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Fiscal Determinants of Central Bank Credibility: Evidence on Inflation-Targeting Economies

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Abstract

This paper studies the main fiscal determinants of central bank credibility (CBC) from 1990 to 2014. Covering 25 inflation-targeting (IT) economies, we have mainly focused on sovereign debt holders and fiscal rules since adopting the IT framework. As the CBC indicator is highly concentrated in the right tail of the distribution, the mean-based approaches are incapable of unearthing the fact that the effect of fiscal factors may be asymmetric across the distribution of the credibility index. In departing from the problem, we use a quantile regression method to estimate parameters over the entire conditional distribution of CBC. The asymmetric response using the quantile regression is state-dependent and conditional on the credibility distribution. Having provided a comprehensive survey on the fiscal factors potentially related to the credibility in the literature, we find that fiscal rules are almost prominent at the lower quantiles while debt holders' composition is strongly significant at the upper tails of CBC distribution. These findings are further supported by the slope equality tests, discussed in [Koenker & Bassett \(1982\)](#). These results could be attributed to the more sensitivity of the private sector expectations to the debt holders' composition. Therefore, central bankers could reduce public expectations by taking into account the non-linear impact of fiscal factors on their credibility.

Highlights

- Fiscal determinants of central bank credibility are examined in 25 IT countries.
- A Quantile Regression is capable to capture the asymmetric effect of fiscal factors on credibility.
- Fiscal rules are almost prominent at the lower quantiles.
- Debt holders' composition is strongly significant at the upper tails of credibility distribution.

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1. Introduction

Since the 1990s, many central banks have performed extensive reforms of their monetary frameworks, such as inflation-targeting (IT), to contribute a lower and more stable inflation rate (Amato & Gerlach, 2002). Under IT, central banks are mandated to keep inflation closer to desirable levels by raising credibility. Over the last thirty years or so, the concept of credibility has become a central concern for monetary economy researchers. Although the concept of credibility has been deeply considered in the seminal papers of Cukierman and Meltzer (1986) and Blinder (1998, 2000), the debate over central bank credibility has remained in two main questions: What measures central bank credibility (CBC)? And what determinants the CBC? To address the first question and according to Leveuge et al. (2018), a central bank is credible if people believe that the monetary authority has the willingness and strength to meet the previously announced inflation target¹.

Furthermore, a credible central bank, on top of being attitude-inducing and willing as defined above, should have the ability. Beyond a strong rationale for internal factors and some beliefs in a central bank's ability to meet the announced target, some have argued that deeper external-specific factors determine whether a central bank can reach and enforce the announced target. These exogenous forces are reflected like political literature which ultimately affect the level of the public's belief, expectations, and attitude toward the central bank's ability. According to this argument and in the case of the latter question, undoubtedly, the most powerful main determinants of CBC are generally nested in its political economy literature, including fiscal aspects such as public debt, sovereign debt holders composition, and fiscal rules (FR). The dominant view is that all constraints at the core of policy-making effectively bind the public's attitude. Taking as our point of departure the CBC that is the public's attitude about the central bank's ability, the analysis below contributes to lines of academic inquiry.

First, only a few studies investigate political determinants of CBC (Kamal, 2022) and most empirical studies do not explicitly take political literature into account. However, the bulk of the research focuses on the political economy of the CBI, fiscal policies, and democratic policymaking². The CBI in democracies limits government actions because of the presence of political opposition. Besides being more disciplinarian (printing less money), this outcome is directly echoed in lower money supply growth and guarantees a more robust money demand by declining inflation expectations. (Bodea & Hicks, 2015). After the financial crisis, FRs have been successively considered too rigid to support the recovery and limit the government deficit to restore severely eroded credibility.

¹ Based on this statement, three main kinds of credibility measures have been developed in the literature (see Section 2).

² See e.g. Cukierman et al., 1992; Grilli et al., 1991; De Haan & Eijnger, 2016; Burkovskaya, 2019 for CBI; Kopits & Symansky, 1998; Schuknecht, 2004; Alesina & Passalacqua, 2015; Beetsma et al., 2018; Debrun & Jonung, 2019 for fiscal policies; Drazen, 2002; for CBI and democracy.

Second, as we use a forward-looking measure of credibility which is highly concentrated in the right tail of the distribution, the mean-based approaches are an incomplete description of CBC reaction when the parameters are not uniform over the conditional distribution of the CBC. In departing from the problem, we use a Quantile Regression (QR) approach to estimate the whole conditional distribution of credibility. Thus, this paper seeks to fill these voids by providing evidence in the context of the fiscal determinants of CBC using the QR method to offer a broad perspective on the asymmetric effect of fiscal factors on CBC in a sample of 25 IT economies during 1990-2014. To realize this notion, the paper is organized as follows. Section Two provides an outline of the existing measures of central bank credibility. Section Three discusses how fiscal determinants (including public debt, debt holders and fiscal rules) affect the public's attitude. Section Four provides data. Section Five analyses empirical results of the QR method, and section Six discusses and concludes.

2. Central Bank Credibility and Existing Measures

Three main types of credibility measures have been extended in the literature (Taghinejadomran & Kamal, 2021). The first refers to the Bomfim and Rudebusch (2000) index. In this index, long-run inflation expectations ($\pi_{\infty|t}^e$) are determined as a weighted average of the current inflation target and the past inflation rates over α periods ($\bar{\pi}_{t-\alpha} = \pi_{t-1} + \dots + \pi_{t-\alpha}$)/ α :

$$\pi_{\infty|t}^e = \lambda \hat{\pi}_t + (1 - \lambda) \bar{\pi}_{t-\alpha}, \quad (1)$$

where the parameter λ measures the central bank credibility, meaning that the higher λ , the higher the attached weight to the target, and as a result, the higher the central bank credibility will be. If $\lambda=1$ the central bank is full credible and private sector's inflation expectations are equal to the announced target. On the contrary, If $\lambda=0$, there is no credibility at all and the inflation target is ignored by economic agents when forming their expectations³.

The second type of credibility measure refers to the backward-looking version of Neuenkirch and Tillmann (2014) where future inflation expectations $\pi_{t|T}^e$ are a weighted sum of the inflation target $\hat{\pi}$ (a rational expectations element) and a non-rational component $(\bar{\pi}_{t-\alpha} - \hat{\pi})|\bar{\pi}_{t-\alpha} - \hat{\pi}|$:

$$\pi_{t|T}^e = \hat{\pi}_t + \delta(\bar{\pi}_{t-\alpha} - \hat{\pi})|\bar{\pi}_{t-\alpha} - \hat{\pi}| \quad (2)$$

$CR_{NT} = (\bar{\pi}_{t-\alpha} - \hat{\pi})|\bar{\pi}_{t-\alpha} - \hat{\pi}|$ is a central bank credibility index ($-1 \leq CR_{NT} \leq 1$), describing that how the average of past deviations from the inflation target affects the current level of credibility and inflation expectations.

The third type of measures refers to the forward-looking measure which is the gap between inflation expectations and the inflation target⁴. In the newest forward-looking measure of Leveuge et al. (2018), any deviation of expectations

³ Two shortcomings in this approach driven by the following restrictions: first, if agents are heterogeneous, λ would be a fraction of the population believing that the target will be achieved. Second, λ is a time-invariant parameter in this approach.

⁴ This index developed by Cecchetti and Krause (2002), De Mendonca (2007), and Leveuge et al. (2018).

from the target is considered as a loss of central bank credibility. Taking values from 0 (no credibility) to 1 (full credibility), it is specified as follows:

$$CR_{LLR} = \frac{1}{\exp(\hat{\pi}^e) - \hat{\pi}^e} \quad (3)$$

where $\hat{\pi}^e$ denotes deviation between the expected inflation (π^e) and the target $\hat{\pi}$. [Levieuge et al. \(2018\)](#) argue that negative and positive deviations of the expected inflation from the target should not be considered equal in terms of credibility⁵. In other words, a negative deviation indicates that credibility is compromised, while any positive deviation signals a higher loss in credibility than an equal negative one.

3. Fiscal Determinants

The early 1990s, not only central banks have successfully kept inflation expectations anchored to the target, but central governments also started to show interest in rules-based fiscal policy as more countries felt the need to reduce their public debt ([Budina et al., 2012](#); [Debrun & Jonung, 2019](#)). [Combes et al. \(2018\)](#) argue that the significant cross-effect exists between IT and fiscal enforcement as IT strengthens fiscal performance. Broadly, more disciplined macroeconomic policies are associated with the combination of FR and IT than if only one of these institutions performs. Since the beginning of the financial crisis in 2008, particularly advanced countries have experienced a rising level of public debt due to fiscal levers and falling tax revenues. Once the government's debt is adjusted to a higher level and the public doubt the central bank's independence, the future expected inflation will incorporate a risk premium for inflation. These would negatively affect the private sector, later on, to reduce CBC back to a lower level ([Krause Stéphane Moyen, 2013](#)). Thus, the behavior of the long-term inflation, inflation's expectation, the public's attitude about CBC, and how expected inflation itself evolves depends crucially on the level of debt and the structure of holders.

