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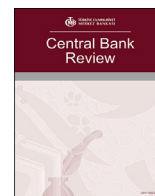
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Heterogeneity across emerging market central bank reaction functions



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ABSTRACT

The purpose of this study is to analyze monetary policy reaction functions of inflation targeting emerging market economies. Heterogeneity across central bank behavior is modelled using dynamic common correlated effects estimator in a panel data framework of 15 countries. The empirical method allows us to obtain country specific coefficients and shows differences across central bank reaction functions. Model results imply that central banks behave according to an extended Taylor rule and respond to deviation of inflation from the target, output gap, real exchange rate and external financial conditions. The study finds that emerging market central banks consider not only price stability, but also financial stability in setting of interest rates.

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1. Introduction

Since the first adoption of inflation targeting by New Zealand in 1990, an increasing number of advanced and emerging market economies have started to use inflation targeting as their monetary policy framework. Inflation targeting has become more and more popular in the last decade and more than 40 central banks around the world have formally adopted inflation targeting by the end of 2016. The number of inflation targeting countries is expected to increase every year as additional emerging market economies join the club.

Central bank behavior and its reaction function is an active field of study. There are several studies that analyze how central banks behave and respond to changes in economic variables. This study investigates the responses of inflation targeting emerging market country central banks to the changes in inflation, output gap, exchange rate, commodity prices and international liquidity conditions using an extended Taylor rule equation. Since there are important differences between the economic structures of the countries and inflation targeting frameworks, reaction functions of central banks are expected to differ across countries. The major aim of the study is to model the heterogeneity across countries and find out how different the behaviours of inflation targeting central banks are. This study uses the Dynamic Common Correlated Effects (DCCE) estimator of Chudik and Pesaran (2015) that allows for cross-sectional dependence, static and dynamic specifications,

endogenous regressors, fixed effects and heterogeneous slopes.

This empirical research has four motivations and contributions. First, many studies in the existing literature focus on inflation targeting in advanced countries and analyze the behavior of developed country central banks. There is relatively less research about inflation targeting developing country central banks. Reaction functions and behaviours of developing country central banks differ from their advanced country counterparts and increasing number of emerging market economies adopt inflation targeting. These are some factors that necessitate further empirical research on the reaction functions of inflation targeting developing country central banks.

Second, most of the studies in the literature rely upon individual country time series analysis. Existing empirical panel data studies use estimators that assume cross section independence and slope homogeneity in data. We employ dynamic common correlated effects (DCCE) estimator developed recently by Chudik and Pesaran (2015) that allows cross section dependence and slope heterogeneity. Since most of the real world data contain cross section dependence and slope heterogeneity, using this method contributes to the literature by obtaining more robust and unbiased results compared to the existing studies.

Third, with the empirical methodology employed, we both use the advantages of panel data analysis and obtain country-specific coefficients. The study contributes to the literature by modelling the heterogeneity across emerging country central bank reaction functions. The empirical methodology provides country specific coefficients of the variables and enables us to compare the behaviours of different central banks.

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Fourth, this study tests the significance of several different variables in an extended Taylor rule framework. In addition to inflation, output and exchange rate that are frequently used in the literature, we also test whether central banks respond to the changes in external financial conditions and commodity prices. The study enriches the literature by including these variables to the model that are very rarely used.

The results of the study show that most inflation targeting central banks in emerging market economies focus their primary attention on maintaining price stability and respond to the deviation of inflation from the target. In addition; current state of the economic cycle, shocks to real exchange rate and external financial conditions are also found to affect interest rate setting behavior. On the other hand, central banks do not respond to the changes in energy and food prices.

The rest of the article is organised as follows: In section 2 we provide the related literature. Section 3 explains empirical methodology and data set. Section 4 reports the model results and section 5 concludes.

2. Literature review

There is a large and growing literature on inflation targeting and it mainly focuses on advanced countries. Most of the existing studies fall into two areas. One strand of the literature analyzes the effects of inflation targeting on macroeconomic variables such as inflation, inflation volatility, interest rates and economic growth. Johnson (2002), Rose (2007), Gonçalves and Salles (2008), Brito and Bystedt (2010) and Ayres et al. (2014) are among the studies in this field and most of these research provide mixed results. Studies related to emerging market economies provide relatively more favourable evidence on the macroeconomic effects of inflation targeting.

