

Does Central Bank Transparency Matter for Inflation: Role of Inflation Targeting

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Abstract This paper examines the relationship between central bank transparency and inflation for six inflation targeting (IT) and ten non-inflation targeting (non-IT) Asian economies. The propensity score matching and panel regression model are employed in the study. The empirical analysis shows that IT enhances central bank transparency. Further, we find that central bank transparency in IT significantly lowers inflation, suggesting that countries promoting greater monetary policy transparency can have a better advantage of experiencing low inflation. Our findings have policy implications for central banks in developing economies that are grappling with low transparency.

Keywords: monetary policy, inflation targeting, central bank transparency, inflation, panel data model

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I. Introduction

The transparency aspects in central banking policy have gained momentum in the last one and a half decades. It is considered an important discovery in today's central banking operation. Fry et al. (2000) observe that in 94 countries, around 74% of central banks consider transparency a vital component of their monetary policy, and 78% publish a forward-looking analysis in the monetary policy report. Most researchers agree that a transparent framework of central

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bank policy is advantageous for market participants because it improves expectations and decisions by increasing the flow of information that economic agents have access to (Blinder, 1999; Crowe & Meade, 2008). Without transparency, asymmetric information problems will lead to uncertain expectations and market failure (Spence, 1976).

The inflation targeting framework is one of the best examples of giving high priorities to monetary policy transparency through an explicit quantitative target in objective and frequent communications with the public (Bernanke et al., 1999; Mishkin, 1999). Inflation targeting central banks have expanded their efforts to engage with the public by releasing documents like an inflation report, conducting extensive outreach programs, and even handing out attractive pamphlets, as in New Zealand. The monetary policy goals and constraints are explained in the inflation reports, which are far more user-friendly than earlier central bank documents. This includes the justification for inflation targets, the numerical values of the inflation targets, how they are determined, how the inflation targets are to be achieved given the current economic conditions, and reasons for any deviations from targets. This may have led IT central banks to massively benefit from higher transparency. The central banks have been able to boost their credibility and stabilize inflation expectations by making explicit statements about their inflation goals (Levin et al., 2004; Sethi & Acharya, 2018, 2019; Sethi et al., 2018).

A substantial body of research on central bank transparency¹⁾ focuses on its impact on the financial market. It is observed that central bank transparency can help bring efficiency to the financial market (Blinder et al., 2001), accurately form future expectations and precisely react to changes in the Federal Reserve's movement in interest rates (Poole et al., 2002), lowers stock market volatility ensure (Papadamou et al., 2014), ensure efficient market functioning of bond markets in industrialized countries (Tomljanovich, 2007), reduce money market risk and volatility (Kia, 2017), improve expectation formation in both advanced and emerging economies by dampening volatility in expectations and lessening the expectation bias in the money market (Neuenkirch, 2012, 2013), improve interest rate forecast accuracy and reduced forecast dispersion (Swanson, 2006; Bauer et al., 2006; Berger et al., 2009; Lahiri & Sheng, 2010; Middeldorp, 2011; Ehrmann et al., 2012).

According to Andersson et al. (2006), central bank transparency can affect both the yield curve's short- and long-term terms. Papadamou et al. (2014) identified a negative correlation between central bank transparency and stock market volatility for a large cross-country sample. Horváth and Vasko (2016) find that central banks with more open monetary policies typically display higher levels of financial stability; however, if transparency is excessive, it might have the opposite effect. Eichler et al. (2017) observed that increasing central bank transparency

1) Dincer et al. (2022) mentioned that central bank transparency indicates monetary policy transparency. In addition to conducting monetary policy, many central banks also perform tasks like macroprudential regulation, supervision, and, increasingly, macroprudential policy.

causes an increase in cross-border claims in destination countries. Eichler and Littke (2018) find compelling evidence that lower exchange rate volatility results from more information availability about monetary policy goals. Sethi and Achary (2019, 2020) found that inflation targeting is effective in Asian economies in reducing the inflation-output tradeoff and financial instability.

Relative to the abundant literature on the effect of central bank transparency on the financial market, only limited literature exists on its impact on inflation. Chortareas et al. (2002) find that central bank transparency lowers inflation in eighty-two countries. They observe that countries following an inflation or monetary target could reduce inflation successfully, while countries following exchange rate targeting could not. The major weakness of the work lies in the proposed measure of transparency. It is calculated for a single year; thus, the time-varying effect of transparency was not captured. Demertzis and Hallett (2007) employ the Eijffinger-Geraats index and suggest a negative relationship between inflation variability and central bank transparency but not between the level of inflation and transparency. Two important sub-indices of transparency-economic and operational- drive this result. Fatas et al. (2007) observe that a central bank with a formal quantitative target in its monetary policy objective reduces inflation. Dincer and Eichengreen (2007) find a strong relationship between transparency and inflation variability. The major cavity of the study is the use of pooled regression analysis that ignores unobserved individual heterogeneity. The persistent effect of transparency over time and neglecting fixed effects analysis could provide inconsistent estimates. In a similar study, Dincer and Eichengreen (2009, 2014) find that higher transparency is associated with less inflation variability across hundreds of countries. Dincer et al. (2022) observe that inflation targeting central banks are the most transparent due to greater stress on transparency and communication. However, the study did not apply any empirical test for arriving at this conclusion; instead, they observed it from the time series plots. Van der Crujssen et al. (2010) observe that central bank transparency benefits private-sector inflation forecasts. However, excess information confuses the private sector and reduces the quality of their inflation forecast through higher inflation persistency.

Despite these studies, the impact of IT-induced central bank transparency on inflation in Asian countries is largely ignored. More specifically, there has been scant literature evaluating how central bank transparency in IT differs in its impact on inflation from central bank transparency without inflation targeting. Further, the existing studies have paid less attention to examining empirically whether central banks that follow IT have greater central bank transparency than the countries that do not follow IT policy.

The present study contributes to the literature in the following ways. First, a propensity score matching method empirically examines whether IT has induced central bank transparency in Asian economies. Further, two panel data regression models are used to check the robustness of the result. Institutional factors such as political stability, government effectiveness, rule of law, corruption, voice and accountability, and regulator quality are used to control for differences

in institutional quality across IT and non-IT countries. Given the previous studies, we anticipate that IT is committed to constant communication and information disclosure, making a significant difference in transparency between IT and non-IT. Second, in contrast to previous empirical studies involving transparency, such as Papadamou et al. (2014) and Eichler and Littke (2018), we examine how greater focus on transparency by IT central banks in Asia has influenced inflation rather than financial markets. Further, unlike recent studies such as Fatas et al. (2007), Dincer and Eichengreen (2009, 2014), and Dincer et al. (2022), we use central bank transparency of inflation targeting to evaluate the role of IT in transparency along with aggregate transparency index. Understanding the issue of inflation is of prime importance to central banks since high inflation can significantly affect macroeconomic stability. Further, the effectiveness of the monetary transmission mechanism is linked to the degree of transparency chosen by a central bank. Toward this objective, we use two panel data regression models with the Panel Corrected Standard Error (PCSE) and Driscoll and Kraay's (1998) robust standard errors. Third, we examine the role of sub-categories of transparency (political, economic, procedural, policy, operational) that are particularly important for reducing inflation.

