Central bank independence and inflation preferences: New empirical evidence on the effects on inflation

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Abstract

On theoretical grounds, a clear distinction exists between central bank independence and inflation aversion. In the conduct of monetary policy, both contribute to lower inflation. In this paper, we re-examine empirically the nexus between central bank independence and inflation for a large sample of advanced and developing countries over the period 1992–2014 by accounting explicitly for the effect of central bank inflation preferences on inflation developments. Our evidence suggests that both features matter for mitigating inflationary pressures, in line with the relevant theoretical studies. Central bank independence alone seems not to be a sufficient condition to curtail inflation; the expected inverse relationship between central bank independence and inflation appears to hold when we account for the (inflation) conservatism of the central bank. At the same time, higher central bank conservatism seems to result in lower inflationary pressures in the economy. Our results do not support the hypothesis of an interaction (either as substitutes or complements) between the degree of independence and conservatism of the central bank.

JEL Classification: E52, E58
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1. Introduction

Over the past three decades, the institutional design of monetary policy has undergone significant changes. The pursuit of independence in the conduct of monetary policy in terms of objectives and instruments, considered a precondition to shelter central banks from political pressures, has significantly altered the institutional framework of central banks' functioning.

In the context of the time inconsistency literature of monetary policy (e.g. Kydland and Prescott 1977; Barro and Gordon 1983), Rogoff (1985) argues that the delegation of monetary policy to a central banker who is independent from

political interference and who is conservative (i.e. more inflation averse compared to the government) leads to lower inflation. As stressed by Lippi (1999 p 106), although both central bank independence (CBI) and central bank conservatism (CBC) 'contribute to the *effective* degree of inflation aversion', they differ conceptually and may fluctuate independently of each other;[4] CBC concerns the central bank's aversion to inflation relative to its targets, while CBI refers to the degree of freedom of the central bank in pursuing its monetary policy objectives.

In effect, theoretical studies address the distinction between CBI and CBC, emphasising that both are important in order to mitigate inflationary pressures (see, for instance, Eijffinger and Hoeberichts 1998; Berger *et al* 2001). Theoretical evidence also supports the hypothesis that CBI and CBC can act either as complements or substitutes in taming inflation (Eijffinger and Hoeberichts 1998, 2008; Hefeker and Zimmer 2011). By contrast, the empirical studies that examine the effect of CBI on inflation provide mixed evidence on their underlying relationship. Most of these studies do not take into account how central bank inflation preferences may potentially evolve over time, partly as a result of the lack of a simple and easily quantifiable measure to capture such preferences. However, if CBC is an important determinant in empirical analysis, its omission could lead to biased estimates. Recently, Levieuge and Lucotte (2014) proposed an index that captures the relative preferences of the monetary authority and is essentially founded on the inflation-output gap volatility trade-off.[5] In contrast to earlier contributions to the literature, this proxy of CBC can be generalised over time and across economies, while it is independent of the monetary regime in effect.

This paper aims to contribute to the empirical literature on the impact of the institutional design of central banks on inflation. By employing a large annual panel dataset of both advanced and developing economies over the period 1992–2014, we investigate the impact of CBI on the inflation rate, by taking explicit account of the inflation preferences, i.e. the degree of conservatism of the central bank. To the best of our knowledge, this is the first study that assesses the CBI-inflation nexus by accounting explicitly for such preferences following the methodology by Levieuge and Lucotte (2014). Omitting a potentially significant independent variable from the empirical analysis may lead to biased estimates of the effects of CBI on inflation, with important repercussions for monetary policy recommendations. For this purpose, we calculate the index of CBC based on Levieuge and Lucotte (2014) over a long time span, including the recent global financial crisis.

Compared to the static analysis that is prevalent in the literature, our dynamic panel modelling framework accounts for the persistence of inflation, the potential endogeneity of the institutional features of monetary policy, and unobserved country heterogeneity, by properly transforming the panel series. More importantly, our System GMM estimator allows the inclusion, in a dynamic panel context, of variables such as CBI that exhibit little or no variation

over time. Following relevant theoretical studies, we also assess empirically the existence of a potential trade-off between CBI and CBC.

Our results suggest that when the inflation preferences of the central bank are taken into account, the institutional characteristics of the monetary policy framework do influence price developments in the economy. In particular, both coefficients of central bank independence and conservatism are negative and statistically significant. A higher degree of CBI, coupled with a higher degree of CBC leads, on average, to lower inflation rates. This finding is in line with relevant theoretical studies that highlight the conceptual distinction of the independence and the conservatism of the central bank and substantiate that both matter for inflation outcomes. However, it masks important differences between advanced and developing economies, with varying policy implications for each country group. Finally, our estimates do not support theoretical evidence on the existence of an interaction (as either substitutes or complements) between central bank independence and conservatism. The interaction of CBI and CBC is positive but not statistically significant over the period and countries considered.

The remainder of this paper is structured as follows. Section 2 presents a short review of the related literature and the derivation of the CBC index. Section 3 outlines the econometric method employed. Section 4 describes the data definitions and sources and provides descriptive statistics. Section 5 presents the results from the panel unit root tests and the baseline System GMM estimations. Section 6 discusses the robustness checks and Section 7 investigates the potential trade-off between CBI and CBC. Finally, Section 8 provides relevant conclusions.

2. Literature Review

From a theoretical standpoint, several studies highlight the distinction between CBI and CBC. Eijffinger and Hoeberichts (1998) and Berger *et al* (2001) corroborate that both CBI and CBC are significant in attaining a lower level of inflation. For instance, if both the government and the monetary authority share the same preferences for inflation, then CBI would not matter. Likewise, when the central bank is not independent to determine monetary policy, then its inflation aversion would not be of importance. In this setting, CBI and CBC act broadly as substitutes; various combinations of CBI and CBC may result in the same level of inflation. As Eijffinger and Hoeberichts argue (1998 p 399): 'In practice, the degree of (legal) independence of a central bank is fixed as measured by the legal indices of independence which reflect the central bank laws in various countries. The level of conservativeness, however, can generally be chosen by the central bank. Hence, a lack of central bank independence can be compensated by choosing more conservative central bankers.' Eijffinger and Hoeberichts (2008) reinstate this trade-off between CBI and CBC in a New Keynesian framework. Nonetheless, under the assumption of uncertainty about the output gap target of the central bank, CBI and CBC act as strategic

complements: assigning higher CBI to a monetary authority with uncertain preferences results in higher output gap and inflation volatility, requiring, in turn, a higher degree of CBC (Hefeker and Zimmer 2011).

The empirical research examining the relationship between inflation and CBI provides mixed evidence. A number of studies corroborates the theoretical predictions of a statistically significant inverse association between CBI and inflation (see, for instance, Alesina and Summers 1993; Eijjfinger and de Haan 1996; Loungani and Sheets 1997; Posso and Tawadros 2013). In contrast, several studies conclude that this inverse hypothesis fails to hold on a number of grounds. For instance, Campillo and Miron (1997) show that, when considering a wider set of controls that includes several economic fundamentals, CBI is not an important factor in explaining inflation performance. More recently, the empirical evidence by Klomp and de Haan (2010b) for a large sample of countries, does not support a general statistically significant relationship between inflation and CBI. Daunfeldt and de Luna (2008) also do not detect a significant relation between price stability and CBI for a set of OECD countries. The meta-regression analysis by Klomp and de Haan (2010a) highlights the wide diversity that characterises the vast empirical literature examining the inflation-CBI nexus. Their evidence corroborates there being a significant negative effect of CBI on inflation, which becomes even more pronounced when the empirical studies include the 1970s and focus on OECD economies. Their findings also suggest that the selection of the CBI indicator does not seem to be significant in conditioning the relationship between CBI and inflation.

