First draft

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Inflation Targeting Twenty Years on: Where, Why, Which results, What lies ahead? *

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Abstract

This paper looks back at 20 years of inflation targeting (IT) in the world, reviewing previous findings and reporting new cross-country and panel-data evidence on the determinants or IT regime choice and the results of IT adoption. After describing the where and when of IT adoption, the paper assesses the determinants of why countries choose this monetary regime against alternative candidates. Which have been the main results under IT? Next the paper focuses on several dimensions of monetary policy performance under IT. One is target achievement; beyond measuring cross-country differences in target deviations, the paper assesses empirically what lies behind those deviations. Two, it reviews monetary policy efficiency more broadly, comparing output and inflation volatility under IT to volatility observed in non-IT experiences. Three, it surveys descriptive evidence on monetary policy transparency attained under IT in comparison to other monetary regimes. A brief discussion of current challenges to monetary policy under IT closes the paper.

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Carl Walsh (2009):

"The ability to deal with demand shocks and financial crises can be enhanced by a commitment to an explicit (inflation) target"

Joseph Stiglitz (2008):

"Today, inflation targeting is been put to the test – and it will almost certainly fail"

Introduction

It's been two decades since the Reserve Bank of New Zealand pioneered modern monetary policy practice by adopting inflation targeting (IT). Since then, IT has gained reputation, becoming the monetary regime of choice among central bankers and many academics. This preference has been revealed by the fact that no central bank endowed with monetary sovereignty that has adopted IT has abandoned IT – to date, at least.[1] While at the time of this writing, in the midst of the worst financial crisis and global recession in a lifetime, it seems a bit early, my bet is that Walsh will be right in its quote and Stiglitz will be wrong.

Widespread adoption of IT as the frontier monetary regime around the world poses some questions about the economic and institutional factors that lead countries to adopt and sustain IT, and about the potential policy and performance benefits of IT. On what drives countries to implement IT, previous work points toward the role of initial institutional and economic conditions satisfied when adopting and maintaining IT adoption (e.g., Mishkin and Schmidt-Hebbel, 2002). In contrast, Batini and Laxon (2007) show that initial conditions do not matter for adopting IT – most countries build up gradually, after starting IT, better macroeconomic conditions and institutional features of full-fledged IT.

[1] Three European countries (Finalnd, Spain, and the Slovak Republic) that had adopted IT in the past have relinquished monetary sovereignty since by joining the Euro area and hence abandoning IT. More European countries will follow in the future.

The literature on the benefits of IT is older and more deeper, spanning a decade of empirical research on the potential effects on inflation levels, output and inflation stability, inflation expectations, exchange-rate to inflation pass-through, monetary policy effciiency, among other policy performance indicators. Such research includes, *inter* alia, country and cross-country empirical work reported by Landerretche *et. al*., 2002; Mishkin and Savastano, 2000; Mishkin and Schmidt-Hebbel, 2002; Schmidt-Hebbel and Werner, 2002; Carare and Stone, 2003; Vega and Winkelried, 2005; and other contributions published in the volumes edited by Bernanke *et. al*., 1999; Bernanke and Woodford (2005); and Mishkin and Schmidt-Hebbel (2008). An important outlier is the finding by Ball and Sheridan (2005) that IT does not improve macroeconomic performance in undustrial countries, compared to other industrial countries that do not target inflation, at least explicitly.

IT also enhances the transparency of monetary policy, largely because it relies heavily on inflation forecasts (hence Svensson's labeling of IT as "inflation-forecast targeting) and private-sector inflation expectations. This feature enhances the efforts of IT central banks in strengthening their forms of communication avenues with the markets and the general public, upgrading and reinforcing their transparency and governance as polic y institutions. Eijffinger and Geraats (2006), and more recently Geraats (2008) show that provide evidence Moreover, as IT aims at anchoring inflation expectations, central banks that aply IT tend to be more transparent in the overall conduct of monetray policy than other central banks.

Yet against IT's generally remarkable record, the recent and still ongoing 2002-2010 boom-bust cycle, triggered and deepened by a massive financial crisis, has put into question the analytical foundation, forecasting, and policy making of modern monetary policy making – with or without explicit IT. For example, Buiter's (2008, 2009) scathing indictment of modern macroeconomics, finance, and monetary policy is contributing to a timely debate of the limitations and failures of the analyical foundation and the practice of monetary policy.

This paper is laid out as follows. I start in section 1 by describing the where and when of IT adoption, focusing on the world sample of currently 28 countries that have IT in place. Next I focus on the why of IT adoption, by assessing empirically the main determinants that lead central banks to choose this monetary regime. In section 3 I review the cross-country performance of IT central banks in attaining their targets, assessing empirically the role of institutional factors that drive those results. Then I present and survey evidence on the role of IT in three areas of monetary policy performance: inflation levels, policy efficiency, and policy transparency. In section 5 I discuss some questions posed to the conduct of monetray policy at large – and under IT in particular – by the still ongoing boom-bust cycle *cum* financial crisis. Brief conclusions close the paper.

1. Where and when? The spreading of IT

The number of IT countries has grown from 1 in 1989-1990 (New Zealand, the mother of all ITers) to 28 in late 2008 (Fig. 1). Among industrial countries, IT is not particularly popular – only 8 of them have joined the IT club to date, the last two ones in 1999. One reason for this is the continuous erosion of monetary sovereignty in Europe as a result of the gradual growth of the Euro Area. The second is that the Big Three – the Fed, the ECB, and the Bank of Japan – have not adopted IT, at least not of the explicit sort favored by the 28 countries included in this paper.[2]

Among developing and emerging-market economies (denoted EMEs subsequently), IT spread early and quickly, starting with Chile in 1991 and attaining a world sub-sample of 20 countries spread over four continents in late 2008. Many EMEs initially adopted partial IT, adopting only later, and often only very gradually, all the bells and whistles of full-fledged IT, including abolition of exchange-rate bands and policy transparency requirements. Moreover, many EME ITers use IT as a price stabilization device, adopting IT at initially moderatde to high inflation levels and pre-announcing a sequence of annually declining inflation targets – what is termed converging-target ITers. While until late 2008 10 EME ITers have graduated from target transition by attaining low-inflation stationary inflation targets, 10 other EMEs are still converging toward stationary targets (Table 1).

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[2] The one possible exception is Switzerland. The Swiss National Bank does not define its monetary policy framework as that of an explicit inflation targeter. Yet I have decided to include Switzerland in the world population of ITers due to the close similarity of its monetary policy regime to those of other ITers.

Adoption dates and inflation rates during the 12 months before adoption show the contrasting experience of IE ITers (with low initial inflation rates; Fig. 2) and many EME ITers (with moderate to high initial inflation rates; Fig. 3).

2. Why? The determinants of adopting IT and holding on to it

Central banks devote time to evaluate if their country's macroeconomic conditions and their own institutional setup and policy framework are ripe for IT adoption, i.e., if they meet so-called pre-conditions for successful IT adoption and maintaining. Standard initial conditions identified by earlier literature include central bank operational independence, absence of fiscal and financial dominance, and moderately low inflation (e.g., Mishkin and Savastano, 2000). In contrast, Batini and Laxton (2008) show that the absence of some of the latter prerequisites, among other preconditions, is no hindrance for sucessful adoption

Next I report selectively work in progress by Calderón and Schmidt-Hebbel (2008) that assesses empirical determinants of the likelihood of choosing IT among alternative monetary regimes. The panel-data specification is the following:

(1) $$y_{i,t} = 1(x_{i,t}'\beta + u_i + e_{i,t} \geq 0)$$

where y is a variable that is set equal to 1 if the argument (the IT choice) is positive and 0 otherwise. The suite of possible determinants are grouped in matrix x. The country-specific effect is u, e is a zero-mean disturbance term, and i and t are country and time subscripts, respectively.

Equation (1) is estimated by using discrete-choice panel estimation techniques applied to annual data covering 1975-2005 for 98 IT and non-IT countries.[3] Selective results are reported in Table 2. Inflation affects negatively the likelihood of adopting IT. The fiscal position (measured by the government balance ratio to GDP) and domestic

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[3] Both fixed and random-effects models are estimated. The fixed-effects approach drops the country-specific effects out of the estimation for assuring consistency in the slope parameters (in contrast to the individual effects). The random-effects approach typically assumes a joint normal distribution between individual effects and the rest of the inflation determinants. The drawback of the first approach is that the estimator is restricted to those individuals whose regime choice changes over time – the so-called movers.

financial development (proxied by the private credit ratio to GDP) raise the probability of having IT in place. The two latter variables suggest that a country is more likely to adopt IT in the absence of fiscal and financial dominance, which conforms to the earlier literature on IT preconditions. Also consistent with previous policy views, we report results that IT is more likely in countries with a floating exchange-rate regime in place. GDP per capita – a proxy of overall institutional development, including, for example, central bank independence – is also a significant determinant. Trade openness stands as a proxy for domestic imitation of best monetary policy practice abroad. All the latter variables, as reflected by a significant number of alternative specifications, are significant and robust determinants of the choice of IT.

Unfortunately the latter estimation approach drops the country-specific effects and therefore preclude proper computation of the marginal effects of individual determinants on the likelihood of having IT in place. Leyva (2008) overcomes this limitation by estimating jointly the individual (country-specific) effects and the slope parameters, at the cost of restricting the country sample to 25 ITers, spanning 1989-2005, i.e., including years before IT adoption for each included country.[4]

The estimation results by Leyva (2008), based on a similar specification, are also similar to those reported in Table 2. His estimated marginal effects of for the main IT choice determinants are reproduced in Table 3. The largest marginal effects stem from changes in overall development: raising income levels from, say, Indonesia's to Poland's contributes in raising the likelihood of having IT in place by a massive 66%. Significnat improvements in the three other determinants have a much smaller impact on the choice of IT.

