

**Right on Target: Exploring the
Determinants of Inflation Targeting
Adoption**

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Abstract

This paper examines which economic, fiscal, external, financial, and institutional characteristics of countries affect the likelihood that they adopt inflation targeting as their monetary policy strategy. We estimate a panel binary response transition model for 60 countries and two subsamples consisting of OECD and non-OECD countries over the period 1985-2008. The findings suggest that past macroeconomic performance of a country, its fiscal discipline, exchange rate arrangements, as well as the structure and development of its financial system have a significant impact on the likelihood to adopt inflation targeting. However, the determinants of inflation targeting differ between OECD and non-OECD countries.

Keywords: inflation targeting, monetary policy strategy.

JEL Classification: E42, E52.

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1. Introduction

Inflation targeting has become a very popular monetary policy strategy. By the end of 2009, 31 countries had adopted inflation targeting. According to Mishkin and Savastano (2001), inflation targeting involves the public announcement of numerical targets for inflation, a strong commitment of the central bank to price stability as a final monetary policy objective, and a high degree of transparency and accountability. The distinctive feature of this strategy is a forward-looking decision-making process known as “inflation-forecast targeting” (Svensson 1997). It means that an inflation targeting central bank sets its policy instruments in such a way that the inflation forecast (after some time) equals the inflation target.

This paper examines which factors affect the choice for inflation targeting. The empirical investigation of the determinants of inflation targeting adoption has received little attention in the literature, which primarily analyzes the impact of inflation targeting on inflation.¹ Scant studies come to different conclusions. For example, while Mishkin and Schmidt-Hebbel (2001) and Mukherjee and Singer (2008) find that countries with higher inflation are more likely to adopt inflation targeting, Hu (2006) and Lucotte (2010) find that low inflation is associated with higher probability to adopt this strategy.

Previous research has several limitations. For instance, most studies have ignored financial market characteristics as possible determinants of inflation targeting. Furthermore, studies usually test for a limited number of potential determinants. This paper adds to the existing literature by examining quite a long list of variables that may influence the choice for inflation targeting; these determinants fall into the categories: macroeconomic, fiscal, external, financial, and institutional factors. The study uses data for 60 countries over the period 1985-2008. Apart from analyzing the full sample, we also investigate OECD and non-OECD countries separately in order to control for possible heterogeneity. Additionally, we analyze whether the determinants differ across soft and full-fledged inflation targeters.

Also from an econometric perspective our study improves upon previous research that has ignored the so-called absorbing state problem. Since no inflation targeting country has decided to change its monetary strategy afterwards, inflation

¹ See Blinder et al. (2008) and Walsh (2009) for surveys of research on the effects of inflation targeting.

targeting becomes an absorbing state – once a country switches to inflation targeting, it sticks to this strategy. Previous studies have ignored this issue, and, as a result, estimate simultaneously the determinants of adoption and continuation of inflation targeting. This may lead to inadequate statistical inference. Following studies on mortality (e.g., Kalwij, Alessie, and Knoef 2009), we use a transition model to identify the determinants of adopting inflation targeting.

Our findings suggest that macroeconomic, fiscal, and financial determinants significantly affect the likelihood of adoption of inflation targeting. The determinants differ between OECD and non-OECD countries and between soft and full-fledged inflation targeters.

The paper is organized as follows. Section 2 reviews the literature and formulates the hypotheses to be tested. Sections 3 and 4 describe the methodology and data, respectively. Section 5 presents the main results, while section 6 offers a sensitivity analysis. Section 7 concludes.

2. Literature review and hypotheses

2.1. Macroeconomic determinants

Inflation

Several authors argue that countries choose inflation targeting in order to achieve low inflation; hence economies with higher prior inflation are more likely to adopt this strategy (Svensson 1997, Mishkin and Schmidt-Hebbel 2001, Gonçalves and Carvalho 2009). However, many inflation targeters adopted the strategy after inflation had come down, so that it may also be argued that low inflation is a prerequisite for inflation targeting (Carare et al. 2002). So our first hypothesis is:

Hypothesis H_1 : low inflation increases the likelihood to adopt inflation targeting.

Turning to practice, it seems that there are differences between advanced and less advanced economies. Several advanced countries chose inflation targeting to maintain low and stable inflation and to acquire a reliable nominal anchor for monetary policy (Bernanke et al. 1999, Freedman and Laxton 2009). In addition, inflation targeting is recommended for countries facing deflation risks, since an institutional commitment to a positive inflation target helps anchor inflation expectations and avoid deflation (Truman 2003, Walsh 2009). Emerging and developing countries did not only search for a good

monetary anchor, but also for a way to increase the credibility of their central banks. Strong commitment to an inflation target was unfeasible for these countries during periods of high inflation, since failure to reach a target could undermine the credibility of monetary authorities. Thus, some emerging and developing countries switched to inflation targeting only after successful disinflation, so that central banks could commit to the inflation target. Previous studies provide mixed results. While Mishkin and Schmidt-Hebbel (2001) and Mukherjee and Singer (2008) report a significant positive impact of inflation on the likelihood to adopt inflation targeting, Hu (2006), Lin and Ye (2007, 2009), Leyva (2008), and Lucotte (2010) find a negative impact of inflation on the probability of adoption.

Output growth and volatility

Several studies on economic performance of inflation targeters find that inflation targeters have, on average, lower output volatility and higher output growth than non-inflation targeters (Vega and Winkelried 2005, Batini and Laxton 2006, Gonçalves and Salles 2008). These results may indicate that countries are attracted to inflation targeting because it helps stimulate and stabilize the economy. This leads us to the following hypotheses:

Hypothesis H₂: low output growth increases the likelihood to adopt inflation targeting.

Hypothesis H₃: high output volatility increases the likelihood to adopt inflation targeting.

Empirically, Mukherjee and Singer (2008) find that GDP growth volatility increases the likelihood of adopting inflation targeting.

Exchange rate regime and volatility

Inflation targeting requires a flexible exchange rate regime since an exchange rate target may lead to a conflict between the objectives of low inflation and a stable exchange rate (Fischer 2001, Mishkin and Savastano 2001, Mishkin 2004). However, several emerging and developing countries initially adopted a soft version of inflation targeting while still using crawling exchange rate bands.² Once these countries completed disinflation, they abandoned exchange rate bands and switched to full-fledged inflation targeting.

² Countries that initially adopted soft inflation targeting are: Chile, Colombia, Israel, Mexico, Peru, and Philippines. See Amato and Gerlach (2002) and Vega and Winkelried (2005).

Meanwhile, advanced countries started to target inflation as a single anchor after the abandonment of exchange rate pegs and the ERM (Bernanke et al. 1999, Freedman and Laxton 2009).

Previous studies report that flexible exchange rates make inflation targeting more likely (Hu 2006, Lin and Ye 2007, 2009, Mukherjee and Singer 2008, Lucotte 2010). We therefore test the following hypotheses:

Hypothesis H₄: countries with a flexible exchange rate regime are more likely to adopt inflation targeting.

Hypothesis H₅: high exchange rate volatility increases the likelihood to adopt inflation targeting.

Money growth volatility

Several advanced countries (Australia, Canada, Spain, and UK) switched to inflation targeting after some unsuccessful experience with monetary targeting. The latter strategy failed to achieve good economic results due to money demand instability and a feeble relationship between monetary aggregates and inflation (Argy, Brennan, and Stevens 1990, Freedman and Laxton 2009). Since monetary targets were more often missed than reached, central banks were searching for an alternative anchor to control inflation. Inflation targeting seemed to be a good option. We therefore test:

Hypothesis H₆: high money growth volatility increases the likelihood to adopt inflation targeting.

2.2. Fiscal determinants

Fiscal discipline is often considered as a prerequisite for inflation targeting (Amato and Gerlach 2002, Carare et al. 2002, Mishkin 2004, Batini and Laxton 2006). Unsustainable fiscal policy may force the central bank to finance fiscal deficits at the cost of higher inflation, jeopardizing the credibility of the central bank. In addition, a highly indebted country may aim for higher inflation in order to reduce the real value of its debt. Thus, a country that wants to adopt inflation targeting should have its public finances in order. We therefore test:

Hypothesis H₇: low budget deficits increase the likelihood to adopt inflation targeting.

