Changes of Monetary Policy Behaviors across IT-Adoption: Evidence from Developing and Emerging Economies

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(Preliminary and incomplete)

Abstract

This paper investigates whether the behavior of the central bank's policy reaction would change across the adoption of the inflation targeting by estimation of policy reaction functions for 32 developing and emerging economies (DEE). Overall estimation results indicate that central banks in DEE with an IT framework more actively respond to foreign exchange rates before the IT adoption and their concerns gradually decrease after the IT introduction as time goes by. More specifically, the central banks care more about the foreign exchange rates during the eight years' IT transition period and then they began to actively respond to inflation and real economic movements in four years later after implementation of IT. Futher estimation results on policy reaction function by DEE groups over IT-adoption period indicate that central banks with less dollarization, high degree of foreign reserve ratio over imports, and low degree of macroeconomic instability are likely to concentrate more on inflation pressure rather than exchange rate movements. Finally, the central banks in transitional economies actively respond to changes of foreign exchange rates as well as inflation pressure and real economic activities even after the IT introduction. This is in line with the fact that transition economies have been structural breaks with big changes in exchange rates in the transition of the economic system.

JEL classification: E52, E58, F31

Key words: policy reaction function, inflation targeting, interest rates

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I. Introduction

The introduction of inflation targeting (IT) in developing and emerging economies (DEE) has been growing in practice since 2000. From around 2000, about 30 DEE have adopted IT, and empirical studies on IT framework have been growing in DEE as country-level data accumulated (Aizenman et al. 2011; Cabral et al. 2016; Asab and Cuestas 2020; Keefe 2020). Discussion on the performance of monetary policy by the central banks of DEE after adopting IT, however, is still insufficient compared to advanced economies for which rich empirical studies have been explored. And conflicting empirical findings have been reported on the effects of IT as well while the overall significant and consistent effects of the adoption of IT on inflation in the advanced economies. in the relatively.

This relatively short discussion on the performance of IT in DEE is associated with the more heterogeneous characteristics of DEE. Accordingly, DEE face quite different IT backgrounds compared to more homogeneous advanced economies including volatile foreign exchange markets, less developed financial markets, relatively high degree of dollarization and less foreign reserves, etc. These factors are likely to affect the behavior the central bank when implementing IT in DEE. In this regard, this paper can fill the gap in the literature for further discussion on the empirical studies on the performances of emerging and development countries.

Under this context, this paper explores the following main questions. First, whether or not the interest rate (or policy rate) rules of the central bank has been changed across the introduction of IT. Second, this paper investigates whether or not mixed (or soft form) IT in DEE is more acceptable for the transitional period after IT implementation. More specifically, this chapter examines the policy behavior of central banks in DEE to see whether their policy weights move from foreign exchange rates to inflation after the introduction of IT. This question has been a central issue in the monetary policy of DEE since some studies have been addressing the fact that reducing the volatility of FX rates is crucial for lowering inflation expectation (Keefe 2020). In addition, we explore some factors associated with the policy response behaviors of central banks. This is because the central bank's decision would differ depending on the degree of dollarization, degree of foreign reserve and degree of macroeconomic stability. Furthermore, we broadly review the characteristics of IT-based

monetary policy for transition economies.

The main estimation results of the central banks' monetary policy behaviors responding to main macroeconomic variables using policy reaction functions for 32 developing and emerging economies who have adopted the inflation targeting are as follows. First, without consideration of IT adoption dates, the estimation results using the overall period from 2005 indicate that central banks with an IT framework in the developing and emerging economies have reacted significantly in response to inflation pressure. In addition, they respond significantly to changes of foreign exchange rates while they weakly respond to business cycles. Second, the estimation results of policy reaction function on separate periods across the IT adoption dates indicate that central banks more actively respond to foreign exchange rates before the IT adoption and their concerns gradually decrease after the IT introduction as time goes by. Third, further estimations focusing on the transition periods only between four years before and after the IT adoption show that central banks adopting IT in DEE care more about the foreign exchange rates during the eight years' IT transition. Three or four years later after implementation of IT, the central banks began to actively respond to inflation and real economic movements and their concerns on exchange rates decayed gradually. Fourth, the estimation results on policy reaction function by DEE groups over IT-adoption period indicate that central banks with less dollarization, high degree of foreign reserve ratio over imports, and low degree of macroeconomic instability are likely to concentrate more on inflation pressure rather than exchange rate movements. In contrast, central banks of opposite country groups care about both inflation and exchange rates simultaneously. Finally, the central banks in transitional economies actively respond to changes of foreign exchange rates as well as inflation pressure and real economic activities even after the IT introduction. This is in line with the fact that transition economies have been structural breaks with big changes in exchange rates in the transition of the economic system.

The structure of this paper is as follows. Chapter II reviews the existing related studies on the IT performances in DEE, and Chapter III provides broad overviews on the main variables in two time domains, with or without the IT adoption dates. In Chapter IV, the main estimation results are discussed. Finally, Section V summarizes the estimation results of this paper and discusses policy implications.

II. Literature Review

After New Zealand first adopted inflation targeting in 1989, about 20 advanced economies have joined this trend since the 1990s. Soon after, developing and emerging economies also started to adopt IT and 33 DEE have implemented IT in their operation of monetary policy as of today. Uzbekistan is the last country to adopt IT in 2019. As the inflation targeting system spread out internationally, many studies on inflation targeting have emerged. Most studies, however, heavily focus on the effectiveness of inflation targeting for advanced economies, while there is relatively less discussion on the policy behaviors of IT-adopting central banks in developing and emerging economies.

The monetary policy behaviors of DEE that implement inflation targeting may be different from those of advanced and industrialized countries. More turbulent foreign exchange markets, underdeveloped financial markets, relatively high degree of dollarization, and restricted foreign reserves may affect the central bank's policy decisions based on the IT framework in DEE. We still do not have much accumulated knowledge regarding these questions.

Now we will briefly summarize empirical studies on the effectiveness of monetary policy in DEE in connection to IT operation. The empirical strategy of this chapter follows the specifications discussed in Aizenman et al. (2011) and Cabral et al. (2016). The former documents that inflation-targeted central banks in emerging markets react more systematically to real exchange rates compared to central banks in advanced economies. The latter argues that IT adopters in emerging markets were successful in delivering low and stable inflation. Additionally, Batini and Laxton (2007), Goncalves and Salles (2008), and Svenssion (2010) also proposed that IT showed significant performance with respect to decrease of inflation in emerging economies.

In contrast, Morozumi et al. (2020) focus on IT performance in low-income countries (LICs) and show that IT has not so far been as effective in reducing inflation in LIC due to the central banks having a low level of instrument independence. Meanwhile, Keefe (2020) investigates both emerging and advanced economies to analyze whether volatility in exchange rate impacts the commitment to implement a monetary policy that lowers inflation. This study documents that central banks are unable or unwilling to respond to deviations in the inflation gap when volatility is beyond the threshold. Case studies were also conducted for each country. Asab and

Cuestas (2020) and Awad (2008) review the cases of Jordan and Egypt, respectively, and concluded that the IT framework showed limited performance under weak institutional arrangements such as the fixed exchange rate regime.

