The Effects of Monetary Policy Transparency, Framework, and Independence on Inflation: A Case of Developing Countries

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Abstract

This paper examines the impact of monetary policy transparency (MPT) on inflation in 34 developing countries from 1998 to 2019, taking into account their central bank independence and monetary policy stance. The association between MPT and subsequent period inflation is overall weakly negative but significantly negative for Inflation Targeting (IT) countries. An application of the median quantile regression with fixed effects reveals that greater MPT is associated with lower inflation in the following period for the countries which have tight monetary policy stance or independent central bank controlling for its tight regime. The study suggests that monetary policy transmission may act against theoretical expectations for nations with non-IT regimes and denpendent central bank, and central banks may benefit from increased MPT when they are independent in developing countries.

Keywords: Monetary policy, Transparency, Independence, Policy stance, Inflation, Developing countries.

1. Introduction

In the past decades, many central banks were granted greater monetary policy independence and called for greater transparency as a result of the rational expectation concept's development and the shift from targeting output to maintaining price stability (Dincer et al., 2022; Weber, 2018). Since then, the question of the inflation phenomenon has engaged the international literature, with scholars concentrating on both its implications and determining factors. Nevertheless, while there are many studies devoted to inflation in both developed and developing countries, the stream of literature that empirically studies the nexus between inflation, monetary policy transparency (MPT), and independence (MPI) is rather modest, especially for the developing world. Furthermore, the actual outcomes of studies in this domain in developing countries are unclear. As a result, it is critical for developing nations to analyze the influence of MPT on inflation while also considering their overall monetary policy independence and stance.

This study examines the impact of MPT as well as the interaction effect of transparency and independence on inflation for other developing nations. The graphical illustration of simple correlation has revealed that the relationship between MPT and the following period's inflation is weakly negative for the sampled countries, while the correlation between MPT and inflation is moderately negative for IT countries. Employing annual data from 34 developing countries from 1998 to 2019 and applying a median quantile regression fixed effects panel data approach while controlling for a large number of factors, the research finds that greater transparency is associated with lower subsequent period inflation for the countries that have either tight monetary policy or independent monetary policy controlling for its tight regime. For the studied nations with either a tight or an easy monetary policy stance, the overall effect of transparency on inflation is primarily negative. The study found that in non-IT non-MPI nations, monetary policy transmission may act against theoretical expectations, confirming previous empirical

literature. This is supported by a number of robustness tests.[1] Due to a range of circumstances, including the lack of key policy rate transmission, the function of monetary policy instruments and features in managing inflation is restricted in developing countries.

This study extends the associated literature in a variety of ways. First, this paper contributes to the existing body of literature by studying the nexus between inflation, monetary policy transparency (MPT), independence (MPI), and stance in developing countries. Second, this study suggests using the Monetary Independence Index (Aizenman et al., 2008, 2010, 2013) as the measure of MPI, because this provides the opportunity to observe de facto monetary policy independence at the country level. Third, scatterplot diagrams analysis highlighted the ambiguity of MPI and stances of monetary policy and a weak diminishing impact of transparency on inflation in sampled developing nations. Further to that, countries with a monetary policy regime of IT have a moderate negative relationship between MPT and inflation. Next, the effects on inflation of MPT as well as both the interactions of MPT with MPI, and MPT with MPI and monetary policy stances have been studied in a novel setting, taking into consideration inflation-targeting countries. For this, and considering the issue of hyperinflation in the developing world, the study applies a novel empirical strategy.

The rest of this paper is organized as follows. Section 2 describes literature review on the link between monetary policy transparency, independence, and inflation. Section 3 provides theoretical background, hypotheses, empirical methods, and data. In section 4, the estimation results and robustness checks are provided. Section 5 concludes.

[1] The results are provided in Appendix.

2. Literature review

The issues of monetary policy transparency (MPT), monetary policy independence (MPI), and especially drivers of inflation have been in the spotlight for a long while.[2] Meanwhile, the study of transparency and independence relationships with inflation started just a few decades ago (Weber, 2018). This section will provide an overview of the theoretical dimension of the relationship and an overview of the empirical research that has been undertaken so far in the field, followed by the model I intend to test.

The years of the 1990s and 2000s witnessed dramatic changes in central banking. In the early 1990s, many countries started to provide substantial legal independence to their central banks (Cukierman, 1998). At the same time, many central banks introduced landscape-changing practices in their operational activity and monetary policy frameworks. For example, the central banks of New Zealand, Canada, the U.K., and Sweden alternately shifted to an "inflation targeting" regime, which has a clear inflation target and publishes inflation projections, among other important features.[3] Some other countries' monetary policy authorities (e.g., Brazil, Japan, and the USA) became more open through other actions, like revealing voting records on policy decisions and discussions around them, and giving detailed explanations about their decisions and actions (Demertzis & Hughes Hallett, 2007). Moreover, the survey by Fry et al. (2000) on the conduct of a monetary policy by 94 central banks in 1998 revealed that the two most important things in their frameworks of monetary policy, after maintaining low inflation expectations, were central bank independence and transparency. The

[2] Following Dincer et al. (2022) the paper uses a more narrow concept of monetary policy transparency rather than the more commonly used term "central bank transparency," as, for example, central bank transparency criteria in terms of macroprudential or microprudential policies may differ from those for monetary policy transparency. Also, we may think about monetary policy transparency as a part of broader central bank transparency. The same is true for central bank independence, which is a broader concept nowadays than just monetary policy independence. Central banks may be responsible for many more things, such as micro- and macroprudential supervision, resolution, and so on, and the concept of monetary policy independence may have different criteria than the other concepts mentioned.

[3] For more information on inflation targeting, see Bernanke et al. (2018) and Svensson (1999).

fact that they are associated with a stronger anchoring of inflation expectations and, therefore, help combat inflation, has aided the shift toward more independent and transparent central banks (Demertzis & Hughes Hallett, 2007). As such, central bank independence and transparency, referring to its monetary policy domain, have become the new monetary policy trends (Geraats, 2002).

Monetary policy transparency

After the concept of independence was adopted by most central banks, it prompted public concern about whether or not including unelected authorities in monetary policymaking is democratic (Stiglitz, 1998). As a result, the critically significant concept of central bank transparency appeared to make central banks more responsible while also increasing their public credibility (Spyromitros & Tuysuz, 2012). Transparency has become a condition for central banks to gain more independence while becoming more accountable, which overall allows them to increase the efficiency of monetary policy (Dincer & Eichengreen, 2014). As such, the transparency of monetary policy is a necessary complement to monetary policy independence, which enables accountability to protect independent central banks' democratic legitimacy (Geraats, 2002). Meanwhile, some scholars consider MPT to be part of the independence concept. For example, Jasmine et al. (2019) measured the independence of the central bank, including transparency as a component.

It is hard to find a comprehensive definition of transparency as it is a multidimensional phenomenon that may be seen from different perspectives (Eijffinger & Geraats, 2006). Geraats (2002) identifies central bank transparency (clearly from the monetary policy side) as *"…the absence of asymmetric information between monetary policy makers and other economic agents. This means that it reduces uncertainty and this is often believed to be beneficial (although it need not be).*" It also limits the central bank's abilities to influence private-sector beliefs. Andrieş et al. (2020) and Yıldırım-Karaman (2017) see central bank

transparency as the degree to which a central bank communicates information regarding its decision-making methods, policy choices and objectives, policy implementations, and economic variables essential to the condition of the economy. Geraats (2002) identifies several aspects of transparency, namely political transparency, economic transparency, procedural transparency, policy transparency, and operational transparency. Many studies, including (Crowe & Meade, 2008; Dincer & Eichengreen, 2007, 2014; Eijffinger & Geraats, 2006) benchmark this taxonomy to develop their measurements of transparency of monetary policy.

Dincer and Eichengreen (2014) outlined several reasons for the transparency concept's development in the central banking field. First, it is part of a larger movement to make the government more responsive to the people regarding public demand. Second, in an era of central bank independence, transparency is considered an important aspect of accountability. Third, central bank transparency is considered a means to help markets react more effectively to policy actions. Fourth, transparency can help the central bank's pledges become more credible. It says that when the central bank explains fully how and why its actions are expected to set the target inflation rate, it will be easier to believe that it is committed to keeping inflation low and stable. More recently, MPT has become a cornerstone for central bank communication policy and forward guidance that helps to eliminate time-inconsistency problems (Dincer et al., 2022).

At the same time, the developed, more complex financial markets demanded more information from central banks, and to guide market expectations, central banks had to become more transparent (Crowe & Meade, 2008). In addition, the widespread application of inflation targeting made monetary policy more information-intensive compared to other policy anchors like the money aggregate rule or the fixed exchange rate (Crowe & Meade, 2008). In fact, the most vocal proponents of enhanced transparency have been inflation-targeting central banks

(Westelius, 2009). As a result, both the supply and demand for transparency have risen (Blinder et al., 2001; Geraats, 2002).

Although there has been a less dramatic increase in MPT, compared to central bank independence, since the late 1990s (Crowe & Meade, 2008), the number of measures shows that transparency, as well as independence, has steadily improved over time (Dincer & Eichengreen, 2014). The central bank's move towards greater transparency is true for countries of all income groups (Dincer et al., 2022). As evidence of the great importance of this concept nowadays, the IMF published its updated Central Bank Transparency Code, a best-practice book in the transparency domain of the central banking field (International Monetary Fund, 2020).

Central bank independence

There are a vast number of studies devoted to central bank (monetary policy) independence and even summarizing the related literature (Berger et al., 2001; Crowe & Meade, 2008; Eijffinger & De Haan, 1996; Masciandaro et al., 2020). The concept of central bank independence for conducting monetary policy was initially proposed in academic circles in the early 1960s (Vonessen et al., 2020). Friedman (1962) sees a central bank's autonomy (i.e., independence) from the government in a similar way to the relationship between the judiciary and the government. The court can only rule independently on the basis of laws enacted by the legislature, and it can only be forced to rule differently if the legislation is changed. In other words, an independent central bank is protected against intervention or pressure from any public institutions or other bodies or persons while performing its goals in line with its mandate and related legislation.

Between the 1970s and 1980s, the concept was further spread to policy-makers, when many developed countries suffered from stagflation, to get a broad policy consensus in the

1990s. As such, by the end of the 2000s, central banks in virtually all developed nations and many emerging economies had been given monetary policy independence, though to various degrees (Vonessen et al., 2020).

There are several theory streams justifying the need for central bank monetary policy independence (Crowe & Meade, 2008; Fischer, 1995) that are mostly related to the ability of an independent central bank to address inflationary biases (de Haan et al., 2018). As politicians can pressure the central bank to bust GDP growth in the short run in order to benefit in the next election, or as the government can finance its expenditures by pressuring the central bank to print money, the central bank cannot be trusted to stick to the agreed-upon inflation target due to loss of credibility (i.e., time inconsistency). To resolve these, first, monetary policymakers should be protected from political pressure (Blinder, 1999). Second, to deal with the time-inconsistency problem[4] that afflicts discretionary policy, Rogoff (1985) suggests delegating monetary policy to a conservative central banker, an institution that is highly averse to inflation. While Walsh (1995) and Persson and Tabellini (1993) see the solution from the principal-agent point of view, suggesting any policymaker with appropriate incentives and a well-defined mandate be in charge of monetary policy. Yet, Crowe and Meade (2008) noted that central bankers and some scholars criticized the literature's emphasis on time inconsistency, claiming that it is not a significant problem for modern central banks, particularly in industrialized nations. Thus, some other issues, like political economy, might be used to justify delegation.

Therefore, according to Walsh (2017), independence has two main aspects: isolation from politics when establishing the goals of monetary policy and autonomy in fulfilling the policy after those objects have been established. Earlier, Grilli et al. (1991) called them political and economic independence, respectively. Also, Fischer (1995) distinguishes them as “goal

[4] See Kydland and Prescott (1977) and Barro and Gordon (1983) for more information.

independence" (i.e., the central bank is free to follow its own policy preferences) and "instrument independence" (the central bank chooses instruments to achieve goals set by the government). Meanwhile, Hasse (1990) identified three areas where government influence on the central bank must be substantially limited or prohibited, namely personnel independence, financial independence, and policy independence. Yet, the degree of independence matters only when the central bank, contrary to the government, places a greater focus on alternative policy goals (Eijffinger & De Haan, 1996).