In most of the empirical research, we can distinguish two basic approaches to proxy CBI; the first pertains to the use of legal indices, such as the CBI indicator of Cukierman *et al* (1992), hereafter CWN. The CWN index consists of four broad components, which pertain to the legal arrangements governing the appointment of the Chief Executive Officer, the central bank objectives, policy formulation, and the limits set on lending to the government; it contains sixteen individual criteria in total (see, Table A1 in the Appendix). The CBI index, which is derived from the aggregation of the above indicators, takes values between 0 and 1, with the latter corresponding to the highest degree of CBI. By construction, legal CBI indices assign higher values of CBI to central banks that abide to the single goal of price stability, as embodied in law, with the aim of reflecting the statutory degree of conservatism of monetary authorities in prioritising price stability over other targets (Cukierman 1992 p 377).

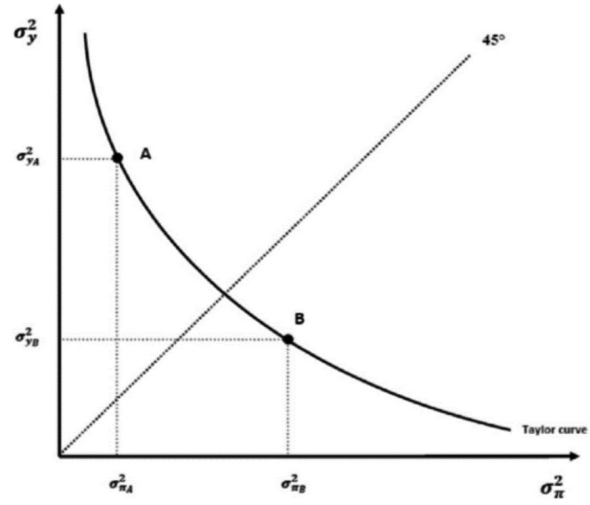
De Haan and Kooi (1997) provide one of the notable exceptions on empirical grounds, to disentangle the individual aspects of the CBI index (i.e. instrument independence, financial independence, independence regarding the appointment procedures and concepts of conservatism) as embodied in the legal mandate, by decomposing the two legal CBI indicators of Cukierman *et al* (1992) and Grilli *et al* (1991). According to their evidence, only instrument independence is significant in explaining inflation performance. A second

commonly-employed proxy for CBI is the turnover rate of the central bank's governor (TOR); a higher turnover rate typically implies a lower level of independence (Cukierman 1992).

Although legal CBI indices exhibit little variation in time, reflecting incremental changes in independence stipulated by law, central bank preferences in practice may vary over time. Focusing on the workings of the German Bundesbank in the post-war period, Berger and Woitek (2005) detect differences in central bank behaviour by identifying a succession of conservative and non-conservative regimes, based on information concerning council members during a period when legal independence remained broadly unchanged. Their findings shed light on the importance of CBC and suggest that conservative council majorities, typically, have reacted more strongly to movements in inflation than non-conservative majorities.

Levieuge and Lucotte (2014) proposed a methodology that allows them to construct a simple proxy of central bank conservatism. More specifically, this measure of CBC is founded on the 'Taylor curve', which describes the trade-off the central bank faces between inflation and output gap stabilisation. Figure 1 depicts the Taylor curve of a central bank.

Figure 1: The Taylor Curve



Source*:* Levieuge and Lucotte (2014) p 413

According to the methodology of Levieuge and Lucotte (2014), CBC is derived by measuring the angle value of the straight line that joins a certain point on the curve and the origin, with the adjacent and opposite sides corresponding to inflation and output gap volatilities. This formula, when rescaled to take values

in the [0,1] interval, provides an estimate of the degree of CBC. More specifically, the CBC index is derived from the following equation:

$$CBC = \frac{1}{90}\left[atan\left(\frac{\sigma_y^2}{\sigma_\pi^2}\right)\times\frac{180}{p_i}\right] \quad (1)$$

Where, *atan* denotes the arc tangent and σ_y and σ_π correspond to the volatility of the output gap and inflation, respectively.

3. Empirical Methodology

We assess the effects of central bank independence on price developments by accounting explicitly for the role of central bank conservatism in the following dynamic panel regression:

$$\pi_{it} = \beta_0 + \beta_1\pi_{it-1} + \beta_2 cbi_{it} + \beta_3 cbc_{it} + X'_k\gamma + u_{it} \quad (2)$$

$$u_{it} = \varepsilon_{it} + \alpha_i + \tau_t \quad (3)$$

where $i = 1,..N$ is the number of cross-sections in the panel, π_t is the change in the natural logarithm of the consumer price index (CPI)[6], π_{t-1} is the first lag of the dependent variable, *cbi* is an index of central bank independence, *cbc* denotes central bank conservatism, X_k is a set of control variables that can affect shifts in prices, u_{it} is the overall disturbance term which includes the country-specific fixed effects, α_i, and the idiosyncratic shocks, ε_{it}, and τ_t denotes time-dummies that capture shocks to inflation that are common across countries.

We employ the change in the consumer price index as a proxy for the general rate of inflation which is also often used by central banks to set inflation targets in the conduct of monetary policy.[7] To measure CBI, we use the (weighted) aggregate legal index proposed by Cukierman *et al* (1992) which is bounded between 0 and 1, with higher values signalling a higher level of independence of the central bank. Following Levieuge and Lucotte (2014), we construct the index of central bank conservatism for an extended sample of advanced and developing economies over the period 1992–2014. In particular, we derive the index of CBC based on inflation and output gap volatilities, which are computed-based on the estimation of a GARCH (1,1) model.

In our analysis, the coefficients of interest are β_2 and β_3. According to theoretical models, both CBI and CBC matter for explaining inflation in an economy (see, Eijffinger and Hoeberichts 1998; Berger *et al* 2001). Central bank conservatism can be an important driver of inflation developments. A higher degree of conservatism is expected to lead to a lower inflation rate in an economy, partly reflecting well-anchored inflation expectations. In this regard, omitting the effect of a significant determinant of inflation developments, such as the conservatism of the central bank, can lead to biased estimates, masking the inferred reaction of inflation to central bank independence. The country-fixed effects would then capture the effects of the omitted variable and would be correlated with the other regressors of the model.

Moreover, shifts in the level of prices can be affected by a set of additional factors, incorporated as control variables in our dynamic panel estimations. These include the change in the natural logarithm of real GDP per capita to capture the impact of business cycle fluctuations, trade openness and capital account openness to control for respective restrictions in the external sector, the change in the debt-to-GDP-ratio to account for shifts in fiscal policy, the change in private credit to capture the 'credit channel' of the transmission of monetary policy to prices, the change in the real effective exchange rate to account for import price pressures to consumer inflation, the exchange rate classification regime and a banking crisis dummy.

We expect that a higher GDP per capita and a lower real effective exchange rate (i.e. a depreciation) would increase price pressures, stemming from the domestic demand and supply sides, respectively. Higher trade openness is expected to decrease inflation as a more open economy would result in higher competition and lower prices (Sachsida *et al* 2003; Gruben and McLeod 2004;). Romer (1993) also finds that higher trade openness leads to lower inflation, though he attributes this negative relation to the effect of monetary policy on the nominal exchange rate. Moreover, increased capital account liberalisation seems to reduce inflation (Gruben and McLeod 2002). However, this effect can be ambiguous, especially for developing economies, as they can be vulnerable to inflationary capital flows (Rodrik 1998). Concerning the effects of fiscal policy, shifts in the debt ratio can be financed by seigniorage with an upward effect on inflation, despite the presence of an independent central bank. Increases in public debt can also fuel domestic demand and prices directly. Finally, with regards to the exchange rate classification, this assigns a lower value to fixed exchange rate regimes and a higher value to floating regimes. The lowest inflation outcomes would commonly be associated with fixed exchange rate regimes and, thus, a higher value of the exchange rate regime classification variable would be related to higher inflation.