The rest of the paper is organized as follows: Section 2 presents the survey of relevant literature on measuring central bank transparency. The theoretical framework is given in section 3. Section 4 describes empirical methodology. Section 5 explains data and variables. The results and discussion is given in section 6. The concluding remarks are offered in the last section.

II. On Measuring Central Bank Transparency

Eijffinger and Geraats (2006) and Dincer and Eichengreen (2014) proposed a five-dimensional measure of central bank transparency: political transparency, economic transparency, procedural transparency, policy transparency, and operational transparency, and provided a time-varying measure which was lacking in Fry et al. (2000), Chortareas et al. (2002) and Siklos (2002). These five-dimensional transparencies are as follows:

- Political transparency is the openness about the formal target of the policy objective. The quantitative target of the objective is disclosed to the public.
- Economic transparency is communicating all information used in monetary policy decisions to the public, such as economic data, policy models, forecasts, etc.
- Procedural transparency refers to the disclosing of the strategy of monetary policy. How the policy decisions are finally reached and in what way it is reached.
- Policy transparency is disclosing policy decisions. It contains explanations for changes in monetary policy and indications for future policy inclination.

- Operational transparency refers to putting all information about implementing monetary policy in the public domain.

For detailed explanations of the methodology, refer to Dincer and Eichengreen (2014) and Dincer et al. (2019).

III. Central Bank Transparency and Inflation: The Theory

The absence of asymmetric information between monetary policymakers and other economic agents can be characterized as central bank transparency. This indicates that it lessens uncertainty, which is generally considered advantageous (Geraats, 2002). The central bank's communication with the public regarding its monetary policy objectives, strategy, economic outlook, and the outlook for future policy decisions could limit the effect of asymmetric information problems and prevent market failure. In the absence of transparency, two effects could lead to market distortion. First, the economic agents experiencing information disadvantages develop uncertainty in expectations, leading to the "uncertainty effect." Second, those with access to private information may attempt to influence others' beliefs through signaling; the reception of the signal may affect the sender's incentives and subsequently change economic behaviour, known as the "incentive effect" of asymmetric information. Blinder et al. (2008) state that a central bank's ability to affect the economy depends on how much it influences market expectations about future inflation and the path of overnight interest rates, not merely on their current level. Rudebusch and Williams (2006) and Berardi and Duffy (2007) argue that while people are learning, an increase in inflation may make the public revise their estimate of long-run average inflation upward, which, in turn, raises actual inflation. Bernanke (2004) suggests that, in such a situation, commitment to stronger communication opens a clear opportunity for the central bank to improve economic performance by providing information about its long-run inflation objective. Bernanke (2004) argues that, in the long run, communicating the central bank's objective and policy strategies can help anchor inflation expectations, which can further impact reducing inflation. Once people are sure about the action of the monetary authority, there will be an impact on wage-setting and pricing behaviour and, finally, the inflation rate.

IV. Empirical Methodology

A. Determinants of central bank transparency

Two different methods have been employed to estimate the determinants of central bank transparency: propensity score matching and panel regression model.

1. Propensity score matching (PSM)

The propensity score matching (PSM) method, which was created initially by Rosenbaum and Rubin (1983) and has since been employed by Vega and Winkelried (2005), Lin and Ye (2007, 2009), Samarina et al. (2014), is used in this study. Propensity Score Matching is commonly used to solve microeconomic problems and is employed in the medical literature to lessen the problem of bias. Using treated and control units as a comparison, the method is intended to calculate the average effects of a programme or therapy. In contrast to experimental investigations, the division of units into treated and control groups in observational studies is not random. Due to the presence of confounding factors, the estimation of the treatment's effect may be biased. By comparing results for treated and control units as closely as possible, the propensity score matching method lessens bias in comparisons between the treated and control groups.

The PSM technique consists of two steps. To determine the conditional probability of adopting IT given the pre-adoption characteristics of the countries, we first evaluate the propensity score. The conditional probability is as follows:

$$p(X) = \Pr(D = 1|X) = E(D|X) \quad (1)$$

Where $D = \{0, 1\}$ stands for treatment effect (IT) dummy that takes value 1 if IT is adopted and 0 otherwise. X stands for a multidimensional vector of factors measuring the macroeconomic and institutional quality characteristics.

Once $p(X)$ is estimated using the probit model, the average effect of treatment on the treated (ATT) is estimated as follows:

$$ATT = E\{Z_{1i} - Z_{0i} | D_i = 1\} = E[E\{Z_{1i} | D_i = 1, P(X_i)\} - E\{Z_{0i} | D_i = 0, P(X_i)\} | D_i = 1] \quad (2)$$

Where, Z_{1i} and Z_{0i} are potential outcomes of central bank transparency in two counterfactual conditions, one with (IT policy present) and another without (IT policy absent) treatment.

To determine ATTs, the units from the treatment group (inflation targeters) are matched

with the most suited units from the control group (non-inflation targeters) based on various matching criteria. We use matching criteria such as nearest-neighbor matching, radius matching, kernel matching, and stratification matching techniques recommended in the literature (Lin and Ye, 2007, 2009; Samarina et al., 2014).

2. Panel regression approach

A panel regression model is estimated to examine IT's impact on central bank transparency.

$$CBTI_{it} = \varnothing_0 + \varnothing_1 IT_{it} + \varnothing_2 X_{it-1} + \varnothing_3 Z_{it} + \epsilon_{it} \quad (3)$$

Where, $CBTI_{it}$ stands for central bank transparency index of Dincer et al. (2022) for i th country for t period. Dincer et al. (2022) have proposed a modified measure of central bank transparency. IT_{it} is a dummy variable which takes the value 1 for i th country if the particular period is under IT regime and takes 0 if that period is not under IT policy. In other words, the dummy variable takes the value 1 for a country at which that country has started adopting IT policy after that and 0 for the pre-adoption period. X_{it} represents macroeconomic variables such as past inflation, trade openness, financial development, and GDP per capita in i th country for t period. Z_{it} stands for institutional factors such as government effectiveness, political stability, voice accountability, rule of law and regulator quality in i th country for t period. ϵ_{it} is an error term not assumed to be independent and identically distributed (i.i.d.). The importance of inflation targeting policy in central bank transparency is demonstrated by the statistical significance of the \varnothing_1 coefficient.

