Adopting inflation targeting in emerging markets: exploring the factors behind the decision

Stojanovikj, Martin and Petrevski, Goran

Integrated Business Faculty - Skopje, Ss. Saints Cyril and Methodius University of Skopje, Skopje, North Macedonia

23 December 2019

Adopting Inflation Targeting in EMEs: Exploring the Factors Behind the Decision

Martin Stojanovikj,

Integrated Business Faculty - Skopje

E-mail: martin_stojanovik@yahoo.com

Goran Petrevski (Corresponding author),

Ss. Cyril and Methodius University in Skopje, Faculty of Economics,

Postal address: Krste Misirkov Blvd. 9V, 1000 Skopje

E-mail: goran@eccf.ukim.edu.mk

Abstract

This paper examines the macroeconomic, financial, and institutional factors which affect the adoption of inflation targeting as a monetary policy strategy. We estimate a panel binary response model for 44 emerging market economies (EMEs) during 1990-2017. The main findings from our empirical investigation suggest that it is inflation and output growth volatility rather than inflation and output which matters for the adoption of IT in EMEs. In addition, we provide evidence that financial development, central bank independence, and capital mobility are associated with higher likelihood to adopt IT, whereas public debt has opposite effects. Finally, we show that, when deciding whether to adopt IT, policy makers take into consideration only medium-term macroeconomic, financial, and institutional conditions, while the longer-run historical performance becomes less relevant in the decision-making process.

Key words: Inflation Targeting, Binary Response Models, Emerging Market Economies.

JEL codes: C25, E42, E52, E58

1. Introduction

Since New Zealand's switch to inflation targeting (IT) in 1990, it has become an increasingly popular monetary policy strategy in both advanced and emerging market economies (EMEs). In contrast to alternative strategies, such as monetary and exchange rate targeting, IT does not rely on intermediate targets. In these regards, Bernanke and Mishkin (1997) describes IT as a "rule-like strategy" or "constrained discretion", which enables the central bank to be focused on price stability while at the same time being able to deal with short-run macroeconomic fluctuations. The practical implementation of IT involves the following common features: announcements of numerical inflation targets, an institutional commitment to price stability as the primary monetary policy objective, short-term flexibility, and central bank independence accompanied by accountability and transparency (Bernanke and Mishkin 1997, Mishkin 2004).

Undoubtedly, the popularity of IT is related to the flexibility in the conduct of monetary policy. On the one hand, it is associated with increased credibility and accountability of central bank, which has favourable effects on inflation expectations; on the other hand, the flexibility of this framework enables the central bank to approach the inflation target gradually over time while offsetting adverse shocks. In addition, Thornton and Vasilakis (2017) show that inflation targeting facilitates the implementation of countercyclical monetary policy in EMEs.

The literature suggests that the adoption of IT requires the fulfilment of several economic and institutional prerequisites, such as: the absence of fiscal dominance, strong external position, relatively low inflation, developed financial markets and sound financial system, central bank independence, structural characteristics (price deregulation, low dollarization, and low sensitivity to supply shocks), the absence of de facto exchange rate targets, and well developed technical infrastructure. However, these preconditions are not stringent so that they have not been met in many EMEs (Agénor 2001, Amato and Gerlach 2002, Battini and Laxton 2006, Carare et al. 2002, Carare and Stone 2006, Eichengreen et al. 1999, IMF 2006, Masson et al. 1997, Mishkin 2000, Mishkin and Savastano 2002, Mishkin and Schmidt-Hebbel 2002).

The specific institutional and macroeconomic environment prevailing in EMEs often complicates the design and implementation of monetary policy regimes. For instance, both the presence of fiscal dominance undermines the effectiveness of monetary policy. Similarly, the weak banking system precludes the use of market-based monetary policy instruments. Also, the poor technical infrastructure (data availability, lack of systematic forecasting process, low understanding of the transmission mechanism etc.) hampers the day-to-day implementation of IT. Further on, the long historical experience with high inflation reduces the credibility of the central bank, requiring at least partial disinflation before the introduction of IT. Finally, given the crucial importance of the exchange rate channel in small open economies as well as the large-scale dollarization, simultaneously with inflation targets, central banks in EMEs must be concerned with exchange-rate fluctuations (Amato and Gerlach 2002, Mishkin 2000, Mishkin 2004, Mishkin and Schmidt-Hebbel 2007).

As mentioned above, an increasing number of EMEs have adopted IT during the past two decades. Yet, many more EMEs still rely on other strategies for controlling inflation. Therefore, it would be interesting to investigate the most important factors that induce policymakers in the EMEs to choose IT vis-a-vis the other monetary policy strategies. In theory, the choice of optimal monetary policy is analyzed within a well specified (usually, a small-scale) macroeconomic model by comparing the central bank's loss function under alternative policy rules. Here, a number of papers

demonstrate that IT outperforms the alternative monetary policy strategies in terms of inflation/output variability (Ball 1999a, 1999b, Haldane and Batini 1999, Rudebusch and Svensson 1999, Svensson 1999a, 1999b, 2000). At the same time, there is an accumulated empirical evidence on the macroeconomic effects of IT, but their findings are inconclusive: while some studies suggest that IT is associated with both lower average inflation and improved inflation/output variability, others show that IT does not produce superior macroeconomic benefits or, at most, they are quite modest (For instance, see: Amira et al. 2013, Ardakani et al. 2018, Ball and Sheridan 2004, Barnebeck Andersen et al. 2015, Batini and Laxton 2006, Brito and Bystedt 2010, de Carvalho Filho 2010, Gonçalves and Salles 2008, Lee 2010, Lin and Ye 2009, Thornton 2016, and Vega and Winkelried 2005). Therefore, the increasing adoption of IT by EMEs is not based on strong empirical evidence with respect to the macroeconomic performance of this monetary regime. In addition, the experience of advanced countries may not be relevant for EMEs due to their specific features.

In these regards, the aim of this paper is to provide additional evidence on the set of preconditions required for adopting IT as a monetary policy strategy in EMEs. Compared with the existing empirical studies, we adopt a slightly different methodological approach by employing a static panel data logistic fixed-effects regression, controlling for time-invariant heterogeneity among the countries, which has not been done previously. Additionally, instead of controlling directly for the time specific effects, we use a modified logistic fixed-effects regression with analytical adjustment for the incidental parameter bias (Fernandez-Val, 2016). Finally, in our baseline model we work with transformed data by means of three-year moving averages, thus allowing for both forward- and backward-looking approach in conducting monetary policy in the medium term.