Relatedly, Laurens et al. (2015) recommend the adoption of transitional arrangements before implementing a full-fledged IT regime. These interim arrangements would include the development of economic analysis capacity and a forward-looking approach to monetary policy, with interest-rate focused operating procedures to achieve inflation objectives.

III. Data, Specifications and Preliminaries

3.1 Data and Specifications

We identified all IT-adopting DEE based on the MSCI emerging and developing country index. As of today, 33 DEE are categorized and a considerable number of these countries introduced IT between 2000 and 2015 as shown in <Table 1>. Particularly, South American countries that suffered high- or hyper- inflation adopted the system relatively early.

<Table 1>

Developing and Emerging Countries Adopting IT[1)]

Adopting date	Once or still dollarized[2)]	Overall, no or less dollarization
First wave: from 1997 to 2004	Peru (2002), Philippines (2002)	Brazil (1999), Chile (2001), Colombia (1999), Czech Rep. (1997)*, Hungary (2001)*, Israel (1997), Korea (1998), Mexico (2001), Poland (1998)*, South Africa (2000), Thailand (2000)
Second wave: from 2005 to 2014	Albania (2009)*, Armenia (2006)*, Georgia (2009)*, Ghana (2007), Indonesia (2005), Kazakhstan (2015)*, Moldova (2010)*, Paraguay (2011), Romania (2005)*, Russia (2014)*, Turkey (2006), Uganda (2011), Ukraine (2005)*	Dominican Rep. (2012), Guatemala (2005), Serbia (2006)*, Slovak Rep. (2005)*
Recently from 2015 up to date	Argentina (2016), Uzbekistan (2019)*[3)]	India (2016),

Notes: 1) Adoption dates are based on Hammond (2012) and Morozumi et al. (2019). And * denotes transitional economies according to IMF (2000) and World Bank (2002, 2009). 2) The dollarization is defined such that foreign deposit ratios have been or used to be above 30%. 3) Excluded from the empirical analysis due to the short data span after IT adoption.

Also, DEE with no dollarization experience introduced IT relatively early. This can be

understood in the sense that it might be relatively easier for these countries to transition from the managed floating (or fixed) exchange rate to the more flexible regime. More flexible regime is likely to be more in accordance with the IT system.

Interestingly, 14 out of the 33 transitional economies adopted IT, comprising almost half of all transitional countries. According to the IMF (2002) and World Bank (2002, 2009), these 14 countries used to be members of the Soviet Union and then obtained independence and shifted to a market economy. Early adopters include the Czech Republic (1997), Poland (1998) and Hungary (2001), who joined the European Union in 2004. The joining condition was stabilization of inflation, which was likely to motivate them to introduce IT in advance. The second wave of IT adoption by transition economies came between 2005 and 2015, resulting in all countries except for Uzbekistan introducing IT. Uzbekistan finally embraced IT in 2019.

<Table 2> shows sample countries by region. Many countries from Asia, Europe and Latin America are included while a relatively small number of countries adopted IT in the Middle East and Africa. Countries that introduced IT, however, are distributed all over the world across Asia, Europe and Africa.

<Table 2>

33 Developing and Emerging Countries Adopting IT by Region

Region[1)]	Country
Asia	Armenia, Kazakhstan, Korea, India, Indonesia, Philippines, Thailand, Uzbekistan
South America	Argentina, Brazil, Chile, Colombia, Dominican Rep., Guatemala, Mexico, Paraguay, Peru
Europe	Albania, Czech Rep., Georgia, Hungary, Moldova, Poland, Romania, Russia, Serbia, Slovak Rep., Ukraine
Middle East and Northern Africa	Israel, Turkey
Central and Southern Africa	Ghana, South Africa, Uganda

Note: 1) It follows the IMF's regional classification criteria.

Following Aizenman et al. (2011) and Cabral et al. (2016), the monetary policy reaction function is a typical specification to evaluate the overall effectiveness of inflation targeting which has been operated through the nominal short-term interest rate. The specification using quarterly data can be presented as in Equation (1):

$$i_{i,t} = \alpha_i + \rho i_{i,t-1} + \beta_1\left(y_{i,t} - \bar{y}_{i,t}\right) + \beta_2\pi_{i,t} + \beta_3 fx\_g_{i,t} + \gamma X_{i,t} + \lambda_a + \varepsilon_{i,t} \qquad (1)$$

$i_{i,t}$ indicates short-term nominal interest rates, for which money market rates are used. In case of insufficient data for money market rates, monetary policy-related interest rates are used instead. α_i represents country-specific fixed effects involving inflation target. This fixed effect can reflect a certain degree of heterogeneity in developing and emerging economies, assumed to be time-invariant for each country. ρ is a smoothing parameter for short-run adjustment which represents the practice of monetary policy implemented by the central bank with a tendency of adjusting little by little toward its target level of nominal interest rate. $y_{i,t} - \bar{y}_{i,t}$ is the country-specific output gap calculated by subtracting the realized real GDP growth from the potential GDP growth estimated using the Hodrick-Prescott filter.

$\pi_{i,t}$ is the inflation for each country. $fx\_g_{i,t}$ is the growth of nominal exchange rates, measured through dividing domestic currency by US$, with increasing values implying depreciation of local currency. $X_{i,t}$ represents control variables such as the volatility of foreign exchange rates that represents the degree of macroeconomic stability including domestic criseis phases. Additionally, the ratio of foreign reserve over imports is used to represent the economy's overall degree of stability against external shock. λ_a is the year dummy variable representing global business cycles including global crises.

According to Clarida et al. (2000), monetary policy reaction function that reflects the central bank's IT behavior is based on an forward-looking attitude in the sense that the monetary policy responses to expected inflation and expected output gap. This is because it takes time for short-term interest rates deeply related to policy rates to have an effect on inflation and the real economy. Thus the expected horizon for advanced economies is somewhere between the second quarter and the sixth quarter. The specification in Equation (3) assumes that central banks in DEE would expect a shorter horizon, i.e. deciding their policy response within a quarter forecast. Forecasting errors are all reflected in the error term, represented by $\varepsilon_{i,t}$ in the specification.

In this chapter, another specification based on IT adoption dates is further investigated and displayed in Equation (2) as follows:

$$i_{i,q_i} = \alpha_i + \rho i_{i,q-1_i} + \beta_1\left(y_{i,q_i} - \bar{y}_{i,q_i}\right) + \beta_2\pi_{i,q_i} + \beta_3 fx\_g_{i,q_i} + \beta_4 fx\_vol_{i,q_i} + \epsilon_{i,t} \qquad (2)$$

Equation (2) is quite similar to Equation (1), but it has a different timing denotation called q_i, which represents the country-specific timing of IT adoption dates. More specifically, q_i stands at zero value for the quarter when IT was adopted for *I* country. After adopting IT, q_i will increase its integer by one each quarter after the introduction of IT. On the contrary, negative values indicate the quarters before IT adoption dates. For example, if q_i is 12, this implies three years after the adoption of IT and vice versa. Accordingly, the timing q_i is different across countries that have different IT adoption dates as displayed in <Table 1> and this is why q_i has country-specific index i in its denotation and there is no yearly dummy variable in Equation (2).