3. Inflation Deviations from Targets

Monetary policy success hinges on consistent central bank behavior and strong private-sector credibility. Inflation targeters have been aiming at the latter by committing to

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[4] Although the number of countries is severely restricted, he shows that the bias in the estimation of slope parameters is reasonably small.

explicit inflation targets. Have they succeeded in meeting their targets? And what explains their success? I answer these questions in two steps. First, I measure inflation deviations from targets using three alternative measures and I estimate half-lives of inflation shocks, for each and every IT country experience and several country groups. Second, I report empirical estimations of the role played by institutional and macroeconomic performance measures in explaining the panel-data variation in inflation deviations vrom targets, based on Albagli and Schmidt-Hebbel (2008).

For measuring inflation deviations from targets I use quarterly data of year-on-year consumer inflation for 28 inflation targeters covering 1990-2008 and offical inflation targets announced since the corresponding IT starting date.[5]

Three alternative inflation deviation measures are reported for each country since the corresponding starting date in Table 5: the mean absolute error (MAE), the mean squared error (MSE), and the root mean squared error (RMSE). Countries are ordered from smallest (Switzerland) to largest (Ghana) MSE or RMSE. The country ranking by MAE is slightly different from the rankings based on any of the two alternative measures but the value or rank correlation between MAE and any of the two alternatives is very high. Interestingly, persistence of inflation shocks – measured by the half-life of monthly inflation deviations from targets[6] – is largely orthogonal to the size of inflation deviations across countries, as shown by the second column of Table 4. Half-lives of inflation deviations range from lows of 6 to 8 months (Armenia, Mexico, Turkey, Norway; although some of these include very few observations) to highs of 27-29 months (United Kingdom, Philippines).

Figures 4-7 depict quarterly inflation deviations measured as MAE for each country over time. Figures 8 and 9 report RMSEs for each country by four main country groups. The average RMSE for EMEs is equal to 3 percentage points (p.p.), more than twice the

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[5] Quarterly inflation rates are taken from the IFS (IMF) database. I use annual inflation targets publicly reported in central bank web pages. I calculate quarterly targets by interpolation, assuming that the fourth-quarter inflation target is the annual inflation target announced for the corresponding year.

[6] Half-lives are computed from a simple AR(1) process for each country's inflation deviation from target, by calculating the impulse response of a unitary shock (1 percentage point).

IC’s average RMSE of 1.4 p.p. (Fig. 8). The average RMSE of stationary ITers is 2 p.p., close to half to the converging ITers’ 3.8 p.p. RMSE.

For assessing how inflation deviations have changed over time, I finally compute rolling estimations of RMSEs, using a window size of 8 quarters (Figure 10). Before 2007 both industrial and emerging economies exhibit downward RMSE trends, during the period that had been labelled as the “Great Moderation” (IMF 2006). This came to an abrupt end during the late phase of the boom, as unprecedented commodity price inflation was passed through consumer prices all over the world – especially in EMEs and even more so in converging-target EMEs. Yet for the full 1992-2008 period, this figure confirms that RMSEs are consistently larger in EMEs than in IEs, and so they are in converging as compared to stationary ITers.

Next I focus on potential determinants of inflation target deviations. I follow Albagli and Schmidt-Hebbel (2008) in specifying the deviation of inflation from target as a function of institutional development, controllling for oil and exchange-rate shocks:

$$(2) \quad AD_{i,t} = \beta_1 abs(OIL_{i,t}) + \beta_2 abs(NER_{i,t}) + \beta_3 IICR_{i,t} + u_i + e_{i,t}$$

where *AD* is the absolute value of inflation deviation, *abs()* denotes absolute value, *OIL* is the HP-filtered oil price, *NER* is the nominal exchange rate depreciation, and *IICR* is the Institutional Investor’s Credit Rating index. The country-specific effect is u, e is a zero-mean disturbance term, and i and t are country and time subscripts, respectively Finally, *u* is a country effect and *e* is the error term.

The main hypothesis is that IICR (and a separate measure of central bank independence, CBI) could reflect stronger monetray policy credibility and better-anchored inflation expectations, reducing the size of inflation deviations from targets. Table 5 reports unbalanced panel-data evidence from a world sample of 19 IT countries of annual data spanning at most 1990-2003. Controlling for the influence of oil and exchange-rate shocks, IICR is shown as a significant and robust factor in lowering inflation deviations. CBI may also help in reducing inflation deviations from targets but its influence is less robust to changes in specification.

4. Which other Results?

In this section I report other performance results of IT, also drawing from cross-country and panel-data evidence. I focus on three performance measures: long-term inflation levels, monetary policy efficiency, and central bank transparency.

Mishkin and Schmidt-Hebbel (2007) assess empirically the effects of IT on inflation, taking as a starting point previous cross-section studies on differences in long-term inflation between ITers and non-ITers. Table 6 summarizes the results of previous studies, adding new estimates by the authors, which show that long-term inflation levels are higher in IT countries than in a stringent controil group of high-performing non-IT industrial countries. Hence empirical results are highly sensitive to the choice of the relavant control group. Moreover, cross-section estimates should be dismissed due to their poor specification (inflation is not instrumentalized for) and the lack of the time dimension. Therefore Mishkin and Schmidt-Hebbel (2007) specify a panel-data IV specification estimated on a large annual cross-country sample of IT and no-IT countries. Table 7 summarizes a wide range of long-term inflation differences between ITers and non-ITers. Those differences are due to different choices of treatment and control groups, confirming that such choices are key for obtaining differential results. However, it is interesting to note that long-term inflation is 1.1% lower in the subset of IE ITers than in the control group of IE non-ITers, in opposition to the cross-country result by Ball and Sheridan (2005), who report no differences betweeen IE ITers and non-ITers.

Calderón and Schmidt-Hebbel (2008) also find that having IT in place lowers inflation rates. They assess the role of non-monetray factors in determining inflation in a world panel based on the following specification:

$$(3)\quad \pi_{i,t} = \beta_0 + \beta_1 INFR + \beta_2 MERR + \beta_3 OPN + \beta_4 STIN + \beta_5 CYC + u_i + e_{i,t}$$

where π is the normalized inflation rate, INFR stand for inflation-related variables (high inflation, hyperinflation dummies and inflation inertia), MERR is a set of dummy variables for monetary and exchange rate regimes, OPN stands for trade, financial, and likely effects of global shocks, STIN is a set of structural and institutional variables (democratic accountability, GDP per capita, fiscal surplus, private credit over GDP), and finally, CYC denotes cyclical variables, such as output gap and oil gap. Finally u is a country-specific effect and e is the error term.

The world sample is based on annual data covering the period 1975-2005 and comprising 97 countries, including both ITers and non-ITers. Estimation for inflation is based on broad specifications using different-panel data estimation techniques and frequencies of data. Selective results are reported in Table 8. The main result for the subject of this paper is that having an IT regime in place lowers inflation by 5 p.p. Note that here the control group is comprised by all non-IT countgries in the world included in this study, among them a dominant sub-set of developing economies.

This result is robust to using different samples, estimating techniques, and specifications that control for a host of inflation determinants. Other than the IT regime, significant and robust variables that reduce inflation in the world are measures of financial openness, the fiscal balance, income per capita, the output gap, and a fixed exchange-rate regime.

Next I turn to the issue of monetary policy efficiency. One way of gauging macroeconomic performance is to focus on the stability of inflation and real output. Extending previous work by Cecchetti et al. (2005, 2008), Mishkin and Schmidt-Hebbel (2007) estimate the inflation and output variability frontier that allows them to derive measures of economic performance and monetary policy efficiency. Under a quadratic loss function they estimate the contribution of supply shocks as an index that is a function of the deviation of inflation and output from their targets under an optimal policy. This supply shock variability is interpreted as a change in the position of the efficiency frontier. The efficiency of monetary policy is measured by the distance between the economy's actual volatility performance from the policy efficiency frontier.

To construct an empirical efficiency frontier, they estimate the system of aggregate demand and supply equations by system GMM, based on quarterly data for 1989-2004. They solve for the minimization of the loss function of the central bank subject to the constraint imposed by the structure of the economy, given by the estimated system. With the latter solution and by varying the weight of inflation in the policymaker's loss function, the policy efficiency frontier is derived. This is performed for different time and country subs-sets of the treatment group comprised by ITers and subsets of control groups comprised by non-ITers. The efficiency frontier is derived for country groups, not for individual countries.

Figure 11 depicts the efficiency frontiers and points of actual output and inflation volatility observed for inflation targeters before they adopted IT and for stationary ITers after they converged to stationary targets. In an analogous way, Figure 12 plots efficiency frontiers and observed volatility points for stationary inflation targeters (again) and for the contriol group on non-IT economies. The bottom line here is that although IT has helped to improve massively the efficiency of monetary policy of ITers, it still falls short of policy efficiency observed in the stringent control group of high-performing non-IT industrial countries.

Finally I review the contribution of IT in attaining higher levels of central bank transparency, based on simple unconditional analysis derived from the data collected by other researchers. Policy transparency is a key issue for IT central banks as they aim at anchoring inflation expectations. Eijffinger and Geraats (2006) develop an aggregate central bank transparency index based on performance indicators grouped into five measures: political transparency (related to policy objectives), economic transparency (related to information disclosure on data, models and forecasts), procedural transparency (which refers to the release of minutes and votes), policy transparency(related to the announcement and explanation of policy decisions), and operational transparency (regarding implementation of policy decisions).

Figure 13, borrowed from Geraats (2008), plots the transparency index calculated for countries with four alternative monetary policy regimes over the period 1998-2006.

ITers achieve by far the highest levels of aggregate centgral bank transparency among all countries pursuing different monetary regimes. Moreover, ITers have been able to increase over time the distance in transparency from countries under other regimes. Dincer and Eichengreen (2007) extend the latter database by including more countries and separating between ICs and EMEs. Figure 14 reflects the transparency improved attained by IC and EME ITers during 1998-2005. While transparency in IC ITers is much larger than in EME ITers, the gap is narrowing over time.