The main findings from our empirical investigation are as follows: we cannot provide evidence that macroeconomic performance as measured by inflation and output growth affects the decision of whether to adopt IT. Instead, we show that higher inflation and output growth volatility lowers the likelihood to adopt IT. The above results suggest that it is macroeconomic instability which matters for the adoption of IT in EMEs. This finding can be explained by the unfavorable macroeconomic environment prevailing in EMEs, which are traditionally exposed to large and persistent exogenous shocks. Under these conditions, central banks have to be engaged frequently in offsetting the adverse shocks, thus, undermining the successful implementation of IT. In addition, we confirm that financial development, central bank independence, and capital mobility are associated with higher likelihood to adopt IT, whereas public debt has opposite effects. Finally, we show that, when deciding whether to adopt IT, policy makers take into consideration only medium-term macroeconomic, financial, and institutional conditions, while the longer-run historical performance becomes less relevant in the decision-making process.

The remainder of this paper is organized as follows: Section 2 reviews the relevant empirical literature, Section 3 presents the data issues, research methodology, estimation results, and robustness checks, while the concluding remarks are provided in Section 4.

2. Literature Review

As mentioned above, although the literature points to a number of macroeconomic, institutional, and technical preconditions for successful implementation of IT. While theoretically sound, the experience shows that many EMEs have not met all of these preconditions, at least in the initial phase of adopting IT. Therefore, since the mid-2000s, the empirical literature has begun to

investigate the most important determinants behind the adoption of IT in EMEs. As expected, the empirical research has not led to firm conclusions reflecting the fact that EMEs represent a heterogeneous group with specific institutional and macroeconomic characteristics. In what follows, we provide a brief overview of the empirical literature on the determinants of IT.

The first attempt to address the factors behind the decision to adopt IT has been provided by Mishkin and Schmidt-Hebbel (2002), who conduct an empirical analysis on 27 developed and developing countries during 1990s, based on cross-section data with 10 year-averages. Their probit model indicate that the adoption of the inflation targeting regime is positively associated with inflation and central bank instrument independence, whereas the existence of money targets and central bank goal independence reduce the probability of adopting IT.

Carare and Stone (2006) review the global experience with IT regimes by focusing on the factors affecting the evolution between various variants of IT ("lite", full-fledged, and eclectic). They find that higher level of economic and financial development, and lower central bank restrictions are significant factors affecting the increase in overall central bank credibility and, thus, the choice of IT regime. They, also, discuss the experience of EMEs and show that the likelihood to move from "lite" to full-fledged IT is higher for countries with higher stock market capitalization, lower public debt, and restrictions on government financing.

Employing a panel logit regression on a sample of 66 developed and developing countries over 1980-2000, Hu (2006) finds that the probability to adopt IT increases with the following conditions: lower output growth, lower inflation, higher real interest rates, balanced fiscal position, de facto floating exchange rate regime, central bank independence, and higher pressure on exchange rates.

Working with a panel of 49 countries between 1987 and 2003, Mukherjee and Singer (2008) show that countries are more likely to adopt IT when the government and the central bank share the same preferences for tight monetary policy. More specifically, the combination of a right-leaning government and a central bank without bank regulatory authority is likely to be associated with the adoption of IT. Also, they show that GDP growth variability, floating exchange rates, real interest rates, inflation have positive effects on the likelihood for adopting IT, while current account deficits reduce the probability to adopt IT.

Based on a survey of 31 central banks in EMEs, Batini and Laxton (2006) assess whether some preconditions must be met before adopting IT, such as: technical infrastructure, financial system, institutional central bank independence, and economic structure. They construct an extensive list of parameters and, by quantifying each of them, conclude that EMEs had not satisfy these required preconditions when adopting IT. Also, they insert these parameters in their Difference-in-Difference regression and find that none of them is significant, concluding that adopting IT does not depend on meeting some strict initial pre-conditions.

Leyva (2008) studies the institutional and macroeconomic factors affecting the adoption of IT in 28 countries over 1975-2005, and finds that inflation rate, financial development, GDP per capita, and trade openness are the most factors affecting the choice of IT. Lucotte (2010) investigates the role of institutional and political factor in adopting IT for a sample of 50 countries during 1986-2005. His findings imply that a number of determinants influence the decision to adopt IT, such as: per capita GDP, exchange rate flexibility, trade openness, central bank independence, the number of veto players in the political system, political stability, and the degree of federalism

(decentralization). Lin and Ye (2007, 2009), and de Mendonca and de Guimaraes e Souza (2012) point to the negative association of the inflation rate with the likelihood of adopting IT. Comparing IT with exchange rate pegs for a large set of countries, Rose (2014) show that IT is a preferred monetary regime for larger countries as well as for those with more developed democratic institutions.

Samarina and De Haan (2014) show that the determinants affecting the choice of IT differ between OECD and non-OECD countries as well as between soft and full-fledged inflation targeters. Specifically, among the full list of the macroeconomic, external, financial, and institutional factors, they show that only flexible exchange rate regime and central bank independence matters for the adoption of IT in non-OECD countries. On the other hand, the most important factors affecting the adoption of IT in OECD countries are the following: inflation, government debt, flexible exchange rates, financial development, openness, and high central bank independence. As for the choice between soft and full-fledge, they find that flexible exchange rate regimes, higher exchange rate volatility, higher central bank independence, lower external debt, and lower financial development are associated with higher probability to adopt soft IT; on the other hand, lower inflation, lower output growth, lower public debt, and lower financial development increase the likelihood to adopt full IT.

Ismailov et al. (2016) investigate the determinants of adopting IT for a cross-section of 82 developed and developing countries in 2010, taking into account the exchange rate regime. They divide the sample into treatment (inflation targeters) and the control group (non-targeters) for both high-income and low-income countries. As for the latter, they are only able to show that the size of public debt reduces the likelihood to adopt IT while the other determinants (most notably, inflation and political risk) are not significant.

Thornton and Vasilakis (2017) investigate the likelihood of adopting IT in 90 industrial and developing countries. Their results indicate that developing countries with lower inflation rates, higher rates of output growth, better fiscal position, developed financial markets, and higher exchange rate flexibility are more likely to adopt IT as their policy strategy.

3. Empirical Investigation

3.1. Data Description

In our empirical study, we work with annual data for a panel of 44 EMEs during the period of 1990-2017. Due to data availability, we work with an unbalanced panel. Before conducting the empirical analysis, we have transformed the raw data into three-year moving averages. Though this is not a conventional approach in the empirical literature, we provide the following rationale for our procedure: first, decision to adopt a particular monetary strategy is usually based on the expected macroeconomic benefits over the medium term; second, when deciding on the adoption of IT, the central bank is both forward- and backward-looking, both of which are captured by the transformation of the data into three-year moving averages; third, within the IT framework, the central bank targets the medium-term inflation rate, extending for a period of 2-3 years. At the same time, we are aware that the above transformation does come at a cost, by reducing the number of available observations, which coupled with the unbalanced panel dataset, creates some issues regarding the use of a non-linear estimator, which does not have a closed-form solution, and it uses sample information to achieve convergence. Due to this problem, we allow a broader significance level in the presentation and interpretation of our results.