3.1 Sovereign Debt and Holders Composition

To consider the main determinants of CBC, in this section, we focus on the level of public debt and holders' structure - broken down by central banks, domestic banks, domestic non-banks, and foreign banks - to glean broad common patterns in changes in debt structure during periods of IT adoption date up to 2019.⁶

To raise some political considerations in the importance of the central bank's role in the context of ongoing government debt, we offer IT country case studies

⁵ The main property of this index, as we use this one in our paper, rather than previous indicators is that the credibility is non-linear function of the gap between expected inflation and the target.

⁶ To address the significant role of the IT framework on the level of public debt and its holders, we split our analysis (following [Abbas et al., 2014](#)) into 4 Tables. Tables 1, 2 and 3 investigate the public debt and the holders' structure over a period from the beginning of the adopted IT framework. The change of public debt level, holders structure and inflation rate from the start date of adoption of IT up to 2019 are also reported in Table 4.

to shed further light on interactions between the debt level, changes in Debt-to-GDP ratio, and holders of the central government debt. The debt reductions' heterogeneity has been marked during the second moderation period⁷ in Table 1. In this period, the government debt ratio has risen in a few emerging countries (Colombia, Czech Republic, Hungary, Mexico, Poland, and South Korea) which are increasingly held by domestic and domestic non-banks. In comparison, United Kingdom is the only advanced country that has seen a lift in the debt level. It is worth noting that although the share of central bank holdings has heavily dropped in both groups of countries, the extent of decline for advanced central banks was mainly greater than emerging ones⁸. However, despite the IT adoption, the central bank holding ratio of Armenia, Brazil, Israel, Thailand, and Uruguay has significantly increased about above 20 percent (Table 1 in Appendix).

As Table 2 in Appendix illustrates, there is a clear rise in the share of the banking system's holdings especially in advanced economies. This confirms that the great recession has significantly elevated the level of government debt in our sample. The emerging data suggest a pattern of holder substitutions, meaning that central banks usually take up from the foreign banks and domestic non-bank sectors during the crisis period. The mechanism is interpreted as suggesting a trade-off. A rise in the share of a given holder (e.g., central bank) has to be matched by a decline in the share(s) of the other holder(s). The increase in the share of central bank holdings in some advanced countries has been a remarkable change in debt composition during the post-great recession⁹. Note that such a notable lift has been a by-product of independent central banks' shots to deter intense deflation rather than to ease the task of ensuring fiscal sustainability¹⁰. However, if sovereigns lean on the central bank's continued injection, the private sector will doubt the CBI and this is the point that credibility may be jeopardized.

Table 2 reports a demand shift and clearly shows the dramatic drop in emerging central banks holding and shift toward the foreign ownership of sovereign debt. As [Bordo et al. \(2005\)](#) emphasize, major external shocks and financial innovation, globalization, and pressure to reduce inflation¹¹ are key explanations for important changes in sovereign debt holdings. However, holding sovereign debt by central banks has varied across emerging countries over time. For instance, the increased debt from the great recession onward has been typically more absorbed by the central banks of Guatemala, Peru, South Africa (see Table 2), and Colombia (see Table 3) than the domestic non-bank sector.

Appendix Table 4 and Figure 1 reveal that emerging and advanced countries pursue two broad types of debt trends and holders strategies since adopting the IT framework. Emerging economies rely on domestic and domestic non-bank holders, while advanced economies count on central banks. Nevertheless, it bears

⁷ From IT adoption date up to the financial crisis.

⁸ 42 percentage-point drop against 26 percentage.

⁹ Quite the opposite with emerging economies.

¹⁰ See Table 2 for the United Kingdom and Australia, and Table 3 for Sweden.

¹¹ From the observed hyperinflation in the 1970s.

asking how the level of public debt and the share of holders influence on public's attitude? Do formal constraints on fiscal discretion affect the CBC?.

3.2 Sovereign Debt, Holders Composition and Rules-Based Fiscal

Combes et al. (2018) discuss that the combined effect of IT and FR on inflation tends to be greater than when only one of those performs. This is often because a well-designed FR is associated with greater fiscal discipline and higher impact on the public's belief. They analyse a broad panel of advanced and developing countries over the period 1990–2009. Findings show that adopting IT might aggravate conflicts between monetary and fiscal authorities; However, restricting fiscal policy to FR and monetary policy framework to IT may be a better-coordinated policy in line with price stability, fiscal discipline, and control of the expected inflation¹².

In general, FR affect the macroeconomy by anchoring expectations on the sustainable course of future policies. Besides, rules constrain the behavior of governments and convince the public and markets that sovereigns and central banks ensure commitment to the announced targets. But this expectation can only materialise if implementation is unconditional and the CBI takes carefully into account (Schuknecht, 2004). Over the past half century, many countries incorporated fiscal constraints including budget balance rules (BBR), debt rules (DR), expenditure rules (ER) and revenue rules (RR)¹³. Since the effect of political and fiscal institutions on the monetary authority credibility cannot be studied in isolation from one another, Figure 2 shows the frequency of countries¹⁴ by type of FR (BBR¹⁵, DR¹⁶, ER¹⁷, RR). As Figure 2 captures, BBR is the main variable among FR. Because it is most closely linked to the debt ratio, easy to monitor, and seen to be the key element determining performance. In general, applied rules stabilize the macroeconomy by limiting the government borrowing

¹² Note that a high public debt increases the temptation of government to repudiate its debt. This action along with a combination of low fiscal discipline and low monetary credibility would shed doubt on the public's belief about the ability of central bank (De Mendonça & Tostes, 2015).

¹³ Rule-based fiscal frameworks increasingly have proliferated the early 1990s as several countries decided to formally accept the IT framework (see e.g. Wyplosz, 2005; Wren-Lewis, 2013; Combes et al., 2018; Ardanaz et al., 2021). Basically, sovereigns set FR at their stabilization programs to avoid large fiscal deficits and public debts (Debrun & Jonung, 2019). According to historical experiences, a growing number of countries including Germany, Italy, Japan, the Netherlands, the United States, Canada and various Latin American were subjected to legislated multiple rules to avoid large fiscal deficits accumulated from the mid- nineteenth century onward (see Cottarelli, 2009).

¹⁴ Including 19 emerging and 6 advanced economies. As Fig. 2 depicts, a significant proportion of about 68 percent of IT countries have approved BBR, and also a similar percentage of 52 percent of those economies adopted DR and ER. However, only one central government (Australia) started to show interest in RR policy since 1990s.

¹⁵ Emerging countries: Chile, Colombia, Czech Republic, Hungary, Indonesia, Israel, Mexico, Peru, Poland, Romania, Uruguay Advanced countries: Australia, Canada, New Zealand, Norway, Sweden, United Kingdom.

¹⁶ Emerging countries: Armenia, Brazil, Czech Republic, Hungary, Indonesia, Peru, Poland, Romania Advanced countries: Australia, Canada, New Zealand, Sweden, United Kingdom.

¹⁷ Emerging countries: Brazil, Colombia, Czech Republic, Hungary, Israel, Mexico, Peru, Poland, Romania Advanced countries: Australia, Canada, Sweden, United Kingdom.

from all domestic sources and removing the main source of base-money creation and inflation (Schuknecht, 2004; Cottarelli, 2009).

Among 25 IT economies with national FR, only Israel, Indonesia, New Zealand, and Norway countries were able to deal with the great recession¹⁸. The level of sovereign debt, central bank holdings, and the inflation rate in mentioned countries have increasingly declined as a result of the adoption of IT framework and more formal fiscal rules¹⁹. Based on Table 4, the large reduction in the public debt, central bank holding, and inflation ratios by 41, 50, and 73 percent (respectively) from 1990 to 2019 confirm stabilizing effects of balance rules under FRA (Fiscal Responsibility Act)²⁰ in New Zealand. Indonesia's rules, as seen in Table 4, have also provided a remarkable degree of fiscal discipline for over 15 years by disallowing domestic financing of budget deficits. Adjusted budget balance along with the adoption of the IT framework has provided the scope to reduce the level of public debt, central bank holdings ratio, and the inflation rate by about 32, 61, and 71 percent, respectively.

As fiscal rules are expected to mitigate the public debt and positively affect the CBC, it is notable to mention that political economy incentives and the level of CBI strongly impact the enforcement of rules. In other words, an ex-ante fiscal adjustment may be announced by governments, but ex-post governments may want to renege on those promises for economic or political reasons. An upward spike in inflation (11 percent) was correlated with an increase in the share central bank's holdings when advanced sovereigns began to release more debt. Several economic and political frictions can explain such distortions and the resulting deficit bias. From a debt bias perspective, the above analysis implies that governments may prefer to raise their spending under all circumstances because of some political incentives. First, in addition to the financial crisis (see Figure 1), concerns about the electoral prospect are potentially led governments to pay insufficient attention to longer-term requirements and opportunistically raise the spending to increase re-election chances (Debrun & Kumar, 2007). Second, in an insufficient political commitment or without adequate prerequisites, adopted rules may not be able to pursue a discipline policy (Blanchard & Giavazzi, 2004). On the central bank side, the one notable change in debt composition has been the increase in the share of domestic and the central bank's holdings in advanced

¹⁸ Such outstanding success has reached out through building flexibility into numerical constraints, time-frame for adjustment, and/or escape clauses (Table 4).