Regardless of theoretical reasoning, the MPI concept has been recognized, and the level of central bank independence has grown substantially since the time it was first measured in late 1980 (Crowe & Meade, 2008). At this point, the literature discusses other dimensions of central bank independence, like, for example, supervisory independence (Fraccaroli et al., 2020).

Empirical findings

Even though transparency and independence of monetary policy of central banks have been actively studied just since the early 2000s, they have demonstrated to be critical components for monetary policy effectiveness and, as a result, for central banks to control inflation (Alesina & Summers, 1993; Crowe & Meade, 2008; Demertzis & Hughes Hallett, 2007; Dincer et al., 2019; Dincer & Eichengreen, 2014; Eijffinger & De Haan, 1996; Geraats, 2005; Hughes Hallett & Libich, 2006; Papadamou & Arvanitis, 2015; Spyromitros & Tuysuz, 2012; Weber, 2018 among few). Some theoretical studies, however, suggest that central bank transparency may have adverse implications (Westelius, 2009).

Although many scholars treat central bank (monetary policy) independence and transparency as separate concepts, Crowe and Meade (2008) see them as complementary ideas that are necessary for good governance. Moreover, Dudchenko (2020) investigates the fact that

the terms "central bank independence" and "central bank transparency" have strong conceptual and practical overlap. Furthermore, Dincer and Eichengreen (2014) show that transparency and independence of central banks go together, being driven by the same imperatives. They show that both transparency and independence have a considerable impact on outcomes such as inflation level and variability.

A vast body of empirical research focuses on the impact of transparency and independence on many macroeconomic variables, including inflation (level, volatility, and persistence). A number of studies found that independence is related to lower inflation (Alesina, 1988, 1989; Alesina & Summers, 1993; Brumm, 2006; Crowe & Meade, 2008; Cukierman et al., 1992; Grilli et al., 1991; Ismihan & Ozkan, 2004) and lower inflation persistence (Diana & Sidiropoulos, 2004; Papadamou et al., 2017). Yet some studies discover that independence has no effect on inflation (Cecchetti & Krause, 2002; Spyromitros & Tuysuz, 2012). Some other studies see that this relationship is ambiguous (Arnone & Romelli, 2013). As such, Masciandaro et al. (2020) recently concluded that academia has not come to an agreement, neither on the direction of the MPT-inflation relationship nor on the factors that may influence this relationship.

In terms of transparency impact, various studies have found that more transparency has a favorable (decreasing) impact on inflation (Cecchetti & Krause, 2002; Dincer & Eichengreen, 2014; Geraats, 2002; Spyromitros & Tuysuz, 2012; Weber, 2018) and a negative impact on inflation persistence (Dincer & Eichengreen, 2007; Oikonomou et al., 2021; Van Der Cruijsen & Demertzis, 2007). While Demertzis and Hughes Hallett (2007) found a positive impact only on inflation variability, there was no effect on inflation level. Crowe and Meade (2007) found no impact either. Fry et al. (2000) found that, on average, the central banks of developing countries are less independent and transparent. Dincer and Eichengreen (2014) confirmed that developing countries have lower transparency than either developed or emerging markets.

While early central bank independence research focused on a modest number of developed countries, further studies, which had either a larger number of developed countries and/or developing countries, discovered more ambiguous outcomes (Arnone et al., 2009; Crowe & Meade, 2008; De Haan & Kooi, 2000; Eijffinger & De Haan, 1996; Klomp & De Haan, 2010). The studies of Presnak (2005) and Kasseeah (2011) on the independence and inflation relationship in Africa contradict each other. The former found no independence impact, while the latter observed a significant effect of independence on inflation. Agoba et al. (2017) find that in Africa and the developing world, CBI is insufficient to achieve lower inflation, unlike in advanced nations. Ismihan and Ozkan (2004) argued that there's no link between independence and decreased inflation in developing countries, while Brumm (2006) opposed these findings, exploring that independence and inflation have a significant negative association for developing nations. Independence and inflation have a negative association for some Latin American and Caribbean countries (Jácome & Vázquez, 2008). Other scholars demonstrate the importance of independence and transparency in maintaining a lower inflation rate for a selection of emerging markets and developing countries (Arnone et al., 2009; Laurens et al., 2009).

Studies related to independence in developing countries greatly outperform those focused on transparency in numbers. Transparency and accountability reduce inflation in developing nations (Hughes Hallett & Libich, 2006). For some emerging market economies, independence and transparency may be prerequisites to lower inflation (Aguir, 2018). Transparency is an important tool to maintain inflation under control in Brazil (de Mendonça & de Siqueira Galveas, 2013). At the same time, there is a gap in cross-country studies on the impact of transparency and the transparency - independence relationship on inflation in the developing world.

2. Data and methods

Theoretical background

This study is based on the model based on Eijffinger and Geraats (2006), where there is a central bank with the following objective function:

$$W = \alpha(\pi - \pi^*)^2 + \beta(y - y^*)^2 \quad (3.1)$$

where inflation is π and output y, while π^* and y^* their respective targets. As Eijffinger & Geraats (2006) noted, at this stage, perfect transparency (they were more specific about the policy transparency dimension of central bank transparency) would mean sharing with the private sector all the information on targets and relative preferences α/β and the objective function functional form. Yet, no central banks are transparent to this extent (Cukierman, 2002). As such, in an ordinary case, transparency would comprise sharing information on the inflation target π^*. Eijffinger and Geraats (2006) emphasize that institutional arrangements are also important since they reveal monetary policymakers' motivations. That is, at this point, MPI ensures that central bankers can fulfill (3.1) without being influenced by politics, as the incentive schemes effectively adjust their objective function.

The aggregate demand and supply equations can be used to illustrate the economy's structure.

$$y = \bar{y} - a(i - \pi^e - \bar{r}) + d \quad (3.2)$$

$$\pi = \pi^e + b(y - \bar{y}) + s \quad (3.3)$$

where inflation expectations are represented by π^e, the nominal interest rate is i, $\bar{r}$ stands for long-run real interest rate, and $\bar{y}$ is a natural output rate. While d and s stand for aggregate demand and supply shocks, respectively. In this regard, “transparency” (its economic dimension) refers to the fact that the private sector and the central bank share the same

knowledge about the economy. And also about the structure of the economy and the portion of the d and s disturbances that the central bank independently anticipates and reflects in its independent actions.

Consider the nominal interest rate i as a monetary policy tool, which is used under central bank discretion in line with MPI settings. Eijffinger and Geraats (2006) list several possible ways for the central bank to set i. Either utilize Taylor's rule or maximize (3.1) subject to (3.2) and (3.3) applying a framework for targeting that allows judgment alike (Svensson, 2002). Likewise, the central bank might employ various methods and develop its own monetary policy strategy. At this stage, transparency (its procedural dimension) is demonstrated through the openness of the central bank's strategy, minutes, voting records, etc., to the private sector.

Furthermore, transparency (from the policy dimension) implies that the central bank communicates its policy instrument decision as soon as possible under the model. In addition, when monetary policy faces some errors related to the policy instrument or aggregate supply and demand shocks that were not expected, the central bank MPT is required to inform the public.

Hypothesis

Since the Asian financial crisis, central banking has undergone a transparency revolution. It has been started by central banks in high-income nations and is spreading throughout the globe (Dincer et al., 2022). Transparency is a critical component of most central banks' monetary policy frameworks nowadays (Dincer et al., 2019). Various studies have discovered that more transparent monetary policy will decrease the inflation rate.

However, developing countries experience difficulties using this instrument as their institutions are generally weak and their past experience with hyperinflation affects their monetary policies (de Mendonça & de Siqueira Galveas, 2013). Meanwhile, some emerging

market countries even reversed their transparency level in 2008 after some significant improvements were achieved earlier (Dincer & Eichengreen, 2014). Furthermore, the empirical results of these domain studies for the developing world are not that clear. As such, it is especially important for developing countries to examine the impact of MPT on inflation while considering their independence and monetary policy stance. We hypothesize that:

Hypothesis 1: an increase in MPT at the time t is associated with a decrease in inflation in time $t+1$;

Hypothesis 2: an increase in MPT at the time t has a diminishing impact on inflation in time $t+1$ for tightening/easing monetary policy stances;

Hypothesis 3: an increase in MPT at the time t has a diminishing impact on inflation in time $t+1$ in countries with independent monetary policy;

Hypothesis 4: at the time t, when an average central bank of an average developing country takes a decision on the future monetary policy stance, measured by a key policy rate direction (tightening or easing), the effect of this decision on inflation in time $t+1$ will be greater if the monetary policy is independent and its transparency is higher.

As such, the following are the research questions: *Does monetary policy transparency affect inflation in developing countries? Does monetary policy transparency affect inflation in developing countries given its independence and stance?* In particular, this study aims to see whether increased MPT leads to better handling of inflation in developing countries

Empirical methods

Given the nature of the dependent variable, transformed *inflation*, to test the hypothesis, the model specifications for multivariate panel data for time *t,* country *i,* and monetary policy stance *k* are as follows: [5]

[5] The variables have been checked for unit roots. Further, Kao's (1999) cointegration test is applied to test whether

$$Inflation_{it} = \beta_0 + \beta_1 Transparency_{it-1} + \beta_2 Independence_{it-1} + \beta_3 Stance_{kit-1} + \beta_4 Transparency_{it-1} * Independence_{it-1} * Stance_{i-1} + \beta_5 Transparency_{it-1} * Independence_{it-1} + \beta_6 Transparency_{it-1} * Stance_{i-1} + \beta_7 Controls_{it} + \varphi_i + Y_t + \varepsilon_{it}, \quad (3.4)$$

where $Inflation_{it}$ is a transformation of the inflation rate, which is based on consumer price level (CPI) annual changes in country *i,* and at year *t*. $Transparency_{it-1}$ is the composite index of MPT, lagged for a one-year period to avoid possible reverse causality (Weber, 2018). $Independence_{it-1}$ stands for lagged MPI dummy, where 1 means independent, otherwise 0. $Stance_{kit-1}$ is measured through two dummies (k) lagged for a one-year period each: $Tightening_{it-1}$, where 1 meaning tightening of monetary policy and otherwise 0 (i.e., tightening as opposed to easing or no changes); and $Easing_{it-1}$ with 1 means easing of monetary policy and otherwise 0 (i.e., easing as opposed to tightening or no changes). It is assumed that the monetary stance dummies reflect the information on monetary policy and price levels at a particular time. The interaction terms: (i) $Transparency_{it-1}$ and $Independence_{it-1}$, (ii) $Transparency_{it-1}$ and $Stance_{it-1}$, and (iii) $Transparency_{it-1}$, $Independence_{it-1}$, and $Stance_{it-1}$ are the main focuses of the study. By applying such interactions, the research aims to analyze the influence of the MPT depending on the monetary policy stance and MPI among developing countries. The key independent variables are lagged to account for possible reverse causality. Furthermore, a *Transparency* squared was added as an explanatory variable to account for the inflation's possible transparency nonlinearity.

$Controls_{it}$ stands for a set of various variables to account for economic, institutional, and other differences between countries as well as factors that may influence inflation, including institutional development, financial development, and so on. Due to the fact that

non-stationary variables altogether are stationary in the long run. The Appendix provides the results of the Fisher Augmented Dickey-Fuller (ADF) test and the cointegration test, respectively.

changes in some explanatory factors may not instantly convert into increased prices, lags are added for such variables. The accuracy of the lag selection is tested using Akaike's and Schwarz's Bayesian information criterion. Moreover, the control of the monetary policy regime of inflation targeting – *IT dummy*, 1 for countries that launched IT starting from the year of official implementation – applied based on Dincer et al. (2019) and publicly available information on official announcements about invoking the IT regime.[6] Furthermore, different financial crises (banking, currency, and debt) have been accounted for by adding a particular dummy, with 1 meaning a particular crisis and otherwise 0. Lastly, country-level fixed effects are marked as φ_i to account for time-invariant countries' specifics, Y_j stands for year dummies to account for time fixed effects, while ε_{it} stands for residuals.

