DO CENTRAL BANK REFORMS LEAD TO MORE MONETARY DISCIPLINE?*

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Abstract

This paper investigates how reforms changing legal central bank independence (CBI) affect monetary policy discipline and credibility, two key mechanisms influencing price stability. Using a sample of 155 countries over more than 50 years (1972–2023), we show that reforms improving CBI strengthen monetary discipline and the credibility of central banks. Our results reveal that significant CBI reforms translate into monetary discipline with a lag reaching the full effect after ten years and that reforms are more impactful on monetary discipline in reforming countries that have not reversed earlier reforms. CBI reforms have the strongest impact in democratic countries, countries with flexible exchange rates, and countries with no monetary policy strategies. The effects of CBI on monetary discipline and credibility are amplified when public debt level is high,. These findings underscore the crucial role of CBI as a key factor influencing price stability, and highlight the risks associated with weakening institutional autonomy.

JEL codes: C21, C23, E42, E52, E58

Keywords: Independence, Money growth, Monetary policy, Institutional reforms, Local projections.

Non-technical summary

Starting in the 1990s, many countries initiated central bank reforms aiming to increase legal independence of their central bank and monetary policy transparency. This paper examines how reforms changing the institutional independence of central banks influence monetary policy discipline and credibility - two essential mechanisms influencing price stability, underscoring the long-lasting effect of CBI in promoting price stability. Analyzing data from 155 countries over more than 50 years (1972–2023), we show that CBI improves monetary discipline and strengthens central bank credibility. Our results suggest that significant CBI reforms translate into more stringent monetary discipline with a lag of ten years and that reforms are more impactful on monetary discipline in reforming countries that have not reversed earlier reforms. CBI reforms have the strongest impact in democratic countries, countries with flexible exchange rates, and countries with no monetary policy strategies. These findings highlight the crucial role of CBI in shaping key mechanisms that influence price stability, while underlining the risks of weakening institutional autonomy. We provide the following key insights:

Key Role Played by Reforms: Reforms that increase legal CBI yield long-lasting improvements in monetary discipline and credibility. CBI reforms limit excessive money supply growth, a major driver of inflation. CBI reforms also strengthen central bank credibility, thereby contributing to stabilize private inflation expectations in line with publicly announced inflation targets. These results highlight the key benefits of preserving and strengthening institutional autonomy to maintain price stability.

Political and Institutional Conditions Matter: CBI's effectiveness depends on political and institutional frameworks. The effects of CBI on monetary discipline and credibility are found to be stronger in democratic countries, where it provides incentives to policymakers to avoid inflationary monetary expansions. Its effects are most pronounced in countries with flexible exchange rates, and countries with no monetary policy strategies. The effects of CBI on monetary discipline and credibility are found to be stronger for countries with high public debt levels.

Implications for Policy Reforms: Central bank independence (CBI) is a key institutional feature that improves the effectiveness of monetary policy in controlling inflation. Policymakers designing reforms in central bank design should account for existing fiscal frameworks and the monetary regime when designing reforms in central bank design. For instance, combining central bank reforms with fiscal reforms that enhance coordination between monetary and fiscal policy or reduce public debt levels could amplify the long-term inflation-stabilizing effects of CBI. Reforms should also consider the broader political context of a country. As shown, in countries with weak democratic institutions, the impact of CBI on monetary discipline and credibility is less pronounced. Therefore, strengthening democratic governance can amplify the benefits of CBI by ensuring accountability and reducing political interference.

1. Introduction

Price stability is one of the most significant challenges for central banks, even though central bank independence (CBI) has become a cornerstone of monetary policy practice in many countries (see Figure 1). CBI refers to the institutional separation of a central bank from political pressures, enabling it to conduct monetary policy with no, or minimal, government intervention. Many central banks conducted central bank reforms clarifying that the main central bank objective is price stability, are prohibited to directly lend to the government, and increased transparency and accountability.[1] Foundational studies by Rogoff (1985) and Alesina and Summers (1993) have established CBI's theoretical significance in addressing the time inconsistency problem and enhancing monetary policy credibility. Independent central banks can better control inflation by minimizing political interference, while price stability can also contribute to financial stability (Klomp and de Haan, 2009).[2] CBI fosters monetary discipline by shaping central bankers' policy preferences, and supports central bank credibility by strenghenting the commitment to a price stability objective (Cukierman, 1992).[3] Countries adopting formal monetary policy strategies such as monetary, inflation, and exchange rate targeting experienced improved inflation performance, particularly when paired with independent central banks (see Mishkin and Schmidt-Hebbel, 2007). After the Great Moderation, the wide adoption of inflation targeting frameworks and the increased globalization, it appears that the correlation between CBI and inflation has weakened (Bernanke et al., 1999; Ball and Sheridan, 2004; Crowe and Meade, 2008; Benati, 2011; Walsh, 2011; Rogoff, 2003).

***** Figure 1 here *****

The US Federal Reserve and the German Bundesbank have the longest tradition with central bank independence in monetary history. Following these two role models, starting in the 1990s, many countries initiated central bank reforms aiming to increase legal independence of their central bank and monetary policy transparency (Cukierman, 2008; Crowe and Meade, 2007; Dincer and Eichengreen, 2014; Masciandaro and Romelli, 2015). Those institutional central bank reforms have contributed to significant improvements in macroeconomic performance around the world, while addressing several

[1] Among the dimensions of CBI, instrument independence - i.e., the freedom to decide on monetary tools – has shown to be a stronger determinant of inflation performance than personal or procedural autonomy (De Haan and Kooi, 1997).

[2] Macroprudential policies targeting financial stability may also support inflation control by regulating credit growth and mitigating systemic risks (Galati and Moessner, 2013).

[3] For the remainder of this paper, monetary discipline is defined as the ability of the central bank to control inflation by avoiding excessive monetary expansion, as measured by excess money growth.

dimensions of independence that are relevant for the implementation of sound monetary policies

Comparative studies highlight differences in CBI across countries and regions, suggesting that, historical, political, and institutional factors matter for the effectiveness of central bank reforms. For example, CBI leads to better economic outcomes, such as lower inflation, in countries with strong political institutions and checks and balances (Acemoglu et al., 2008; dall'Orto et al., 2020). Even if formally established as independent, central banks may still be subject to partisan influences (Carmignani, 2025). Policy reforms may also give rise to a "*seesaw effect*", which refers to the behavior that, following a reform, governments may have an incentive to regain control over monetary policy and undo the effects of CBI reforms with political appointments (Acemoglu et al., 2008; Ioannidou et al., 2023).[4] In fact, there is ample anecdotal evidence from case studies suggesting that in many countries governments have dismissed governors before the end of their regular term, thereby allowing governments to have greater influence on monetary policy and inflation (Cukierman, 1992 and 2008; Crowe and Meade, 2008; Eijffinger and de Haan, 1996; De Haan and Eijffinger, 2019; Ioannidou et al., 2023). Attempts to weaken CBI have occurred coinciding with extraordinary circumstances such as massive financial or political crises, pandemics, fiscal dominance situations, and the rise of populist movements (BIS, 2012; Binder, 2021; Ferrara et al., 2022; Bianchi et al., 2023).

Such adaptative behavior by central bankers with differing degrees of independence reveals that important knowledge gaps still exist, particularly regarding the exact mechanisms through which CBI reforms affect domestic inflation dynamics and the extent to which its impact depends on other factors. This paper empirically investigates central questions of central bank institutional design focussing on reforms that lead to measurable changes in the central bank statute of a country: Do reforms changing legal CBI influence monetary discipline and do they also impact central bank credibility? Do other factors such as the political system and the institutional framework of a country play a role in this respect? Using a unique dataset of 155 countries spanning five decades (1972–2023), with different measures of CBI, we explore the interplay between CBI reforms, monetary discipline, and central bank credibility. In particular, we focus on tow key dimensions of reforms, notably whether effects are state-dependent and whether there are specific conditions under which CBI reforms are more effective, including the broader institutional and political contexts. The empirical analysis uses novel econometric techniques, such as local projections with instrumental variables and semiparametric estimations, allowing us to analyze the dynamic relation between CBI, monetary discipline and credibility.

[4] It is also conceivable. that political appointments become more averse to inflation than the government would like, given the central bank mandate and peer pressure in committees (Eijffinger and de Haan, 1996; Issing, 2008). To our knowledge, there is only anecdotal evidence in some countries supporting that view but no systematic analysis.

Our findings reveal several novel insights and contribute to the literature as follows. First, we show for a large panel of countries that reforms improving legal CBI lead to more monetary discipline and strengthen central bank credibility, thereby adding to our understanding of how institutional independence contributes to safeguarding price stability. Second, we complement existing evidence that reforms deliver significant effects, although it takes many years until the full effects materialize, and that political and institutional conditions influence the effectiveness of reforms. We show that reforms improving legal independence have a lasting impact on monetary discipline and credibility. Our results reveal that CBI exerts a significant influence on monetary disicipline and central bank credibility, especially for democratic countries and for countries that have flexible exchange rates and have not adopted formal monetary policy strategies of frameworks.

The paper is organized as follows. Section 2 reviews the literature on CBI and monetary discipline. Section 3 describes the dataset. Section 4 outlines the empirical strategy, including local projections and semiparametric estimation techniques. Section 5 presents the findings on the effects of CBI on monetary discipline and credibility, while Section 6 discusses the policy implications and concludes.

2. Literature review

The theoretical and empirical literature on central bank institutional design has established that CBI is an important element of the central bank statute, supporting price stability. Since the 1990s practically all central banks in the world have increased their level of legal independence (Crowe and Meade, 2008). Countries with large and influential financial sectors or countries forming monetary unions were on the forefront of this trend (Posen, 1995). Democracies are more likely to establish and maintain independent central banks for reasons of transparency and accountability (Crowe and Meade, 2008), whereas countries with political instability, weak institutions, and high public debt levels tended to reverse reforms (Cukierman, 2008; De Haan and Eijffinger, 2019; Dincer and Eichengreen, 2014). In addition, legislative reforms enhancing CBI often occured in response to high inflation, while IMF conditionality typically contributed to higher levels of CBI, especially in developing countries (Romelli, 2022).

The main result of the policy reform model by Acemoglu et al. (2008) is that central bank reform will be ineffective in countries with unconstrained leaders or in countries with highly constrained leaders (because inflation will already be low). The largest effect is likely to occur in countries with moderate levels of constraints on their leaders (Romer, 2008). Two mechanisms appear to be key in this respect, notably a better control of the money supply growth and enhanced central bank credibility (Rogoff, 1985; Cukierman, 1992 and 2008, Bodea and Hicks, 2015). The "*money view*", grounded on a stable long-run link between excess money growth and inflation, highlights the importance of monetary

discipline, since it has implied that variations in the money supply are a primary source of changes in the price level (McCandless and Weber, 1995; Barro, 2007). Several studies have established the validity of the money-inflation link based on the quantity theory of money (Lucas, 1980; Christiano and Fitzgerald, 2003; Assenmacher-Wesche and Gerlach, 2007; Haug and Dewald, 2012; Fratianni et al., 2021; Gao et al., 2025). However, recent empirical studies have suggested that the link is time-varying and has weakened in recent decades, particularly in advanced economies, where structural changes and financial liberalization have altered inflation and monetary dynamics (Benati, 2005 and 2008; Gertler and Hofmann, 2018; Jung, 2024).[5]

CBI is one of several channels strengthening central bank credibility, defined as the ability of a central bank to stabilize inflation expectations around policy targets, which in turn fosters trust among the public and financial markets (Blinder, 2000).[6] Moreover, sound monetary policy strategies, clear and transparent communication, and consistent achievement of policy goals contribute to credibility (Blinder, 2000; Crowe and Meade, 2008).[7] Credibility-enhancing strategies, such as monetary, inflation or exchange rate targeting, but also simple monetary policy rules like the Taylor rule, have proven particularly effective in anchoring inflation expectations and mitigating time inconsistency problems (Taylor, 2019; Rose and Rose, 2024). These strategies function by improving the management of inflation expectations through credible communication (Blinder et al., 2008), whereas exchange rate targeting strategies enhances credibility by importing low inflation from an anchor country (Obstfeld and Rogoff, 1995; Fielding and Bleaney, 2000).

Beyond monetary discipline and credibility, the literature stresses that fiscal discipline is an essential complement to CBI for achieving price stability (Woodford, 2001). When independent central banks cannot monetize public debt, governments are incentivized to adopt sustainable fiscal policies, reducing inflationary pressures (De Haan and Eijffinger, 2019). Effective fiscal and monetary policy coordination helps to control inflation, as it aligns government spending and taxation plans with monetary objectives. Fiscal rules can further amplify the effectiveness of monetary policy strategies by aligning fiscal and monetary objectives (von Thadden, 2004), particularly in high-debt contexts where fiscal dominance risks are prominent.

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[5] In contrast, the "*credit view*" emphasizes the role of credit availability, where bank lending drives aggregate demand and, consequently, inflation (Schularick and Taylor, 2012). That perspective illustrates the complex interplay between monetary aggregates, credit conditions, price levels, and the more frequent boom-and-bust cycles across economies (Gertler and Hofmann, 2018).

[6] "*A central bank is credible if people believe it will do what it says*" (Blinder, 2000).