¹⁹ For instance, fiscal rules in Indonesia are included in the Guidelines for State Policy. Interestingly, the ministry of finance within the executive branch exercises both enforcement and monitoring of the rules. In New Zealand, a formal requirement in Fiscal Responsibility Act (FRA) ensures a high degree of transparency by binding both the minister of finance and the secretary of the treasury. While all legislated rules are intended to apply strictly and permanently (for consecutive governments), those are, in practice, open to some interpretation, revision, suspension, or abolition given the economic and political situation (Kopits & Symansky, 1998; Cottarelli, 2009).

²⁰ FRA (1994) sets out the principles for responsible fiscal management including maintenance of a balanced operating budget.

countries²¹. However, this increase seems to be a by-product of an independent central bankers' attempt to prevent severe deflation²².

Furthermore, political institutions play a significant role in addressing the relationship between CBI and fiscal policies (Debrun & Jonung, 2019; Strong & Yayi, 2021). This correlation in a democratic system asserts that the CBI may constrain fiscal policies because of having a deterrent effect on fiscal overspending. Central banks in a democratic system not only have a delegated authority to achieve their legally mandated objective(s), but they also have the instrument independence to reach them. In this case, central banks are protected from what Sargent and Wallace (1981) call a regime of fiscal dominance (Mishkin, 2011).

Following Sargent and Wallace (1981), Leeper (1991) provides some evidence about interactions between central banks and fiscal authorities. He argues that under fiscal dominance and the PMAF²³ regime, the higher the debt levels, the higher the inflation rate will be. However, the recent financial crisis has put much more pressure on central banks and changed monetary policy framework²⁴. As shown in Tables 2-4, the threat of fiscal dominance might be more significant in the advanced world as they remarkably have heavy increases in sovereign debt levels. In the depth of the recession, the financial crisis not only pushed short-term nominal interest rates to their effective lower bound but also rendered the traditional policy instrument almost useless. In such a circumstance, many central banks turned to unconventional monetary policies such as forward guidance, quantitative easing, and/or lending to banks and sometimes to non-banks to hold the huge volume of the sovereign debt (see Tables 2 and 3). In all cases, their indirect support from the government would increase the expected inflation and undermine the CBC.

4. Data

Given mentioned characteristics of political economy settings, a set of key drivers are taken into account to capture the fiscal determinants of the CBC. We construct a data set describing two main fiscal determinant groups of CBC, such as debt holders and FR for 25²⁵ IT countries, observed from 1990 to 2014²⁶. In this study, the endogenous variable is a CBC index as suggested by Leveuge et al. (2018). The indicator is in line with Cukierman and Meltzer (1986),

²¹ See Table 4 and Fig. 1.

²² From -1 percent in 1998 to 2 percent in 2019 in Sweden.

²³ Under the passive monetary, active fiscal policy (PMAF) regime, fiscal policy no longer fully stabilizes government debt and the monetary policy is no longer able to fully control inflation (see Leeper, 1991).

²⁴ Bradley, in a global debt hangover environment, the higher public debt level tempts fiscal authorities to rely on monetary policy to generate additional inflation and alleviate the debt burden (De Haan & Eijffinger, 2016).

²⁵ According to this classification, our sample of IT economies is composed of Albania, Armenia, Australia, Brazil, Canada, Chile, Colombia, Czech Republic, Guatemala, Hungary, Indonesia, Israel, Mexico, New Zealand, Norway, Peru, Poland, Romania, South Africa, South Korea, Sweden, Thailand, Turkey, United Kingdom, and Uruguay.

²⁶ Based on data availability for expected inflation.

introducing that credibility can be viewed as a non-linear measure of the difference between the private-sector inflation expectations and the announced policy target. Concerning inflation expectations, we use the forecast survey dataset provided by Consensus Economics, gathering forecasts of professional analysts for a large sample of macroeconomic variables.

In the case of independent variables, the debt holders' composition data, broken down by Central bank, Domestic bank, Domestic non-bank, and Foreign bank, were gathered from the Monetary and Capital Markets Department published by International Monetary Fund (IMF). Concerning FR variables, we use the data from IMF. FR dummies will take the value 1 as a country placed a numerical constraint on fiscal aggregates at the national level in a given year. Additional to the main determinants, we consider three control variables to capture other factors considered in the literature. The variables refer to the economic structure and the macroeconomic performance, including pegged exchange rate regime, inflation rate, and the trade openness index. Regarding exchange rate, we think that countries with pegged exchange rate arrangements are relatively less resilient to exchange rate fluctuations and thus less likely to be credible their central bank. The International Monetary Fund's Annual Report on Exchange Arrangements and Exchange Restrictions (1990-2019) presents information on exchange rate regimes. We classified countries according to those that adopt some form of a nominal pegged exchange rate (=1) and those that do not. We also use the inflation rate gathered from WDI as a control variable as the higher the inflation rate, the higher the expected inflation, and as a result, the lower the credibility. Finally, trade openness is a proxy for exposure degree to external shocks measured by the ratio of exports plus imports to GDP. According to Romer (1993) and Lane (1997), the larger the degree of openness, the weaker the incentives for policymakers to generate an inflationary bias, and thus higher credibility will be.

5. Empirical Results

5.1 Regression Analysis

The principal objective of our empirical analysis is to identify the main fiscal determinants to boost the extent of the CBC in IT countries. Therefore, first of all, we evaluate the effect of the first group of fiscal determinants given as follows:

$$CBC_{it} = \beta_0 + \beta_1 Holders_{it} + \beta_2 X_{it} + u_{it} \quad (4)$$

CBC_{it} is a credibility index and $Holders_{it}$ include the vector of all sovereign debt holders. X_{it} denotes the vector of control variables, the subscripts i and t describe the country and year, respectively and β_0 refers to the constant term.

Following Abbas et al. (2014), we examine how the composition of debt holders, broken down by central banks, domestic banks, domestic non-banks and foreign banks affect the credibility.

Equation 5 shows the effect of FR on CBC, where FR_{it} is fiscal rules, broken down by ER, BBR, RR, and DR:

$$CBC_{it} = \beta_3 + \beta_4 FR_{it} + \beta_5 X_{it} + v_{it} \quad (5)$$

The empirical evidence in Table 5 relies primarily on data for the 1990–2014 period. Regressions are estimated via fixed effects²⁷. Across specifications, all types of debt holdings, as expected in Eq. 4, have statistically significant and negative impacts on credibility. An increase in the central bank's holding ratio is not a free lunch and involves significantly economically costs. In other words, an increase in sovereign debt and an uptick in the central bank holdings will boost inflation expectations. In this circumstance, private sectors are strongly sure about the political interference and fiscal dominants, which can negatively affect the public's attitude toward the central bank's ability. In particular, the risk of monetarization of the public debt is relevant in the IT environment because it can trigger a process of expected inflation and drop credibility (De Mendonça & Tostes, 2015). On the other fiscal group, none of the FR has a significant effect on CBC except BBR (at the significance level of 10 percent). As previously mentioned, BBR has been designed to tie policymakers' hands and not the mere existence of rules (Combes et al., 2018). The use of BBR points to the bilateral objectives of downsizing government size and giving more attention to the rule's stabilization attributes.

5.2 Quantile Regressions

Figure 3 plots the histogram of the outcome and highlights the considerable heterogeneity in CBC distribution. This plot provides a graphical summary of the distribution of credibility covering the 1990–2014 period. Although the credibility is distributed across the whole spectrum of index values, which vary between 0 and 1, the CBC is highly concentrated in the right tail of the distribution.

Although all significant coefficients in Table 5 have the expected sign, note that none of the regressions examined so far make any allowance for the fact that their impacts may not be symmetric across the distribution of the outcome. This means that the coefficients might differ between those central bankers who have high and those who have low credibility. To address that effect, we estimate a series of quantile regressions to evaluate the effect of all mentioned determinants across various percentiles of the credibility distribution. The QR approach introduced by Koenker and Bassett (1978) seeks to estimate how the conditional quantiles of outcome (CBC) are influenced by the interest variables (fiscal determinants) through a richer analysis of the statistical relationship among covariates (Koenker & Hallock, 2001; Siklos, 2008; Christelis et al., 2020). To deliver this notion, following Siklos (2008) all regressions (4 and 5) are fitted for various quantiles such as (0.25, 0.50, 0.75, and 0.95) as follows:

$$Q_{cbc}(q|Holders) = \gamma_0 + \gamma_1 Holders_{it} + \gamma_2 X_{it} + F_u^{-1}(q) \quad (6)$$

$$Q_{cbc}(q|FR) = \gamma_3 + \gamma_4 FR_{it} + \gamma_5 X_{it} + F_u^{-1}(q) \quad (7)$$

where F_u denotes the joint distribution function of the errors, q is the quantile, and all other terms have previously been defined.

