First Draft

For Comments Only

By How Much and Why do Inflation Targeters Miss Their Targets?

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July 2004

Abstract

Monetary policy success hinges on consistent central bank behavior and strong private-sector credibility. Since the early 1990s, increasing numbers of central banks are aiming at strengthening their interaction with markets by committing to explicit inflation targets. Have they succeeded in meeting their targets? And what explains their success? This paper responds to the latter questions in two steps. First it proposes several measures of inflation-targeting performance and applies them to the world population of inflation-targeting countries, using annual and monthly country data for 1990-2003. Then the paper tests for the role of fundamental determinants and measures of institutional and macroeconomic credibility in the success (or lack thereof) in meeting inflation targets, controlling for external and domestic shocks. The world evidence reported here suggests that several measures of institutional and policy weakness – including low overall institutional quality, lack of central bank independence, and high country risk-premiums – contribute significantly to inflation-target misses.

Key Words: Monetary Policy, Inflation Targeting, Credibility, Institutions
JEL Classification: E42, E52, E58

I. Introduction

"Travesting Tolstoy, one could say:
'Every good monetary policy is (approximately) the same,
but bad monetary policies are all different' "
L.E.O. Svensson, Invited Lecture at the Federal Reserve Bank of Atlanta
Conference on Monetary Policy and Learning, March 2003.

Good monetary policy hinges on playing a complex dynamic game between central banks and the private sector, which is shaped by policy rules (Kydland and Prescott 1977), policy credibility (Cukierman and Meltzer, 1986), dynamic consistency (Barro and Gordon 1983) , central bank independence (Cukierman, Webb, and Neyapti 1992), bounded rationality (Sargent 1993), imperfect knowledge of central bankers and private agents (Svensson 2003), and some luck. Since the early 1990s, increasing numbers of central banks are aiming at strengthening their interaction with markets by committing to explicit inflation targets. Inflation targeting (IT), characterized as a monetary framework of constrained discretion (Bernanke, Laubach, Mishkin, and Posen 1999), seeks to improve upon alternative monetary regimes by optimizing the tradeoff between rules and flexibility, avoiding dynamic policy inconsistency, committing reputation to attainment of a policy goal that is trivial to monitor, and strengthening policy transparency and accountability.

Previous work on IT has focused on several potential benefits of central bank commitment to an explicit inflation target. Empirical research has suggested that IT has contributed to more focused and accountable monetary policy, strengthened policy credibility, reduced inflation levels and volatility, stabilized inflation expectations, and improved on the tradeoff between inflation and output volatility (Leiderman and Svensson 1995, Bernanke et al. 1999, Loayza and Soto 2002, Mishkin and Schmidt-Hebbel 2002, Truman 2003).

For emerging market economies (EMEs) that start at higher-than-stationary inflation levels and lack strong credibility at the start of IT, the boost in monetary policy strength and credibility brought by IT often implies larger benefits than those reaped in low-inflation industrial countries (Corbo, Landerretche, and Schmidt-Hebbel 2002). However if initial credibility remains weak – i.e. inflation expectations remain largely backward-looking and/or respond excessively to temporary inflation shocks – inflation is more persistent and inflation target misses are larger and more frequent (Schmidt-Hebbel and Werner 2002, Fraga, Goldfajn, and Minella 2003). More generally, empirical research has shown that the success in meeting inflation targets across industrial and emerging-market economies depends on institutions and macroeconomic policy credibility (Calderón and Schmidt-Hebbel 2003).

This paper extends preceding research significantly and in several dimensions. First it proposes several ways to measure inflation-targeting performance, based on alternative

measures of high-frequency (monthly) inflation targets, absolute deviations of actual inflation from inflation targets, and large inflation deviation episodes. Then the paper applies the latter measures to the world population of 19 IT countries that have adopted explicit inflation targets since 1990, reporting the above mentioned measures and ranking country IT performance accordingly.

What explains inflation-target misses? As suggested by previous work, inflation target accuracy rises with the lack of policy credibility, controlling for the intensity of inflation shocks. Calderón and Schmidt-Hebbel (2003) use central bank independence and sovereign country debt risk premiums as determinants of policy credibility and show that the two latter measures reduce significantly inflation target misses. Here we extend the latter research significantly in several directions. First we use the various alternative measures of inflation-target misses that were defined above. Then we broaden the determinants of private-sector credibility by using Institutional Investor's aggregate ICRG measure of countries' institutional quality, in addition to country risk premiums and a measure of central bank independence. We also broaden the search for control variables that cause inflation deviations from targets, including several sources of domestic and foreign shocks. We consider both monthly and annual frequencies and extend our sample to cover data thta extends at most (depending on IT adoption by each country) from 1990 to 2003. Finally we conduct both cross-country and panel-data estimations.

Section II describes the alternative measures for high-frequency inflation targets and inflation-targeting performance and applies them to the 19 countries during 1990-2003 to derive country rankings according to their IT accuracy. Data and estimation methodology are discussed in section III. Section IV introduces the empirical specification used in testing the role of institutional and macro credibility fundamentals that drive IT accuracy, controlling for domestic and external shocks that. Brief conclusions close the paper.

II. Descriptive analysis: Measuring IT performance

1. Measuring inflation and inflation targets

The first step before computing any measure of IT performance is to define an appropriate and comparable inflation target measure for each country. While this may seem trivial, building comparable IT performance measures across countries needs to deal with several complications. First, target width varies across countries, varying from point targets to target ranges. Second, initial inflation levels are much higher in many EMEs than in industrial economies at the date of IT adoption, so inflation targets are typically defined annually toward convergence of low inflation. In addition, inflation targets are (infrequently) adjusted by (mostly industrial) countries at low or stationary inflation levels. This poses an issue of inflation target measurement at high (monthly) frequencies and hence for IT performance measurement. In

particular, the issue arises if the official (annual) inflation target should be considered or if a smoothened series should be used.

The first of these issues is settled by in a rather simple fashion. To make range and point targets comparable, in the case of countries that define target ranges or bands, we use the central value of the range as our target measure. We deal with the second issue of monthly target measures by using three different target definitions: the official target for a given year (OFT), a smoothened series that extracts the time-variant inflation-target path computed by a Hodrick-Prescott filter trend of the annual OFT step series (HPT), and a monthly linear interpolation between time-varying annual OFT targets (IPT). The second measure (HPT) is based on the complete convergence process while the third measure (IPT) based only on the two corresponding OFT values. As an illustration of the differences between the three measures, Figure 1 depicts the three monthly inflation target series for New Zealand and Chile.

For measuring inflation, the annual figure was computed as the 12-month variation of the consumer price index or core inflation, depending on which index is used as the relevant target by the corresponding central bank. For monthly series, inflation is defined as the 12-month variation since the corresponding month one year ago.

2. Measuring inflation targeting performance

Our IT performance measures to assess two dimensions of inflation target misses: the typical deviation of actual inflation from target and the typical large inflation deviation episode.

The first aspect is assessed by computing three statistics:

1- The mean absolute deviation: the sample average of the absolute value of the difference between inflation and the corresponding target.

2- The normalized mean absolute deviation: The sample average of the absolute value of the difference between inflation and the respective target, divided by the target. This measure adjusts the former in order to compare countries that have converged from radically different levels of initial inflation, given the known fact that the first moment of the distribution of inflation is highly correlated with the second.

3- The half life of inflation deviations: Number of periods that a given inflation deviation from target takes to converge to one-half its initial value. This measure is obtained from statistical simulations derived from estimating auto-regressive processes for inflation deviation series for each country, and reflects persistence of a given deviation from target (see appendix).