Other line of research focuses on the behavior and reaction functions of central banks. This literature emerged after the pioneer paper by Taylor (1993). The reaction functions of central banks have been analyzed for developed economies by several studies such as Taylor (1993), Clarida et al. (1998, 2000), Dennis (2003), Lubik and Schorfheide (2007), Cukierman and Muscatelli (2008), Qin and Enders (2008) and Neuenkirch and Tillmann (2014). These studies analyze how advanced country central banks respond to the changes in variables such as inflation, output and exchange rate. Both time series and panel data methods are employed and several different empirical methods are used.

However, empirical studies on monetary policy rules and central bank reaction functions of emerging market economies are relatively few. They mostly use Taylor rule equations to investigate the behavior of central banks. What they find out in common is that emerging market central banks give an important weight on price stability in their monetary policy implementation and respond to deviation of inflation from the target. Minella et al. (2003) shows that Central Bank of Brazil has reacted strongly to inflation expectations consistent with the inflation-targeting framework. Bleich et al. (2012) find that the introduction of inflation targeting changes central bank reaction function towards inflation stabilization.

Although price stability is the leading objective of the central banks, it is not the only one. Emerging market central banks also take into account the state of the economic cycle and respond to the changes in output gap. Studies indicate that monetary policy reaction functions vary across countries. Corbo et al. (2001) find out that four out of eight countries respond to inflation gap while two of them respond to output gap. By employing VAR methodology, Schmidt-Hebbel et al. (2002) show that central banks in Brazil and Chile react to inflation gap and output gap, respectively. De Mello

and Moccero (2011) estimate a structural model and VAR model for a number of Latin American countries. Results show that the central banks of Brazil and Chile react strongly to expected inflation during inflation targeting. According to the author, monetary policies of Colombia and Mexico have become less counter-cyclical.

In addition to inflation and output, changes in exchange rate are also an important variable to consider in monetary policy for emerging market economies. Mohanty and Klau (2004) imply that price stability is the main focus of central banks and they respond to inflation, output gap and exchange rates. The authors assert that response to exchange rate shocks is even stronger compared to inflation and output gap in some countries. Moura and Carvalho (2010) show that central banks react to inflation in Brazil, Mexico, Chile and Peru. Exchange rate matters for only Mexico and output gap for Chile, Colombia and Venezuela. By using a fixed effect least squares estimation, Aizenman et al. (2011) find out that inflation and real exchange rates are significant determinants of policy interest rates while output gap is not.

Besides domestic economic variables, external economic and financial conditions are also important for emerging economy central banks. Guney (2016) studies interest rate setting behavior of the Central Bank of the Republic of Turkey by using the GMM estimator. Empirical findings show that the central bank responds to U.S. ten year bond yield in addition to inflation gap, inflation and growth uncertainties. Similarly, Caputo and Herrera (2017) find that central banks respond to federal funds rate, inflation and output gap.

Although, the number of studies related to the reaction functions of emerging market economies continue to increase, the literature is far from complete. A particular gap in the existing literature is that most researchers have focused on either individual country or regional experiences. However, very little attention has been paid to the heterogeneity of interest rate setting behavior across countries. None of the existing studies take into account cross section dependence and slope heterogeneity which arise serious econometric problems unless responded to. Empirical evidence is also scant about the significance of commodity prices. This study intends to fill these gaps and contribute to the literature.

3. Empirical methodology and data

Early empirical studies on panel data ignored cross section dependence of errors and assumed homogenous slopes. Fixed and random effect estimators that perform instrumental variable technique and the generalized methods of moments (GMM) were frequently used. These models allow only the intercepts to vary across units and leave a high degree of homogeneity that is not very realistic. A crucial contribution has been the development of first generation panel time series estimators that allow for heterogeneity in the slope coefficients such as Mean Group (Pesaran and Smith, 1995) and Pooled Mean Group (Pesaran et al., 1999). These estimators allow for heterogeneity; however they are inconsistent in case cross section dependence exists. Another contribution to panel time series literature has been the introduction of estimators that are robust to both heterogeneity and cross section dependence. These include Common Correlated Effects (Pesaran, 2006) and Augmented Mean Group (Eberhardt and Bond, 2009) estimators.