It would be more appropriate to apply Equation (2) than Equation (1) to empirically investigate the effectiveness of IT in DEE. This is because Equation (2) involves the only the period after IT implementation, not including the time prior to IT adoption. Accordingly, we examine the effectiveness of IT with greater focus on Equation (2).

<Table 3>

Explanations of Variables

Variables	Explanations
Money market rate (i)	Nominal quarterly rates; monetary policy-related interest rates are used instead in case of limited availability of the money market rates for following 9 countries: Albania, Guatemala, Hungary, Indonesia, Israel, Kazakhstan, Moldova, Paraguay and Turkey; %
Output gap ($y - \bar{y}$)	Four quarter growth rates of real annualized GDP; Potential output growth is estimated using Hodrick-Prescott filter with 1600 smoothing parameter; Quarterly data are generated using interpolation for following 12 countries with only yearly dataset: Albania, Armenia, Dominican Republic, Georgia, Ghana, Guatemala, India, Kazakhstan, Paraguay, Peru, Russia and Uganda; %p
Inflation (π)	Four quarter growth rates of consumer price index; %
Growth of foreign exchange rate (fx_g)	Four quarter growth of nominal exchange rates, domestic currency over US$; growing values implying depreciation of domestic currency against US$; %
Volatility of foreign exchange rates (fx_vol)	Applying square root on the values calculated through square on difference between logarithmic current foreign exchange rate and logarithmic mean of it involving total period
Foreign reserve ratio ($reserve$)	Ratio of foreign reserve over nominal annualized imports; %

Note: ( ) means abbreviation for variable
Sources: IMF's International Financial Statistics

As seen in <Table 3>, all variables are constructed in quarterly frequency which is believed

to be appropriate to capture monetary policy behaviors that are usually conducted in monthly or bimonthly frequency. The quarterly data for interest rates, however, are relatively limited in developing countries, which leads to restriction in sample period for empirical estimation. As for interest rates, for nine countries that do not have enough data on money market rates used monetary policy-related rates instead. In addition, for Slovak and Uganda, two countries where neither of the interest rates were available, government bond rates and deposit interest rates were used, respectively. Also, for these two countries, quarterly series are constructed through interpolation of yearly dataset based on cubic function.

The output gap is built by subtracting the trends accumulated by the Hodrick-Prescott filter in the fourth quarter growth rate of real annualized GDP with a typical 1600 smoothing parameter. The quarterly data series are constructed using the same interpolation function on a yearly dataset for the following 12 countries: Albania, Armenia, Dominican Republic, Georgia, Ghana, Guatemala, India, Kazakhstan, Paraguay, Peru, Russia and Uganda.

The volatility of foreign exchange rates is compiled through the log difference between the current foreign exchange rate and the mean of it involving the total period. The log difference is squared first and then standardized using the square root as follows:

$$fx_{vol_{i,t}} = \sqrt{\left(logfx_{i,t} - logfx_{avg}\right)^2} \tag{3}$$

The foreign reserve ratio is calculated quarterly by the ratio of foreign reserve over nominal imports which is converted through multiplying quarterly values by four to represent annualized values. Like the real GDP, the quarterly series is constructed using the same interpolation function for the following 15 countries without quarterly dataset: Albania, Armenia, Dominican Republic, Georgia, Ghana, Guatemala, India, Kazakhstan, Moldova, Paraguay, Peru, Philippines, Russia, Uganda and Ukraine.

The basic statistics on variables used in panel estimation are listed in <Table 4>. A number of heterogeneous DEE around the world are illustrated in unbalanced country panel data, indicating that standard deviations, minimums and maximums have large bounds. The basic statistics are calculated using observations after the first quarter of 1997 because adoption of IT began in DEE at that time.

<Table 4>

Basic Statistics

Variables	Obs.	Mean	S.D.	Min	Max
Money market rate (i); %	2,731	9.4	11.2	0.1	183.2
Real GDP growth (y); %	2,432	3.6	4.0	-23.3	31.1
Potential GDP growth ($\bar{y}$); %	2,432	3.6	2.5	-8.1	12.5
Output gap ($y - \bar{y}$); %p	2,432	-0.01	2.8	-25.3	21.3
Inflation (π); %	3,071	7.1	9.2	-5.0	101.5
Growth of foreign exchange rates (fx_g); %	3,035	5.3	16.7	-49.2	168.9
Volatility of foreign exchange rates (fx_vol)	3,039	0.36	0.43	0.00003	3.31
Foreign reserve ratio ($reserve$); %	2,683	65.4	131.0	3.5	1779.8

Note: ( ) means abbreviation for variable
Sources: IMF's International Financial Statistics

A brief overview of variables included in the estimation is as follows. The overall average of money market rates is 9.4% with huge variations involving 183.2% as the maximum value. This maximum value is connected to Turkey's economic turmoil in 2000. The average annual economic growth rate is 3.6% and also has a wide data distribution. Accordingly, the output gap has a big fluctuation. Inflation turns out to be 7.1% on average and in particular, 101.5% per annum being the highest inflation rate recorded at Romania in 1997.

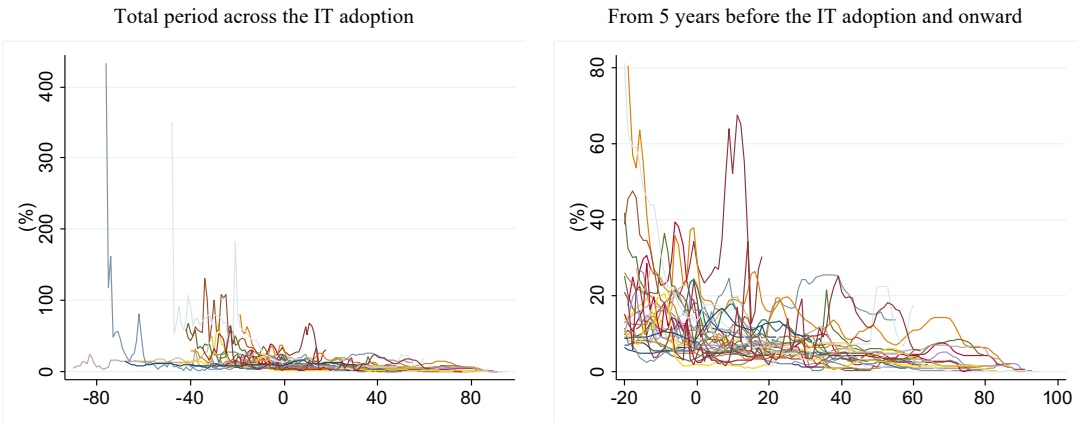
The growth of foreign exchange rates shows a consistent overall 5.3% annual depreciation against US$ in DEE since 1997. This can be understandable given the context that there has been a tendency of US$ appreciation as a global safe asset since 1997 due to four major global crises including the 1997 Asian Crisis, the 2008 Global Financial Crisis, the 2010 Euro Fiscal Crisis and the 2020 COVID-19 pandemic. Foreign reserve ratio over annualized imports is 65.4%, indicating a stable buffer against external shocks, which is one of the underlying factors for DEE introducing IT along with a more floating foreign exchange regime.

3.2 Preliminaries

This section illustrates the overall development of main variables across time, especially prior to and after IT adoption.