[7] The Bundesbank, for example, provides a clear example of how credible central banks stabilize inflation through disciplined monetary policies based on a long tradition of CBI (Issing, 2021). This point was described in the famous words of former European Commission President Jacques Delors: "*Not all Germans believe in God, but they all believe in the Bundesbank*" (*The Guardian*, 11 December 1992).

3. Data

The link between CBI, monetary discipline and credibility is apparent from Figure 2, which shows that a negative correlation between CBI and excess money growth and a positive correlation between CBI and credibility exist on average over the past 50 years. However, this descriptive evidence does not allow conclusion about causality of the link. Additionally, the data reveals distinct trends for (excess) money growth and the policy rates over time. Figure 3 illustrates three states of monetary discipline: (1) high money growth with low but increasing policy rates (pre-1995); (2) reduced money growth when policy rates were maintained at high levels (1995–2008); (3) low money growth rates and low policy rates, despite expanding central bank balance sheets in several advanced countries owing to unconventional monetary policy measures post-global financial crisis (2008-2020). Furthermore, coinciding with the COVID-19 pandemic in 2020, a spike in money growth rates was observed coinciding with low policy rates.

***** Figure 2 and 3 here *****

We employ a comprehensive panel dataset covering 155 countries over more than 50 years (1972–2023).[8] The dataset integrates macroeconomic, institutional, and control variables from the World Bank's World Development Indicators (WDI), the IMF's International Financial Statistics (IFS), and the ECB's Statistical Data Warehouse (SDW).[9]

a) Macroeconomic Indicators

Inflation is measured as the annual change in consumer prices extracted from the IFS dataset. Nominal GDP growth is obtained by adding inflation to real GDP growth (source: WDI).[10] Our primary proxy for monetary discipline is excess broad money growth (*Δmex*; sources: WDI and SDW), defined as the difference between nominal money growth and real GDP growth (Barro, 2007; Borio et al., 2023):

$$\Delta mex_{it} = \Delta m_{it} - \Delta \mathrm{yr}_{\mathrm{it}}, \quad (1)$$

where small letters denote logs of each respective variable, Δm_{it} is the annual growth rate of broad

[8] For detailed formulas, data transformations, and sources, see Appendix A. Appendix Table A.1 provides the summary statistics of the main variables used in our empirical analysis. Appendix Table A.2 provides a short description of the variables used in our analysis and the data sources, while Table A.3 reports the list of countries present in our database.

[9] For robustness, we checked the results using the GDP deflator (source: WDI) and obtained similar results.

[10] For the euro area aggregate, we obtained the nominal GDP growth and CPI inflation data from the ECB's Statistical Data Warehouse.

money growth of country *i* in nominal terms, and Δyr_{it} is real GDP growth of the same country.[11]

To provide robustness checks for the response of credit dynamics, we compute excess credit growth (Δcex), defined as the difference between nominal credit growth (Δc) and nominal GDP growth (Δyn) (Jorda et al., 2013):

$$\Delta cex_{it} = \Delta c_{it} - \Delta \mathrm{yn}_{\mathrm{it}}, \tag{2}$$

where Δc_t is the annual growth rate of the nominal credit supply, measured as private credit by deposit money banks and other financial institutions (source: WDI) and Δyn_t the annual growth rate of nominal GDP. We also compute real excess credit growth ($\Delta crex$), which replaces nominal GDP growth with real GDP growth in the above formula. All macroeconomic indicators are winsorized at the 1% and 99% levels to minimize the influence of outliers.

b) Indicators of Central Bank Independence

The legal independence of central banks is captured by the Central Bank Independence Extended (CBIE) index (Romelli, 2024). This index spans 155 countries over the 1972–2023 period and integrates key aspects of governance, monetary policy frameworks, lending restrictions, and accountability standards based on 42 classification criteria. It extends the classical CBI indices from Grilli et al. (1991) and Cukierman et al. (1992). The index provides a legal measure of independence, scaled from 0 (least independent) to 1 (most independent), allowing for cross-country comparisons. The CBIE index includes six sub-indices to assess the impact of specific dimensions on policy outcomes: 1) Governor and central bank board (CBIE Board), 2) Monetary policy formulation and conflict resolution (CBIE Policy), 3) Central bank objectives (CBIE Objective), 4) Restrictions on central bank lending to the government (CBIE Lending), 5) Financial independence of the central bank (CBIE Finances), and 6) Accountability standards (CBIE Report). Each dimension is weighted equally within the CBIE index.[12] Additionally, we include the weighted (LVAW) CBI index in Cukierman et al. (1992), as updated by

[11] We favour broad monetary aggregates over narrow ones, since they include a wide range of liquid public assets, providing a clearer view of money creation and its inflationary implications (Fischer et al., 2009), whereas narrow money includes only the most liquid forms of money. Using the classification from WDI, broad money encompasses narrow money (M1) plus a range of other liquid assets held by the public, such as savings accounts, time deposits, and money market instruments. Monetary aggregates from WDI are not fully harmonized across countries. To address the issue of missing national data during monetary union, broad money growth data for M3 from official statistics of the respective euro area national central bank have been included in the dataset.

[12] For an in-depth discussion see Romelli (2022). Adrian et al. (2024) introduce a new CBI index based on weights from a new survey on central bank priorities based on a set of ten categories of CBI, suggesting that this would improve the measurement. Data for this new index are not publicly available yet, and coverage is limited to a maximum of 87 countries. Moreover, it is unclear whether the new weighting system improves on existing measures or introduces a new bias, e.g., if central bankers' assessments on which dimension is most critical lack objectivity.

Romelli (2024). This weighted index is based on an aggregated calculation of sixteen questions distributed across four categories: Governor and central bank board, Monetary policy and conflict resolution, Objectives, and Limitations on lending to the government.

For de facto independence, we use the turnover rate of central bank governors (TOR) as an average over rolling five-year periods, where higher rates suggest greater political interference (Cukierman, 1992; Dreher et al., 2010; Klomp and de Haan, 2010; De Haan and Eijffinger, 2019). As the TOR may face limitations in specific contexts (Binder, 2021), we address these concerns in robustness checks using regular and irregular turnovers.[13]

c) Credibility Indicators

Central bank credibility (CRED) is assessed using deviations between observed inflation and announced inflation targets (Weber et al., 1991). Alternative monetary policy frameworks may imply different benchmarks for credibility. For instance, the credibility of a central bank with an IT strategy may be assessed by the gap between the public's inflation expectations and the central bank's announced inflation target (Svensson, 2000), while in countries with exchange rate targeting strategies, credibility is better reflected in the alignment between expected future exchange rates and the announced central parity (Svensson, 1993).[14] The midpoint of the announced target range serves as the benchmark for inflation targeting regimes. In contrast, for fixed exchange-rate regimes, we use the anchor country's inflation as the reference (for details on numerical inflation or policy targets by country, see Appendix Table A.4). This backward-looking indicator reflects the ability of central banks to meet their goals across different frameworks. Higher credibility corresponds to smaller deviations from the inflation target. In particular, we measure credibility as follows:[15]

$$CRED_{it} = -|m_{it}^{a} - \mathbb{E}(m_{it}|\Omega_{it})| = -(|\pi_i^* - \pi_{it}|), \quad (3)$$

where m_{it}^{a} represents the policy announcement of country i at time t, i.e., the implicit or explicit inflation target π_i* relative to rational expectations on inflation, $\pi_{it,}$ based on available information, Ω_{it}, available

[13] A recently developed alternative measure for de facto independence is the Governor Appointment Index (see Ioannidou et al., 2023). This index exploits information from governors' biographical information, the perception of the international press, and the opinions of independent academic experts. However, it only covers a subsample of 57 countries over the sample 1985-2020 and, to our knowledge, the dataset has not yet been published.

[14] For central banks with monetary targeting strategies, the match between the monetary target and actual money growth is an alternative measure of credibility (Cukierman and Meltzer, 1986). However, even if a central bank has limited control over an intermediate target, it can still be deemed credible if it consistently achieves the ultimate goal of price stability and therefore we use an inflation target in these cases.

[15] Average credibility assesses the central bank's historical performance against its announced goals. In contrast, marginal credibility relies on survey expectations or forecasts to gauge the public's confidence in the central bank's future actions (Weber et al., 1991). However, due to data limitations, particularly for developing countries, our measure of credibility does not include forward-looking indications about future inflation.

at time *t*.[16]

For consistency with the macro data, we have winsorized the credibility data at the 1% and 99% levels, removing extreme values from the dataset to prevent outliers from skewing our results.

d) Control Variables

Our set of control variables includes measures capturing monetary policy regimes, fiscal policy, and systemic crises to account for broader economic and political influences. For instance, we distinguish between inflation-targeting (IT) and monetary-targeting (MT) regimes using binary indicators based on the classification by Cobham (2021), while exchange rate targeting (ERT) strategies are captured by a dummy variable (FixedExhRate), which create based on the detailed classification in Ilzetzki et al. (2019). Membership in a monetary union is denoted by the MonetaryUnion dummy, whereas an EMU dummy indicates participation in the European Economic and Monetary Union. The degree of exchange rate flexibility, labelled ERS, draws from the classification by Reinhart and Rogoff (2004), later updated by Ilzetzki et al. (2019) and is correlated with the exchange rate regime dummy. Crisis episodes are identified using binary variables created from Laeven and Valencia's (2020) dataset on banking (SCC), currency (SBC), and sovereign debt crises (SDC). Episodes of negative policy interest rates during the past decade are captured by a binary ZLB dummy, acknowledging the potential for non-linear effects on monetary policy transmission, as discussed by Fernández-Villaverde et al. (2015). The influence of fiscal policy on monetary discipline is examined by including the debt-to-GDP ratio obtained from WDI.

Additionally, we control for democratization and regional dynamics. Peer pressure to reform CBI is quantified by comparing a country's independence level to its regional average (CBIE_RegPress). At the same time, democratic governance is captured using Polity2 scores (source: Polity5 database), with a democracy dummy variable applied to countries scoring above 5, indicating a democratic status.[17] Regional classification, enabling geographic insights, follows the World Bank's seven-region taxonomy (as in Acemoglu et al., 2019).[18]

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[16] Note that we refer to the most recent available data on inflation goals by country and thus ignore adjustments in the inflation target over time, which may be important for the precise measurement of average credibility in some countries (e.g., Canada, Hungary, etc.) from a conceptual point of view. However, those adjustments in inflation targets mainly reflected the transition towards price stability rather than the longer-term goals of the central bank.

[17] A widely used measure for democracy is the Polity2 score from the Polity5 database, which maps countries in a range between -10 (autocracies) and 10 (democracies) (Marshall, 2020). The scaling is such that fully democraticized countries enter with a 0 value, and autocratic countries or countries in the democratization process enter with negative values.

[18] These regions include: 1) Africa, 2) East Asia and the Pacific, 3) Eastern Europe and Central Asia, 4) Western Europe and other developed countries, 5) Latin America and the Caribbean, 6) the Middle East and North Africa, and 7) South Asia.

3. Empirical Strategies and Methods

This section outlines the econometric methods employed to assess the impact of CBI on monetary discipline and policy credibility. Our analysis leverages local projections and semiparametric methods to analyze the dynamic relationships between reforms in CBI, monetary discipline, and credibility.

4.1. Panel Data Local Projections

To examine the dynamic effects of CBI on monetary discipline and credibility, we apply the panel local projections (LP) method. This approach estimates impulse response functions for a dependent variable (y_{it}) following a policy intervention (s_{it}). The typical panel LP model (see Jordà, 2023) for $i = 1, \ldots, n$ units observed over $t = 1, \ldots, T$ periods has the form:

$$y_{i,t+h} = \alpha_i + \delta_t + \beta_h s_{it} + \gamma_h X_{it} + v_{i,t+h} \quad (4)$$

where α_i are unit-fixed effects, δ_t are time-fixed effects, $v_{i,t+h}$ is an error term, and X_{it} is a vector of control variables. The coefficient β_h measures the change of the dependent variable h periods into the future.

To establish causality and address potential endogeneity concerns, we apply the instrumental variables approach (LP-IV). The empirical strategy follows Jordà et al. (2015), uses long differences to show cumulative changes, and GMM to compute robust standard errors:

$$\textit{First stage}: CBI_{i,t} = \alpha_i + \delta_t + \beta Z_{it} + \gamma X_{it} + \varepsilon_{i,t} \quad (5)$$

$$\textit{Second stage}: y_{i,t+h} - y_{i,t-1} = \alpha_i + \delta_t + \beta_h \widehat{\Delta CBI_{it}} + \gamma_h X_{it} + v_{i,t+h}$$

with notations as above, β and γ are the first-stage coefficients, Z_{it} is an instrumental variable, and $\varepsilon_{i,t}$ is the first-stage error term. The coefficient β_h in the second-stage regression measures the cumulative effect of a change in the CBI index on the dependent variable h periods into the future. In our specification, we include the inflation gap, exchange rate, monetary targeting and inflation targeting regime dummies, the debt-to-GDP ratio, a ZLB dummy, and dummies for crises events.[19] To ensure robustness, we calculate standard errors that are adjusted for serial correlation and potential heteroskedasticity. To assess the significance of the results from local projections, we also report the p-value of a joint significance test of the hypothesis that there is a non-zero response of the impulse response function, as suggested by Jordà and Taylor (2016, 2024).