5. What lies ahead for IT regimes?

I will refer to two sets of challenges that lie ahead for IT central banks. The first relates to demands for enlarging monetary policy transparency. The second stems from questions posed by the handling of monetary policy during the current bomm-bust cycle.

The evidence discussed in this and other papers on the comparative achievements of monetary policy under IT suggests that explicit IT dominates other successful monetary regimes (including implicit IT and other non-explicit monetray regimes, like those pursued by the Big Three) in three dimensions. First, IT enhances transparency and accountability, as shown by the evidence reported by Geraats and stressed by Walsh (2008). IT also provides more predictability because of less discretion in monetary policy decisions (Walsh, 2008). Third, IT guarantees better anchoring of inflation expectations (Gürkaynak et al., 2007 and De Carvalho and Minella, 2009).

But many inflation-targeting central banks still face important transparency and communication challenges. First, following the advicde of academics and the encouraging of several IT centgral banks, all ITers should publishing their interest-rate forecasts and fan charts, complementing publication of inflation and output growth forecasts and fancharts. Second, to make a clearer, more transparent connection between monetary policy decisions and full base-scenario of central banks, they also should publish their backcasts and forecasts of key unobservables variables, including potential output (and the output gap), natural unemployment (and the natural rate of unemployment), the neutral rate of interest (and the interest-rate gap), and the equilibrium exchange rate. Finally, while central banks have made improvements in procedural transparency, they should commit to publishing timely and full transcripts (minutes) of their monetary policy meetings.

Frontier monetary policy—both explicit and implicit IT— is severely challenged by our current understanding of the crises and the boom-and-bubble period that preceded it. Stiglitz, quoted at the beginning of the paper, has certainly a point, although one may not share his pessimistic conclusion.

Monetary theorists and central bank practitioners ought to focus on the following issues that the crisis has put into the open. First, central banks should reevaluate their choice of inflation target levels in the light of the zero lower rate bound attained by major IT and non-IT cenytral banks in fighting the financial crisis and recession. A related issue is to come to a better theoretical and practical understanding of how conventional monetary policy is complemented by unconventional monetary policy, as reflected by the massive depolyment of quantitative and credit easing to provide liquidity to illiquid financial markets and firms. Another challenge for IT design is to assess the possible extension of standard policy horizons under IT (typically between 2 and 3 years) to 5 years or more, as suggested recently bu Mishkin (2008). Careful evaluation should also be devoted to more radical proposals relating to an extension of the standard two-argument policy function, either by giving a larger weight to output (especially, loner-term output forecasts) and to consider additional arguments in the objective and policy functions, such as credit growth gaps and/or asset price gaps. The discussion of the latter proposals will certainly focus on how the tradeoffs involved, including those involving the commitment to and credibility of the inflation target vis-s-vis those additional objectives.

6. Conclusions

IT has come a long way since its birth two decades ago. The evidence shows that IT is not observationally equivalent to other monetary regimes used by frontier central banks (like implicit IT) or to best-practice monetary policy—neither in design nor in performance. Moreover, IT dominates alternative monetray regimes (including implicit IT and non-explicit regimes) in several dimensions. Yet the current crisis and the preceding boom-and-bubble period pose serious challenges to IT as we know it – and to modern monetray policy making in general.

Many more emerging economies are likely to adopt a variant of IT in the future. It is also possible that some current ITers in Europe will drop out of the club as they join the Euro area. Yet the specific form that frontier best-practice IT will take in the next (third) decade of its existence is far from clear now—the same way the current frontier IT regime was not anticipated at the birth of IT two decades ago.

References (to be completed):

Albagli, E. and K. Schmidt-Hebbel (2008). "By how much and why do inflation targeters miss their targets?" *manuscript,* Santiago.

Bernanke, B. and M. Woodford (2005).

Bernanke, B., T. Laubach, F. Mishkin and A. Posen (1999). "Inflation Targeting: Lessons from the International Experience." Princeton University Press.

Ball and Sheridan (2005), in Bernanke and Woodford, *op.cit.*

Calderón, C. and K. Schmidt-Hebbel (2008). "What drives inflation in the world?" *Central Bank of Chile Working Paper* No. 491.

Calderón, C. and K. Schmidt-Hebbel (2008). "What drives the choice of inflation targets in the world?" m*anuscript*.

Carare, A. and M. Stone (2003). "Inflation targeting regimes." *IMF Working Paper* WP/03/9.

Cecchetti, S. *et al.*

Dincer, N. and B. Eichengreen (2007). "Central bank transparency: where, why, and with what effects," *NBER Working Paper* No. 13003.

Eijffinger, S. and P. Geraats (2006). "How transparent are central banks?" *European Journal of Political Economy* 22:1-22.

Geraats, Petra (2008). "Trends in monetary policy transparency," Bank of Canada Economic Conference Presentation, Ottawa.

Gürkaynak, R.S. A. Levin, A. Marder and E. Swanson (2007). "Inflation targeting and the anchoring of inflation expectations in the Western Hemisphere," in F.S. Mishkin and K. Schmidt-Hebbel (eds). *Monetary Policy under Inflation Targeting*. Central Bank of Chile.

Landerretche, O, V. Corbo and K. Schmidt-Hebbel (2002). "Does Inflation Targeting Make a Difference? In N. Loayza and R. Soto (eds.) *Inflation Targeting: Design, Performance, Challenges*. Central Bank of Chile.

Laxton, D. and N. Batini (2007). "Under what conditions can inflation targeting be adopted? The experience of emerging markets" in F.S. Mishkin and K. Schmidt-Hebbel (eds). *Monetary Policy under Inflation Targeting*. Central Bank of Chile.

Leyva, Gustavo (2008). "The choice of inflation targeting." *Central Bank of Chile Working Paper* No. 475.

Mishkin (2008).

Mishkin, F and M. Savastano (2000). "Monetary Policy Strategies for Latin America." NBER *Working Paper*, No. 7617.

Mishkin, F. and K. Schmidt-Hebbel (2002). "A Decade of Inflation Targeting in the World: What do we know and what do we need to know? In N. Loayza and R. Soto (eds). *Inflation Targeting: Design, Performance, Challenges*. Central Bank of Chile.

Mishkin, F and K. Schmidt-Hebbel (2008). "Does Inflation Targeting Make a Difference?" In F. Mishkin and K. Schmidt-Hebbel (eds.) *Monetary Policy under Inflation Targeting*. Santiago: Central Bank of Chile.

Schmidt-Hebbel, K and A. Werner (2002). "Inflation Targeting in Brazil, Chile, and Mexico: Performance, Credibility, and the Exchange Rate." Banco Central de Chile, *Documento de Trabajo*, No. 171.

Stiglitz, Joseph (2008). "The failure of inflation targeting," Project Syndicate.

Vega. M. and D. Winkelried (2005). "Inflation Targeting and Inflation Behavior: A Successful Story" *International Journal of Central Banking*. Vol. 1, No. 3. December.

Walsh, Carl (2009). "Inflation targeting: what have we learned" m*anuscript,* University of California, Santa Cruz, January.

Table 1: Inflation Targeters classified by Country Groups

Country	*Date of Adoption*	*Inflation Target at the End of 2008 (%)*	*Definition of an Inflation Targeter according to:*	
			Country Group	*Inflation Targets Path*
Armenia	2006	4.00	E	C
Australia	1993	2.50	I	S
Brazil	1999	4.50	E	C
Canada	1991	2.00	I	S
Chile	1991	3.00	E	S
Colombia	2000	4.00	E	C
Czech Republic	1998	3.00	E	S
Ghana	2007	5.00	E	C
Guatemala	2005	5.00	E	C
Hungary	2001	3.00	E	C
Iceland	2001	2.50	I	S
Indonesia	2005	5.00	E	C
Israel	1992	2.00	E	S
Korea	1998	3.00	E	S
Mexico	1995	3.00	E	S
New Zealand	1990	2.00	I	S
Norway	2001	2.50	I	S
Peru	1994	2.00	E	S
Philippines	2002	4.00	E	S
Poland	1999	2.50	E	S
Romania	2005	3.80	E	C
Serbia	2007	4.50	E	C
South Africa	2000	4.50	E	S
Sweden	1993	2.00	I	S
Switzerland	2000	1.00	I	S
Thailand	2000	1.75	E	S
Turkey	2006	4.00	E	C
United Kingdom	1993	2.00	I	S

Notes:

Adoption dates are taken from Leyva (2008)

Inflation targets are taken from central bank's web pages

The middle point of the target is reported when the inflation target is defined as a range

If the inflation targeting adoption date is July or later of any year t, the annual date reported is year t+1

