the list of analysed countries, the first year of availability of the CBI index and their developmental cluster, i.e. Adv for advanced economics and Dev for developing countries.

Table A.1 Continued: Analyzed countries

Countries, year of first analyzed legislation and development clusters					
Liberia	1974	Dev	Saint Kitts and Nevis	1983	Dev
Libya	1996	Dev	Saint Lucia	1983	Dev
Lithuania	1994	Adv	St. Vincent and the Grenadines	1983	Dev
Luxembourg	1983	Adv	Saudi Arabia	1957	Dev
Macao S.A.R	2000	Dev	Senegal	1956	Dev
Macedonia	1992	Dev	Seychelles	1986	Dev
Malawi	1989	Dev	Sierra Leone	1963	Dev
Malaysia	1982	Dev	Singapore	1991	Adv
Maldives	1982	Dev	Slovakia	1992	Adv
Mali	1984	Dev	Slovenia	1991	Adv
Malta	1994	Adv	Somalia	1960	Dev
Mauritania	1956	Dev	South Africa	1956	Dev
Mauritius	1966	Dev	South Korea	1950	Adv
Mexico	1960	Dev	Spain	1962	Adv
Moldova	1992	Dev	Sri Lanka	1953	Dev
Mongolia	1996	Dev	Sweden	1966	Adv
Montenegro	2005	Dev	Switzerland	1953	Adv
Morocco	1959	Dev	Taiwan	1979	Adv
Myanmar	1952	Dev	Thailand	1942	Dev
Namibia	1990	Dev	The Bahamas	1974	Dev
Nepal	1955	Dev	Togo	1956	Dev
Netherlands	1948	Adv	Trinidad and Tobago	1964	Dev
New Zealand	1933	Adv	Tunisia	1958	Dev
Niger	1956	Dev	Turkey	1970	Dev
Nigeria	1969	Dev	Turkmenistan	1994	Dev
Norway	1966	Adv	Uganda	1966	Dev
Oman	2000	Dev	Ukraine	1991	Dev
Pakistan	1972	Dev	United Arab Emirates	1980	Dev
Panama	1941	Dev	United Kingdom	1946	Adv
Paraguay	1952	Dev	United Republic of Tanzania	1966	Dev
Peru	1962	Dev	United States of America	1951	Adv
Philippines	1948	Dev	Uruguay	1938	Dev
Poland	1997	Dev	Uzbekistan	2000	Dev
Portugal	1962	Adv	Venezuela	1939	Dev
Qatar	1993	Dev	Vietnam	1990	Dev
Republic of Congo	1972	Dev	Yemen	1971	Dev
Romania	1991	Dev	Zambia	1971	Dev
Russia	1992	Dev	Zimbabwe	1956	Dev
Rwanda	1997	Dev			

Note: The table reports information on the list of analysed countries, the first year of availability of the CBI index and their developmental cluster, i.e. Adv for advanced economics and Dev for developing countries.

B Coding rules for the CBIE index

This index provides an indicator of central bank *de jure* independence and disclosure. Source: Romelli (2022).

I. **Governor and central bank board**

I.1) Who appoints the governor?

Central bank board / shareholders (if different from the government)	1.00
A council of the central bank board, executive branch, and legislative branch	0.75
By legislative branch (congress, King)	0.50
By executive branch collectively (e.g. council of ministers)	0.25
By one or more members of executive branch	0.00

I.2) Term of office of the 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

I.3) Is there any reappointment option for the governor?

No	1.00
Restricted to two consecutive terms	0.50
Yes	0.00

I.4) 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

I.5) May the 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

I.6) Is there any qualification requirement for the governor?

Yes	1.00
No	0.00

I.7) Who appoints the rest of the board?

Central bank board / shareholders (if different from the government)	1.00
A council of the central bank board, executive branch, and legislative branch	0.75
By legislative branch (congress, King)	0.50
By executive branch collectively (e.g. council of ministers)	0.25
By one or more members of executive branch	0.00

I.8) 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

I.9) Is there any reappointment option for the rest of the board?

No	1.00
Restricted to two consecutive terms	0.50
Yes	0.00

I.10) 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

I.11) May the rest of the board 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

I.12) Is there any qualification requirement for the rest of the board?

Yes	1.00
No	0.00

I.13) Does the legislation require a staggering term of office for the appointment of board members?

Yes	1.00
No	0.00

I.14) No mandatory participation of government representatives in the board

Yes	1.00
No, but without voting rights	1.00
No	0.00

II. **Monetary policy and conflicts resolution**

II.1) 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

II.2) Is the central bank responsible for setting the policy rates?