²⁷ As shown in Table 5, F limer test rejects pooled data in favor of panel and Hausman test also rejects random effect in favor of fixed effect at the significant level of 1 and 5 percent, respectively.

Figure 4 illustrates the basic idea of a quantile analysis of the fiscal determinants of credibility. Superimposed on the plot are four estimated quantile regression scatters corresponding to the quantiles 0.25 (1), 0.5(2), 0.75(3), and 0.95(4). The median $q=0.5$ fit is indicated by the red plus, the lower quantile (25 percent) shown by (1) plotted by the circle, and the upper tails (0.75 and 0.95) of the CBC captured by times and triangular signs. The space of the quantile regression scatters on the panel reveals that the conditional distribution of the credibility index skewed to the left. The narrower spacing of the upper quantiles denotes high density with a short upper tail, and the wider spacing of the lower quantiles indicates a lower density with a longer lower tail. The conditional median and other quantiles confirm that the least square fit provides a relatively poor estimate of the conditional mean in the sample.

Appendix Table 6 and Figure 5 report quantile regression estimations. We focus both on the median and the tails of the distribution. In Figure 5 we plot 8 distinct quantile regression estimates (q) ranging from 0.25 to 0.95 as the solid curve with filled dots. Each plot has a horizontal quantile with a (q) scale, and the vertical scale indicates the fiscal determinants. The dashed line marks the ordinary least squares estimate of the conditional mean effect, the dotted lines present conventional 90 percent confidence bands for the least-squares estimate, and the shaded gray area describes a 90 percent confidence interval for the QR estimates. All plots reinforce the reason why least square regression may not fully convey the connection between political variables and CBC.

We now start with the regression at the median credibility. As expected, all sovereign debt holders are statistically significant and negative at the 5 and 10 percent levels. Among the second category of fiscal determinants, BBR and ER have a significantly positive impact on average CBC, 0.08 and 0.06 percent, respectively. Next, we turn to analysis at the lower quantile (*viz.*, 0.25). Here, note that among all fiscal factors only the effect of BBR and ER on the level of credibility is significant (0.18 and 0.01 percent, respectively). Finally, we turn to the upper tail of the CBC distribution and report regression results for the 0.75 and 0.95 quantiles. The result here is rather different. Although at the 0.75 and 0.95 quantiles none of the fiscal rules are statistically significant, debt holders negatively impact the CBC at the all upper tails of credibility distribution. This finding might be suggestive of the importance of how to finance the government debt and holders' structure to reach lower inflation expectations and higher credibility over time. Concerning control variables, the inflation rate is statistically significant and negative in all quantiles, while pegged exchange rate regime negatively affects the credibility only at the upper tail of 95 percent CBC²⁸.

²⁸ To justify the use of QR analysis, we run the heteroscedasticity test and equality test of slopes across various quantiles. As shown in Table 6, Breusch-Pagan / Cook-Weisberg test for heteroskedasticity rejects the constant variance, and the latter test also rejects equality of regression coefficients at the different conditional quantiles.

6. Discussion, Robustness and Conclusion

This paper identifies the major fiscal determinants of the CBC in 25 IT economies by contributing to the literature in two ways. First, as empirical evidence on this concept is limited to the political economy of CBI, this paper seeks to fill this void by providing evidence in the context of fiscal determinants of the CBC. At the beginning of the analysis, we saw that the IT countries have pursued two broad types of debt trends and holders' strategies since adopting the IT framework. Emerging economies strategy involves raising the share of domestic and domestic non-bank holders while the advanced countries have relied more on central bank holdings and surprise inflation. This finding suggests that this policy may be temporarily successful in reducing inflation. However, it may impose additional costs in the long term, such as reducing the public's trust in the central bank's ability. Second, as the credibility is highly concentrated in the right tail of the distribution, the mean-based approaches are incapable of unearthing the fact that the effect of political factors may be asymmetric across the distribution of the CBC. In departing from the literature, we use the quantile regression approach, which provides superior information on the political determinants nexus across various parts of the distribution of the credibility. Having provided a comprehensive survey on the fiscal factors potentially related to the credibility in the literature, we empirically test our data over a period from 1990 to 2014. The main results of fiscal determinants of the CBC can be summarized as follows.

First, debt holders negatively influence the CBC, and the effect is significant across all upper tails. As we see in Table 6, the extent of dropping is more prominent at the median and the right tail (75th quantile) of the credibility distribution. Such tail dynamics and the obvious asymmetry are important information existing literature has failed to capture. The results suggest that during episodes of raising credibility, financing the sovereign debt by central banks appears to cause the CBC to fall significantly more than during periods of dropping credibility. In line with [Abbas et al. \(2014\)](#), when the CBC is high, financing the government debt by monetary institutions could be regarded as "bad news" causing the private sector to respond more negatively.

Second, the effect of BBR and ER matters at the lower and median of the distribution. This finding could be a sign that a well-designed fiscal rule can be an instrument to stabilize expectations and help improve the credibility of the policy when CBC is almost low. In this sense, showing interest in building rules-based fiscal policy by the government might be a proper way to anchor expectations on the sustainable course of future policies.

For a proper comparison with the main findings and to check the robustness of our empirical results, we extend our series of quantile regressions into different smaller locations such as 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9. Comparing Tables 6 and 7, we find our main results are significantly robust. Appendix Table 8 illustrates that an increase in all debt holders over the range of quantiles significantly decreases the CBC in the upper tails, which is more aggressive at levels 50th, 60th, and 70th quantiles. For instance, an increase in the central bank

holding reduces the credibility by around 1.66 percent when the central bank is highly credible²⁹. On the FR side, in line with [Combes et al. \(2018\)](#), one can see that at the lower distribution of CBC establishing a BBR and ER could be appropriate instruments to reinforce credibility. The results confirm that BBR is the most engaging fiscal rule, which can strongly affect the public expectations and the level of CBC. A BBR removes the main source of base-money creation and inflation by limiting government borrowing from all domestic sources³⁰. Concerning control variables, in line with Table 6, the inflation rate has negatively affected the level of credibility at all considered quantiles. The trade openness index is statistically insignificant across various locations of CBC. The pegged exchange rate is negatively related to the level of credibility only at the 90th quantile³¹. This means that setting a specific fixed exchange rate with a foreign currency when the central bank is highly credible could be bad news and increase expectations.

The quantile regression analysis indicates that the CBC responds to the debt holders at the upper and fiscal rules at the lower tails. The evidence could be attributed to the more sensitivity of the private sector's expectations to the monetarization of the public debt than the FR establishment.

An understanding of the asymmetries in the relationship between CBC and fiscal determinants could be useful to policymakers. Central bankers, aiming to stabilize the economy, credibility growth, or target inflation, could reduce public expectations by taking into account the non-linear impact of fiscal factors on their credibility.

Author Contributions

Conceptualization, methodology, validation, formal analysis, resources, writing-original draft preparation, writing-review, and editing: all authors.

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Conflicts of Interest

The authors declare no conflict of interest.

Data Availability Statement

The data used in the study were taken from:

<http://www.consensuseconomics.com>

<http://www.centralbanknews.info/>

<https://databank.worldbank.org/source/world-development-indicators>

²⁹ 70 percent credibility=0.7th quantile.

³⁰ Especially when the credibility is low.

³¹ 95th in Table 6.

IMF Fiscal Rules Dataset, 2016

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Appendices

Table 1. Effective IT adoption date-financial crisis date: Public debt and holders