An instrumental variable strategy can mitigate endogeneity concerns provided that relevant and exogenous external instruments are available (Stock and Watson, 2018). Drawing on the findings by Romelli (2022), we use regional peer pressure as a suitable instrument, given its key role as a driver of

reforms in central bank design. We define peer pressure as the 75th percentile of the distribution of the CBI index in a region in a given year, excluding the own-country observation. Regional peer countries are identified using the geographical classification in Acemoglu et al. (2019). This instrument strongly correlates with changes in de jure CBI, providing a credible source of exogenous variation for our analysis. The assumption for our choice of instrument is that the level of central bank independence of regional leaders does not affect the inflation of neighbours, while regional neighbours with more independent central banks might push a country to reform its central bank.

Furthermore, we employ state-dependent local projections with instrumental variables based on stratification to capture regime changes. Let D_{t-r} be a binary indicator variable for a measure of the state of the economy at time *t-r* prior to the regime change, the specification of the second stage in (5) is modified as follows (see Jordà and Taylor, 2024):

$$y_{i,t+h} - y_{i,t-1} = \alpha_i^j + \delta_t^j + \beta_h^j \widehat{\Delta CBI}_{it} + \gamma_h^j X_{it} + \nu_{i,t+h} \; ; \mathrm{D}_{t-r} = j \; \{0,1\}, \; r > 0 \qquad (6)$$

where the dependent variable is excess money growth, and the regimes refer to whether a country is a democracy or not, whether it has adopted a monetary or inflation targeting strategy or whether it uses fixed versus flexible exchange rates.

4.2. Semiparametric Estimations of Reforms

To analyze the effects of significant reforms in CBI – we call those reforms "*relevant reforms*" in the following -, we employ semiparametric techniques that compare treated countries (those implementing reforms) with control groups (non-reforming countries). We aim to isolate the impact of central bank reforms on monetary discipline while accounting for other factors that might influence it. The semiparametric estimation method allows us to estimate the treatment effects of central bank reforms on the distribution of excess money growth without imposing a specific functional form for its evolution over time, since this approach assumes that the likelihood of reforms depends on observable factors, notably past excess money growth rates for which no parametric process needs to be specified and time effects.[20] The treatment effect for the treated group that is subject to a reform can be estimated as follows:

$$\beta^s = \mathbb{E}[\, \Delta y_{it}^s(1) - \Delta y_{it}^s(0) | D_{it} = 1, \; D_{it-1} = 0] \qquad (7)$$

where $y^s_{it}(D)$ represents the excess money growth rate at time $t+s$ for country i, and D indicates whether, at time t, the country has undergone a reform ($D=1$) or not ($D=0$). The treatment effect measures the

[20] However, we still need to specify a model for either the likelihood of a transition to reform or the conditional expectation of future excess money growth among countries with no reforms; hence the label "*semiparametric*".

difference in excess money growth of country *i* due to the reform.[21]

We follow Acemoglu et al. (2019) and base our comparisons on three complementary techniques, which isolate reform effects from confounding factors and ensure balanced comparisons, namely linear regression counterfactuals, propensity score weighting, and "*doubly robust estimator*". First, when applying a counterfactual approach using linear regression, we run regressions on the changes in excess money growth for the periods preceding and following the implementation of the reforms. These regressions include year-fixed effects and four lags of excess money growth to create a counterfactual scenario for countries that did not reform, assuming that past trends in excess money growth would have continued in the absence of reforms. Second, when calculating the propensity score of the likelihood of a country implementing a reform, we use a Probit regression based on year-fixed effects and past excess money growth rates for each country and the efficient weighting scheme proposed by Hirano, Imbens, and Ridder (2003). This second approach allows for more robust estimation of the causal effect of reforms than linear regression counterfactuals since it assigns more weight to control group observations with a high propensity score that exhibit dynamics in excess money growth that resemble those of the reforming countries. Third, we combine these two estimates into a doubly robust estimator that both reweights observations in the control group by their propensity score and adjusts the counterfactual outcome using a linear regression model. The doubly robust estimator is consistent if either the linear model for potential outcomes or the probit model is valid (see Imbens and Wooldridge, 2009).

4. Empirical Results

5.1. Evidence from Local Projections

a) Baseline results

The results from the instrumental variable local projections show that improvements in central bank independence lead to increases in monetary discipline and central bank credibility (see Figure 4). The estimated coefficients for CBI in Figure 4a (LHS) suggest that a one-percentage increase in the CBI index is associated with an average reduction in excess money growth of 10% after three years following a reform. This effect persists over time and is most pronounced seven years after a reform. Higher independence also strengthens monetary policy credibility. The results of the LP-IV estimates in Figure 4a (RHS) show that an increase in the CBI index leads over time to a significant increase in average credibility, by 6% after three years. This effect is persistent, and most pronounced eight years after a reform. When specifically looking at countries with CBI reforms without reform reversals (Figure 4b),

[21] Despite the soundness of this econometric approach, a violation of the underlying assumption may occur if a country exerts more monetary discipline for reasons unrelated to the reform.

we find that the impact on monetary discipline is even more significant compared to the baseline, though the credibility impact gets less significant. This could suggest that other factors overlay the credibility channel, for example the monetary policy strategy.

Additionally, we re-estimated the local projections for two subsamples: from 1972 to 2000 and from 2001 to 2023. Figure 4c illustrates that the link between CBI and monetary discipline or credibility mainly relates to the reforms conducted in the first period.[22] That period coincides with a large number of reforms that led to the strongest increase in the global CBI index observed in history (see Figure 1). Amid those developements were the creation of a monetary union in Europe with a modern central bank statute and a primary objective of price stability, while many countries introduced a credible IT strategy.

***** Figure 4 here *****

b) Role of political systems and monetary regimes

The influence of CBI on monetary discipline may depend on a country's political system. Democracies differ from autocracies in that political interference is less likely and that monetary policy decision making is more transparent, while the central bank is held accountable by democratic institutions. Therefore, the link between CBI and monetary discipline could be stronger in democracies, as suggested by Bodea and Hicks (2015) who show that the freedom to oppose government actions is reflected in lower money growth. However, the electoral cycle in democracies can create pressures for more expansionary fiscal and monetary policies, undermining monetary discipline.

To test whether differences in political systems influence the effects of central bank reforms on excess money growth and credibility, we re-estimate the LP-IV results distinguishing between democratic and autocractic countries. The results of these estimations for the political system, which are presented in Figure 5, suggest that, in democratic countries, an increase in the CBI index leads to a significant decline in excess money growth and coinciding improvements in credibility, while those effects are not significant in autocracies.

***** Figure 5 here *****

Next, we examine whether monetary policy strategies and exchange rate regimes explain differences in how CBI reforms impact on monetary discipline and credibility. The results of these

[22] For comparison with the earlier empirical literature, we also run standard panel OLS regressions, and detect time variation in the relationship between CBI and monetary discipline. Those results, which are available from the authors, confirm that the negative relationship between CBI and excess money growth was mainly driven by the first subsample of the analysis, i.e., between 1972 and 2001. At the same time, we emphaisze that applying panel OLS regressions is not well suited to identify causal effects and may lead to biased results.

estimations in Figure 6 show that the influence of CBI on monetary discipline and credibility is signifiant for countries adopting no monetary policy strategies and is weak or even absent for countries with IT strategies. Additionally, the results show that that the disciplining effect of CBI on excess money growth and credibility is significant in countries with flexible exchange rates, whereas it is not significant for countries with fixed exchange rates.

***** Figure 6 here *****

c) Interplay between monetary and fiscal policies

Independent central banks can resist political pressures to monetize debt, thereby helping to control inflation. However, the effectiveness of CBI depends on the broader institutional framework and the coordination of fiscal and monetary policies. Previous studies have shown that that countries with independent central banks achieve better inflation outcomes, even in high-debt environments. However, high public indebtedness can create pressures to finance deficits through inflationary means, particularly if the government can influence the policy decisions adopted by the central bank. Moreover, in high-debt countries, fiscal policy can dominate monetary policy, undermining the central bank's ability to maintain price stability, something which is more likely if the central bank is not independent.

The results presented in Figure 7 show that the impact of CBI on monetary discipline varies significantly depending on the fiscal context of a country. In countries with debt-to-GDP ratios above 90%, CBI reforms reduce excess money growth more substantially, reflecting the alleviation of fiscal dominance pressures. Conversely, in low-debt environments (debt-to-GDP below 60%), the effects are more muted, as fiscal pressures on monetary policy are less severe. These findings suggest that prudent fiscal frameworks preventing high-debt levels can amplify the benefits of CBI reforms by minimizing political incentives to monetize debt.

The pronounced effects of CBI in high-debt environments suggest that its influence extends beyond enhancing monetary discipline and credibility. Countries with high debt-to-GDP ratios benefit disproportionately from CBI reforms. This is even more evident when looking at the significant decline in excess money growth in these contexts, which suggests that CBI reforms alter fiscal incentives by limiting access to inflationary monetary financing.

***** Figure 7 here *****

These findings emphasize that while monetary discipline and credibility are core channels through which CBI influences inflation, policymakers should also consider the broader institutional and economic context. For example, pairing CBI reforms with measures aimed at enhancing coordination

between fiscal and monetary policy or reducing public debt could magnify the inflation-stabilizing effects of independence. This reinforces the importance of designing central bank reforms as part of a broader institutional framework.

5.2. Treatment Effects of Relevant Reforms

Reforms involve changes to the legal and institutional frameworks governing the central bank. These changes can profoundly impact the central bank's autonomy and its ability to implement policy without political interference. So far our local projections have implied that reforms that enhance CBI can strengthen the credibility of the central bank, leading to better-anchored inflation expectations and improved policy effectiveness. Conversely, reforms that weaken CBI (reversals) can damage credibility and lead to higher inflation expectations. In this subsection, we delve deeper into possible asymmetries of the treatment effects of relevant institutional central bank reforms. To this end, we define relevant reforms (reversals) as quantifiable changes in the CBI index above (below) the historical mean for all countries, with distinct thresholds distinguishing between reforms and reversals (i.e. for reforms a +4.6 percentage point change of CBIE and for reversal a -3.6 percentage point change).

Table 1 presents the average effects of these relevant reforms on monetary discipline over various time horizons based on semiparametric estimates.[23] The treatment effect takes around 10 years after the reform to fully materialize, with a reduction in excess money growth of approximately 2-3 percent. The indications from the three semiparametric techniques suggest that those effects are rather persistent, since they are still observable 20 years after the reform. Reversals of reforms in principle have the opposite effect on monetary discipline, i.e., lead to an increase in excess money growth that could be larger than its decrease owing to a reform strenghtening CBI. However, all three semiparametric techniques suggest that these effects are not statistically significant at the 5%-level.

Overall, these results confirm the significant, long-lasting effects of CBI reforms on monetary discipline and credibility from the baseline local projections, while suggesting that the adverse effects of reform reversals, potentially eroding the benefits of earlier reforms, are not significant at conventional levels. In this sense, the analysis of relevant reforms and reversals reveals asymmetries in the effects of changes in legal CBI on monetary discipline.

***** Table 1 here *****

[23] Over the last 50 years, relevant reforms leading to improvements in CBI were observed in 136 countries, whereas relevant reversals were only observed in 15 countries.

Table 2 presents the average effects of relevant reforms on credibility over the same time horizons, as estimated using the semiparametric methods. Reforms fostering CBI have a significant effect on credibility. The results from linear regression adjustment and the doubly robust estimator suggest that the effects of relevant reforms on central bank credibility are around 1%, materialize with a lag of 10 years following a reform, and persist 20 years after the reform. In contrast, relevant reform reversals may have substantial adverse effects on credibility, though again, those results are not significant at conventional levels. Overall, these findings suggest that the impact of relevant CBI reforms extends to credibility, while revealing that the average impact of those reforms is smaller compared to the overall impact estimated by the baseline local projections which capture that countries made a series of reforms to improve legal CBI.

***** Table 2 here *****

The evidence presented in this section supports the view that the link between CBI and monetary discipline has a causal interpretation. However, the effects stemming from both the implementation of reforms takes considerable time to manifest, highlighting the longer-term impact of central bank institutional changes on policy outcomes.

5.3. Robustness tests

To test the robustness of our findings, we perform a series of tests. First, we test the robustness of our results by using alternative measures of CBI, i.e., the LVAW and LVAU indices by Cukierman et al. (1992), of the dimensions of the CBI, and of the democracy index. The results of the LP-IV estimations presented in Appendix Figure A.1 confirm the negative relationship between CBI and monetary discipline with these alternative measures of CBI. Focusing on the dimensions of the CBIE index, we find that several dimensions of CBI are the main drivers of the influence of CBI on monetary discipline, most notably the provisions relating to the governor, monetary policy and conflict resolution, clear policy objectives, and lending provisions (see Appendix Figure A.2). When looking at geographical factors, we find that the link is more pronounced in emerging market economies and developing countries (see Appendix Figure A.3). As suggested by Meade and Crowe (2008) this could be attributable to threshold effects in advanced countries, whose existence we detect based on a threshold of 0.75 for the CBIE, i.e. the average index in advanced countries after 1999 (see Appendix Figure A.4). Furthermore, following Jordà (2023) we explore the presence of a nonlinear relationship by including an interactive term with the level of the CBIE index, and, alternatively by adding a quadratic term for the change in the CBIE. Those results suggest the absence of non-linearities in the relationship between

CBI and monetary discipline or credibility (see Appendix Figure A.5).