Yes	1.00
No	0.00

II.3) Is there no responsibility of the 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

II.4) Central bank given active role in formulation of government's budget and/or debt

Approves government budget and/or debt	1.00
Legally required to provide opinion on technical aspects	0.50
No involvement at all	0.00

II.5) Who has final word in resolution of conflicts?

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	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

III. **Objectives**

III.1) 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
Price stability plus others goals including financial stability of financial system that may conflict with the former, without priority	0.50
Price stability together with economic growth/development with no priority	0.25
Objectives do not include price stability	0.00

IV. **Limitations on lending to the government**

IV.1) 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

IV.2) Lending to government

Not allowed	1.00
In the secondary market with restricted limits	0.75
In the secondary market with lax or without limits	0.50
In the primary market with limits or approved by central bank board with a qualified majority	0.25
In the primary market without limits	0.00

IV.3) 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

IV.4) Potential borrowers from the central bank

Only the government	1.00
Government plus local governments	0.67
All of the above plus public enterprises	0.33
All of the above and to the private sector, also if it is not mentioned otherwise	0.00

IV.5) Limits on central bank lending defined

As an absolute cash amount	1.00
As a percentage of central bank capital or other liabilities	0.67
As a percentage of government revenues	0.33
As a percentage of government expenditure	0.00

IV.6) 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

IV.7) Interest rates on advances

At market rates	1.00
Interest rates not specified in law	0.50
At below market rates	0.00

IV.8) Central bank prohibited from buying or selling government securities in the primary market

Yes	1.00
No	0.00

V. **Financial independence**

V.1) Does the statute describe precisely the provisions relating to the payment of the initial capital?

Yes	1.00
No	0.00

V.2) The Statute quantify precisely the authorized capital of the central bank

Yes	1.00
No	0.00

V.3) Financial autonomy

Government should maintain central capital integrity	1.00
Government is legally allowed to capitalize the central bank	0.67
The law does not allow the government to capitalize the central bank	0.33
The central bank conducts quasi-fiscal operations	0.00

V.4) Are there legal arrangements allowing for an automatic capital contribution upon the request by the central bank (automatic recapitalization)?

Yes	1.00
No	0.00

V.5) How are managed, from a legislative point of view, transfers of money from the treasury to the central bank?

The decision is based on technical criteria	1.00
The transfer requires approval by the Treasury	0.50
The transfer requires an act of the legislature	0.00

V.6) The central bank has the exclusive right to determine and approve its annual budget

Yes	1.00
Ex-post approval by the government	0.50
No	0.00

V.7) The adoption of the annual balance sheet of the central bank belongs exclusively to its decision-making bodies

Yes	1.00
No	0.00

V.8) The accounts of the central bank are subject to the control of a state agency of auditing

No	1.00
No, but the external audit agency is appointed by the government	0.50
Yes	0.00

V.9) 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

V.10) How is the allocation of profits to the general reserve fund handled by the central bank?

The decision is just on objective criteria established precisely by the statute	1.00
The decision is left to the discretion of the central bank	0.67
The decision is made by the central bank in consultation with the government	0.33
Left to the discretion of the government	0.00

V.11) Can the state or the shareholders receive partial payments before the end of the fiscal year, based on an estimate for that year?

No	1.00
Yes	0.00

V.12) Are unrealized profits included in the calculation of distributable profits?

No	1.00
Yes	0.00

VI. **Reporting and disclosure**

VI.1) 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

VI.2) 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

C Data

Table C.1: Data and data sources

Variable	Definition	Data sources
	Dependent variable	
Inflation	Annual percentage change of consumer price index re-scaled using the formula: $\pi_{c,t} = \frac{inflation_{c,t}}{1+inflation_{c,t}}$	IMF - International Financial Statistics: PCPI_IX
Consumer Price Index	Consumer Price Index, All items.	IMF - International Financial Statistics: PCPI_IX
	Explanatory variables	
CBI	Central Bank Independence - Extended (CBIE) index.	Romelli (2022)
Output gap	Deviations of real GDP from HP trend.	World Bank: NY.GDP.MKTP.KD
Debt to GDP	Variable that captures the level of gross government debt-to-GDP. Following Abbas et al. (2010), updated to 2017 using the data on Debt to GDP provided in the IMF World Economic Outlook (WEO).	Abbas et al. (2010) and authors
Exchange rate regime	Dummy variable that takes the value of one in countries adopting a fixed exchange rate regime.	Authors following Ilzetzki et al. (2019)
Openness to trade	Degree of openness to trade of a country. $Opnness_{c,t} = \frac{Imports_{c,t}+Exports_{c,t}}{GDP_{c,t}}$.	World Bank
Log of GDP per capita	Log of per capita GDP	World Bank: NY.GDP.MKTP.KD
Electoral democracy index	Index that measures to which extent political leaders are elected under comprehensive voting rights in free and fair elections, and freedoms of association and expression are guaranteed. It ranges from 0 to 1 (most democratic).	Lindberg et al. (2014)
Chinn-Ito index	Index of capital account openness, with higher values suggesting greater openness.	Chinn and Ito (2008)
Banking crisis	Dummy variable that takes the value of one in the two years following a systemic banking crisis.	Authors following Laeven and Valencia (2012)
Currency crisis	Dummy variable that takes the value of one in the two years following a systemic sovereign debt crisis.	Authors following Laeven and Valencia (2012)
Sovereign debt crisis	Dummy variable that takes the value of one in the two years following a systemic sovereign debt crisis.	Authors following Laeven and Valencia (2012)
Government crisis	Dummy that takes the value of one if a situation which could lead to the downfall of the ruling government takes place in a country.	Banks and Wilson (2021)
Transition economies	Dummy variable that takes the value of one for transition economies.	Authors following Acemoglu et al. (2019)