The research utilizes quantile regression with fixed effects and bootstrap standard errors following the Machado and Santos Silva (2019) method. Firstly introduced by Koenker and Bassett Jr (1978), the quantile regression technique allows one to account for the specificity of the studied response variable by examining the impact of explanatory variables on different quantiles of the dependent variable. Quantile regression estimates the response variable's conditional median, whereas OLS derives its conditional mean across multiple values of the characteristics. More specifically, quantile regression has two advantages over OLS regression: (i) it does not make any assumptions about the dependent variable's distribution, and (ii) it is resistant to outliers. As such, the dependent variable, $Inflation_{it}$ of Eq. (3.4) depends on the quartile value, while the beta coefficients are now functions that rely on the quantile (i.e., change depending on it) rather than being constants. In the study, the median regression (i.e., a middle quantile / a middle value of the sample; 50th percentile regression) was performed. It is often a better choice than a linear regression because it is "robust to outliers" (Yu et al.,

[6] It will help to account for the effect of the IT regime in some sampled countries, as generally such countries are the main advocates of monetary policy independence and transparency (Westelius, 2009).

2003). Following Weber (2018), it is assumed that the inflation culture within countries is unchanged over the studied period, though it may differ across countries. As such, a fixed effects application allows for control over this as well as other time-invariant factors that may affect inflation. At the same time, time-invariant characteristics and other variables "are allowed to have different impacts on different regions of the conditional distribution of Y" (Machado & Santos Silva, 2019, p. 148).

Data and descriptive analysis

For the purpose of this study, a constructed dataset consists of yearly observations of developing countries' monetary policy related variables, financial indicators, banking sector characteristics, macroeconomic variables, and other socio-economic characteristics that cover the period from 1998 to 2019. The study considers a developing country as a country that is on the list of low- and lower-middle-income economies countries in the World Bank's classification for the 2020 fiscal year.[7] At that time, there were 78 countries on the list.[8]

The dependent variable, the inflation rate, is based on consumer price level (CPI) annual change data from the World Bank's World Development Indicators (originally from the International Financial Statistics of the IMF). Given the nature of inflation in developing countries, i.e., frequent hyperinflations experienced, it is hardly expected to have this variable distribution be close to normal, mainly due to a large number of outliers (Fig. 1, Graphs 1-3). As such, the initial data on inflation rates was rescaled by applying the following approach: $\pi_{it}/(1+\pi_{it})$.[9] This type of transformation is particularly valuable for research on emerging markets and developing nations, which are exposed to hyperinflationary periods (Arnone & Romelli, 2013). Although the transformation helps to make the shape of the distribution closer

[7] The terms "low and lower middle-income nations" are frequently interchanged with "developing countries," despite the fact that the latter's definition is not universally agreed upon.
[8] The period of study and number of countries are largely determined by the data accessibility of MTI by Dincer et al. (2014, 2022) and have also decreased for the countries that belong to monetary unions.
[9] Given that the original inflation data is in %, the transformation formula is actually $(\pi_{it}/100)/(1+(\pi_{it}/100))$.

to normal, yet it is seen that the outliers' issue persists (Fig. 1, Graphs 4-6). Nevertheless, especially in the case of response variables, these outliers may be informative, as they have a sense, taking into account the hyperinflation periods of some countries. As such, the goal is to accommodate them rather than cut them out. Therefore, this issue must be addressed through the application of an appropriate empirical methodology.

A set of independent variables, which are the main focus of this study, consist of a measure of MPT, key policy rates, and a measure of MPI for sampled countries. There are several ways in the literature to measure central bank transparency (from the monetary policy side). This study utilizes the composite transparency index of Dincer et al. (2022). Following Eijffinger and Geraats (2006) and an extension of Dincer and Eichengreen (2014) and Dincer et al. (2019), which is one of the most widely utilized measures in the field. The measures are available for 112 countries from 1998 to 2019. This index consists of five dimensions, namely political, economic, procedural, policy, and operational transparency. Where each dimension has a sub-index comprised of three items, each with a score of 0, 0.5, or 1. The composite index equals the sum of all items' scores. It has a range from 0 to 15. Dincer et al. (2022) utilized publicly available information in English to build this index.

In terms of MPI measures, there are also a number of approaches. This study departs from the standard practice of using the mostly applicable index of Cukierman et al. (1992) or the mostly recent index of Romelli (2022) in search of a proxy for MPI. Instead, the MPI is measured through the Monetary Independence Index of Aizenman et al. (2008, 2010, 2013), which gives a chance of seeing the de facto monetary policy independence at the country level. The authors calculate the index for a vast number of countries, including developing nations, across time. They use the inverse of the yearly correlation between the monthly interest rates of the home and base countries, and as such, the index values have a continuous nature. The index ranges from 0 to 1, where more monetary policy independence is associated with higher

index scores. For this study's purposes, next, a binary indicator has been developed, with 1 indicating a country with a monetary independence index greater than 0.4800511 (the index's mean value), indicating that the country has an independent monetary policy, and 0 indicating otherwise.[10]

Lastly, the annual data on central bank policy rates (average over the period) from IHS Markit of S&P Global has been utilized. Then, there have been created the binary indicators for monetary policy tightening (1 means rate increase, 0 otherwise) and monetary policy easing (1 means rate decrease, 0 otherwise). In addition, inflation-targeting countries have been identified based on Dincer et al. (2019) and publicly available information on official announcements about invoking the IT regime.[11] The list of countries with the particular indicator of IT dummy in Table 1.

Apart from the variables mentioned above, the study also employs plenty of control factors that have been shown in empirical research to affect inflation (Arnone & Romelli, 2013; Weber, 2018). The macroeconomic variables are mostly taken from the World Development Indicators and the International Financial Statistics of the IMF. The data comes from the Worldwide Governance Indicators, IHS Markit of S&P Global, and the Global Financial Development Database. In addition, the study takes advantage of Nguyen et al. (2022) financial crises' data. To reduce the impact of outliers and missing data, all variables have been verified for them. To find some missing data, the central banks' websites of particular countries were exploited.

As such, a panel data sample has been constructed for 34 developing countries over the period 1998–2019, with 748 observations in total. As lagged variables are included in the models, the number of observations should decrease. Therefore, the study employs 22 variables

[10] Other cut-off values will be used in the robustness checks.
[11]

and lags of some of them based on their correlation and multicollinearity analysis.[12] Summary staitistics are provided in Table 2.

First, before going into empirical analysis, the study descriptively explores the relationships between *inflation* (transformed) and key variables of interest, namely *MPT* and *MPI dummy*.

Fig. 2 illustrates the trend of inflation and MPT in sampled developing countries for 21 years starting in 1998. Several general patterns may be seen from there. Some countries, like Indonesia and Moldova, have a clear sign of an improvement in MPT and a decline in inflation in parallel. Other countries have either an inflation change/volatility with a flat MPT (like Angola and Sudan), or a simultaneous increase of both (Sierra Leone and Nigeria), or even volatility of both (like in Mozambique).

Graph 1 of Fig. 3 illustrates that sampled countries with more transparent monetary policies tend to have lower inflation. At the same time, it is evident that countries with low inflation and high MPT are not necessarily independent from monetary policy perspectives. Meantime, Graph 2 of Fig. 3 shows that countries that utilize an IT regime have mostly lower inflation and higher MPT. It confirms the general view of the literature that IT countries highly price MPT.

Further, the study runs simple correlation analysis by plotting scatterplot diagrams of the inflation against MPT and MPI dummy. Fig. 4 comprises graphs of the inflation–MPT correlation for each sampled country. Although literature indicates a mostly negative (strongly negative) relationship (Dincer & Eichengreen, 2014), the figure shows that the correlation for all samples is indeed negative but weakly (-.187). Yet, there is a variation between countries. Out of 32 countries with MPT data, 14 countries have a positive, and for some, like Sierra

[12] Please find the related Tables in Appendix.

Leone (.738) and Tunisia (.728), even a strongly positive, correlation, which goes against general expectations from the literature. The remaining 18 countries have a canonical negative relationship, led by Zambia's (-.852) figures. To sum up, at this stage, there is no conclusive answer to whether inflation is lower in countries with more transparent monetary policy.

Fig. 5 shows the correlation between inflation (transformed) and the MPI dummy for the sample of developing nations. For the total sample, the relationship is ambiguous (.004). Next, out of 32 countries, 22 have a positive correlation ranging from almost zero (Egypt, .023) to a strong one (Tunisia, .686). Meanwhile, 10 countries have a negative correlation ranging from almost ambiguous (Solomon Islands, -.018) to moderate (Indonesia, -.482). As above, there is no ultimate answer to whether inflation is lower in countries with more independent monetary policy.

Nevertheless, taking into account that MPT and MPI are two important cornerstones of the inflation targeting regime of monetary policy, the following Fig. 6 illustrates the relationship between MPT and inflation (Graph 1) and MPI and inflation (Graph 2) for IT and Non-IT countries. Graph 1 shows a moderate inverse correlation for IT countries (-.504), which is in line with the literature (Westelius, 2009). It means that countries with an IT regime in place tend to have lower inflation when their MPT increases. Meanwhile, Graph 2 shows that the correlation between MPI and the dummy is ambiguous (.004). Independence, even in the case of an IT regime, does not necessarily mean lower inflation.

Lastly, the following correlation analysis in Fig. 7 shows the relationships between a country's average inflation (transformed) and average MPT (Graph 1) and MPI (Graph 2), respectively. The outputs confirm the previous analysis's findings. There is a clear negative correlation between average inflation and average MPT (Graph 1). While the correlation between average inflation and MPI is close to zero (Graph 2).

As such, taking into account the uncertainty of both MPT and MPI's relationship with inflation, the study further moves to an empirical examination of their effects on inflation.

4. Empirical results and discussion

First, following the initial descriptive analysis, the relationships between the dependent variable, transformed *inflation*, and lagged key independent variables, namely *MPT*, *MPI dummy,* and *monetary policy stance dummies,* have been studied. As above, it is investigated using basic correlation analysis, which involved graphing inflation scatterplot diagrams against each of the latter variables.

Contrary to de Mendonça and de Siqueira Galveas (2013), who revealed a strong negative relationship between inflation and transparency for emerging economies, Fig. 8 shows that such a strong or even inverse relationship is not necessarily true, especially in the case of the sampled developing countries.

Although some countries, like Moldova and Zambia, may indeed have some strong inverse relationships (i.e., below -.70) between MPT and inflation (when there is a higher *MPT* in the previous period, then there is lower *inflation* in the following period). About half of the sampled countries had a positive relationship between *inflation* and *MPT* for the preceding period. Nevertheless, the last graph in Fig. 6 demonstrates that the correlation is weakly inverse (-.175) for the whole sample. These go in line with the Fig. 4 findings.

Next, Fig. 9 contains the analysis of scatterplot diagrams of the relationship between inflation and the *MPI dummy* in the sampled countries. According to the literature, the MPI has a diminishing impact on inflation. Hence, a negative correlation was expected. Yet, the last graph of the figure shows that for the total sample, the relationship is weakly negative (-.025, which is even closer to being ambiguous), like in Fig. 5, as some countries have positive while

others have negative relationships. It means that the independent monetary policy of the previous period is not necessarily followed by lower inflation in the next period.[13]

As in Fig. 6, Fig. 10 shows the inflation-MPT (Graph 1) and inflation-MPI (Graph 2) relationship for IT and Non-IT countries. Graph 1 demonstrates a moderate inverse correlation (-.445) for IT nations, which matches Fig. 6 and the literature. Meanwhile, Graph 2 demonstrates that the relationship between the MPI dummy and inflation in the subsequent period is equivocal (.057).

Lastly, Fig. 11 and Fig. 12 include the scatterplot diagrams for the relationship between *inflation* and *monetary policy stance*. The conventional view is that when a central bank increases its policy rate, i.e., sets contractionary monetary policy/tightening (or decreases, i.e., expansionary monetary policy/easing) the inflation should decrease (increase).[14] The important element for this to happen is a workable transmission mechanism of monetary policy. Yet, developing countries, for a number of reasons, including underdeveloped institutions and financial markets and uncompetitive banking systems, may have weak transmission.