Hypothesis H₈: low public debt increases the likelihood to adopt inflation targeting.

Indeed, several previous studies find that fiscal discipline makes inflation targeting more likely (Hu 2006, Gonçalves and Carvalho 2009, Lucotte 2010).

Similar to hypothesis 1, there is a potential reverse causality problem here as well: inflation targeting implementation may influence fiscal performance.

2.3. External determinants

Openness of the economy

The literature mentions openness of the economy as a relevant factor for monetary policy conduct and strategy choice (Houben 1999, Fatás, Mihov, and Rose 2004, Batini and Laxton 2006). Small open economies are dependent on foreign trade and exposed to external real shocks. As such countries are sensitive to exchange rate and commodity price changes, they tend to limit exchange rate movements. Consequently, open economies often prefer to have exchange rate pegs rather than inflation targeting with flexible exchange rates. Nevertheless, as Svensson (2000) argues, open economies can still successfully implement inflation targeting if the reaction function of the central bank is modified to include exchange rate changes, while preserving the inflation objective. We therefore test:

Hypothesis H_9 : openness of the economy increases the likelihood to adopt inflation targeting.

The empirical evidence provides mixed results. While Gerlach (1999) and Lin and Ye (2009) find that less open economies are more likely to adopt inflation targeting, Mishkin and Schmidt-Hebbel (2001), Leyva (2008), and Lucotte (2010) come to the opposite conclusion.

Currency risk

Low currency risk reduces the exchange rate exposure of a country and makes it less vulnerable to currency crises. Several authors emphasize these factors as preconditions for inflation targeting especially for emerging and developing countries (Carare et al. 2002, Mishkin 2004, Batini and Laxton 2006). Our next hypothesis is therefore:

Hypothesis H_{10} : low currency risk increases the likelihood to adopt inflation targeting.

2.4. Financial determinants

While macroeconomic, external, and fiscal determinants of inflation targeting have been discussed in the literature, financial system characteristics have received little attention.

Financial stability

A stable financial system contributes to the effectiveness of monetary policy. Moreover, it enables the central bank to focus on reaching the inflation target rather than maintaining financial stability. According to Truman (2003), Mishkin (2004), and Roger (2009), weak and unstable financial institutions may create circumstances under which the central bank cannot raise interest rates to sustain the inflation target since it may cause the collapse of fragile banking sector and subsequently lead to a financial crisis. In addition, weak financial institutions may turn for liquidity injections to the central bank which may lead to escalating inflation. In both situations, inflation targeting may fail and the credibility of the central bank may be undermined. We therefore test:

Hypothesis H_{11} : financial instability reduces the likelihood to adopt inflation targeting.

Financial system development

A well-developed financial system with liquid and active financial markets may facilitate inflation targeting (Carare et al. 2002, Truman 2003, Batini and Laxton 2006). Well-functioning financial markets absorb short-term financial shocks, minimizing their impact on the real economy. In addition, a well-developed financial system provides more opportunities for resource allocation and reduces the risk that funding dries up. Consequently, a central bank has to care less about financial system and can focus on inflation control.

Hypothesis H_{12} : countries with developed financial systems are more likely to adopt inflation targeting.

Two studies include financial development factor in their analyses of inflation targeting adoption: Leyva (2008) and Lucotte (2010). While Leyva (2008) finds that countries with developed financial systems are more likely to adopt inflation targeting, Lucotte (2010) reports opposite results for emerging and developing countries.

Financial structure

A distinction can be made between market-based and bank-based systems (Demirgüç-Kunt and Levine 2001). In a bank-based system, the banking sector dominates in financing the real economy, while in a market-based system the stock and bond markets are more important for intermediation. Chowdhury, Hoffmann, and Schabert (2006) and Kwapil and Scharler (2010) find that countries with a market-based financial system have a higher interest rate pass-through than countries with a bank-based system. To ensure a strong response of inflation expectations to monetary policy decisions, inflation targeting requires effective monetary policy transmission channels. We therefore test:

Hypothesis H_{13} : countries with market-based financial systems are more likely to adopt inflation targeting.

2.5. Institutional determinants

Several authors emphasize central bank independence as an important institutional factor for inflation targeting adoption (Gerlach 1999, Amato and Gerlach 2002, Carare et al. 2002, Truman 2003, Mishkin 2004, Batini and Laxton 2006, Roger 2009). What matters most is instrument independence, i.e. the central bank is independent from the government in choosing instruments to achieve its goals. Similar to inflation, an important issue here is whether countries should have an independent central bank before adopting inflation targeting or whether they grant instrument independence to their central bank when they adopt this strategy. Mishkin and Schmidt-Hebbel (2001) find that instrument independent central banks are more likely to adopt inflation targeting. We therefore test:

Hypothesis H_{14} : instrument independence of a central bank increases the likelihood to adopt inflation targeting.

All the hypotheses and proxies used to test them are summarized in Table 1. We consider the hypotheses H_1 , H_4 , H_7 , H_8 , and H_{14} as most important in our analysis. Central banks that adopt inflation targeting, tend to focus on inflation, exchange rate regime, fiscal discipline, and central bank independence as fundamental issues in monetary policy conduct.

3. Methodology

The econometric methodology is based on transition analysis that models the probability of a country to switch from one state (monetary policy strategy) to another. Suppose a country can choose between two states (strategies) in monetary policy. State 1 means implementation of inflation targeting, and state 0 is a non-inflation targeting strategy. The transition model specifies a first-order Markov chain process with the following transition probabilities between periods $(t-1)$ and t :

$P(y_{it} = 1 | y_{i,t-1} = 0) = P_{01}$ is the probability to switch from state 0 to 1;

$P(y_{it} = 0 | y_{i,t-1} = 0) = P_{00}$ is the probability to switch from state 0 to 0;

$P(y_{it} = 0 | y_{i,t-1} = 1) = P_{10}$ is the probability to switch from state 1 to 0;

$P(y_{it} = 1 | y_{i,t-1} = 1) = P_{11}$ is the probability to switch from state 1 to 1.

Since in the period under consideration, countries did not change their monetary strategy after the adoption of inflation targeting, it has become an absorbing state.³ That is, once a country adopts inflation targeting, the probability of continuing this strategy is one, $P_{11} = 1$. Consequently, the probability to abandon inflation targeting is zero, $P_{10} = 0$. Thus, we need to estimate only probabilities of transition from non-inflation targeting to inflation targeting (P_{01}) and from non-inflation targeting to non-inflation targeting (P_{00}). We estimate a panel binary response model where the dependent variable is a dummy indicating a monetary strategy type.⁴

³ Only Finland, Spain, and Slovakia gave up inflation targeting when they joined the euro area.

⁴ See Cameron and Trivedi (2005, Chapter 23) and Baltagi (2008, Chapter 11).

Table 1. Hypotheses to be tested

Nr	Hypothesis	Variables used to test the hypothesis	Expected sign
H ₁	Low inflation increases the likelihood to adopt inflation targeting	CPI inflation rate	-
H ₂	Low output growth increases the likelihood to adopt inflation targeting	GDP growth rate	-
H ₃	High output volatility increases the likelihood to adopt inflation targeting	Standard deviation of monthly Industrial Production growth rates	+
H ₄	Countries with a flexible exchange rate regime are more likely to adopt inflation targeting	Dummy for flexible exchange rate regime	+
H ₅	High exchange rate volatility increases the likelihood to adopt inflation targeting	Standard deviation of monthly changes of REER	+
H ₆	High money growth volatility increases the likelihood to adopt inflation targeting	Standard deviation of monthly growth rates of money aggregates	+
H ₇	Low budget deficits increase the likelihood to adopt inflation targeting	Fiscal balance as percentage of GDP	+
H ₈	Low government debt increases the likelihood to adopt inflation targeting	Central government debt as percentage of GDP	-
H ₉	Openness of the economy increases the likelihood to adopt inflation targeting	Export plus import as percentage of GDP	+
H ₁₀	Lower currency risk increases the likelihood to adopt inflation targeting	Three proxies: external debt, FDI, and portfolio investment inflows	-
H ₁₁	Financial instability reduces the likelihood to adopt inflation targeting	Financial crisis dummy	-
H ₁₂	Countries with developed financial systems are more likely to adopt inflation targeting	Financial development index	+
H ₁₃	Countries with market-based financial systems are more likely to adopt inflation targeting	Financial structure dummy	+
H ₁₄	Central bank instrument independence increases the likelihood to adopt inflation targeting	Dummy for central bank instrument independence	+

We include a group of inflation targeters as well as a control group of countries that did not adopt inflation targeting. As a result, it is not possible to use fixed effects logit since it drops the entire control group. The presence of the absorbing state rules out the possibility of estimating a fixed effects model. In the presence of unobserved country-specific characteristics, the appropriate specification is a panel probit model with random effects that is estimated using Maximum Likelihood.