Table C.2: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Inflation	5141	7.907	11.669	-43.266	99.196
CBIE index	5141	.599	.174	.098	.929
Output gap	5141	0	.043	-.656	.406
Debt to GDP	5141	55.9	38.6	0	349.9
Exchange rate regime	5141	.326	.469	0	1
Openness to trade	5141	75.219	47.78	6.32	437.327
Log of GDP per capita	5141	857.133	147.559	556.905	1162.998
Electoral democracy index	5141	.532	.283	.013	.922
Chinn-Ito index	4870	.244	1.553	-1.931	2.299
Banking crisis	4350	.083	.277	0	1
Currency crisis	4350	.032	.175	0	1
Sovereign debt crisis	4350	.011	.102	0	1
Government crises	5115	.146	.429	0	5
Transition economies	5141	.032	.176	0	1

D Dynamic panel models: specification analysis

In order to estimate the dynamic effects of CBI on inflation, we followed the three main specification choices needed for this type of analysis.[I] The first one requires the identification of the correct specification of the dynamic structure of the model, i.e. the choice of the lag structure for the dependent and the main explanatory variables. The second consists in identifying the specification of the conditional mean function, i.e. the selection of the exogenous controls to include in the model. Finally, given the stochastic structure of the data, we needed to select the appropriate robust estimator. In this section we briefly describe the process of selecting our preferred model.

To decide on the dynamic specification we applied the general-to-simple approach of Hendry and Mizon (1978), and Mizon (1984). In particular, we start from a saturated ARDL(p,q,n) model with p and q lags of the dependent and independent variables, respectively, and n weakly exogenous independent variables. The inclusion of p lags of the dependent variable characterises the dynamics of inflation, while the q lags of the independent variables describe the timing of the impact of our variable of interest, i.e. CBI.

Specifically we start from this general model:

$$\pi_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i y_{t-i} + \sum_{k=0}^{q} \beta_q \, CBI_{t-q} + \sum_{j=1}^{n-1} \sum_{k=0}^{q} \beta_{jk} \, X_{t-q} + \varepsilon_t, \tag{5}$$

where π_t is the outcome of interest, i.e. inflation, CBI is the CBIE index of central bank independence, and X_t is a vector of n weakly exogenous predetermined variables, for which we make the sequential exogeneity assumption that $E(\varepsilon_t, X_{j,s}) = 0 \; \forall t, s, j$, with s being all lags from $t_0 \geq 0$ to t. In our context, the sequential exogeneity assumption implies that past values of the independent variables are orthogonal to contemporaneous and future shocks to inflation, and that the error terms ε_t are serially uncorrelated. The coefficients of interest is β_q on the index of central bank independence CBI_{t-q}. In this specification, we assume that this variable is also weakly exogenous.

In our specification analysis, in order to identify the most appropriate model to use given our data, we first tested the coefficient constraints of three models nested in the ARDL linear dynamic model: i) the partial adjustment model (also known as the Koyck model), ii) a model with serially correlated errors (also called the common factor model), and iii) the 'dead start' model where only lags of the CBI variable are included but not its contemporaneous values.[II] Our specification analysis results suggest that we cannot reject the partial adjustment model but we can reject the need to include *both* the contemporaneous value of the CBI index and its lagged value in the specification. Indeed, the CBI index, is a very persistent variable. When a reform takes place the CBI index remains at its new (almost always higher) level until the adoption of a reform able to change the degree of independence of the analyzed central bank. From the perspective of dynamics, lags of very persistent variables contribute little in substance, as the sum of the coefficients of all lags is often not far from the contemporaneous coefficient, which is also the case in our data.[III]

[I] For a practitioners perspective on specification selection for dynamic panels see the discussion in Beck and Katz (2011) and De Boef and Keele (2008).