To deal with the second dimension of IT misses, we define episodes of large inflation deviations (LID) as periods during which inflation exceeds (or is lower than) the respective target in more than 1% (-1%). An additional issue arises regarding the proper termination of a given episode. Again, for robustness consideration, episodes are defined in two alternative

ways. The first (LID1) considers an episode finished the first month where inflation deviations return to be less than 1%, in absolute value. With this definition, a six-month episode of large deviations, followed by a sudden one-month return to low deviation, and then again several months of deviations would be considered as two separate events. Given that it might seem reasonable, in occasions, to consider the former as just one large episode, the second definition (LID2) considers as separate episodes those with a minimum interval of six months with low deviations from target.

The episode analysis seeks to assess frequency, intensity and persistence of deviation from targets by computing the following LID statistics for each country:

1- Frequency: Number of months of LID episodes, divided by the total number in each country's sample.
2- Average duration: Number of months of LID episodes, divided by the total number of LIDs.
3- Maximum duration: The duration of the longest LID episode.
4- Average accumulated deviation: The sum of percentage points of inflation in excess of 1% (below -1%), divided by the number of LID episodes.

3. Results

Our sample comprises only current inflation-targeting countries that have had clear target definitions throughout the sample, which implies considering 19 countries.[1] Inflation series are taken from data available at the respective central banks' web sites or series published by the statistical offices, while targets are constructed from inflation reports' statements. Inflation targets and levels are depicted for all sample countries in figure 2.

The results reported below consider only a subset of possibilities opened up by the alternative definitions of targets, deviation measures, and LID episodes. Tables 1-3 summarize the main statistics using annual and monthly frequencies, in relation to inflation deviations and LID episode features. The tables reflect several relevant facts. First, deviating from inflation targets by more than 1% is quite common among IT countries. In fact, including both upward and downward deviations, they occur during more than 50% of the time at the monthly frequency. Second, LIDs last for an average spell of about 3 quarters, which is supported by a rather persistent half-life estimation of about 5 quarters. Of course, it is important to consider the magnitude of the deviations as well. From the information about LID cumulative deviations and average episode duration, it can be inferred that when large deviations occur, the typical monthly deviation from target is around 3% for episodes above, and 2.5% for events below the defined target.

[1] These criteria imply exclude Finland and Spain, which had inflation targets in place until joining EMU, and Hungary because of lack of a clear definition of targets throughout the period considered.

Table 4 shows the rankings obtained from the previous statistics, according to measures of inflation deviation and the main features of LID episodes. In summary, Switzerland, England, Chile and Sweden are among the most accurate ITers, while the Czech Republic, Poland, South Africa and Brazil are among the most inaccurate. In general, accurate performers also exhibit lower episode frequency, and shorter episode spells. The only ranking that radically changes countries positions is the normalized mean absolute deviation, which by construction tends to punish ITers of historically low targets as Switzerland and Sweden, favoring countries with high initial inflation targets, as Colombia, Mexico and Peru.

III. Econometric data description and estimation methodology

1. Data description

Departing from previous studies, we use quarterly data for the period between 1990Q1-2003Q4, which corresponds to the adoption date of formal IT by New Zealand. For each country, series are built only since the formal implementation of inflation objectives, so the sample corresponds to an unbalanced panel of around 520 observations.

Inflation is computed, for each quarter, as the one-year percent change of the average price level for that quarter. Given that the spirit of the exercise is to measure each country in relation to its explicit target, for most countries the price index used is headline CPI, with the exception of England, Korea and Thailand, for whom we use core CPI. Inflation targets are computed in the three ways described in section II, using the official, trend component and interpolated series. Most of the data are from statistical datasets available at the respective central banks' web pages, or alternatively from national statistics offices.

Regarding the explanatory variables used for credibility, external debt spreads for emerging economies are taken from Bloomberg's series of EMBI bonds, expressed in basis points. For industrialized countries like Canada, England, Sweden and Switzerland, this series is set to zero for the whole period. This procedure leaves a couple of countries without observations, as they lack dollar denominated debt for making comparable spreads series[2], and can't neither be classified reasonably as having close to zero default probability. Given that most of this series start from late 1997 or early 1998, the inclusion of this series in the estimations provides additional data restrictions. The dummy of central bank independence was set to one for countries in which the central bank decides independently the inflation target as well as the use of instruments to conduct monetary policy, and zero for the rest. This distinction classifies only 8 countries as formally independent. Finally, the variable for the perceptions of institutions and overall country risk assessment, which we use as a proxy for credibility, was obtained from the Institutional Investor's country risk rating. This series is published twice a year, so the

[2] This is the case of Australia, Czech Republic, Iceland, Israel, Norway and South Africa.

missing quarters were completed using standard statistical procedures for transforming frequencies. This indicator is based on an evaluation of a number of macroeconomic, financial and political variables, like growth prospects, current account balances, debt-service payments, and the government's capacity to implement measures needed to stabilize the economy, meet external payments, as well as the likelihood and potential effects of political instability. The range of the series is 0-100, from worst to best rating.

As control variables, we include the role of the external sector in determining consumer price inflation, mainly through the effect of nominal exchange rate fluctuations. For this variable, we alternatively try both the simple depreciation rate as well as the deviation from trend, under the criteria that what matters for inflation misses is not external price fluctuations per se, but their deviation from medium/long-run trends. The impact of external shocks is captured by the evolution of the terms of trade, and by measures of global activity and financial conditions through the US GDP growth rate, the Federal Fund's rate, and the evolution of oil prices. Once again, all variables are computed in period changes as well as deviations from trends, using similar criteria. These variables were constructed mostly from data taken from the International Monetary Fund's "International Financial Statistics" datasets. Such is the case for nominal exchange rates, terms of trade, the evolution of US GDP and oil brent prices. For constructing deviations from trends of these series, standard Hodrick-Prescott filters were applied to the data. All observations are in one-year percent changes, or percent deviations from trend in the case of filtered series.

2. Estimation methodology

The estimation methodology is based on two complementary approaches. The first relies on averages of the main variables for each country through OLS regressions, in order to have an idea about the cross-country variability and main determinants of IT performance. For robustness purposes, three alternatives of the dependent variable were used: the mean absolute deviation (MAD), the normalized mean absolute deviation (NMAD) and the cumulative sum of percentage points of inflation deviations over and under 1% for the average episode as defined in section II (AECD). Each of these measures was correspondingly computed using the three definitions of targets discussed previously. Additional robustness is provided by estimations using different horizons, including regression results considering 1998 onwards, a period from which most of the countries considered were already implementing IT.

The second approach is based on panel data estimation, which exploits both temporal and cross-country variability to explain IT performance. In the regression specifications, the dependent variable is the absolute value of inflation deviations over the respective target (AD), once again defined according to the three alternatives discussed. The intuition behind using

absolute deviations is that central banks working under credible a environment should perform near their inflation targets, no matter if deviations are positive or negative. Both pool-mean group and fixed-effects specifications are estimated, and robustness checks are implemented varying the estimation specification, in particular the variables used as proxies of credibility.