IT Economies	Public debt			Central bank			Domestic banks			domestic-non banks			Foreign banks		
	Start	End	$\bar{\Delta}$	Start	End	$\bar{\Delta}$	Start	End	$\bar{\Delta}$	Start	End	$\bar{\Delta}$	Start _t	End	$\bar{\Delta}$
Emerging Countries															
Armenia (2006-2008)	16	15	-6	1	2	74	10	14	40	3	1	-71	86	83	-3
Brazil (1999-2008)	65	61	-6	22	26	19	30	27	-12	26	35	34	23	12	-46
Chile (1999-2008)	16	5	-69	69	11	-84	5	19	302	4	47	939	50	24	-53
Colombia (1999-2008)	20	27	34	2	1	-78	24	14	-41	25	55	124	60	31	-49
Czech Republic (1998-2008)	9	25	174	0	0	-	62	38	-39	24	34	41	13	28	109
Guatemala (2005-2008)	21	20	-4	0	0	-	34	32	-5	6	17	167	60	51	-15
Hungary (2001-2008)	52	68	32	18	2	-89	21	23	9	31	25	-18	30	54	64
Indonesia (2005-2009)	44	26	-39	23	18	-23	25	19	-23	0	10	⁴⁴⁸ / ₉	52	53	2
Israel (1997-2009)	91	73	-20	2	3	30	10	13	32	62	66	7	26	18	-31
Mexico (2001-2007)	18	20	11	0	0	-	5	12	145	61	62	1	34	26	-23
Peru (2002-2008)	43	23	-47	0	0	-	6	8	25	17	28	61	75	64	-14
Poland (1998-2007)	39	42	8	7	0	⁻ / ₁₀₀	23	22	-2	220	42	113	51	36	-29
Romania (2005-2008)	16	12	-23	0	0	-	13	34	160	6	5	-19	81	61	-25
South Africa (2000-2009)	42	30	-29	0	0	-	33	43	32	3	8	216	65	49	-25
south Korea (2001-2008)	16	26	61	9	5	-49	43	31	-28	8	52	578	40	12	-70
Thailand (2000-2008)	22	21	-4	10	13	28	13	27	119	66	47	-29	14	24	66
Turkey (2006-2008)	43	38	-13	5	4	-33	34	30	-9	52	52	0	7	5	-33
Uruguay (2007-2009)	53	45	-15	11	18	62	51	61	19	14	9	-34	29	27	-9
Median	39	26	-6	4	2	-32	22	22	14	18	34	37	44	30	-23
Average	36	34	2	10	5	-26	24	25	40	23	32	366	44	37	-10
Developed Countries															
Australia (1993-2009)	17	11	-35	9	2	-77	22	13	-38	36	46	27	24	37	54
Canada (1991-2008)	55	34	-37	5	4	-9	15	28	86	56	50	-10	23	17	-28
New Zealand (1990-2008)	55	19	-66	8	15	83	24	9	-60	44	28	-35	27	46	66
Norway (2001-2008)	18	13	-25	2	0	⁻ / ₁₀₀	24	17	-26	25	13	-46	52	68	29
Sweden (1998-2008)	80	41	-49	2	0	⁻ / ₁₀₀	17	22	28	34	51	48	46	26	-43
United Kingdom (1992-2007)	32	41	26	5	2	-51	4	2	-48	76	70	-7	13	24	80
Median	44	27	-36	4	2	-64	19	15	-32	40	48	-9	26	31	41
Average	43	27	-31	5	3	-42	18	15	-9	45	43	-3	31	36	26

Source: World Bank, IFS and Author's calculations.

Table 2. Recession: Public debt and holders

IT Economies	Public debt			Central bank			Domestic banks			domestic-non banks			Foreign banks		
	Start	End	$\bar{\Delta}$	Start	End	$\bar{\Delta}$	Start	End	$\bar{\Delta}$	Start	End	$\bar{\Delta}$	Start	End	$\bar{\Delta}$
Emerging Countries															
Albania (2009-13)	60	66	10	13	8	-40	44	39	-12	7	14	93	39	38	-1
Armenia (2008-13)	15	36	140	2	1	-42	14	14	0	1	4	347	83	81	-3
Brazil (2008-10)	61	62	1	26	30	15	27	21	-20	35	34	-4	12	15	23
Chile (2008-13)	5	13	159	11	6	-46	19	17	-8	47	58	25	24	18	-22
Colombia (2008-13)	27	30	9	1	1	-89	14	21	45	55	48	-12	31	31	0
Czech Republic (2008-13)	25	41	64	0	0	0	38	39	3	34	28	-16	28	33	15
Guatemala (2008-13)	20	25	27	1	3	200	32	32	0	17	11	-35	51	53	4
Hungary (2008-13)	68	75	10	2	1	-70	23	22	-5	25	19	-24	50	58	17
Indonesia (2009-13)	26	25	-6	18	15	-15	19	13	-31	10	13	30	53	59	10
Israel (2009-13)	73	66	-10	3	2	-38	13	13	0	66	71	8	18	14	-22
Mexico (2007-13)	20	31	50	0	0	0	12	8	-35	62	46	-26	26	46	78
Peru (2008-13)	23	16	-30	1	2	100	8	11	39	28	22	-19	64	65	1
Poland (2007-13)	42	51	20	0	0	0	22	21	-1	42	30	-27	36	48	32
Romania (2008-13)	12	36	192	0	0	0	34	43	25	5	3	-42	61	54	-11
South Africa (2009-13)	30	44	47	1	2	77	43	43	0	8	3	-63	49	54	11
south Korea (2008-13)	26	31	20	5	4	-20	31	24	-24	52	59	13	12	13	11
Thailand (2008-13)	21	30	35	13	6	-49	27	21	-22	47	41	-13	24	35	48
Turkey (2008-10)	38	41	7	4	2	-38	30	30	0	52	53	1	5	7	65
Uruguay (2009-15)	45	48	6	18	19	6	61	47	-23	9	10	12	27	40	50
Median	26	36	20	2	2	-14	25	21	-2	31	28	-11	29	40	11
Average	33	40	40	6	5	-2	26	25	-3	30	31	13	34	40	16
Developed Countries															
Australia (2009-13)	12	21	75	2	5	160	13	10	-19	46	37	-19	37	46	22
Canada (2008-13)	35	42	19	5	4	-9	28	16	-41	50	53	5	17	24	42

Table 2 (Continued). Recession: Public debt and holders

New Zealand (2008-13)	19	35	82	15	3	-75	9	23	137	28	15	-44	46	57	23
Norway (2008-13)	13	20	47	0	0	0	17	36	101	13	25	89	68	38	-44
Sweden (2008-13)	41	43	5	0	0	0	22	23	8	51	37	-27	26	37	44
United Kingdom (2007-13)	41	83	105	2	25	924	2	9	262	70	39	-43	24	26	6
Median	27	38	61	2	4	22	15	19	54	48	37	-23	31	37	23
Average	27	41	56	3	6	175	15	19	74	43	34	-6	36	38	15

Source: World Bank, IFS and author's calculations.

Table 3. Post-Recession: Public debt and holders

IT Economies	Public debt			Central bank			Domestic banks			domestic-non banks			Foreign banks		
	Start	End	$\bar{\Delta}$	Start	End	$\bar{\Delta}$	Start	End	$\bar{\Delta}$	Start	End	$\bar{\Delta}$	Start	End	$\bar{\Delta}$
Emerging Countries															
Albania (2013-19)	65	66	1	8	5	-33	39	37	-4	14	13	-12	39	45	16
Armenia (2013-19)	36	50	38	1	0	-56	14	19	37	4	1	-78	81	80	-2
Brazil (2010-19)	62	84	37	30	29	-2	21	18	-17	34	42	24	15	11	-26
Chile (2013-19)	13	28	119	6	1	-92	17	16	-7	58	53	-9	18	30	65
Colombia (2013-19)	30	42	42	1	3	200	21	15	-28	48	32	-33	31	50	61
Czech Republic (2013-19)	41	29	-30	0	0	0	39	31	-20	28	30	7	33	38	18
Guatemala (2013-19)	25	27	6	3	3	0	32	45	40	11	8	-31	53	45	-16
Hungary (2013-19)	75	66	-11	1	0	-77	22	28	28	19	39	102	58	33	-43
Indonesia (2013-19)	25	30	21	15	9	-40	13	15	15	13	18	36	59	58	-1
Israel (2013-19)	66	58	-11	2	0	-88	12	13	5	71	72	1	14	14	0
Mexico (2013-19)	31	36	18	0	0	0	7	8	6	46	51	10	46	41	-11
Peru (2013- 19)	16	23	44	2	1	-19	11	15	33	22	24	6	65	60	-7
Poland (2013-19)	51	43	-15	0	0	0	21	37	72	30	24	-22	48	39	-18
Romania (2013-19)	36	35	-1	0	0	0	43	52	23	3	1	-86	54	47	-13
South Africa (2013-19)	44	62	41	2	1	-48	43	52	23	3	1	-86	54	47	-13

Table 3 (Continued). Post-Recession: Public debt and holders

south Korea (2013-19)	31	36	18	4	2	-33	24	18	-24	59	65	10	13	14	6
Thailand (2013-19)	30	34	15	6	7	2	21	23	8	41	38	-8	35	38	7
Turkey (2010-19)	41	34	-24	2	2	0	30	31	5	53	46	-13	7	16	115
Uruguay (2015-19)	48	54	13	19	17	-12	47	50	5	10	12	21	40	36	-11
Median	26	36	15	2	1	-7	21	23	6	29	30	-3	42	40	-1
Average	40	44	17	5	4	-13	24	28	9	31	30	-4	40	39	7
Developed Countries															
Australia (2013-19)	21	35	66	5	4	-15	10	17	56	37	38	3	46	39	-14
Canada (2013-19)	42	37	-11	4	4	0	16	17	5	53	53	0	24	23	-2
New Zealand (2013-19)	35	32	-9	3	4	15	23	32	42	15	17	10	57	45	-20
Norway (2013-19)	20	14	-27	0	0	0	36	29	-18	25	20	-20	38	49	31
Sweden (2013-19)	43	36	-16	0	20	3287	23	27	14	37	31	-15	37	20	-46
United Kingdom (2013-19)	83	84	1	25	26	3	9	7	-15	39	37	-4	26	28	8
Median	38	35	-10	4	5	2	19	22	10	37	34	-2	37	33	-8
Average	41	40	1	6	10	547	19	22	14	34	33	-4	38	34	-7

Source: World Bank, IFS and author's calculations.