[II] The 'dead start' model assumes that the contemporaneous effect of the variable of interest is zero, hence the name of the model, but lagged effects are significant.

[III] In our panel of annual data, we lag the treatment variable by one period to address timing concerns,

We do not run models with no lags of the dependent variable, i.e. distributed lag models with no auto-regressive component, as this would imply that inflation persistence is not important, a view that we do not explore on the basis of theoretical grounds suggesting the possibility of backward looking expectations.

In the following subsections, we provide a discussion of the tests implemented in our specification search.

D.1 Stationarity

We carried out several tests to address questions of stationarity in the series we analyse. In Culver and Papell's (1997) classic study of panel unit root test, the authors easily reject the non-stationarity of inflation in a panel of 13 OECD countries. The results of the first-generation unit root tests run for inflation, i.e. the Im et al. (2003) one as well as the Fisher test implemented by Maddala and Wu (1999), allow us to comfortably reject the presence of unit roots.

We also run the second-generation panel unit root test of Pesaran (2007). This test allows for cross-sectional spatial dependence in the data, where the pairwise correlations are not the same across the panel series. The Pesaran (2004) post estimation tests for cross-sectional dependence indicate that our models are spatially dependent. In light of this finding, for robustness we estimate our models using the Driscoll and Kraay (1998) estimator.

As the most important independent variables in our analysis, i.e. the CBI index is bounded between 0 and -1, we therefore believe that its inclusion in our models is not a cause for spurious correlations (see Beck and Katz, 2011, for a discussion on the non-stationary of bounded variables).

However, the issue of interest here is not necessarily the stationarity of the individual series, but rather the stochastic properties of our variable of interest, i.e. inflation conditional on observes covariates. To that end, we used the Levin et al. (2002) test including covariates, whose results, reported at the bottom of each one of the results tables, indicate that we can reject the null of a unit root in inflation.

D.2 Serial correlation

Standard tests for serial correlation in linear panel-data models reject the no serial correlation null. However, the bias-corrected test introduced in Born and Breitung (2016) does not reject the no AR1 correlation hypothesis. This squares with the common intuition that lagged dependent variable models address the serial correlation issue. Nevertheless, in our specifications we will assume an AR1 model.

D.3 Cross-sectional dependence and heteroskedasticity

The Pesaran (2004) test rejects cross-sectional (spatial) independence even in the presence of year fixed effects. The average cross-sectional correlation is around .24 in our data,

but estimates with the contemporaneous values are essentially identical. We also assume that we can adequately capture the effects of slow moving (mostly political economy) variables without the need of including their lags. This assumption proved innocuous in tests that we do not report, but are available upon request, as they did not affect the coefficients of the variables of interest.

a reasonable value for cross-national data like ours. The data are also heteroskedastic according to a modified Wald test for groupwise heteroskedasticity following Greene (2000).

Given the N>T shape of our data, we therefore use an OLS estimator with the spatial correlation consistent errors proposed by Driscoll and Kraay (1998).

E Modeling of inflation dynamics

This section presents the results of a linear dynamic panel model of inflation where we estimate the effects of CBI on inflation only accounting for the dynamics of inflation and without any additional controls. The objective of Table E.3 is to present the sensitivity of our baseline results to different lag specifications.

Columns (1)-(4) of Table E.3 present the results obtained for the full sample of countries, Columns (5)-(8) focus on the sub-sample of advanced economies, while Columns (9)-(12) are centred on developing countries. In Columns (1), (5) and (9), we only include one lag of inflation and in the following columns we progressively increase the number of lags to two, four, and eight. We only report the coefficient estimates for the first four lags, and report the p-values for the test of the joint significance of lags 5 to 8.[IV] On the balance of evidence, we choose the specification with four lags of inflation as the preferred model.