Adopting a dynamic panel specification has several advantages. First, a dynamic model of inflation provides a more realistic representation of price developments, allowing for potential inertia in the adjustment of prices in the short-term. Second, dynamic panel modelling can provide more consistent estimates in the presence of autocorrelation in the panel, compared with the static panel regressions often met in the relevant literature. Finally, such a framework allows us partly to capture the potential bias from omitted variables varying over time (De Grauwe and Skudenly 2000).

Given the dynamic nature of our empirical specification, the lagged dependent variable is endogenous to the individual fixed effects, which results in 'dynamic panel bias' (see Nickell 1981; Kiviet 1995; Roodman 2009a). Hence, standard OLS estimation leads to inconsistent estimates.[8] Against this background, we estimate Equations (2)–(3) by employing the System GMM estimator proposed by Blundell and Bond (1998). The System GMM estimator can account for unobserved country heterogeneity by appropriately transforming the panel

series.[9] By contrast to difference GMM estimators, where future changes of a variable are instrumented by its past levels, the System GMM estimator is more efficient as variables in levels are instrumented with past changes.

The merits of our approach are multi-fold. First, dynamic panel estimators allow us to tackle potential endogeneity issues by using the appropriate set of instruments for the endogenous regressors. Second, the System GMM estimator allows us to include time-invariant variables in the estimations. Given our unbalanced data set, the time series on central bank independence can be rather short for some countries, while exhibiting little or no variation over time. By contrast to other dynamic panel estimators, such as the Arellano-Bond (1991) first-difference GMM estimator, the System GMM does not eliminate time-invariant regressors. Third, taking into account the potential high persistence of the inflation series, the System GMM is a more efficient estimator since past changes can be better predictors, and thus, more relevant instruments, of the current levels of the instrumented variable.[10] Finally, the System GMM estimator would decrease the gaps in the case of unbalanced panels, thereby increasing the sample size.

Given our unbalanced panel dataset and the relatively large time dimension of our sample, we collapse and limit our instrument set.[11] Limiting the lag length is warranted as deeper lags are commonly weaker instruments and, hence, they add very little new information to the estimation. Moreover, we mitigate the gaps in the panel by employing the forward orthogonal deviations transform, which can perform better than the first differences transform in System GMM (see, Hayakawa 2009; Roodman 2009b). The set of instruments is selected from the available regressors of the empirical analysis; we employ the *t–2* and *t–3* lags of the central bank conservatism variable, and the *t–2* to *t–4* lags of the change in the consumer price index. In the baseline model, we assume that the index of legal CBI is strictly exogenous. Most of the remaining control variables enter in lagged form to mitigate potential endogeneity issues.[12]

Finally, we apply the Hansen (1982) *J* test of over-identifying restrictions, to assess the validity of the instrument set. We also perform the Difference-in-Hansen test, which investigates the joint validity of the full instrument set for the levels equation.[13] Potential serial correlation across the cross-sections in our panel is controlled partly by introducing time dummies in all model specifications, though these are not reported. These time dummies capture temporal shocks (e.g. the enforcement of the Stability and Growth Pact in 1996, the 2007–2009 global economic and financial crisis, and the introduction of the EMU-deepening blueprint in 2012) which are common across countries. We formally test for first-order autocorrelation in the residuals by applying the Arellano and Bond autocorrelation test.

4. Data

4.1 Data definitions and sources

We employ an annual unbalanced panel dataset of 36 advanced and 83 developing economies over the period 1992–2014. The CWN indicator of legal CBI is based on Cukierman *et al* (1992), as updated by Bodea and Hicks (2015). Following Klomp and de Haan (2010b), the turnover rate of central bank governor (TOR) is calculated in a ten-year rolling window, based on the dataset of central bank governors' turnovers by Sturm and de Haan (2001), Dreher *et al* (2008) and Dreher *et al* (2010).

The inflation rate, trade openness (defined as the sum of exports and imports as a percentage of GDP), domestic credit to the private sector (as a percentage of GDP), the real effective exchange rate (the nominal effective exchange rate, as a measure of the value of a currency against a weighted average of several foreign currencies, divided by a price deflator or index of costs, 2010=100) and real GDP per capita, are drawn from the World Bank, World Development Indicators. The Kaopen Index is taken from Chinn and Ito (2006) and proxies capital account openness, with higher values suggesting greater openness. In particular, the index incorporates information concerning restrictions regarding current account and capital account transactions, the existence of multiple exchange rates and requirements of the surrender of export proceeds. The debt-to-GDP ratio is drawn from the IMF Historical Public Debt Database (Abbas *et al* 2010). The regime classification of the exchange rate is based on coarse classification of the dataset by Ilzetzki *et al* (2008), where higher values correspond to more flexible exchange rate arrangements. Data on systemic banking crises come from Laeven and Valencia (2018). Finally, for the classification of inflation targeting countries in our sample and official adoption dates, we consult Hammond (2012) and Schmidt-Hebbel and Carrasco (2016). For the breakdown of our sample into advanced and developing economies, we follow the IMF World Economic Outlook April 2019 classification.

4.2 Preliminary data assessment

Given our large, unbalanced panel dataset, we perform a preliminary assessment of the statistical properties of the data. Specifically, we tabulate the summary statistics of the main variables and examine their pairwise contemporaneous correlation, the cross-sectional and within-time series variation in the panel of CBI, CBC and TOR, and the existence of outlier values, notably in the inflation rate (see, Tables A2–A4 and Figures A1–A2 in the Appendix). We do not detect exceptionally high values in the pairwise correlations of the main variables that would signal a multicollinearity problem. Also, as expected, CBI exhibits some variation over time, though this is low. With regards to the outlier values, only a few developing countries have experienced excessive, well above sample mean, inflation rates.[14] Finally, the availability of sufficient data is necessary in order to draw firm conclusions on the effects of central bank inflation preferences on price developments. For this purpose, we exclude from the sample the

economies which have less than 10 annual observations of the CBC index. The final dataset thus consists of an annual panel of 36 advanced and 83 developing economies over the period 1992–2014.[15]

In our sample, central bank independence in developing countries is low, with an average index of 0.52 compared to 0.60 for advanced economies. The difference between the two groups is higher when it comes to central bank conservatism; the CBC index is 0.45 and 0.70 on average in the respective country groups.

5. Empirical Results

5.1 Panel unit root analysis

As a preliminary step of the econometric estimations, we perform panel unit root tests to assess the stationarity properties of the inflation rate and of key regressors of the baseline model. Inflation can exhibit a high degree of persistence which is associated both with the anchoring of inflation expectations and with a certain degree of price stickiness, notably in advanced economies (Altissimo *et al* 2006). Unit root testing in a panel setting exploits the cross sectional information and can enhance the power of the tests.