Our sample consists of 17 inflation targeters and 27 EMEs with alternative monetary regimes (See Table 1).[1] Since the group of EMEs is not strictly defined and it is very heterogeneous, we take an eclectic approach and include all countries that have been characterized as EMEs in the empirical literature in this field. Concerning the adoption date of IT, we rely on the classification provided by Hammond (2012), by taking the year when the central banks decided to adopt this strategy regardless on the particular month of that respective year when the move to IT occurred. In addition, as inflation targeting can take several flexible forms of implementation, we follow Calvo and Mishkin (2003) in regarding the switch to full-fledged IT as the adoption date.

Table 1. Dates of inflation targeting adoption in a sample of 17 EMEs

Country	Year of adoption of IT
Brazil	1999
Chile	1999
Colombia	1999
Czech Republic	1998
Hungary	2001
Israel	1997
Mexico	1999
Peru	2002
Philippines	2002
Poland	1998
South Africa	2000
South Korea	1998
Thailand	2000
Turkey	2006
Ghana	2007
Indonesia	2005
Serbia	2009

We choose 1990 as the starting year for the empirical analysis as it coincides with the year when New Zealand adopted IT as a monetary strategy (Mishkin and Schmidt-Hebbel 2002). While the concept of IT was already present in the theoretical literature, we assume that its practical implementation only became valid in 1990, once it was officially adopted by the Central Bank of New Zealand. Hence, we treat the period prior to this year as irrelevant to our analysis. We find this assumption to be reasonable given that before 1990 the central banks in EMEs were not in a position to decide whether or not to adopt IT as their monetary strategy. In other words, IT as a policy option for EMEs emerged only after its practical implementation in New Zealand. As a result, including the pre-1990 period in the analysis would only bias the estimation results by increasing the likelihood not to adopt IT. However, we also report the results concerning the full dataset available for the 1970-2017 period.

[1] The sample consists of the following countries: Argentina, Algeria, Brazil, Botswana, China, Costa Rica, Cote d'Ivoire, Chile, Colombia, Czech Republic, Croatia, Dominican Republic, Ecuador, Egypt, El Salvador, Ghana, Guatemala, Hungary, Israel, Indonesia, India, Jordan, Lebanon, Malaysia, Morocco, Mexico, Nigeria, Pakistan, Panama, Peru, Philippines, Poland, Russia, Serbia, Singapore, South Africa, South Korea, Tanzania, Thailand, Turkey, Tunisia, Uruguay, Ukraine, and Venezuela.

We work with CPI-based annual inflation rate because it is a target variable in all the countries within our sample. Here, a potential source of concern is the high inflation rates prevailing in the early years in our sample, which might bias both the volatility measure derived from it and the overall estimation results. Therefore, following Cukierman et al. (1992) and Cukierman et al. (2002) we adopt a common approach in the empirical literature and transform the inflation rate by the following formula: *infltr* = *infl* / (1+ *infl*), where *infl* denotes the actual inflation rate. It is expected that this approach will reduce heteroskedasticity and potential bias in the estimation process, thus improving the efficiency of parameter estimates. Output growth is expressed as the annual growth of real GDP while inflation and output growth volatility are measured by the standard deviation of transformed inflation rate and real GDP growth, respectively. Net capital flows (NCF) are measured in billions of US dollars whereas both public debt (Debt) and credit to private sector (CPS) are expressed as ratios to GDP.

Table 2 Inflation Targeting Regime and Related Variables for 44 Countries (1990-2017): Descriptive Statistics and Simple Correlations

Descriptive Statistics

	IT	Inflation	Output growth	Output growth volatility	Inflation volatility	CBI	NCF	Debt	CPS
Mean	0.244	0.088	0.040	0.004	0.0004	0.540	-0.18	0.528	0.475
St. Dev.	0.43	0.113	0.032	0.004	0.0015	0.209	2.155	0.303	0.356
Min	0	-0.009	-0.164	0.002	0.0000	0.121	-34.6	0.046	0.017
Max	1	0.936	0.308	0.047	0.021	0.904	3.71	1.90	1.559

Correlation Matrix

Variable	IT	Inflation	Output growth	Output growth volatility	Inflation volatility	CBI	NCF	Debt	CPS
IT	1								
Inflation	-0.21	1							
Output growth	-0.09	-0.29	1						
Output growth volatility	-0.14	0.23	-0.214	1					
Inflation volatility	0.003	0.71	-0.34	0.255	1				
CBI	0.18	0.01	-0.06	0.015	-0.086	1			
NCF	0.08	0.06	-0.22	-0.019	0.045	0.038	1		
Debt	-0.12	-0.02	-0.06	-0.045	0.016	-0.21	0.018	1	
CPS	0.10	-0.29	0.21	-0.063	-0.088	-0.38	-0.24	-0.02	1

All the variables in our dataset have been extracted from the World Bank's World Development Indicators database, except for the IT dummy and the index of central bank independence (CBI). As for the latter, we use the weighted CBI index provided by Gariga (2016) for a large set of countries, including many which are part of our sample, and covering the same period as our

sample, thus making it compatible to our analysis. The descriptive statistics along with the simple correlation coefficients among the variables are presented in Table 2.

3.2. Model Specification

An increasing number of EMEs have adopted IT during the past two decades. In this regard, it would be interesting to investigate the most important factors behind the decision of policymakers in the EMEs to switch to IT. Specifically, our primary research interest lies in explaining the likelihood of adopting IT, based on a set of explanatory variables. Consequently, we can express the IT variable as a latent variable model:

$$y_{it} = 1(y_{it}^{*} \geq 0) \quad (1),$$

where 1(·) is an indicator function mapping non-negative y_{it}^{*} to 1 if country *i* chooses IT in period *t*, and 0 otherwise. This restricts our analysis to a non-linear specification of the model within the framework of binary discrete choice models. Equation (1) indicate that the choice of IT as a monetary regime is a complex decision.

Additionally, we assume an implicitly linear dynamic functional form for y_{it}^{*},

$$y_{it}^{*} = \theta + \alpha y_{i,t-1} + \boldsymbol{x_{it}'}\beta + \omega_i + v_{it} \quad (2),$$

with relatively strong assumptions that $E(v_{it}{}'\boldsymbol{x_{it}}) = E(v_{it}' y_{i,t-1}) = 0$ and $v_{it} \sim Logistic(\mu, \sigma)$. The first of these assumptions will be relaxed further on, as our baseline specification will not include the autoregressive component. The second assumption is an arbitrary choice of the potential density function, which in our case is restricted by the modelling setup we have proposed. Specifically, simple functions of the parameters of interest, which are independent of the heterogeneity parameters ω_i are non-existent, rendering the probit fixed-effects approach computationally immensely difficult (Hsiao 2014). As we work with a panel of EMEs, which represent a rather heterogeneous group, it is of crucial importance that we control for their respective country-specific characteristics, represented by ω_i. This assumption, thus, offers a manner to address this issue, without making the analysis computationally challenging.