The underlying latent model has the general structure:

$$y_{it}^* = \alpha + \beta' MAC_{i,t-1} + \gamma' FIS_{i,t-1} + \eta' EXT_{i,t-1} + \kappa' FIN_{i,t-1} + \delta' INST_{i,t-1} + \mu_i + \varepsilon_{it}, \quad i=1,...,N; \quad t=1,...,T \quad (1)$$

where $y_{it} = 1$ if $y_{it}^* > 0$, $y_{it} = 0$ if $y_{it}^* \leq 0$, y_{it}^* is an unobserved latent variable which describes the decision to adopt inflation targeting, α is a constant term; $\beta, \gamma, \eta, \kappa, \delta$ are

vectors of parameter estimates; μ_i are country-specific random effects, uncorrelated with explanatory variables, $\mu_i \sim \text{NID}(0, \sigma^2_{\mu})$; ε_{it} is a normally, independently and identically distributed error term with mean zero and variance 1; and $x_{i,t-1} = (MAC_{i,t-1}, FIS_{i,t-1}, EXT_{i,t-1}, FIN_{i,t-1}, INST_{i,t-1})$ are strictly exogenous explanatory variables. The explanatory variables represent information available to the central bank in the current period. We include only one lag of each variable since adding more lags may lead to a significant loss of degrees of freedom.

The probability to adopt inflation targeting is:

$$\Pr(y_{it} = 1 | x_{i,t-1}, \mu_i) = \Phi[\alpha + \beta' MAC_{i,t-1} + \gamma' FIS_{i,t-1} + \eta' EXT_{i,t-1} + \kappa' FIN_{i,t-1} + \delta' INST_{i,t-1} + \mu_i] \quad (2)$$

$\Phi(\cdot)$ is a standard normal cumulative distribution function. The dependent variable y_{it} takes the value 1 if a country i adopted inflation targeting in a year t , and 0 otherwise.

The explanatory variables can be classified in five groups: 1) Macroeconomic factors ($MAC_{i,t-1}$): inflation, output growth and volatility, exchange rate regime, exchange rate volatility, and money growth volatility; 2) Fiscal factors ($FIS_{i,t-1}$): fiscal balance and government debt; 3) External factors ($EXT_{i,t-1}$): openness of the economy and currency risk; 4) Financial factors ($FIN_{i,t-1}$): financial instability, financial structure, and financial development; and 5) Institutional factors ($INST_{i,t-1}$): central bank instrument independence.

The decision to adopt inflation targeting is based on information available to the central bank at the moment of decision-making. What happens afterwards is not relevant for the decision to adopt inflation targeting and we therefore do not keep these observations. In fact, using explanatory variables that refer to the post-adoption period may lead to reverse causality and endogeneity problems. For example, inflation in year $(t-1)$ could influence the decision to change to inflation targeting in year t . However, inflation in year $(t+i)$ will be influenced by the inflation targeting strategy. To avoid reverse causality and focus exclusively on the transition into inflation targeting, we only retain observations for the pre-adoption period and the first year after the introduction of this strategy for the inflation targeting countries in the sample.

4. Data Description

The dataset for this study consists of 60 countries in the period 1985-2008.⁵ The treatment group includes 30 countries that have adopted inflation targeting during this period, and 30 countries that did not adopt it. Within each group advanced, and emerging and developing countries are distinguished based on the IMF classification.

The treatment group includes 17 OECD and 13 non-OECD countries. To make treatment and control groups comparable and reduce the risk of selection bias, we include in the control group also OECD and non-OECD countries. The OECD part of the control group consists of 13 OECD non-inflation targeters. The non-OECD part of the control group includes 17 emerging and developing countries with a GDP per capita that is at least as high as average GDP per capita of the non-OECD inflation targeters.

Table 2 lists the countries in our sample and shows the dates of inflation targeting adoption. There is disagreement in the literature over the precise dates of adoption, since different criteria are used for pinpointing the switch to inflation targeting. Bernanke et al. (1999) associate the start of inflation targeting with the public announcement of the first inflation target, and Ball and Sheridan (2003) with the implementation of the first target. Batini and Laxton (2006) consider central banks as inflation targeters if they use an inflation target as the single nominal anchor for monetary policy. In relation to the latter, Mishkin and Schmidt-Hebbel (2001), Vega and Winkelried (2005), and Freedman and Laxton (2009), suggest that central banks may choose one of the two forms of the strategy – soft or full-fledged inflation targeting – depending on their commitment and policy objectives. Soft inflation targeting (SIT) involves the simple announcement of an inflation target, not accompanied by a strong institutional commitment, and coexistence of the inflation target with other nominal anchors (e.g., exchange rate pegs). This description applies mostly to emerging and developing countries, which often adopted SIT but initially kept exchange rate pegs in place. Meanwhile, full-fledged inflation targeting (FFIT) uses the inflation target as the single nominal anchor for monetary policy and requires strong commitment to the target.

⁵ Inflation targeting was adopted for the first time in December 1989 in New Zealand. The sample period therefore starts in 1985. Our sample period ends in 2008 and is therefore not affected by the discussion that started in the aftermath of the recent global financial crisis about the necessity of incorporating financial stability considerations into the inflation-targeting framework (Roger 2009, Mishkin 2011).

Table 2 shows three dates for the start of inflation targeting: the start according to the central bank, and dates for the start of soft inflation targeting (SIT) and full-fledged inflation targeting (FFIT). While SIT and FFIT adoption dates for OECD countries tend to coincide, there are substantial differences between SIT and FFIT dates for 6 non-OECD countries and Mexico. Our main analysis is based on official dates; in the sensitivity analysis we will use SIT and FFIT dates to check whether preconditions for adoption are different between the two forms of inflation targeting.

Another issue is whether Switzerland should be classified as an inflation targeter. While Mishkin and Schmidt-Hebbel (2001), Fatás, Mihov, and Rose (2004), and Vega and Winkelried (2005) classify Switzerland as a *de facto* inflation targeter, Truman (2003) and Roger (2009) do not include it in their sample of inflation targeting countries. The Swiss National Bank does not consider itself an inflation targeter. However, it uses inflation forecasts as a main indicator of monetary policy aimed to achieve price stability in the medium and long run. Thus, in our main analysis we include Switzerland as an inflation targeter; in the sensitivity analysis we exclude it from this group.

Annex 1 offers a detailed description of the variables used and their data sources. To minimize the impact of hyperinflation episodes in Latin American and transition countries, the CPI inflation rate is transformed. To proxy output growth and volatility we use annual GDP growth rates and the annual standard deviation of monthly Industrial Production growth rates, respectively. The exchange rate regime dummy is based on the *de facto* classification of Levy-Yeyati and Sturzenegger (2005) and takes the value 1 if a country has a floating exchange rate regime, and 0 otherwise. Exchange rate volatility is measured by annual standard deviation of monthly changes of REER. For money growth volatility we use the annual standard deviation of monthly growth rates of broad money aggregates.

The fiscal determinants included are the general government fiscal balance and central government debt, both expressed as percentage of GDP.⁶ Openness is measured as the sum of exports and imports as share of GDP. Following Frankel and Rose (1996), Kaminsky, Lizondo, and Reinhart (1998), and Milesi-Ferretti and Razin (1998), we use three proxies for currency risk, namely: external debt, FDI inflows, and portfolio investment inflows (all as percentage of GDP).

⁶ As for many countries the data on general government debt is not available, we use central government debt as a proxy for government debt.