As a benchmark, we initially employ the IPS panel unit root test proposed by Im *et al* (2003).[16] The IPS test does not explicitly account for the potential cross-sectional dependence in the panel series. However, we perform the IPS by taking the demeaned series in order to mitigate cross-sectional dependence issues. In addition, we report the Fisher-type test (based on the Augmented Dickey Fuller test) which assumes under the null hypothesis individual coefficients and non-stationary series for all cross sections, while the alternative hypothesis supports the assumption that there is at least one stationary panel.[17] Table 1 (Columns 1 and 2) reports the results for the main variables.[18] According to both the IPS and the Fisher test, we cannot accept the null that all panels contain a unit root for any of the variables considered.

5.2 Baseline results

As discussed above, we assess the effects of CBI on inflation after explicitly accounting for the role of CBC for a panel of 119 advanced and developing economies over the period 1992–2014. Table 2 presents the dynamic panel System GMM estimates. The specification tests reported at the end of the Table do not show any misspecification problems.

Column (1) presents the impact of a legal measure of CBI on inflation, along with a set of control variables. The coefficient on CBI has the expected negative sign, indicating that a higher degree of independence of the central bank leads to lower inflation, though it is not statistically significant. In Column (2), we incorporate central bank inflation preferences in the regressions. Our dynamic panel estimates suggest that when we account for central bank conservatism, the negative response of the inflation rate to higher CBI strengthens and turns statistically significant. This suggests that failing to control for central bank

Table 1: Panel unit root tests

Variables:	IPS[a] (1)	Fisher[b] (2)
ΔLn(CPI)	–35.96 ***	1079.48 ***
Central bank independence (CBI)	–16.87 ***	687.93 ***
Central bank conservatism (CBC)	–12.66 ***	393.02 ***
Δ(GDP per capita)	–18.93 ***	364.31 ***
Δ(debt ratio)	na	438.71 ***
Δ(domestic credit)	na	696.88 ***
Δ(trade openness)	na	577.05 ***
Capital account openness (kaopen)	–18.23 ***	950.72 ***
Δ(real effective exchange rate)(REER)	–22.69 ***	292.30 ***

Notes:
a: IPS denotes the Im-Pesaran-Shin (2003) panel unit root test (based on the Augmented Dickey Fuller test).
b: Fisher corresponds to the Fisher-type panel unit root test.
Probabilities for the Fisher tests are based on an asymptotic Chi-square distribution. The IPS panel unit root test assumes asymptotic normality. **, *** indicate rejection of the null hypothesis that all panels contain a unit root at 5% and 1%, respectively. "na" indicates that the test could not be performed, notably due to insufficient observations or gaps in the panel series.

conservatism underestimates the impact of central bank independence on inflation. In other words, an inverse relation between the independence of the central bank and the level of inflation seems to hold, when we account for central bank conservatism. This finding is in line with theoretical studies that substantiate that both institutional characteristics of monetary policy matter for lowering inflation. Moreover, inflation seems to respond directly to central bank inflation preferences; a higher inflation aversion (conservatism) of the central bank exercises a downward pressure on inflation.

Columns (3) to (6) report estimates of alternative specifications of the baseline model. Column (3) adds capital account openness and Column (4) introduces an EMU dummy, taking a value of 1 for membership to the EMU, starting when a country officially joined EMU, and 0 otherwise. In Columns (5) and (6), we drop the 'change in the real effective exchange rate' variable, which increases substantially the sample size. Instead, we control for the classification of the exchange rate regime. Our main conclusions remain unchanged. Both CBI and CBC exercise a negative and statistically significant effect on inflation.

Concerning the remaining regressors, we find that an increase in real GDP per capita growth will tend to put upward pressure on prices. Also, positive changes in the debt-to-GDP ratio, notably indicating an expansionary fiscal policy and thereby, higher domestic demand, are associated on average with a higher inflation rate. Negative changes in the real effective exchange rate signal an increase in cost competitiveness and result in higher cost-push inflation,

Table 2: Effect of CBI on inflation: The role of CBC (System GMM estimates)

Dependent variable: ΔLn(CPI)	(1)	(2)	(3)	(4)	(5)	(6)
ΔLn(CPI) (t–1)	0.73 (0.08)***	0.70 (0.08)***	0.74 (0.08)***	0.70 (0.08)***	0.67 (0.10)***	0.67 (0.10)***
CBI	–0.021 (0.014)	–0.029 (0.009)***	–0.026 (0.009)***	–0.027 (0.009)***	–0.024 (0.011)**	–0.023 (0.011)**
CBC		–0.096 (0.03)**	–0.088 (0.03)**	–0.09 (0.03)**	–0.08 (0.03)**	–0.081 (0.03)**
Δ(GDP per capita) (t–1)	0.15 (0.10)	0.24 (0.12)**	0.19 (0.10)*	0.23 (0.11)*	0.21 (0.08)***	0.20 (0.07)***
Δ(debt ratio) (t–1)	0.0013 (0.0006)**	0.0016 (0.0007)**	0.0017 (0.0007)**	0.0016 (0.0006)**	0.0013 (0.0005)***	0.0012 (0.0004)***
Δ(domestic credit) (t–1)	0.005 (0.003)*	0.0055 (0.003)*	0.0055 (0.003)*	0.0055 (0.003)*	0.0047 (0.002)*	0.0047 (0.002)*
Δ(trade openness) (t–1)	0.0004 (0.0005)	0.0003 (0.0005)	0.0003 (0.0004)	0.0003 (0.0004)	0.0004 (0.0002)**	0.0004 (0.0002)**
Kaopen (t–1)			0.0007 (0.002)		–0.0005 (0.002)	–0.0005 (0.002)
ΔREER (t–1)	–0.13 (0.07)*	–0.13 (0.07)*	–0.14 (0.07)**	–0.13 (0.07)*		
Xeclass (t–1)					0.013 (0.006)**	0.012 (0.006)*
Banking crisis (t–1)	0.011 (0.03)	0.0001 (0.03)	–0.008 (0.03)	0.0023 (0.028)	0.0026 (0.02)	0.0031 (0.02)
EMU dummy				–0.047 (0.026)*		–0.013 (0.25)
No. of observations	1103	1103	1092	1103	1806	1806
No. of instruments/No. of groups	23/59	26/59	28/59	28/59	28/103	30/103
Arellano-Bond AR(2) (*p*-value)	0.192	0.199	0.207	0.199	0.104	0.104
Hansen test of overidentified Restrictions(*p*-value)	0.33	0.57	0.64	0.71	0.48	0.56
Diff-in-Hansen test of exogeneity of instruments (*p*-value)	0.74	0.79	0.33	0.79	0.13	0.13

Notes: CBI=central bank independence, CBC=central bank conservatism, Kaopen=Capital account openness, ΔREER=change in real effective exchange rate, Xeclass=exchange rate classification regime. The parentheses report heteroskedasticity and autocorrelation (HAC) robust standard errors. ***, **, * significant at the 1%, 5%, 10% level, respectively. Country fixed effects and time-specific effects are included in all estimations. We report the *p*-values for the Arellano Bond test for autocorrelation, the Hansen test of over-identified restrictions for the full instrument set, and for the Difference-in-Hansen test of the exogeneity of instruments.

notably as a result of higher import prices. Also, a higher value of the index of the exchange rate classification regime, indicating a shift towards a floating exchange rate regime, leads to higher inflation. The latter reflects the fact that currency pegs and fixed exchange rate regimes often serve as inflation anchors, notably in developing economies (see also Krause and Mendez 2008). An increase in credit growth to the private sector is also associated with higher inflation. By contrast, we generally do not find a statistically significant impact on the inflation rate from higher capital account and trade openness, nor from systemic banking crises, over the period considered.[19] Also, the effect of the EMU era on inflation developments is ambiguous; the coefficient on the EMU dummy is negative, but not always statistically significant.