Table E.3: Modeling inflation dynamics

	All countries				Advanced countries				Developing countries			
$CBI_{i,t-1}$	-4.383**	-3.591**	-4.034**	-3.421**	-1.919**	-1.825**	-1.861**	-1.607**	-7.224**	-5.814**	-6.371**	-5.397**
	(1.443)	(1.475)	(1.592)	(1.379)	(0.599)	(0.536)	(0.519)	(0.649)	(2.117)	(2.085)	(2.282)	(1.978)
$Inflation_{i,t-1}$	0.582**	0.482**	0.436**	0.422**	0.577**	0.504**	0.551**	0.524**	0.580**	0.480**	0.434**	0.420**
	(0.049)	(0.055)	(0.056)	(0.064)	(0.067)	(0.070)	(0.070)	(0.073)	(0.050)	(0.055)	(0.055)	(0.063)
$Inflation_{i,t-2}$		0.131**	0.079*	0.089**		0.088**	-0.027	-0.040		0.133**	0.083*	0.093**
		(0.038)	(0.043)	(0.044)		(0.033)	(0.080)	(0.085)		(0.038)	(0.043)	(0.043)
$Inflation_{i,t-3}$			0.100**	0.099**			0.148**	0.195**			0.095**	0.093**
			(0.040)	(0.042)			(0.064)	(0.078)			(0.040)	(0.042)
$Inflation_{i,t-4}$			0.028	0.032			-0.020	0.060			0.031	0.033
			(0.034)	(0.034)			(0.030)	(0.054)			(0.034)	(0.034)
p-value lags 5 to 8				[0.001]				[0.328]				[0.002]
Effect after 10 years	-10.450**	-9.110**	-10.608**	-8.952**	-4.521**	-4.418**	-5.118**	-5.122**	-17.111**	-14.711**	-16.703**	-13.988**
	(3.428)	(3.710)	(4.166)	(3.759)	(1.622)	(1.468)	(1.624)	(2.273)	(5.432)	(5.458)	(6.178)	(5.511)
Long-run effect of CB reform	-10.497**	-9.282**	-11.313**	-9.571**	-4.539**	-4.466**	-5.341**	-6.151**	-17.185**	-14.987**	-17.805**	-14.908**
	(3.450)	(3.787)	(4.534)	(4.147)	(1.640)	(1.500)	(1.749)	(3.054)	(5.480)	(5.593)	(6.776)	(6.088)
Persistence of Inflation process	0.582**	0.613**	0.643**	0.643**	0.577**	0.591**	0.652**	0.739**	0.580**	0.612**	0.642**	0.638**
	(0.049)	(0.038)	(0.047)	(0.057)	(0.067)	(0.051)	(0.059)	(0.075)	(0.050)	(0.039)	(0.048)	(0.057)
Unit root test	-17.124	-19.031	-15.162	-8.040	-12.054	-11.306	-4.665	-1.410	-13.725	-15.079	-11.884	-7.788
p value (reject unit root)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.079	0.000	0.000	0.000	0.000
Sample inflation mean	25.728	20.372	18.374	17.484	5.251	5.029	4.894	4.389	31.931	25.058	22.566	21.608
Observations	6577	6492	6319	5707	1529	1519	1499	1367	5048	4973	4820	4340
Countries in sample	153	153	153	153	33	33	33	33	120	120	120	120

Note: The dependent variable is the normalised level of inflation. CBI is the Central Bank Independence - Extended index. All models include country and year fixed effect. Driscoll and Kraay (1998) standard errors in parentheses. ***/**/* denote significance at 1, 5 and 10 percent levels, respectively.

[IV] While this joint test indicates that lags 5 to 8 are jointly significant for the full sample and the sample of developing countries, this result is driven by lag 7 which is the only one which is statistically significant.

F Dynamic panel additional results

Table F.4 expands the results presented in Table 3 for the full sample of countries. The first and last columns reproduce the results in Table 3, Columns (1) and (2), while the rest of the table introduces the control variables individually.

Table F.4: Dynamic effects of CBI, all countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CBI_{t-1}	-4.709**	-4.544**	-4.406**	-5.027**	-4.922**	-4.722**	-4.603**	-4.665**
	(1.660)	(1.588)	(1.622)	(1.642)	(1.680)	(1.643)	(1.622)	(1.552)
$Inflation_{t-1}$	0.500**	0.495**	0.496**	0.498**	0.500**	0.499**	0.499**	0.490**
	(0.067)	(0.068)	(0.067)	(0.068)	(0.067)	(0.067)	(0.068)	(0.068)
$Inflation_{t-2}$	0.051	0.052	0.050	0.051	0.051	0.051	0.051	0.050
	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)
$Inflation_{t-3}$	0.090**	0.088**	0.091**	0.089**	0.090**	0.089**	0.090**	0.088**
	(0.040)	(0.040)	(0.039)	(0.040)	(0.040)	(0.040)	(0.040)	(0.039)
$Inflation_{t-4}$	0.012	0.012	0.012	0.012	0.012	0.009	0.011	0.010
	(0.029)	(0.029)	(0.029)	(0.030)	(0.029)	(0.030)	(0.029)	(0.029)
Output gap		-11.571**						-8.445*
		(4.475)						(4.557)
Debt to GDP			2.310**					1.829**
			(0.669)					(0.676)
Exchange rate regime				-1.179**				-0.927**
				(0.336)				(0.309)
Openness to trade					0.008			0.005
					(0.006)			(0.005)
Log of GDP per capita						-0.013**		-0.007
						(0.006)		(0.007)
Electoral democracy index							-2.101	-1.672
							(1.474)	(1.522)
Effect after 10 years	-12.866**	-12.241**	-11.921**	-13.648**	-13.439**	-12.763**	-12.532**	-12.339**
	(4.401)	(4.148)	(4.228)	(4.326)	(4.486)	(4.301)	(4.305)	(3.981)
Long-run effect of CB reform	-13.562**	-12.861**	-12.545**	-14.365**	-14.166**	-13.400**	-13.195**	-12.906**
	(4.682)	(4.399)	(4.472)	(4.612)	(4.787)	(4.552)	(4.582)	(4.211)
Persistence of Inflation process	0.653**	0.647**	0.649**	0.650**	0.653**	0.648**	0.651**	0.639**
	(0.047)	(0.048)	(0.047)	(0.048)	(0.047)	(0.048)	(0.048)	(0.050)
Unit root test	-15.162	-14.203	-14.532	-14.814	-14.128	-14.294	-15.330	-13.020
p value (reject unit root)								
Sample inflation mean	19.372	19.372	19.372	19.372	19.372	19.372	19.372	19.372
Observations	5141	5141	5141	5141	5141	5141	5141	5141
Countries in sample	134	134	134	134	134	134	134	134