There are several methodological issues that are worth mentioning at this point. First, all equations estimated in panel regressions consider the inclusion of lagged dependent variables, which brings into discussion the need to consider the use of dynamic panel estimation techniques in order to avoid the usual biases that emerge from the correlation between the residuals and the lagged values (see Arellano and Bond, 1991). Fortunately, given that our panel is "long", the estimation bias is negligible, given that there is no serial correlation of the estimated residuals, as the Durbin's H statistic shows. Second, about the proper use of Fixed or Random effects for the estimation, the second alternative is not recommendable for the current case, given that such estimations are inconsistent when the country specific effect is correlated with the explanatory variables. Given that in this case, the specific coefficient of each country regarding IT performance might well be correlated to, say, the overall credibility of the economy, this alternative is discarded. Anyway, the coefficients and significance levels obtained with this methodology —not reported— barely change, with main conclusions unaltered. Third, the Institutional Investor's rating series, though intuitively a stationary variable of order I(0), fails to reject the null hypothesis of unit root process for several countries —under standard dickey-fuller contrasts, not reported. This might be due to the short period of time consider, specially when taking into account that for many countries the period implies a structural change in risk perception that reflects in a marked upward trend of the rating. To face this issue, we conducted stationarity tests on the residuals of the regressions using the variable in levels. In all specifications, the residuals are stationary, meaning that the variable can regressed in levels without incurring in misspecification problems.

A final remark regards exogeneity considerations of the estimations. It might seem reasonable to think that credibility not only affects the achievement of inflation targeting, but is also a result of past target performance. The variables used here, nonetheless, escape such problem. Regarding central bank independence, this is clearly an exogenous situation in each country, and has kept unchanged during the whole sample[3]. The Institutional Investor's rating, on the other hand, though it considers aspects of macroeconomic stability and therefore the behavior of inflation, is a figure computed by many other indicators, so the individual weight of inflation performance might be thought of playing a rather small part. Something similar happens with EMBI spreads, which are mainly measures of fiscal sustainability. Moreover, the

[3] One exception is Sweden, the only country registering a change from partial dependence to total formal central bank independence.

large existing literature of spread determinants[4] doesn't consider inflation —much less inflation performance relative to targets — among the usual determinants of bond spreads differences across countries. Anyway, among the battery of estimations performed, various specifications use two-stage least squares to deal with this potential problem, with the main conclusions unaltered.

IV. Econometric Results

1. Simple correlation analysis

For a first reading of the data, table 5 shows the main correlations found between the variables used both in the cross-section regressions as well as in the panel-data specification. For the cross-section data, the explanatory variables are highly correlated with de mean absolute deviations (MAD), with the expected sign. Higher MAD's are associated with higher average IT (TARGET), higher IT ranges (RANGE), higher Institutional Investor's rating (RISK), lower spreads and with central banks that are not formally independent (CBI). Normalized MAD's (NMAD) and the average total accumulated deviations during episodes (AECD) as defines in section II share the main results, except for the negative association of the former with TARGET, which is very obvious given that the normalization is done dividing the MAD by the target.

The correlation found in panel-data observations are very similar, with coefficients somewhat lower than in the cross-country average data, but highly significant given the large number of paired observations used in calculations.

2. Cross section results

The equations estimated using cross-country average measures include basically the following specification[5]:

$$(1) \qquad MAD_i = a + b_1 \mathrm{TARGET}_i + b_2 \mathrm{RANGE}_i + b_3 \mathrm{DNER}_i + b_4 \mathrm{RISK}_i + ß_5 \mathrm{CBI}_i$$

Table 5 summarizes the main results of cross-country averages regressions. As explanatory variables, the equations include the average target for each country, for which the sign is positive (and significant) as expected, given the known correlation between the first and second moments of the distribution of inflation. The average range also has the expected positive (and significant) sign, presumably because countries that define their targets in a less restrictive manner are more likely to deviate from the range's center. The standard deviation of nominal

[4] See Cantor and Packer (1995), Min (1998) and Eichengreen and Mody (1998).

exchange rate changes also has the expected positive (and significant) sign, reflecting that countries subject to more exchange rate volatility have more trouble meeting their targets. The results basically hold when considering the shorter horizon since 1998.

Regarding measures of credibility, when explaining MAD's both CBI and the average RISK have the expected negative signs, but the former is not significant. When regressed against the normalized mean absolute deviation, RISK has the opposite sign, presumably because the normalization tends to punish countries that have kept consistently low targets. Similarly, when explaining AECD's, proxies for credibility have negative signs, but are in general not significant.

3. Panel data results

Including the time series dimension of variability reveals an important and consistent role for the different measures of credibility. The models estimated include basically the following specification:

(1) $$AD_{it} = a + b_1 abs(OIL_t) + b_2 abs(NER_{it}) + b_3 RISK_{it} + b_4 CBI_i$$

for the pooled regressions, and

(2) $$AD_{it} = a_i + b_1 abs(OIL_t) + b_2 abs(NER_{it}) + b_3 RISK_{it}$$

for the fixed-effects specification.[6]

Table 6 summarizes the main results for these estimations. Starting from pooled estimations sharing a common constant term, both RISK and CBI have the expected sign, being highly significant. Using fixed-effects specifications, the main results hold. Although the F-statistic calculated between pooled and fixed-effects specifications always reject the null hypothesis of common constant term —implying that the correct choice is the later—, in order to assess the importance of the central bank independence dummy it is necessary to run pooled regressions[7]. The sign is negative, as expected, and significant in most cases. The results are robust for different specifications of the dependent variable —varying on the definition of the target— and the use of EMBI spreads as an alternative measure of credibility.

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[5] Other external controls as USGDP, the FED's rate and OIL prices can't be controlled for, as they are obviously common for all countries.
[6] These equations exclude control variables that were found to be not significant in all specifications.
[7] Given that CBI is a dummy with unchanged values for each country during the whole period, it's impossible to test it simultaneously with fixe-effects estimation, as the matrix defined in such manner would be singular.

The size of the coefficients is also considerable. For RISK, the results show that a 40-point jump in the scale —moving from the average rating of Chile to that of Switzerland— would imply a reduction in the typical inflation deviation of 0.4 - 0.6 percentage points, not bad considering a mean deviation of about 1.5 percentage points for the whole sample. With respect to the independence dummy, the results show that on average, central banks that enjoy full independence achieve between 0.1 - 0.15 percentage points lower deviations.

Regarding external and control variables, only nominal exchange rates and oil prices are often significant. US GDP growth and terms of trade —not reported— are never significant, neither in year % changes nor in deviations from their respective trends[8].

V. Conclusions

This paper has analyzed and explained the IT performance in the world sample of 19 inflation targeting countries in the world, focusing on tow questions: how large have been inflation target misses?, and what explains those misses?

The descriptive statistics for alternative measures of IT performance suggest that, while IT has been generally a useful device for attaining and maintaining low levels of inflation, persistent deviations from targets are common among inflation targeters. Considering several measures of inflation deviations and the main features of large inflation-deviation episodes, our performance rankings put Switzerland, England, Chile, and Sweden among the most accurate inflation targeters.

Regarding the main determinants of IT performance, our results suggest that several measures of policy credibility are significantly and robustly related to IT performance. This finding is in line with predictions of the theoretical literature, that assign a key role to credibility in monetary policy and economic institutions in achieving low and stable levels of inflation. In particular, we find that overall institutional quality, low country risk premiums, and central bank independence help significantly and by sizeable magnitudes to bring inflation levels closer to targets.

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[8] Something similar happens with the target level and the target range. Despite being significant in the cross-country regressions, they loose importance in all specifications of panel estimations.