Table 4. Sovereign debt, holders composition, and inflation rate: The start date of IT adoption up to 2019

IT Economies	Public debt			Central bank			Domestic banks			domestic-non banks			Foreign banks			Inflation			
	Start	End	$\bar{\Delta}$	Start	End	$\bar{\Delta}$	Start	End	$\bar{\Delta}$	Start	End	$\bar{\Delta}$	Start	End	$\bar{\Delta}$	Start	End	$\bar{\Delta}$	
Emerging Countries																			
Albania (2009-19)	60	66	10	13	5	-60	44	37	-16	7	13	69	39	45	69	2	1	-37	
Armenia (2006-19)	16	50	21	2	1	0	-56	10	19	86	3	1	-72	86	80	-7	3	1	-50
Brazil (1999-19)	65	84	29	22	29	33	30	18	-41	26	42	61	23	11	-51	5	4	-23	
Chile (1999-19)	16	28	75	69	1	-99	5	16	221	4	53	1230	50	30	-39	4	3	-23	
Colombia (1999-19)	20	42	11	0	2	3	54	24	15	-39	25	32	-39	60	50	-17	11	4	-68

Table 4 (Continued). Sovereign debt, holders composition, and inflation rate: The start date of IT adoption up to 2019

Czech Republic (1998-19)	9	29	$\frac{22}{2}$	0	0	0	62	31	-50	24	30	26	13	38	185	11	3	-73	
Guatemala (2005-19)	21	27	29	1	3	200	34	45	34	6	8	20	60	45	-26	9	4	-59	
Hungary (2001-19)	52	66	27	18	0	-99	21	28	32	31	39	27	30	33	9	9	3	-63	
Indonesia (2005-19)	44	30	$\frac{-}{32}$	23	9	-61	25	15	-38	1	18	1700	52	58	11	10	3	-71	
Israel (1997-19)	91	58	$\frac{-}{36}$	2	0	-88	10	13	33	62	72	17	26	14	-45	9	1	-91	
Mexico (2001-19)	18	36	$\frac{10}{0}$	0	0	0	5	8	68	61	51	-17	34	41	21	6	4	-43	
Peru (2002-19)	43	23	$\frac{-}{47}$	0	1	100	6	15	148	17	24	40	75	60	-20	0	2	200	
Poland (1998-19)	39	43	10	7	0	-100	23	37	61	220	24	-89	51	39	-24	12	2	-81	
Romania (2005-19)	16	35	$\frac{11}{9}$	0	0	0	13	52	301	6	0	-93	81	47	-41	9	4	-58	
South Africa (2000-19)	42	62	48	0	1	100	33	52	61	3	0	-83	65	47	-27	5	4	-23	
South Korea (2001-19)	16	36	$\frac{12}{5}$	9	2	-73	43	18	-58	8	65	746	40	14	-65	4	0	-91	
Thailand (2000-19)	22	34	55	10	7	-35	13	23	79	66	38	-43	14	38	163	2	1	-56	
Turkey (2006-19)	43	34	$\frac{-}{21}$	5	2	-65	34	31	-6	52	46	-12	7	16	138	10	15	58	
Uruguay (2007-19)	53	54	2	11	17	51	51	50	-3	14	12	-11	29	36	22	8	9	3	
Average	36	44	54	10	4	-31	25	28	45	33	30	186	43	39	10	7	4	-34	
Developed Countries																			
Australia (1993-19)	17	35	$\frac{10}{6}$	9	5	-50	22	17	-23	36	39	8	24	39	65	2	1	-8	
Canada (1991-19)	55	37	$\frac{-}{33}$	5	6	13	15	17	16	56	53	-5	23	24	4	6	2	-65	
New Zealand (1990-19)	55	32	$\frac{-}{42}$	8	4	-47	24	33	35	44	18	-60	27	45	67	6	2	-73	
Norway (2001-19)	18	14	$\frac{-}{22}$	3	0	-100	24	30	22	25	21	-18	52	50	-4	3	2	-28	
Sweden (1998-19)	80	36	$\frac{-}{55}$	2	20	960	17	27	60	35	32	-8	46	20	-56	-1	2	300	
United Kingdom (1992-19)	32	84	$\frac{18}{3}$	5	26	424	4	8	90	76	38	-50	13	28	118	5	2	-62	
Average	43	40	22	5	10	200	18	22	33	45	33	-22	31	34	32	3	2	11	

Source: World Bank, IFS and author's calculations.

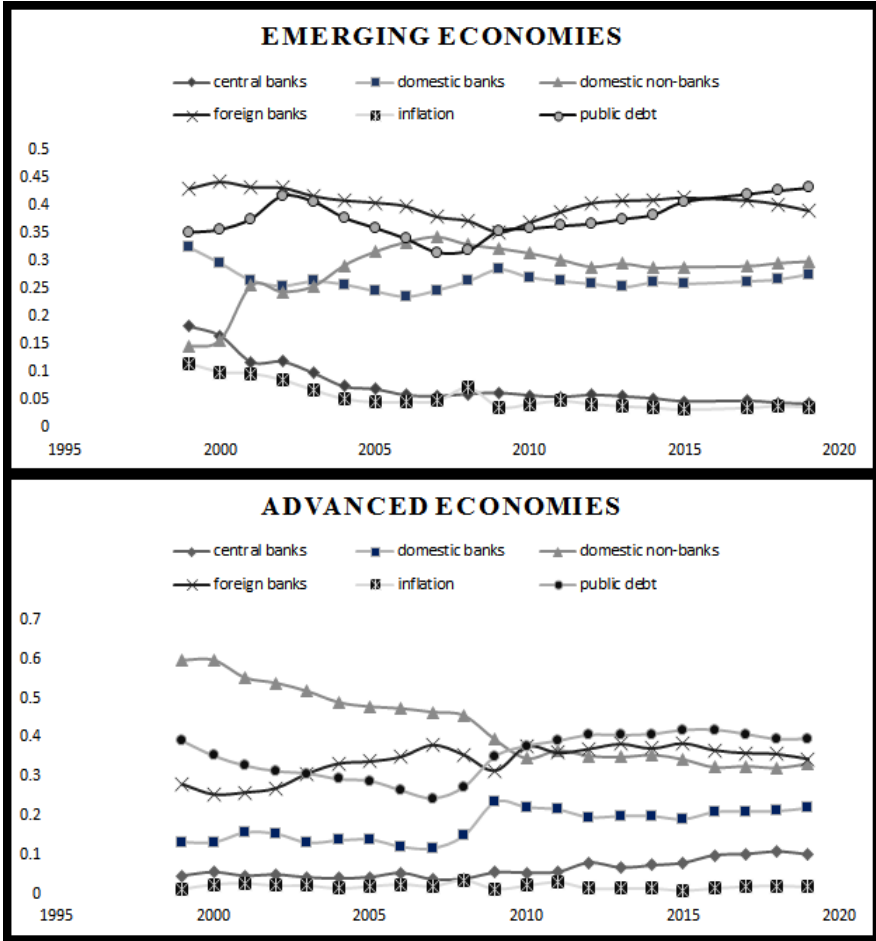


Figure 1. Debt to GDP ratio, the share of holders, and inflation rate in emerging and advanced IT economies
 Source: Research findings

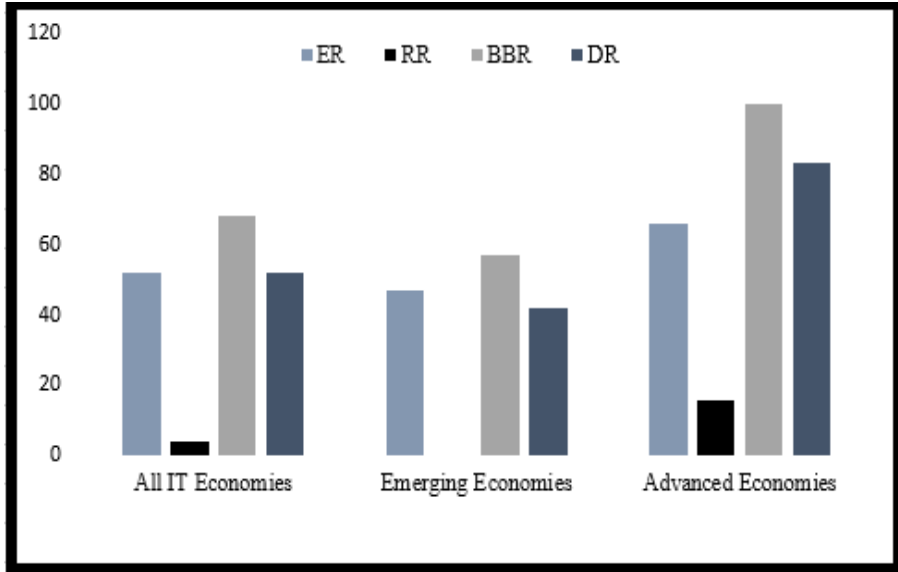


Figure 2. Participation rate with fiscal rules by type and country group, 1990-2019
Source: Research findings

Table 5. Baseline results (fixed effects estimation)