B. Determinants of inflation: Assessing the role of Inflation targeting

In this section, we explore the crucial role of central bank transparency in inflation targeting countries in explaining inflation. Two different approaches have been implemented to test the role of IT policy in enhancing transparency and its impact on inflation. Firstly, we use a panel regression model for aggregate central bank transparency and its impact on inflation. Secondly, we use disaggregate indices of central bank transparency in the transparency-inflation nexus.

1. Panel regression model

To estimate the impact of central bank transparency in IT countries on inflation, the following regression equation has been estimated:

$$Inflation_{it} = \varnothing_0 + \varnothing_1 CBTI_{it} + \varnothing_2 CBTI_{it} * IT_{it} + \varnothing_3 X_{it-1} + \varnothing_4 Z_{it} + \mu_{it} \quad (4)$$

Where, $CBTI_{it}$ stands for central bank transparency index. Dincer et al. (2022) have proposed a modified measure of central bank transparency. The index has addressed limitations remaining in the past central bank transparency index measures. $CBTI_IT_{it}$ stands for central bank transparency index in IT countries. It is an interaction variable created by multiplying central bank transparency for t period in ith country with an IT dummy. IT dummy takes the value 1 for a country that has started adopting IT policy after that and 0 for the pre-adoption period. X_{it} and Z_{it} are two sets of control variables used to control for macroeconomic conditions and institutional quality. To control for macroeconomic conditions, variables used are such as past inflation, trade openness, and financial development. The variables such as government effectiveness, political stability, rule of law, corruption and regulator quality are used to control countries' institutional quality that can influence the level of transparency. ϵ_{it} is an error term that does not follow an independent and identical distribution (i.i.d.) process. The statistical significance of δ_1 coefficient shows the crucial role of inflation targeting policy in central bank transparency.

Further, to estimate the impact of individual indices of central bank transparency on inflation the following models are estimated:

$$Inflation_{it} = \alpha_0 + \alpha_1 CBTI_{it}^{PoltT} + \alpha_2 CBTI_{it} * IT_{it}^{PoltT} + \alpha_3 X_{it-1} + \alpha_4 Z_{it} + \mu_{it} \quad (5)$$

$$Inflation_{it} = \beta_0 + \beta_1 CBTI_{it}^{EcoT} + \beta_2 CBTI_{it} * IT_{it}^{EcoT} + \beta_3 X_{it-1} + \beta_4 Z_{it} + \mu_{it} \quad (6)$$

$$Inflation_{it} = \gamma_0 + \gamma_1 CBTI_{it}^{ProT} + \gamma_2 CBTI_{it} * IT_{it}^{ProT} + \gamma_3 X_{it-1} + \gamma_4 Z_{it} + \mu_{it} \quad (7)$$

$$Inflation_{it} = \delta_0 + \delta_1 CBTI_{it}^{PolcT} + \delta_2 CBTI_{it} * IT_{it}^{PolcT} + \delta_3 X_{it-1} + \delta_4 Z_{it} + \mu_{it} \quad (8)$$

$$Inflation_{it} = \vartheta_0 + \vartheta_1 CBTI_{it}^{OprT} + \vartheta_2 CBTI_{it} * IT_{it}^{OprT} + \vartheta_3 X_{it-1} + \vartheta_4 Z_{it} + \mu_{it} \quad (9)$$

Where, TI_{it}^{PoltT} and $CBTI_{it} - IT_{it}^{PoltT}$ refer to political transparency in aggregate countries and inflation targeting countries. TI_{it}^{EcoT} and $CBTI_{it} - IT_{it}^{EcoT}$ refer to economic transparency in both aggregate countries and inflation targeting countries. TI_{it}^{ProT} and $CBTI_{it} - IT_{it}^{ProT}$ refer to procedural transparency in aggregate and IT countries. TI_{it}^{PolcT} and $CBTI_{it} - IT_{it}^{PolcT}$ political transparency. TI_{it}^{OprT} and $CBTI_{it} - IT_{it}^{OprT}$ stand for operational transparency in aggregate and inflation targeting countries. All other variables are kept same as described in equation (4).

C. Estimation technique

We initially start with a fixed effect regression model to estimate equations 1 and 4. A set of control variables is added to the regression equation to account for the influence of other

factors that may impact the dependent variable in the context of an inflation targeting regime. This is done to prevent misspecification issues brought on by regressions with omitted variables. However, in that regression, the residual is assumed to be independent and identically distributed (i.i.d.). This assumption creates a problem when there is a significant country-to-country dependence, i.e., cross-sectional dependence. The estimates may be biased if cross-sectional dependence (CD) is not considered (Pesaran, 2004, 2015). The Pesaran (2004) test is used to check for CD on the estimated fixed effect regression, and the results showed that our sample had a considerable cross-sectional dependence (see Table 3).²⁾ Therefore, the model is estimated using the panel-corrected standard error (PCSE) technique. The PCSE estimate produces an efficient and unbiased estimate by addressing important econometric issues such as serial correlation, heteroskedasticity, and cross-sectional dependence in panel data (Beck & Katz, 1995; Hoechle, 2007).

Further, we deploy the panel spatial correlation consistent (PSCC) standard errors for robustness checks and to examine the consistency of the results. This estimator (Cameron & Trivedi, 2005; Hoechle, 2007) corrects the standard errors of the coefficient estimates for potential dependence using the Driscoll and Kraay (1998) robust standard errors technique. Hoechle (2007) observe that when cross-sectional dependence is present, Driscoll and Kraay standard errors have noticeably superior small sample properties than widely used alternative approaches.