6. Robustness Checks

We assess the robustness of the empirical findings by performing a set of alternative estimations. Tables 3 and 4 present the robustness checks.

First, we investigate whether the institutional design of monetary policy can differ across countries; panel data estimates on the aggregate sample can mask important differences between advanced and developing economies. In this regard, we repeat estimations presented in Table 2 (Column 2) by splitting the sample into developing and advanced economies. Columns (1) and (2) in Table 3, respectively, present these results. As expected, both central bank independence and conservatism matter in shaping inflation in developing economies; these institutional characteristics of monetary policy have a strongly negative and statistically significant effect on inflation. Coefficients of both CBI and CBC are close in absolute value to the baseline estimates; more central bank independence and conservatism would tend to curtail inflation in developing economies.

By contrast, our estimates do not support an important role for central bank independence and conservatism for price developments in advanced economies over the period considered.[20] The respective coefficients have the expected sign but are not statistically significant at conventional levels.[21] A potential interpretation of this finding is that our sample runs from 1992, when we do not observe excessive inflation rates in most advanced economies, implying higher price stability compared to past decades. At the same time, in some cases, major changes in the institutional design of monetary policy, such as the establishment of legal independence of the central bank, had already taken place in the early 1990s or even before, thus mitigating *on average* the impact of such institutional reforms on price developments over the period considered.[22] We see this in the EU in particular: the legal basis for the single monetary policy and higher independence of EU central banks is the Treaty on the Functioning of the European Union, originated in 1957 (as the Treaty of Rome) later reformed by the Maastricht Treaty (1992), as well as the Statute of the European System of Central Banks and of the European Central Bank, which entered into force in 1998.

With regards to the remaining regressors, the factors that contribute to shifts in prices seem to differ between the two country groups. The real effective exchange rate, the debt ratio and credit growth determine inflationary pressures in developing economies. The importance of the pass-through of exchange rates to prices in developing economies is in line with other studies that find a larger effect for these economies (Frankel *et al* 2012). By contrast, real GDP per capita growth and the debt ratio seem on average to affect price developments in advanced economies while the remaining regressors are not statistically significant.

As a second robustness check, we assess whether the role of central bank independence and of conservatism remain prominent in shaping inflation when accounting for the adoption of an inflation targeting regime. We assign a value of 1 to the periods when country *i* has an inflation targeting regime in place (*IT*=1), and 0 when non-inflation targeting regime applies (*IT*=0). We expect that the adoption of an inflation targeting regime would reduce inflation. Columns (3) and (4) in Table 3 present the results for the non-inflation and the inflation targeting regime, respectively. Our estimates suggest that the institutional characteristics of independence and conservatism remain important for curtailing inflation when there is no explicit inflation targeting regime in place. In the latter case, the coefficients of both CBI and CBC are negative and statistically significant, while their size increases relative to the baseline estimates. On the other hand, the establishment of an inflation targeting regime renders the independence of the central bank irrelevant in affecting inflation.[23] Central bank conservatism, however, still matters in reducing inflation.

A caveat of employing a *legal* measure of CBI is that it may be an inferior measure of independence of the central bank, notably when legal provisions diverge from actual practices (Cukierman *et al* 1992; Walsh 2005). This divergence may become particularly relevant in the case of developing economies (see, among others, Klomp and de Haan 2010b). In Column (5) (Table 3), we assess the robustness of our findings by considering the turnover rate of the central bank governor (TOR) as an alternative proxy of CBI. A higher turnover rate of the central bank governor typically implies a lower level of independence. Our main findings on the effects of the institutional characteristics of the central bank on inflation remain robust. TOR has a positive and statistically significant effect on inflation, indicating that a lower level of central bank independence leads to higher inflation. Also, higher central bank conservatism is associated with lower price pressures, in line with our previous findings.

Furthermore, in our baseline estimates, we have employed a *legal* measure of CBI which is assumed to be strictly exogenous with regards to the inflation rate. Nevertheless, as already discussed, divergence of actual practices from legal provisions, notably in developing economies, may imply that the legal index of CBI is only weakly exogenous to the inflation outcome. In Column (1) (Table 4), we examine the robustness of our findings by assuming that CBI is a pre-determined regressor, meaning that past changes in prices can partly affect

Table 3: Robustness checks

Dependent variable: ΔLn(CPI)	Developing economies (1)	Advanced economies (2)	Non-inflation targeting (3)	Inflation targeting (4)	Alternative CBI measure (5)
ΔLn(CPI)(t–1)	0.73 (0.064)***	0.51 (0.026)***	0.71 (0.077)***	0.46 (0.068)***	0.38 (0.16)**
CBI	–0.027 (0.013)*	–0.031 (0.022)	–0.042 (0.015)***	–0.003 (0.004)	
TOR					0.079 (0.044)*
CBC	–0.067 (0.021)***	–0.16 (0.12)***	–0.103 (0.037)***	–0.031 (0.008)***	–0.091 (0.023)***
Δ(GDP per capita) (t–1)	0.15 (0.014)	0.52 (0.26)*	0.27 (0.14)*	0.20 (0.05)***	0.088 (0.11)
Δ(debt ratio) (t–1)	0.0011 (0.0005)**	0.0025 (0.008)***	0.0015 (0.0005)**	0.0010 (0.0003)***	0.0009 (0.0005)*
Δ(domestic credit) (t–1)	0.009 (0.005)*	0.0024 (0.022)	0.008 (0.004)*	0.00013 (0.00008)	0.003 (0.002)
Δ(trade openness) (t–1)	–0.0001 (0.0006)	0.00008 (0.0005)	0.0003 (0.0005)	–0.0004 (0.0002)	0.0007 (0.0003)*
ΔREER (t–1)	–0.13 (0.07)*	–0.28 (0.25)	–0.16 (0.09)*	–0.052 (0.019)**	–0.054 (0.07)
Banking crisis (t–1)	0.020 (0.025)	0.005 (0.032)	0.015 (0.03)	–0.005 (0.004)	0.017 (0.018)
No. of observations	696	407	767	336	869
No. of instruments/No. of groups	26/37	26/22	26/56	26/26	28/64
Arellano-Bond AR(2) (*p*-value)	0.228	0.271	0.211	0.202	0.146
Hansen test of overidentified Restrictions (*p*-value)	0.39	0.99	0.76	0.28	0.62
Diff-in-Hansen test of exogeneity of instruments (*p*-value)	0.51	0.95	0.58	0.95	0.59

Notes: See also, notes in Table 2. TOR=governor turnover rate. The parentheses report heteroskedasticity and autocorrelation (HAC) robust standard errors. ***, **, * significant at the 1%, 5%, 10% level, respectively. Country fixed effects and time-specific effects are included in all estimations. We report the *p*-values for the Arellano Bond test for autocorrelation, the Hansen test of over-identified restrictions for the full instrument set, and for the Difference-in-Hansen test of the exogeneity of instruments.

the current institutional design of monetary policy as regards the independence of the central bank. CBI is instrumented by employing its *t–1* and *t–2* lags as instruments. The point estimates of the coefficients of CBI and CBC are very similar to those in Table 2. Also, our main conclusions on the remaining regressors outlined in Table 2 remain robust.

We also re-estimate our benchmark model by accounting explicitly for high inflation outcomes. It can be the case that during periods of excessive inflation, the importance of certain institutional characteristics of monetary policy in reducing inflation varies compared to more normal times. In particular, we assume a dummy that takes a value of 1 for an inflation rate above 9% and 0, otherwise.[24] Results presented in Column (2) of Table 4 suggest that during periods of high inflation, the inflation preferences of the central bank matter for lowering inflation; a higher degree of central bank conservatism would tend to mitigate inflationary pressures in an economy. On the other hand, the coefficient of legal CBI is negative, but it is not statistically significant.