Table 2. List of countries with dates of adoption

Inflation targeting countries							
OECD (17)				Non-OECD (13)			
Country	Official adoption	SIT dates	FFIT dates	Country	Official adoption	SIT dates	FFIT dates
Australia	1993	1993	1994	Armenia ⁽²⁾	2006	2006	n/a
Canada	1991	1991	1994	Brazil	1999	-	-
Czech Republic	1998	-	-	Chile	1991	1991	1999
Finland ⁽¹⁾	1993	-	-	Colombia	2000	1995	2000
Hungary	2001	-	-	Ghana	2007	-	-
Iceland	2001	-	-	Guatemala	2005	-	-
Mexico	2001	1995	2001	Indonesia	2005	-	-
New Zealand	1990	1990	1991	Israel	1992	1992	1997
Norway	2001	-	-	Peru	2002	1994	2002
Poland	1999	-	-	Philippines	2002	1995	2002
Slovakia ⁽¹⁾	2005	-	-	Romania	2005	-	-
South Korea	1998	-	-	South Africa	2000	-	-
Spain ⁽¹⁾	1995	1994	1995	Thailand	2000	-	-
Sweden	1993	-	-				
Switzerland	2000	-	-				
Turkey	2006	-	-				
United Kingdom	1993	-	-				
Non-inflation targeting countries							
OECD (13)				Non-OECD (17)			
Austria	Italy			Argentina	Latvia		
Belgium	Japan			Bolivia	Lithuania		
Denmark	Luxemburg			Bulgaria	Malaysia		
France	Netherlands			China	Pakistan		
Germany	Portugal			Costa Rica	Panama		
Greece	United States			Cyprus	Singapore		
Ireland				Egypt	Sudan		
				Estonia	Venezuela		
				India			

Notes: ⁽¹⁾ - Finland and Spain abandoned inflation targeting in 1999 due to the adoption of the euro; the same holds for Slovakia in 2009; ⁽²⁾ - Armenia is still officially in transition to full-fledged inflation targeting.

Official adoption dates are based on central banks' documents. Following Hu (2006) and Lucotte (2010), we apply the "half-year rule" – if inflation targeting is adopted in the second half of year t , the adoption year is year $(t+1)$, otherwise the adoption year is year t . The alternative dates refer to the start of soft or full-fledged inflation targeting (SIT and FFIT, respectively).

Sources: Mishkin and Schmidt-Hebbel (2001), Truman (2003), Fatás, Mihov, and Rose (2004), Vega and Winkelried (2005), Leyva (2008), Freedman and Laxton (2009), Roger (2009), and central banks' publications.

A financial crisis dummy is used as a proxy for financial instability. It takes the value 1 if a country experiences a sovereign debt, currency, or banking crisis in a given year, and 0 otherwise. The data on financial crises come from Honahan and Laeven (2005) and Laeven and Valencia (2008). Following Levine, Loayza, and Beck (2000),

Demirgüç-Kunt and Levine (2001), and Beck, Demirgüç-Kunt, and Levine (2009), we collected data for private credit, liquid liabilities, stock market capitalization, and domestic banks assets to GDP as proxies for financial development. As these variables are highly and significantly correlated (see Annex 2), we apply Principal Component Analysis and use the first principal component as our measure for financial development.⁷ It explains 74.8% of the cumulative variance of four variables. The methodology for constructing a financial structure dummy is based on Demirgüç-Kunt and Levine (2001), and Beck and Levine (2002).⁸

The final variable is central bank instrument independence. As a proxy, we use the dummy for economic independence of the central bank, which takes the value 1 if the central bank is economically independent, and 0 otherwise.⁹ The dummy values are based on indices constructed in the literature (Cukierman, Webb, Neyapti 1992, Cukierman, Miller, and Neyapti 2002, Arnone et al. 2007). Since most studies measure independence as average over periods, we use additionally central banks' legal documents to indicate the exact year when a legislation change enhanced instrument independence.

Panel unit-root tests suggest that most of explanatory variables are stationary (results available on request). To check for potential multicollinearity between the variables, we perform a correlation analysis (see Annex 2). Most explanatory variables are not highly and significantly correlated except for the external determinants.

Table 3 presents the mean values of all explanatory variables for inflation targeters and non-inflation targeters in the pre-adoption period. The table suggests that there are important differences between both groups of countries, as the mean values differ significantly for all the analyzed variables. The statistics suggest that prior to adoption, inflation targeters had higher inflation, lower levels of output growth and volatility, and higher exchange rate and money growth volatilities than non-inflation targeters. In addition, inflation targeters had more frequently flexible exchange rate

⁷ The Keiser-Meyer-Olkin Measure of Sampling Adequacy is equal 0.674, and Barlett's Test of Sphericity has a p-value of 0.00, suggesting that PCA can be used.

⁸ The structure index consists of the size, activity and efficiency indices, which measure respectively, the size, activity and efficiency of the financial system. They are calculated as follows: Size Index = Stock Market Capitalization/Domestic Assets of Deposit Money Banks; Activity Index = Total Stock Market Value Traded/Private Credit of Deposit Money Banks; Efficiency Index = (Total Stock Market Value Traded/GDP)*Overhead Costs. The structure index is the average of these three indices. If the index is above the mean for the full sample, a country is said to have a market-based financial system.

⁹ Following Grilli, Masciandaro, and Tabellini (1991), economic independence of the central bank includes instrument and financial independence. The latter refers to the restriction to finance government spending from central bank credits.

regimes, a better fiscal performance and lower currency exposure. Surprisingly, prior to adoption, central banks in inflation targeting countries had lower instrument independence than central banks in non-inflation targeting countries. This suggests that inflation targeters made their central bank independent when they adopted inflation targeting.¹⁰

The means of the financial variables suggest that inflation targeters more frequently experienced financial crises prior to the adoption and have less developed financial markets than non-inflation targeters. In addition, inflation targeters more often have a market-based financial system than non-inflation targeters.

Table 3. Pre-adoption mean value statistics

Variables	Inflation targeters			Non-inflation targeters		
	All countries	OECD	Non-OECD	All countries	OECD	Non-OECD
Inflation	0.160	0.101	0.198	0.072	0.030	0.110
Output growth	3.226	2.854	3.454	4.032	2.842	5.095
Output volatility	9.411	11.192	8.050	11.137	12.653	9.261
Exchange rate regime	0.368	0.401	0.347	0.192	0.218	0.168
Exchange rate volatility	2.597	1.810	3.079	1.539	0.937	2.078
Money growth volatility	2.228	1.512	2.977	1.794	1.461	2.131
Fiscal balance	-1.860	-1.854	-1.863	-2.319	-2.970	-1.674
Government debt	40.405	33.358	46.064	59.362	61.188	57.592
Openness of the economy	60.647	63.545	58.893	92.471	86.187	98.138
External debt	53.487	58.914	49.962	77.534	112.186	51.783
Portfolio investment inflows	1.444	2.242	0.799	3.487	6.252	1.045
FDI inflows	1.784	1.953	1.674	3.813	3.127	4.376
Financial instability	0.305	0.227	0.353	0.207	0.154	0.255
Financial structure	0.500	0.488	0.508	0.283	0.289	0.277
Financial development	1.594	2.061	1.297	2.536	3.327	1.735
Central bank instrument independence	0.333	0.380	0.301	0.467	0.644	0.300

Notes: For inflation targeting countries the pre-adoption period starts in 1985 (or in the first year for which the data is available) and ends with the official adoption date for each country. For non-inflation targeting countries the period is 1985-2008.

The comparison of the mean values for OECD and non-OECD countries shows that the difference between the means of OECD inflation targeters and OECD non-inflation

¹⁰ The means of central bank independence index for inflation targeters indicate that in the pre-adoption period the independence was much lower than in the post-adoption period. It holds for the full sample of inflation targeters as well as for OECD and non-OECD subsamples (descriptive statistics are available on request). This supports our prior that central banks gained instrument independence after the adoption of inflation targeting.

targeters is often negligible. In contrast, the means of explanatory variables for non-OECD inflation targeters and non-inflation targeters are significantly different.