Chudik and Pesaran (2015) extend the static Common Correlated Effects (CCE) approach into a dynamic model by including lags of dependent variable and weakly exogenous regressors. Neal (2015) contributes further by replacing OLS with GMM/2SLS and also use lags of the variables to form the instrument set to overcome the problem of endogeneity. Monte Carlo simulations show that this extension makes CCE approach robust to endogenous

regressors both in static and dynamic models by improving efficiency of the estimator.

This study uses the dynamic common correlated effects estimator to investigate the reaction functions of inflation targeting developing country central banks. Consider the following heterogeneous panel data model:

$$y_{it} = \mu_i + \rho_i y_{it-1} + \beta_i x_{it} + \lambda_i f_t + u_{it} \quad (1)$$

$$x_{it} = \alpha_i f_t + e_{it} \quad (2)$$

where μ_i is the individual-specific fixed effect, ρ_i is the autoregressive parameter for unit i , β_i is a $1 \times K$ vector of coefficients for individual i , x_{it} is a $NT \times K$ matrix of regressors, f_t is a $1 \times M$ vector of unobserved common factors, λ_i and α_i are heterogeneous factor loadings, u_{it} and e_{it} are the idiosyncratic error terms. When $\rho_i = 0$, it reduces to static model introduced by [Pesaran \(2006\)](#).

Since both the regressors x_{it} and the dependent variable y_{it} depend on the vector of unobserved common factors f_t , pooled or mean group OLS will give an inconsistent estimate of ρ_i or β_i . The logic behind the common correlated effects estimation is to approximate the projection space of the unobserved common factors by adding cross section averages of the variables in the regression equation. [Everaert and De Groot \(2016\)](#) show that the standard CCE estimation method is inappropriate in models with a lagged dependent variable due to a number of biases.

[Chudik and Pesaran \(2015\)](#) extend CCE into a dynamic specification ($\rho_i \neq 0$) and weakly exogenous regressors by adding lags of cross section averages to the regression as follows:

$$y_{it} = \rho_i y_{it-1} + \beta_i x_{it} + \sum_{p=0}^{p_T} \delta_{xip} \bar{x}_{t-p} + \sum_{p=0}^{p_T} \delta_{yip} \bar{y}_{t-p} + u_{it} \quad (3)$$

Where p_T shows the number of lags included in cross section averages. [Chudik and Pesaran \(2015\)](#) suggest $p_T = T^{1/3}$. In order to overcome the problem of endogeneity, GMM is used instead of OLS.

In our benchmark specification, the dependent variable y_{it} is short term central bank policy interest rate of the related country. The explanatory variables x_{it} are determined according to Taylor rule. Taylor rule states that central banks set policy interest rate mainly in response to deviations of inflation from target and output from potential. For instance, central banks raise policy rate when inflation is above target and lower it when output is below potential. Following [Clarida et al. \(1998, 2000\)](#) and [Aizenman et al. \(2011\)](#), we use an extended Taylor rule and in addition to inflation gap (inflation minus inflation target) and output gap (actual output minus potential output), real exchange rate, 10 year U.S. government bond yields and commodity prices are also added to the model. The model is as follows:

$$\begin{aligned} i_{it} = & \nu_i + \rho_i i_{it-1} + \beta_i (\pi_{it} - \pi_{it}^*) + \alpha_i (y_{it} - y_{it}^*) + \gamma r_{it} + \delta \Delta u_{st} \\ & + \theta \Delta \text{en}_t + \mu \Delta f_t + \varepsilon_{it} \end{aligned} \quad (4)$$

where i_{it} is the short term central bank policy interest rate, ν_i is constant, π_{it} is year-on-year inflation rate, π_{it}^* is central bank inflation target, y_{it} is industrial production index and y_{it}^* is its potential, r_{it} is real exchange rate, u_{st} is 10 year U.S. government bond yield, en_t is energy price index, f_t is food price index and ε_{it} is the error term.