As Fischer (2015) stated, "…*even though some central banks use policy rates, changes to these policy rates have only limited effect on other interest rates and on the economy more generally*" (Fischer, 2015, p. 12). As a matter of anecdotal evidence, central banks of developing countries tend to decide to change their policy stance too late or miscalculate the needed size of the intervention, for example, when inflation has already started speeding up and the central bank's policy rate increase only slows the inflation growth but not reverse that.

[13] To exclude the chance that this may be connected to the way the MPI dummy has been constructed, the Appendix contains the per-country illustrations for transformed inflation and the original MPI of Aizenman et al. (2008, 2010, 2013). It shows that the relationship is indeed ambiguous for the sample of developing countries.

[14] Please see, for example, The Economics of Money, Banking and Financial Markets Global Edition of Mishkin (2019) for more details.

Mishra and Montiel (2013) discovered that developing nations' monetary policy transmission appears to be weak. Although some studies argue that some channels of transmission may work well in developing countries too (Abuka et al., 2019). Yet, in line with Mishra et al. (2016) for the case of India, Fig. 5 shows that a monetary policy shock may have no effect on the following period's inflation in the sampled developing countries, or such an effect may be ambiguous. Furthermore, it confirms Huh and Lee (2021), who found that in Bangladesh "…*increasing the reserve money and lowering the repo rate does not increase M2 or inflation …. Such results are not consistent with the monetary easing effects in monetary theory*" (Huh & Lee, 2021, p. 16). Fig. 6 elaborates more on this, showing that even for IT countries the relationship between policy rate increase/decrease and following period's inflation is weak and its direction is not consistent with the monetary theory.

Next, the empirical examination of Eq. (3.4) has been started by testing it through various specifications, taking into consideration the *tightening* of the monetary policy stance (i.e., an increase in the policy rate as opposed to its decrease and no changes in it) and the application of the IT regime in some countries. Table 3 contains the results of quintile regression panel fixed effects estimation, which, overall, confirm the study's hypotheses.

The negative impact of *Transparency* (MPT) on the following period's *inflation* is revealed across almost all specifications, which confirms Hypothesis 1, though statistically not significant. This is as expected from the Fig. 7 findings and goes in line with the empirical literature in the field. At the same time, the *quadratic term of MPT* has mostly a positive sign, which is in line with Weber (2018). Next, the coefficients of interaction between *MPT* and *Tightening* show the diminishing impact on inflation in the following period at a 10% significance level mostly. As such, if a country's monetary policy is in tight mode, a 1-unit increase in *MPT* will decrease the following period's inflation by about 0.6 pp. This is in line with Hypothesis 2. Furthermore, the results of *MPT* and *Independence* (MPI) interaction term

advocate for the contracting effect of increased transparency on inflation for the countries with an independent monetary policy, which confirms Hypothesis 3. Hence, an increase in *MPT* will curb inflation by about 0.4 pp for countries with independent monetary policy, at a 10% significance level. To check the effect of transparency on following period inflation, provided that monetary policy is independent and in a tightening stance, Hypothesis 4, the coefficients of the interaction term between *MPT*, the *MPI dummy* and the *monetary policy tightening dummy* have been estimated. Contrary to the author's expectations, all estimates are positive. The coefficients imply that, with a 5–10% level of significance, a 1-unit increase in the *MPT* index is associated with an inflation increase of about 0.9 pp in the following period for countries with independent monetary policy in a tightening stance. At the same time, the total impact of *MPT* on *inflation,* after controlling for a large number of factors, ranges from -0.7 pp to 0.05 pp based on specifications (3)-(5) estimates.[15]

Importantly, statistically significant estimates for *MPI* and *Tightening dummies* have a positive sign after controlling for all other factors. It means that monetary policy transmission may work against theoretical expectations in non-IT, non-MPI countries, which confirms Huh and Lee's (2021) findings. Yet, the overall effect of both *MPI* and *Tightening* on *inflation* in the following period for the sampled developing countries is negative across specifications (3)-(5), which goes in line with the previous empirical findings in the field.[16]

Then, Eq. (3.4) has been tested by the same specification as above while considering the *easing* of the monetary policy stance (i.e., a decrease in the policy rate as opposed to its increase and no changes in it) and an application of the IT regime in some countries. The quintile regression panel fixed-effects estimates are presented in Table 4. The *MPT* estimates,

[15] The derivative with respect to MPT was taken to get -0.006 from (-0.007+2*0.001*1-0.006*1-0.004*1+0.009*1) for Specification (5) and then transformed back to the initial inflation scale.
[16] The derivative with respect to MPI was taken to get -0.028 from (0.037-0.004*min(MPT)-0.07*1+0.009*1* min(MPT)) for Specification (3) with minimum MPT value of 1 applied, and then transformed back to the initial inflation scale. Similar procedure with respect to monetary policy tightening gives – 0.015 for Specification (5).

though statistically not significant, show the negative effect of transparency on the following period's *inflation* across almost all specifications, even after controlling for a large number of factors. This is consistent with the findings in Fig. 7, the estimates in Table 3, and Hypothesis 1. All other coefficients of main interest (i.e., estimations of interaction terms) are statistically not significant, though with mostly expected signs as in the correlation analysis above and in the literature. The overall effect of transparency on inflation is negative across almost all specifications, though not statistically significant.

The study first utilizes a panel fixed effects estimator multivariate regression approach for the robustness check of the finding. Although there are outliers in the data that may influence both the coefficients' magnitude and standard deviation, the estimation results are generally in line with the output in Tables 3.2 and 3.3.[17] Second, the cut-off to identify a country with an independent monetary policy has been changed to check the sensitivity of the results to the MPI dummy. Two options are considered: higher and lower cut-offs for identifying the MPI dummy. As such, now MPI dummy equals 1 for countries with an MPI index higher than the average of the cut-offs at .75 and .50 percentiles, 0.598975; and higher than the average of the cut-offs at .50 and .25 percentiles, 0.4349765.[18] The results show that the results for the main coefficients of interest remain qualitatively the same, though some become statistically less or more significant.[19] It means that the estimates are not generally sensitive to the change in cut-offs for MPI dummy settings.

As with almost any study on developing countries' issues, this paper's findings are limited to the available data. Variables not included in Eq. (3.4) may be the ones that matter the most for inflation performance in developing nations. The lack of persistence of some

[17] The results are provided in Appendix.
[18] The percentile cut-offs for MPI .25, .50, and .75 are 0.369953, 0.500000, and 0.598975, respectively.
[19] The results are provided in Appendix.

estimates might be due to monetary transmission instability in developing countries or empirical methodology constraints. Future studies should look at these issues.

5. Conclusion

The main goal of this study was to examine the effect of monetary policy transparency (MPT) on inflation in developing countries, given their monetary policy independence (MPI) and stance. Previous literature on this matter is scarce. For the sake of the analysis, the research employed a panel data set on MPT, MPI, and MP stance together with a large number of controls for 34 developing nations from 1998 to 2019.

First, the graphical examination of correlations has revealed that the relationship between MPT and the following period's inflation is weakly negative for the sampled countries, while the correlations of either MPI or MP stance with inflation are ambiguous. It confirms a set of findings on the weak institutional capacity and unstable monetary policy transmission in developing countries. At the same time, the correlation between MPT and inflation is moderately negative for Inflation Targeting (IT) countries.

Second, the quantile regression fixed effects estimations elaborate on these findings. The study revealed that MPT has a diminishing effect on the following period's inflation for countries with tight monetary policy. Furthermore, it is found that increased transparency has a contracting effect on inflation in nations with independent monetary policy while controlling for a tight monetary policy stance, among other factors. Surprisingly, the increase in MPT in the developing countries with independent monetary policies in tight mode may be associated with the increase in the following period's inflation. The overall effect of transparency on inflation is mainly negative for the sampled countries with either tight or easy monetary policy stances. In addition, the study revealed that monetary policy transmission may work against

theoretical expectations in non-IT non-MPI countries, which confirms some related literature. Several robustness checks have been conducted to assess the sensitivity of the results, which generally confirm the findings.

Overall, the paper's major policy implication is that developing nations may benefit more from increased monetary policy transparency when they have an independent monetary policy. At the same time, the role of monetary policy instruments and characteristics in combating inflation may be limited in the case of developing nations due to various factors, including the lack of key policy rate transmission. For monetary policy to be effective, some prerequisites related to countries' economies, markets, and institutions' development should be achieved.

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Table 1. Inflation Targeting countries

#	Country	IT	Since
1	Angola	0	
2	Bangladesh	0	
3	Bhutan	0	
4	Cambodia	0	
5	Egypt, Arab Rep.	0	
6	El Salvador	0	
7	Ethiopia	0	
8	Ghana	1	2007
9	India	1	2016
10	Indonesia	1	2005
11	Kenya	1	2013
12	Kyrgyz Republic	0	
13	Lao PDR	0	
14	Lesotho	0	
15	Malawi	0	
16	Moldova	1	2010
17	Mongolia	1	2007
18	Mozambique	0	
19	Nigeria	0	
20	Pakistan	0	
21	Papua New Guinea	0	
22	Philippines	1	2002
23	Rwanda	1	2019
24	Sierra Leone	0	
25	Solomon Islands	0	
26	Sudan	0	
27	Tajikistan	0	
28	Tanzania	0	
29	Tunisia	0	
30	Uganda	1	2011
31	Ukraine	1	2015
32	Vanuatu	0	
33	Yemen, Rep.	0	
34	Zambia	0	

Notes: IT stands for Inflation Targeting regime dummy, 1 for countries that launched IT starting from the year of official implementation, based on Dincer et al. (2019) and publicly available information on official announcements about invoking the IT regime.

Table 2. Summary statistics

Variable	N	Mean	Std. Dev.	Min	Max
Dependent variables					
Inflation	719	0.08	0.08	-0.22	0.76
Independent variables					
$Inflation_{t-1}$	717	0.09	0.08	-0.22	0.76
$Transparency_{t-1}$	714	4.37	2.51	1	11
$Transparency^2_{t-1}$	714	25.43	27.33	1	121
Independence $_{t-1}$ dummy	636	0.55	0.50	0.00	1.00
Monetary policy stance dummies:					
tightening $_{t-1}$	549	0.34	0.47	0.00	1.00
easing $_{t-1}$	549	0.48	0.50	0.00	1.00
Controls					
Inflation Targeting regime dummy	748	0.13	0.33	0	1.00
GDP growth (annual %)	747	4.91	4.19	-27.99	26.42
Cereal, log	700	14.46	2.73	6.55	19.58
Food, log	714	4.38	0.28	3.27	5.03
Real Rate (%)	601	7.26	10.30	-72.58	50.98
Money growth (annual %)	717	20.49	27.42	-10.14	528.19
FX rate (LCU per US$, period average)	748	4.08	2.61	-1.46	9.56
Econ Open (%)	668	72.28	34.15	1.22	175.35
GDP per capita, log	747	7.20	0.70	5.52	8.39
Financial development index	748	0.17	0.09	0.04	0.50
Control of corruption estimates	680	-0.65	0.53	-1.68	1.64
Government effectiveness estimates	680	-0.58	0.45	-2.28	0.83
Regulatory quality estimates	680	-0.57	0.42	-2.63	0.47
Voice and accountability estimates	680	-0.49	0.64	-1.85	0.81
Banking crises dummy	748	0.04	0.20	0.00	1.00
Currency crises dummy	748	0.07	0.26	0.00	1.00
Debt crises dummy	738	0.42	0.49	0.00	1.00
For reference purposes					
Independence index	659	0.48	0.17	0.02	0.92
Central bank policy rates	585	13.54	15.39	0.83	150

Note: Inflation is calculated based on the transformation of the CPI annual change (%). Data is sourced from the World Bank's World Development Indicators, IHS Markit, IFS of the International Monetary Fund, central banks' webpages, Dincer et al. (2019, 2022); Aizenman et al. (2010, 2013, 2015); and Nguyen et al. (2022).