Second, political pressure for more flexible monetary policy and factors such as democracy levels, legislative systems, and the freedom of the press have led to a decoupling between de jure and de facto independence over time (Eijffinger and De Haan, 1996; Klomp and de Haan, 2010; De Haan and Eijffinger, 2019; Ioannidou et al., 2023). To address this point, we reestimate our local projections with instrumental variables and use turnover rates, which are popular measures of de facto independence, as the dependent variable. Notably, we use regular and irregular turnover rates of central bank governors (TOR) as a proxy for de facto independence (see Cukierman, 1992, among others). The LP-IV estimations run using the standard five-year TOR metric do not provide any evidence of a relationship between reductions in de facto CBI (higher TOR) and excess money growth or credibility measures (Appendix Figure A.6, upper panel). Similar results (see the lower panel of Appendix Figure A.6) are obtained when we focus our analysis on the alternative measure centred around irregular turnovers—instances where governors are replaced before completing their legal term (see Dreher et al., 2010). Varying the average length of the regular and irregular turnover rate between 3 and 10 years yields similar results. Overall, the lack of significant results for de facto independence highlights potential limitations in using TOR as a proxy for de facto independence. While turnover measures are informative, they may not fully reflect the operational independence of central banks, as frequent leadership changes can occur for non-political reasons, such as retirements or health issues (e.g., De Haan and Eijffinger, 2019).

Third, to examine whether a decoupling of money and credit growth over past decades, as observed by Schularick and Taylor (2012) influences the link between CBI and monetary discipline or credibility, we reestimate the local projections (LP-IV) and use excess credit growth as a dependent variable in Equation 5. If the growth of credit has become more detached from traditional measures of money supply, such as broad money, credit dynamics could exert separate influences on the monetary policy transmission in addition to the key channels that we explore in this study. However, our results show that changes in CBI have no significant impact on the credit provision to the economy (Appendix Figure A.7.

5. Conclusion

This paper provides robust evidence on the mechanisms through which CBI contributes to price stability, notably by fostering monetary discipline and enhancing policy credibility. By analyzing a comprehensive dataset spanning 155 countries and five decades, we show that improvements in legal CBI have led to more monetary discipline, and have had a beneficial impact on central bank credibility.

Our results suggest that significant CBI reforms translate into more stringent monetary discipline and increase credibility only after some time, reaching the full effect after ten years. Reforms are more impactful in reforming countries that have not reversed earlier reforms. The effects were most pronounced in the 1990s and in democratic countries with flexible exchange rates and no monetary policy strategies. To capture the effects of institutional reforms, we apply novel techniques, such as local projections with instrumental variables and semiparametric estimations. These methods support a causal interpretation of our results and offer a robust framework for the analysis of reforms of monetary policy institutions. The evidence presented thus reinforces the enduring relevance of CBI as a pillar of sound monetary policy, emphasizing the need for policymakers to prioritize and protect institutional autonomy in an era of heightened economic and political uncertainty.

To conclude, this study offers critical lessons for policymakers. It demonstrates that the beneficial effect of CBI on inflation operates through multiple channels, including monetary discipline, credibility, while high debt levels act as an amplifier for its effectiveness. The findings corroborate the view that it is important to preserve, and where possible enhance, legal CBI. However, CBI is not a panacea and other credibility-enhancing strategies exist to achieve price stability, specifically when the level of CBI is already high, as is the case in most advanced countries. Policymakers should account for existing fiscal frameworks and the monetary regime when designing reforms in central bank design. For instance, combining central bank reforms with fiscal reforms that enhance coordination between monetary and fiscal policy or reduce public debt levels could amplify the long-term inflation-stabilizing effects of CBI. Reforms should also consider the broader political context of a country. As shown, in countries with weak democratic institutions, the impact of CBI on monetary discipline and credibility is less pronounced. Therefore, strengthening democratic governance can amplify the benefits of CBI by ensuring accountability and reducing political interference. These insights reinforce the need for policymakers to view CBI reforms as part of a broader institutional framework.

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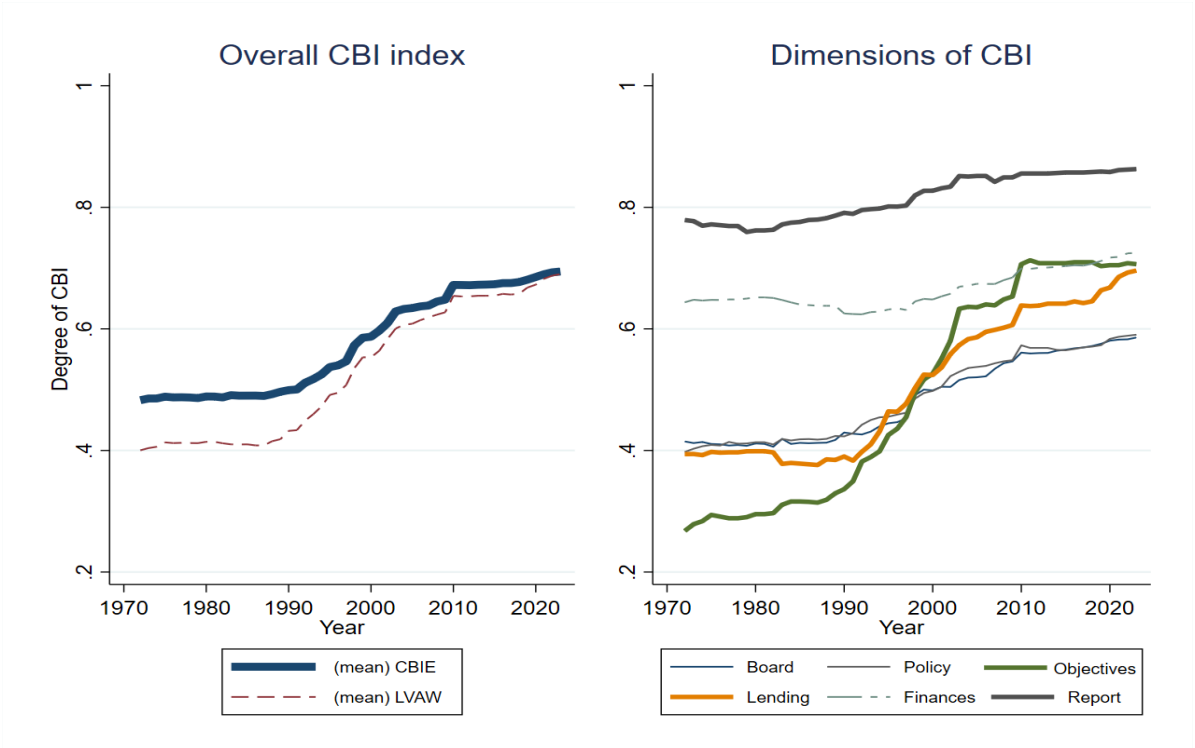
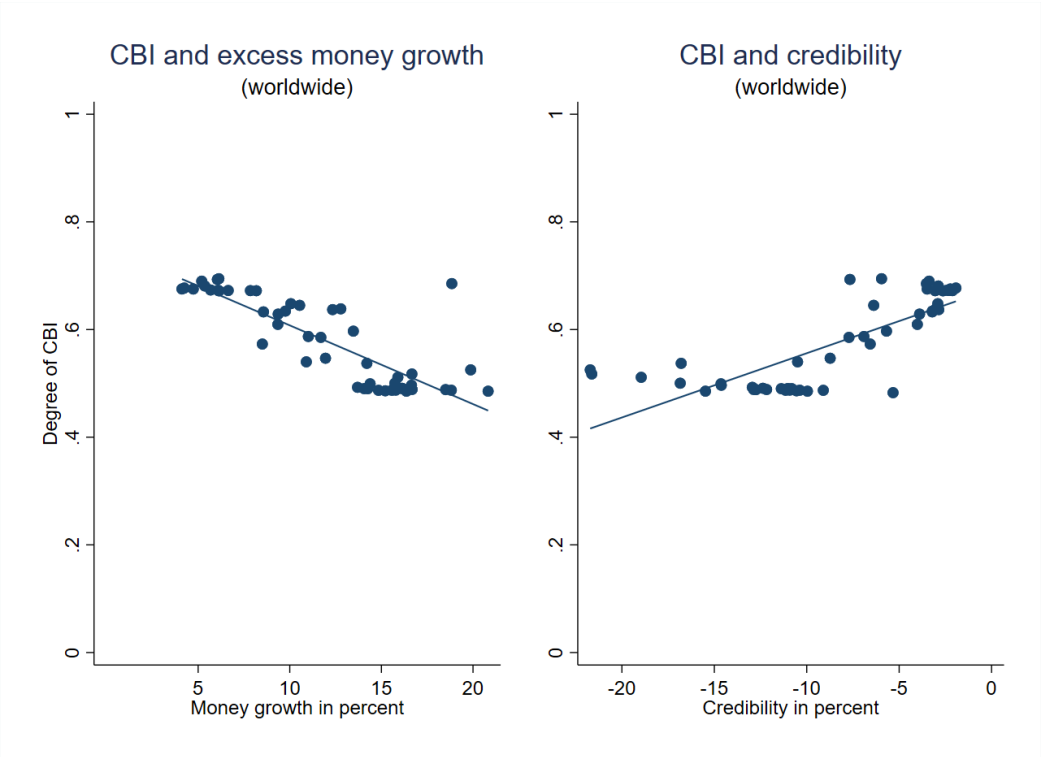
Figure 1. Central bank independence: 1972-2023



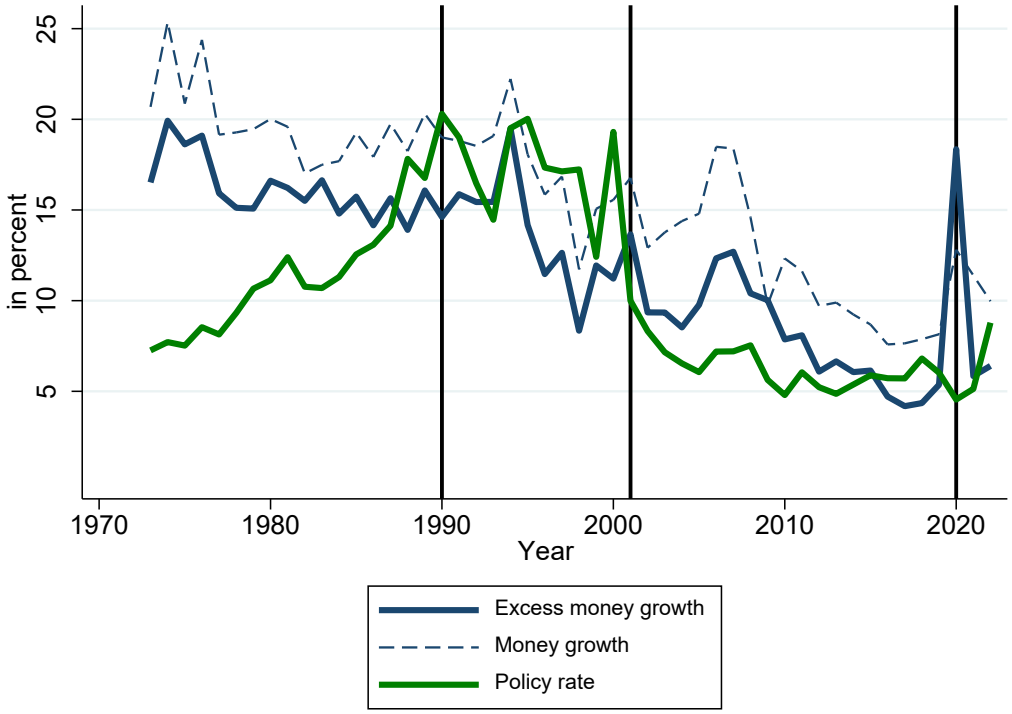
Notes: The LHS chart shows the world average of central bank independence measured by the CBI index (CBIE) of Romelli (2024) for 155 countries and the weighted LVAW index by Cukierman et al. (1992), updated by Romelli (2024). The RHS chart shows the world average of six dimensions of the CBIE index. Board: relates to the governor and central bank board; Policy: monetary policy and conflicts resolution; Objectives: monetary policy objectives; Lending: limitations on lending to the government; Finances: financial independence; Report: reporting and disclosure.

Figure 2. CBI, monetary discipline and credibility



Notes: The figure shows observations for an average of 155 countries. The LHS chart shows annual growth rates for broad money aggregates. Excess money growth is the difference between nominal and real GDP growth (see Equation 1). The RHS chart shows average credibility, measuring how much the public expects policy outcomes to deviate from prior policy announcements (see Equation 3). Outliers have been excluded.