V. Data and Variables Descriptions

The study uses an annual dataset of 16 Asian economies, including IT and non-IT, from 1998 to 2019 (see Table 1). The variables used are the Central Bank transparency index, Inflation, Trade openness (% GDP), Broad money (% GDP), GDP per capita, Government effectiveness, Political stability, Voice accountability, Rule of law, Control of Corruption, and regulator quality. The variables are obtained from the World Development Indicator (WDI), Worldwide Governance Indicators, World Bank, and IMF. The non-IT countries are following different forms of monetary policy. For instance, Jordan's monetary policy centers around a fixed exchange rate with the US dollar, in place since 1995. The Central Bank of Jordan (CBJ) adjusts policy rates as needed to maintain the peg and support financial stability. Singapore's monetary policy focuses on managing the trade-weighted exchange rate to ensure price stability over the medium term, forming a basis for sustainable economic growth. The monetary policy framework of the United Arab Emirates (UAE) primarily aims to ensure the stability of the UAE dirham (AED) and support the country's economic goals. The UAE follows a fixed exchange rate policy, pegging the dirham to the US dollar. Hong Kong's monetary policy objective is to maintain a stable exchange value of

2) CD test rejects the null hypothesis of no cross-sectional dependence across different specifications.

the Hong Kong dollar, particularly in terms of its exchange rate against the US dollar. Iran's central bank follows a monetary targeting policy, aimed at controlling monetary aggregates and preventing monetary expansion. The length and sample of the data are selected based on the availability of data. The annual percentage change in the CPI index was taken as a measure of inflation. Data for the Central Bank Transparency Index (CBTI) has been collected from Dincer et al. (2019, 2022). They have calculated the CBTI based on information found on the websites, statutes, annual reports, and other published papers of central banks. Instead of sending a survey instrument to the central banks directly and depending on the subjectivity of responding personnel (like Fry et al., 2000), they gather these data in this way (Dincer & Eichengreen, 2014). The index produces an aggregate score between 0 and 15 to indicate the level of transparency across countries. This score is calculated from five different aspects of transparency: political, economic, procedural, policy, and operational. Then, a sub-index that consists of three distinct elements, each of which receives a score of 0, 1/2, or 1, is used to measure each aspect of transparency. The overall index, which ranges from 0 to a maximum of 15, equals the sum of the scores across all items.

There are some important advantages of using CBTI calculated by Dincer et al. (2019, 2022). Dincer et al. (2019) provide a detailed coding of procedural and policy transparency. Compared to past work, the Dincer et al. (2019) index introduced stricter criteria for procedural transparency because the financial crisis illustrated the value of timely disclosure, particularly during times of increased uncertainty. On policy transparency, they set stricter requirements for forward guidance regarding the expected timing, direction, extent, or tempo of future monetary policy activities.

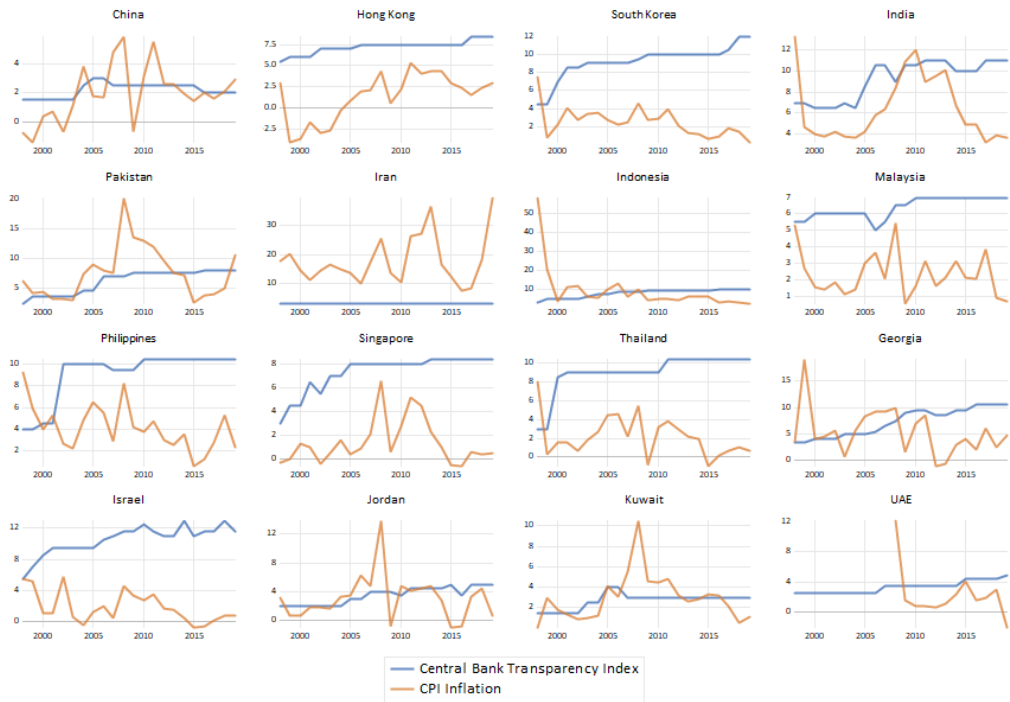
Table 1. *Inflation Targeting Countries with Starting Years and Non-Inflation Targeting Countries*

Inflation targeting countries	Non-inflation targeting countries
South Korea (1998), India (2016), Indonesia (2005), Philippines (2002), Thailand (2000), Israel (1997)	China, Hong Kong, Pakistan, Iran, Malaysia, Singapore, Georgia, Jordan, Kuwait, UAE

(Source) Hammond (2012) and RBI. The adoption years of IT in countries are given in brackets.

Figure 1 shows a general trend of central bank transparency and inflation in Asian economies from 1998 to 2019. Figure 1 sheds light on the dynamic relationship between central bank transparency and inflation in Asian economies from 1998 to 2019. From the above figure, we could not observe any consistent pattern between the two variables in non-IT countries. However, a negative relationship is observed for IT countries in some cases. For instance, Singapore and Malaysia show both variables to be negatively related and other countries like China, Pakistan, Kuwait, Jordan, Iran, Georgia, etc. show no clear-cut relationship between the two. However, Thailand, Philippines, Israel, Korea, and India show a negative relationship between transparency and inflation after the country entered an IT regime.