Finally, the importance of the institutional design of monetary policy may have changed since the onset of the recent financial crisis. In the pre-crisis era, the aim of central banks was to preserve price stability, to mitigate increases in prices and to anchor inflation expectations. Instrument independence from political interference was warranted in order to achieve the price stability goal, even in advanced economies (de Haan and Eijffinger 2016). By contrast, in the aftermath of the recent financial crisis, many central banks focused on achieving financial stability via macro-prudential supervision as well as on boosting prices, given that in most leading economies inflation was too low. Against this background, we split our sample into two subsamples covering the pre-crisis era (i.e. the 1992–2005 period) and the crisis-era, from 2006 onwards.[25] Columns (3) and (4) of Table 4 assess whether our empirical findings remain valid during the pre-crisis and the crisis era, respectively. Results suggest that higher degrees of central bank independence and conservatism have a dampening effect on inflation in both periods. Still, in the crisis era, the coefficients of both CBI and CBC are lower in absolute terms than in the pre-crisis era. The latter suggests that the importance of the particular characteristics of the institutional framework of monetary policy in reducing inflation has somewhat weakened since the recent financial crisis.

7. Is There a Trade-Off Between CBI and CBC?

So far, our empirical analysis confirms the significance of central bank inflation preferences, in tandem with central bank independence, in explaining inflation developments. This is in accordance with theoretical studies that emphasise the distinction between central bank independence and conservatism (Eijffinger and Hoeberichts 1998; Berger *et al* 2001): both CBI and CBC should co-exist in order to attain a lower level of inflation.

As a further step in the analysis, a handful of theoretical studies also examine the interaction between CBI and CBC, qualifying the idea of a potential

Table 4: Robustness checks (continued)

Dependent variable: ΔLn(CPI)	Weak exogeneity CBI (1)	High inflation economies (2)	Pre-crisis era (1992–2005) (3)	Crisis era (2006–) (4)
ΔLn(CPI)(t–1)	0.70 (0.087)***	0.73 (0.046)***	0.71 (0.079)***	0.65 (0.13)***
CBI	–0.033 (0.019)*	–0.051 (0.035)	–0.025 (0.013)*	–0.018 (0.010)*
CBC	–0.097 (0.038)**	–0.071 (0.036)*	–0.090 (0.031)***	–0.030 (0.013)**
Δ(GDP per capita) (t–1)	0.27 (0.12)**	0.004 (0.31)	0.21 (0.15)	0.15 (0.045)***
Δ(debt ratio) (t–1)	0.0016 (0.0007)**	0.0005 (0.0006)	0.0017 (0.0007)**	0.0006 (0.0003)**
Δ(domestic credit) (t–1)	0.005 (0.003)*	0.019 (0.005)***	0.007 (0.004)*	0.005 (0.0002)**
Δ(trade openness) (t–1)	0.0003 (0.0005)	–0.002 (0.0015)	0.0012 (0.0009)	–0.0001 (0.0001)
ΔREER (t–1)	–0.13 (0.07)*	–0.24 (0.13)*	–0.12 (0.08)	–0.11 (0.05)**
Banking crisis (t–1)	0.00003 (0.03)	0.071 (0.04)	0.0055 (0.04)	0.007 (0.007)
No. of observations	1103	250	598	505
No. of instruments/No. of groups	28/59	26/35	22/53	25/59
Arellano-Bond AR(2) (*p*-value)	0.199	0.204	0.170	0.152
Hansen test of overidentified Restrictions (*p*-value)	0.84	0.84	0.80	0.60
Diff-in-Hansen test of exogeneity of instruments (*p*-value)	0.68	0.68	0.89	0.69

Notes: see also, notes in Table 2. The parentheses report heteroskedasticity and autocorrelation (HAC) robust standard errors. ***, **, * significant at the 1%, 5%, 10% level, respectively. Country fixed effects and time-specific effects are included in all estimations. We report the *p*-values for the Arellano Bond test for autocorrelation, the Hansen test of over-identified restrictions for the full instrument set, and for the Difference-in-Hansen test of the exogeneity of instruments.

trade-off between independence and conservatism. Several studies show that independence and conservatism can be viewed as strategic substitutes (e.g., Eijffinger and Hoeberichts 1998, 2008; Lippi 2000; Hughes Hallett and Weymark 2005; Weymark 2007). In particular, Eijffinger and Hoeberichts (1998, 2008) show that the central bank can be more conservative, in the sense of putting more weight on inflation than on output stabilisation, the less independent it is, in order to conduct optimal monetary policy. This allows the central bank to pursue its monetary policy objectives, even when its independence is challenged or has been reduced, via increasing its inflation aversion.

By contrast, based on a model of endogenous monetary policy delegation, Hefeker and Zimmer (2011) assert that under high uncertainty over the central bank's output gap target, a positive correlation may occur between independence and conservatism, implying that the two features of monetary policy act as complements rather than substitutes. In this case, higher central bank independence will also tend to increase the need for inflation conservatism to achieve an optimal central bank design, and vice versa.

Against this background, we investigate empirically the existence of a potential trade-off between the levels of independence and conservatism of the central bank. This trade-off is assessed by including in the estimations an interaction term of CBI and CBC.[26] Table 5 presents the estimates of alternative model specifications. Column (1) repeats the baseline estimation of Table 2 (Column 2) while in Columns (2) and (3) we also control for EMU effects and capital account openness, respectively. Column (4) drops the real effective exchange rate and controls instead for the classification of the exchange rate regime. Finally, Column (5) assumes that CBI is strictly exogenous as in the baseline estimations.

Our estimates fail to detect a statistically significant interaction of CBI and CBC, on average, over the period considered. The coefficient of the interaction term is positive under any model specification, albeit the effect is not statistically significant at conventional levels. Moreover, when adding the interaction of CBI and CBC, our preceding conclusions on the importance of both independence and conservatism in lowering inflation remain valid. The respective coefficients are negative and statistically significant.

8. Conclusions

One of the main trends that has characterised the institutional design of central banks over the past three decades is the worldwide shift towards higher central bank independence with a series of factors, on a regional and global scale, contributing to this direction (Cukierman 2008). While theoretical studies conclude that both central bank independence and the inflation preferences of the central bank matter in taming inflation, most empirical studies to date have not taken explicit consideration of the degree of central bank conservatism when assessing the effects of CBI on inflation. However, omitting a significant