E=emerging, I=industrial, S=stationary, and C=converging

Table 2: Determinants of the Likelihood of having an IT Regime in place

	Fixed effects Logit		Random effects Logit					
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
Inflation	-130.026 ***	-117.311 ***	-35.392 ***	-36.295 ***	-43.349 ***	-36.421 ***	-39.508 ***	-33.487 ***
	(2.95)	(3.18)	(5.10)	(5.46)	(6.13)	(5.88)	(6.63)	(6.46)
Government budget balance	-25.066	-	19.307 **	20.685 **	15.040 **	17.909 **	-	-
	(1.45)	-	(2.07)	(2.31)	(1.98)	(2.53)	-	-
Financial development	19.872 ***	16.881 ***	0.775	-	3.299 ***	3.186 ***	2.633 ***	2.677 ***
	(3.07)	(3.39)	(0.55)	-	(3.19)	(3.40)	(2.99)	(3.22)
Exchange rate regime	-20.320 ***	-17.824 ***	-4.958 ***	-5.068 ***	-4.978 ***	-4.464 ***	-3.990 ***	-3.655 ***
	(3.03)	(3.22)	(5.27)	(5.54)	(7.04)	(7.20)	(7.74)	(7.49)
GDP per capita	104.027 ***	90.130 ***	5.042 ***	5.249 ***	4.605 ***	3.478 ***	4.822 ***	3.829 ***
	(3.19)	(3.56)	(4.78)	(5.29)	(5.08)	(3.49)	(5.90)	(4.19)
Trade openness	46.763 ***	42.343 ***	1.156	-	2.289 **	0.837	3.185 ***	2.134 **
	(2.83)	(3.03)	(0.82)	-	(2.06)	(0.68)	(4.01)	(2.53)
Money growth volatility	-	-	-0.142	-0.126	-	-	-	-
	-	-	(0.44)	(0.39)	-	-	-	-
Terms of trade volatility	-	-	1.760	0.959	-	-	-	-
	-	-	(0.28)	(0.15)	-	-	-	-
Dummy LAC	-	-	6.986 ***	6.741 ***	7.789 ***	-	7.433 ***	-
	-	-	(3.84)	(4.11)	(4.63)		(4.85)	-
Constant	-	-	-45.403 ***	-45.517 ***	-43.798 ***	-30.343 ***	-47.961 ***	-36.263 ***
	-	-	(5.01)	(5.27)	(5.68)	(3.44)	(7.01)	(4.57)
Observations	491	554	1143	1163	1854	1854	2305	2305
Number of countries	19	24	71	71	76	76	98	98
Countries with the IT regime	19	24	19	19	19	19	24	24
Countries without the IT regime (control group)	0	0	52	52	57	57	74	74
LR statistic	450.19	499.19	76.03	75.10	126.91	126.90	177.77	161.95
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Absolute value of z statistics in parentheses
** significant at 10%; ** significant at 5%; *** significant at 1%*

Source: Calderón and Schmidt-Hebbel (2008)

Table 3: Marginal Contribution of Key Determinants to IT Regime Likelihood

Table 12: Marginal Contribution of Key Determinants to IT Regime Likelihood

Variable	Marginal contribution	Measure	Impact of ...
CPI inflation rate	13.19%	$\pi^n = \pi/(1+\pi)$	a reduction of π^n by 10 percentage points (p.p.) which amounts roughly a reduction of π from 17% to 5%
Financial development	6.79%	ratio	an increase of the indicator by 10 p.p.
GDP per capita	65.64%	in logs	an increase of the log of GDP per capita by 1.2 which accounts for passing from 2 (8.1 Indonesia) to 3 (9.3 Poland) in income category
Trade openness	8.82%	ratio	an increase of the indicator by 10 p.p.

The figures for Indonesia and Poland correspond to averages of the log of GDP per capita computed over the period 2001-2005. For income categories see table 5.

Source: Leyva (2008)

Table 4: Inflation Deviation According to Several Measures

Country	*Number of observations*	*Half-life (in months)*	*MAE*	*MSE*	*RMSE*
Switzerland	36	11.6	0.4	0.3	0.5
United Kingdom	69	27.1	0.9	1.1	1.1
Canada	72	14.2	0.9	1.3	1.1
Sweden	56	25.3	1.1	1.6	1.3
Norway	32	8.0	1.1	2.0	1.4
New Zealand	76	20.1	1.1	2.0	1.4
Australia	64	20.0	1.1	2.1	1.4
Colombia	37	15.7	1.2	2.8	1.7
Romania	14	-	1.3	2.9	1.7
Korea	44	18.9	1.1	3.1	1.8
Thailand	36	23.2	1.2	3.1	1.8
Chile	72	14.7	1.1	3.1	1.8
Philippines	28	29.3	2.1	5.1	2.3
Czech Republic	44	14.4	1.7	5.8	2.4
Poland	42	24.4	2.0	6.1	2.5
Israel	68	14.6	2.1	7.0	2.6
Guatemala	16	14.5	2.2	7.1	2.7
Iceland	32	16.6	2.2	8.1	2.8
Armenia	12	6.8	2.5	8.2	2.9
Peru	60	9.1	1.7	8.5	2.9
Hungary	32	18.4	2.3	9.2	3.0
South Africa	36	24.7	2.4	9.5	3.1
Serbia	10	24.9	3.6	19.4	4.4
Brazil	40	22.6	2.9	19.4	4.4
Mexico	56	7.6	2.8	24.6	5.0
Turkey	12	7.1	4.9	25.3	5.0
Indonesia	16	10.3	3.9	30.4	5.5
Ghana	8	-	6.2	40.1	6.3

Notes:

Sample comprises inflation targets and inflation rates from the start of IT in each country until the fourth quarter of 2008

Half-life of an inflation deviation are defined as the number of periods that a given inflation deviation from target takes to converge to one-half its initial value

Half-lives are computed asumming that the best autoregressive process for inflation deviations for each country is an AR(1)

MAE=Mean absolute error

MSE=Mean squared error

RMSE=Root mean squared error

Table 5: Determinants of Inflation Deviations using IICR as a Credibility Proxy

	(1) AD1	(2) AD2	(3) AD3	(4) AD1	(5) AD2	(6) AD3	(7) AD1	(8) AD2	(9) AD3
C	1.144	0.860	1.147	1.914	1.294	1.880	1.962	1.277	1.925
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
ABS(AD1(-1))	0.800	0.876	0.871	0.725	0.844	0.824	0.724	0.822	0.824
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ABS(AD1(-2))	-0.191	-0.246	-0.195	-0.190	-0.261	-0.186	-0.190	-0.225	-0.185
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ABS(AD1(-3))	-0.055		-0.076	-0.087		-0.104	-0.088	-0.059	-0.104
	(0.104)		(0.037)	(0.016)		(0.004)	(0.016)	(0.098)	(0.004)
ABS(NER)		0.009	0.009						
		(0.022)	(0.031)						
ABS(NER(-1))	0.015			0.012	0.009	0.010	0.012	0.009	0.011
	(0.000)			(0.007)	(0.039)	(0.019)	(0.007)	(0.043)	(0.018)
ABS(OILG)	0.007	0.007	0.006	0.007	0.007	0.006	0.007	0.007	0.006
	(0.020)	(0.013)	(0.035)	(0.018)	(0.013)	(0.025)	(0.018)	(0.009)	(0.025)
ABS(OILG(-1))	-0.010	-0.010	-0.006	-0.010	-0.010	-0.006	-0.010	-0.010	-0.006
	(0.006)	(0.002)	(0.065)	(0.005)	(0.001)	(0.049)	(0.005)	(0.002)	(0.049)
ABS(OILG(-2))	0.009	0.006	0.006	0.008	0.006	0.005	0.008	0.005	0.005
	(0.002)	(0.016)	(0.049)	(0.004)	(0.021)	(0.063)	(0.003)	(0.044)	(0.062)
ABS(GAP(-3))	-0.040		-0.033			-0.025			-0.025
	(0.005)		(0.024)			(0.108)			(0.104)
CBI	-0.161	-0.149	-0.144						
	(0.010)	(0.007)	(0.015)						
IICR	-0.011	-0.007	-0.010	-0.020	-0.012	-0.020	-0.021	-0.011	-0.021
	(0.000)	(0.000)	(0.000)	(0.002)	(0.034)	(0.001)	(0.002)	(0.063)	(0.001)
R2	0.51	0.58	0.59	0.53	0.61	0.62	0.53	0.58	0.62
Adj. R2	0.50	0.57	0.58	0.50	0.59	0.60	0.50	0.55	0.60
U-root test 2	-22.02	-21.56	-21.84	-22.26	-21.58	-21.46	-21.46	-22.09	-18.10
N	517	536	517	517	536	517	517	517	517
Intercept	C	C	C	F-Effs.	F-Effs.	F-Effs.	F-Effs.	F-Effs.	F-Effs.
Method	OLS	OLS	OLS	OLS	OLS	OLS	TSLS	TSLS	TSLS
Sample	All	All	All	All	All	All	All	All	All

Source: Albagli and Schmidt-Hebbel (2008)

Table 6: Cross-section Inflation Levels Regressions

Authors	*Sample*	*Method*	*Long-term Inflation-level Differences (in percentage points)*
Ball and Sheridan (2005)	ICs: 7 IT, 13 NIT	Cross-section OLS	Zero[a]
Vega and Winkelried (2005)	World: 23 IT, 86 NIT	Propensity Score	(-2.6 , -4.8)[b]
IMF (2005)	EMEs: 13 IT, 22 NIT	Cross-section OLS	-4.8
Mishkin and Schmidt-Hebbel (2007)	21 world IT, 13 ICs	Cross-section OLS	1.2

Notes:

a. Zero means statistically zero

b. Denotes an interval for inflation-level differences

ICs denotes inflation converging ITers

OLS=Ordinary Least Squares

Table 7: Panel Data Inflation Levels Regressions

Treatment Group / Control Group	*Method*	*NIters and pre-ITers*	*ITers*	*pre-ITers*
All ITers	OLS	-1.9	zero[a]	-5.0
All ITers	IV	-4.8	zero	-5.0
Industrial ITers	IV	zero	-1.1	zero
Emerging ITers	IV	-7.5	zero	-6.4
Stationary ITers	IV	-2.1	zero	zero
Converging ITers	IV	-8.0	zero	-8.2

Notes:

a. Zero means statistically zero

OLS=Ordinary Least Squares

IV=Instrumental Variable Estimator

Table 8: Determinants of Inflation in the World

Table 3
Determinants of Inflation
Dependend Variable: Normalized Inflation
Estimation: Fixed Effects with Instrumental Variables
Sample. 1975-2005 (annual data)