<Figure 1>

Developments of Money Market Rates (i)[1)2)]

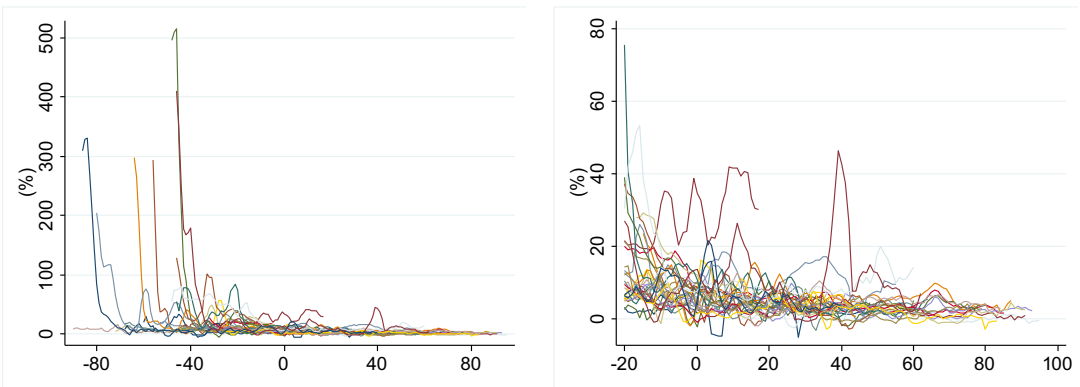


Notes: 1) Zero in x axis indicates the IT adoption dates for each country. Accordingly, positive values indicate quarterly times after the adoption and negative values quarterly times before it. 2) Monetary policy-related rates are used instead for 9 countries. Please refer to <Table 3> for more detailed explanation on the data.
Source: Authors' calculation

Plots in <Figure 1> indicate the development of money market rates, which is the dependent variable in Equations (1) and (2). The zero value in x axis indicates the IT adoption date of each country and positive values indicate quarterly time according to the passage of time after adoption. The negative values are quarterly time before IT adoption.

<Figure 2>

Developments of Inflation (π)[1)2)]



Notes: 1) Zero in x axis indicates the IT adoption dates for each country. Accordingly, positive values indicate quarterly times after the adoption and negative values quarterly times before it. 2) Inflation is a four-quarter growth rate using the consumer price index. Please refer to <Table 3> for more detailed explanation on the data.
Source: Authors' calculation

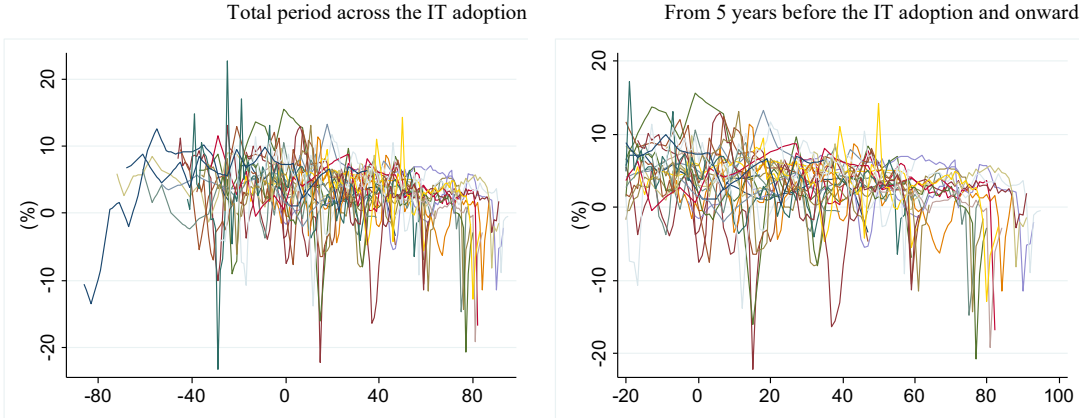
The left panel in <Figure 1> shows all observations across all 32 DEE including several

outliers 20 years before IT adoption. The highest peak, which was over 400%, is the money market rate for Russia in the first quarter of 1995. With the passage of time, particularly after IT adoption, overall money market rates have a tendency of lowering in level and decreasing in variability. This trend is better illustrated in the right panel that restricted observations to start at five years before IT adoption for each country. The right panel in <Figure 1> also indicates that some countries have more than 20 years of experience in operating IT-based monetary policy.

The overall development of inflation is displayed in <Figure 2>, which presents a similar pattern to short-term interest rates. The left panel in <Figure 2> indicates some outliers reflecting cases of hyper-inflation and lowering and stable trends across IT adoption dates with the passage of time. The right panel highlights the period of five years prior to the adoption date and onward. Around five years before IT introduction, Serbia and Turkey underwent a pretty high inflation. Argentina is a special case in that the average inflation continued to increase up to 30% even five years after IT introduction. Another interesting case is Ukraine, which experienced a very high inflation of 46% in the second quarter of 2015 due to a regional conflict in the Creamean Peninsula that caused a steep rise in natural gas price. The inflation, however, has been stabilized for the last five years.

<Figure 3>

Developments of Real GDP Growth (y)[1)2)]



Notes: 1) Zero in x axis indicates the IT adoption dates for each country. Accordingly, positive values indicate quarterly times after the adoption and negative values quarterly times before it. 2) Growth is a four quarter basis using quarterly frequency data including interpolated series for 12 countries. Please refer to <Table 3> for more detailed explanation on the data.

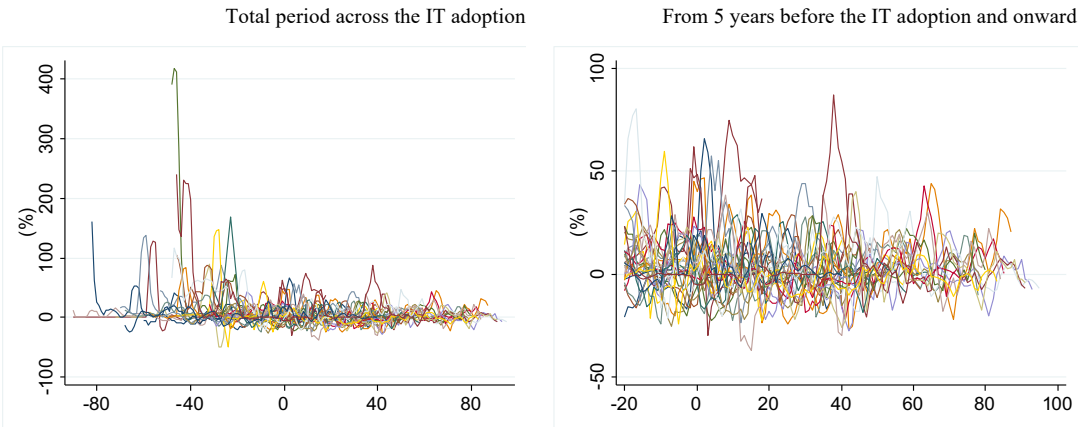
Source: Authors' calculation

Economic growth plots are presented in <Figure 3>, which shows huge fluctuations across

business cycles and crises periods. The overall trend indicates slightly lowering values with several big drops even after IT adoption as illustrated in the right panel of <Figure 4-3>. Severe recessions mostly came from the 2020 COVID-19 Pandemic while some came from the 2008 Global financial crisis. Since the time of occurrence for these two events on the x axis based on the date of IT adoption, however, are differentiated, drops appear several times across the x axis.