Table 5: Trade-off between CB independence and CB conservatism

Dependent variable: ΔLn(CPI)	(1)	(2)	(3)	(4)	(5)
ΔLn(CPI) (t–1)	0.69 (0.089)***	0.69 (0.09)***	0.73 (0.082)***	0.68 (0.10)***	0.73 (0.083)***
CBI	–0.10 (0.061)*	–0.11 (0.06)*	–0.11 (0.053)**	–0.05 (0.03)*	–0.12 (0.067)*
CBC	–0.17 (0.09)*	–0.18 (0.09)*	–0.18 (0.08)**	–0.11 (0.05)**	–0.18 (0.08)**
CBC*CBI	0.13 (0.11)	0.14 (0.11)	0.15 (0.09)	0.06 (0.05)	0.16 (0.10)
Δ(GDP per capita) (t–1)	0.24 (0.12)**	0.22 (0.11)*	0.18 (0.09)*	0.21 (0.07)***	0.19 (0.10)*
Δ(debt ratio) (t–1)	0.0016 (0.0007)**	0.0016 (0.0006)**	0.0017 (0.0007)**	0.0012 (0.0004)***	0.0017 (0.0007)**
Δ(domestic credit) (t–1)	0.0055 (0.003)*	0.0055 (0.003)*	0.0054 (0.003)*	0.005 (0.002)*	0.0054 (0.003)*
Δ(trade openness) (t–1)	0.0003 (0.0004)	0.0003 (0.0005)	0.0003 (0.0004)	0.0004 (0.0002)**	0.0003 (0.0004)
Kaopen (t–1)			0.0008 (0.002)	–0.0006 (0.002)	0.0009 (0.002)
ΔREER (t–1)	–0.13 (0.07)*	–0.13 (0.07)*	–0.14 (0.07)**		–0.14 (0.07)**
Xeclass (t–1)				0.013 (0.007)*	
Banking crisis (t–1)	–0.001 (0.027)*	0.0009 (0.03)*	–0.010 (0.028)	0.002 (0.02)	–0.010 (0.028)
EMU dummy		–0.056 (0.03)*		0.013 (2.56)**	
No. of observations	1103	1103	1092	1806	1092
No. of instruments/No. of groups	31/59	33/59	33/59	33/103	31/59
Arellano-Bond AR(2) (*p*-value)	0.202	0.203	0.212	0.104	0.212
Hansen test of over identified Restrictions (*p*-value)	0.82	0.87	0.84	0.57	0.85
Diff-in-Hansen test of exogeneity of instruments (*p*-value)	0.68	0.69	0.58	0.18	0.89

Notes: see also, notes in Table 2. The parentheses report heteroskedasticity and autocorrelation (HAC) robust standard errors. ***, **, * significant at the 1%, 5%, 10% level, respectively. Country fixed effects and time-specific effects are included in all estimations. We report the *p*-values for the Arellano Bond test for autocorrelation, the Hansen test of over-identified restrictions for the full instrument set, and for the Difference-in-Hansen test of the exogeneity of instruments.

independent variable from the empirical analysis may lead to biased estimates of the effects of CBI on inflation.

In a dynamic panel modelling framework for a large panel dataset of advanced and developing economies over the period 1992–2014, we examine the CBI-inflation nexus, while accounting explicitly for the degree of central bank conservatism, based on the index by Levieuge and Lucotte (2014). We find that both central bank independence and inflation preferences matter for mitigating inflation pressures, in line with the relevant theoretical literature. Central bank independence alone seems insufficient to curtail inflation; the inverse relation between central bank independence and inflation holds only when we account for the inflation preferences (conservatism) of the central bank. At the same time, higher central bank conservatism seems to result in lower price pressures in the economy. Our findings also suggest that countries without an inflation targeting regime in place may benefit by increasing both central bank independence and conservatism in the effort to lower inflation. On the other hand, for inflation targeters, the inflation preferences of the central bank seem to matter more for explaining inflation performance.

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APPENDIX

Table A1: Criteria of the CWN Central Bank Independence Index

Categories	*Weight*
1. Chief Executive Officer (CEO)	0.20
a. Term of office	
b. Who appoints CEO?	
c. Dismissal	
d. May CEO hold other offices in government?	
2. Policy formulation	0.15
a. Who formulates monetary policy?	
b. Who has final word in resolution of conflict?	
c. Role in the government's budgetary process	
3. Objectives	0.15
4. Limitations on lending to the government	
a. Advances	0.15
b. Securitised lending	0.10
c. Terms of lending (maturity, interest, amount)	0.10
d. Potential borrowers from the bank	0.05
e. Limits on central bank lending	0.025
f. Maturity of loans	0.025
g. Interest rates on loans	0.025
h. Is the central bank prohibited from buying or selling government securities in the primary market?	0.025

Source: Cukierman et al. 1992 pp 358-359.

Preliminary data assessment (Tables A2–A4 & Figures A1–A2)

Table A2: Summary statistics of main variables

	Mean	Stand. deviation	Min	Max	Obs
ΔLn(CPI)	0.097	0.24	–0.09	3.87	2418
CBI	0.542	0.19	0.14	0.95	2398
CBC	0.545	0.36	0	1	2439
TOR	0.198	0.16	0	1.4	1790
Δ(GDPpercapita)	0.024	0.04	–0.37	0.28	2463
Δ(debtratio)	–1.06	14.2	–164.2	155.6	2383
Δ(domesticcredit)	1.393	6.6	–66.07	97.8	2229
Δ(tradeopenness)	0.700	10.5	–132.2	218.5	2385
Kaopen	0.526	1.5	–1.9	2.3	2433
ΔREER	0.005	0.09	–1.37	0.61	1491
Xeclass	2.28	1.1	1	6	2522
Bankingcrisis	0.055	0.2	0	1	2533

Notes: CBI = central bank independence, CBC = central bank conservatism, TOR = turnover of central bank governor, Kaopen = Capital account openness, ΔREER = change in real effective exchange rate, Xeclass = exchange rate classification regime.

Table A3: Pairwise correlation of main variables

	ΔLn(CPI)	CBI	CBC	TOR	Δ(GDPpc)	Δ(debtr)	Δ(d.credit)	Δ(tradeop.)	Kaopen	ΔREER	Xeclass	B.crisis
ΔLn(CPI)	1											
CBI	–0.13	1										
CBC	–0.31	0.01	1									
TOR	0.07	0.06	–0.03	1								
Δ(GDP per capita)	–0.22	0.13	0.06	0.02	1							
Δ(debt ratio)	–0.08	–0.01	0.07	–0.02	–0.25	1						
Δ(domestic credit)	–0.12	0.03	0.14	0.005	0.04	0.03	1					
Δ(trade openness)	–0.02	–0.0002	0.04	–0.04	0.07	0.04	0.02	1				
Kaopen	–0.25	0.20	0.35	–0.10	–0.05	0.02	0.05	0.02	1			
ΔREER	0.09	0.05	–0.05	–0.002	0.10	–0.09	0.01	–0.19	–0.004	1		
Xeclass	0.38	–0.17	–0.21	–0.002	–0.21	0.05	–0.10	0.03	–0.11	–0.018	1	
Banking crisis	0.05	–0.04	–0.03	0.05	–0.18	0.12	–0.14	0.003	0.02	–0.02	0.09	1

Notes: see the notes to Table A2.

Table A4: Overall, between cross sectional and within-time series variation for CBI, CBC, TOR

	Mean	Stand. deviation	Min	Max	Obs
Overall:CBI	0.54	0.19	0.14	0.95	2398
Between		0.16	0.15	0.89	119
Within		0.10	–0.026	1.03	20.15
Overall: CBC	0.54	0.36	0	1	2439
Between		0.28	0.018	0.98	119
Within		0.22	–0.33	1.26	20.50
Overall: TOR	0.19	0.16	0	1.4	1790
Between		0.13	0	0.99	107
Within		0.10	–0.23	0.87	16.72

Notes: CBI = central bank independence, CBC = central bank conservatism, TOR = turnover of central bank governor. For within-time series variation, T-bar is reported in the number of observations