	Fixed Effects and Random Effects Instrumental Variables Estimates				
	(1)		(2)	(3)	(4)
	FE IV	RE IV	FE IV	FE IV	FE IV
Inflation Related Variables					
Lagged Inflation	0.160 ***	-0.033	0.196 *	0.141	0.139
Normalized and Instrumented value	(1.97)	(0.22)	(1.87)	(1.42)	(1.39)
Hyper Inflation	0.348 ***	0.488 ***	0.357 ***	0.363 ***	0.364 ***
	(9.29)	(6.54)	(8.24)	(8.83)	(8.82)
High Inflation	0.232 ***	0.308 ***	0.226 ***	0.230 ***	0.232 ***
	(14.02)	(8.29)	(11.14)	(11.85)	(11.72)
Monetary and Exchange-Rate Regime					
Inflation Targeting	-0.051 ***	-0.045 ***	-0.051 † ***	-0.054 † ***	-0.055 † ***
Lagged († Not lagged but Instrumented)	(5.41)	(4.25)	(3.80)	(4.16)	(4.27)
Exchange Rate Regime	-0.029 ***	-0.037 ***	-0.031 ***	-0.033 ***	-0.033 ***
Lagged († Not lagged but Instrumented)	(7.70)	(5.97)	(6.77)	(7.70)	(7.82)
Openness					
Trade Openness	-0.009	-0.012 **	-0.019	-0.010	
Lagged († Not lagged but Instrumented)	(0.81)	(2.15)	(1.43)	(0.73)	
Capital Openness	-0.013 ***	-0.011 ***	-0.013 ***	-0.013 ***	-0.013 ***
Lagged († Not lagged but Instrumented)	(5.94)	(4.90)	(4.79)	(5.09)	(5.06)
Relevant External Inflation	0.210 ***	0.412 ***	0.169 **	0.080	0.127
Normalized	(3.11)	(4.77)	(2.10)	(0.96)	(1.57)
Structural / Institutional Variables					
Fiscal Surplus	-0.204 ***	-0.179 ***	-0.251 ***	-0.459 † ***	-0.427 † ***
Lagged († Not lagged but Instrumented)	(5.30)	(4.46)	(5.17)	(5.15)	(5.00)
Income per capita	-0.040 ***	0.012 ***	-0.045 ***	-0.051 † ***	-0.047 † ***
Lagged († Not lagged but Instrumented)	(3.67)	(3.09)	(3.46)	(4.06)	(4.20)
Domestic Private Credit	0.018 *	-0.059 ***	0.028 **	0.025 **	0.024 **
Lagged († Not lagged but Instrumented)	(1.87)	(4.65)	(2.37)	(2.26)	(2.29)
Democratic accountability	-0.002	-0.003 *	-0.002	-0.002	
	(1.22)	(1.65)	(1.05)	(0.74)	
Cyclical Domestic and Foreign Variales					
Cyclical component of oil prices	0.019 **	0.017	0.013	0.026 **	0.021 **
	(2.01)	(1.48)	(1.14)	(2.34)	(2.05)
National Output Gap	0.238 ***	0.057	1.182 † ***	0.724 † **	0.709 † **
Lagged († Not lagged but Instrumented)	(3.60)	(0.55)	(3.06)	(2.07)	(2.02)
Foreign output gap (weighted by GDP)	-0.204	-0.406	-0.565 **	-0.366	
	(0.93)	(1.40)	(2.11)	(1.45)	
Constant	0.467 ***	0.086 ***	0.504 ***	0.557 **	0.512 ***
	(4.80)	(3.68)	(4.47)	(5.09)	(5.22)
Hausman test (RE vs FE) *p-value*	0.00		0.00	0.00	0.00
Observations	1574	1574	1574	1570	1619
Number of Country number	65	65	65	65	65
R2 Overall	0.75	0.79	0.71	0.68	0.69

Note 1 : Absolute value of t statistics in parentheses
** significant at 10%, ** significant at 5%, * significant at 1%*
Note 2: The Hausman test favors FE regressions in all cases. Thus RE, being inconsistent, is no reported from equation 2

Source: Calderón and Schmidt-Hebbel (2008)

Figure 1: Number of Inflation Targeters, 1990-2008

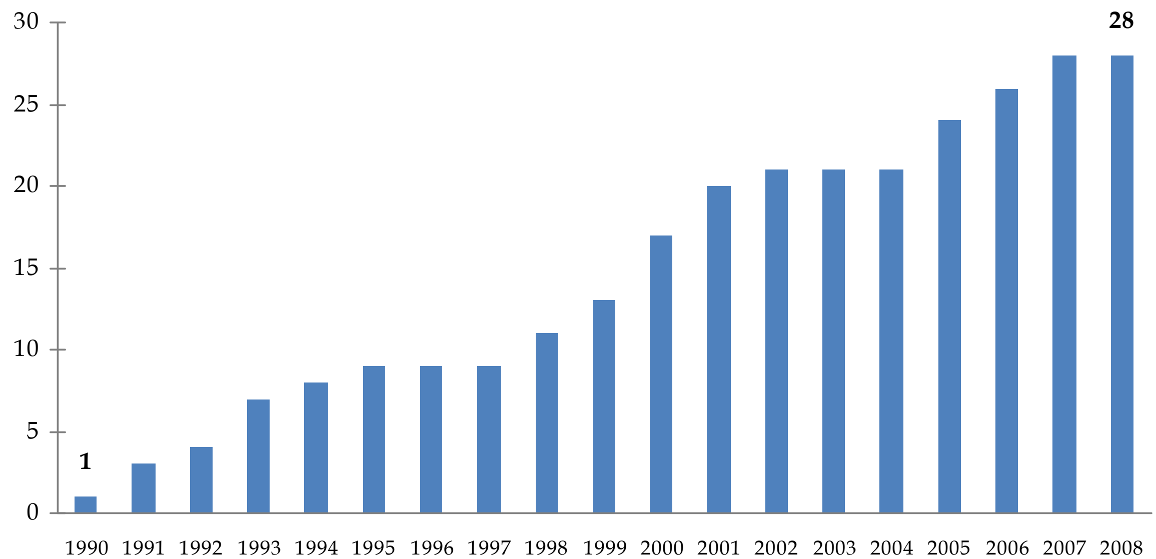
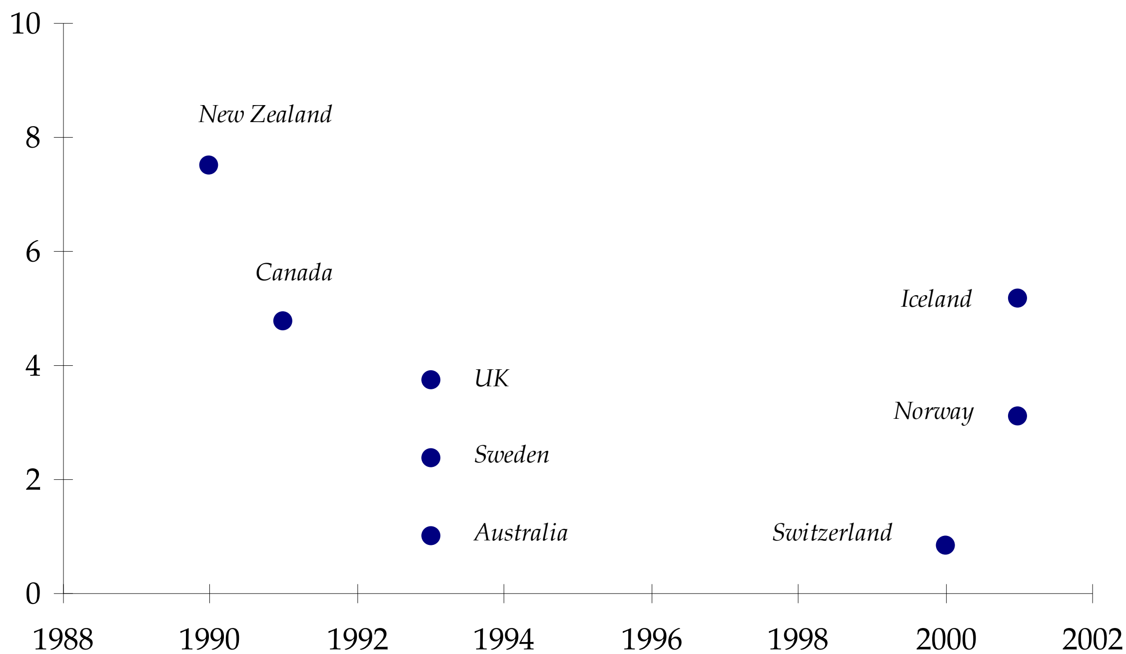
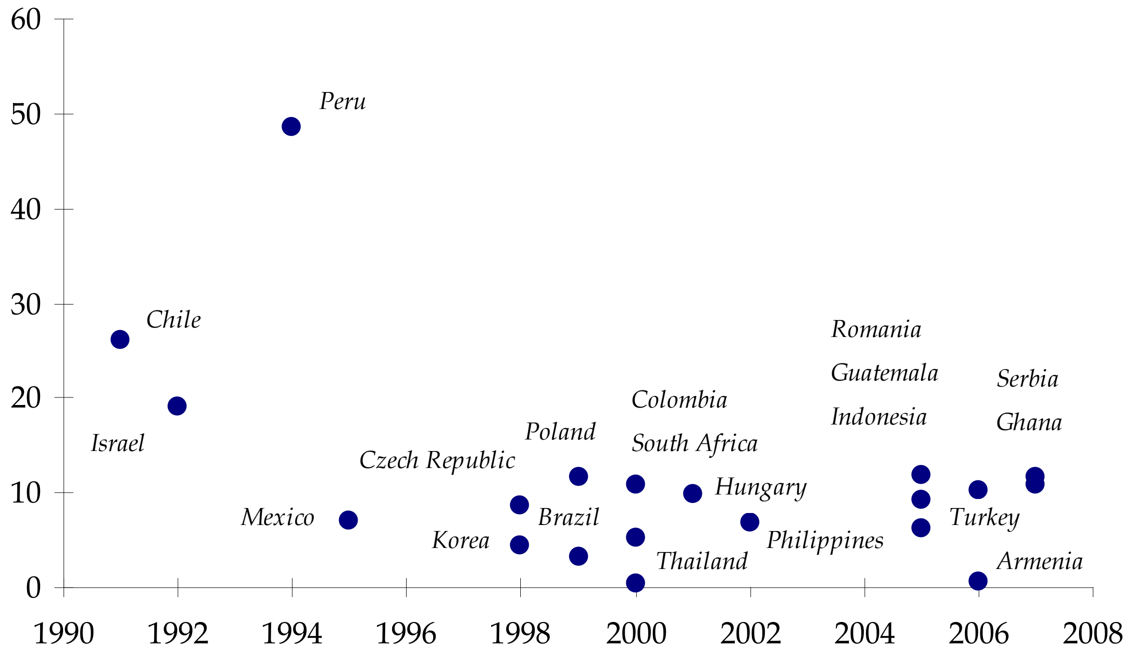