5. Empirical results

Table 4 presents the estimation results for the full sample. We find no evidence for the existence of unobserved cross-country heterogeneity since random effects are highly insignificant. Consequently, we estimate a panel probit model with robust (White-corrected) standard errors. Since coefficient estimates in probit cannot be interpreted directly, we report average marginal effects.¹¹ Column (1) provides the results for the fully specified model, proposed in Section 3. Then different variations of the model are estimated. The model in column (2) uses external debt as the most suitable currency risk measure.¹² To check whether the results are sensitive to the specification of financial development, we estimate models with different financial market indicators included separately (columns (3)-(6)).

The results suggest that the likelihood that a country adopts inflation targeting is significantly associated with the country's macroeconomic performance, its exchange rate arrangements, fiscal discipline as well as financial structure and development.

There is strong evidence that countries with low inflation are more likely to adopt inflation targeting, so hypothesis H_1 is supported. Thus, countries adopt inflation targeting when they have already achieved low and sustainable inflation. The marginal effect of inflation is much higher than that of other determinants, indicating the high relevance of this variable for inflation targeting choice.

In most models GDP growth is significant with a negative sign, while output volatility is significant with a positive sign. Thus, countries with past lower output growth and higher output volatility are more likely to adopt inflation targeting. These outcomes confirm hypotheses H_2 and H_3 .

¹¹ Average marginal effects are computed as averages (over N and T) of individual marginal effects. The standard errors of these marginal effects are calculated using the delta method (see Cameron and Trivedi 2005, Chapter 14).

¹² We also estimate models with other currency risk measures included separately. They do not change our main results substantially. In the paper we report the results of the model with external debt, because it outperforms models with other currency risk measures. The estimation results using alternative currency risk measures are available on request.

Next, we find that a country with a flexible exchange rate regime is more likely to adopt inflation targeting. According to the size of the marginal effect, this variable is the second most relevant for the decision to adopt inflation targeting. Exchange rate volatility is significant with a positive sign indicating that countries with more volatile exchange rates tend to choose inflation targeting. Thus, our results lend support to hypotheses H₄ and H₅.

Money growth volatility is insignificant, so our evidence does not support hypothesis H₆.

Our findings indicate that lower government debt significantly increases the probability to adopt inflation targeting. However, the coefficient of fiscal balance is insignificant. Thus, hypothesis H₇ is supported, but H₈ is rejected.

The external determinants – the openness of the economy and currency risk – do not affect the likelihood to adopt inflation targeting. Our results therefore do not lend support to hypotheses H₉ and H₁₀.

Also our proxy for financial instability is insignificant. Interestingly, the financial development index is significant with a negative sign. This counterintuitive result is found in models with a financial development index as well as with separate financial indicators. It suggests that countries with less developed financial systems are more likely to adopt inflation targeting. In fact, it may be the case that countries with underdeveloped financial systems choose to implement inflation targeting as a way to control inflation and also to develop financial systems. Thus, we reject hypotheses H₁₁ and H₁₂.

The financial structure index is significant in several models. It has a positive sign, which implies that countries with a market-based financial system are more likely to adopt inflation targeting, confirming hypothesis H₁₃.

Our proxy for central bank instrument independence is insignificant with a negative sign, which rejects hypothesis H₁₄. As suggested in Section 2, it is possible that the central bank becomes independent when inflation targeting is adopted. In addition, this result may be caused by the fact that - at this stage - we do not distinguish between advanced and emerging and developing countries. The quality of institutions in advanced countries may be better than in emerging and developing countries. Thus, while there is no evidence that central bank instrument independence affects the choice for inflation targeting in the full sample, this may be different for the subsample of emerging and developing countries.

6. Sensitivity analysis

We conduct an extensive sensitivity analysis to check for the robustness of our findings, changing the explanatory variables and the inflation targeting adoption dates, and distinguishing several sub-samples. Most of the results are presented in Table 5.

First, to test the sensitivity of our results to different specifications of volatility and exchange rate regime, alternative measures are used. Following Lin and Ye (2007, 2009) and Lucotte (2010), the exchange rate regime indicator is based on the de facto classification of Reinhart and Rogoff (2004).¹³ This classification is often used in the literature. To examine the effects of long-term economic and monetary volatility on the choice for inflation targeting, we use alternative volatility measures: 3-year moving standard deviations of annual GDP and money growth rates. The estimations results with these alternative measures are not reported, but are available on request. The alternative measures for output volatility and the exchange rate regime do not considerably change our main results. The use of the alternative measure for money growth volatility alters our main results by making government debt, financial structure, and output growth insignificant.

Next, we include several additional explanatory variables that have been suggested in the literature to correct for a potential omitted variables bias. First, following Carare and Stone (2006) and Lucotte (2010), we include the level of economic development - proxied by the log of real GDP per capita - as a determinant of inflation targeting adoption. According to Lucotte (2010), more developed countries have better preconditions for inflation targeting. Second, we include financial openness as another external determinant. Higher capital mobility may shift the central bank's focus from inflation to exchange rates, making inflation targeting a less preferred strategy option. We use the Chinn-Ito index to proxy financial openness (Chinn and Ito 2008). The inclusion of these additional variables does not substantially change main results. The economic development proxy is highly insignificant, while the coefficient of the financial openness index is significant with a negative sign.¹⁴ This implies that financially open countries are less likely to adopt inflation targeting.

As a third robustness check, we drop all observations for EMU countries after the start of the currency area. With joining the euro area, these countries gave up their

¹³ Indicator takes values from 1 (no separate legal tender) to 14 (freely falling). More flexible exchange rate regimes imply higher values of the indicator.

¹⁴ The results of these two robustness checks are not included in Table 5, but are available on request.

national sovereignty and delegated monetary policy to the European Central Bank (ECB). Since the ECB is responsible for monetary policy in the euro area, countries within the EMU do not choose a monetary strategy of their own. The estimation results as shown in column (1) of Table 5 are quite similar to those reported in Table 4.

Next, the alternative dates of adoption as shown in Table 2 are used, indicating the start of soft (column (2) of Table 5) and full-fledged inflation targeting (column (3) of Table 5). The findings suggest that the determinants of both types of inflation targeting differ slightly. Most importantly, inflation is less important for adopting SIT than for adopting FFIT. Apparently, countries may adopt SIT without much concern for low inflation, since central banks do not strongly commit to reaching the inflation target. However, the decision to switch to FFIT requires sufficiently low inflation.¹⁵ As for the other determinants, countries with high output and exchange rate volatility, a more flexible exchange rate regime, and better fiscal discipline are more likely to adopt SIT. Financial structure and development play a significant role too. The choice of FFIT is not related to financial structure, but the other determinants have a similar impact as in the model for the likelihood to adopt SIT.

We also re-estimate the model with official dates after including Switzerland as a non-inflation targeter (column 4, Table 5). This modification does not change our main conclusions.

Finally, we split the sample into OECD and non-OECD countries. In view of the small number of observations, the results should be interpreted with care. In the non-OECD sample, the financial development index and openness of the economy are highly correlated. Therefore, private credit is used instead of the financial development index.¹⁶

While the results for the OECD sample are similar to the findings for the full sample, for the non-OECD sample the results are different (columns (5) and (6) of Table 5). OECD and non-OECD countries with low inflation, flexible exchange rates, high output volatility, and low government debt are more likely to adopt inflation targeting. However, whereas openness increases the likelihood to adopt inflation targeting in OECD countries, it has a negative effect in non-OECD countries. Likewise, central bank instrument independence increases the likelihood to adopt inflation targeting in the non-

¹⁵ E.g., Chile adopted soft inflation targeting in 1991 when the country had high inflation. After inflation was brought down from 21,8% in 1991 to 3,3% in 1999, Chile switched to full-fledged inflation targeting.

¹⁶ Correlation between the financial development index and private credit is 0.93, and between private credit and openness - 0.53. The latter is the lowest correlation between openness and all the other measures for financial development.

OECD sample, while it is insignificant in the OECD sample.¹⁷ In addition, non-OECD countries with much financial instability and a developed financial system are more likely to adopt inflation targeting, whereas these variables are insignificant in the OECD sample. This may reflect the similarity of financial development and similar frequency of financial crises among OECD countries.