Table 3. Quantile Panel FE model. Regressions output for tight monetary policy

	(1)	(2)	(3)	(4)	(5)
$Transparency_{t-1}$	0.025	-0.002	-0.001	-0.008	-0.007
	(0.029)	(0.012)	(0.013)	(0.014)	(0.012)
$Transparency^2_{t-1}$	-0.001	0.000	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Tightening_{t-1}$	0.020***	0.010**	0.047*	0.056***	0.059**
	(0.006)	(0.004)	(0.025)	(0.020)	(0.024)
$Independence_{t-1}$	-0.006	0.009*	0.037**	0.033**	0.034***
	(0.009)	(0.005)	(0.015)	(0.013)	(0.011)
Inflation Targeting	0.002	-0.002	0.004	0.017	0.014
	(0.015)	(0.013)	(0.014)	(0.012)	(0.013)
$Transparency_{t-1}$*$Tightening_{t-1}$			-0.005	-0.006*	-0.006*
			(0.004)	(0.003)	(0.003)
$Transparency_{t-1}$*$Independence_{t-1}$			-0.004*	-0.004*	-0.004**
			(0.002)	(0.002)	(0.002)
$Tightening_{t-1}$*$Independence_{t-1}$			-0.070*	-0.074***	-0.077**
			(0.039)	(0.027)	(0.034)
$Transparency_{t-1}$*$Tightening_{t-1}$*			0.009*	0.009**	0.009**
*$Independence_{t-1}$			(0.006)	(0.004)	(0.004)
Controls	No	13	13	19	22
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Bootstrap SE	Yes	Yes	Yes	Yes	Yes
Countries	32	27	27	27	27
Observations	505	362	362	342	342

Notes: The dependent variable, Inflation, transformed inflation rate, measured by the CPI annual change (%) from the World Bank's World Development Indicators (WDI); Transparency stands for the composite index of MPT of Dincer et al. (2014, 2022); Tightening is a dummy for monetary policy tightening (1 means tight monetary policy stance, 0 otherwise) based on the annual data on central bank policy rate (average of the period) from IHS Markit; Independence is a dummy where 1 stands for independent monetary policy based on Aizenman et al. (2010, 2013, 2015) monetary independence index, where the cut-off of MPI index mean value (i.e., 0.5494875) applied. Inflation Targeting stands for an IT dummy (1 means a country with an IT regime) based on Dincer et al. (2019) and publicly available information on official announcements about invoking the IT regime. Controls include, for specifications (2)-(3) current and 1-period lagged: GDP growth (annual %), log of cereal production (metric tons), log of food production index; real interest rate (%), a broad money growth (annual %); an official exchange rate (LCU per US$, period average); economic openness based on exports of goods and services (% of GDP) and import of goods and services (% of GDP) from WDI; for specification (4): all previous plus, financial development index, log of GDP per capita, control of corruption estimates, government effectiveness estimates, regulatory quality estimates, voice and accountability estimates; for Specification (5): all previous plus banking crises, currency crises and debt crises from Nguyen et al. (2022). Each model uses panel estimations, controls for year-fixed effects, accounts for fixed effects for each country. Bootstrap standard errors by nations, clustered, with parenthesis. Significance levels of 10%, 5%, and 1% are indicated, respectively, by the symbols *, **, and ***.

Table 4. Quantile Panel FE model. Regressions output for ease monetary policy

	(1)	(2)	(3)	(4)	(5)
$Transparency_{t-1}$	0.023	-0.003	-0.004	-0.008	-0.008
	(0.027)	(0.012)	(0.013)	(0.013)	(0.015)
$Transparency^2_{t-1}$	-0.001	0.000	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Easing_{t-1}$	-0.024***	-0.013***	-0.027	-0.026	-0.027*
	(0.006)	(0.004)	(0.021)	(0.020)	(0.014)
$Independence_{t-1}$	-0.007	0.008*	0.002	-0.002	-0.002
	(0.009)	(0.004)	(0.015)	(0.016)	(0.014)
Inflation Targeting	0.002	-0.001	0.001	0.013	0.009
	(0.015)	(0.014)	(0.014)	(0.013)	(0.015)
$Transparency_{t-1}$*$Easing_{t-1}$			0.002	0.001	0.002
			(0.003)	(0.003)	(0.002)
$Transparency_{t-1}$*$Independence_{t-1}$			0.000	0.000	-0.000
			(0.002)	(0.002)	(0.002)
$Easing_{t-1}$*$Independence_{t-1}$			0.025	0.018	0.019
			(0.024)	(0.018)	(0.017)
$Transparency_{t-1}$*$Easing_{t-1}$*			-0.004	-0.002	-0.002
*$Independence_{t-1}$			(0.003)	(0.002)	(0.002)
Controls	No	13	13	19	22
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Bootstrap SE	Yes	Yes	Yes	Yes	Yes
Countries	32	27	27	27	27
Observations	505	362	362	342	342

Notes: The dependent variable, Inflation, transformed inflation rate, measured by the CPI annual change (%) from the World Bank's World Development Indicators (WDI); Transparency stands for the composite index of MPT of Dincer et al. (2014, 2022); Easing is a dummy for monetary policy easing (1 means ease monetary policy stance, 0 otherwise) based on the annual data on central bank policy rate (average of the period) from IHS Markit; Independence is a dummy where 1 stands for independent monetary policy based on Aizenman et al. (2010, 2013, 2015) monetary independence index, where the cut-off of MPI index mean value (i.e., 0.5494875) applied. Inflation Targeting stands for an IT dummy (1 means a country with an IT regime) based on Dincer et al. (2019) and publicly available information on official announcements about invoking the IT regime. Controls include, for specifications (2)-(3) current and 1-period lagged: GDP growth (annual %), log of cereal production (metric tons), log of food production index; real interest rate (%), a broad money growth (annual %); an official exchange rate (LCU per US$, period average); economic openness based on exports of goods and services (% of GDP) and import of goods and services (% of GDP) from WDI; for specification (4): all previous plus, financial development index, log of GDP per capita, control of corruption estimates, government effectiveness estimates, regulatory quality estimates, voice and accountability estimates; for specification (5): all previous plus banking crises, currency crises and debt crises from Nguyen et al. (2022). Each model uses panel estimations, controls for year-fixed effects, accounts for fixed effects for each country. Bootstrap standard errors by nations, clustered, with parenthesis. Significance levels of 10%, 5%, and 1% are indicated, respectively, by the symbols *, **, and ***.

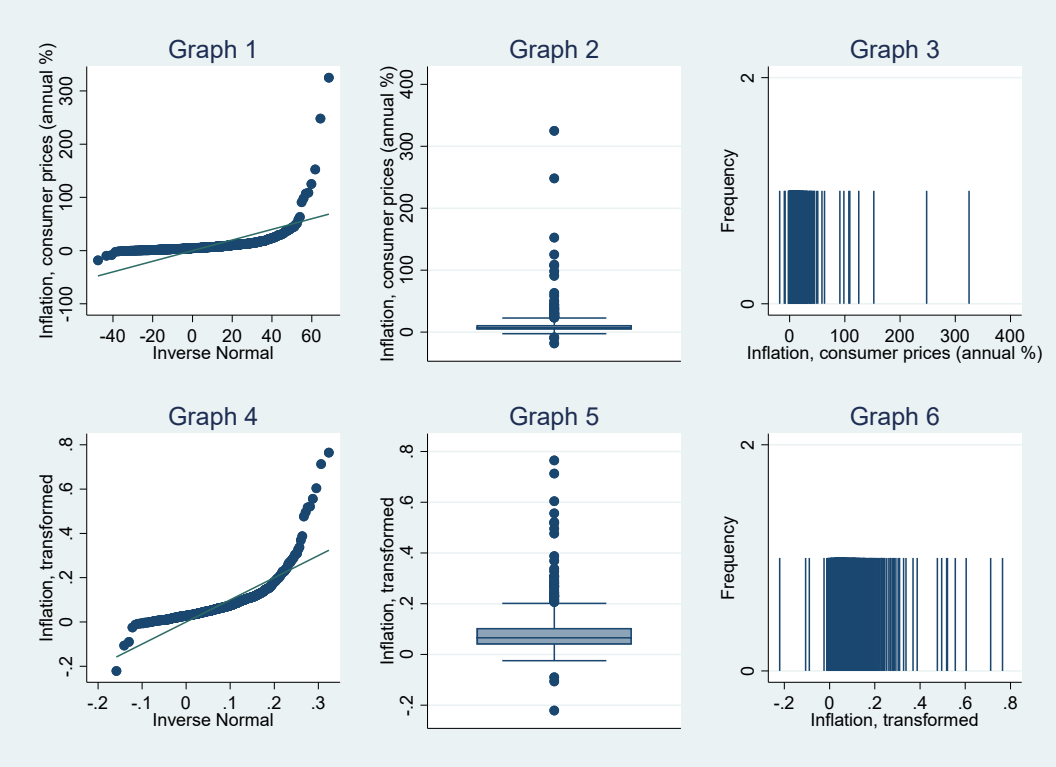

Fig. 1. Inflation data examination

Note: Graph 1 – a Q-Q plot of Original Inflation data to a normal distribution, Graph 2 – a box plot of Original Inflation data, Graph 3 – a spike plot (frequency plot) of Original Inflation data, Graph 4 – a Q-Q plot of transformed Inflation data to normal distribution, Graph 5 – a box plot of transformed Inflation data, Graph 6 – a spike plot (frequency plot) of transformed Inflation data.

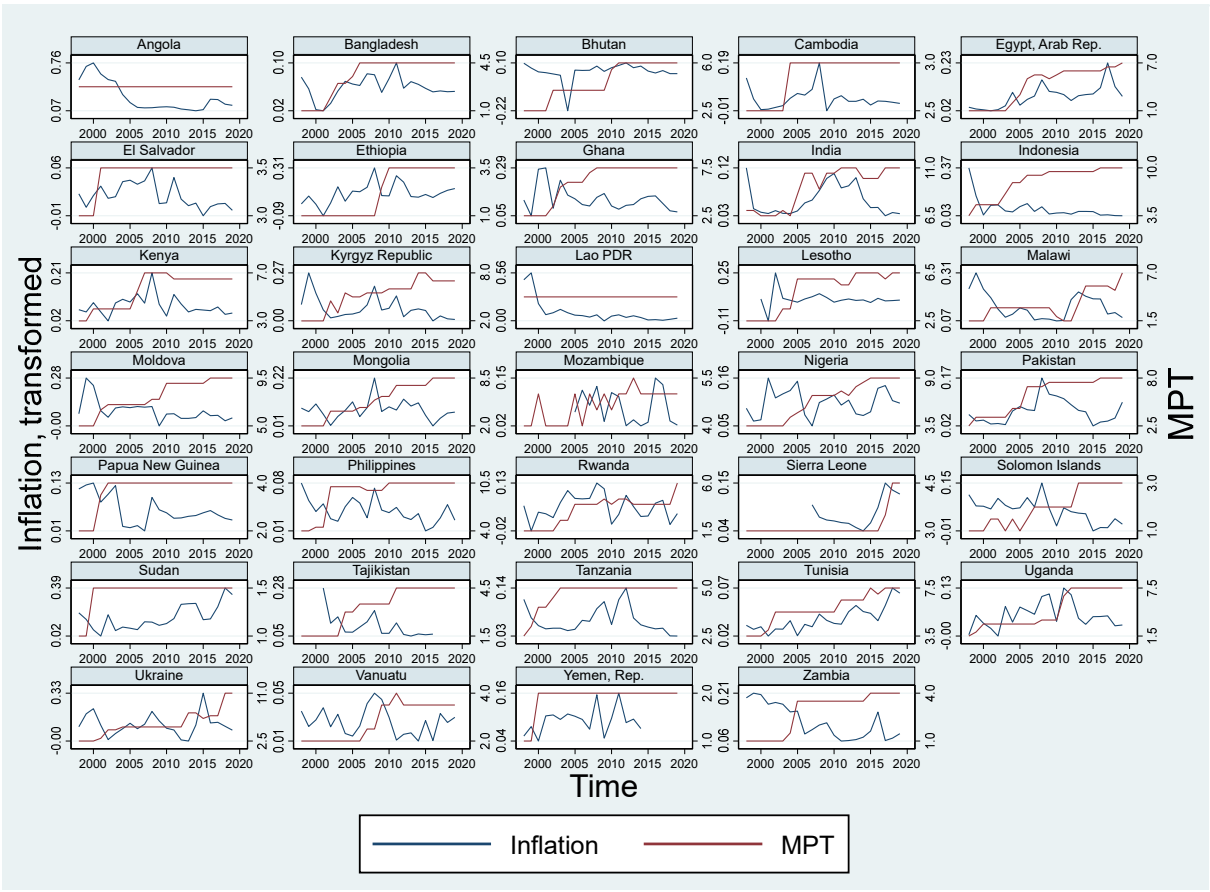

Fig. 2. Inflation and Monetary Policy Transparency across countries

Note: Inflation is a transformed inflation rate, which is measured by the CPI annual change (%) from the World Bank's World Development Indicators. MPT stands for the composite Transparency index of Dincer et al. (2022).