Figure 2: Dates of IT Adoption and Annual Inflation (%) before IT Adoption, Industrial Economies, 1990-2001



Notes
Source: IFS (IMF) database
Reported inflation rates are annual inflation rates of the year previous to the IT adoption date

Figure 3: Dates of IT Adoption and Annual Inflation (%) before IT Adoption, Emerging Market Economies, 1991-2007



Notes
Source: IFS (IMF) database
Reported inflation rates are annual inflation rates of the year previous to the IT adoption date

Figure 4: Annual Absolute Inflation Deviations from Targets in Industrial Economies, 1990-2008

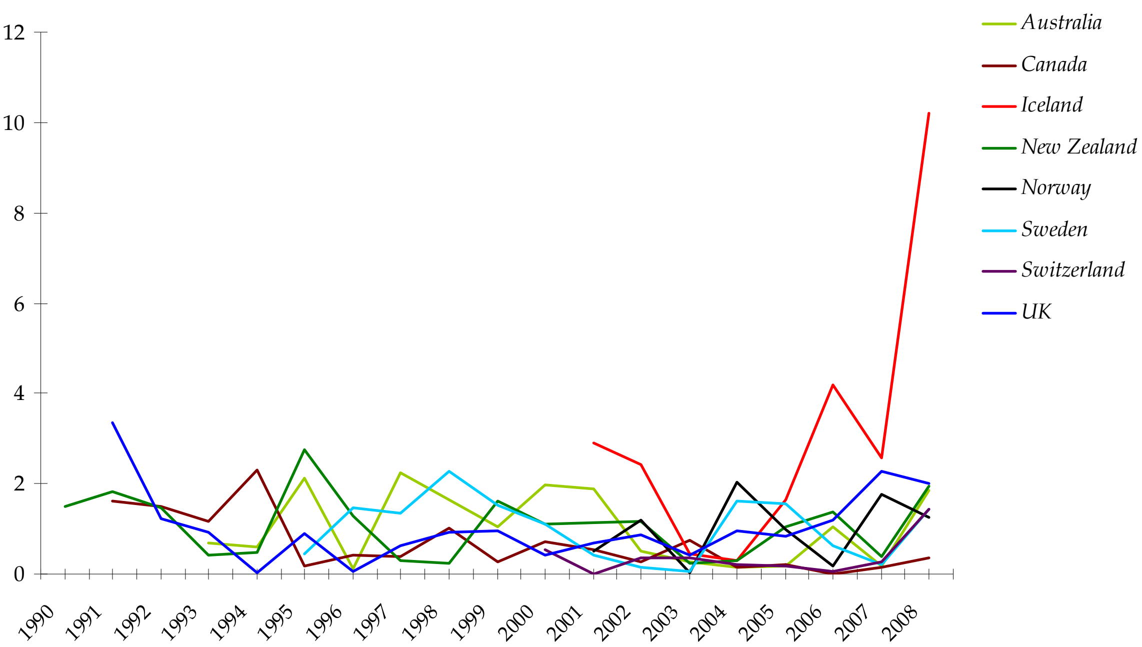


Figure 5: Annual Absolute Inflation Deviations from Targets in Latin American Economies, 1991-2008

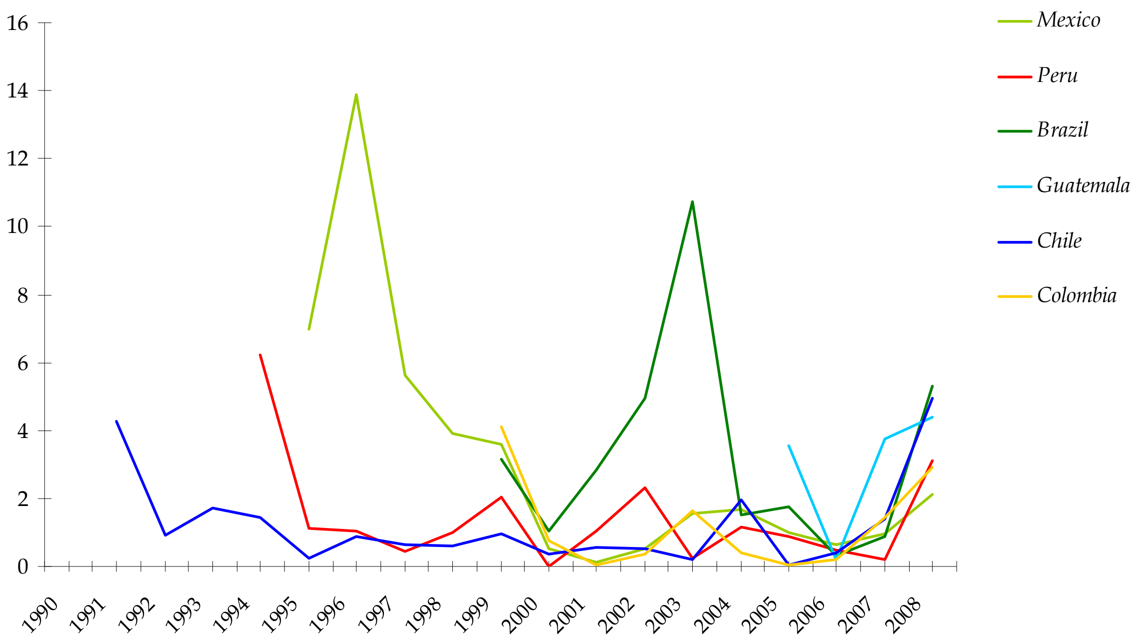


Figure 6: Annual Absolute Inflation Deviations from Targets in Asian Economies, 1992-2008

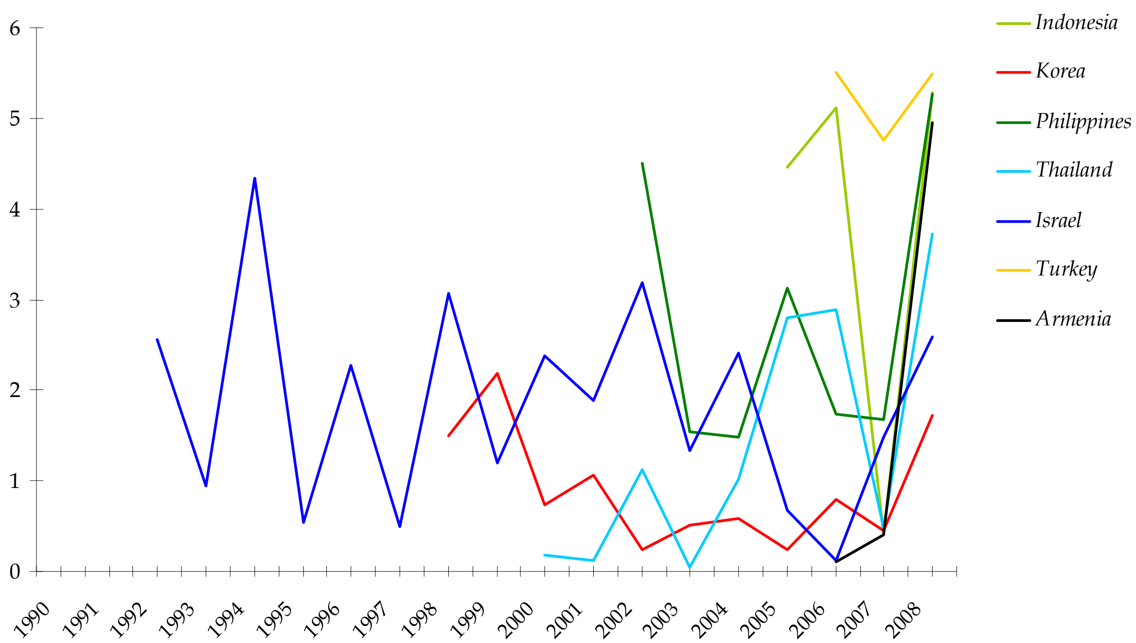


Figure 7: Annual Absolute Inflation Deviations from Targets in Central-Eastern European and African Economies, 1998-2008