The likelihood of adopting IT can be modelled as:

$$\Phi(y_{it} = 1) = \Phi(y_{it}^{*} \geq 0) = \Phi(\theta + \alpha y_{i,t-1} + \boldsymbol{x_{it}'}\beta + \omega_i) \quad (3),$$

where Φ (·) is an index function (in our case, the logistic density function), $(\theta, \alpha, \beta, \omega_i)$ are the unknown parameters to be estimated, $y_{i,t-1}$ is the autoregressive variable, and $\boldsymbol{x_{it}'}$ is the set of explanatory variables. In this setup, the autoregressive term ($y_{i,\,t\text{-}1}$) depicts the effect of the choice made in the previous period of the implementation of IT regime on the likelihood that the IT regime will be retained in the current period. Here, there are two issues to be addressed: 1) all the countries in our sample exhibit a highly persistent behavior in the adoption of the IT regime, that is once they have adopted IT, they do not switch to an alternative monetary regime (hence, the effect of $y_{i,t-1} = 1$ on $y_{it} = 0$ is absent); 2) policymakers are unlikely to incline towards changing their monetary strategy just because they are implementing a certain type; instead, they are likely to adjust or to change the existing strategy based on a closely monitoring of macroeconomic, fiscal, institutional, and other domestic and global conditions. It is for these reasons that we opt for a static baseline specification:

$$\Pr(y_{it} = 1|x_{it}, \omega_i) = \boldsymbol{x}'_{\boldsymbol{it}}\beta + \omega_i \quad (4),$$

where $\boldsymbol{x}'_{\boldsymbol{it}}$ is the set of explanatory variables (including the constant term), and ω_i are the unobserved country-specific (time-invariant) effects.

We estimate two variants of the baseline specification for the same dependent variable (IT) by varying the macroeconomic variables – inflation, inflation volatility, output growth, and growth volatility - while at the same time controlling for the fiscal position, financial market development, supply shocks, and central bank independence. As regards the control variables, our specification is basically similar to those commonly employed in the empirical literature. Yet, we choose a slightly different set-up primarily to demonstrate that inflation and output volatility are significant factors in deciding whether to adopt IT in EMEs (once we control for the rest of the macroeconomic, financial, and institutional determinants), especially in light of the long historical experience of these countries with unstable macroeconomic environment.

In what follows we provide brief explanation of the control variables included in the empirical model: inflation, output growth, inflation variability, and output variability comprise the block of variables representing macroeconomic performance. As mentioned above, we estimate two variants of the empirical model – one with inflation and output growth and another one with inflation and growth variability. Central banks choose their monetary strategy in a response to the macroeconomic performance. In theory, inflation and output are the two standard elements in the central bank's loss function. Similarly, in practice, inflation control is the primary goal of monetary policy, but central banks often pay attention to output growth, too. In this regard, if a country has experienced unsatisfactory growth rates, then the central bank might consider switching from one strategy (say, exchange rate peg) to IT as the latter enables policy makers to take care for output, too. Similarly, the central bank might choose its monetary policy strategy based on its experience with inflation: on the one hand, if inflation is very high, the central bank might choose exchange rate peg, while if inflation is moderate, then it can adopt IT.

In EMEs, capital flows (NCF) seem to be an important factor that affects the choice of monetary policy strategy, because some strategies (such as IT) allow the central bank to offset exogenous capital flows via exchange rate depreciation, while other strategies (most notably, exchange rate pegs) do not allow for this flexibility. In this regard, capital mobility has been the main driving force behind the secular trend towards regimes with greater exchange rate flexibility (Eichengreen 1999, Fischer 2001).

The inclusion of public debt (Debt) as a control variable is motivated by the notion that fiscal discipline represents one of the basic requirements for adopting IT. Clearly, unsustainable fiscal policy undermines the central bank's efforts to keep inflation low with harmful effects on the credibility of announced inflation targets. Also, central bank independence (CBI) as an important institutional factor necessary for implementing IT. Here, the literature points to the so-called instrument independence, i.e., the autonomy of central banks in choosing their instruments to achieve inflation targets.

In addition, the literature identifies financial development as a precondition for successful implementation of IT. Therefore, we include bank credit to the private sector (CPS) as a proxy for the development of the banking sector. Moreover, this variable can be used as proxy for the anti-inflation preferences of the society. For instance, one may argue that the societies with greater preferences for price stability choose IT as a means of keeping inflation low. A special variant of

this argument is presented by Posen (1995), who argues that monetary policy makers are influenced by various interest groups. In particular, those sectors in the society that benefit from price stability (the banking and financial sectors) lobby for increased CBI as a means for maintaining low inflation. Since the contracts in the banking sector are predominantly expressed in nominal terms and banks hold substantial proportion of their assets in fixed-income instruments, then it is quite expected that this sector would be inflation-averse. Hence, according to this argument, higher level of financial development implies higher aversion to inflation.

3.3. Estimation Strategy

We assume that the asymptotic framework for analysis is $N \to \infty$ with T fixed, and we treat the country-specific effects as parameters to be estimated. As a result, the Maximum Likelihood (ML) estimation of parameters is consistent. However, this framework gives rise to the incidental parameters problem, which is addressed below (Neyman and Scott 1948). In order to estimate the likelihood as well as the average partial effects of macroeconomic factors, fiscal position, domestic financial market development, central bank independence, and supply shocks on the likelihood of adopting IT in EMEs, we employ the conditional logit estimator (Chamberlain 1984). In this regard, we implement the ML estimation conditional on the country-specific fixed effects. This estimator allows us to control for the country-specific fixed-effects, and to obtain consistent results under the framework presented in the previous section. Wright and Douglas (1976) show that the ML estimation for the fixed-effects logit model when T=20 yields virtually unbiased results for the β parameters. This property has been confirmed in the Monte Carlo simulations by Greene (2004) where, as the T dimension increases, the bias of the parameters decreases.

It is well known that fixed-effects estimators suffer from the incidental parameters problem, which is a cause of concern particularly for non-linear panel data models, where ML estimates of β and ω_i are not independent. In contrast to linear models, the failure to satisfy this assumption in non-linear models introduce a bias in the estimation results of both parameters rendering the within transformation obsolete (Hsiao 2014). In order to deal with this issue, we use the analytical bias correction proposed by Fernandez-Val and Weidner (2016), and Cruz-Gonzalez et al. (2017), which removes the estimates of the leading terms of the bias from the estimator of β. Since the baseline specification in (4) is static and assumes exogenous independent variables, there is no need for specifying a trimming parameter. Despite its potential shortcomings related to the strong assumptions behind it, this estimator is preferred to its alternatives (non-parametric estimators) since they converge at rates slower than the parametric estimator (which is of great importance in a panel structure as ours), making the interpretation of parameter estimates is dubious (Hsiao 2014). The chosen estimation strategy restricts us to losing all the observations for which $y_{it} = 0$.