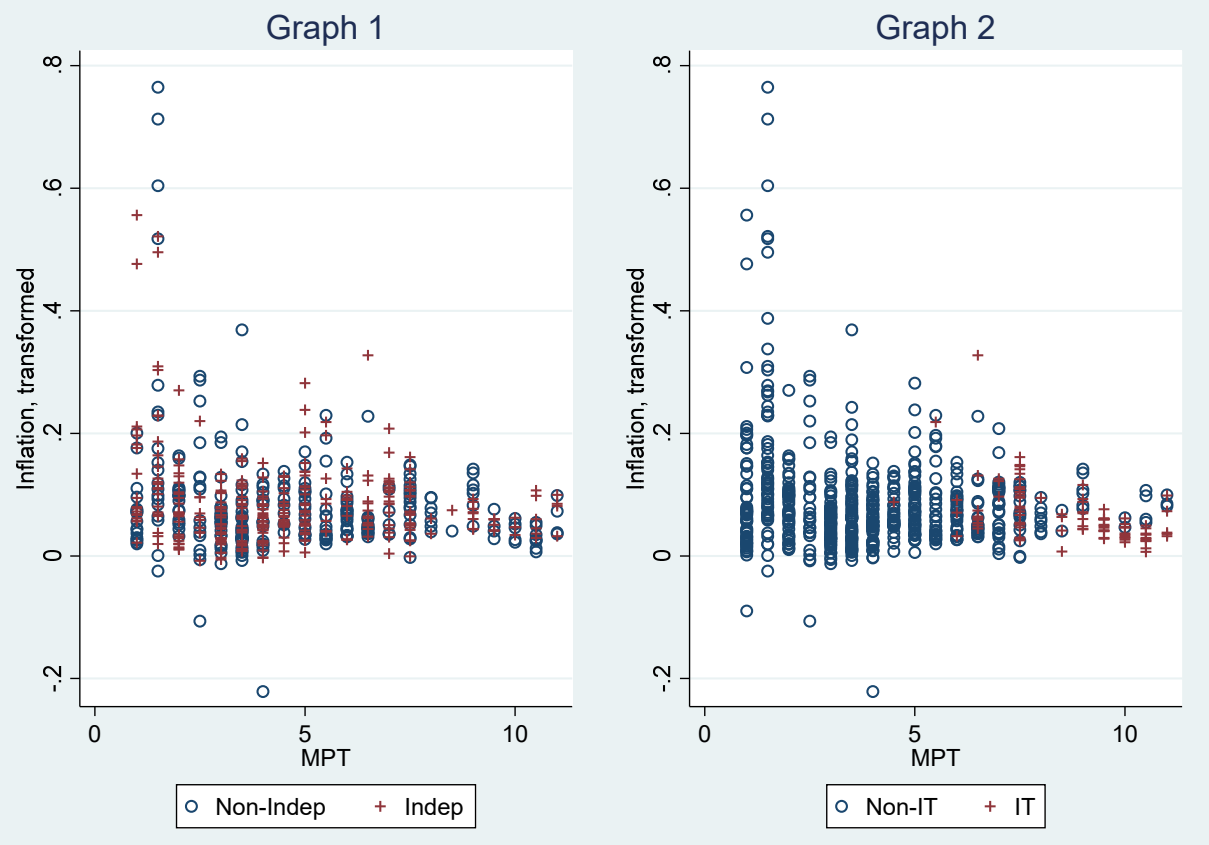

Fig. 3. Inflation vs. Monetary Policy Transparency by Independence and IT

Note: Inflation is a transformed inflation rate, which is measured by the CPI annual change (%) from the World Bank's World Development Indicators. MPT stands for the composite Transparency index of Dincer et al. (2022). MPI is a dummy where 1 stands for independent monetary policy based on Aizenman et al. (2010, 2013, 2015) monetary independence index. IT stands for countries that utilize Inflation Targeting, otherwise Non-IT, based on Dincer et al. (2019) and publicly available information on official announcements about invoking the IT regime.

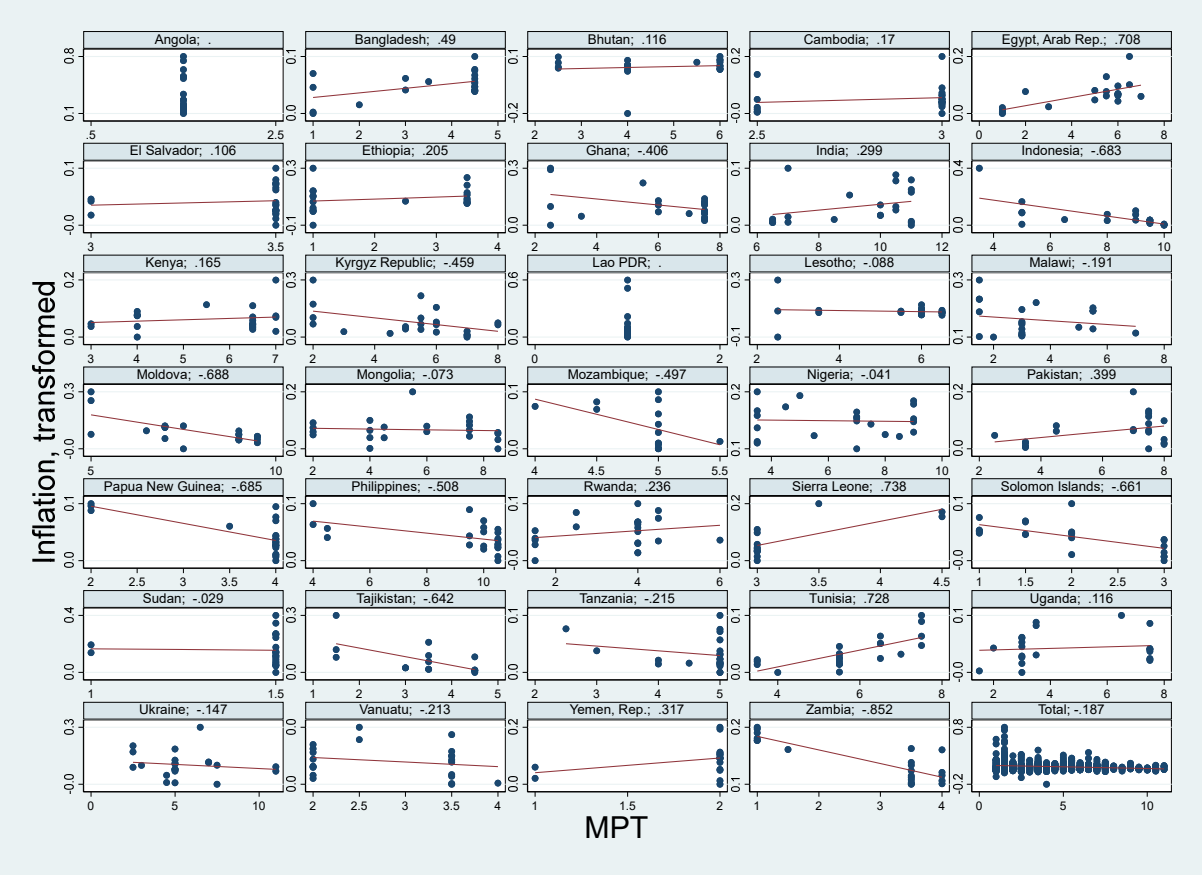

Fig. 4. Inflation vs. Monetary Policy Transparency (MPT)

Note: Inflation is a transformed inflation rate, which is measured by the CPI annual change (%) from the World Bank's World Development Indicators. MPT stands for the composite Transparency index of Dincer et al. (2022). A particular correlation coefficient is in a graph's title. Source: results from own analysis.

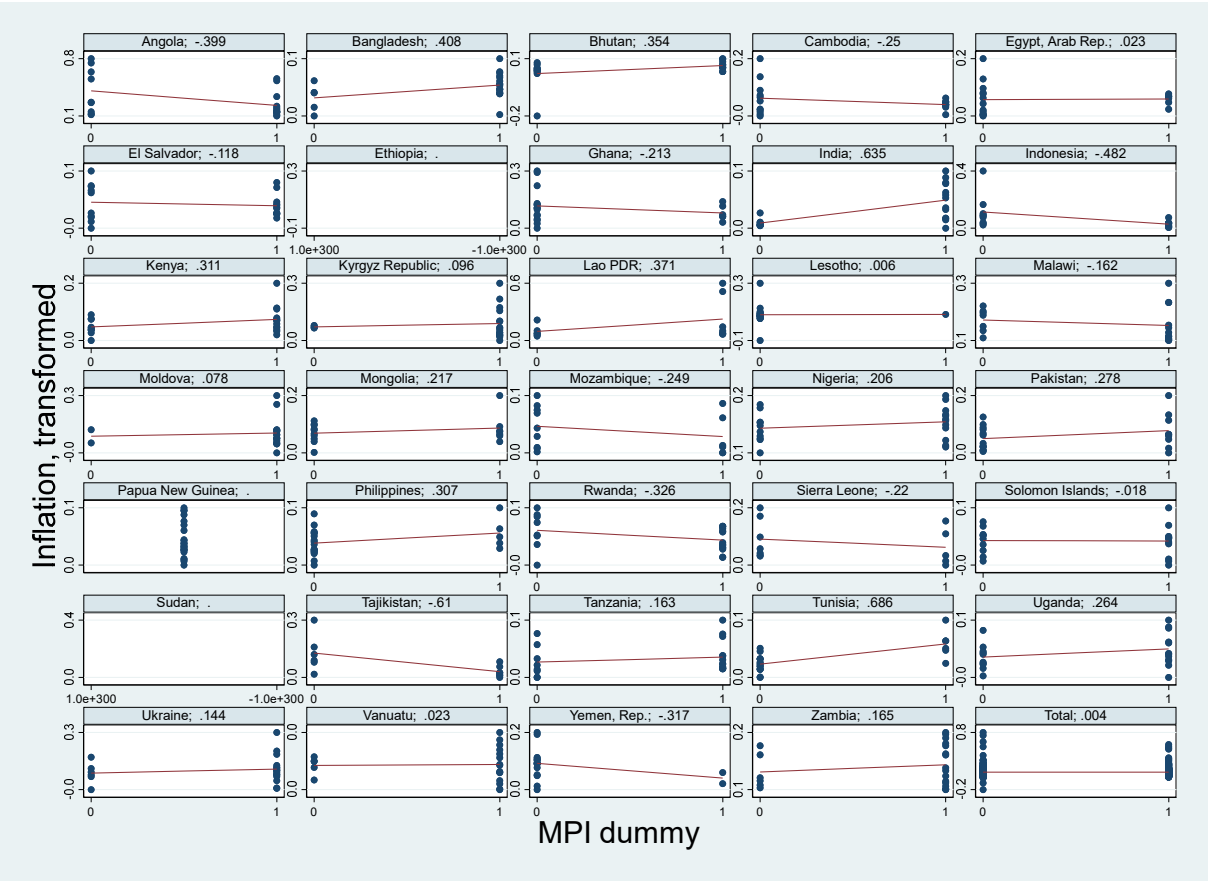

Fig. 5. Inflation vs. Monetary Policy Independence (MPI dummy)

Note: Inflation is a transformed inflation rate, which is measured by the CPI annual change (%) from the World Bank's World Development Indicators. MPI is a dummy where 1 stands for independent monetary policy based on Aizenman et al. (2010, 2013, 2015) monetary independence index. A particular correlation coefficient is in a graph's title. Source: results from own analysis.