Variables	(1)	(2)
Central Banks Holding	-1.845 ** (0.704)	
Domestic Banks Holding	-2.61 *** (0.712)	
Domestic Non-Banks Holding	-1.95 ** (0.725)	
Foreign Banks Holding	-2.04 *** (0.71)	
Debt Rules		0.021 (0.069)
Budget Balanced Rules		0.03 * (0.054)
Expenditure Rules		0.04 (0.04)
Revenue Rules		0.14 (0.1)
Trade Openness	0.08 (0.152)	-0.28 (0.17)
Pegex	-0.047 (0.183)	-0.01 (0.11)
Inflation	-4.596 *** (0.602)	-4.195 *** (0.56)
Const.	3.168 *** (0.703)	1.06 *** (0.11)
Observations	239	288
F Limer	4.75 ***	3.31 ***
Hausman Test	63.17 ***	56.2 **

Source: Research findings

*Notes: Standard errors are in parentheses. *, **, and *** denote significance at the 10, 5 and 1 percent levels, respectively. Dependent variable is CBC. F limer test rejects pooled data in favor of panel and Hausman test also rejects random effect in favor of fixed effect at the significant level of 1 and 5 percent, respectively.*

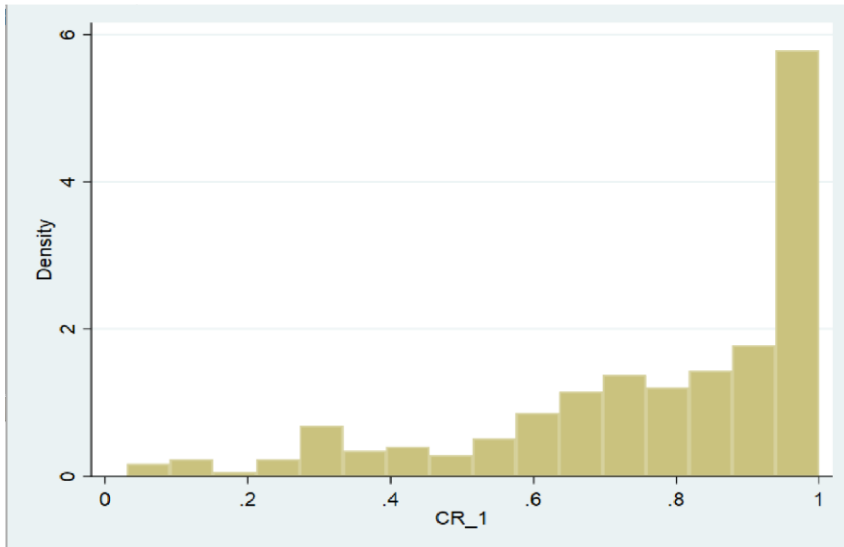


Figure 3. Histogram of the CBC
Source: Research findings

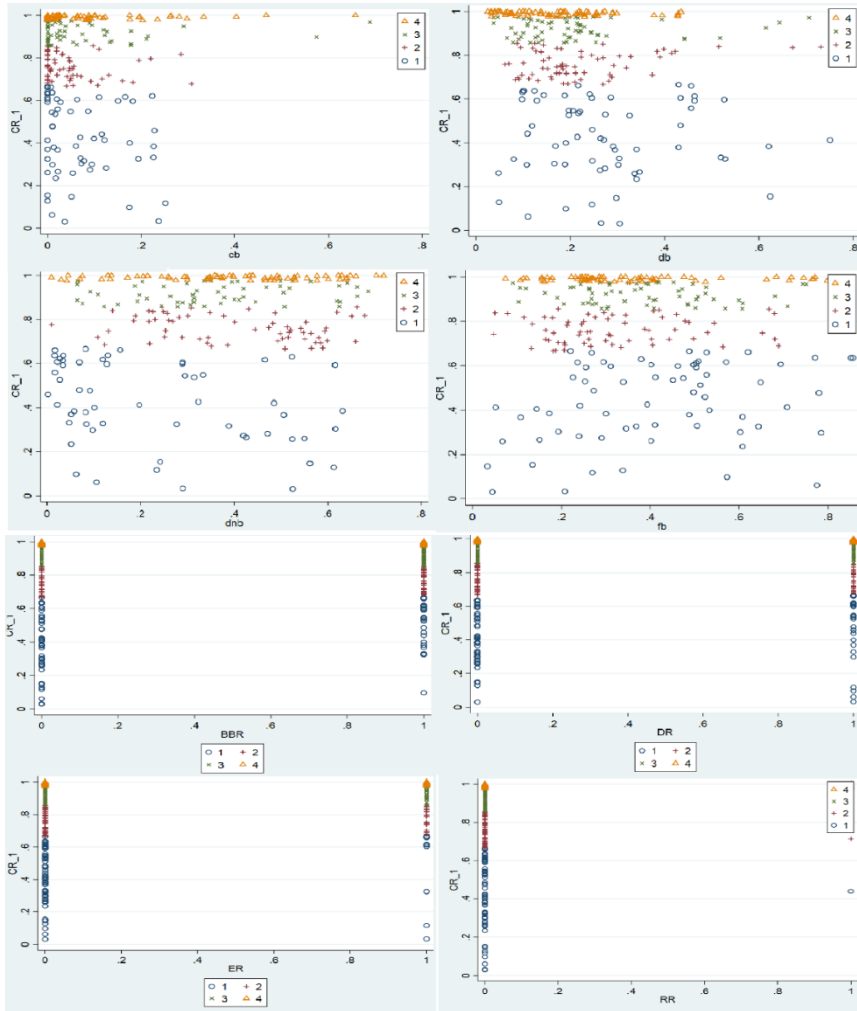


Figure 4. Quantile regression estimates
Source: Research findings

Table 6. Quantile regression estimates (debt holders)

Variables	(0.25)	(0.5)	(0.75)	(0.95)	Test of equality of slope estimates across various quantiles
Central Banks Holding (cb)	-0.336 (0.538)	-0.953 * (0.54)	-1.194 *** (0.41)	-0.239 *** (0.039)	6.44 **
Domestic Banks Holding (db)	-0.78 (0.58)	-1.473 ** (0.541)	-1.252 *** (0.42)	-0.258 *** (0.033)	8.01 ***
Domestic Non-Banks Holding (dnb)	-0.68 (0.591)	-1.184 ** (0.58)	-1.258 *** (0.437)	-0.256 *** (0.046)	7.05 ***
Foreign Banks Holding (fb)	-0.67 (0.56)	-1.246 ** (0.55)	-1.468 *** (0.421)	-0.211 *** (0.045)	5.11 ***
Trade Openness	0.15 (0.06)	-0.07 (0.06)	0.06 (0.04)	0.004 (0.04)	3.19 ***
Peggedex	0.027 (0.143)	-0.1 (0.130)	-0.0178 (0.092)	-0.062 *** (0.009)	4.21 ***
Inflation	-7.686 *** (0.74)	-4.518 *** (0.72)	-1.538 *** (0.55)	-0.227 *** (0.038)	6.07 ***
Constant	1.743 ** (0.58)	2.34 *** (0.551)	2.31 *** (0.43)	1.249 *** (0.035)	
Observations	239	239	239	239	
heteroscedasticity test				45.22 ***	

Source: Research findings

Notes: Standard errors are in parentheses. *, **, and *** denote significance at the 10, 5 and 1 percent levels, respectively. Test of equality of slopes rejects equality of the regression coefficients at different conditional quantiles. Breusch-Pagan / Cook-Weisberg test for heteroskedasticity rejects constant variance and justifies the use of quantile approach.

Table 6-1. Quantile regression estimates (fiscal rules)

Variables	(0.25)	(0.5)	(0.75)	(0.95)	Test of equality of slope estimates across various quantiles
BBR	0.185 *** (0.046)	0.083 ** (0.034)	0.01 (0.03)	0.002 (0.002)	7.73 ***
DR	0.02 (0.04)	0.048 (0.03)	-0.007 (0.022)	-0.001 (0.001)	7.01 **
ER	0.01 * (0.048)	0.06 * (0.031)	0.021 (0.023)	0.0006 (0.0002)	5.06 **
RR	-0.003 (0.08)	0.102 (0.081)	0.009 (0.06)	0.008 (0.002)	4.15 **
Trade Openness	0.15 (0.06)	0.16 (0.05)	-0.04 (0.04)	0.002 (0.004)	3.25 **
Peggedex	-0.034 (0.121)	-0.126 (0.163)	-0.02 (0.075)	-0.074 *** (0.028)	3.17 **
Inflation	-5.32 *** (0.75)	-3.98 *** (0.665)	-1.085 *** (0.51)	-0.084 * (0.041)	6.11 **
Constant	0.841 *** (0.06)	0.961 *** (0.06)	1.002 *** (0.04)	1.008 *** (0.004)	
Observations	288	288	288	288	
heteroscedasticity test		47.11 ***			

Source: Research findings

*Notes: Standard errors are in parentheses. *, **, and *** denote significance at the 10, 5 and 1 percent levels, respectively. Test of equality of slopes rejects equality of the regression coefficients at different conditional quantiles. Breusch-Pagan / Cook-Weisberg test for heteroskedasticity rejects constant variance and justifies the use of quantile approach.*