Figure 1. Central bank transparency and inflation



(Source) Authors' compilation from World Development Indicator and Dincer et al. (2022)

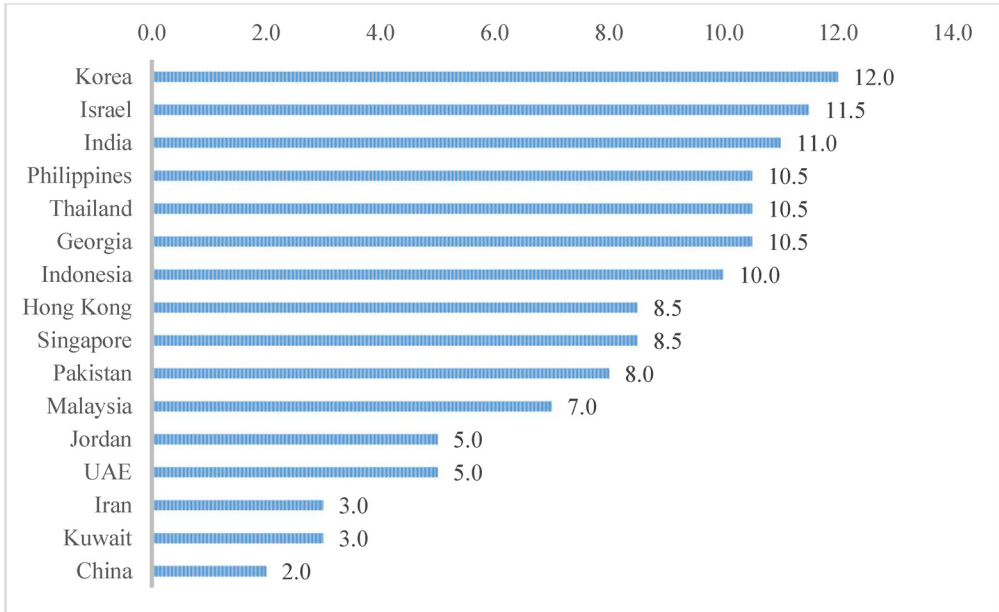
VI. Results and Discussion

The central bank transparency analysis for sixteen Asian economies shows that the average transparency score stood at 7.88. Figure 2 shows that the top-performing central bank is the Bank of Korea of South Korea, scoring 12. This is followed by Israel, India, Philippines, Thailand, Georgia, and Indonesia. Some countries such as Singapore, Malaysia, Hong Kong, UAE, and Kuwait have shown a better ranking in transparency. This validates the statement put forward by Mervyn King. According to him, "The most important distinguishing characteristic of inflation target regimes is the emphasis they place on transparency and accountability."—Mervyn King, 1997. This achievement can be attributable to the greater focus of the monetary authorities on all five aspects of transparency: political, economic, procedural, policy, and operational. IT framework has been designed based on two premises: setting a quantitative target for inflation and maintaining greater transparency and accountability (Mishkin, 2001; Mishkin & Savastano, 2001). This may have led to increased transparency in ITers.

On the other hand, given our sample, the People's Bank of China is the least transparent

central bank. The People's Bank of China is not open regarding economic data, forecast models, policy decisions, the impact of their decisions, and problems of policy implementation and execution. Kuwait, Iran, UAE, and Jordan are the remaining countries whose central banks have been ranked low in transparency.

Figure 2. Central bank transparency in Asian countries as of 2019



(Source) Dincer et al. (2022)

A. The dynamics of central bank transparency over three decades

This analysis aims to assess the trends of central bank transparency across Asian economies over three decades. The country-wise transparency level is reported in Table 2. The value of the transparency index shows a difference in transparency levels among the IT and no-IT groups.

1. Central bank transparency in 1998

The top five transparent central banks are from India, Malaysia, Hong Kong, Israel, and South Korea during the period. Reserve Bank of India scored 7, the highest score in the sample during 1998. It is mainly attributable to political, procedural, operational, and policy transparencies. The country regularly evaluates target achievement and promptly discloses policy decisions for information about the sub-groups transparency scores (Dincer et al., 2022). In the group, Israel is the first country to adopt IT as the monetary policy in Asia followed by South Korea.

After changing the monetary policy to IT policy, they have initiated several changes in the monetary policy to keep the central bank transparent. They publish and communicate with the public regarding their monetary policy strategy, objectives, and contracts with the government. They put more trust in strengthening political and procedural transparency. The Malaysian Central Bank focuses on policy and operational transparency, but the Hong Kong Central Bank focuses on political and operational transparency.

China, Kuwait, Jordan, Pakistan, and UAE are the bottom five central banks. Given our sample, China with a score of 1.5 stands as the lowest transparent central bank in Asia. The worst performance in disclosing information is mainly due to low economic, policy, procedural, and operational transparency. Kuwait, Jordan, Pakistan, and UA have problems similar to those in China. They lack transparency in economic, policy, procedural, and operational aspects.

2. Central bank transparency in 2009

During a decade (1998-2009), the average central bank transparency has increased from 3.6 to 7.16, a 3.6 unit rise in the index. This double growth in the central bank transparency score indicates the critical role of information pertaining to central bank monetary policy post-global financial crisis. Frykström (2022) rightly points out that bank transparency has become an inevitable post-financial crisis to maintain a healthy financial system. During the decade, inflation targeting central banks have made greater efforts to become more transparent than non-inflation targeting countries except India. Top six countries that make significant progress in transparency are Israel (from 5.5 to 11.5), Korea (from 4.5 to 10), Indonesia (3.5 to 9.5), Philippines (4 to 9.5), India (7 to 11.5), and Thailand (3 to 9). This is attributable to a greater focus on Economic, procedural, and policy transparencies. Further, this decade witnessed a major structural change in monetary policy. Most of the IT countries officially adopted IT policy during this period. For instance, Indonesia, Philippines, and Thailand switched to IT from 2000 to 2005, and Korea's policy changed after a time lag. The observation is in line with Mishkin (2001) who argued that the key element that the central banks in emerging economies have achieved under IT is transparency in monetary policy. However, the countries that did not adopt IT were seen doing worse in transparency during the decade. The bottom five countries are China (from 1.5 to 2.5), Iran (3 to 3), Kuwait (1.5 to 3), UAE (2.5 to 3) and Jordan (2 to 4). China's central bank remained the least transparent bank in Asia given our sample. The central banks in these countries constantly ignore the importance of Economic, procedural, and policy transparency.

3. Central bank transparency in 2019

Although a sudden jump was observed between 1998 and 2009, since then, the growth in

transparency has remained at a standstill. The average central bank transparency score was 7.88 in 2019 compared to 7.16 in 2009. This may be because IT countries have already achieved a significant change in transparency arrangements in the central bank monetary policy, and non-IT countries in Asia are not making serious efforts to improve their transparency level. IT countries in Asia made the required change immediately after adopting IT, and that is reflected in the previous decade. During this decade, India is the new member, and its transparency score was already high before IT adoption.