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Appendix

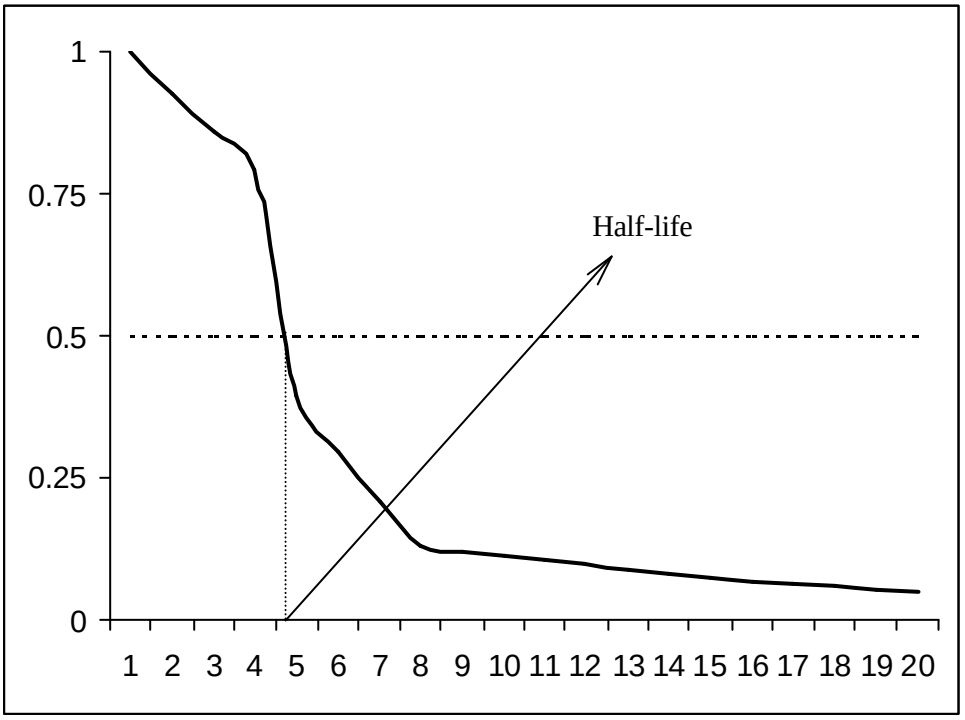
Measuring persistence: Half-life of inflation deviations

The half-life of an event is defined as the time it takes for a certain variable to reach one half the value attained at the outset of the event. This index is usually used for assessing persistence of series at the face of disturbances. In the case of interest, such event is defined as a 1% deviation from target disturbance of inflation, and its half-life calculated from simulations that use coefficients estimated from the series' AR(q) process, of the type

$$e_{it} = c_i + a_{1i} e_{it-1} + a_{2i} e_{it-2} + ... + a_{pi} e_{it-p}$$

where e_{it} is the deviation of inflation respect to the target in country i at period t, and the coefficients a_{ji} represent the persistence in the current value of the variable of the value j periods ago. By estimating these parameters, it's possible to simulate the response of inflation deviation from a one-time, exogenous perturbation. The optimal lag order (q) is selected using standard criteria of residual correlation (Ljung-Box Q statistic).
Figure A1 shows the example for the case of Chile, with parameters taken from the autoregressive process of the deviations of inflation defined respect to the official target.

Figure A1: Half-life of inflation deviations, Chile

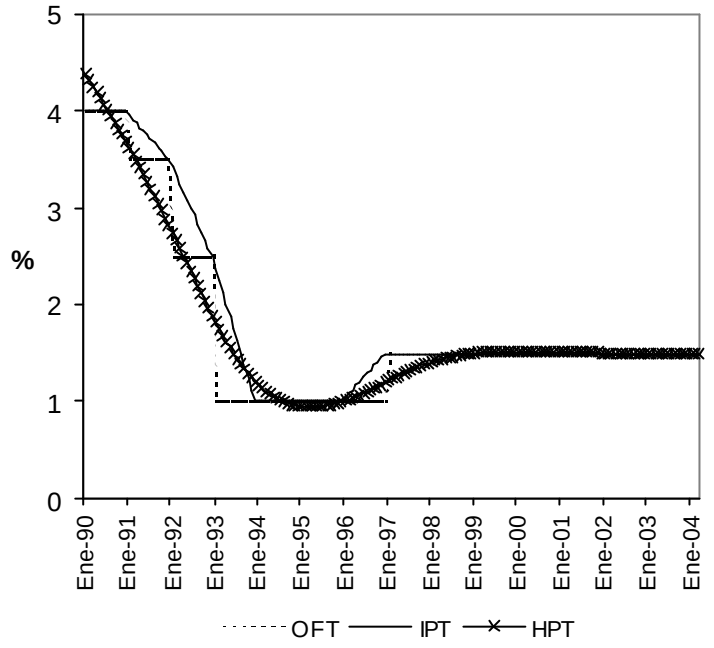


Figures and tables

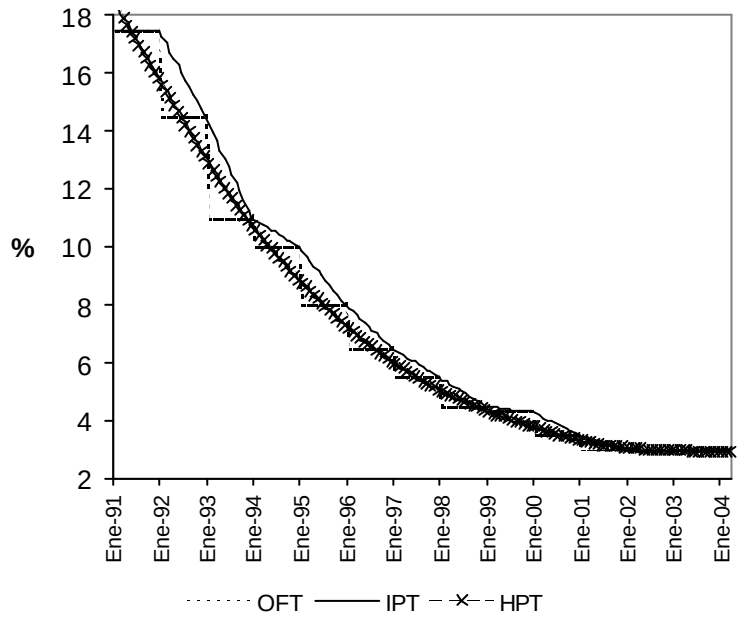
Figure 1

Alternative measures of inflation targets

1a) New Zealand



1b) Chile



Source: Own construction from Central Banks' official data.

Figure 2

Interpolated inflation targets and inflation in the world

(19 countries, variable periods within 1990-2003)