<Figure 4>

Developments of Growth of Foreign Exchange Rates (fx_g)[1)2)]



Notes: 1) Zero in x axis indicates the IT adoption dates for each country. Accordingly, positive values indicate quarterly times after the adoption and negative values quarterly times before it. 2) Growth is a four-quarter basis using domestic currency over US$. Please refer to <Table 3> for more detailed explanation on the data.

Source: Authors' calculation

Plots for fourth quarter growth rates of foreign exchange rates are presented in <Figure 4>. A significant portion of values are placed around zero, implying swings across depreciation and appreciation of domestic currency against US$. More positive values, however, indicate overall depreciation of domestic currency for IT-adopting DEE. The left panel of <Figure 4> also shows steep deprecations, implying currency instabilities. For example, the green line represents the growth rates of Armenia, whereby growth increased more than four times from the previous year of 1994 when the economy just started to reform as a transitional economy. In line with reforms and regional conflicts in transitional economies such as Romania, Kazakhstan, Russia, Serbia, and Ukraine all underwent more than 100% deprecation in the 1990s. Other countries such as Argentina, Indonesia and Turkey went through a deprecation of more than 100% due to suffering several turbulences caused by the global financial crisis. The

right panel in <Figure 4> indicates less fluctuation in foreign exchange rate with the passage of time after IT adoption.

IV. Estimation Results

4.1 Policy Reaction Functions: All Periods

Panel estimation results using fixed effect models for Equation (1) are displayed in <Table 5>. The fixed effect model is more suitable for capturing changes over time within a single country in that individual characteristics of each country regarding financial and economic systems or institutions are quite different across developing and emerging economies.

<Table 5>

Monetary Policy Reaction Function: 2000-2021[1)2)]

Variables	Equation (1): fixed effect models			
	(1)	(2)	(3)	(4)
$i_{i,t-1}$	0.5890*** (0.1035)	0.5806*** (0.1043)	0.5894*** (0.0979)	0.5893*** (0.0979)
$y_{i,t} - \bar{y}_{i,t}$	0.1210 (0.0763)	0.1537* (0.0820)	0.1543* (0.0808)	0.1542* (0.0812)
$\pi_{i,t}$	0.3876** (0.1460)	0.3497** (0.1538)	0.3511** (0.1487)	0.3515** (0.1488)
$fx\_g_{i,t}$		0.0327** (0.0148)	0.0314** (0.0121)	0.0314** (0.0121)
$fx\_vol_{i,t}$			0.2563 (1.1827)	0.2403 (1.2051)
$reserve_{i,t}$				-0.0007 (0.0014)
Year dummies	yes	yes	yes	yes
# of observations	1996	1960	1960	1957
# of countries	32	32	32	32
Within R-sq.	0.7159	0.7175	0.7176	0.1181
Sample period	2000 q1 – 2021 q1			

Notes: 1) Values in parentheses indicate standard errors robust to heteroskedasticity and autocorrelation in the errors. 2) *, **, and *** indicate 10%, 5% and 1% statistical significance levels, respectively

Source: Authors' calculation

The estimation results in <Table 5> involve all observations from 2000 to 2021 based on the fact that most of DEE had introduced IT since 2000 and were able to effectively control extreme

values from before IT adoption. Estimation results overall indicate that central banks equipped with an IT framework in developing and emerging economies have reacted significantly in response to inflation pressure. What is interesting is that these central banks have been weakly responding to the business cycle while responding significantly to the movement of depreciation in their own currencies. These results are overall consistent with existing studies (Aizenman et al. 2008; Cabral et al. 2016).

<Table 6>

Monetary Policy Reaction Function: 2005-2021 and 2010-2021[1)2)]

Variables	Equation (1): fixed effect models			
	(1)	(2)	(3)	(4)
$i_{i,t-1}$	0.8325*** (0.0184)	0.8172*** (0.0226)	0.8173*** (0.0162)	0.7907*** (0.0239)
$y_{i,t} - \bar{y}_{i,t}$	0.0793** (0.0351)	0.0762** (0.0344)	0.0749 (0.0508)	0.0713 (0.0501)
$\pi_{i,t}$	0.1073*** (0.0247)	0.1068*** (0.0249)	0.1030*** (0.0247)	0.1029*** (0.0316)
$fx\_g_{i,t}$	0.0317** (0.0120)	0.0295** (0.0115)	0.0401** (0.0170)	0.0361** (0.0161)
$fx\_vol_{i,t}$		0.5409** (0.2299)		0.8211*** (0.2880)
Year dummies	yes	yes	yes	yes
# of observations	1670	1634	1218	1218
# of countries	32	32	31	31
Within R-sq.	0.8451	0.8503	0.8302	0.8314
Sample period	2005 q1 – 2021 q1		2010 q1 – 2021 q1	

Notes: 1) Values in parentheses indicate standard errors robust to heteroskedasticity and autocorrelation in the errors.
2) *, **, and *** indicate 10%, 5% and 1% statistical significance levels, respectively
Source: Authors' calculation

Regarding the volatility of foreign exchange rates and the ratio of foreign reserve over imports, the response is generally insignificant. The volatility was probably already reflected in annual dummy variables included to capture a global financial crisis. Since the foreign reserve ratio can also be represented by other external variables, we have excluded the variable from the specification. Different policy reactions by country groups across high and low volatility, however, will be explored in the next section. Finally, the coefficients of lagged dependent variable $i_{i,t-1}$ are quite significant, implying the persistent property of short-term interest rates and reflecting the smooth operation of the monetary policy. The magnitude of coefficients is relatively small, however, indicating more or less big changes in current interest

rates with less dependence on the previous level of interest rates. This can be understood when we observe that the two variables of interest rate and inflation had large fluctuations in the early 2000s. With the passage of time, these two variables showed more stabilization and less volatile movement as discussed in <Figure 1> and <Figure 2>.

Similar estimations are conducted using two recent sample periods: from 2005 to 2021 and from 2010 to 2021. The estimation results in <Table 6> are overall aligned with those in <Table 5>. The difference features the magnitude of estimated coefficients for lagged dependent variables and inflation. As discussed above, the previous level of short-term interest rates had a greater impact on current interest rate rules and the magnitude of inflation coefficients also shrunk in reflection of the relatively smaller variation in recent times.

4.2 Policy Reaction Functions across IT Adoption Dates

Estimates on Equation (1) in the previous section present overall consistent results with the literature, which has significance for having more IT-adopted emerging and developing countries use a more recent and updated dataset. The estimations using all datasets prior to or after the IT adoption dates can also be limited in identifying whether the coefficients truly represent the effectiveness of the adopting inflation targeting for the operation of the monetary policy. Against this rationale, we conduct further estimations on Equation (2), which specifies the financial and macro variables rearranged in line with the timings of IT adoption.