Note: The dependent variable is the normalised level of inflation. CBI is the Central Bank Independence - Extended index. *Output gap* is the deviation of real GDP from the Hodrick-Prescott filter. *Debt to GDP* is the Debt to GPD ratio of a country. *Exchange rate regime* is a dummy equal to one for countries adopting a fixed exchange rate regime. *Openness to trade* is the degree of trade openness of a country measured as the ratio of imports plus exports over GDP. *Log of GDP per capita* is the logarithm of the level of GDP per capita of a country. *Electoral democracy index* is the index of electoral democracy. All models include country and year fixed effect. Driscoll and Kraay (1998) standard errors in parentheses. ***/**/* denote significance at 1, 5 and 10 percent levels, respectively.

Table F.5 and Table F.6 below replicate the estimations presented in Table 3, Columns (3)-(4) and (5)-(6), respectively by introducing the control variables individually. The main conclusions from table 3 follow through.

Table F.5: Dynamic effect of CBI, advanced economies

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CBI_{t-1}	-2.046**	-2.125**	-2.114**	-2.210**	-2.348**	-2.039**	-1.851**	-2.391**
	(0.543)	(0.543)	(0.540)	(0.555)	(0.592)	(0.538)	(0.564)	(0.655)
$Inflation_{t-1}$	0.568**	0.553**	0.562**	0.567**	0.566**	0.567**	0.565**	0.547**
	(0.069)	(0.071)	(0.069)	(0.069)	(0.070)	(0.069)	(0.069)	(0.072)
$Inflation_{t-2}$	-0.014	-0.016	-0.016	-0.014	-0.015	-0.014	-0.012	-0.016
	(0.070)	(0.072)	(0.070)	(0.070)	(0.070)	(0.069)	(0.070)	(0.072)
$Inflation_{t-3}$	0.132**	0.131**	0.130**	0.131**	0.132**	0.132**	0.132**	0.131**
	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)	(0.055)	(0.054)	(0.054)
$Inflation_{t-4}$	-0.022	-0.012	-0.022	-0.022	-0.021	-0.019	-0.022	-0.013
	(0.029)	(0.028)	(0.028)	(0.029)	(0.029)	(0.027)	(0.029)	(0.026)
Output gap		13.501**						12.809**
		(3.079)						(3.632)
Debt to GDP			-0.746**					-0.453
			(0.340)					(0.370)
Exchange rate regime				-0.170				-0.087
				(0.208)				(0.199)
Openness to trade					0.007			0.007
					(0.005)			(0.005)
Log of GDP per capita						0.004		-0.001
						(0.006)		(0.007)
Electoral democracy index							-1.921*	-1.532
							(1.057)	(1.058)
Effect after 10 years	-5.816**	-5.915**	-5.875**	-6.275**	-6.645**	-5.829**	-5.268**	-6.538**
	(1.641)	(1.532)	(1.591)	(1.649)	(1.769)	(1.637)	(1.722)	(1.790)
Long-run effect of CB reform	-6.074**	-6.189**	-6.105**	-6.549**	-6.938**	-6.106**	-5.507**	-6.817**
	(1.781)	(1.665)	(1.716)	(1.789)	(1.925)	(1.791)	(1.856)	(1.925)
Persistence of Inflation process	0.663**	0.657**	0.654**	0.662**	0.662**	0.666**	0.664**	0.649**
	(0.055)	(0.056)	(0.056)	(0.055)	(0.054)	(0.056)	(0.054)	(0.058)
Sample inflation mean	4.861	4.861	4.861	4.861	4.861	4.861	4.861	4.861
Observations	1466	1466	1466	1466	1466	1466	1466	1466
Countries in sample	33	33	33	33	33	33	33	33