Figure A1: Inflation rate in advanced economies in 1992–2014

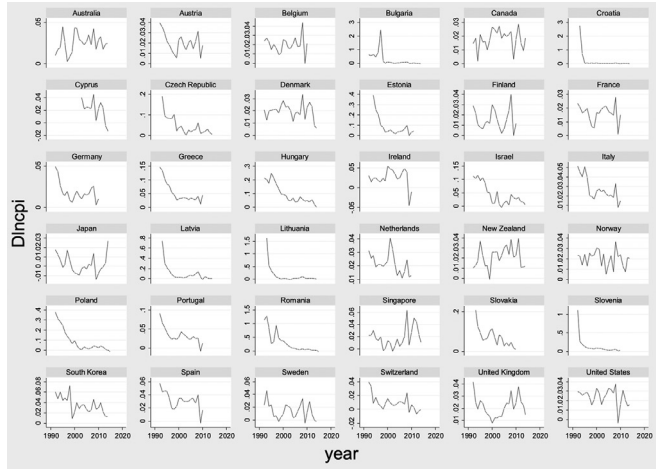
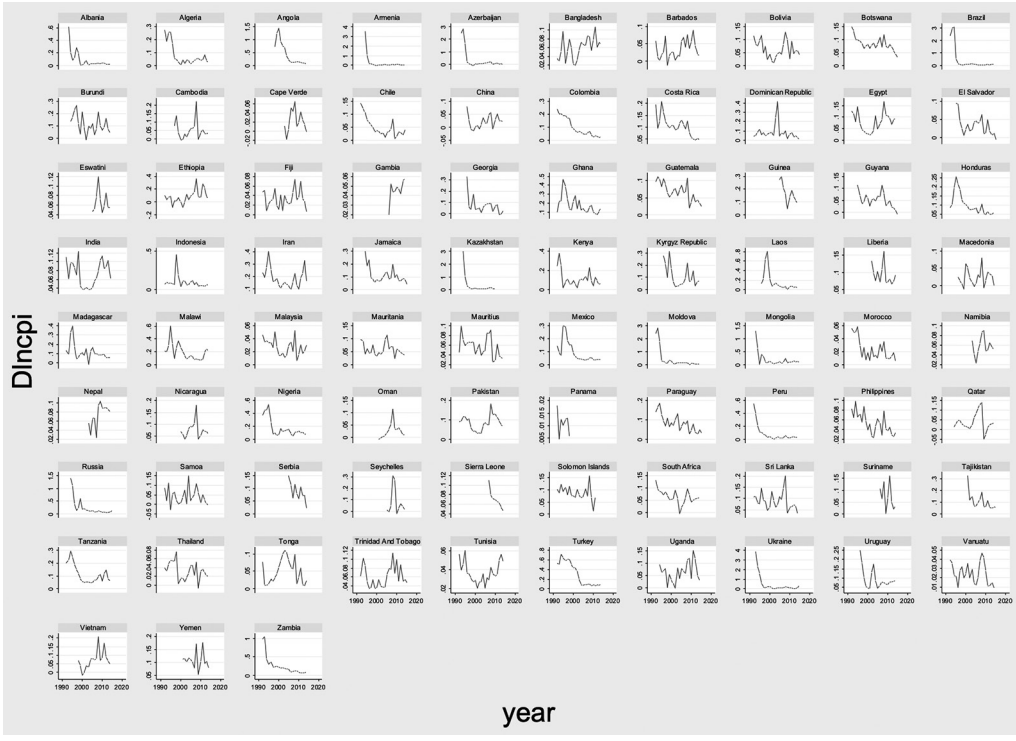


Figure A2: Inflation rate in developing economies in 1992–2014



Endnotes

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4. The terms central bank conservatism, central bank inflation preferences and central bank inflation aversion are used interchangeably in the text.

5. The measure of CBC of Levieuge and Lucotte (2014) is also employed in empirical studies that examine broader issues related to the institutional design of central banks (e.g. Chortareas *et al* 2016) as well as the vulnerability of the banking system (Levieuge *et al* 2019).

6. The use of the logarithm of CPI mitigates potential heteroskedasticity issues, given the inclusion in the sample of countries with high inflation rates.

7. Although changes in the CPI can also reflect shifts in energy prices, as well as the effect on prices stemming from discretionary fiscal measures, such as changes in VAT rates or tariffs, the CPI is still considered an adequate proxy of price developments influenced by monetary policy authorities.

8. The dynamic panel bias decreases as the time dimension of the panel tends to infinity. Still, even in cases where T is large, endogeneity may have a significant impact on the estimations. Judson and Owen (1999) find up to 20% bias in the lagged dependent variable, even in samples where T=30.

9. Unobserved country heterogeneity refers to the time-invariant country characteristics that have a direct effect on the dependent and independent variables. If one does not account for such factors, the explanatory variables will be correlated with the error term and the regression coefficients will be biased. Accounting for country heterogeneity translates to properly transforming the panel series to remove the fixed effects from the error component. The latter is inherent in the System GMM estimator.

10. Although the System GMM is more efficient when the dependent variable is near a random walk, the latter should still lie below unity in order for the system to converge. In effect, the stationarity of the dependent variable is an important precondition.

11. It is noted that the number of instruments is quadratic to T (see, among others, Windmeijer 2005; Mehrhoff 2009).

12. Apart from the time dummies and the EMU dummy, which enter in their contemporaneous form in the analysis.

13. We also apply the Difference-in-Hansen test for each instrument set to assess the validity of individual instruments (not tabulated).

14. These are Armenia, Azerbaijan, Bolivia, Kazakhstan, Moldova, Peru and Ukraine.

15. Following, among others, Levieuge *et al* (2019), EMU countries are considered separately until they join EMU. However, our main findings remain qualitatively robust in the case of extending the sample to 2014 for the EMU countries.

16. Lags are specified based on the Akaike Information Criterion (AIC). The IPS test assumes under the null hypothesis that all panels contain a unit root, and under the alternative that some panels are stationary.

17. The selected lag structure for the ADF regressions is based on the Akaike Information Criterion. Again, we consider the demeaned series to mitigate cross-sectional dependence. The Bartlett kernel is employed for estimating the long run variance of the panel series and the number of lags is determined based on the Newey-West bandwidth algorithm.

18. Following a visual inspection of the data, we perform the panel unit root tests under different assumptions for the deterministic terms. For most variables, we include no deterministic terms or a drift term.

19. Significant capital account liberalisation that has contributed to disinflation took place in the early 1990s (Gruben and McLeod 2002).

20. The Hansen test of over-identifying restrictions reported at the end of Table 2 can be affected by a large number of instruments, though it is robust to the presence of heteroskedasticity. Given the large number of instruments with respect to the country groups, we repeated estimations for the advanced economies by employing only the *t–2* lag of the CBC and of the inflation rate as instruments. Results remain qualitatively the same.

21. For a similar finding, see also, Daunfeldt and de Luna (2008), who do not find a significant relation between price stability and central bank independence for a panel of 23 OECD countries.

22. Political economy factors, such as corporatism, could also be at play (see also Oatley 1999).

23. Several empirical studies substantiate that IT cannot directly tame inflation. For instance, Arestis *et al* (2014) find that inflation differentials have converged irrespective of the adoption of an IT regime.

24. For a similar exogenous threshold on the inflation rate, see also Krause and Mendez (2008).

25. The merits of employing 2006 as the breakpoint date of the pre- and post-crisis periods are two-fold. First, it better captures the fact that the financial crisis commenced in early 2006 in the US, following the increased securitisation of riskier mortgages; it spread to major advanced and emerging economies in some cases with a significant lag. Second, although our main findings remain qualitatively robust when changing the crisis breakpoint date to 2007 or 2008, the instrument exogeneity of the inflation rate is weakened.

26. Given the assumed endogeneity of the CBC and the weak exogeneity of the CBI, their interaction would also be endogenous. We therefore instrument the interaction term by employing its *t-2* and *t-3* lags as instruments.

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