Exchange rate is important for emerging market economies due to several reasons. It affects inflation through exchange rate pass-through, alters competitiveness of the economy and serves as a key component of financial stability. Our model tests whether emerging market central banks respond to real exchange rate. 10

year U.S. government interest rate captures policy stance of advanced economies, global liquidity conditions and international financing costs. It shows whether the monetary policies of the emerging economies react to external financial conditions. Another crucial question is whether developing countries central banks respond to changes in energy and food prices. In order to test their significance, food and energy prices are also included to the model.

This study uses monthly data covering the period from 2006:01 to 2016:10 for 15 inflation targeting emerging market economies. The countries included in the study are: Brazil, Chile, Colombia, Czech Republic, Hungary, Indonesia, Korea, Mexico, Peru, Philippines, Poland, Romania, Thailand, Turkey and South Africa. Selection of the countries is due to data availability and long enough history of inflation targeting.¹ Data for industrial production, consumer price index and exchange rate are taken from World Bank Global Economic Monitor database. Data for 10 year US government bond yield is received from Bloomberg, commodity price data is taken from IMF and inflation targets are obtained from central bank websites.

For the calculation of inflation gap, the deviation of year on year change in consumer price index from the inflation target is used.² Output gap is calculated by detrending seasonally adjusted industrial production index using the Hodrick Prescott (HP) filter.³ Since central banks adjust interest rates gradually [see, e.g. [Clarida et al. \(1998\)](#); [Sack and Wieland \(2000\)](#)], interest rate smoothing is allowed by including one lag⁴ of interest rate in the monetary policy rule. Exchange rate and commodity prices are used in logarithm form and all other variables are in levels.

Prior to estimation, we first present summary statistics below in [Table 1](#). Then, we examine the panel data properties of the series. Notably, we investigate the order of integration of the series using panel unit root tests, test whether the data are cross sectionally dependent and heterogeneously sloped.

It has been the common practice to test for stationarity in empirical studies. We employ [Maddala and Wu \(1999\)](#) and [Im et al. \(2003\)](#) tests for panel unit root. The null hypothesis of both tests is

Table 1
Summary statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
Policy Rate	1950	5.44	3.39	0.05	17.50
Inflation Gap	1950	0.62	2.08	-6.15	9.74
Output Gap	1950	0.05	3.81	-27.76	17.63
Real Exchange Rate	1950	1.98	0.05	1.78	2.12
Nominal Exchange Rate	1950	1.60	1.17	0.07	4.16
US 10 Year Yield	1950	3.01	1.05	1.50	5.11
Energy Price	1950	2.15	0.14	1.78	2.40
Food Price	1950	2.18	0.07	2.01	2.29

¹ We prefer to use balanced data in the panel since unbalanced data create some problems in testing and estimation. Developing economies that adopted inflation targeting after 2006 are not included in the sample.

² Expected inflation is used for those countries that have data and current inflation is used for the countries that do not have expected inflation data. Current inflation is an appropriate proxy for expected inflation since expected inflation is a function of current inflation and there is a strong correlation between two. [Taylor \(1999\)](#) states that there is not much difference between the performance of inflation forecasts and actual inflation in his policy rule. Many of the studies in the literature such as [Mohanty and Klau \(2004\)](#) and [Aizenman et al. \(2011\)](#) use actual inflation instead of expected inflation. Replacing expected inflation with actual inflation does not make a significant difference.

³ In HP filter, smoothing parameter is set as 14,400 that is appropriate for monthly data. Output gap is in percent of total production. Industrial production is used as a proxy for economic activity.

⁴ Two or more lags are found to be insignificant.

the presence of unit root and the results are provided below in Table 2. According to test results, all variables except nominal exchange rate are stationary. Phillips-Perron unit root test is used to investigate whether cross-sectionally invariant variables are stationary. The results are presented in Table 3 and show that all the variables are I(1). Therefore, first differences of these variables are used in the study.