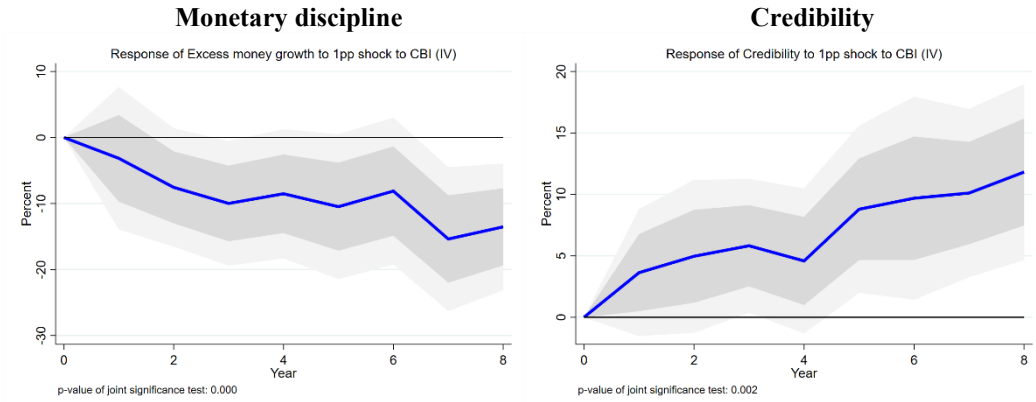
Figure 3. Money growth and policy interest rates (worldwide)



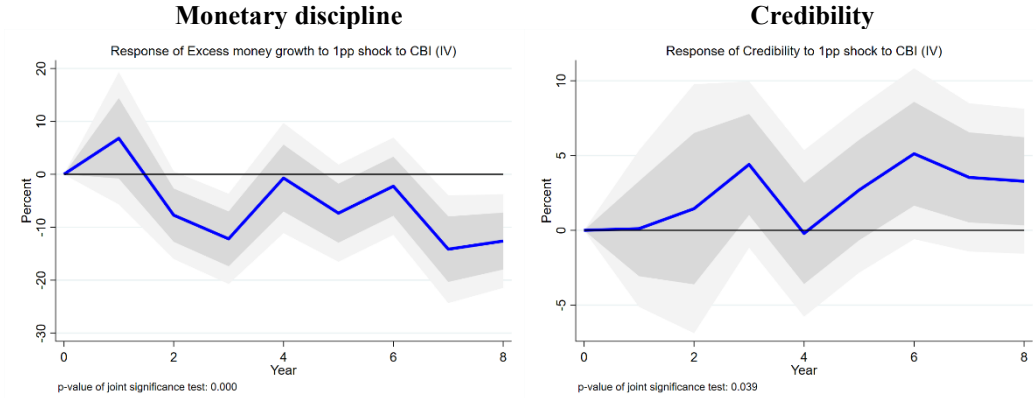
Notes: The figure shows the unweighted mean of broad money growth and policy rates for 155 countries. Vertical lines denote the start of inflation targeting in New Zealand (in 1990), the 2001 recession, and the outbreak of the COVID-19 pandemic (in 2020), respectively.

Figure 4. Results from instrumental variable local projections for legal CBI (LP-IV)

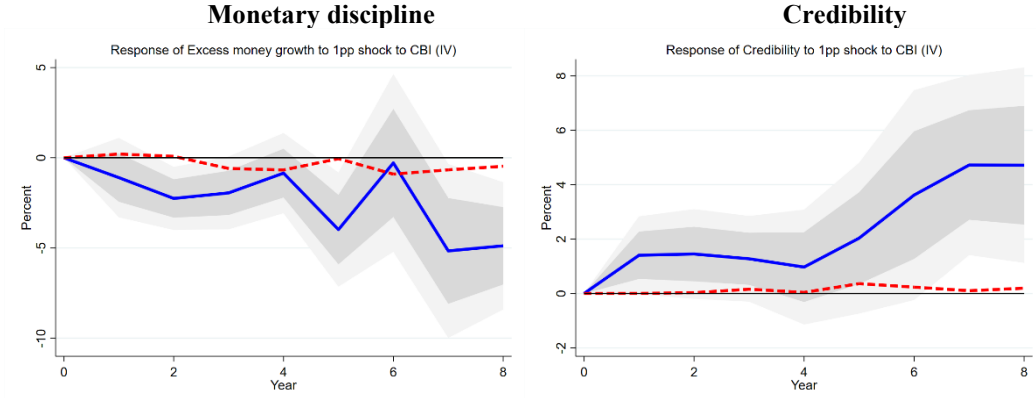
a) Baseline



b) Reform countries without reversals



c) Time variation

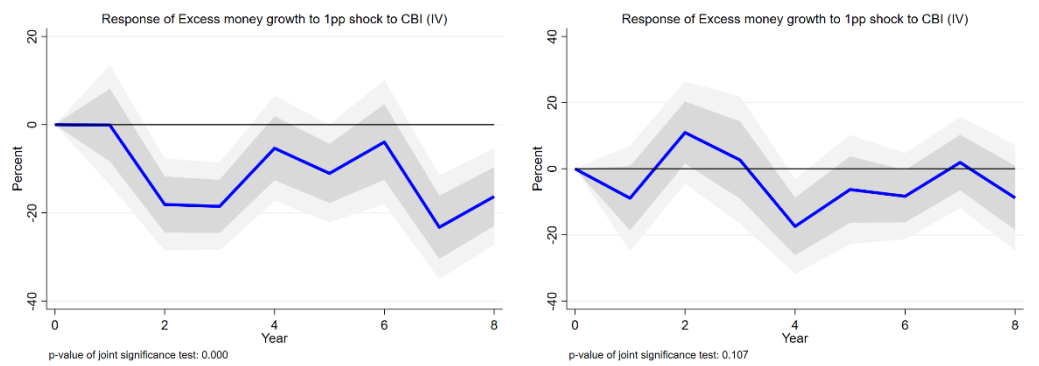


Notes: The estimation of Equation 5 in panel (a and b) is for the sample 1972-2023 and in panel (c) is for two subsamples 1972-2000 (blue solid) and 2001-2023 (red dashed). Monetary discipline is measured by excess money growth (see Equation 1). Average credibility measures how much the public expects policy outcomes to deviate from prior policy announcements (see Equation 3). Regional peer pressure is used as the instrument for LP-IV. The confidence intervals are for 68% and 90%. Notes: Outliers have been excluded.

Figure 5. Results from instrumental variable local projections for legal CBI: political systems

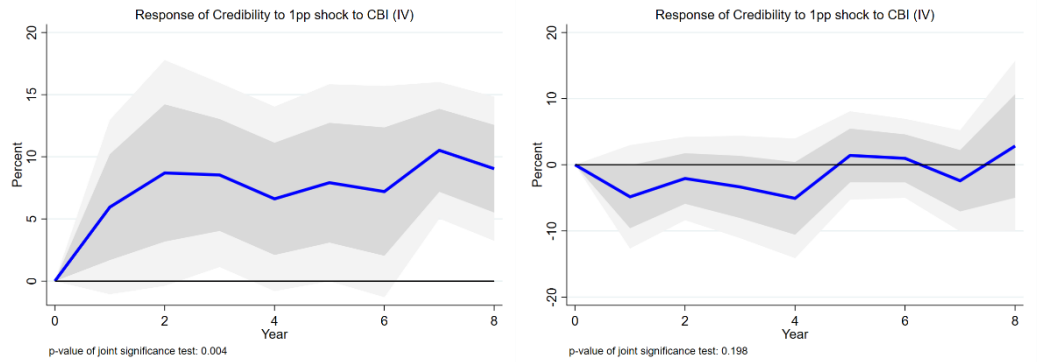
a) Monetary discipline and the political system

Countries in democracy **No democracy**



b) Credibility and the political system

Countries in democracy **No democracy**

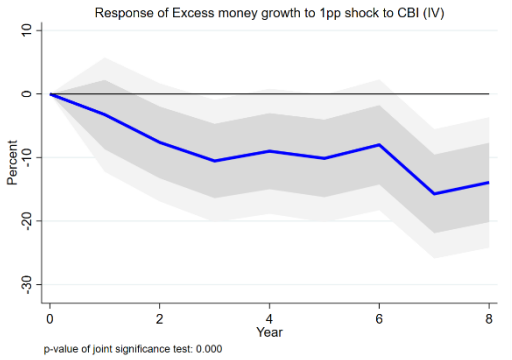


Notes: The estimation of Equation 6 is for the sample 1972-2023 and the respective regimes. The confidence intervals are for 68% and 90%. The charts show monetary discipline, as measured by excess money growth (see Equation 1). Regional peer pressure is used as the instrument for LP-IV. Outliers have been excluded.

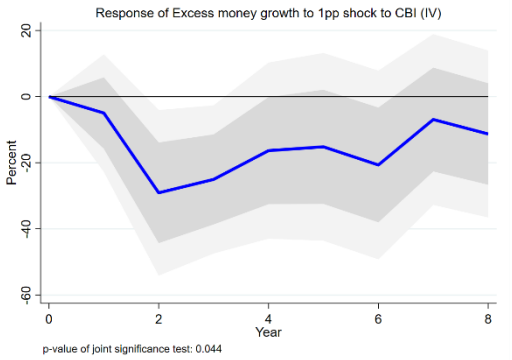
Figure 6. Results from instrumental variable local projections for legal CBI: monetary regimes

a) Monetary discipline and monetary policy strategies

No monetary policy strategies

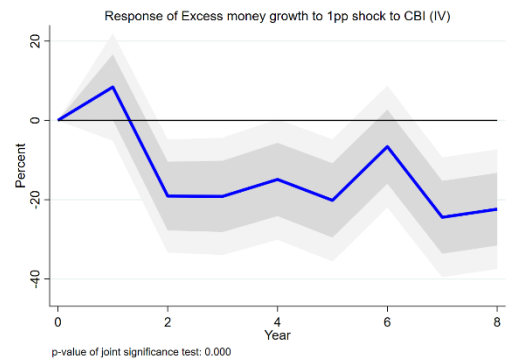


Inflation targeting countries

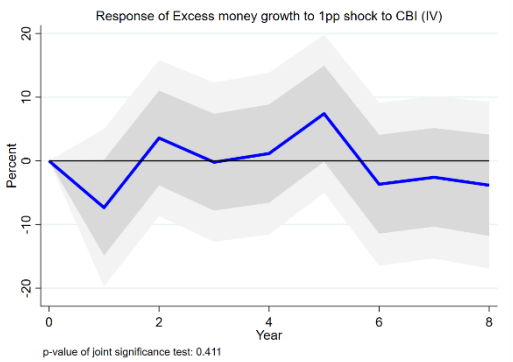


b) Monetary discipline and the exchange rate regime

Countries with flexible exchange rates

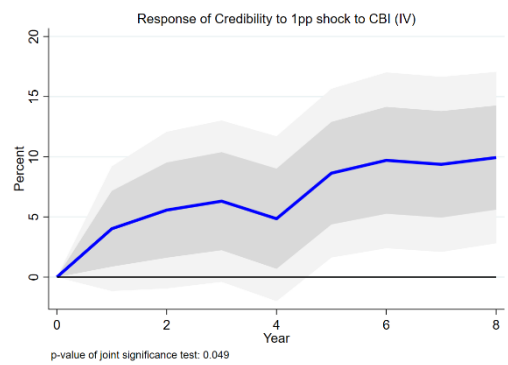


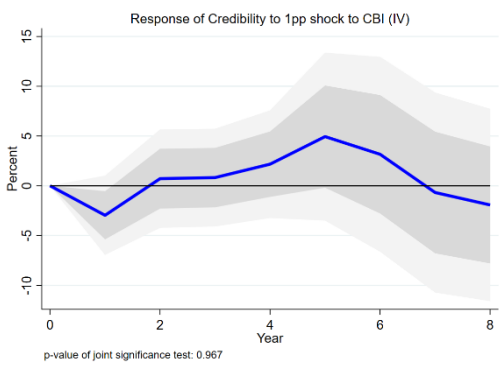
Countries with fixed exchange rates



c) Credibility and monetary policy strategies

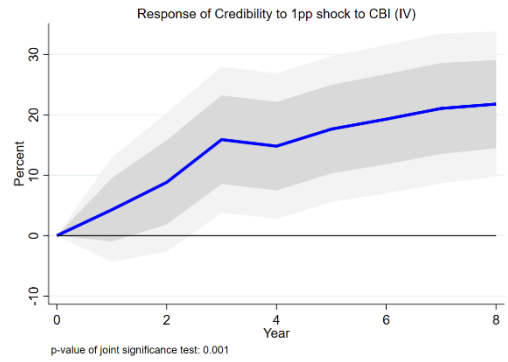
No monetary policy strategies | **Inflation targeting countries**

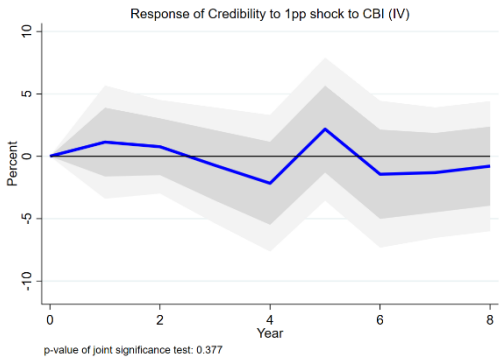




d) Credibility and the exchange rate regime

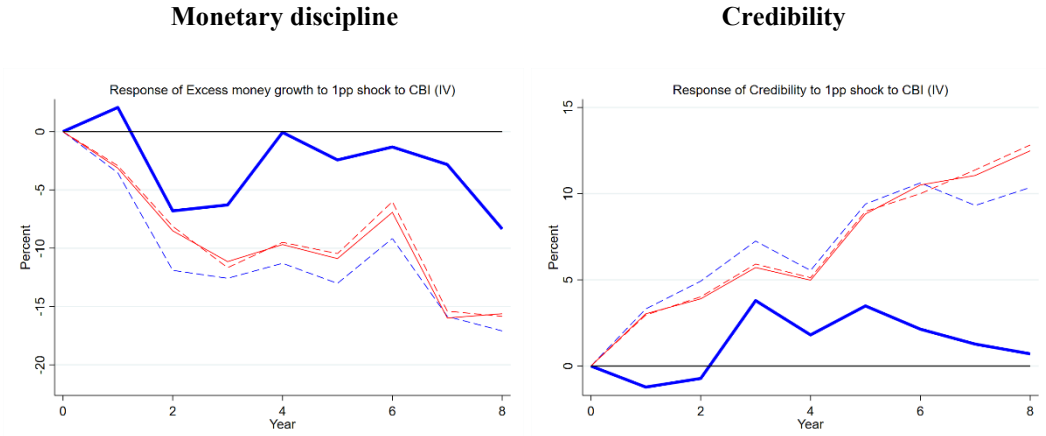
Countries with flexible exchange rates | **Countries with fixed exchange rates**





Notes: The estimation of Equation 6 is for the sample 1972-2023 and the respective regimes. The confidence intervals are for 68% and 90%. The charts show monetary discipline, as measured by excess money growth (see Equation 1). Regional peer pressure is used as the instrument for LP-IV. Outliers have been excluded.