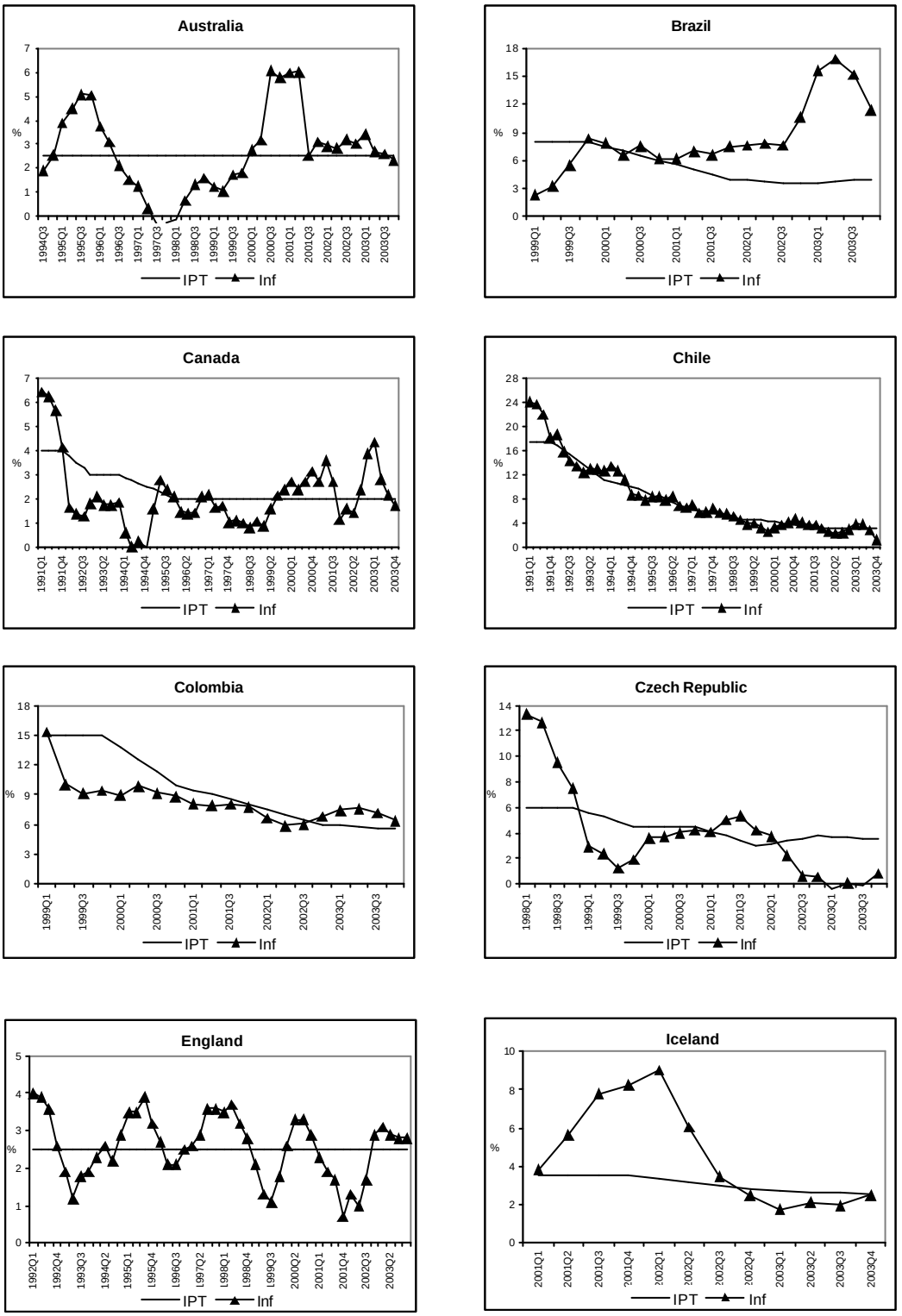


Figure 2

(cont.)

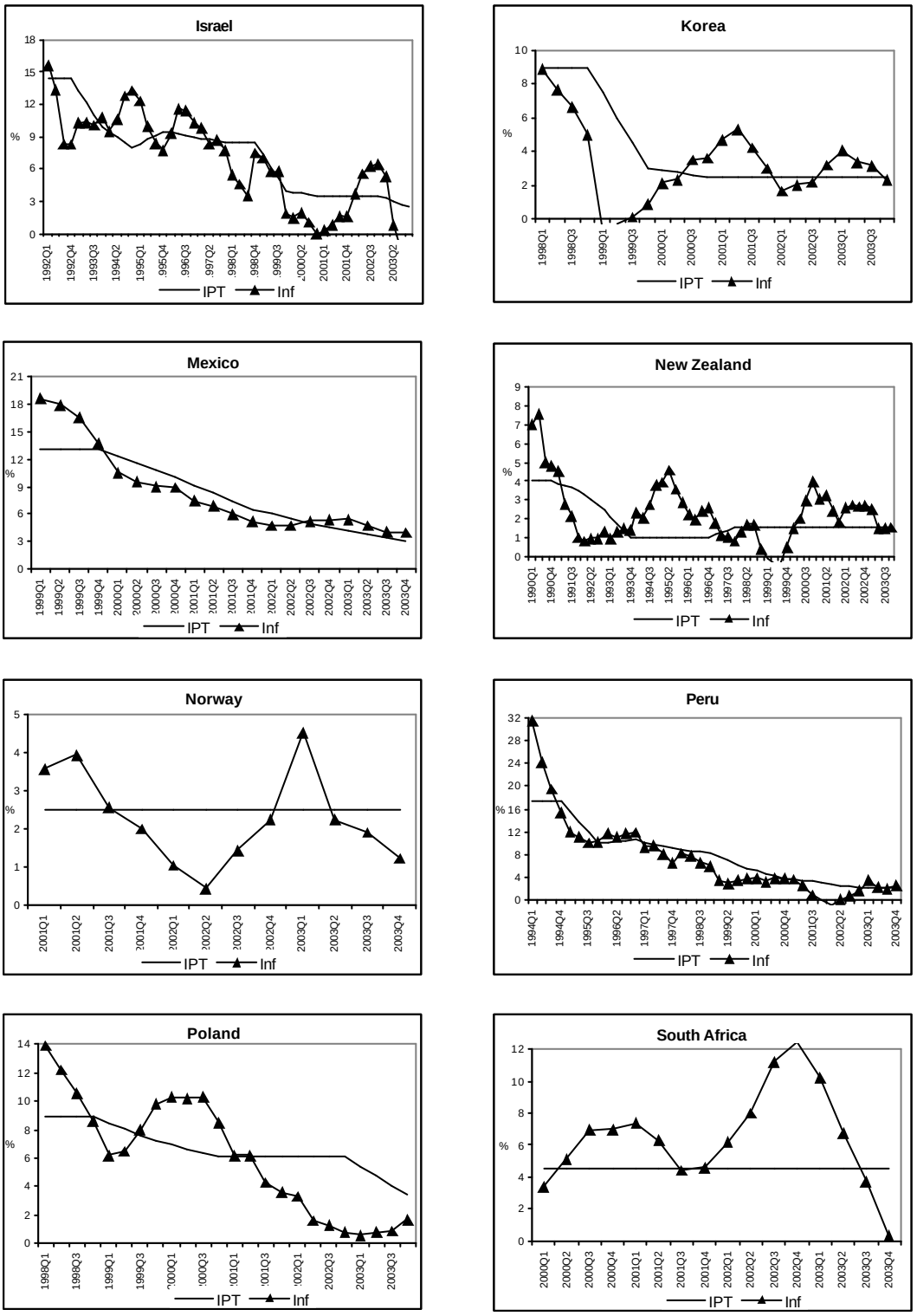
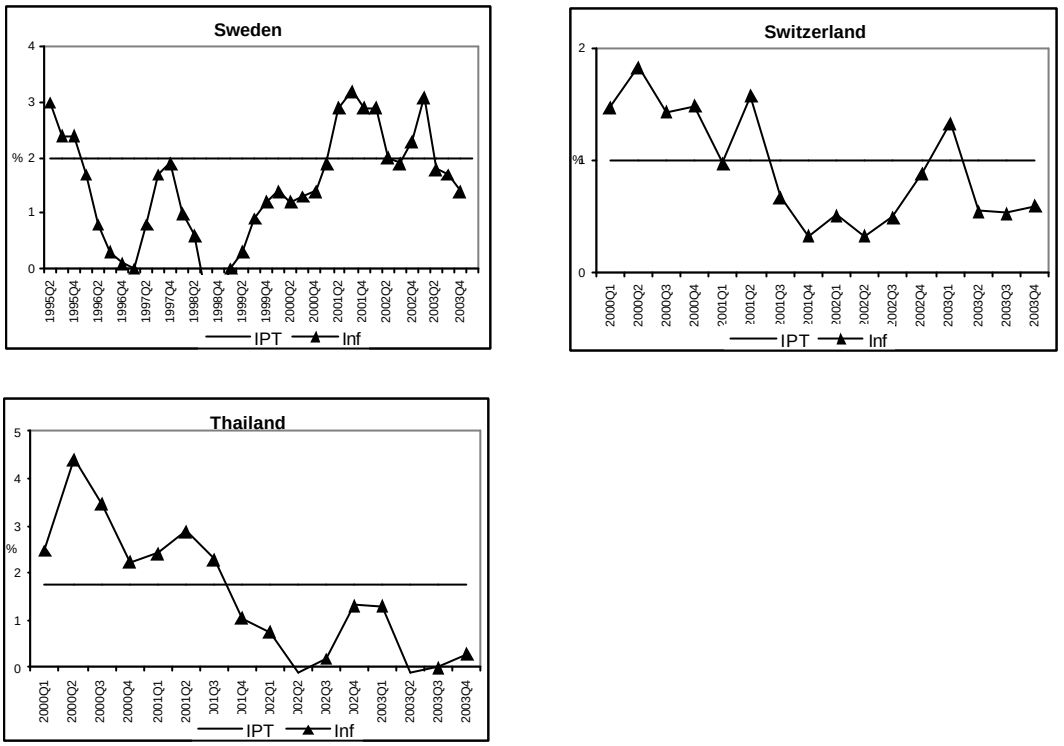


Figure 2

(cont.)