Cross section dependence has become the rule rather than the exception because of strong interdependencies between countries due to globalization and common shocks such as economic crises and oil shocks. Therefore, it is vital to test for cross section dependence and use second generation estimators in case cross section dependence exists. We employ Pesaran's (2004) CD test to test for cross section dependence. Results of the CD test are provided in Table 4. According to results, the null hypothesis of cross-section independence is rejected at 1 percent level for all series. Therefore, we conclude that cross section dependence exists.

Many empirical studies assume homogeneous slope and heterogeneity across units is confined to unit-specific intercepts. However, in real world, the assumption of slope homogeneity is usually inappropriate. To detect whether slope is heterogeneous, we employ Pesaran and Yamagata (2008) slope homogeneity test. According to test results presented in Table 5, 4 out of 5 test statistics reject the null hypothesis of slope homogeneity.

Therefore, the existence of cross section dependence and slope heterogeneity necessitates the use of a second generation panel estimator.

4. Empirical results

Results of dynamic common correlated effects estimation of the model is presented in Table 6. Column 1 shows a parsimonious model where one lag of the central bank policy rate, output and inflation gaps are included as explanatory variables. Model results imply that the degree of persistence measured by the coefficient of the lagged interest rate is high. Both inflation and output gap are significant determinants of policy rate. That is, central banks in emerging market economies respond to deviations of inflation from the target level and economic activity from potential output. Central banks raise rates when inflation is above target and/or output is above potential. The second model (column 2) includes real exchange rate in addition to inflation and output gap variables. Exchange rate is an important economic indicator for emerging market economies and the literature shows that central banks respond to changes in exchange rates [see, e.g. Mohanty and Klau (2004) and Aizenman et al. (2011)]. Model results are in line with the existing literature and point out that the changes in real exchange rate affects the behavior of central banks in developing economies. Central banks increase policy interest rate when there is real exchange rate depreciation mainly due to fear of floating and the pass-through from exchange rates to domestic inflation. The studies in the literature use both real and nominal exchange rates in Taylor rule equations. In order to see whether central banks

Table 3
Phillips perron unit root test results.

	Level	First Difference
US 10 Year Yield	−1.37	−9.01***
Energy Price	−1.83	−6.95***
Food Price	−2.53	6.69***

*, **, *** show significance level at 10%, 5% and 1%, respectively.

Table 4
Cross-section dependence test results.

	CD Test
Policy Rate	67.36***
Inflation Gap	33.32***
Output Gap	59.26***
Real Exchange Rate	23.90***
Nominal Exchange Rate	65.92***

*, **, *** show significance level at the 10%, 5% and 1% respectively. The null hypothesis is no cross-sectional dependence.

Table 5
Slope homogeneity test results.

	Value
Swamy \hat{S}	885.4***
$\hat{\Delta}$	58.05***
$\hat{\Delta}_{adj}$	59.42***
$\hat{\Delta}$	75.35***
$\hat{\Delta}_{adj}$	0.60

*, **, *** show that test statistics are significant at the 10%, 5% and 1% significance level, respectively. The null hypothesis is slope homogeneity.

Table 6
Model results.

Explanatory Variables	(1)	(2)	(3)	(4)	(5)
Policy Rate (−1)	0.922*** (0.015)	0.907*** (0.012)	0.929*** (0.013)	0.906*** (0.014)	0.925*** (0.015)
Inflation Gap	0.054*** (0.014)	0.038* (0.023)	0.039*** (0.010)	0.029 (0.063)	0.051** (0.023)
Output Gap	0.010** (0.004)	0.010** (0.005)	0.010** (0.004)	0.010** (0.004)	0.023** (0.012)
Real Exchange Rate		−1.36** (0.669)		−1.38** (0.658)	−1.41* (0.741)
Nominal Exchange Rate			−0.251 (0.576)		
Food Price				0.09 (0.482)	
Energy Price				0.116 (0.177)	
US 10 Year Yield					0.174*** (0.066)

Note: Dependent variable: Central bank policy interest rates. Dynamic common correlated effects estimation. The associated t-statistics are provided in parenthesis. *, **, *** show significance level at the 10%, 5% and 1% respectively.