Figure 7. State-dependence: different public debt regimes



Notes: The estimation of Equation 6 is for the sample 1972-2023 and for four states: debt-to-GDP ratio ≤ 60% (blue solid thick), debt-to-GDP ratio ≤ 90% (blue dashed thin), debt-to-GDP ratio ≤ 120% (red dashed thin), and debt-to-GDP ratio ≤ 150% (red solid thin). The confidence intervals are for 68% and 90%. Monetary discipline is measured by excess money growth (see Equation 1). Average credibility measures how much the public expects policy outcomes to deviate from prior policy announcements (see Equation 3). Regional peer pressure is used as the instrument for LP-IV. Outliers have been excluded.

Table 1. Semiparametric estimates of the effect of reforms on monetary discipline

	Relevant reforms					Relevant reversals				
Average effect on excess money growth	-5 to -1 Years (1)	0 to 4 Years (2)	5 to 9 Years (3)	10 to 14 Years (4)	15 to 19 Years (5)	-5 to -1 Years (1)	0 to 4 Years (2)	5 to 9 Years (3)	10 to 14 Years (4)	15 to 19 Years (5)
A. Linear Regression Adjusment	-0.158	-1.503	-1.556	-2.778	-2.208	0.913	3.431	4.740	8.382	7.091
	(0.238)	(0.984)	(0.927)	(0.700)	(0.450)	(0.554)	(2.258)	(3.330)	(5.216)	(5.754)
B. Inverse-Propensity-Score Reweighting	-0.116	-0.822	-0.444	-1.910	-1.474	2.606	4.931	5.918	10.700	8.071
	(0.331)	(1.133)	(1.001)	(0.805)	(1.052)	(2.649	(4.413)	(5.236)	(6.944)	(6.558)
C. Doubly Robust estimator	-0.180	-0.969	-0.741	-2.421	-2.219	1.141	3.495	4.202	8.105	4.940
	(0.264)	(0.891)	(0.732)	(0.592)	(0.574)	(0.666)	(2.541)	(3.361)	(5.680)	(5.393)

Notes: This table presents semiparametric estimates of the effect of reforms changing CBI on excess money growth over different time horizons. Panel A shows regression adjustment estimates to compute counterfactual outcomes for treated countries. Panel B shows estimates obtained via inverse-propensity-score reweighting. Panel C presents estimates obtained with a doubly robust estimator, combining the regression adjustment and the inverse-propensity-score reweighting. Below each estimate we report robust standard errors obtained via bootstrapping.

Table 2. Semiparametric estimates of the effect of reforms on credibility

	Relevant reforms					Relevant reversals				
Average effect on credibility	-5 to -1 Years (1)	0 to 4 Years (2)	5 to 9 Years (3)	10 to 14 Years (4)	15 to 19 Years (5)	-5 to -1 Years (1)	0 to 4 Years (2)	5 to 9 Years (3)	10 to 14 Years (4)	15 to 19 Years (5)
A. Linear Regression Adjusment	-0.210	1.396	1.343	0.996	0.`827	0.081	-3.130	-14.426	-7.351	-4.981
	(0.194)	(0.968)	(0.615)	(0.287)	(0.254)	(0.258)	(1.822)	(11.688)	(5.056)	(6.211)
B. Inverse-Propensity-Score Reweighting	-0.181	1.119	0.650	0.342	0.024	-3.317	-3.199	-14.547	-8.387	-6.327
	(0.496)	(1.139)	(0.803)	(0.659)	(0.893)	(5.313)	(2.779)	(14.489)	(7.838)	(9.602)
C. Doubly Robust estimator	-0.190	1.244	0.992	0.779	0.733	0.118	-2.593	-13.464	-6.865	-4.568
	(0.179)	(1.130)	(0.707)	(0.350)	(0.288)	(0.509)	(1.975)	(10.987)	(5.785)	(7.756)

Notes: This table presents semiparametric estimates of the effect of reforms changing CBI on average credibility over different time horizons. Panel A presents regression adjustment estimates to compute counterfactual outcomes for treated countries. Panel B presents estimates obtained via inverse-propensity-score reweighting. Panel C presents estimates obtained with a doubly robust estimator, combining the regression adjustment and the inverse-propensity-score reweighting. Below each estimate we report robust standard errors obtained via bootstrapping.

Appendix: Dataset description

Table A.1. Descriptive statistics of key variables

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Broad money growth	6,584	15.24536	16.16919	-14.07948	100.0446
Excess broad money growth	6,419	11.66476	16.39782	-18.27946	98.60706
Inflation (CPI)	6,476	10.8665	27.56409	-19.40755	547.5339
Real GDP growth	7,235	3.292651	5.158721	-17.09061	18.9539
Debt-to-GDP ratio	6,725	56.34209	43.835	0	523.382
Excess credit growth to non-financial sector	6,081	2.509066	15.83348	-57.4194	56.31858
Credibility (CRED)	6,476	-7.806234	16.83348	-124.3322	-0.0453219
CBIE	6,828	.5895833	.1650381	0.0985	0.929
LVAW	6,828	.5490948	.2321265	0.055	0.979
LVAU	6,828	.5599461	.2462743	0.0405	0.987
Turnover rate (TOR), 5 years	5,491	.8910945	.8672208	0	5
CBIE Objective	6,828	.5252636	.3422684	0	1
CBIE Board	6,828	.494654	.1943281	0	0.94
CBIE Policy	6,828	.4996837	.2031205	0	0.8
CBIE Finances	6,828	.668105	.1684625	0	1
CBIE Lending	6,828	.5279275	.3184655	0	1
CBIE Report	6,828	.8219464	.2095935	0	1

Notes: Sample 1972 to 2023. CBIE is the CBI index from Romelli (2022); LVAW is the weighted, and LVAU is the unweighted CBI index from Romelli (2024).

Table A.2. Data and data sources

Variable	Definition	Data sources
FM_LBL_BMNY_CN	Annual volume of the broad monetary aggregate in local currency	World Bank
NY_GDP_MKTP_KD	GDP in constant prices of 2015 and the US dollar.	World Bank
WDI_INFL	Annual percentage change of the GDP deflator.	World Bank
CPI	Annual percentage change of the consumer price index.	IMF
GFDD_DI12	Private credit by deposit money banks and other financial institutions to GDP (%)	World Bank
CBIE	Central Bank Independence – Extended (CBIE) index and subindices:	Romelli (2024)
LVAU	Central Bank Independence, unweighted index	Romelli (2024)
LVAW	Central Bank Independence, weighted index	Romelli (2024)
CBIE Board	Subindex on governor and central bank board	Romelli (2024)
CBIE Policy	Subindex on monetary policy and conflict resolution	Romelli (2024)
CBIE Objective	Subindex on central bank objective	Romelli (2024)
CBIE Lending	Subindex on restrictions to lending to the government	Romelli (2024)
CBIE Finances	Subindex on financial independence	Romelli (2024)
CBIE Report	Subindex on accountability (reporting and disclosure)	Romelli (2024)
CRED	Average credibility is the extent to which the public expects policy outcomes to deviate from prior policy announcements; see Equation (3)	Weber et al. (1991)
DebtToGDP	Gross Public Debt,% of nominal GDP	IMF/World Bank
FixedExhRate	A dummy variable that takes the value of one in countries adopting a fixed exchange rate regime	Ilzetzki et al. (2019)
ERS	Index on Exchange Rate Stability	Reinhart and Rogoff (2004); Ilzetzki et al. (2019)
ITRegime	A dummy variable that takes the value of one in countries adopting an inflation-targeting strategy	Cobham (2021)
MTRegime	A dummy variable that takes the value of one in countries adopting a monetary-targeting strategy	Cobham (2021), Authors
CBIE_RegPress	Index measuring (regional) peer pressure on central banks.	Romelli (2022)
CBIE_reforms (CBIE_reversals)	Central bank reforms, as measured by a change of at least 4.6% (-3.6%) in the CBIE , take the value of 1 if the change in the CBIE index exceeds that threshold.	Authors
Polity2	An index that measures the difference between a country's democratic and autocratic scores, ranging from +10 (strongly democratic) to -10 (strongly autocratic).	Marshall (2020)

Democracy	A dummy variable that takes the value of one if the Polity2 score exceeds the threshold of 5.	Authors
SBC	A dummy variable that takes the value of one in the two years following a systemic banking crisis.	Laeven and Valencia (2020)
SCC	A dummy variable that takes the value of one in the two years following a currency crisis.	Laeven and Valencia (2020)
SDC	A dummy variable that takes the value of one in the two years following a systemic sovereign debt crisis.	Laeven and Valencia (2020)
MonetaryUnion	A dummy variable that takes the value of one in countries having joined a currency union.	Authors
EMU	A dummy variable that takes the value of one in countries having joined the European Economic and Monetary Union.(1)	Authors
TOR	Turnover rate of central bank governors over x prededing years, where x= 5 years in the baseline.	Authors
ZLB	A dummy variable that takes the value of one when policy rates in a country are negative.(2)	Authors

Notes: (1) In 1999, eleven European countries formed an Economic and Monetary Union. Founding members were Germany, France, Italy, Spain, Austria, Belgium, Luxembourg, the Netherlands, Portugal, Ireland, and Finland. Further joiners were Greece in 2001, Slovenia in 2007, Cyprus and Malta in 2008, Slovakia in 2009, Estonia in 2011, Latvia in 2014, Lithuania in 2015, and Croatia in 2023. (2) The dummy takes the value of one for euro area countries, Switzerland from 2014 to 2022, Denmark from 2013 to 2022, Sweden from 2015 to 2019, and Japan from 2016 to 2023.

Table A.3. Analyzed countries

Country	Year	Region	Country	Year	Region
Afghanistan	2006	ECA	Lebanon	1988	MNA
Albania	1994	ECA	Liberia	1974	AFR
Algeria	1972	AFR	Libya	1972	AFR
Angola	1997	AFR	Lithuania	2004	ECA
Antigua and Barbuda	1983	LAC	Luxembourg	1983	INL
Argentina	1972	LAC	Macao S.A.R	2000	EAP
Australia	1972	INL	Macedonia	1993	ECA
Austria	1972	INL	Malawi	1989	AFR
Azerbaijan	1996	ECA	Malaysia	1982	EAP
Bahrain	1980	MNA	Maldives	1982	SAS
Bangladesh	2003	SAS	Mali	1984	AFR
Belarus	1994	ECA	Malta	2006	INL
Belgium	1972	INL	Mauritania	1972	AFR
Benin	1972	AFR	Mauritius	1972	AFR
Bolivia	1972	LAC	Mexico	1972	LAC
Bosnia and Herzegovina	1997	ECA	Moldova	1992	ECA
Botswana	1976	AFR	Mongolia	1996	EAP
Brazil	1972	LAC	Montenegro	2005	ECA
Brunei	1999	EAP	Morocco	1972	AFR
Bulgaria	1991	ECA	Myanmar	1972	EAP
Burkina Faso	1972	AFR	Namibia	1990	AFR
Burundi	1972	AFR	Nepal	1972	SAS
Cambodia	1993	EAP	Netherlands	1972	INL
Cameroon	1972	AFR	New Zealand	1972	INL
Canada	1972	INL	Niger	1972	AFR
Central African Republic	1972	AFR	Nigeria	1972	AFR
Chad	1972	AFR	Norway	1972	INL
Chile	1972	LAL	Oman	2000	MNA
China	1995	EAP	Pakistan	1972	SAS
Colombia	1972	LAC	Panama	1972	LAC
Comoros	1987	AFR	Paraguay	1972	LAC
Costa Rica	1972	LAL	Peru	1972	LAC
Croatia	1999	ECA	Philippines	1972	EAP
Cyprus	2005	INL	Poland	1997	ECA
Czech Republic	1993	ECA	Portugal	1972	INL
Democratic Rep. of the Congo	1993	AFR	Qatar	1993	MNA
Denmark	1972	INL	Republic of Congo	1972	AFR
Dominica	1983	AFR	Romania	1991	ECA
Dominican Republic	1972	LAC	Russia	2001	ECA