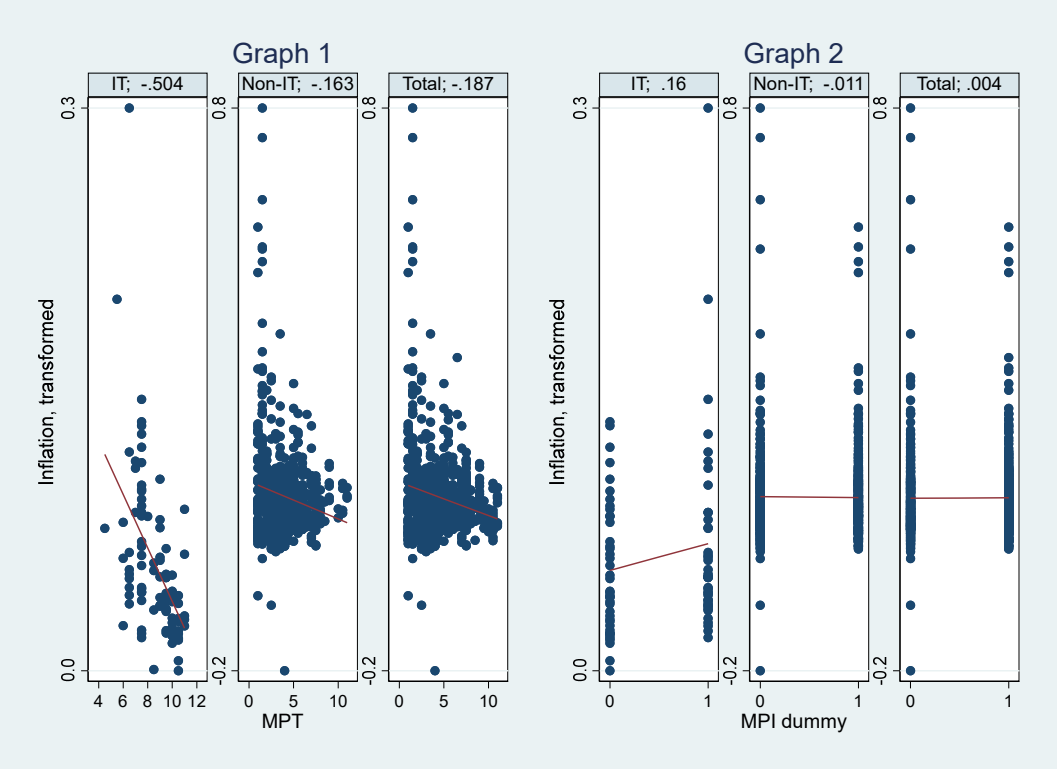

Fig. 6. Inflation vs. Monetary Policy Transparency and Independence by IT and Non-IT regimes (MPT, MPI dummy)

Note: Inflation is a transformed inflation rate, which is measured by the CPI annual change (%) from the World Bank's World Development Indicators. MPT stands for the composite Transparency index of Dincer et al. (2022). MPI is a dummy where 1 stands for independent monetary policy based on Aizenman et al. (2010, 2013, 2015) monetary independence index. IT stands for countries that utilize Inflation Targeting, otherwise Non-IT, based on Dincer et al. (2019) and publicly available information on official announcements about invoking the IT regime. A particular correlation coefficient is in a graph's title. Source: results from own analysis.

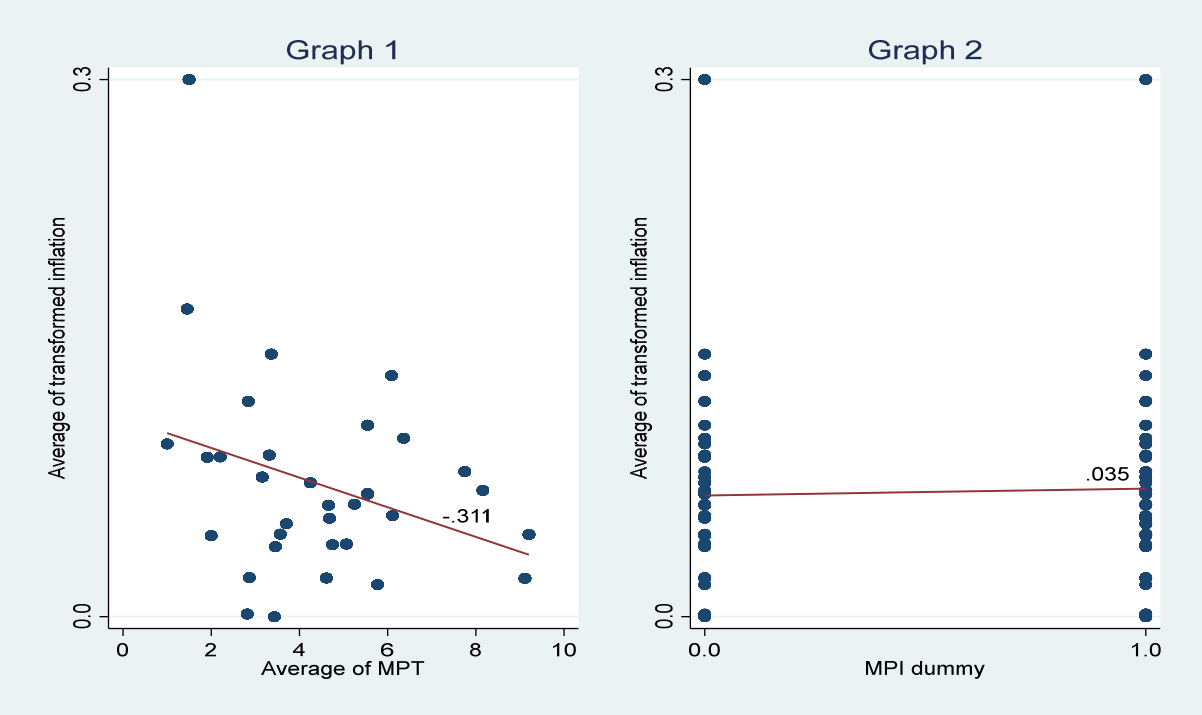

Fig. 7. Average Inflation vs. Average Monetary Policy Transparency and Independence (average MPT, MPI dummy)

Note: Average of transformed inflation is a mean of a transformed inflation rate of each sampled country, which is measured by the CPI annual change (%) from the World Bank's World Development Indicators. MPI is a dummy where 1 stands for independent monetary policy based on Aizenman et al. (2010, 2013, 2015) monetary independence index. Particular correlation coefficients are above graph's fitted lines. Source: results from own analysis.

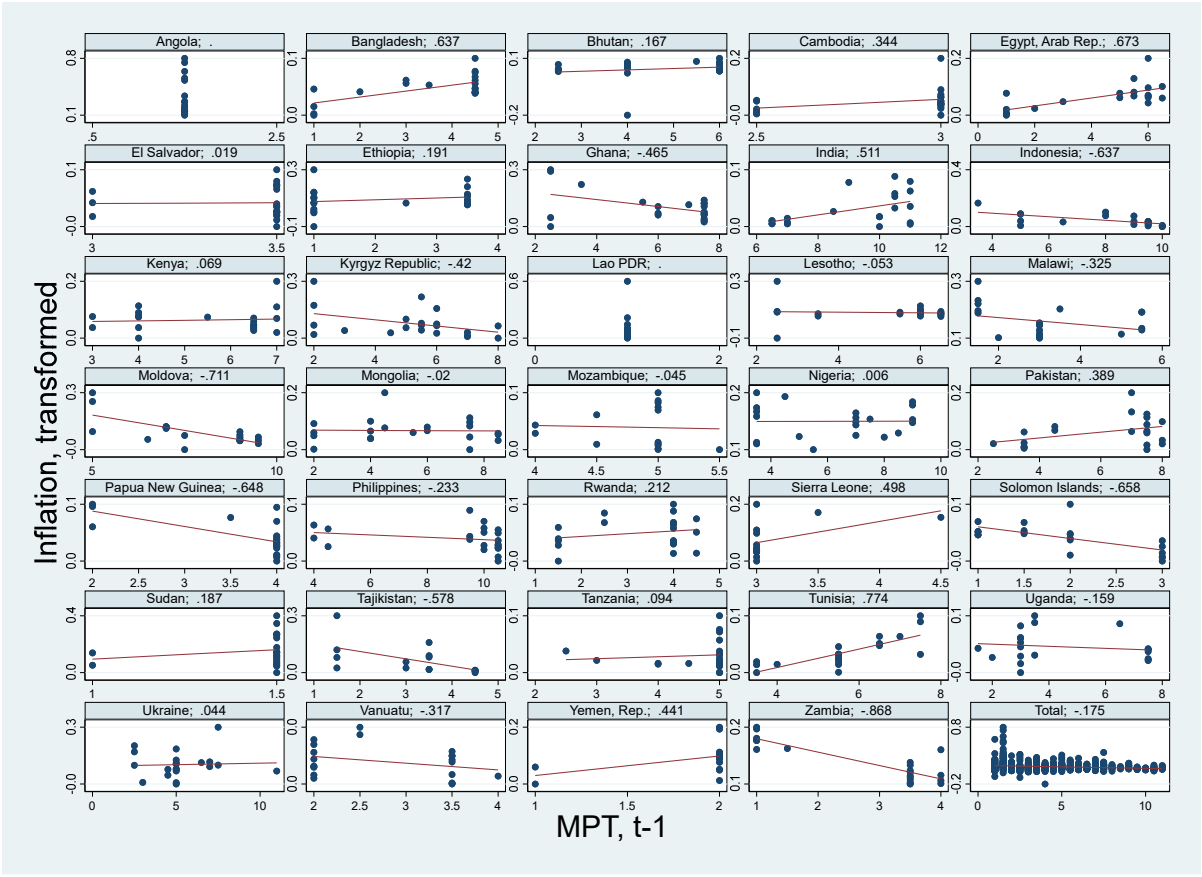

Fig. 8. Inflation vs. Monetary Policy Transparency (MPT lagged)

Note: Inflation is a transformed inflation rate, which is measured by the CPI annual change (%) from the World Bank's World Development Indicators. MPT stands for the composite Transparency index of Dincer et al. (2022) lagged for 1 period. A particular correlation coefficient is in a graph's title. Source: results from own analysis.

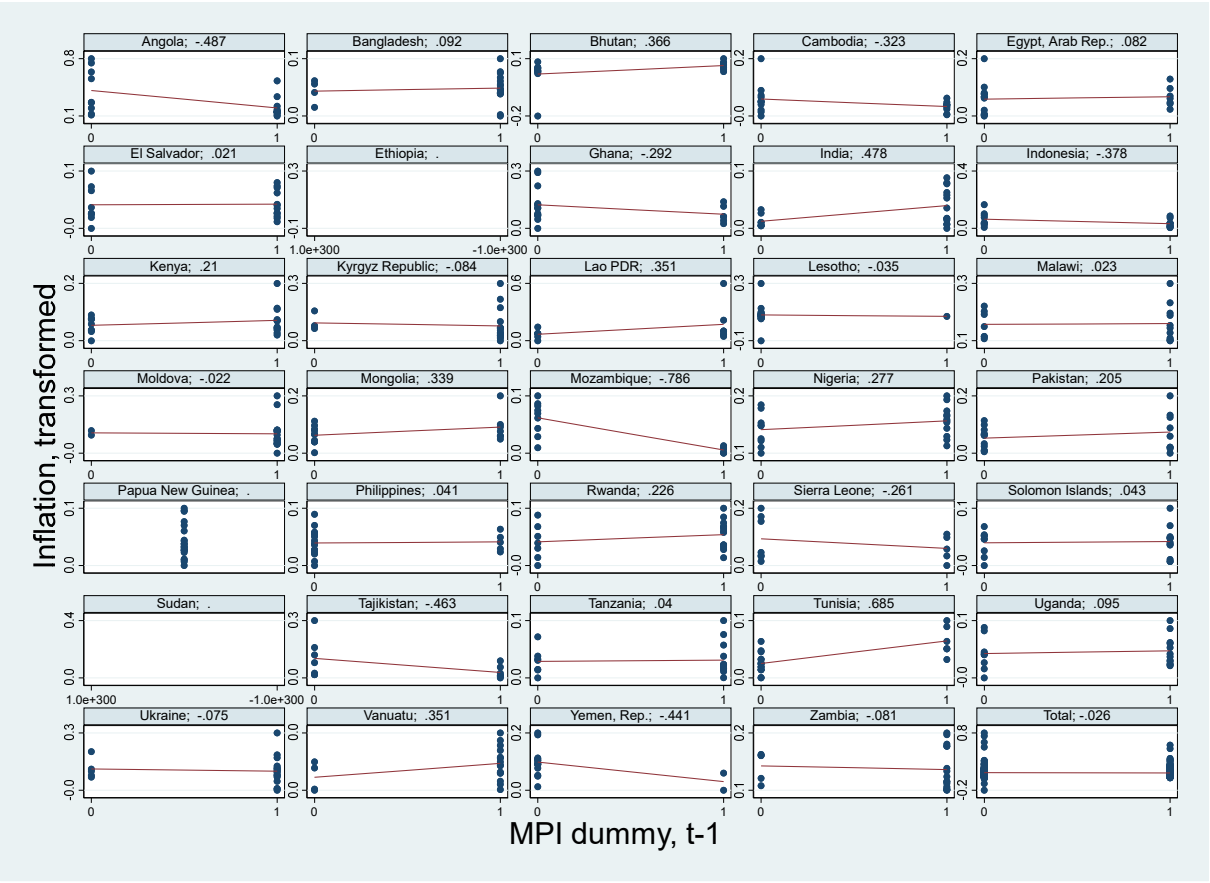

Fig. 9. Inflation vs. Monetary Policy Independence (MPI dummy, lagged)

Note: Inflation is a transformed inflation rate, which is measured by the CPI annual change (%) from the World Bank's World Development Indicators. MPI is a dummy where 1 stands for independent monetary policy based on Aizenman et al. (2010, 2013, 2015) monetary independence index lagged for 1 period. A particular correlation coefficient is in a graph's title. Source: results from own analysis.