Table 2. *Ranking Performance of Asian Economies in Central Bank Transparency*

Countries	1998		2009		2019	
	CBTI	Rank	CBTI	Rank	CBTI	Rank
China	1.5	15	2.5	16	2.0	16
Hong Kong	5.5	2	7.5	9	8.5	8
Korea	4.5	5	10.0	3	12.0	1
India	7.0	1	10.5	2	11.0	3
Pakistan	2.5	12	7.5	9	8.0	10
Iran	3.0	9	3.0	14	3.0	14
Indonesia	3.5	7	9.5	4	10.0	7
Malaysia	5.5	2	6.5	11	7.0	11
Philippines	4.0	6	9.5	4	10.5	4
Singapore	3.0	9	8.0	8	8.5	8
Thailand	3.0	9	9.0	6	10.5	4
Georgia	3.5	7	9.0	6	10.5	4
Israel	5.5	2	11.5	1	11.5	2
Jordan	2.0	14	4.0	12	5.0	12
Kuwait	1.5	15	3.0	14	3.0	14
UAE	2.5	12	3.5	13	5.0	12
Average	3.6		7.16		7.88	

(Source) Dincer et al. (2022)

Note. The relative ranking has been done for the sample countries, and an increase in ranking indicates a highly transparent central bank.

B. Central Bank transparency and inflation relationship: Role of inflation targeting

In this section, we try to assess the extent to which IT countries can influence central bank transparency compared to non-IT countries and how transparency in IT affects inflation. In order to do so, our empirical analysis relies on Propensity Score Matching (PSM) and some panel data models. Those panel models are Panel-Corrected Standard Error (PCSE) Estimates and Panel-Spatial Correlation Consistent (PSCC) estimates based on Driscoll and Kraay's (1998) standard error. We use these different panel data models to check for the robustness of the

results. Before all this, we checked Pesaran's (2004) CD test and found a significant cross-sectional dependency. Therefore, the result of the fixed effect model is not reported here and only the CD test. The results of PSM, PCSE, and PSCC are reported in Tables 3-8.

Table 3 reports the estimated average treatment effect on the treated (ATTs) on central bank transparency by the PSM model. It reveals that IT policy has a significant impact on increasing central bank transparency in Asian economies. This holds irrespective of the matching methods and different specifications used in the analysis. For instance, the result remained unchanged when we controlled for macroeconomic and institutional factors in ATT1. This result supports the argument that IT emphasizes transparency and accountability, two crucial pillars for the success of IT (King, 1997; Mishkin, 2002; Sethi et al., 2024).

Further, this finding has been complemented with the PCSE and PSCC regression approach as a robustness check. These approaches allow an understanding of the impact of factors other than IT on transparency. Tables 4 and 5 reveal that Asian countries adopting IT significantly increase central bank transparency. Further, the countries with deeper financial markets, a highly open economy, and better quality of government and political institutions significantly increase transparency in central bank monetary policy. Countries with effective government in terms of public service quality, quality of policy formulation, and credibility of government's commitment to policies increase the likelihood of becoming transparent in monetary policy. The result remains robust irrespective of the methods and alternative specifications used in the model.

Table 3. Matching Estimates of Treatment Effect on the Central Bank Transparency

Model	Nearest-neighbour matching	Radius matching				Kernel matching	Stratification method
		r = 0.1	r = 0.05	r = 0.01	r = 0.001		
ATT	3.72*** (0.86)	4.87*** (0.32)	5.03*** (0.31)	4.93*** (0.40)	4.84** (1.74)	4.07*** (0.72)	4.96*** (0.34)
ATT1	2.47*** (0.41)	2.70*** (0.34)	2.67*** (0.35)	2.80*** (0.59)	3.15*** (0.67)	2.54*** (0.38)	2.65*** (0.46)

(Source) Author's calculation

Note. ATT includes only macroeconomic variables. ATT1 includes macroeconomic and institutional factors. Bootstrapped standard errors are reported in parentheses. They are based on 1000 replications of the data. *** indicate the significance level of 1%.

Table 4. Determinants of Central Bank Transparency (PCSE Method)

Dep var: CBTI	(1)	(2)	(3)	(4)	(5)	(6)
IT	4.47*** (33.66)	4.86*** (30.81)	4.93*** (30.19)	2.34*** (9.43)	2.38*** (8.89)	2.03*** (7.85)
Past Inflation	-0.03** (-2.44)			-0.03 (-1.59)	-0.03 (-1.33)	-0.01 (-0.46)
L.Trade Openness		0.56*** (5.48)	0.55*** (5.38)	1.27*** (6.44)	1.15*** (4.92)	0.50** (2.14)

Table 4. *Continued*

Dep var: CBTI	(1)	(2)	(3)	(4)	(5)	(6)
L.Financial Depth		0.48*** (2.86)	0.42** (2.33)	0.36** (2.05)	0.30** (1.93)	0.02 (0.16)
L.GDPPC			-0.03 (-1.16)	0.08*** (2.92)	0.08*** (2.89)	0.03 (1.24)
Voice and accountability				2.34*** (15.21)	2.13*** (8.45)	2.34*** (8.56)
Political stability				-1.46*** (-8.98)	-1.61*** (-11.77)	-1.50*** (-10.35)
Rule of Law					0.44 (1.72)	1.43*** (4.99)
Government effectiveness						2.05*** (8.18)
Regulator quality						0.34 (1.01)
Constant	5.48*** (26.21)	0.46*** (6.26)	1.12 (1.08)	2.04 (1.70)	1.41 (1.30)	2.72*** (2.35)
R-squared	0.47	0.50	0.50	0.73	0.73	0.78
Observations	341	349	349	311	311	311
Countries	16	16	16	16	16	16
Pesaran's CD test	24.84***	7.69***	4.40***	3.00***	4.06***	3.87***

(Source) Author's calculation

Note. ***, and ** indicate statistical significance at 1% and 5% levels. Z-statistics in parenthesis. Pesaran's CD test statistics have been derived from the fixed effect regression model. IT is a dummy that takes the value 1 if that period covers the IT regime and 0 otherwise.

Table 5. *Determinants of Central Bank Transparency (PSCC Method)*

Dep Var:CBTI	(1)	(2)	(3)	(4)	(5)	(6)
IT	4.47*** (27.02)	4.86*** (27.96)	4.93*** (26.19)	2.34*** (6.56)	2.38*** (6.57)	2.03*** (5.41)
Past Inflation	-0.03 (-1.78)			-0.03 (-1.35)	-0.03 (-1.32)	-0.01 (-0.38)
L.Trade Openness		0.56*** (4.94)	0.55*** (4.90)	1.27*** (14.40)	1.15*** (9.13)	0.50*** (2.88)
L.Financial Depth		0.48*** (4.90)	0.42*** (3.83)	0.36 (1.13)	0.29 (0.93)	0.02 (0.07)
L.GDPPC			-0.03 (-0.77)	0.08 (2.00)	0.08 (2.01)	0.03 (1.23)
Voice and accountability				2.34*** (8.97)	2.13*** (6.77)	2.34*** (8.53)
Political stability				-1.46*** (-9.16)	-1.61*** (-11.24)	-1.50*** (-9.23)
Rule of Law					0.44** (2.19)	1.43*** (4.72)
Government effectiveness						2.05*** (5.39)

Table 5. Continued

Dep Var:CBTI	(1)	(2)	(3)	(4)	(5)	(6)
Regulator quality						0.34 (0.53)
Constant	5.48*** (14.21)	0.46 (0.88)	1.12 (0.89)	2.04 (-0.84)	-1.41 (-0.57)	2.72*** (1.15)
R-squared	0.46	0.50	0.50	0.73	0.73	0.78
Observations	341	349	349	311	311	311
Countries	16	16	16	16	16	16

(Source) Author's calculation

Note. ***, and ** indicate statistical significance at 1%, and 5% levels. T-statistics in parenthesis.