Ecuador	1972	LAC	Rwanda	1997	AFR
Egypt	1972	AFR	Saint Kitts and Nevis	1983	LAC
Equatorial Guinea	1985	AFR	Saint Lucia	1983	LAC
Estonia	2008	ECA	St. Vincent and the Grenadines	1983	LAC
Ethiopia	1994	AFR	Saudi Arabia	1972	MNA
Finland	1972	INL	Senegal	1972	AFR
France	1972	INL	Seychelles	1986	AFR
Gabon	1972	AFR	Sierra Leone	1972	AFR
Gambia	1972	AFR	Singapore	1991	EAP
Georgia	1995	ECA	Slovakia	2005	ECA
Germany	1972	INL	Slovenia	2007	ECA
Ghana	1975	AFR	Somalia	1972	AFR
Greece	1980	INL	South Africa	1972	AFR
Grenada	1983	LAC	South Korea	1972	EAP
Guatemala	1972	LAC	Spain	1972	INL
Guinea-Bissau	1994	AFR	Sri Lanka	1972	SAS
Guinea	1997	AFR	Sweden	1972	INL
Haiti	1979	LAL	Switzerland	1972	INL
Hungary	1991	ECA	Thailand	1972	EAP
Iceland	1972	INL	The Bahamas	1974	LAC
India	1972	SAS	Togo	1972	AFR
Indonesia	1972	EAP	Trinidad and Tobago	1972	LAC
Iran	1972	MNA	Tunisia	1972	MNA
Iraq	1972	MNA	Turkey	1972	ECA
Ireland	1972	INL	Uganda	1972	AFR
Italy	1972	INL	Ukraine	1992	ECA
Ivory Coast	1972	AFR	United Arab Emirates	1980	MNA
Jamaica	1992	LAC	United Kingdom	1972	INL
Japan	1972	INL	United Republic of Tanzania	1972	AFR
Jordan	1976	MNA	United States of America	1972	INL
Kazakhstan	1993	ECA	Uruguay	1972	LAC
Kenya	1984	AFR	Uzbekistan	2013	ECA
Kuwait	1972	MNA	Vietnam	1992	EAP
Kyrgyzstan	1995	ECA	Yemen	1990	MNA
Laos	1995	EAP	Zambia	1972	AFR
Latvia	2010	ECA	Zimbabwe	1979	AFR

Note: The table reports information on the list of analyzed countries, the first year of joint data availability, and their regional cluster, i.e., AFR: Africa, EAP: East Asia and the Pacific, ECA: Eastern Europe and Central Asia, INL: Western Europe and other developed countries, LAC: Latin America and the Caribbean, MNA: the Middle East and the North of Africa, and SAS: South Asia.

Table A.4: Inflation goals by country

Country	Code	Inflation target	Assumption
Afghanistan	AFG	2.00	
Albania	ALB	3.00	
Algeria	DZA		2.00
Angola	AGO		9.00
Anguilla	AIA		2.00
Antigua and Barbuda	ATG		2.00
Argentina	ARG		5.00
Aruba	ABW		2.00
Australia	AUS	2.50	
Austria	AUT	2.00	
Azerbaijan	AZE	4.00	
Bahrain	BHR		2.00
Bangladesh	BGD	5.00	
Belarus	BLR	5.00	
Belgium	BEL	2.00	
Benin	BEN		2.00
Bolivia	BOL		2.00
Bosnia and Herzegovina	BIH		2.00
Botswana	BWA	4.50	
Brazil	BRA	3.75	
Brunei	BRN		2.00
Bulgaria	BGR		2.00
Burkina Faso	BFA		2.00
Burundi	BDI		2.00
Cambodia	KHM		5.00
Cameroon	CMR		2.00
Canada	CAN	2.00	
Central African Republic	CAF		2.00
Chad	TCD		2.00
Chile	CHL	3.00	
China	CHN	3.00	
Colombia	COL	3.00	
Comoros	COM		2.00
Costa Rica	CRI	3.00	
Croatia	HRV	2.00	
Cuba	CUB		2.00
Cyprus	CYP	2.00	
Czech Republic	CZE	2.00	

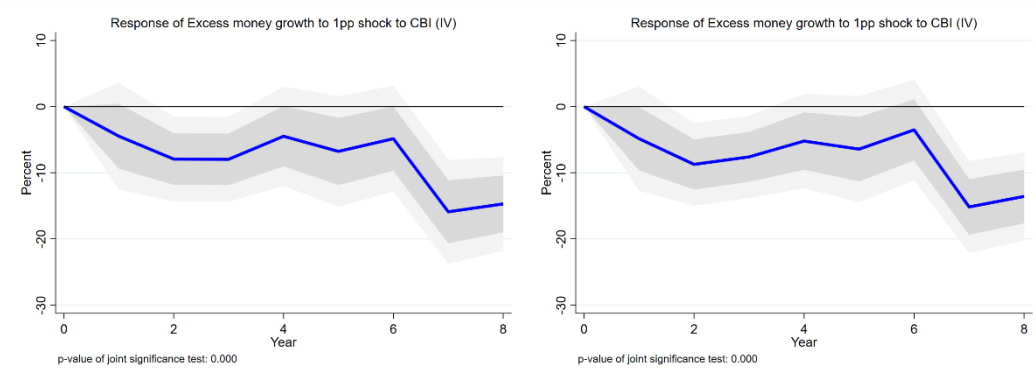
Democratic Republic of the Congo	ZAR	7.00	
Denmark	DNK		2.00
Dominica	DMA		2.00
Dominican Republic	DOM	4.00	
Ecuador	ECU		2.00
Egypt	EGY	7.00	
Equatorial Guinea	GNQ		
Estonia	EST	2.00	
Ethiopia	ETH		20.00
Euro Area		2.00	
Finland	FIN	2.00	
France	FRA	2.00	
Gabon	GAB		2.00
Gambia	GMB	2.00	
Georgia	GEO	3.00	
Germany	DEU	2.00	
Ghana	GHA	8.00	2.00
Greece	GRC	2.00	
Grenada	GRD		2.00
Guatemala	GTM	4.00	
Guinea	GIN		2.00
Guinea Bissau	GNB		2.00
Haiti	HTI		2.00
Hungary	HUN	3.00	
Iceland	ISL	2.50	
India	IND	4.00	
Indonesia	IDN	3.00	
Iran	IRN		12.00
Iraq	IRQ	2.00	
Ireland	IRL	2.00	
Italy	ITA	2.00	
Ivory Coast	CIV		2.00
Jamaica	JAM	5.00	
Japan	JPN	2.00	
Jordan	JOR	2.00	
Kazakhstan	KAZ	5.00	
Kenya	KEN	5.00	
Kuwait	KWT		2.00
Kyrgyzstan	KGZ	5.00	
Laos	LAO		9.00
Latvia	LVA	2.00	

Lebanon	LBN		2.00
Liberia	LBR	8.50	2.00
Libya	LBY		2.00
Lithuania	LTU	2.00	
Luxembourg	LUX	2.00	
Macao S.A.R	MAC		2.00
Macedonia	MKD		2.00
Malawi	MWI	5.00	
Malaysia	MYS		2.00
Maldives	MDV		2.00
Mali	MLI		2.00
Malta	MLT	2.00	
Mauritania	MRT		2.00
Mauritius	MUS	3.50	
Mexico	MEX	3.00	
Moldova	MDA	5.00	
Mongolia	MNG	6.00	
Montenegro	MNE		2.00
Morocco	MAR		2.00
Myanmar	MMR		2.00
Namibia	NAM		4.50
Nepal	NPL	6.00	
Netherlands	NLD	2.00	
New Zealand	NZL	2.00	
Niger	NER		2.00
Nigeria	NGA	6.00	2.00
Norway	NOR	2.00	
Oman	OMN	3.00	
Pakistan	PAK	6.00	
Panama	PAN		2.00
Paraguay	PRY	4.00	
Peru	PER	2.00	
Philippines	PHL	3.00	
Poland	POL	2.50	
Portugal	PRT	2.00	
Qatar	QAT		2.00
Republic of Congo	COG	7.00	
Romania	ROM	2.50	
Russia	RUS	4.00	
Rwanda	RWA	5.00	
Saint Kitts and Nevis	KNA		2.00

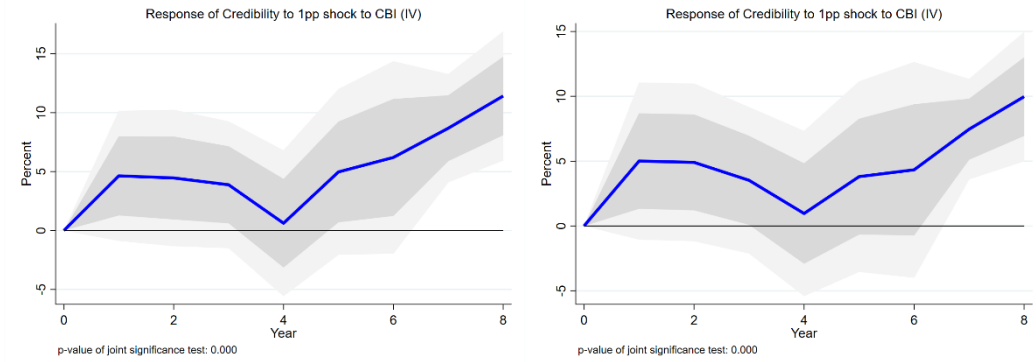
Saint Lucia	LCA		2.00
Saint Vincent and the Grenadines	VCT		2.00
Saudi Arabia	SAU		2.00
Senegal	SEN		2.00
Seychelles	SYC		2.00
Sierra Leone	SLE		2.00
Singapore	SGP	2.00	
Slovakia	SVK	2.00	
Slovenia	SVN	2.00	
Somalia	SOM		2.00
South Africa	ZAF	4.50	
South Korea	KOR	2.00	
Spain	ESP	2.00	
Sri Lanka	LKA	5.00	
Sweden	SWE	2.00	
Switzerland	CHE	2.00	
Taiwan	TWN	2.00	
Thailand	THA	2.00	
The Bahamas	BHS		2.00
Togo	TGO		2.00
Trinidad and Tobago	TTO	3.00	
Tunisia	TUN		2.00
Turkey	TUR	5.00	
Turkmenistan	TKM		
Uganda	UGA	5.00	
Ukraine	UKR	5.00	
United Arab Emirates	ARE		2.00
United Kingdom	GBR	2.00	
United Republic of Tanzania	TZA	5.00	
United States of America	USA	2.00	
Uruguay	URY	5.00	
Uzbekistan	UZB	5.00	
Venezuela	VEN		11.00
Vietnam	VNM	4.00	
Yemen	YEM	20.00	
Zambia	ZMB	7.00	
Zimbabwe	ZWE	5.00	

Figure A.1. Results from local projections, with CBI measures from Cukierman et al. (1992)

a) Monetary discipline

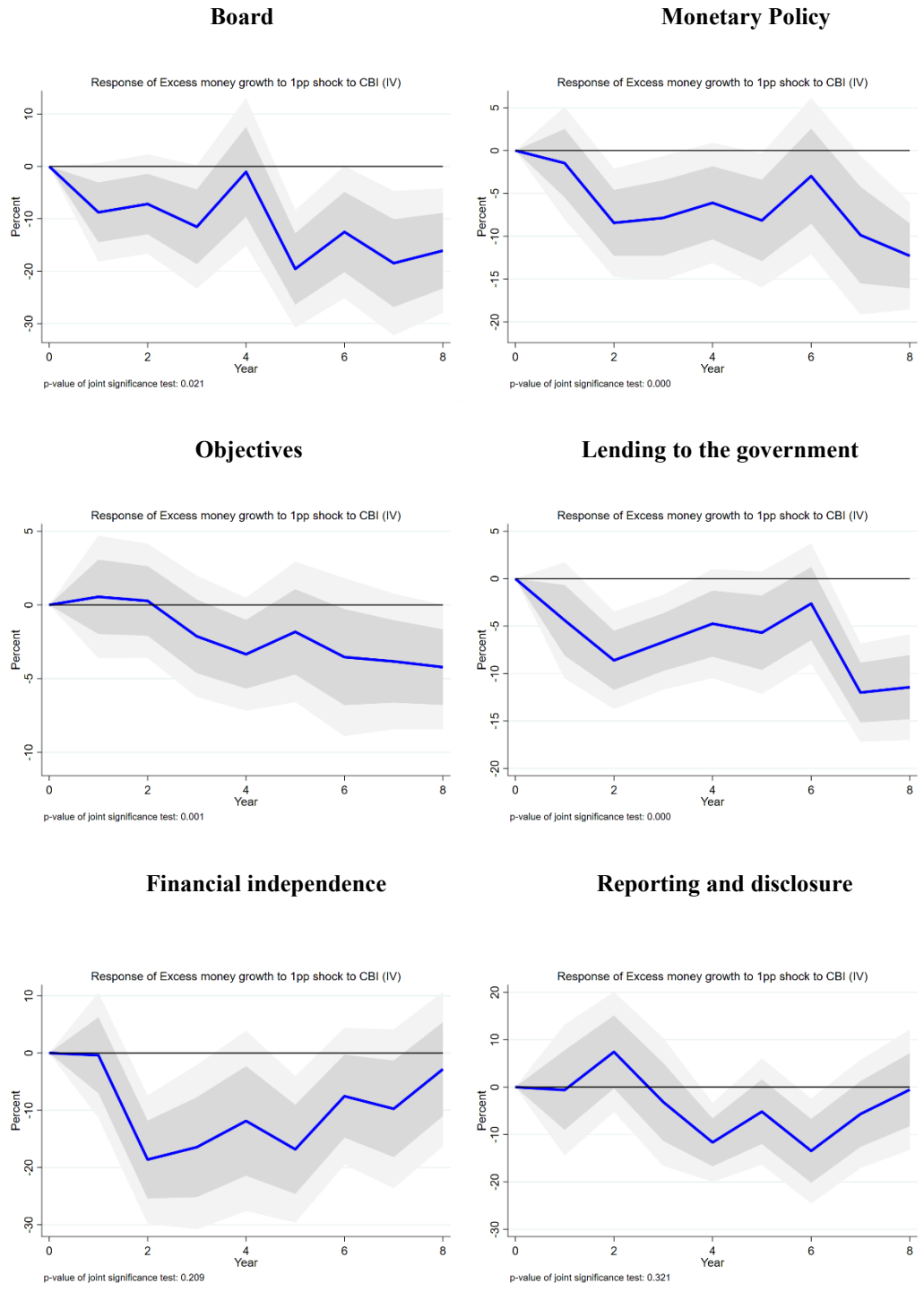


b) Credibility



Notes: The estimation of Equation 5 is for the sample 1972-2023 and for the CBI measure LVAW on the LHS and for the CBI measure LVAU on the RHS. Monetary discipline is measured by excess money growth (see Equation 1) and average credibility measures how much the public expects policy outcomes to deviate from prior policy announcements (see Equation 3). The confidence intervals are for 68% and 90%.