¹⁷ One needs to treat this result with caution. Especially for the non-OECD sample, where this variable is positive and significant, the result may be overestimated due to the small number of observations. In addition, a legal index of central bank independence may be a poor proxy for actual independence in emerging and developing countries. The legal index is based on official documents that set legal rules for central banks. However, those rules of law are not always respected. Therefore, we constructed an alternative index: (legal index * rule of law index). The latter is based on the Law and Order index from the International Country Risk Guide database. This proxy for independence is significant with a negative sign for the sample of non-OECD countries. This indicates that non-OECD countries had a low level of actual central bank independence before they adopted inflation targeting. Mean value statistics show that the actual index of central bank independence was lower for inflation targeters (both OECD and non-OECD ones) before the adoption and increased substantially in the post-adoption period.

Table 4. Determinants of inflation targeting adoption – probit results

	(1)	(2)	(3)	(4)	(5)	(6)
Inflation	-0.821*** (0.227)	-0.809*** (0.223)	-0.592*** (0.183)	-0.701*** (0.210)	-0.707*** (0.210)	-0.787*** (0.212)
GDP growth	-0.005* (0.003)	-0.005* (0.003)	-0.004 (0.003)	-0.005* (0.003)	-0.005* (0.003)	-0.006** (0.003)
Output volatility	0.004** (0.002)	0.004** (0.002)	0.004** (0.002)	0.004*** (0.002)	0.003** (0.002)	0.004** (0.002)
Exchange rate regime	0.083*** (0.023)	0.082*** (0.023)	0.076*** (0.021)	0.076*** (0.022)	0.076*** (0.022)	0.074*** (0.020)
Exchange rate volatility	0.014** (0.006)	0.014*** (0.006)	0.013** (0.005)	0.012** (0.005)	0.012** (0.005)	0.014*** (0.006)
Money growth volatility	0.0002 (0.003)	0.0002 (0.003)	0.002 (0.003)	0.0006 (0.003)	-0.0003 (0.003)	-0.0001 (0.003)
Fiscal balance	0.004 (0.004)	0.004 (0.004)	0.004 (0.004)	0.003 (0.004)	0.003 (0.004)	0.004 (0.004)
Government debt	-0.002*** (0.0005)	-0.002*** (0.0005)	-0.001*** (0.0005)	-0.002*** (0.0005)	-0.001*** (0.0005)	-0.002*** (0.0004)
Openness	-0.00001 (0.0003)	-0.0001 (0.0002)	-0.0001 (0.0002)	-0.00001 (0.0002)	0.00001 (0.0002)	-0.0001 (0.0002)
External debt	0.0001 (0.0002)	0.00002 (0.0001)	-0.0001 (0.0002)	0.0001 (0.0001)	0.00001 (0.0001)	-0.00001 (0.0002)
Portfolio investment inflows	-0.001 (0.002)					
FDI inflows	-0.002 (0.003)					
Financial instability	-0.004 (0.024)	-0.004 (0.023)	-0.007 (0.022)	0.010 (0.022)	0.008 (0.022)	-0.002 (0.021)
Financial structure	0.050** (0.024)	0.050** (0.023)	0.060*** (0.023)	0.030 (0.024)	0.036 (0.023)	0.047** (0.022)
Financial development	-0.027*** (0.011)	-0.026** (0.011)				
Market capitalization			-0.041 (0.037)			
Bank assets				-0.067*** (0.026)		
Liquid liabilities					-0.096* (0.051)	
Private credit						-0.067** (0.021)
Central bank instrument independence	-0.007 (0.023)	-0.006 (0.022)	0.002 (0.021)	-0.007 (0.022)	-0.005 (0.022)	-0.003 (0.021)
No. of observations	435	445	473	473	475	483
Log likelihood	-67.44	-67.61	-70.76	-70.06	-70.25	-68.70
Pseudo R ²	0.251	0.253	0.231	0.238	0.237	0.257
Wald χ^2 test	48.50***	46.03***	55.06***	48.05***	47.73***	52.97***

Notes: The Table reports average marginal effects and their robust standard errors (in brackets), computed using the delta method. ***, **, and * indicate the significance on 1%, 5%, and 10% significance level, respectively. Wald χ^2 test, equivalent to the F test in linear regression, evaluates the goodness-of-fit of the model based on the difference between the parameter estimates and their constrained values.

Table 5. Sensitivity analysis

	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample, modified for EMU countries	Full sample, SIT adoption dates	Full sample, FFIT adoption dates	Full sample, Switzerland as a non-IT	OECD sample	Non-OECD sample
Inflation	-0.933*** (0.263)	-0.368** (0.165)	-0.645*** (0.202)	-0.826*** (0.213)	-1.612*** (0.628)	-1.032*** (0.273)
GDP growth	-0.006* (0.003)	-0.003 (0.003)	-0.006** (0.003)	-0.006** (0.003)	-0.003 (0.005)	-0.006 (0.004)
Output volatility	0.005** (0.002)	0.005*** (0.002)	0.003 (0.002)	0.004** (0.002)	0.006*** (0.002)	0.007 (0.006)
Exchange rate regime	0.094*** (0.027)	0.092*** (0.025)	0.076*** (0.023)	0.085*** (0.023)	0.072** (0.030)	0.195*** (0.051)
Exchange rate volatility	0.016** (0.007)	0.016*** (0.005)	0.013** (0.006)	0.014*** (0.005)	0.048*** (0.016)	-0.003 (0.009)
Money growth volatility	-0.001 (0.005)	-0.0004 (0.002)	-0.005 (0.009)	0.0002 (0.003)	-0.020 (0.014)	0.003 (0.002)
Fiscal balance	0.004 (0.005)	0.009** (0.004)	0.003 (0.004)	0.004 (0.004)	0.005 (0.006)	0.008 (0.007)
Government debt	-0.002*** (0.001)	-0.001*** (0.0004)	-0.001* (0.0005)	-0.001*** (0.0004)	-0.002*** (0.001)	-0.001* (0.001)
Openness	-0.0001 (0.0002)	-0.0003 (0.0002)	-0.0001 (0.0002)	-0.00004 (0.0002)	0.002*** (0.001)	-0.001** (0.001)
External debt	0.0003 (0.0005)	0.0001 (0.0001)	0.0001 (0.0001)	-0.0002 (0.0004)	-0.0004* (0.0002)	0.0001 (0.0005)
Financial instability	-0.007 (0.027)	-0.009 (0.025)	-0.011 (0.024)	-0.002 (0.022)	-0.030 (0.038)	0.050** (0.025)
Financial structure	0.059** (0.029)	0.070*** (0.026)	0.031 (0.023)	0.046* (0.024)	0.064** (0.033)	0.006 (0.038)
Financial development	-0.031*** (0.012)	-0.027** (0.014)	-0.026** (0.011)	-0.035*** (0.010)	-0.035 (0.023)	
Private credit						0.059** (0.025)
Central bank instrument independence	0.005 (0.028)	0.007 (0.023)	-0.020 (0.023)	-0.012 (0.023)	0.011 (0.026)	0.068* (0.038)
No. of observations	373	418	456	445	255	208
Log likelihood	-66.65	-65.32	-73.57	-61.52	-36.68	-16.71
Pseudo R ²	0.228	0.267	0.193	0.298	0.357	0.507
Wald χ^2 test	42.15***	43.71***	40.73***	46.59***	40.20***	31.67***

Notes: The Table reports average marginal effects and their robust standard errors (in brackets), computed using the delta method. ***, **, and * indicate the significance on 1%, 5%, and 10% significance level, respectively. Wald χ^2 test, equivalent to the F test in linear regression, evaluates the goodness-of-fit of the model based on the difference between the parameter estimates and their constrained values.

The financial structure index is significant only for the OECD sample. The distinction between market- and bank-based financial systems does not seem to matter for adopting inflation targeting by non-OECD countries.

In conclusion, the sensitivity analysis shows that our main results are quite robust to several modifications. The most important new insight is that the determinants of inflation targeting differ between OECD and non-OECD countries. Non-OECD countries, which choose inflation targeting, need to satisfy different prerequisites than OECD countries.