<Table 7>

Countries Involving Policy Reaction Function across IT Adoption[1)]

Periods	Country name
First wave: from 1990 to 2004	Hungary (2001)*, Korea (1998), Mexico (2001), Peru (2002)
Second wave: from 2005 to 2014	Armenia (2006)*, Dominican Rep. (2012), Ghana (2007), Indonesia (2005), Romania (2005)*, Slovak Rep. (2005)*, Turkey (2006), Uganda (2011)
Recently from 2015 up to date	Argentina (2016), India (2016), Kazakhstan (2015)*

Notes: 1) Adoption dates are based on Hammond (2012) and Morozumi et al. (2019). And * denotes transitional economies according to IMF (2000) and World Bank (2002, 2009)

Hence, based on Equation (2) we can more appropriately investigate whether the central bank's policy reactions in DEE would change before and after IT implementation. In addition, for IT operation periods, we can explore whether the behavior of the central bank's policy reaction would differ by country group: the degree of dollarization, the degree of foreign reserve ratio over imports and the degree of volatility of foreign exchange markets.

For the first question of whether the central bank's policy reaction really changes before and after IT implementation, 15 countries are selected based on the requirement that it should have at least 12 observations over three years of experience prior to or after IT adoption. The 15 selected countries are displayed in <Table 7>.

This is one way of weakening sample selection bias whereby sample countries belonging to groups of two periods prior to or after the dates differ from each other. By restricting the samples to countries that have enough datasets for both periods, we can observe whether the identical central bank's behavior changes across IT implementation in a more consistent manner.

<Table 8>

Monetary Policy Reaction Function Across IT Adoption Dates[1)2)]

Variables	Equation (2): fixed effect models			
	(1)	(2)	(3)	(4)
$i_{i,q-1_i}$	0.4041*** (0.0723)	0.6437*** (0.0647)	0.7465*** (0.0666)	0.7942*** (0.0461)
$y_{i,q_i} - \bar{y}_{i,q_i}$	0.4806 (0.3287)	0.1402 (0.1013)	0.2804 (0.1600)	0.1752** (0.0759)
π_{i,q_i}	0.2741*** (0.0883)	0.2055** (0.0758)	0.1613** (0.0696)	0.1717*** (0.0338)
fx_g_{i,q_i}	0.2094** (0.0763)	0.0839** (0.0324)	0.0706 (0.0515)	0.0365 (0.0221)
fx_vol_{i,q_i}	-5.1322 (4.5506)	1.0324 (2.0948)	-2.5903*** (0.8264)	-0.2914 (0.5619)
# of observations	445	266	282	728
# of countries	15	15	15	15
Within R-sq.	0.5336	0.8847	0.7244	0.7829
Sample period	$q_i < 0$	$-20 \leq q_i < 0$	$0 \leq q_i \leq 20$	$q_i \geq 0$

Notes: 1) Values in parentheses indicate standard errors robust to heteroskedasticity and autocorrelation in the errors. 2) *, **, and *** indicate 10%, 5% and 1% statistical significance levels, respectively
Source: Authors' calculation

For the group consisting of 15 countries, the monetary policy reaction functions in Equation (2) are estimated for separate periods across IT adoption dates. Estimation results in <Table 8> indicate that central banks' policy responses change across the IT implementation date given consistent and significant response to inflation pressure throughout the periods. Before IT adoption, central banks more actively responded to foreign exchange rates as shown in columns (1) and (2). Their concerns definitely decreased as time went by after IT introduction as displayed in columns (3) and (4). Meanwhile, central banks become more cautious about real economic activities or business cycles represented by output gaps after IT adoption compared to before.

Lastly, for five years after IT introduction, central banks respond quite actively to the volatility of foreign exchange rates to secure macroeconomic stability. The degree of macroeconomic fluctuation can be heightened sharply in the transition period after the introduction of IT in that the change in monetary policy framework is usually accompanied by a structural change in the foreign exchange market from a fixed or managed regime to a floating or freer regime.

<Table 9>

Monetary Policy Reaction Function Across IT Adoption Four Years[1)2)]

Variables	Equation (2): fixed effect models					
	(1)	(2)	(3)	(4)	(5)	(6)
$i_{i,q-1_i}$	0.6824*** (0.0865)	0.6859*** (0.0750)	0.5638*** (0.0666)	0.6281*** (0.1070)	0.6292*** (0.1786)	0.7631*** (0.0477)
$y_{i,q_i} - \bar{y}_{i,q_i}$	0.1410 (0.1106)	0.1215 (0.1021)	0.0846 (0.1667)	0.1393 (0.1057)	0.2452*** (0.0643)	0.3683* (0.1806)
π_{i,q_i}	0.2050** (0.0910)	0.1274 (0.0758)	0.1620 (0.0995)	0.0618 (0.0598)	0.1973 (0.1227)	0.1400* (0.0671)
fx_g_{i,q_i}	0.0826** (0.0356)	0.0812* (0.0411)	0.0786* (0.0431)	0.0130 (0.0201)	0.0425** (0.0177)	0.0992 (0.0656)
fx_vol_{i,q_i}	1.1466 (2.1161)	3.2936 (2.9138)	5.3702* (2.8241)	14.1298* (6.9889)	7.8167 (6.8119)	-4.0341** (1.3571)
# of obs.	221	165	105	120	180	236
# of countries	15	15	15	15	15	15
Within R-sq.	0.8221	0.7088	0.6455	0.7302	0.8207	0.7379
Sample period	$-16 \le q_i < 0$	$-12 \le q_i < 0$	$-8 \le q_i < 0$	$0 \le q_i \le 8$	$0 \le q_i \le 12$	$0 \le q_i \le 16$

Notes: 1) Values in parentheses indicate standard errors robust to heteroskedasticity and autocorrelation in the errors. 2) *, **, and *** indicate 10%, 5% and 1% statistical significance levels, respectively

Source: Authors' calculation

<Table 9> presents more in-depth estimations focusing on the transition period by adding four years before and after IT adoption with smaller time spans. Estimation results show that central banks adopting IT in DEE care more about foreign exchange rates during the eight years of IT transition. Central banks begin to actively respond to inflation and real economic movements only three or four years after implementation of IT and their concern on exchange rates decline with the passage of time.

Next, we explore whether the policy behaviors of IT-adopting central banks in DEE would differ by country group: the degree of dollarization, the degree of foreign reserve ratio over imports and the degree of macroeconomic stability measured by volatility of foreign exchange markets. For this task, 16 countries with the highest ratio of foreign reserve over imports are categorized as the country group with the high reserve ratio while 16 countries with the lowest ratio belong to the country group with the low reserve ratio. The ratios are calculated as simple means over a total period involving all available observations. The same method is applied to categorize countries by the volatility measure into the upper 16 vs. the lower 16 countries using the mean value of the respective country.