Tables 6 and 7 illustrate the impact of central bank transparency on inflation in Asia. The data indicates that increased transparency in inflation-targeting (IT) countries has contributed to reducing inflation. The variable (CBTI*IT), which measures this impact, is statistically significant and shows a negative sign. In contrast, overall transparency is found to have an insignificant effect on inflation. This suggests that merely having transparency is not sufficient to influence inflation; it is the higher level of transparency that makes a significant difference. The result remains unchanged when we use a different method and control for some additional factors. The result based on the PSCC method confirms our earlier findings that central bank transparency in IT significantly reduces inflation. Our result aligns with Chortareas et al. (2002) and Siklo (2011), who observe a negative relationship between transparency and inflation. The possible reasons for this result could be explained as follows. In the presence of information asymmetry, the 'uncertainty effect' and 'incentive effect' could otherwise lead to an undesirable consequence on inflation expectations and inflation (Gerrates, 2002). The IT reduces information asymmetries and maintains low inflation, by putting a credible nominal anchor for inflationary expectations in developing economies. The new relevant information convinces households and firms that it is committed to low inflation, thus making risks more apparent for all agents (Galor & Zeira, 1993; Greenwood & Jovanovic, 1990). The strong communication mechanism of IT central banks helps anchor inflation expectations, reducing further impact on inflation. This can happen through an anchoring effect on wage-setting and economic agents' pricing behaviour, which affect inflation. The transparency facilitates accountability of the central bank's monetary policy, leading to better policy outcomes. Further, we find that IT has an insignificant impact on reducing inflation.

Of the other explanatory variables, we also find that greater international trade activities and financial market depth are significantly affecting inflation. The negative impact of greater financial market depth (measured as M_3 as percent of GDP) on inflation indicates the anticipated inflation effect dominating the liquidity effect. Kydland and Prescott (1982) and Long and Plosser (1983) explained in a monetary version of the real business cycle model where they argued that a money supply shock leads people to expect more such rise in the future and

thus nominal interest rate rise. Trade openness was found statistically significant at a 1% level. However, its relationship with inflation varies as we control for some institutional factors. Initially, we found that a more open economy reduces domestic inflation after controlling for the effect of some macroeconomic factors, supporting the findings of Romer (1993). The claim is that an open economy prevents inflation brought on by an expansion of the money supply. The likelihood of the currency rate depreciating due to an excessive money supply is greater in small open economies. As a result, monetary authorities are less inclined to pursue an expansionary monetary policy, which will hold down inflation. However, that relationship changed to positive as we control for the effect of political intuition and governance. The positive relationship between the two remained statistically significant throughout different specifications (see 4 to 7 columns in Table 6). Kurihara (2013) found similar evidence for Asia and OECD countries, a stronger relationship for Asian economies. This could be explained as a higher degree of trade openness can exacerbate the cost of inflation through exchange rate volatility and increasing world commodity and metal prices. Further, increased trade openness can cause a monetary expansion, leading to a larger increase in domestic prices (Evans, 2007). This indicates that the relationship between the two needs to be carefully interpreted since it varies depending on institutional quality and macroeconomic conditions.

Furthermore, governance and institutional factors such as political stability and regulation quality significantly reduce inflation. The quality of public and civil services, the quality of policy implementation and the government's commitments to such policies in developing countries reduce market instability and speculations thus reducing inflation. This supports the findings of Agoba et al. (2017) and Law and Soon (2020), who argue that better institutional quality is associated with low inflation.

Table 6. *Central Bank Transparency, Inflation Targeting and Inflation (PCSE Method)*

Dep Var: Inflation	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CBTI	-0.25*** (-2.23)	0.02 (0.23)	0.03 (0.31)	0.18 (1.72)	0.23** (2.04)	0.19 (1.55)	0.18 (1.50)
IT	2.27 (1.47)	3.28** (2.23)	0.72 (0.57)	2.24 (0.87)	3.92 (1.62)	3.49 (1.62)	3.71 (1.65)
CBTI*IT	-0.34*** (-2.13)	-0.65** (-4.67)	-0.43*** (-3.40)	-0.50** (-9.57)	-0.60*** (-2.51)	-0.58*** (-2.68)	-0.60*** (-2.70)
L.Trade Openness		-3.02*** (-9.76)	-1.10*** (-2.85)	2.88*** (4.80)	2.75*** (4.56)	3.00*** (4.91)	2.98*** (4.89)
L.Broad Money			-4.22** (-6.55)	-2.26*** (-3.96)	-1.60*** (-2.58)	-1.76*** (-2.88)	-1.83*** (-3.26)
Political stability				-1.19*** (-2.68)	-1.65*** (-4.28)	-1.98*** (-4.42)	-2.03*** (-4.52)
Regulator quality				-3.62*** (-5.64)	-5.91*** (-3.38)	-6.49*** (-3.95)	-6.60*** (-3.77)

Table 6. *Continued*

Dep Var: Inflation	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Control of Corruption					2.66 (1.83)	1.73 (1.08)	1.53 (1.01)
Rule of Law						1.98** (2.30)	1.96** (2.30)
Government effectiveness							0.49 (0.55)
Constant	6.59*** (7.06)	18.95*** (10.10)	29.54*** (10.61)	2.14 (0.59)	-0.79*** (-0.21)	-1.09 (-0.30)	-0.77 (-0.23)
R-squared	0.03	0.15	0.24	0.34	0.35	0.36	0.36
Observations	342	342	342	312	312	312	312
Countries	16	16	16	16	16	16	16
Pesaran's CD test	16.32***	11.86***	11.83***	10.96***	10.24***	9.92***	11.33***

(Source) Author's calculation.