Table 2
Panel unit root test results.

	Madalla and Wu Test		Im, Paseran and Shin Test	
	Level	First Difference	Level	First Difference
Policy Rate	46.65**	186.4***	−2.01***	−4.20***
Inflation Gap	72.48***	298.9***	−2.49***	−5.04***
Output Gap	134.4***	545.6***	−3.96***	−7.55***
Real Exchange Rate	44.74**	507.8***	−2.22***	−5.42***
Nominal Exchange Rate	20.88	294.3***	−1.60	−5.38***

*, **, *** show significance level at 10%, 5% and 1%, respectively.

Table 7
Country specific model results.

Countries	Policy Rate (–1)	Inflation Gap	Output Gap	Real Ex. R.	US 10Y
Panel	0.925*** (0.015)	0.050** (0.023)	0.023** (0.012)	–1.41* (0.741)	0.174*** (0.066)
Brazil	0.998*** (0.016)	0.197* (0.115)	0.143*** (0.024)	–2.72** (1.20)	0.169 (0.327)
Chile	0.945*** (0.025)	0.005 (0.021)	–0.003 (0.017)	–0.40 (2.05)	0.610** (0.269)
Colombia	0.935*** (0.055)	0.073 (0.097)	0.063 (0.038)	1.64 (1.15)	0.227 (0.350)
Czech Rep.	0.964*** (0.040)	0.015 (0.019)	0.006 (0.004)	–1.14* (0.632)	0.068* (0.101)
Hungary	0.820*** (0.057)	0.104*** (0.027)	0.034** (0.014)	–5.50*** (0.741)	0.127 (0.086)
Indonesia	0.935*** (0.026)	0.01 (0.010)	–0.014 (0.010)	–4.17*** (0.741)	0.001 (0.125)
Korea	1.03*** (0.042)	0.092*** (0.024)	–0.001 (0.008)	1.27** (0.590)	0.315*** (0.109)
Mexico	0.981*** (0.038)	0.130*** (0.031)	0.038* (0.020)	–3.33*** (0.761)	0.433*** (0.119)
Peru	0.841*** (0.025)	0.006 (0.022)	0.016 (0.012)	4.31*** (0.781)	–0.033 (0.099)
Philippines	0.933*** (0.050)	0.050*** (0.009)	–0.001 (0.007)	0.290 (0.735)	0.161** (0.079)
Poland	0.839*** (0.026)	0.102*** (0.014)	0.015 (0.014)	–0.68 (1.20)	–0.124 (0.139)
Romania	0.918*** (0.025)	0.069*** (0.007)	0.042*** (0.015)	–6.85*** (1.28)	–0.398*** (0.091)
Thailand	0.934*** (0.025)	0.008 (0.016)	0.001 (0.003)	–1.60 (1.84)	0.279*** (0.094)
Turkey	0.902*** (0.018)	0.216* (0.111)	0.058** (0.029)	–2.10 (2.41)	0.512 (0.502)
South Africa	0.899*** (0.017)	0.082*** (0.024)	–0.053*** (0.020)	–0.176 (0.733)	0.266** (0.066)

Note: Dependent variable: Central bank policy interest rates. Dynamic common correlated effects estimation. The associated t-statistics are provided in parenthesis. *, **, *** show significance level at the 10%, 5% and 1% respectively.

respond to nominal exchange rate, real exchange rate is replaced with nominal exchange rate in the third model. According to the results, nominal exchange rate is insignificant and central banks do not respond to changes in nominal exchange rate.