<Table 10>

Country Groups by Degree of Foreign Reserve Ratio and Degree of Volatility of Foreign Exchange Markets[1)2)]

Degree of reserve ratio over imports		Degree of volatility in fx. markets	
High	**Low**	**High**	**Low**
Argentina, Brazil, Chile, Colombia, Guatemala, India, Indonesia, Israel, Korea, Peru, Philippines, Russia*, Serbia*, Slovak Rep.* Thailand, Uganda	Albania*, Armenia*, Czech Rep.*, Dominican Rep., Georgia*, Ghana, Hungary*, Kazakhstan*, Mexico, Moldova*, Paraguay, Poland*, Romania*, South Africa, Turkey, Ukraine*	Argentina, Armenia*, Brazil, Colombia, Dominican Rep., Ghana, Indonesia, Kazakhstan*, Mexico, Paraguay, Romania*, Russia*, South Africa, Turkey, Uganda, Ukraine*	Albania*, Chile, Czech Rep.*, Georgia*, Guatemala, Hungary*, India, Israel, Korea, Moldova*, Peru, Philippines, Poland*,Serbia*, Slovak Rep.*, Thailand,

Notes: 1) * denotes transitional economies according to IMF (2000) and World Bank (2002, 2009). 2) The upper 16 countries for higher values belong to country groups of high and the leftovers belong to country groups of low, respectively.

<Table 10> displays countries belonging to each group and <Table 11> presents key basic statistics for each country group. Many countries from South Asia and East Asia belong to both the group with low volatility of foreign exchange markets and the group with high degree of foreign reserve. A considerable number of countries from South America belong to the group with high degree of volatility while many transitional economies belong to the group with low degree of foreign reserve ratio. Other than these findings, no distinct features are discovered for each country group.

Looking at the basic statistics by country group displayed in <Table 11>, there are some different patterns in several key economic indicators. First, inflation and policy rates are overall lower in country groups that are de-dollarized, have a high degree of foreign reserve ratio and have low macroeconomic volatility than in contrasting country groups. Second, the depreciation of domestic currency is also more conspicuous in the former country group. Lastly and interestingly, there was no significant difference in economic growth rates across country groups.

<Table 11>

Basic Statistics by Country Groups[1)2)]

Main Variables	Degree of dollarization		Degree of reserve ratio over imports		Degree of volatility in fx. markets	
	Once or still dollarized	Never or less dollarized	High	Low	High	Low
Money market rate (i); %	13.7	8.1	9.0	12.6	15.2	6.4
Real GDP growth (y); %	4.1	3.1	3.7	3.5	3.6	3.6
Inflation (π); %	15.3	6.1	7.7	13.5	14.8	6.6
Growth of foreign exchange rates (fx_g); %	10.2	3.2	4.3	9.1	11.3	2.1
Volatility of foreign exchange rates (fx_vol)	0.55	0.24	0.30	0.48	0.59	0.18
Foreign reserve ratio ($reserve$); %	46.2	85.6	99.6	32.7	43.9	87.8

Notes: 1) Simple averages over associated countries for the total period.
2) See <Table 4-1> and <Table 4-10> for the categorization for the groups.
Source: Authors' calculation

<Table 12> shows panel estimation results on policy reaction function by degree of

dollarization for the period of IT adoption only. Estimation results indicate that central banks from two groups have actively responded to inflation pressure since IT implementation. The magnitude of inflation coefficients, however, are greater in undollarized or less dollarized economies than in dollarized countries. The most contrasted variable is the fluctuation in foreign exchange rates in that central banks in dollarized countries keep significantly responding to depreciation of domestic currency while central banks from the other groups are less concerned about changes to foreign exchange rates. These results are in line with the fact that DEE with no dollarization have introduced more market-based floating regimes in foreign exchange markets.

Estimation results by degree of foreign reserve ratio are displayed in <Table 13> to indicate that with more buffer against external shock, central banks respond more actively to inflation pressure and growth of real GDP. In contrast, with less resources to cope with external shock, the central banks with low degree of foreign reserve ratio must respond to three major variables in equal measure.

<Table 12>
Monetary Policy Reaction Function After IT Adoption: Degree of Dollarization[1)2)]

Variables	Equation (2): fixed effect models			
	Once or still dollarized		Never or less dollarized	
$i_{i,q-1_i}$	0.7771*** (0.0397)	0.7831*** (0.0366)	0.8522*** (0.0154)	0.8513*** (0.0164)
$y_{i,q_i} - \bar{y}_{i,q_i}$	0.1504* (0.0761)	0.1526* (0.0767)	0.0970*** (0.0183)	0.0970*** (0.0184)
π_{i,q_i}	0.1072*** (0.0232)	0.1044*** (0.0209)	0.1982*** (0.0301)	0.1987*** (0.0307)
fx_g_{i,q_i}	0.0484** (0.0187)	0.0508** (0.0202)	0.0015 (0.0036)	0.0019 (0.0036)
fx_vol_{i,q_i}		-0.3624 (0.4284)		-0.1336 (0.2607)
# of observations	678	678	990	990
# of countries	16	16	16	16
Within R-sq.	0.7530	0.7536	0.9532	0.9532
Sample period	$q_i \geq 0$			

Notes: 1) Values in parentheses indicate standard errors robust to heteroskedasticity and autocorrelation in the errors. 2) *, **, and *** indicate 10%, 5% and 1% statistical significance levels, respectively
Source: Authors' calculation

<Table 13>

Monetary Policy Reaction Function After IT Adoption: Degree of Reserve Ratio[1)2)]

Variables	Equation (2): fixed effect models			
	High		Low	
$i_{i,q-1_i}$	0.7926*** (0.0505)	0.7889*** (0.0476)	0.8472*** (0.0284)	0.8474*** (0.0272)
$y_{i,q_i} - \bar{y}_{i,q_i}$	0.1800* (0.0928)	0.1797* (0.0902)	0.0852*** (0.0761)	0.0853*** (0.0194)
π_{i,q_i}	0.2072*** (0.0466)	0.2047*** (0.0539)	0.1149*** (0.0203)	0.1149*** (0.0209)
fx_g_{i,q_i}	0.0144 (0.0155)	0.0204 (0.0186)	0.0210** (0.0078)	0.0211** (0.0076)
fx_vol_{i,q_i}		-1.3923* (0.7431)		-0.0129 (0.2074)
# of observations	814	814	854	854
# of countries	16	16	16	16
Within R-sq.	0.8203	0.8236	0.8630	0.8630
Sample period	$q_i \geq 0$			

Notes: 1) Values in parentheses indicate standard errors robust to heteroskedasticity and autocorrelation in the errors. 2) *, **, and *** indicate 10%, 5% and 1% statistical significance levels, respectively
Source: Authors' calculation

<Table 14>

Monetary Policy Reaction Function After IT Adoption: Degree of Volatility of Foreign Exchange Markets[1)2)]

Variables	Equation (2): fixed effect models			
	High		Low	
$i_{i,q-1_i}$	0.8005*** (0.0381)	0.8043*** (0.0355)	0.8616*** (0.0191)	0.8614*** (0.0190)
$y_{i,q_i} - \bar{y}_{i,q_i}$	0.1480** (0.0643)	0.1506** (0.0647)	0.0826*** (0.0200)	0.0826* (0.0200)
π_{i,q_i}	0.1395*** (0.0315)	0.1371*** (0.0308)	0.1533*** (0.0238)	0.1535*** (0.0242)
fx_g_{i,q_i}	0.0265* (0.0140)	0.0296* (0.0153)	0.0064 (0.0072)	0.0062 (0.0069)
fx_vol_{i,q_i}		-0.4329 (0.3993)		0.0648 (0.3357)
# of observations	744	744	924	924
# of countries	16	16	16	16
Within R-sq.	0.7781	0.7790	0.9455	0.9455
Sample period	$q_i \geq 0$			

Notes: 1) Values in parentheses indicate standard errors robust to heteroskedasticity and autocorrelation in the errors. 2) *, **, and *** indicate 10%, 5% and 1% statistical significance levels, respectively
Source: Authors' calculation

Finally, <Table 14> displays estimation results on the policy reaction function of IT-adopting DEE by degree of volatility in foreign exchange markets, which represents the degree of overall

macroeconomic stability. In the same way as before, estimations were made for the period after IT implementation for each country. Estimation results are overall consistent with those in <Table 12> and <Table 13> in that central banks with low degree of volatility have a tendency to concentrate more on inflation pressure while being less responsive to changes in foreign exchange rates. Central banks experiencing periodic high economic volatility must consider both inflation and exchange rates simultaneously.