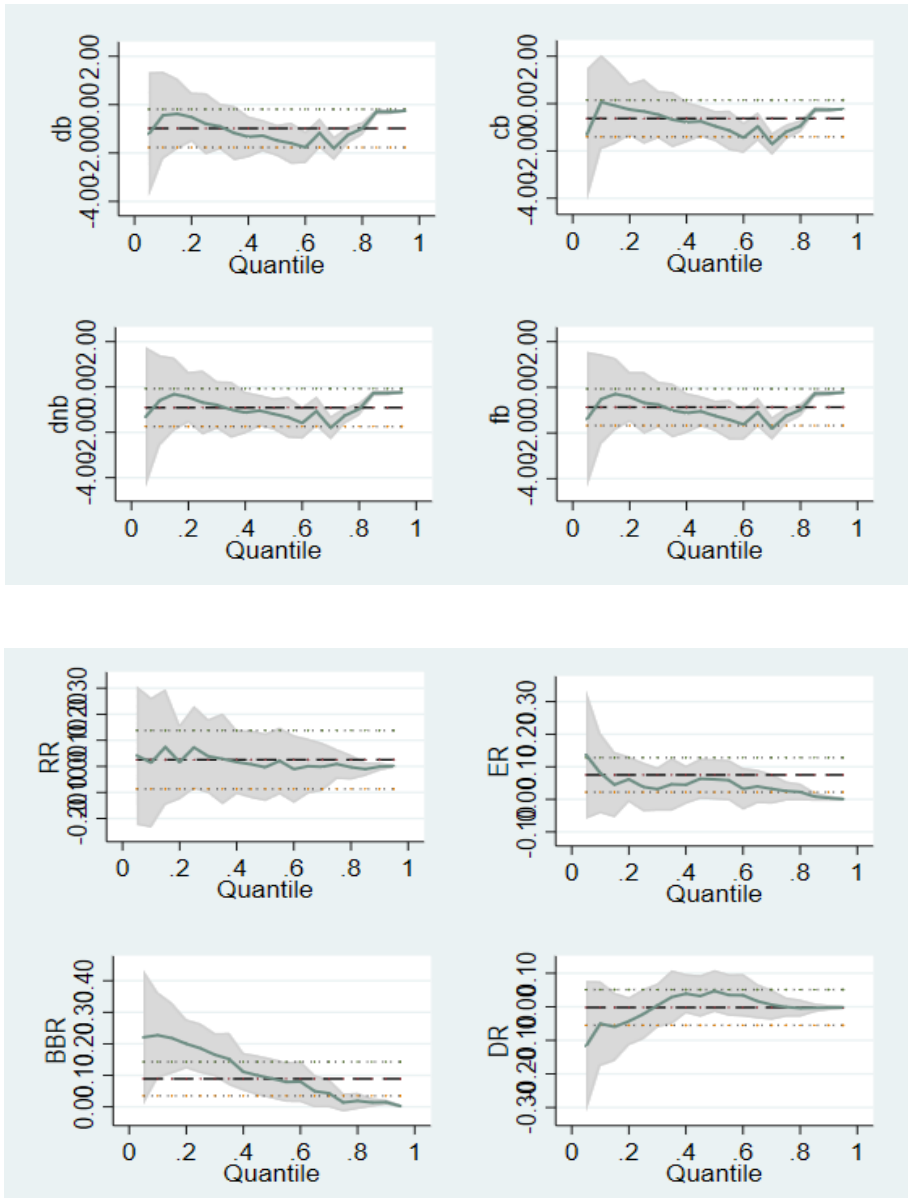


Figure 5. Ordinary least squares and quantile regression estimates
Source: Research findings

Table 7. Quantile regression estimates (debt holders)

Variables	(0.1)	(0.2)	(0.3)	(0.4)	(0.5)	(0.6)	(0.7)	(0.8)	(0.9)	Test of equality of slope estimates across various quantiles
Central Banks Holding (cb)	0.067 (1.03)	-0.25 (0.64)	-0.461 (0.585)	-0.82 (0.503)	-0.953* (0.54)	-1.44** (0.55)	-1.66*** (0.51)	-0.93*** (0.28)	-0.26*** (0.07)	5.85***
Domestic Banks Holding (db)	-0.442 (1.05)	-0.514 (0.654)	-0.898 (0.595)	-1.338 (0.514)	-1.473** (0.541)	-1.763*** (0.56)	-1.78*** (0.52)	-0.96*** (0.29)	-0.3*** (0.07)	4.09**
Domestic Non-Banks Holding (dnb)	-0.586 (1.11)	-0.449 (0.692)	-0.789 (0.629)	1.161 (0.543)	1.184** (0.58)	1.584*** (0.59)	1.74*** (0.55)	-0.95*** (0.3)	-0.26*** (0.07)	3.08**
Foreign Banks Holding (fb)	-0.517 (1.13)	-0.418 (0.666)	-0.754 (0.606)	1.145 (0.523)	-1.246** (0.55)	-1.62*** (0.57)	-1.754*** (0.53)	-0.97*** (0.29)	-0.26*** (0.07)	5.01**
Trade Openness	0.25 (0.09)	0.26 (0.093)	-0.136 (0.12)	-0.16 (0.15)	-0.07 (0.06)	-0.094 (0.067)	0.11 (0.23)	0.05 (0.03)	0.007 (0.008)	4.64**
Pegged exchange	0.125 (0.129)	0.087 (0.11)	0.05 (0.109)	0.032 (0.08)	-0.1 (0.130)	-0.096 (0.13)	0.079 (0.121)	0.008 (0.9)	-0.05*** (0.01)	7.11**
Inflation	8.82*** (1.18)	7.32*** (0.86)	-6.64*** (0.78)	5.684*** (0.681)	4.518*** (0.72)	-4.39*** (0.74)	2.12** (0.69)	-1.39*** (0.38)	-0.34*** (0.09)	9.23**
Constant	1.55 (1.06)	1.53*** (0.66)	1.883*** (0.6)	2.27*** (0.52)	2.34*** (0.551)	2.72*** (0.77)	2.84*** (0.53)	2.02*** (0.29)	1.27*** (0.07)	
Observations	239	239	239	239	239	239	239	239	239	

Source: Research findings

Notes: Standard errors are in parentheses. *, **, and *** denote significance at the 10, 5 and 1 percent levels, respectively. Equality test of slopes rejects equality of the regression coefficients at different conditional quantiles.

Table 7-1. Quantile regression estimates (fiscal rules)

Variables	(0.1)	(0.2)	(0.3)	(0.4)	(0.5)	(0.6)	(0.7)	(0.8)	(0.9)	Test of equality of slope estimates across various quantiles
BBR	0.228 *** (0.05)	0.21 *** (0.04)	0.16 *** (0.03)	0.11 *** (0.03)	0.083 ** (0.034)	0.08 (0.04)	0.044 (0.03)	0.017 (0.02)	0.013 (0.01)	3.04 ***
DR	-0.051 (0.05)	-0.042 (0.04)	0.0005 (0.03)	0.039 (0.03)	0.048 (0.03)	0.034 (0.04)	0.006 (0.03)	0.002 (0.02)	0.004 (0.005)	4.07 **
ER	0.081 (0.05)	0.057 (0.04)	0.05 * (0.03)	0.043 (0.03)	0.06 * (0.031)	0.032 (0.04)	0.032 (0.03)	0.022 (0.02)	0.004 (0.005)	4.53 ***
RR	0.014 (0.11)	0.022 (0.09)	0.039 (0.08)	0.033 (0.08)	0.102 (0.081)	-0.006 (0.08)	-0.002 (0.07)	-0.007 (0.04)	0.003 (0.01)	7.53 **
Trade Openness	-0.021 (0.8)	0.144 (0.98)	0.205 (0.06)	-0.092 (0.06)	0.16 (0.05)	0.165 (0.11)	0.130 (0.12)	-0.058 (0.03)	0.0087 (0.009)	4.13 **
Peggedex	0.12 (0.18)	0.111 (0.14)	0.091 (0.13)	-0.037 (0.13)	-0.126 (0.163)	-0.088 (0.15)	0.15 (0.12)	0.025 (0.07)	-0.04 ** (0.01)	6.51 **
Inflation	-6.26 *** (0.92)	-4.87 *** (0.75)	-5.53 *** (0.67)	-5.16 *** (0.66)	-3.98 *** (0.665)	- 3.65 *** (0.75)	- 2.61 *** (0.61)	- 0.99 *** (0.37)	-0.14 * (0.12)	7.41 **
Constant	0.62 *** (0.08)	0.77 *** (0.07)	0.92 *** (0.06)	0.90 *** (0.06)	0.961 *** (0.06)	1.3 *** (0.07)	1.4 *** (0.05)	1.02 *** (0.03)	0.99 *** (0.008)	
Observations	288	288	288	288	288	288	288	288	288	

Source: Research findings

Notes: Standard errors are in parentheses. *, **, and *** denote significance at the 10, 5 and 1 percent levels, respectively. Equality test of slopes rejects equality of the regression coefficients at different conditional quantiles.