Finally, note that we only control for the country-specific fixed effects, i.e., we do not control for the time-specific fixed effects in our analysis. This has been motivated by the fact that the countries in our dataset exhibit smooth behavior in the main variables (inflation, inflation volatility, output growth and output growth volatility) throughout the period covered by the analysis. In addition, the design of our methodological approach allows us to control these effects indirectly by transforming the raw data into three-year moving averages, thus smoothing out the time effects across the three-year periods and reducing their impact on the estimates. This has a direct bearing on the choice of the above estimator, which enable us to correct for both country- and time-specific effects bias.

3.4. Results and Discussions

Table 3 shows the estimates of the two variants of equation (4) based on the sample over 1990-2017: the first regression contains inflation and output growth as dependent variables whereas the second set of estimates refers to the equation with inflation and output growth variability. Since the regression coefficients in binary response models do not have a meaningful interpretation, we only comment the average marginal effects. As can be seen, in the first regression, most of the variables are statistically insignificant, except for inflation and net capital flows (NCF), which are significant at 15% significance level. Therefore, we cannot provide strong evidence that macroeconomic performance as measured by inflation rates and output growth affects the decision of whether to adopt IT. As for the inflation performance, our findings are consistent with the stylized facts that IT is not a feasible strategy for the countries with high inflation rates, i.e., the adoption of IT should be preceded by disinflation to relatively low level of inflation (Mishkin 2000). The regression coefficient of NCF has a negative sign, too, implying that the greater exposure to capital flows reduces the likelihood to adopt IT in EMEs. This finding is contrary to our prior expectations as, when faced with higher capital mobility, countries usually tend to move towards monetary strategies with flexible exchange rate regimes, such as IT.

Table 3. Estimates of the likelihood of adopting IT

	Logit FE (1)			Logit FE (2)	
	Likelihood	Marginal effect		Likelihood	Marginal effect
Inflation	-161.077***	-3.75*	Inflation	-858.08***	-47.423*
	(33.132)	(2.538)	volatility	(405.512)	(32.419)
Output growth	47.418***	1.105	Output growth	-464.79***	-25.687**
	(22.732)	(0.887)	volatility	(130.620)	(14.598)
Debt	-13.423***	-0.313	Debt	-8.027***	-0.444**
	(5.093)	(0.234)		(2.395)	(0.256)
CPS	2.430	0.056	CPS	0.633	0.035
	(2.855)	(0.076)		(1.827)	(0.102)
CBI	31.228*	0.727	CBI	58.714***	3.245**
	(21.422)	(0.685)		(13.963)	(1.779)
NCF	-2.998***	-0.070*	NCF	-1.344***	-0.074**
	(0.800)	(0.049)		(0.370)	(0.042)
Pseudo R squared	0.8279		Pseudo R squared	0.487	
Log-likelihood	-42.174		Log-likelihood	-90.115	

Notes: (1) IT is the binary dependent variable; (2) logit FE estimator with an analytical bias correction for the incidental parameter bias (both time and country specific), conditional on the country specific fixed effects; (3) ***, **, and * indicate significance levels of 5, 10 and 15% respectively; (4) robust standard errors are reported in parentheses.

The results from the second regression are much more favourable. Except for financial development (CPS), all the marginal effects are statistically significant at 10% level of significance. As for macroeconomic performance, both inflation and output volatility have negative signs, suggesting that increased macroeconomic instability lowers the likelihood to adopt IT. In other words, the estimates from this variant of the regression model imply that it is macroeconomic instability (inflation and output growth volatility) which matters for the adoption

of IT in EMEs. This finding can be explained by unfavorable macroeconomic environment prevailing in EMEs, which traditionally have worse performance than advanced economies due to the worse inflation-output trade-off as well as the exposure to large and persistent exogenous shocks (Fraga et al. 2003). Under these conditions, central banks have to be engaged frequently in offsetting the adverse shocks with harmful effects on the credibility of inflation targets (Svensson 1995, Agénor 2001).

As for the other regressors, we obtain the following results: once again, the greater exposure to capital flows (higher NCF) reduces the likelihood to adopt IT in EMEs; higher government debt significantly reduces the probability to adopt IT, thus confirming that strong fiscal position is a prerequisite for successful implementation of IT; also, we provide evidence that higher central bank independence is associated with increased likelihood to adopt IT; finally, we find that financial development does not affect the decision to adopt IT, which can be explained by the fact that EMEs have less developed financial sectors in comparison to advanced economies.

3.5. Sensitivity Analysis

In Tables 4 to 6 we present the results of various robustness checks. We examine the sensitivity of the results with respect to: estimating the model on the sample covering the whole available data from 1970 to 2017 (with yearly observations); estimation with different data transformations (three-year, five-year, and ten-year averages; and estimation based on cross-section instead of panel data.

The first regression in Table 4 presents the estimates of equation (1) based on the whole available data from 1970 to 2017. As can be seen, the estimation based on the extended sample does not affect the baseline results (regression 1 of Table 3) in any substantial way. In fact, it is quite expected that extending the sample backward could not affect the main findings from our study: on the one hand, it is obvious that distant past may not be relevant for the present choice of monetary regimes; on the other hand, IT was not available as a policy option back in the 1970s and 1980s. Here, inflation is the only statistically significant regressor at 15% significance level. Once again, the coefficient is negative implying that high inflation reduces the likelihood to adopt IT in EMEs.

In contrast to our baseline panel-data model presented in Table 3, the regressions 2 to 4 in Table 4 are estimated with cross-section data, but with different transformations of data, i.e., we work with three-year, five-year, and ten-year averages, respectively. However, for all these three regressions, the sample has been constructed as follows: for inflation targeters, the sample begins from each individual date of adopting IT, whereas for non-targeters the sample begins in 2001, which is the average adoption year for our sample. In each case, this procedure has resulted in 34 observations in total.

As can be seen, estimating the empirical model with cross-section instead of panel-data logit model does affect the results: inflation loses its statistical significance whereas CPS, CBI, and NCF become statistically significant at much higher level (10% and 5%). Also, the sign of the coefficient before NCF changed from negative to positive in the regressions based on cross-section data. According to this set of estimates, higher capital mobility increases the probability to adopt IT as a strategy that goes hand in hand with greater exchange rate flexibility. In addition, the positive signs before CPS and CBI confirm the favourable impact of financial development and central bank independence on the choice to adopt IT.