As discussed earlier, transitional economies are 14 countries out of 33 IT-adopting DEE, which is a significant portion. Excluding Israel and Korea, which are classified as advanced economies by the IMF, the share of transitional economies is close to half of DEE. Accordingly, the central bank's behavior in these countries since IT adoption may provide meaningful implications to the latest IT starter, Uzbekistan. Against this backdrop, this section briefly reviews the IT-based monetary policy and its associated macroeconomic outcome using datasets in this chapter.

Let's review these countries in <Table 15>, which rearranged <Table 1> to include only transition economies. In addition, six countries with sufficient observations for IT operation experience are selected as follows: Armenia, Czech Republic, Hungary, Kazakhstan, Romania and Slovak Republic, which are marked in bold type in <Table 15>.

<Table 15>

Transition Economies Adopting IT[1)]

Adopting date	Once or still dollarized[2)]	Overall, no or less dollarization
First wave: from 1997 to 2004		**Czech Rep. (1997)**, **Hungary (2001)**, Poland (1998)
Second wave: from 2005 to 2014	Albania (2009), **Armenia (2006),** Georgia (2009), **Kazakhstan (2015)**, Moldova (2010), **Romania (2005)**, Russia (2014), Ukraine (2005)	Serbia (2006), **Slovak Rep. (2005)**
Recently from 2015 up to date	Uzbekistan (2019)[3)]	

Notes: 1) Adoption dates are based on Hammond (2012) and Morozumi et al. (2019). And countries with bold type are selected for their sufficient observations across the IT implementation. 2) The dollarization is defined such that foreign deposit ratios have been or used to be above 30%. 3) Excluded from the empirical analysis due to the short data span after IT adoption.

We conduct an estimation of monetary policy reaction functions for the sample of transition economies using Equation (2). <Table 16> displays the results of both IT-adopting transition

economies and other IT operating economies after IT implementation. Estimation results are overall consistent with those found in <Table 12>, <Table 13> and <Table 14>. The central banks of transitional economies have been actively responding to changes in foreign exchange rates as well as inflation pressure and real economic activities even after IT introduction. This can be understood by the fact that transition economies experience structural breaks accompanied by large movements in exchange rates after opening the economy and introducing market-based reforms. In contrast, the central banks in other economies focus more on inflation pressure and movements of real activity rather than foreign exchange markets with their policy responses.

<Table 16>

Monetary Policy Reaction Function After IT Adoption: Transitional Economies or Not[1)2)]

Variables	Equation (2): fixed effect models			
	Transition economies		Other economies	
$i_{i,q-1_i}$	0.8354*** (0.0357)	0.8378*** (0.0331)	0.8107*** (0.0441)	0.8124*** (0.0418)
$y_{i,q_i} - \bar{y}_{i,q_i}$	0.0631*** (0.0165)	0.0636*** (0.0157)	0.1664** (0.0605)	0.1675** (0.0617)
π_{i,q_i}	0.1156*** (0.0182)	0.1164*** (0.0159)	0.1998*** (0.0401)	0.1980*** (0.0403)
fx_g_{i,q_i}	0.0147* (0.0060)	0.0155** (0.0061)	0.0187 (0.0132)	0.0205 (0.0154)
fx_vol_{i,q_i}		-0.5549* (0.2851)		-0.2314 (0.4835)
# of observations	662	662	1006	1006
# of countries	13	13	19	19
Within R-sq.	0.8727	0.8735	0.8196	0.8198
Sample period	$q_i \geq 0$			

Notes: 1) Values in parentheses indicate standard errors robust to heteroskedasticity and autocorrelation in the errors. 2) *, **, and *** indicate 10%, 5% and 1% statistical significance levels, respectively
Source: Authors' calculation

V. Conclusion

This paper investigates the central bank's monetary policy behaviors responding to main macroeconomic variables by using the policy reaction functions for 32 developing and emerging economies that adopted inflation targeting. To this end, two empirical specifications are examined: the first equation involves the overall period since 2000 that can control extreme

values from the pre-2000 period, and the second equation is mainly explored in the sense that it can represent behavioral changes in the central bank's policy reactions before and after IT implementation. In addition, for IT operation periods only based on the second equation, further questions are explored such as whether the behavior of the central bank's policy reaction would differ by the country group: the degree of dollarization, the degree of foreign reserve ratio over imports and the degree of volatility of foreign exchange markets.

Estimation results can be summarized as follows. First, without considerations of the IT adoption dates, estimation results on the period after 2000 indicate that central banks in developing and emerging economies with an IT framework have reacted significantly in response to inflation pressure. In addition, they respond significantly to changes in foreign exchange rates but weakly respond to business cycles.

Second, estimation results of policy reaction function on separate periods across IT adoption dates indicate that central banks respond more actively to foreign exchange rates before IT adoption and their concerns gradually decrease after IT introduction over time.

Third, further estimations that focus on the transition periods of four years before and after IT adoption show that central banks that adopt IT in DEE care more about foreign exchange rates during the eight years of IT transition. Three or four years after IT implementation, central banks began to actively respond to inflation and real economic movements and their concern over exchange rates gradually dropped.

Fourth, estimation results on policy reaction function by DEE groups in the period after IT-adoption indicate that central banks with less dollarization, high degree of foreign reserve ratio over imports, and low degree of macroeconomic instability are likely to concentrate more on inflation pressure than exchange rate movements. In contrast, central banks of opposite country groups simultaneously cared about both inflation and exchange rates.

Finally, the central banks of transitional economies actively respond to the change in foreign exchange rates as well as inflation pressure and real economic activities even after IT introduction. This is in line with the fact that transition economies have shown structural breaks with big changes in exchange rates during the transition of the economic system.

Based on analyses in this chapter, the policy implication for developing and emerging economies under consideration of IT adoption, can be summarized as follows: overall, it takes at least four or five years of transition after IT implementation for central banks to gradually

move more weight from foreign exchange rates to inflation. Furthermore, the central bank's concern over exchange markets is quite persistent in transitional economies that adopted IT early. Therefore, co-targeting (or soft form) of IT would be recommendable for a reasonable period of time. From a long-term perspective, however, lowering the degree of dollarization, expanding accumulation of foreign reserves and lessening of macroeconomic instability would be crucial for central banks to focus on inflation and output gap more effectively through the IT framework.

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