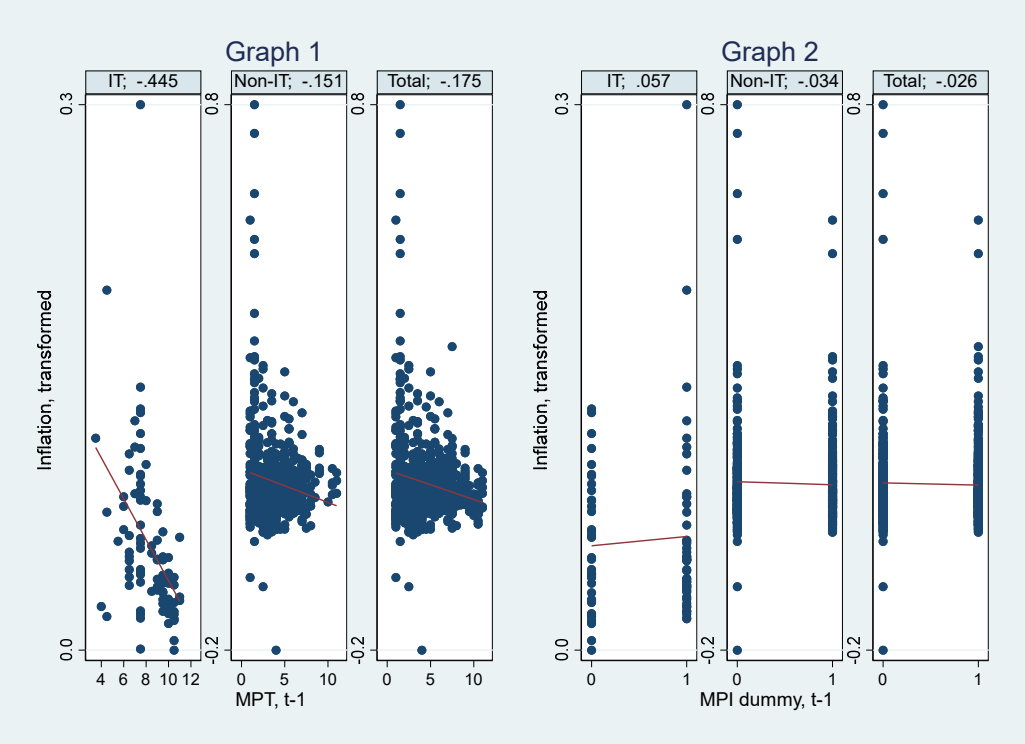

Fig. 10. Inflation vs. Monetary Policy Transparency and Independence by IT and Non-IT regimes (MPT lagged, MPI dummy lagged)

Note: Inflation is a transformed inflation rate, which is measured by the CPI annual change (%) from the World Bank's World Development Indicators. MPT stands for the composite Transparency index of Dincer et al. (2022) lagged for 1 period. MPI is a dummy where 1 stands for independent monetary policy based on Aizenman et al. (2010, 2013, 2015) monetary independence index lagged for 1 period. IT stands for countries that utilize Inflation Targeting, otherwise Non-IT, based on Dincer et al. (2019) and publicly available information on official announcements about invoking the IT regime. A particular correlation coefficient is in a graph's title. Source: results from own analysis.

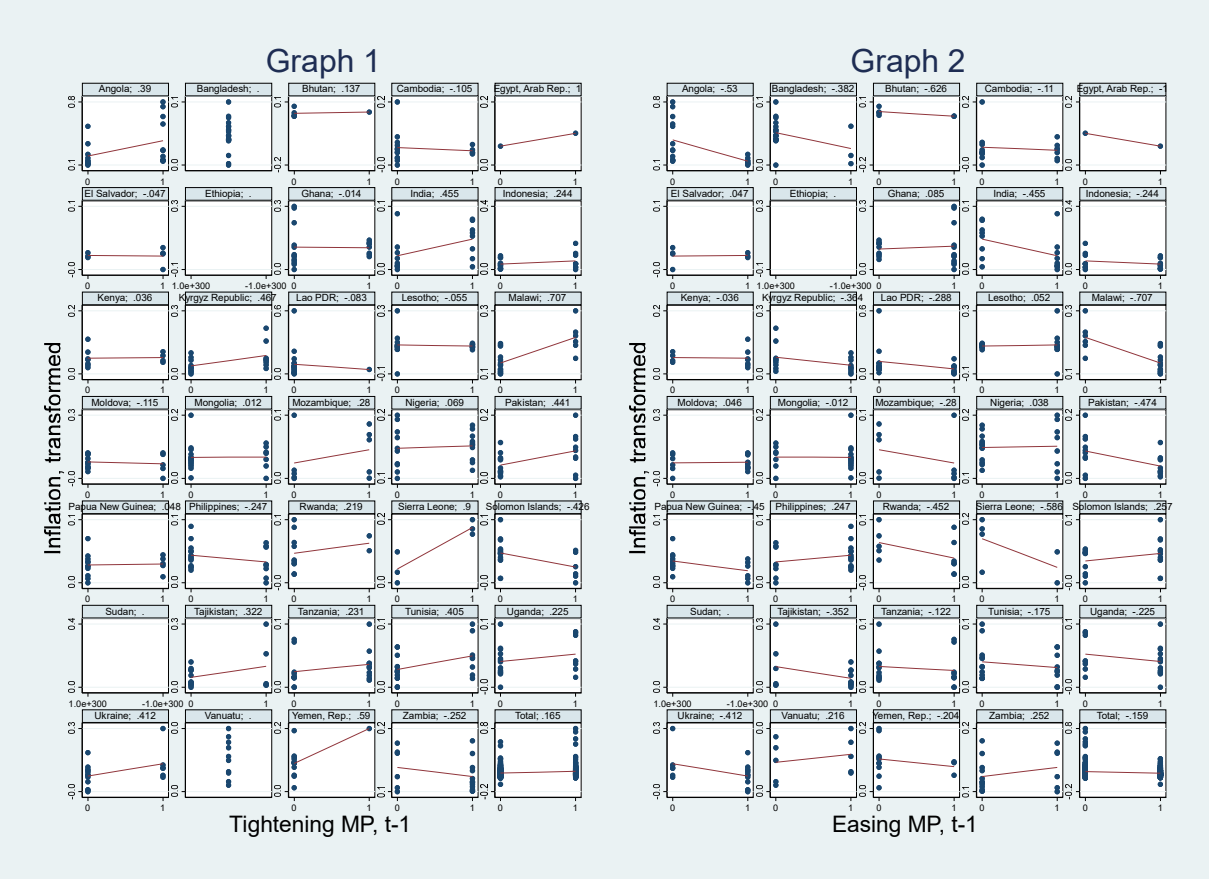

Fig. 11. Inflation vs. Monetary Policy Stance (dummies, lagged)

Note: Inflation is a transformed inflation rate, which is measured by the CPI annual change (%) from the World Bank's World Development Indicators. Tightening is a dummy for monetary policy tightening (1 means rate increase, 0 otherwise), and easing is a dummy for monetary policy easing (1 means rate decrease, 0 otherwise) both lagged for 1 period based on the annual data on central bank policy rates (average of the period) from IHS Markit. A particular correlation coefficient is in a graph's title. Source: results from own analysis.

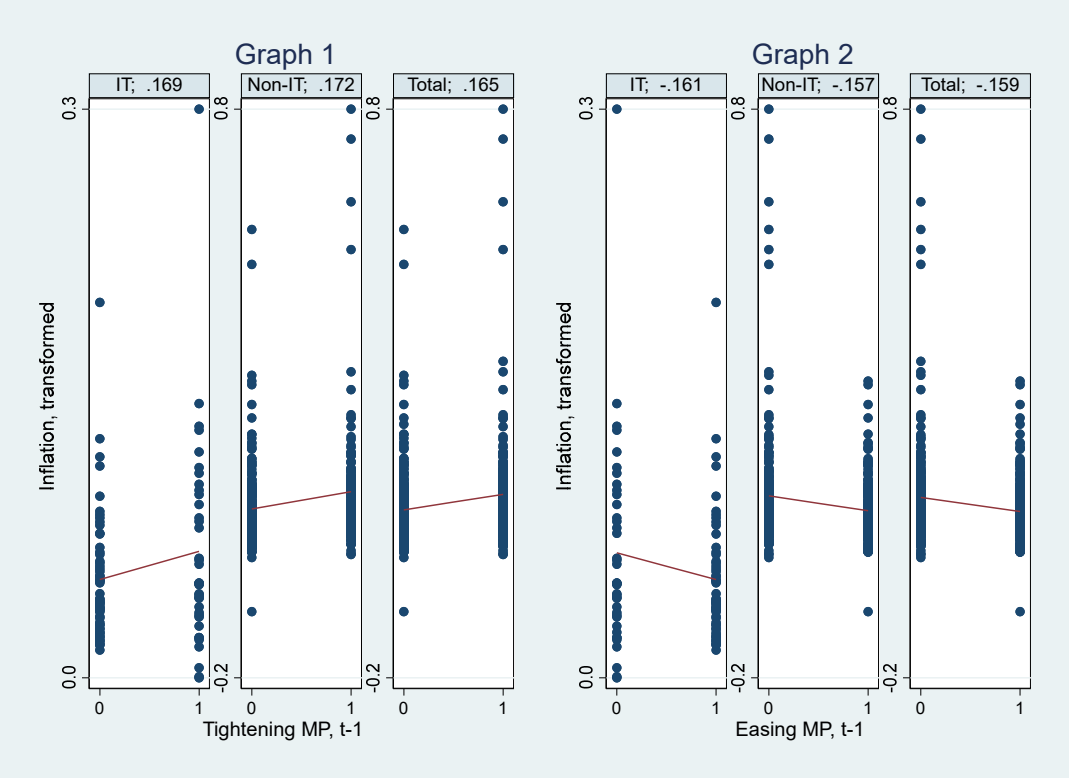

Fig. 3. Inflation vs. Monetary Policy Stance (dummies, lagged) by IT and Non-IT regimes

Note: Inflation is a transformed inflation rate, which is measured by the CPI annual change (%) from the World Bank's World Development Indicators. Tightening is a dummy for monetary policy tightening (1 means rate increase, 0 otherwise), and easing is a dummy for monetary policy easing (1 means rate decrease, 0 otherwise) both lagged for 1 period based on the annual data on central bank policy rates (average of the period) from IHS Markit. IT stands for countries that utilize Inflation Targeting, otherwise Non-IT, based on Dincer et al. (2019) and publicly available information on official announcements about invoking the IT regime. A particular correlation coefficient is in a graph's title. Source: results from own analysis.