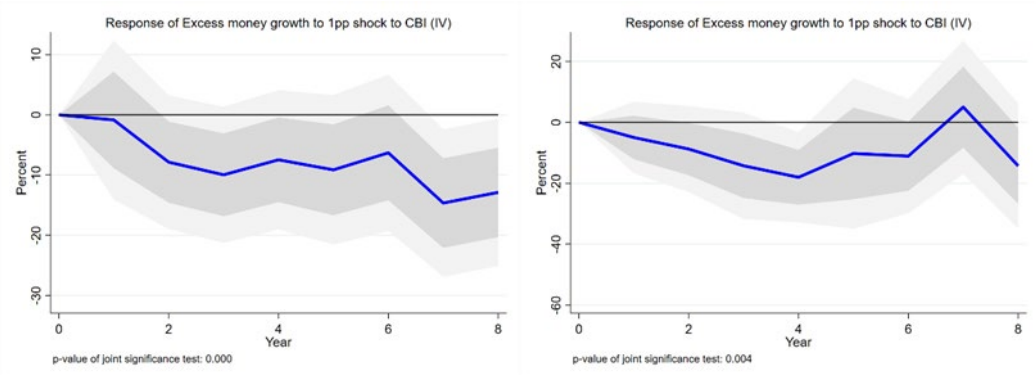
Figure A.2. Results from local projections: individual dimensions of the CBIE index



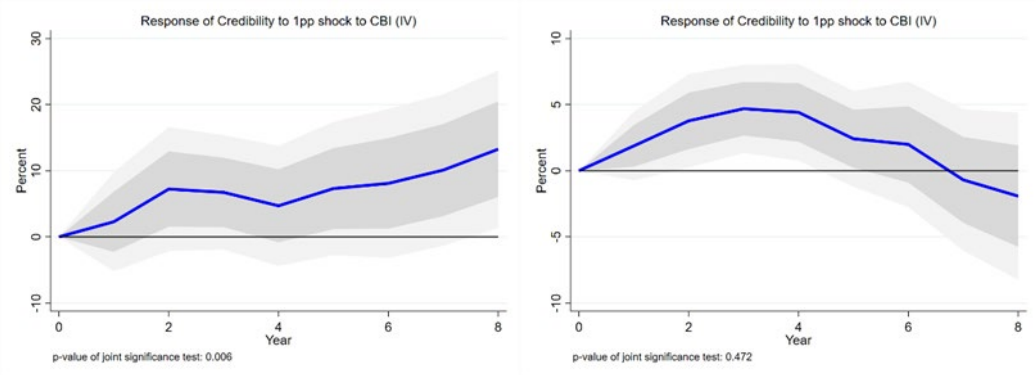
Notes: The estimation of Equation 5 is for the sample 1972-2023. The confidence intervals are for 68% and 90%. Outliers have been excluded. Board relates to governor and central bank board; Monetary policy: monetary policy and conflicts resolution. Objectives: monetary policy objectives. Lending to the government: limitations on lending to the government. Financial independence: financial independence. Reporting and disclosure: reporting and disclosure.

Figure A.3. Results from panel data local projections for de facto CBI: country groups

a) Monetary discipline



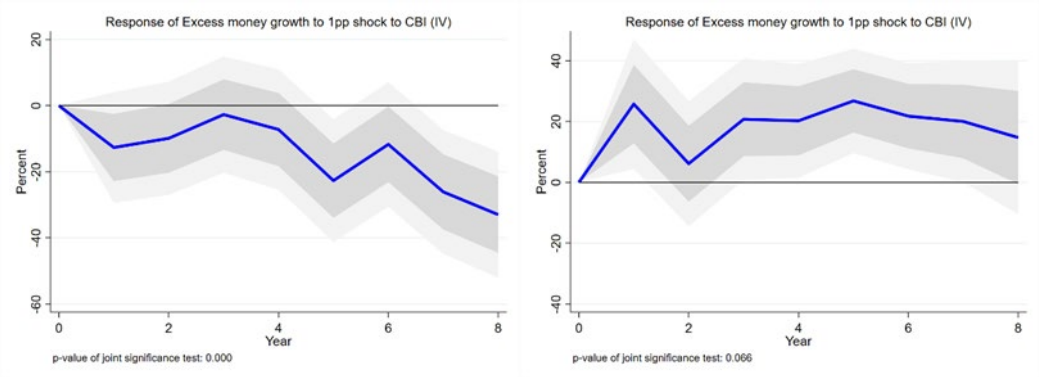
b) Credibility



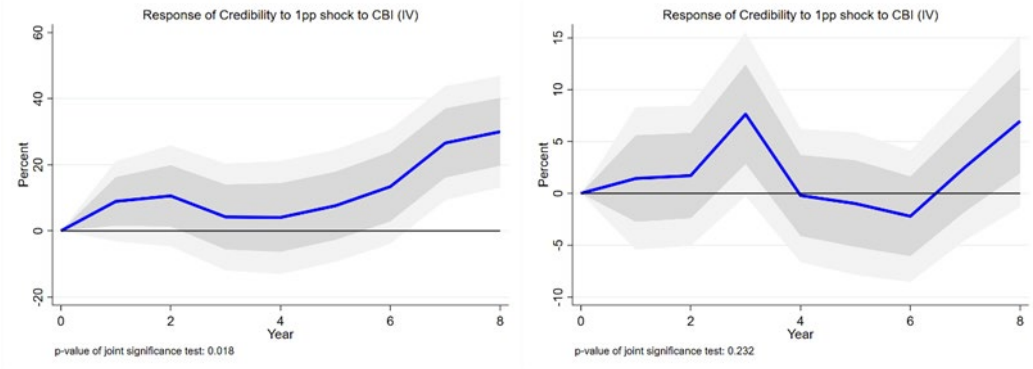
Notes: The estimation of Equation 5 is for the sample 1972-2023. The confidence intervals are for 68% and 90%. The LHS charts are for emerging market and developing countries and the RHS charts for advanced countries. Regional peer pressure is used as the instrument for LP-IV. Outliers have been excluded.

Figure A.4. Results from panel data local projections for de facto CBI: Low versus high CBIE

a) Monetary discipline



b) Credibility

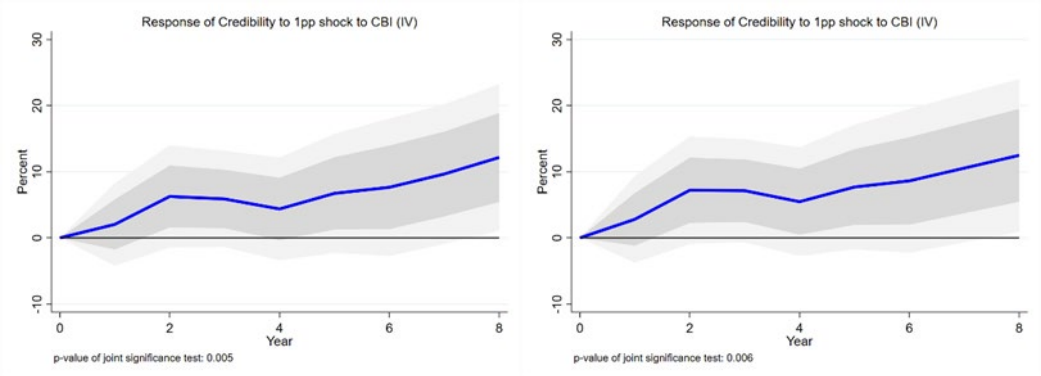


Notes: The estimation of Equation 5 is for the sample 1972-2023. The confidence intervals are for 68% and 90%. The LHS charts are for countries with lower levels of the CBIE (below 0.75) and the RHS charts for countries with high levels (equal or above 0.75). Regional peer pressure is used as the instrument for LP-IV. Outliers have been excluded.

Figure A.5. Results from panel data local projections for de facto CBI: Non-linearities

a) Monetary discipline

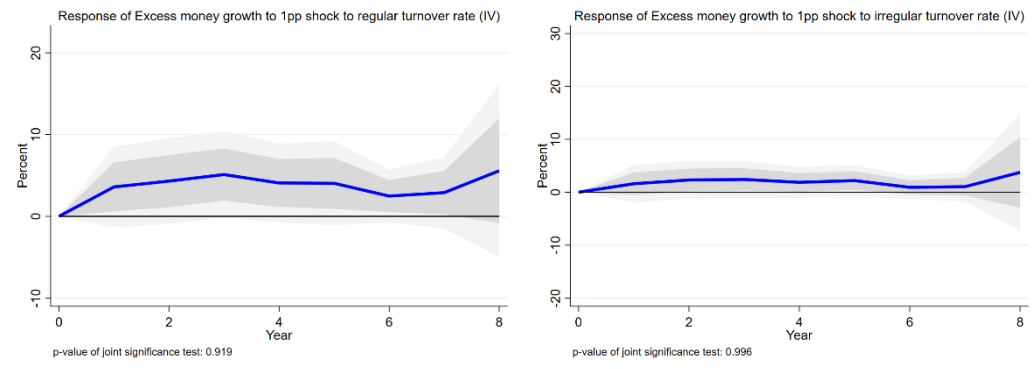
b) Credibility



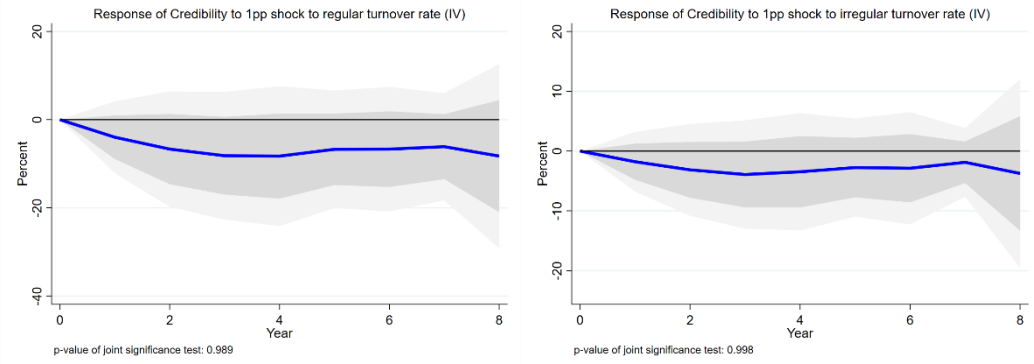
Notes: The estimation is for the sample 1972-2023. The confidence intervals are for 68% and 90%. The LHS charts show the results with an interaction of CBIE*dCBIE and the RHS charts show the results if a quadratic term $dCBIE^2$ is added to Equation 5. Regional peer pressure is used as the instrument for LP-IV. Outliers have been excluded.

Figure A.6. Results from panel data local projections for de facto CBI

a) Monetary discipline



b) Credibility



Notes: The estimation of Equation 5 is for the sample 1972-2023. The confidence intervals are for 68% and 90%. The LHS charts show the results for the regular turnover rate measures of de facto CBI and the RHS charts show the results for the irregular turnover rate measures de facto CBI with a rolling window of five years. Outliers have been excluded.

Figure A.7. Results from panel data local projections for legal CBI – credit supply

Notes: The estimation of Equation 5 is for the sample 1972-2023. The confidence intervals are for 68% and 90%. The charts show excess credit growth derived from private credit to the non-financial sector (see Equation 2). Regional peer pressure is used as the instrument for LP-IV. Outliers have been excluded.