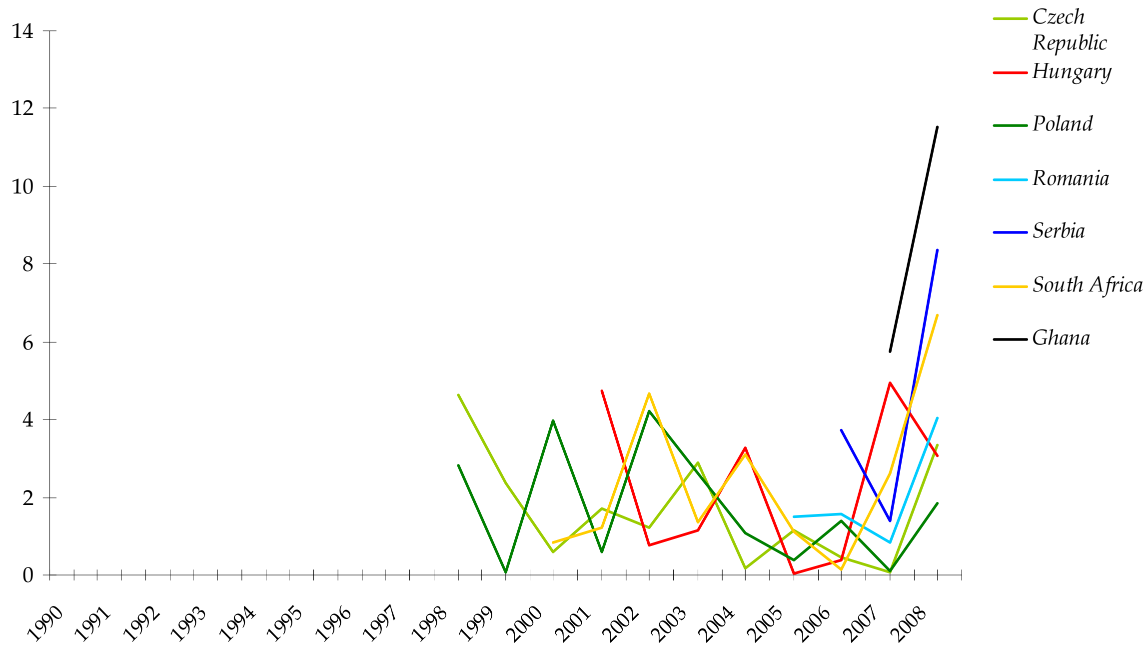
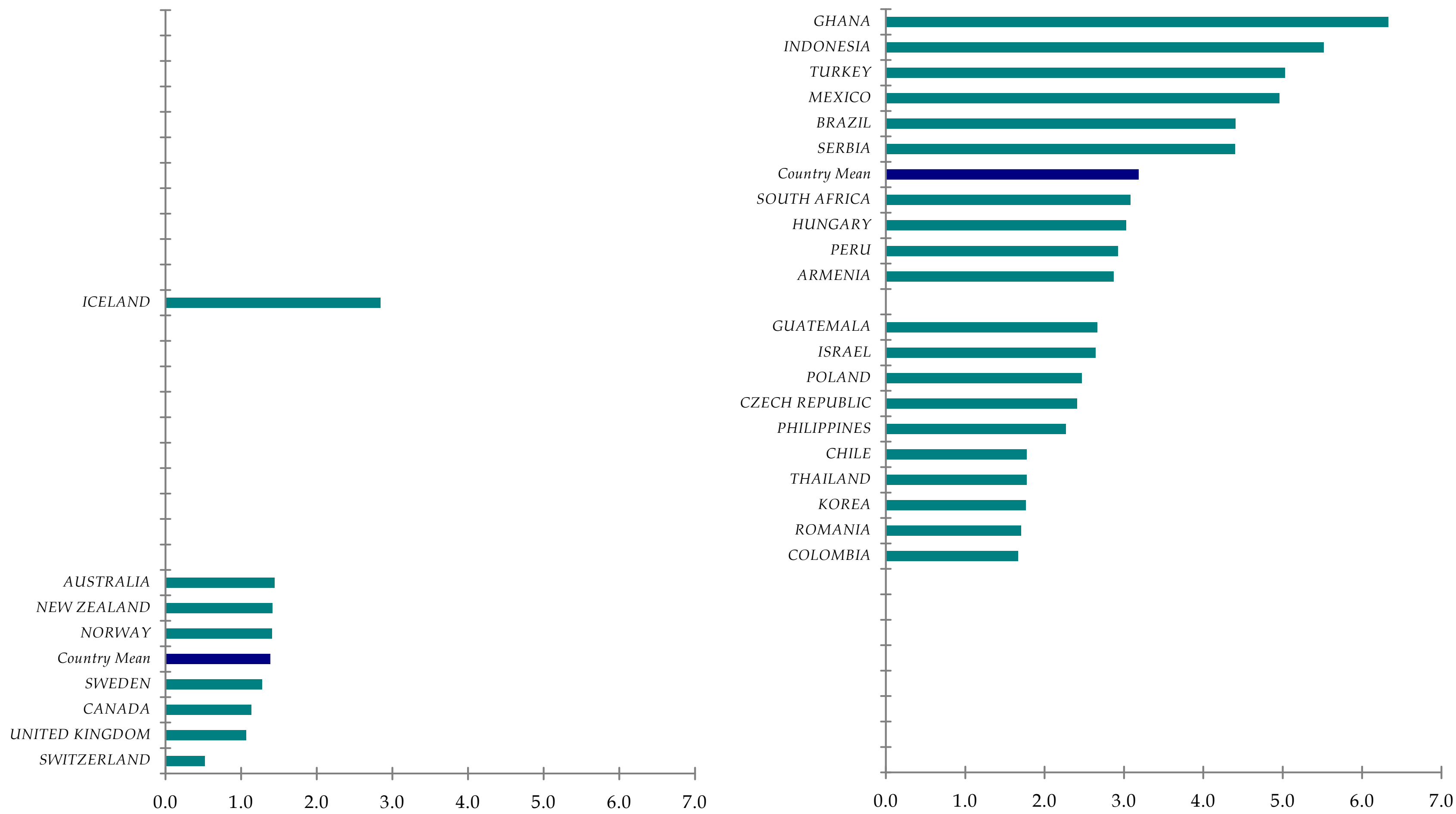
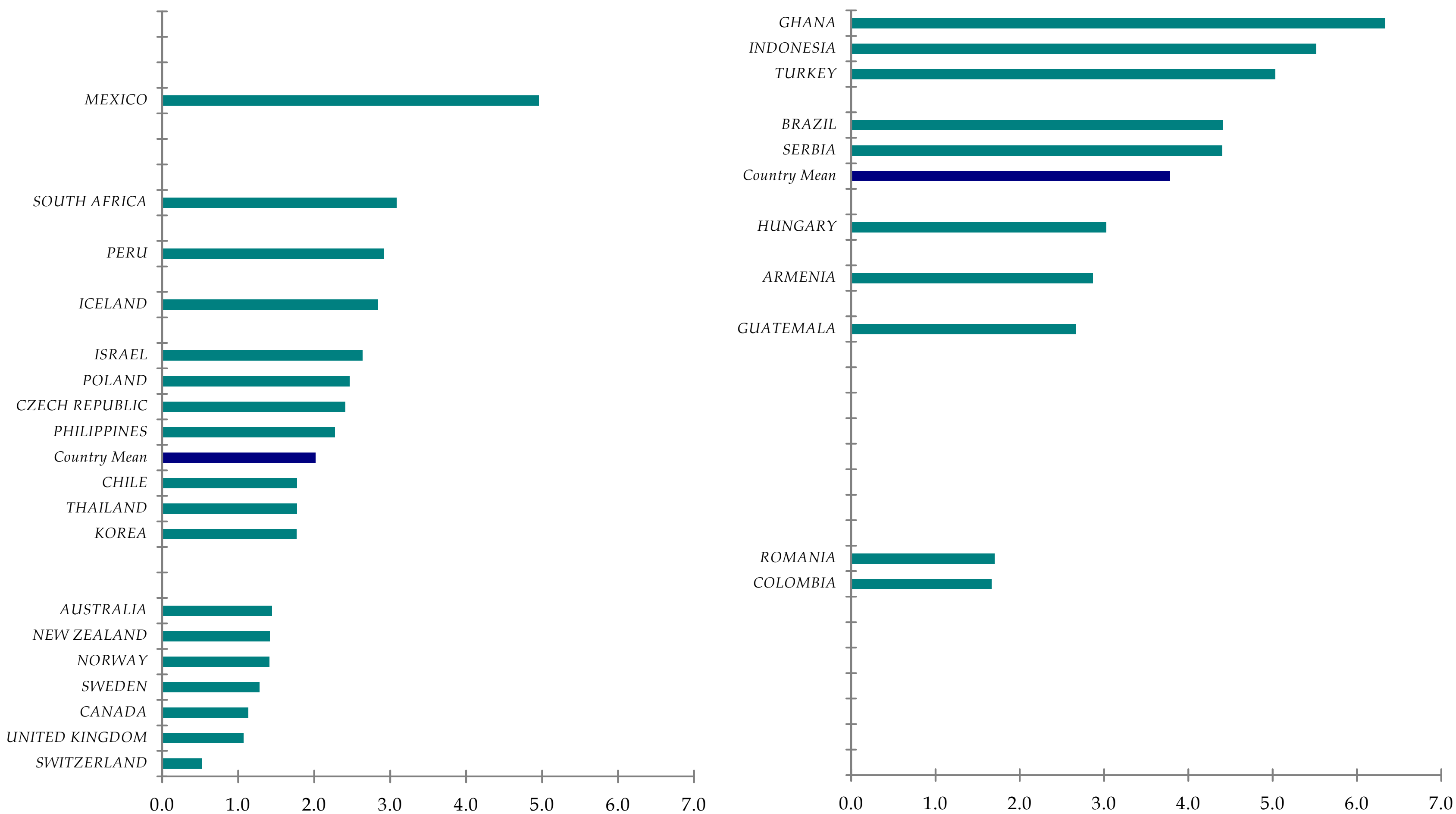


Figure 8: Inflation Deviations from Targets measured by RMSE: Industrial versus Emerging Inflation Targeters