Table 4: Estimates of the likelihood of adopting IT: Sensitivity analysis of Logit FE (1)

	Logit FE (1) Full sample (1970-2017)		Logit FE (2) Cross-section data		Logit FE (3) Cross section data		Logit FE (4) Cross section data	
	Likelihood	Marginal effect	Likelihood	Marginal effect	Likelihood	Marginal effect	Likelihood	Marginal effect
Inflation	-161.21*** (32.484)	-2.561* (1.800)	-0.941 (8.702)	-0.135 (1.242)	1.760 (14.109)	0.238 (1.905)	1.803 (3.086)	0.497 (0.866)
Output growth	38.434** (20.291)	0.611 (0.522)	-10.234 (30.065)	-1.472 (4.492)	0.438 (25.532)	0.059 (3.452)	-5.984 (10.607)	-1.649 (2.825)
Debt	-15.788*** (5.335)	-0.251 (0.189)	0.161 (2.018)	0.023 (0.289)	0.570 (1.752)	0.077 (0.236)	-0.002 (0.886)	-0.0006 (0.244)
CPS	4.813** (2.615)	0.076 (0.066)	4.949*** (1.648)	0.712*** (0.188)	3.592*** (1.749)	0.485*** (0.192)	1.421* (0.910)	0.391** (0.230)
CBI	49.832*** (20.587)	0.792 (0.625)	8.236 (5.900)	1.185** (0.622)	8.482*** (3.878)	1.146*** (0.459)	3.441*** (1.608)	0.948*** (0.350)
NCF	-3.203*** (0.791)	-0.051 (0.036)	4.114** (2.101)	0.592*** (0.185)	5.459*** (2.331)	0.737*** (0.199)	2.829** (1.623)	0.779*** (0.375)
constant	-	-	-7.154 (5.191)	-	-7.524*** (3.015)	-	-2.678*** (1.302)	
Pseudo R squared	0.8279		0.3776		0.4014		0.2957	
Log-likelihood	-42.174		-14.632		-14.071		-16.558	

Notes: (1) IT is the binary dependent variable; (2) ***, **, and * indicate significance levels of 5, 10 and 15% respectively; (3) robust standard errors are reported in parentheses.

Table 5 replicates the above regressions for the second specification of the empirical model, which includes inflation and output variability as measures of macroeconomic performance. Once again, the first regression in Table 4 presents the results based on the whole available data from 1970 to 2017, while regressions 2 to 4 refer to the estimates with cross-section data with three-year, five-year, and ten-year averages, respectively.

Several basic conclusions emerge from this set of estimates: inflation volatility reduces the probability to adopt IT, thus confirming the common notion that countries need to stabilize inflation before moving to IT; as for growth variability, we obtain conflicting results: the sign of the regression coefficient changes from first to second regression, but loses its statistical significance when working with longer averages; we obtain similar results for the public debt, which becomes statistically insignificant and changes its sign in the regression with cross-section data; however, this set of results, too, confirm that financial development, central bank independence, and capital mobility are all associated with higher likelihood to adopt IT; finally, note that when working with ten-year averages, only two variables retain its statistical significance, implying that, when deciding whether to adopt IT, policy makers take into consideration only medium-term macroeconomic, financial, and institutional conditions, while the longer-run historical performance becomes less relevant in the decision-making process.

Table 5: Estimates of the likelihood of adopting IT: Sensitivity analysis of Logit FE (2)

	Logit FE (1) Full sample (1970-2017)		Logit FE (2) Cross section data		Logit FE (3) Cross section data		Logit FE (4) Cross section data	
	Likelihood	Marginal effect	Likelihood	Marginal effect	Likelihood	Marginal effect	Likelihood	Marginal effect
Inflation volatility	-1142.1*** (390.295)	-41.627* (26.375)	-3606.4** (2064.53)	-427.6*** (194.506)	-2009.7** (1040.56)	-258.8*** (112.61)	-21.456 (272.545)	-3.617 (45.605)
Output growth volatility	-497.31*** (126.818)	-18.126** (10.719)	5.127*** (2.549)	0.608** (0.322)	0.843 (2.931)	0.108 (0.379)	0.909 (1.593)	0.153 (0.263)
Debt	-7.034*** (2.146)	-0.256** (0.157)	0.807 (1.938)	0.096 (0.225)	0.782 (1.717)	0.101 (0.221)	0.080 (1.430)	0.013 (0.241)
CPS	3.632*** (1.365)	0.132* (0.086)	5.930*** (2.624)	0.703*** (0.232)	3.515** (1.893)	0.453*** (0.202)	1.562 (1.511)	0.263 (0.243)
CBI	58.582*** (12.169)	2.135** (1.222)	13.537*** (6.314)	1.605*** (0.432)	10.035*** (3.427)	1.292*** (0.304)	5.588*** (2.521)	0.942*** (0.359)
NCF	-1.406*** (0.370)	-0.051** (0.030)	6.013*** (2.512)	0.713*** (0.165)	6.242*** (2.209)	0.804*** (0.162)	5.176* (3.347)	0.872*** (0.415)
constant	-	-	-12.489*** (4.927)	-	-8.305*** (3.040)		-4.487*** (2.190)	
Pseudo R squared	0.6189		0.474		0.4248		0.2720	
Log-likelihood	-93.532		-12.356		-13.521		-17.113	

Notes: (1) IT is the binary independent variable; (2) ***, **, and * indicate significance levels of 5, 10 and 15% respectively; (3) robust standard errors are reported in parentheses.

Finally, in Table 6 we conduct an additional sensitivity analysis. Here, we work with yearly data instead of moving average, i.e., in contrast to our baseline specification, here, we do not perform any transformation of the data, but we work with ordinary panel data. In each regression we introduce a slight modification in the model: the first regression refers to the specification with inflation and output growth, the second one includes their volatilities as regressors, while in the third regression the standard deviation of inflation is substituted by the coefficient of variation. The three regressions provide consistent results with respect to the impact of inflation on the choice of monetary strategy, i.e., both the level of inflation and its variability are associated with lower likelihood to adopt IT. Hence, once again, we provide evidence that EMEs need to lower inflation to a relatively low level before moving to IT. Similarly, greater output volatility reduces the probability of adopting IT.

Combined, these two findings suggest that adopting IT is not feasible in countries with high degree of macroeconomic instability, i.e., large macroeconomic uncertainty compromises the credibility of this monetary regime. As regards CBI and NCF, the sensitivity analysis produces similar results to our previous regressions. However, two additional findings emerge from this set of estimates: financial development loses its statistical significance as a determinant in the choice of IT in EMEs, whereas higher level of public debt decreases the likelihood to adopt IT, i.e., we are able to provide some evidence that fiscal discipline is an important precondition for successful implementation of this strategy.