Note. ***, and ** indicate statistical significance at 1% and 5% levels. Z-statistics in parenthesis.

Table 7. *Central Bank Transparency, Inflation Targeting and Inflation (PSCC Method)*

Dep var: Inflation	(1)	(2)	(3)	(4)	(5)
CBTI	0.02 (0.21)	-0.23 (-1.77)	0.18 (1.34)	0.23 (1.30)	0.18 (0.92)
IT	3.28 (1.20)	3.62 (1.84)	2.24 (0.75)	3.92** (2.34)	3.71** (2.15)
CBTI*IT	-0.65*** (-2.70)	-0.63*** (-3.03)	-0.50*** (-2.82)	-0.60*** (-3.74)	-0.60*** (-4.20)
L.Trade Openness	-3.03*** (-10.56)	1.22 (1.63)	2.88*** (3.56)	2.75*** (2.88)	2.98*** (2.74)
L.Broad Money		-3.34*** (-4.27)	-2.26*** (-2.75)	-1.60 (-1.39)	-1.83 (-1.62)
Political stability		-2.51*** (-3.62)	-1.19 (-1.49)	-1.65** (-2.25)	-2.03*** (-2.19)
Regulator quality			-3.62*** (-6.12)	-5.91*** (-2.91)	-6.60*** (-3.25)
Control of Corruption				2.66 (1.55)	1.53 (0.75)
Rule of Law					1.96 (1.57)
Government effectiveness					0.49 (0.55)
Constant	18.95*** (10.56)	15.71*** (4.60)	2.15*** (0.54)	-0.79 (-0.17)	-0.77*** (-0.19)
R-squared	0.15	0.29	0.34	0.35	0.36
Observations	342	312	312	312	312
Countries	16	16	16	16	16

(Source) Author's calculation

Note. ***, and ** indicate statistical significance at 1% and 5% levels. T-statistics in parenthesis.

For a better understanding of the transparency effect on inflation, we employ all five different aspects of central bank transparency: political transparency, economic transparency, procedural transparency, policy transparency and operational transparency. We examine whether all five dimensions of CBTI are associated with lower inflation rates or if the aggregate index performs better than its components. The analysis by components sheds light on what dimensions of CBTI may be more effective at fighting inflation in developing countries. Table 8 shows that all the sub-indices of transparency are not equally important in lowering inflation. Sub-indices of transparency such as political, economic, procedural, and operational, have the largest impact. This suggests that central banks focus on disclosing quantitative targets in the objective, macroeconomic forecast, relevant data, and models used in monetary policy analysis, the risk associated with policy transmission, regular evaluation of policy targets, and policy deliberations within a reasonable time frame are expected to gain out of it. IT dummy and political transparency in IT are significant factors in lowering inflation. Further, it is noteworthy that the coefficients for the subcategories are larger than those for the overall transparency index in Tables 6 and 7. The coefficient of 1.84 for political transparency, 3 for economic transparency, 2.42 for procedural, and 1.90 for operational transparency is higher than the overall transparency, which ranges from 0.34 to 0.65. Interestingly, we find that political and operational transparency of the aggregate transparency index significantly lowers inflation.

Table 8. *Central Bank Transparency Sub-Indices and Inflation (PCSE Method)*

Depvar: Inflation	Political	Economic	Procedural	Policy	Operational
CBTI	1.15 (0.95)	1.16 (0.90)	1.68 (0.37)	-1.11*** (2.74)	-1.37*** (-3.40)
IT	-6.54*** (-5.11)	1.96*** (3.64)	0.88 (0.91)	3.39*** (2.38)	1.32 (0.84)
CBTI*IT	-1.84*** (-2.49)	-3.00*** (-4.60)	-2.42*** (-4.86)	0.67 (1.02)	-1.90*** (-2.19)
L.Trade Openness	4.19*** (6.58)	2.61*** (4.28)	2.71*** (5.05)	3.37*** (6.19)	4.00*** (6.41)
L.Broad Money	-1.85*** (-3.09)	-2.15*** (-3.57)	-2.18*** (-3.55)	-2.55*** (-4.03)	-2.33*** (-4.13)
Government effectiveness	2.41 (1.81)	1.80 (1.46)	0.92 (0.69)	2.24 (1.83)	-2.28 (1.85)
Political stability	-1.75*** (-4.06)	-1.19*** (-2.92)	-1.27*** (-2.83)	-1.95*** (-6.36)	-2.41*** (-6.05)
Voice and accountability	0.42 (1.05)	0.44 (0.94)	-0.25 (-0.38)	1.60** (2.87)	1.18** (2.33)
Regulator quality	-6.27*** (-3.88)	-5.91*** (-3.99)	-4.03*** (-2.63)	-5.44*** (-3.91)	-5.36*** (-3.71)
Constant	2.49 (0.56)	2.59 (0.65)	1.64 (0.46)	3.30 (0.90)	-0.32 (-0.10)

Table 8. *Continued*

Depvar: Inflation	Political	Economic	Procedural	Policy	Operational
R-squared	0.38	0.36	0.36	0.36	0.37
Observations	312	312	312	312	312
Countries	16	16	16	16	16

(Source) Author's calculation.

Note. ***, and ** indicate statistical significance at 1%, and 5% levels. Z-statistics in parenthesis.

VII. Conclusion

The paper raises two important questions. First, whether IT implementation increases central bank transparency. Second, what is the relationship between central bank transparency and inflation and what role IT plays in the transparency-inflation nexus? Towards that, propensity score matching, and two panel regression models are employed for sixteen Asian economies. Based on the analysis, we arrive at the following conclusions. First, the most transparent central banks are inflation targeting countries. An analysis of the three different periods confirms that countries have witnessed a significant rise in transparency post-2009, showing the significant reforms in central bank monetary policy at the global level post-global financial crisis. Second, IT countries are found to be significantly inducing transparency. Further, some open economies and countries with strong political and governance quality augment transparency. Third, central bank transparency in IT significantly lowers inflation, whereas non-IT countries did not witness such benefits. This indicates that with the help of more information, ITers can mitigate the asymmetric information problem between agents and banks and anchor inflation expectations. Fourth, all the sub-indices of transparency are not equally important for lowering inflation. Transparency on political, economic, procedural, and operational dimension have the largest impact on inflation. Further, the coefficients for the subcategories are larger than those for the overall transparency index.

These findings have several important policy implications. One of these could be that it is helpful to central bankers and policymakers to investigate the feasibility of inflation targeting in developing countries, where arguably they have low transparency. Low transparency in central bank monetary policy can negatively affect the macroeconomy and overall policy objective of monetary policy.

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