Source: Data published by central banks and national statistics offices.

Table 1

Inflation deviations from targets in the world

(19 countries, variable periods, annual frequency)

Country	IT starting date	Current target (%)	Mean absolute deviation (%)	Normalized mean absolute deviation (%)	Episode Frecuency >1 (% of sample years)	Episode Frecuency <-1 (% of sample years)
Australia	Sep-94	2-3	1.25	0.50	20.0	10.0
Brazil	Jun-99	3-8	4.84	0.99	60.0	0.0
Canada	Feb-91	1-3	0.96	0.61	15.4	30.8
Chile	Jun-91	2-4	0.90	0.17	23.1	30.8
Colombia	Sep-99	5-6	1.87	0.18	0.0	40.0
Czech Rep.	Jan-98	2-4	1.89	0.48	16.7	50.0
Iceland	Oct-92	2	2.03	0.61	33.3	0.0
Israel	Mar-01	2.5	1.53	0.62	33.3	58.3
England	Dec-91	2.5	0.57	0.23	8.3	8.3
Korea	Jan-98	2.5	1.84	0.40	16.7	33.3
Mexico	Jan-99	3	1.20	0.21	20.0	40.0
New Zealand	Mar-90	0-3	1.23	0.83	35.7	28.6
Norway	Mar-01	2.5	1.06	0.43	0.0	33.3
Peru	Jan-94	1.5-3.5	1.44	0.27	10.0	50.0
Poland	Oct-98	<4	2.47	0.43	33.3	50.0
South Africa	Feb-00	3-6	3.66	0.81	50.0	25.0
Sweden	Jan-93	2	0.91	0.46	0.0	22.2
Switzerland	Jan-00	<2	0.42	0.42	0.0	0.0
Thailand	Apr-00	0-3.5	0.77	0.44	0.0	25.0
		Average	1.62	0.48	19.8	28.2
		Median	1.25	0.44	16.7	30.8

Source: Authors' construction from data published by central banks and national statistics offices.

Table 2

Inflation deviations from targets, alternative target definitions

(19 countries, variable periods, monthly frequency)

Country	Mean absolute deviation			Normalized mean absolute deviation			Inflation deviations half-life (months)		
	OFT	IPT	HPT	OFT	IPT	HPT	OFT	IPT	HPT
Australia	1.74	1.74	1.74	0.54	0.54	0.54	41		
Brazil	4.60	4.14	4.46	1.08	0.88	1.02	11	25	40
Canada	1.03	1.12	1.04	0.42	0.43	0.42	5	13	11
Chile	1.30	1.13	1.20	0.19	0.16	0.18	28	5	4
Colombia	1.46	2.08	1.53	0.15	0.20	0.18	14	18	14
Czech Rep.	2.44	2.59	2.34	0.56	0.54	0.52	18	14	16
England	0.70	0.70	0.70	0.28	0.28	0.28	16	11	11
Iceland	1.88	1.82	1.89	0.62	0.55	0.61	9	18	18
Israel	2.55	2.42	2.20	0.52	0.47	0.47	11	11	10
Korea	1.46	1.90	1.54	0.45	0.45	0.46	7	18	13
Mexico	1.48	1.78	1.48	0.24	0.22	0.25	25	15	16
New Zealand	1.04	1.09	1.00	0.76	0.73	0.74	6	22	20
Norway	1.11	1.11	1.11	0.44	0.44	0.44	17	6	6
Peru	1.70	2.12	1.87	0.29	0.32	0.31	19	9	15
Poland	2.63	2.85	2.58	0.46	0.46	0.45	16	21	27
South Africa	2.79	2.79	2.79	0.62	0.62	0.62	25	16	16
Sweden	0.99	0.99	0.99	0.50	0.50	0.50	5	25	25
Switzerland	0.47	0.47	0.47	0.47	0.47	0.47	17	5	5
Thailand	1.15	1.15	1.15	0.66	0.66	0.66	11	17	17
Average	1.71	1.79	1.69	0.49	0.47	0.48	15.83	14.94	15.78
Median	1.46	1.78	1.53	0.47	0.47	0.47	15.83	15.50	15.50

Source: Authors' construction from data published by central banks and national statistics offices.

Table 3

Features of large inflation deviation episodes in the world

(19 countries, variable periods, monthly frequency, IPT target)

3a) Episode definition LID1

Country	Episode frequency		Average episode length		Maximum episode length		Average episode cummulative deviation	
	>1	<-1	>1	<-1	>1	<-1	>1	<-1
	(%)		(months)		(months)		(%)	
Australia	23.7	23.7	13.5	13.5	15	21	35.5	-26.0
Brazil	60.0	15.0	12.0	9.0	33	10	67.5	-38.8
Canada	13.2	32.1	4.2	7.3	9	37	8.0	-13.9
Chile	18.9	17.6	3.8	3.5	9	6	10.8	-6.1
Colombia	17.5	49.2	5.5	15.5	10	28	8.7	-50.3
Czech Repub	25.8	47.0	8.5	15.5	11	17	33.9	-47.8
England	12.9	14.3	4.8	3.5	10	7	6.4	-4.5
Iceland	41.0	7.7	16.0	1.5	16	2	60.1	-1.7
Israel	30.6	43.8	6.3	12.6	20	27	19.6	-38.7
Korea	20.0	29.3	5.0	11.0	10	22	9.6	-47.1
Mexico	27.0	44.4	4.3	28.0	10	28	13.3	-48.4
New Zealand	30.6	21.7	12.0	17.0	19	21	20.7	-29.0
Norway	28.6	28.6	4.0	4.0	5	6	6.4	-6.4
Peru	17.1	47.2	3.5	11.6	9	25	16.6	-28.0
Poland	34.7	52.0	13.0	19.5	16	32	42.2	-62.4
South Africa	58.0	16.0	14.5	4.0	17	5	56.0	-12.2
Sweden	5.4	34.2	2.0	9.5	2	20	2.4	-16.7
Switzerland	0.0	3.9	0.0	1.0	0	1	0.0	-1.1
Thailand	21.6	37.3	5.5	6.3	15	12	9.4	-10.0
Average	25.6	29.7	7.3	10.2	12.4	17.2	22.5	-25.7
Median	23.7	29.3	5.5	9.5	10.0	20.0	13.3	-26.0