Note: The dependent variable is the normalised level of inflation. *CBI* is the Central Bank Independence - Extended index. *Output gap* is the deviation of real GDP from the Hodrick-Prescott filter. *Debt to GDP* is the Debt to GPD ratio of a country. *Exchange rate regime* is a dummy equal to one for countries adopting a fixed exchange rate regime. *Openness to trade* is the degree of trade openness of a country measured as the ratio of imports plus exports over GDP. *Log of GDP per capita* is the logarithm of the level of GDP per capita of a country. *Electoral democracy index* is the index of electoral democracy. All models include country and year fixed effect. Driscoll and Kraay (1998) standard errors in parentheses. ***/**/* denote significance at 1, 5 and 10 percent levels, respectively.

Table F.6: Dynamic effect of CBI, developing countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CBI_{t-1}	-7.521**	-7.343**	-6.227**	-7.225**	-7.535**	-7.868**	-7.336**	-6.163**
	(2.657)	(2.575)	(2.506)	(2.620)	(2.668)	(2.654)	(2.628)	(2.424)
$Inflation_{t-1}$	0.498**	0.493**	0.495**	0.497**	0.498**	0.496**	0.498**	0.489**
	(0.067)	(0.068)	(0.066)	(0.067)	(0.067)	(0.067)	(0.067)	(0.067)
$Inflation_{t-2}$	0.055	0.056	0.054	0.055	0.055	0.055	0.055	0.054
	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)
$Inflation_{t-3}$	0.084**	0.082**	0.086**	0.084**	0.084**	0.083**	0.084**	0.083**
	(0.040)	(0.040)	(0.040)	(0.041)	(0.040)	(0.041)	(0.040)	(0.040)
$Inflation_{t-4}$	0.013	0.013	0.014	0.014	0.013	0.010	0.012	0.012
	(0.030)	(0.030)	(0.029)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
Output gap		-12.865**						-8.814*
		(4.909)						(5.109)
Debt to GDP			2.826**					2.399**
			(0.867)					(0.869)
Exchange rate regime				-1.329**				-0.983**
				(0.477)				(0.447)
Openness to trade					0.001			0.004
					(0.007)			(0.007)
Log of GDP per capita						-0.019**		-0.012
						(0.007)		(0.008)
Electoral democracy index							-1.057	-0.986
							(2.032)	(2.024)
Effect after 10 years	-20.474**	-19.641**	-16.860**	-19.608**	-20.513**	-21.086**	-19.941**	-16.289**
	(7.151)	(6.778)	(6.600)	(7.055)	(7.192)	(7.019)	(7.173)	(6.349)
Long-run effect of CB reform	-21.553**	-20.593**	-17.752**	-20.636**	-21.595**	-22.075**	-20.980**	-17.038**
	(7.619)	(7.186)	(6.978)	(7.514)	(7.667)	(7.433)	(7.662)	(6.700)
Persistence of Inflation process	0.651**	0.643**	0.649**	0.650**	0.651**	0.644**	0.650**	0.638**
	(0.049)	(0.050)	(0.049)	(0.050)	(0.049)	(0.050)	(0.050)	(0.051)
Sample inflation mean	25.161	25.161	25.161	25.161	25.161	25.161	25.161	25.161
Observations	3675	3675	3675	3675	3675	3675	3675	3675
Countries in sample	101	101	101	101	101	101	101	101

Note: The dependent variable is the normalised level of inflation. CBI is the Central Bank Independence - Extended index.. *Output gap* is the deviation of real GDP from the Hodrick-Prescott filter. *Debt to GDP* is the Debt to GPD ratio of a country. *Exchange rate regime* is a dummy equal to one for countries adopting a fixed exchange rate regime. *Openness to trade* is the degree of trade openness of a country measured as the ratio of imports plus exports over GDP. *Log of GDP per capita* is the logarithm of the level of GDP per capita of a country. *Electoral democracy index* is the index of electoral democracy. All models include country and year fixed effect. Driscoll and Kraay (1998) standard errors in parentheses. ***/**/* denote significance at 1, 5 and 10 percent levels, respectively.