7. Conclusion

This paper examines the determinants of the likelihood to adopt inflation targeting. While the theoretical literature describes several important factors affecting the choice for this monetary policy strategy, previous empirical evidence on their actual relevance is incomplete and mixed. We formulate 14 hypotheses and use a large sample of countries to investigate the relevance of macroeconomic, external, fiscal, financial, and institutional determinants for the choice of inflation targeting. We improve upon previous studies by taking the absorbing state problem into account in our modeling approach. Using a transition model, we deal with the absorbing state and also solve potential endogeneity and reverse causality problems. In addition, we examine whether the structure, characteristics, and stability of the financial system affects the likelihood to adopt inflation targeting.

Our findings lend support for seven out of fourteen formulated hypotheses. Our findings suggest that countries with low inflation and GDP growth, high output and exchange rate volatility, a flexible exchange rate regime, fiscal discipline, less developed and a market-based financial system are more likely to adopt inflation targeting. Moreover, our results suggest differences in preconditions of inflation targeting adoption between non-OECD and OECD countries. Low openness of the economy and a high degree of central bank instrument independence are associated with the choice of inflation targeting by non-OECD countries.

References

- Amato, Jeffery D., and Stefan Gerlach. (2002) "Inflation Targeting in Emerging Market and Transition Economies: Lessons after a Decade." *European Economic Review*, 46, 781-90.
- Argy, Victor, Anthony Brennan, and Glenn Stevens. (1990) "Monetary Targeting: The International Experience." *Economic Record*, 66, 37-62.
- Arnone, Marco, Bernard J. Laurens, Jean-François Segalotto, and Martin Sommer. (2007) "Central Bank Autonomy: Lessons from Global Trends," IMF Working Paper No. 07/88.
- Ball, Laurence, and Niamh Sheridan. (2003) "Does Inflation Targeting Matter?" NBER Working Paper No. 9577.
- Baltagi, Badi H. (2008) "Econometric Analysis of Panel Data." 4th Edition. Chichester: Wiley.
- Batini, Nicoletta, and Douglas Laxton. (2006) "Under What Conditions Can Inflation Targeting Be Adopted? The Experience of Emerging Markets." Central Bank of Chile Working Paper No. 406.
- Beck, Thorsten, Asli Demirgüç-Kunt, and Ross Levine. (2009) "Financial Institutions and Markets across Countries and Over Time. Data and Analysis." World Bank Policy Research Working Paper No. 4943.
- Beck, Thorsten, and Ross Levine. (2002) "Industry Growth and Capital Allocation: Does Having a Market- or a Bank-Based System Matter?" NBER Working Paper No. 8982.
- Bernanke, Ben S., Thomas Laubach, Frederic Mishkin, and Adam Posen. (1999) "Inflation Targeting: Lessons from the International Experience." Princeton, NJ: Princeton University Press.
- Blinder, Alan S., Michael Ehrmann, Marcel Fratzscher, Jakob de Haan, and David-Jan Jansen. (2008) "Central Bank Communication and Monetary Policy: A Survey of Theory and Evidence." *Journal of Economic Literature*, 46, 910-45.
- Cameron, Colin A., and Pravin K. Trivedi. (2005) "Microeconometrics: Methods and Applications." New York: Cambridge University Press.
- Carare, Alina, Andrea Schaechter, Mark R. Stone, and Mark Zelmer. (2002) "Establishing Initial Conditions in Support of Inflation Targeting." IMF Working Paper No. 02/102.
- Carare, Alina, and Mark R. Stone. (2006) "Inflation Targeting Regimes." *European Economic Review*, 50, 1297-1315.
- Chinn, Menzie D., and Hiro Ito. (2008) "A New Measure of Financial Openness." *Journal of Comparative Policy Analysis*, 10, 309-22.
- Chowdhury, Ibrahim, Mathias Hoffmann, and Andreas Schabert. (2006) "Inflation Dynamics and the Cost Channel of Monetary Transmission." *European Economic Review*, 50, 995-1016.

- Cukierman, Alex, Geoffrey P. Miller, and Bilin Neyapti. (2002) "Central Bank Reform, Liberalization and Inflation in Transition Economies – an International Perspective." *Journal of Monetary Economics*, 49, 237-64.
- Cukierman, Alex, Steven B. Webb, and Bilin Neyapti. (1992) "Measuring the Independence of Central Banks and Its Effect on Policy Outcomes." *The World Bank Economic Review*, 6, 353-98.
- Demirgüç-Kunt, Asli, and Ross Levine. (2001) "Bank-based and Market-based Financial Systems: Cross-Country Comparisons." In *Financial Structure and Economic Growth: A Cross-Country Comparison of Banks, Markets, and Development*, edited by Demirgüç-Kunt Asli and Ross Levine. Cambridge, MA: MIT Press.
- Fatás, Antonio, Ilian Mihov, and Andrew K. Rose. (2004) "Quantitative Goals for Monetary Policy." NBER Working Paper No. 10846.
- Fischer, Stanley. (2001) "Distinguished Lecture on Economics in Government. Exchange Rate Regimes: Is the Bipolar View Correct?" *Journal of Economic Perspectives*, 15, 3-24.
- Frankel, Jeffrey A., and Andrew K. Rose. (1996) "Currency Crashes in Emerging Markets: An Empirical Treatment." *Journal of International Economics*, 41, 351-66.
- Freedman, Charles, and Douglas Laxton. (2009) "Why Inflation Targeting?" IMF Working Paper No. 09/86.
- Gerlach, Stefan. (1999) "Who Targets Inflation Explicitly?" *European Economic Review*, 43, 1257-77.
- Gonçalves, Carlos E., and Alexandre Carvalho. (2009) "Inflation Targeting Matters: Evidence from OECD Economies' Sacrifice Ratios." *Journal of Money, Credit and Banking*, 41, 233-43.
- Gonçalves, Carlos E., and Joao M. Salles. (2008) "Inflation Targeting in Emerging Economies: What Do the Data Say?" *Journal of Development Economics*, 85, 312-18.
- Grilli, Vittorio, Donato Masciandaro, and Guido Tabellini. (1991) "Political and Monetary Institutions and Public Financial Policies in the Industrial Countries." *Economic Policy*, 13, 341-92.
- Honahan, Patrick, and Luc Laeven. (2005) "Systemic Financial Distress: Containment and Resolution." Cambridge, UK: Cambridge University Press.
- Houben, Aerd C.F.J. (1999) "The Evolution of Monetary Policy Strategies in Europe." PhD thesis, Rijksuniversiteit Groningen.
- Hu, Yifan. (2006) "The Choice of Inflation Targeting – an Empirical Investigation." *International Economics and Economic Policy*, 3, 27-42.
- Jaimovich, Dany, and Ugo Panizza. (2010) "Public Debt around the World: a New Data Set of Central Government Debt." *Applied Economics Letters*, 17, 19-24.
- Kaminsky, Graciela, Saul Lizondo, and Carmen M. Reinhart. (1998) "Leading Indicators of Currency Crises." *IMF Staff Papers*, 45, 1-48.
- Kalwij, Adriaan, Rob Alessie, and Marike Knoef. (2009) "Individual Income and Remaining Life Expectancy at the Statutory Retirement Age of 65 in the Netherlands." Netspar Discussion Paper No. 09/2009-033.