3b) Episode definition LID2

Country	Episode frequency		Average episode length		Maximum episode length		Average episode cummulative deviation	
	>1	<-1	>1	<-1	>1	<-1	>1	<-1
	(%)		(months)		(months)		(%)	
Australia	23.7	23.7	13.5	13.5	15	21	35.5	-26.0
Brazil	0.6	0.2	12.0	9.0	33	10	202.6	-38.8
Canada	0.2	0.3	5.3	12.8	9	37	10.0	-24.3
Chile	0.2	0.2	6.0	5.6	15	9	17.4	-9.7
Colombia	0.2	0.5	5.5	15.5	10	28	8.7	-50.3
Czech Repub	0.3	0.5	8.5	15.5	11	17	33.9	-47.8
England	12.9	14.3	6.3	7.0	10	10	8.6	-9.0
Iceland	0.4	0.2	16.0	3.0	16	7	60.1	-3.5
Israel	0.3	0.5	8.8	12.6	28	27	27.4	-38.7
Korea	0.2	0.3	7.5	11.0	13	22	14.4	-47.1
Mexico	0.3	0.4	5.7	28.0	10	28	17.7	-48.4
New Zealand	0.3	0.2	16.0	17.0	27	21	27.6	-29.0
Norway	0.3	0.3	4.0	8.0	5	9	6.4	-12.8
Peru	0.2	0.5	5.3	19.3	12	40	24.9	-46.6
Poland	0.3	0.5	13.0	19.5	16	32	42.2	-62.4
South Africa	0.6	0.2	14.5	4.0	17	5	56.0	-12.2
Sweden	0.1	0.4	2.0	12.7	2	22	2.4	-22.2
Switzerland	0.0	0.0	0.0	1.0	0	1	0.0	-1.1
Thailand	0.3	0.4	11.0	9.5	15	12	18.7	-14.9
Average	2.2	2.3	8.5	11.8	13.9	18.8	32.3	-28.7
Median	0.3	0.4	7.5	12.6	13.0	21.0	18.7	-26.0

Source: Authors' construction from data published by central banks and national statistics offices.

Table 4

IT performance rankings according to inflation deviations and large deviations episodes

(19 countries, variable periods, variable frequencies)

Country	Inflation deviations				Episode features				Overall ranking
	Mean absolute deviation (%)		Normalized mean absolute deviation (%)		Frequency (%)		LID1 avg. Lenght	LID1 avg. cumm. deviation	
	Annual fqcy.	Mon. fqcy., avg. 3 targets	Annual fqcy.	Mon. fqcy., avg. 3 targets	Total deviations, annual	Total deviations, avg. 3 targets			
Australia	10	12	13	13	5	7	16	15	11.4
Brazil	19	19	19	19	12	18	13	19	17.3
Canada	6	5	14	6	9	5	5	5	6.9
Chile	4	8	1	2	11	3	2	6	4.6
Colombia	14	11	2	1	8	11	14	9	8.8
Czech Rep.	15	16	12	14	16	15	15	14	14.6
England	2	2	4	4	2	2	4	4	3.0
Iceland	16	13	15	15	6	6	10	18	12.4
Israel	12	15	16	11	19	17	12	11	14.1
Korea	13	10	6	8	10	8	9	8	9.0
Mexico	8	9	3	3	13	12	18	12	9.8
New Zealand	9	4	18	18	15	9	17	13	12.9
Norway	7	6	8	7	7	13	3	3	6.8
Peru	11	14	5	5	14	10	8	10	9.6
Poland	17	17	9	9	18	19	19	16	15.5
South Africa	18	18	17	16	17	16	11	17	16.3
Sweden	5	3	11	12	3	4	6	2	5.8
Switzerland	1	1	7	10	1	1	1	1	2.9
Thailand	3	7	10	17	4	14	7	7	8.6

Source: Authors' construction from data published by central banks and national statistics offices.

Table 5

Data correlations (variable frequencies, 1990-2003)

5a) Cross-section correlations

	NMAD1	NMAD2	NMAD3	ATCD1	ATCD2	ATCD3	TARGET	RANGE	DNER	RISK	SPREAD	CBI
MAD1	0.67	0.60	0.66	0.93	0.98	0.98	0.38	0.50	0.62	-0.67	0.88	-0.19
MAD2	0.67	0.60	0.66	0.91	0.98	0.97	0.36	0.49	0.70	-0.65	0.87	-0.10
MAD3	0.64	0.58	0.64	0.92	0.97	0.97	0.39	0.46	0.71	-0.67	0.87	-0.10
NMAD1	1.00	0.99	1.00	0.74	0.75	0.70	-0.39	0.82	0.60	-0.25	0.48	-0.39
NMAD2	0.99	1.00	0.99	0.70	0.69	0.65	-0.46	0.82	0.58	-0.21	0.41	-0.44
NMAD3	1.00	0.99	1.00	0.73	0.75	0.69	-0.39	0.82	0.61	-0.25	0.48	-0.40
ATCD1	0.74	0.70	0.73	1.00	0.93	0.97	0.20	0.54	0.63	-0.51	0.70	-0.33
ATCD2	0.75	0.69	0.75	0.93	1.00	0.98	0.25	0.54	0.66	-0.58	0.86	-0.23
ATCD3	0.70	0.65	0.69	0.97	0.98	1.00	0.32	0.47	0.65	-0.61	0.83	-0.23
TARGET	-0.39	-0.46	-0.39	0.20	0.25	0.32	1.00	-0.35	-0.03	-0.67	0.56	0.29
RANGE	0.82	0.82	0.82	0.54	0.54	0.47	-0.35	1.00	0.32	-0.28	0.35	-0.49
DNER	0.60	0.58	0.61	0.63	0.66	0.65	-0.03	0.32	1.00	-0.37	0.53	0.16
RISK	-0.25	-0.21	-0.25	-0.51	-0.58	-0.61	-0.67	-0.28	-0.37	1.00	-0.84	-0.05
SPREAD	0.48	0.41	0.48	0.70	0.86	0.83	0.56	0.35	0.53	-0.84	1.00	-0.10
CBI	-0.39	-0.44	-0.40	-0.33	-0.23	-0.23	0.29	-0.49	0.16	-0.05	-0.10	1.00

5a) Panel-data correlations

	AD1	AD2	AD3	T1	T2	T3	RANGE	ABSNER	RISK	SPREAD	CBI
AD1	1.00	0.94	0.96	0.32	0.29	0.30	0.30	0.26	-0.35	0.43	-0.05
AD2	0.94	1.00	0.95	0.31	0.29	0.30	0.30	0.25	-0.36	0.42	-0.03
AD3	0.96	0.95	1.00	0.33	0.31	0.32	0.26	0.26	-0.38	0.44	-0.04
T1	0.32	0.31	0.33	1.00	0.98	0.99	0.08	0.14	-0.66	0.51	0.17
T2	0.29	0.29	0.31	0.98	1.00	0.99	0.04	0.11	-0.68	0.53	0.18
T3	0.30	0.30	0.32	0.99	0.99	1.00	0.05	0.13	-0.68	0.53	0.19
RANGE	0.30	0.30	0.26	0.08	0.04	0.05	1.00	0.26	-0.21	0.17	-0.19
ABSNER	0.26	0.25	0.26	0.14	0.11	0.13	0.26	1.00	-0.26	0.42	0.01
RISK	-0.35	-0.36	-0.38	-0.66	-0.68	-0.68	-0.21	-0.26	1.00	-0.79	-0.18
SPREAD	0.43	0.42	0.44	0.51	0.53	0.53	0.17	0.42	-0.79	1.00	0.01
CBI	-0.05	-0.03	-0.04	0.17	0.18	0.19	-0.19	0.01	-0.18	0.01	1.00