Table 6: Estimates of the likelihood of adopting IT: Sensitivity analysis

	Logit FE (1) (1990-2017) Yearly data			Logit FE (2) (1990-2017) Yearly data		Logit FE (2) (1990-2017)	
	Likelihood	Marginal effect		Likelihood	Marginal effect	Likelihood	Marginal effect
Inflation	-59.507*** (9.871)	-2.436** (1.356)	Inflation volatility	-484.3*** (218.274)	-34.069* (21.584)	-	-
			Coefficient of variation			-1.967** (1.053)	-0.112* (0.080)
Output growth	-2.842 (9.514)	-0.116 (0.394)	Output growth volatility	-1.347*** (0.622)	-0.095* (0.061)	-455.403*** (129.444)	-25.581** (14.465)
Debt	-9.305*** (2.732)	-0.381** (0.231)	Debt to GDP	-5.873*** (1.631)	-0.413** (0.217)	-8.107*** (2.350)	-0.455** (0.259)
CPS	0.997 (1.685)	0.041 (0.072)	CPS	1.129 (1.268)	0.079 (0.096)	0.174 (1.824)	0.010 (0.102)
CBI	30.162*** (10.648)	1.235* (0.788)	CBI	37.697*** (9.063)	2.652*** (1.342)	59.807*** (14.316)	3.359** (1.828)
NCF	-1.249*** (0.346)	-0.051** (0.031)	NCF	-0.664*** (0.209)	-0.047** (0.025)	-1.287*** (0.361)	-0.072** (0.041)
Pseudo R squared	0.6099		Pseudo R squared	0.3672		0.479	
Log-likelihood	-76.503		Log-likelihood	-124.097		-91.532	

Notes: (1) IT is the binary independent variable; (2) logit FE estimator with an analytical correction for the incidental parameter bias (both time and country specific), conditional on the country specific fixed effects; (3) ***, **, and * indicate significance levels of 5, 10 and 15% respectively; (4) robust standard errors are reported in parentheses.

4. Conclusion

The main research goal of this paper is to investigate the most important determinants behind the adoption of IT in a sample of 44 emerging market economies (EMEs) during 1990-2017. Specifically, we estimate a fixed-effects logit model, controlling for several macroeconomic, financial, and institutional factors affecting the choice of monetary strategies in EMEs. Based on our empirical investigation, we cannot provide evidence that macroeconomic performance as measured by inflation and output growth affects the decision of whether to adopt IT. Instead, we show that higher inflation and output growth volatility lowers the likelihood to adopt IT. Therefore, the above results suggest that it is macroeconomic instability which matters for the adoption of IT in EMEs. This finding can be explained by the unfavorable macroeconomic environment prevailing in EMEs, which are traditionally exposed to large and persistent exogenous shocks. Under these conditions, central banks must be engaged frequently in offsetting the adverse shocks, thus, undermining the successful implementation of IT. In addition, we confirm that financial development, central bank independence, and capital mobility are associated with higher likelihood to adopt IT, whereas public debt has opposite effects. Finally, we show that, when deciding whether to adopt IT, policy makers take into consideration only medium-term macroeconomic, financial, and institutional conditions, while the longer-run historical performance becomes less relevant in the decision-making process.

References

Agénor, P-R. (2001). Monetary Policy under Flexible Exchange Rates: An Introduction to Inflation Targeting. Central Bank of Chile Working Paper No. 124.

Amato, J.D., Gerlach, S. (2002). Inflation targeting in emerging market and transition economies: Lessons after a decade. *European Economic Review,* 46(4-5), 781-790.

Amira, B., Mouldi, D., & Feridun, M. (2013). Growth effects of inflation targeting revisited: empirical evidence from emerging markets. *Applied Economics Letters*, 20(6), 587-591.

Ardakani, M. O., Kishor, K. N., & Song, S. (2018). Re-evaluating the effectiveness of inflation targeting, *Journal of Economic Dynamics and Control*, 90, 76-97.

Ball, L. (1999a). Efficient Rules for Monetary Policy. *International Finance*, 2(1), 63-83.

Ball, L. (1999b). Policy rules for open economies. In John B. Taylor, ed., *Monetary policy rules*. Chicago: University of Chicago Press, 127-156.

Ball, L. M., & Sheridan, N. (2004). Does Inflation Targeting Matter? In Ben S. Bernanke and Michael Woodford, eds., *The Inflation-Targeting Debate*. Chicago: University of Chicago Press, 249-282.

Barnebeck Andersen, T., Malchow-Møller, N., & Nordvig, J. (2015). Inflation targeting and macroeconomic performance since the Great Recession. *Oxford Economic Papers*, 67(3), 598-613.

Batini, N. & Laxton, D. (2006). Under What Conditions Can Inflation Targeting Be Adopted? The Experience of Emerging Markets. Central Bank of Chile Working Paper No. 406.

Bernanke, B. & Mishkin, F.S. (1997). Inflation Targeting: A New Framework for Monetary Policy?, *Journal of Economic Perspectives*, 11(2), pp. 97-116.

Brito, R. D., & Bystedt, B. (2010). Inflation targeting in emerging economies: Panel evidence. *Journal of Development Economics*, 91, 198-210.

Calvo, G., Mishkin, F. (2003). The mirage of exchange rate regimes for emerging market countries. *Journal of Economic Perspectives*, 17 (4), 99-118.

Carare, A., Schaechter, A., Stone, M. & Zelmer, M. (2002). Establishing Initial Conditions in Support of Inflation Targeting. IMF Working Paper 02/102. Washington, D.C.: International Monetary Fund.

Carare, A., & M. R. Stone (2006). Inflation Targeting Regimes. *European Economic Review*, 50(5), 1297-1315.

Chamberlain, G. (1984). Panel Data, In Z. Griliches and M. Intriligator, eds., *Handbook of Econometrics*.

Cruz-Gonzalez, M. Fernandez-Val, & I. Weidner, M. (2017). Bias Correction for Probit and Logit Models with Two-way Fixed Effects. *The Stata Journal*, 17(3). 517-545.

Cukierman, A., Miller, G.P., & Neyapti, B. (2002). Central Bank Reform, Liberalization and Inflation in Transition Economies - An International Perspective. *Journal of Monetary Economics,* 49(2), 237-264.

Cukierman, A., Webb, S.B., & Neyapti, B. (1992). Measuring the Independence of Central Banks and its Effect on Policy Outcomes. *The World Bank Economic Review*, 6(3), 353-398.

de Carvalho Filho, I. (2010). Inflation Targeting and the Crisis: An Empirical Assessment. IMF Working Paper 10/45. Washington, D.C.: International Monetary Fund.

de Mendonca, H. F. & G. J. de Guimaraes e Souza. (2012). Is Inflation Targeting a Good Remedy to Control Inflation? *Journal of Development Economics*, 98(2), 178–91.