One important question is whether inflation targeting emerging market country central banks respond to changes in energy and food prices. Model output (column 4) demonstrates that central bank behavior is not affected from the changes in energy and food prices. Another question is whether central bank behavior is affected from external financial conditions. The fifth model (column 5) adds the change in 10 year U.S. government bond yield as a proxy of global financial conditions. Results imply that central banks not only respond to country specific variables such as real exchange rate, inflation and output gap but also to external financial conditions. When there is abundant amount of global liquidity, it is reflected into lower U.S. interest rate and central bank policy rate in emerging market economies. This result is in line with the existing literature such as [Guney \(2016\)](#) and [Caputo and Herrera \(2017\)](#). One complication is that some of the explanatory variables in the analysis may be endogenous. In order to overcome this problem, lagged variables⁵ are employed as instruments and the model is estimated with the generalized method of moments (GMM) instead of OLS. The fifth model (column 5) provides the estimation with the GMM. The alternative is employing two-stage least squares (2SLS) and the model results are similar with 2SLS.⁶

Dynamic common correlated effects (DCCE) estimation mean

group results are presented in [Table 6](#). One important strength of the DCCE estimator is that heterogeneity is allowed among units and it provides country specific estimation results in addition to mean group results. Country specific results presented in [Table 7](#) give valuable information regarding reaction functions of central banks in developing economies. According to these results, the degree of policy interest rate persistence is high in all countries in the sample. Inflation gap is the variable that is significant in the highest number of countries. Accordingly, 9 out of 15 country central banks respond to inflation gap variable. Specifically, the effect of inflation gap is strong and significant especially in Brazil, Hungary, Mexico, Poland and Turkey. The coefficients of the real exchange rate and 10 year U.S. bond yields are significant in 8 out of 15 countries. Moreover, real exchange rate is an important and significant determinant of policy interest rate in Hungary, Indonesia, Mexico, Peru and Romania. On the other hand, 10 year U.S. bond yield is crucial especially for central banks in Chile, Korea, Mexico, Thailand and South Africa. Finally, output gap is a significant variable in 6 out of 15 developing economies.

An important question is why interest rate setting behavior differ across countries. Reaction function of central banks may be different due to several factors such as the economic structure of the country, trade openness, degree of financial integration, different inflation targeting frameworks, exchange rate regime, inflation and macro-economic histories of the countries. For instance, in case price stability is the only objective of the central bank and there is a rigid inflation targeting framework, coefficient of inflation in Taylor rule equation tends to be higher. Central banks in countries with high trade openness and financial integration to the rest of the world most likely respond to changes in external financial conditions strongly. Countries with a history of high

⁵ Three lags of the variables are used. Changing the number of lags do not make a significant difference.

⁶ Results may be provided upon request.

inflation and real exchange rate volatility tend to have a higher real exchange rate coefficient in Taylor rule equations.

5. Conclusion

Inflation targeting as a monetary policy framework is used by an increasing number of countries and has attracted attention of both researchers and policy makers around the world. This study investigates the monetary policy response functions of inflation targeting emerging market economies in a panel data framework. Heterogeneity across emerging country central bank reaction functions is modelled using the dynamic common correlated effects estimator which allows for cross section dependence and slope heterogeneity in data.

Empirical results show that inflation targeting emerging market central banks behave according to an extended Taylor rule. Central banks respond to real exchange rate and external financial conditions in addition to inflation and output gaps. On the other hand, central bank behavior is not affected from the changes in commodity prices. Inflation gap variable is found to be significant in the highest number of countries while output gap is significant in the lowest number of countries.

The study contributes to the existing literature from several aspects. It enriches the literature regarding the monetary policy reaction functions of emerging market economies by using a wide set of countries and variables. Modelling heterogeneity of central bank behavior across countries using a recent econometric methodology is a significant contribution to the literature. This method allows us to obtain country-specific and more robust results regarding the reaction functions.

The study provides important conclusions and policy implications regarding reaction functions of inflation targeting emerging economies central banks. Central banks not only follow “pure” inflation targeting strategies. Rather, we find that central banks consider financial stability in addition to price stability and external variables play a very important role in interest rate setting. Some of the emerging market central banks also take into account the state of the economic cycle when making the policy rate decision. On the other hand, not all of the countries in our sample respond to the deviation of inflation from the target level. This somewhat contradicts with the rationale of inflation targeting regime. The results give valuable information for the policy makers and open the door for the analysis of heterogenous behavior of central banks. Future work in this area may be on time varying behavior of inflation targeting central banks.

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