- Kwapil, Claudia, and Johann Scharler. (2010) "Interest Rate Pass-Through, Monetary Policy Rules and Macroeconomic Stability." *Journal of International Money and Finance*, 29, 236-51.
- Laeven, Luc, and Fabian Valencia. (2008) "Systemic Banking Crises: A New Database." IMF Working Paper No. 08/224.
- Levine, Ross, Norman Loayza, and Thorsten Beck. (2000) "Financial Intermediation and Growth: Causality and Causes." *Journal of Monetary Economics*, 46, 31-77.
- Levy-Yeyati, Eduardo, and Federico Sturzenegger. (2005) "Classifying Exchange Rate Regimes: Deeds vs. Words." *European Economic Review*, 49, 1603-35.
- Leyva, Gustavo. (2008) "The Choice of Inflation Targeting." Central Bank of Chile Working Paper No. 475.
- Lin, Shu, and Haichun 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, 2521-33.
- Lin, Shu, and Haichun Ye. (2009) "Does Inflation Targeting Make a Difference in Developing Countries?" *Journal of Development Economics*, 89, 118-23.
- Lucotte, Yannick. (2010) "The Choice of Adopting Inflation Targeting in Emerging Economies: Do Domestic Institutions Matter?" MPRA Paper No. 27118, University Library of Munich, Germany.
- Milesi-Ferretti, Gian M., and Assaf Razin. (1998) "Current Account Reversal and Currency Crises: Empirical Regularities." NBER Working Paper No. 6620.
- Mishkin, Frederic S. (2004) "Can Inflation Targeting Work in Emerging Market Countries?" NBER Working Paper No. 10646.
- Mishkin, Frederic S. (2011) "Monetary Policy Strategy: Lessons from the Crisis." NBER Working Paper No. 16755.
- Mishkin, Frederic S., and Miguel Savastano. (2001) "Monetary Policy Strategies for Latin America." *Journal of Development Economics*, 66, 415-44.
- Mishkin, Frederic S., and Klaus Schmidt-Hebbel. (2001). "One Decade of Inflation Targeting in the World: What Do We Know and What Do We Need to Know?" NBER Working Paper No. 8397.
- Mukherjee, Bumba, and David A. Singer. (2008) "Monetary Institutions, Partisanship, and Inflation Targeting." *International Organization*, 62, 323-58.
- Reinhart, Carmen, and Kenneth Rogoff. (2004) "The Modern History of Exchange Rate Arrangements: A Reinterpretation." *Quarterly Journal of Economics*, 119, 1-48.
- Roger, Scott. (2009) "Inflation Targeting at 20: Achievements and Challenges." IMF Working Paper No. 09/236.
- Svensson, Lars E.O. (1997) "Inflation Forecast Targeting: Implementing and Monitoring Inflation Targets." *European Economic Review*, 41, 1111-46.
- Svensson, Lars E.O. (2000) "Open-economy Inflation Targeting." *Journal of International Economics*, 50, 155-83.
- Truman, Edwin M. (2003) "Inflation Targeting in the World Economy." Washington, DC: Institute for International Economics.

- Vega, Marco, and Diego Winkelried. (2005) "Inflation Targeting and Inflation Behavior: A Successful Story?" *International Journal of Central Banking*, 1, 153-75.
- Walsh, Carl E. (2009) "Inflation Targeting: What Have We Learned?" *International Finance*, 12, 195-233.

Annex 1. List of variables and data sources

Variable	Description of variable	Data sources
Broad money growth volatility	(1) Annual standard deviation of monthly broad money growth rates (2) 3-year rolling standard deviation of annual broad money growth rates (in sensitivity analysis)	IFS IMF, Datastream
Capital account openness	Chinn-Ito index for capital account openness of a country (KAOPEN)	Chinn and Ito (2008), based on the IMF's Annual Reports on Exchange Arrangements and Exchange Restrictions.
Currency risk	- External debt as percentage of GDP (debt for OECD countries is calculated using the IFS data on International Investment Position) - FDI inflows; Portfolio investment inflows as percentage of GDP	WDI&GDF World Bank, IFS IMF, Datastream
Economic development	Log of real GDP per capita, in U.S. 2000 prices	WDI&GDF World Bank
Exchange rate regime	(1) Dummy, 1- floating exchange rate regime, 0 – fixed exchange rate regime (2) Polynomial indicator, values from 1 (hard peg) to 14 (freely falling) (in sensitivity analysis)	Levy-Yeyati and Sturzenegger (2005); Reinhart and Rogoff (2004)
Exchange rate volatility	Annual standard deviation of monthly percentage changes in REER (for Sudan, Guatemala, Estonia, Latvia, Lithuania – market exchange rates)	IFS IMF, Datastream
Financial development	Liquid liabilities/GDP; Private credit (of banks and other financial institutions)/GDP Stock market capitalization/GDP; Deposit money bank assets/GDP	Financial Structure Dataset (April 2010)
Financial instability	Financial crisis dummy, 1 – a financial crisis occurred in a given year, 0 – otherwise	Honahan and Laeven (2005), Laeven and Valencia (2008)
Financial structure	Dummy, 1 – market-based financial system (Structure Index above mean), 0 – bank-based system (Structure Index below mean)	Own calculations based on Financial Structure Dataset of Beck and Al-Hussainy (April 2010)
Fiscal balance	Fiscal surplus as percentage of GDP	WDI&GDF World Bank, IFS IMF, Datastream
GDP growth	Annual percentage growth rate	WDI&GDF, World Bank; IFS IMF
Government debt	Central government debt as percentage of GDP	Datastream, IFS IMF; Jaimovich, and Panizza (2010): The Dataset on Central Government Debt
Inflation	CPI inflation rate, transformed as $\frac{p/100}{1+p/100}$	IFS IMF; Datastream
Inflation targeting	Dummy, 1- a country adopted inflation targeting in year t , 0 – otherwise	See sources to Table 2
Central bank instrument independence	Legal index: 1 – central bank is instrument independent, 0 – otherwise Actual index: (legal index * rule of law index)	Cukierman, Webb, and Neyapti (1992), Cukierman, Miller, and Neyapti (2002), Arnone et al. (2007), central banks' laws; International Country Risk Guide database.
OECD member	Dummy, 1- a country is an OECD member, 0 – otherwise	www.oecd.org
Openness of economy	Sum of export and import as a share of GDP	WDI&GDF World Bank, IFS IMF
Output volatility	(1) Annual standard deviation of monthly Industrial Production growth rates (2) 3-year rolling standard deviation of annual GDP growth rates (in sensitivity analysis)	Datastream; WDI&GDF, World Bank; IFS IMF

Annex 2. Correlation matrix of explanatory variables

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Inflation	1.00																			
2	Output growth	-0.04	1.00																		
3	Output volatility	-0.13	-0.18	1.00																	
4	Exchange rate regime	0.12	0.04	-0.24	1.00																
5	Exchange rate volatility	0.34	-0.29	-0.12	0.15	1.00															
6	Money growth volatility	0.51	-0.11	0.01	-0.04	0.25	1.00														
7	Fiscal balance	-0.18	0.27	-0.13	-0.19	-0.13	0.01	1.00													
8	Government debt	-0.19	0.11	0.36	-0.03	-0.04	0.03	-0.13	1.00												
9	Openness of the economy	-0.20	0.27	-0.01	-0.31	-0.11	-0.08	0.58	0.11	1.00											
10	External debt	-0.14	-0.09	0.01	-0.24	-0.11	0.02	0.06	-0.03	0.12	1.00										
11	Portfolio investment inflows	-0.07	0.06	0.04	-0.14	-0.13	0.02	0.11	-0.07	0.14	0.65	1.00									
12	FDI inflows	-0.12	0.23	-0.06	-0.25	-0.13	-0.02	0.42	0.02	0.60	0.10	0.01	1.00								
13	Financial crisis	0.12	-0.26	-0.05	0.13	0.39	0.08	-0.22	0.04	-0.13	-0.09	-0.11	-0.16	1.00							
14	Financial structure	0.12	0.08	-0.35	0.16	0.07	0.04	0.04	0.01	0.11	-0.07	-0.15	-0.03	0.13	1.00						
15	Stock market capitalization	-0.27	0.10	-0.14	-0.01	-0.11	-0.08	0.32	0.16	0.49	0.11	0.02	0.24	-0.08	0.46	1.00					
16	Bank assets	-0.40	-0.22	0.11	-0.13	-0.17	-0.17	0.09	0.17	0.22	0.35	0.16	0.02	0.02	-0.13	0.43	1.00				
17	Liquid liabilities	-0.40	-0.14	-0.02	0.01	-0.12	-0.20	0.02	0.38	0.22	0.17	0.06	0.05	0.07	-0.01	0.49	0.87	1.00			
18	Private credit	-0.41	-0.23	0.00	-0.07	-0.18	-0.19	0.15	0.01	0.20	0.34	0.18	0.00	-0.01	0.06	0.57	0.84	0.70	1.00		
19	Financial development	-0.43	-0.15	-0.01	-0.07	-0.17	-0.18	0.18	0.19	0.32	0.29	0.13	0.09	0.00	0.11	0.72	0.92	0.88	0.92	1.00	
20	Central bank instrument independence (legal index)	-0.19	-0.08	0.01	-0.07	-0.12	0.04	0.04	-0.14	-0.13	0.27	0.11	0.04	-0.15	-0.25	-0.16	0.01	-0.15	0.05	-0.06	1.00

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