Eichengreen, B. (1999). Kicking the Habit: Moving from Pegged Exchange Rates to Greater Exchange Rate Flexibility. *The Economic Journal*, 109(454), 1-14.

Eichengreen, B., Masson R.P., Savastano M., & Sharma S., (1999). Transition Strategies and Nominal Anchors on the Road to Greater Exchange-Rate Flexibility. In Essays in International Economics, No. 213. International Finance Section, Department of Economics. Princeton, N.J.: Princeton University.

Fernandez-Val, I., & Weidner M., (2016). Individual and time effects in nonlinear panel models with large N, T. *Journal of Econometrics*, 192(1), 291–312.

Fischer, S. (2001). Exchange rate regimes: is the bipolar view correct? *Journal of Economic Perspectives*, *15*(2), 3-24.

Fraga, A., Goldfajn, I., & Minella, A. (2003). Inflation Targeting in Emerging Market Economies. In Mark Gertler and Kenneth Rogoff, eds., *NBER Macroeconomics Annual 2003*, Vol. 18. Cambridge, Massachusetts: The MIT Press, 365-400.

Gariga, C. A., (2016). Central Bank Independence in the World: A New Data Set. *International Relations*, 42(5), 849-868.

Gonçalves, C. E., & Salles, J. (2008). Inflation Targeting in Emerging Economies: What Do the Data Say? *Journal of Development Economics*, 85, 312-318.

Greene, W. (2004). The Behavior of the Maximum Likelihood Estimator of Limited Dependent Variable Models in the Presence of Fixed Effects. *Econometrics Journal*, (7), 98-119.

Haldane, A. G., & Batini, N. (1999). Forward-Looking Rules for Monetary Policy. In John B. Taylor, ed., *Monetary policy rules*. Chicago: University of Chicago Press, 157-202.

Hammond, G. (2012). State of the Art of Inflation Targeting. Bank of England – Centre for Central Banking Studies.

Hsiao, C. (2014). *Analysis of Panel Data* (third edition). Cambridge: Cambridge University Press.

Hu, Y. (2006). The choice of inflation targeting - An empirical investigation. *International Economics and Economic Policy*, 3(1), 27-42.

IMF (2006), Inflation Targeting and the IMF. Washington DC: International Monetary Fund.

Ismailov, S., Kakinaka, M., & Miyamoto, H. (2016). Choice of inflation targeting: Some international evidence. *The North American Journal of Economics and Finance*, (36), 350-365.

Lee, W. S. (2010). Comparative case studies of the effects of inflation targeting in emerging economies. *Oxford Economic Papers*, 63, 375-397.

Leyva, G. (2008). The Choice of Inflation Targeting. Central Bank of Chile, Working Paper No. 475.

Lin, S. and H. Ye. (2007). Does Inflation Targeting Really Make a Difference? Evaluating the Treatment Effect of Inflation Targeting in Seven Industrial Countries. *Journal of Monetary Economics*, 54(8), 2521-2533.

Lin, S. & Ye, H. (2009). Does inflation targeting make a difference in developing countries? *Journal of Development Economics*, 89, 118-123.

Lucotte, Y. (2010). The Choice of Adopting Inflation Targeting in Emerging Economies: Do Domestic Institutions Matter? MPRA Paper No. 27118.

Masson, P.R., Savastano, M. A., & Sharma, S., (1997). The Scope for Inflation Targeting in Developing Countries. IMF Working Paper 97/130. Washington DC: International Monetary Fund.

Mishkin, F.S. (2000). Inflation Targeting in Emerging Market Countries. *American Economic Review*, 90(2), pp. 105-109.

Mishkin, F.S. (2004). Can Inflation Targeting Work in Emerging Market Countries. NBER Working Paper 10646.

Mishkin, F.S. & Savastano, M.A. (2002). Monetary Policy Strategies for Emerging Market Countries: Lessons from Latin America. *Comparative Economic Studies*, 44(2), 45-83.

Mishkin, F.S. & Schmidt-Hebbel, K. (2002). A Decade of Inflation Targeting in the World: What Do We Know and What Do We Need to Know? *Inflation Targeting: Design, Performance, Challenges*, 2002. Santiago: Central Bank of Chile, 171-219.

Mishkin, F.S. & Schmidt-Hebbel, K. (2007). Monetary Policy under Inflation Targeting: An Introduction. In F. S. Mishkin & K. Schmidt-Hebbel, eds., *Monetary Policy under Inflation Targeting*. Santiago, Chile: Central Bank of Chile, pp. 1-22.

Mukherjee, B. & Singer, D.A. (2008). Monetary Institutions, Partisanship, and Inflation Targeting. *International Organization*, 62(2), 323-58.

Neyman, J., & Scott E., (1948). Consistent estimates based on partially consistent observations. *Econometrica*, 16(1), 1-32.

Posen, A.S. (1995). Declarations Are Not Enough: Financial Sector Sources of Central Bank Independence. In: B. S. Bernanke & J. J. Rotemberg, eds., *NBER Macroeconomics Annual 1995*, Vol. 10, Cambridge: MIT Press, 253-274.

Rose, A. K. (2014). Surprising Similarities: Recent Monetary Regimes of Small Economies (draft).

Rudebusch, G. D. & Svensson, L. E. O. (1999). Policy Rules for Inflation Targeting. In John B. Taylor, ed., *Monetary policy rules*. Chicago: University of Chicago Press, 203-262.

Samarina, A. & De Haan J. (2014). Right on Target: Exploring the Factors Leading to Inflation Targeting Adoption. *Contemporary Economic Policy*, 32(2), 372-289.

Svensson, L. E. O. (1995). The Swedish Experience of an Inflation Target. NBER Working Paper 4985.

Svensson, L. E. O. (1999a). Inflation Targeting: Some Extensions. *Scandinavian Journal of Economics*, 101(3), 337-361.

Svensson, L. E. O. (1999b). Inflation targeting as a monetary policy rule. *Journal of Monetary Economics*, *43*(3), 607-654.

Svensson, Lars E. O. (2000). Open-economy inflation targeting. *Journal of International Economics*, 50(1), 155-183.

Thornton, J. (2016). Inflation targeting in developing countries revisited. *Finance Research Letters*, 16, 145-153.

Thornton, J. & Vasilakis, C. (2017). Inflation Targeting and the cyclicality of monetary policy. *Finance Research Letters*, 20, 296-302.

Vega, M. & Winkelried, D. (2005). Inflation Targeting and Inflation Behavior: A Successful Story? *International Journal of Central Banking*, 1 (3), 153-175.

Wright, B.D. & Douglas, G. (1976). Better procedures for sample-free item analysis. Research Memorandum 20, Statistical Laboratory, Department of Education, University of Chicago.