Table F.7: Dynamic effect of CBI, sample exclusions - advanced economies

	No Currency unions	No hyperinflation years	No hyperinflation countries	No Transition	No Western Europe
	(1)	(2)	(3)	(4)	(5)
CBI_{t-1}	-3.300**	-2.641**	-1.793**	-2.008**	-8.725**
	(1.048)	(0.702)	(0.710)	(0.665)	(2.839)
Effect after 10 years	-8.140**	-6.371**	-4.833**	-5.910**	-13.830**
	(2.656)	(1.574)	(1.895)	(1.906)	(4.180)
Long-run effect of CB reform	-8.348**	-6.521**	-5.407**	-6.569**	-13.835**
	(2.786)	(1.617)	(2.082)	(2.202)	(4.178)
Persistence of Inflation process	0.605**	0.595**	0.668**	0.694**	0.369**
	(0.066)	(0.051)	(0.046)	(0.062)	(0.080)
Sample inflation mean	5.847	4.745	4.450	4.865	4.170
Observations	1078	1463	1308	1428	497
Countries in sample	33	33	28	33	13

Note: The dependent variable is the normalised level of inflation. In column (1), currency union periods are excluded. In column (2), years with hyperinflation are excluded. In column (3), countries that have experienced hyper-inflationary episodes in the years of our sample are excluded. In column (4), former transition countries are excluded. In column (5), EMU countries are excluded. Hyperinflation is defined as a period with inflation of more than 50%. All models include country and year fixed effect. Driscoll and Kraay (1998) standard errors in parentheses. ***/**/* denote significance at 1, 5 and 10 percent levels, respectively.

Table F.8: Dynamic effect of CBI, sample exclusions - developing countries

	No Currency unions	No hyperinflation years	No hyperinflation countries	No Transition	No Western Europe
	(1)	(2)	(3)	(4)	(5)
CBI_{t-1}	-11.730**	-2.399	0.741	-6.256**	-6.163**
	(2.568)	(1.854)	(2.539)	(2.543)	(2.424)
Effect after 10 years	-32.065**	-3.175	0.895	-16.845**	-16.289**
	(7.392)	(2.407)	(3.127)	(6.857)	(6.349)
Long-run effect of CB reform	-33.370**	-3.177	0.896	-17.790**	-17.038**
	(8.041)	(2.408)	(3.131)	(7.357)	(6.700)
Persistence of Inflation process	0.648**	0.245**	0.173	0.648**	0.638**
	(0.051)	(0.038)	(0.116)	(0.055)	(0.051)
Sample inflation mean	28.875	8.550	6.990	24.684	25.161
Observations	3100	3507	1752	3549	3675
Countries in sample	88	101	49	101	101

Note: The dependent variable is the normalised level of inflation. In column (1), currency union periods are excluded. In column (2), years with hyperinflation are excluded. In column (3), countries that have experienced hyper-inflationary episodes in the years of our sample are excluded. In column (4), former transition countries are excluded. In column (5), EMU countries are excluded. Hyperinflation is defined as a period with inflation of more than 50%. All models include country and year fixed effect. Driscoll and Kraay (1998) standard errors in parentheses. ***/**/* denote significance at 1, 5 and 10 percent levels, respectively.

G Instrumental variable local projection estimations

Table G.9: IV First stage estimates

	All countries (1)	Advanced countries (2)	Developing countries (3)
CBI_{t-2}	0.988**	0.963**	1.030**
	(0.016)	(0.017)	(0.033)
Regional $pressure_{t-2}$	0.108**	0.064**	0.190**
	(0.023)	(0.027)	(0.039)
IMF programmes $_{t-1}$	0.005*	0.010*	0.005*
	(0.002)	(0.005)	(0.003)
$Inflation_{t-1}$	0.011	-0.058*	0.017
	(0.017)	(0.032)	(0.018)
$Inflation_{t-2}$	-0.005	-0.064	-0.005
	(0.008)	(0.038)	(0.008)
$Inflation_{t-3}$	0.013	-0.001	0.014
	(0.009)	(0.031)	(0.009)
$Inflation_{t-4}$	-0.010**	-0.010	-0.011**
	(0.003)	(0.014)	(0.003)
Output gap	-0.033**	0.015	
	(0.015)	(0.041)	
Debt to GDP	-0.003	-0.009	0.001
	(0.006)	(0.006)	(0.007)
Exchange rate regime	-0.008**	-0.024**	0.005
	(0.004)	(0.006)	(0.004)
Openness to trade	0.000**	0.000**	0.000
	(0.000)	(0.000)	(0.000)
Log of GDP per capita	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Electoral democracy index	0.021**	0.027**	0.020*
	(0.009)	(0.009)	(0.011)
Currency Union	0.045**	0.051**	
	(0.006)	(0.007)	
Inflation crisis	-0.000	0.019*	0.000
	(0.005)	(0.010)	(0.005)
Observations	3354	1128	2226
Countries in sample	127	33	94
R-Squared	0.865	0.926	0.785

Note: The table shows the first stage results of the IV estimation. We instrument the CBI index with its lagged value, a measure of regional peer pressure and an IMF program dummy that takes value of 1 if a country has been part of an IMF program in the previous 2 years. KP weak IV refers to the Kleibergen and Paap (2006) Wald rk F-statistic.