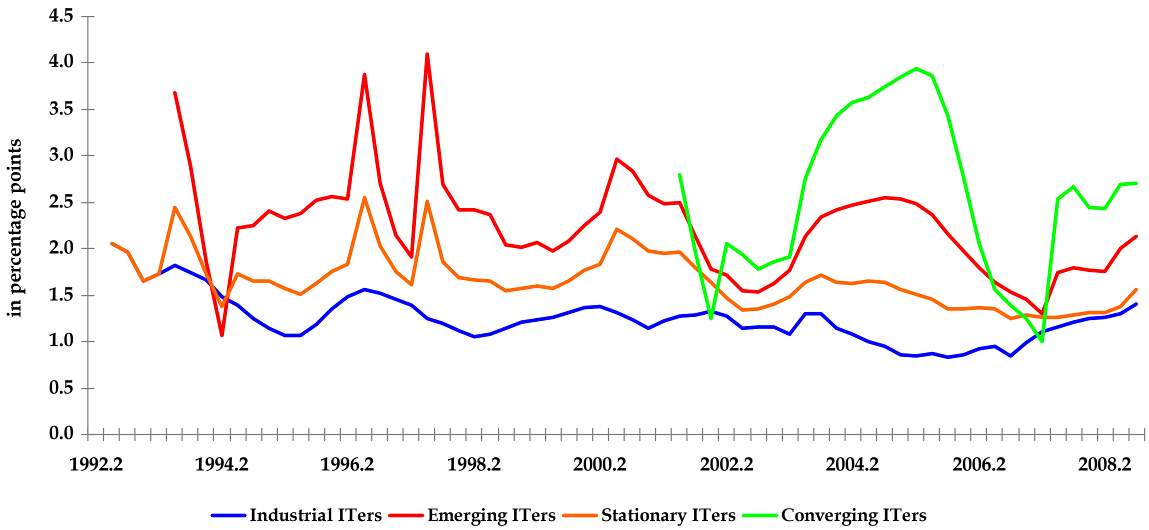
Note: at the left, industrial economies; at the right, emerging economies

Figure 9: Inflation Deviations from Targets measure by RMSE: Stationary versus Converging Inflation Targeters



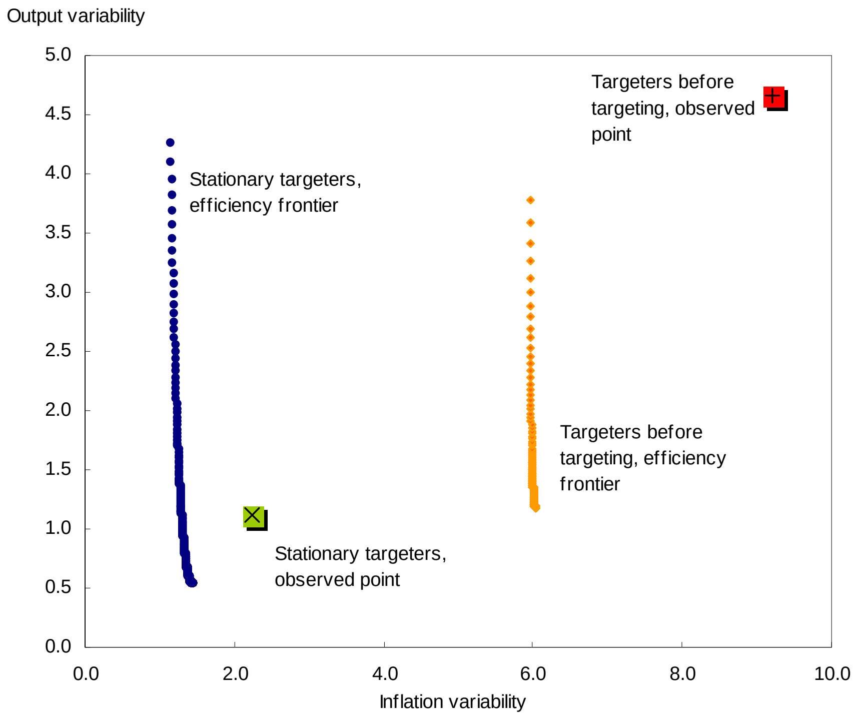
Note: at the left, stationary ITers; at the right, converging ITers

Figure 10: Rolling Estimation of RMSE (8-quarter windows), 1990-2008



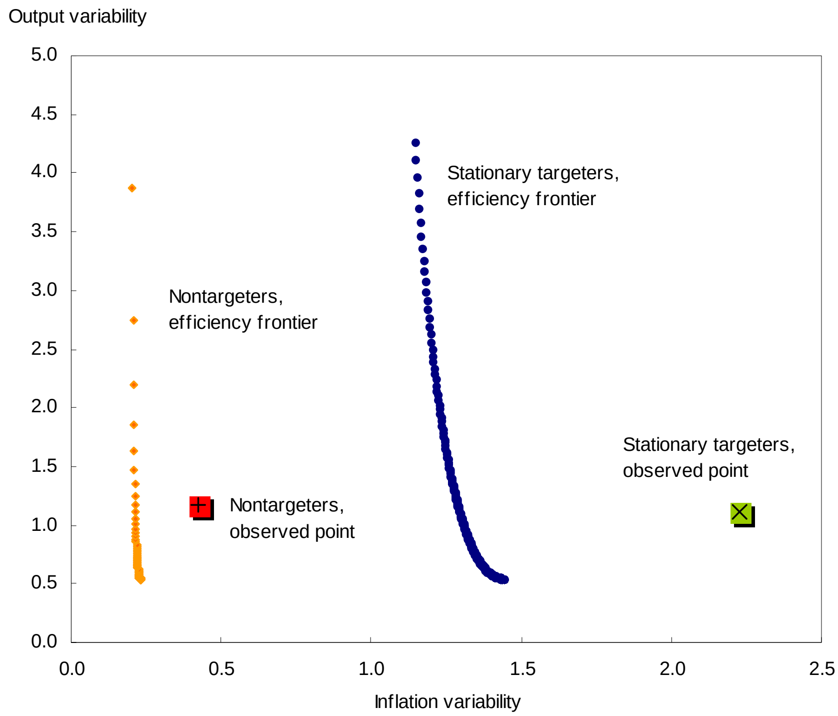
Note: Rolling series for inflation deviations from target for each country group correspond to the simple mean of inflation deviations of each country member

Figure 11: Targeters before IT and Stationary Targeters



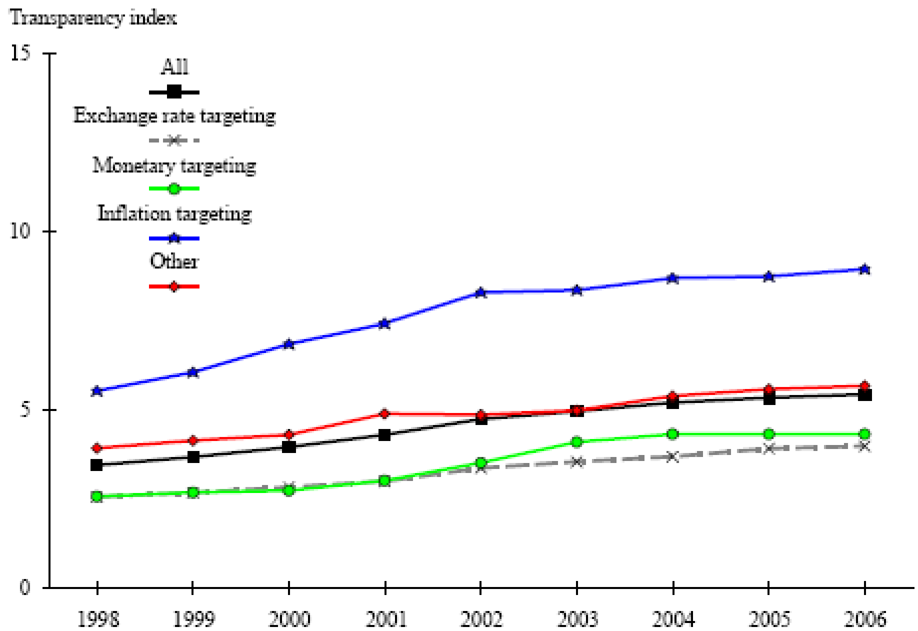
Source: Mishkin and Schmidt-Hebbel (2007)

Figure 12: Stationary Targeters and Non-targeters



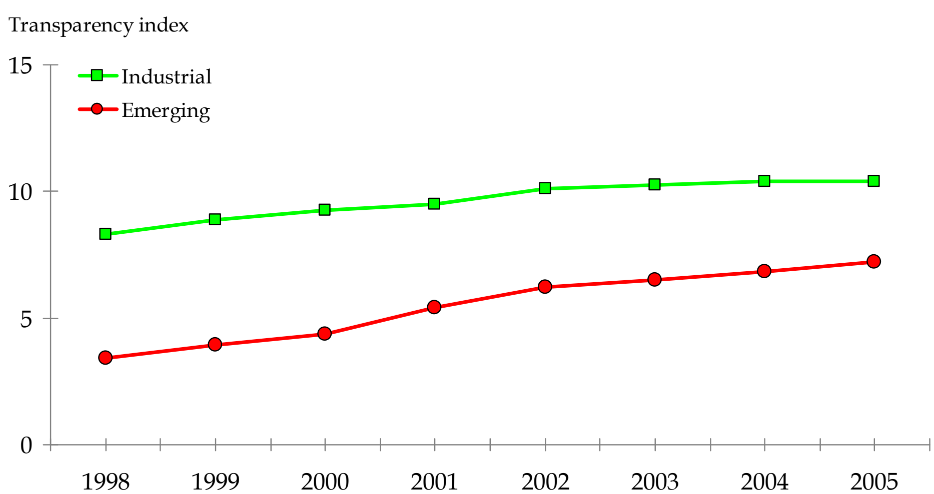
Source: Mishkin and Schmidt-Hebbel (2007)

Figure 13: Central bank Transparency Index according to Monetary Policy Regimes, 1998-2006



Source: Geraats (2008)
Notes: The transparency index runs from 0 (less transparent) to 15 (more transparent)

Figure 14: Central bank Transparency Index for Inflation Targeters, 1998-2005



Source: Dincer and Eichengreen (2007). Author's elaboration
Notes: The transparency index runs from 0 (less transparent) to 15 (more transparent).