Table 6
Cross-section regressions

Dependent Variable	MAD1	MAD2	MAD3	MAD1	MAD2	MAD3
TARGET	0.263	0.237	0.260	0.299	0.280	0.305
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
RANGE	0.285	0.240	0.212	0.312	0.274	0.238
	(0.032)	(0.058)	(0.087)	(0.033)	(0.057)	(0.076)
DNER	0.083	0.097	0.104	0.065	0.082	0.087
	(0.006)	(0.001)	(0.002)	(0.042)	(0.013)	(0.007)
RISK	-0.008	-0.008	-0.007	-0.005	-0.007	-0.008
	(0.148)	(0.060)	(0.084)	(0.251)	(0.140)	(0.088)
CBI	-0.415	-0.231	-0.359	-0.420	-0.283	-0.291
	(0.172)	(0.431)	(0.224)	(0.196)	(0.376)	(0.336)
R2	0.79	0.81	0.81	0.74	0.75	0.78
Adj. R2	0.73	0.75	0.76	0.66	0.67	0.72
Sample	90-03	90-03	90-03	98-03	98-03	98-03
N° Obs	19	19	19	19	19	19

Dependent Variable	NMAD1	NMAD2	NMAD3	AECD1	AECD2	AECD3
TARGET				3.979	5.776	4.037
				(0.040)	(0.009)	(0.027)
RANGE	0.105	0.084	0.096	7.947		6.096
	(0.002)	(0.003)	(0.002)	(0.097)		(0.164)
DNER	0.015	0.014	0.015	2.187	2.835	2.402
	(0.021)	(0.009)	(0.009)	(0.044)	(0.005)	(0.020)
RISK	0.003	0.003	0.003	-0.098	-0.083	-0.155
	(0.005)	(0.001)	(0.002)	(0.506)	(0.608)	(0.262)
CBI	-0.138	-0.135	-0.134	-24.496	-17.264	-12.573
	(0.060)	(0.032)	(0.043)	(0.042)	(0.169)	(0.236)
R2	0.68	0.69	0.71	0.61	0.50	0.62
Adj. R2	0.59	0.60	0.63	0.50	0.40	0.51
Sample	90-03	90-03	90-03	90-03	90-03	90-03
N° Obs	19	19	19	19	19	19

Note:
P-values in parenthesis

Variable definitions:
MAD: Mean-absolute deviation
NMAD: Normalized mean-absolute deviation
AECD: Average episode cumulative deviations
TARGET: Average target
RANGE: Width of inflation target range
DNER: Standard deviation of nominal exchange rate variations
RISK: Institutional Investor's country rating average
CBI: Central Bank formal independence dummy

Table 7
Panel-data regressions

Dependent Variable	AD1	AD2	AD3	AD1	AD2	AD3	AD1	AD2	AD3
C	0.980	0.825	0.978	1.890	1.294	1.737	1.887	1.10	1.74
	(0.000)	(0.000)	(0.000)	(0.000)	0.001	(0.000)	(0.000)	(0.007)	(0.000)
AD(-1)	0.795	0.881	0.878	0.721	0.844	0.824	0.721	0.849	0.82
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AD(-2)	-0.199	-0.253	-0.212	-0.194	-0.261	-0.185	-0.194	-0.294	-0.18
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
AD(-3)	-0.050		-0.062	-0.087		-0.096	-0.087		
	(0.170)		(0.087)	(0.016)		(0.008)	(0.016)		
ABS(NER(-1))	0.009	0.010	0.009	0.009	0.009	0.010	0.009	0.03	0.01
	(0.068)	(0.012)	(0.025)	(0.091)	(0.038)	(0.030)	(0.091)	(0.010)	(0.030)
ABS(NER(-3))	0.008			0.008			0.008		
	(0.050)			(0.068)			(0.068)		
ABS(OILG)		0.007			0.007			0.010	
		(0.009)			(0.013)			(0.064)	
ABS(OILG(-1))	-0.005	-0.011		-0.005	-0.010		-0.005	-0.012	
	(0.088)	(0.001)		(0.055)	(0.001)		(0.055)	(0.006)	
ABS(OILG(-2))	0.007	0.007	0.003	0.007	0.006	0.003	0.007	0.006	0.00
	(0.012)	(0.015)	(0.176)	(0.014)	(0.021)	(0.221)	(0.014)	(0.026)	(0.221)
CBI	-0.122	-0.107	-0.093						
	(0.045)	(0.050)	(0.113)						
RISK	-0.009	-0.007	-0.009	-0.019	-0.012	-0.018	-0.019	-0.009	-0.02
	(0.000)	(0.000)	(0.000)	(0.003)	(0.034)	(0.003)	(0.003)	(0.122)	(0.003)
SPREAD									
SPREAD(-1)									
R2	0.50	0.58	0.568	0.53	0.61	0.613	0.529	0.575	0.61
Adj. R2	0.49	0.57	0.562	0.50	0.59	0.594	0.504	0.554	0.59
F-stat (F-E vs. Pool)				1.95	2.51	3.15			
Durbin's H	0.48	0.28	0.11	-0.18	-0.61	-0.05	-0.18	-1.07	-0.05
Sample	90-03	90-03	90-03	90-03	90-03	90-03	90-03	90-03	90-03
Method	Pooled OLS	Pooled OLS	Pooled OLS	F-Eff. OLS	F-Eff. OLS	F-Eff. OLS	F-Eff. TSLS	F-Eff. TSLS	F-Eff. TSLS
N° obs.	517	536	517	517	536	517	517	517	517

Instrument list in TSLS: c ad(-1) ad(-2) ad(-3) abs(ner(-1)) abs(ner(-3)) abs(oilg) abs(oilg(-1)) abs(oilg(-2)) risk(-1) risk(-2) abs(fedg) abs(fedg(-1)) abs(usg) abs(usg(-1))

Table 7
(cont.)

Dependent Variable	AD1	AD2	AD3	AD1	AD2	AD3
C	0.242	0.215	0.238	0.311	0.268	0.219
	(0.002)	(0.004)	(0.001)	(0.026)	(0.028)	(0.069)
AD(-1)	0.901	0.967	0.981	0.806	0.949	0.946
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AD(-2)	-0.230	-0.304	-0.251	-0.178	-0.338	-0.211
	(0.003)	(0.000)	(0.001)	(0.016)	(0.000)	(0.006)
AD(-3)	-0.070		-0.067	-0.133		-0.119
	(0.210)		(0.223)	(0.015)		(0.027)
ABS(NER(-1))	0.006	0.007	0.007	0.004	0.006	0.230
	(0.244)	(0.141)	(0.128)	(0.512)	(0.251)	(0.030)
ABS(NER(-3))	0.005			0.001		
	(0.281)			(0.855)		
ABS(OILG)		0.007			0.006	
		(0.033)			(0.077)	
ABS(OILG(-1))	-0.003	-0.007		-0.003	-0.006	
	(0.424)	(0.066)		(0.383)	(0.106)	
ABS(OILG(-2))	0.004	0.003	0.000	0.004	0.002	0.000
	(0.186)	(0.415)	(0.859)	(0.255)	(0.581)	(0.942)
CBI	-0.094	-0.064	-0.050			
	(0.164)	(0.301)	(0.451)			
RISK						
SPREAD	0.053	0.047	0.048			
	(0.008)	(0.004)	(0.007)			
SPREAD(-1)				0.131	0.089	0.124
				(0.014)	(0.047)	(0.005)
R2	0.55	0.60	0.63	0.59	0.66	0.700
Adj. R2	0.54	0.59	0.62	0.57	0.64	0.682
F-stat (F-E vs. Pool)						
Durbin's H	1.65	-1.14	-1.77	-0.45	-0.66	-0.56
Sample	90-03	90-03	90-03	90-03	90-03	90-03
Method	Pooled OLS	Pooled OLS	Pooled OLS	F-Eff. OLS	F-Eff. OLS	F-Eff. OLS
N° obs.	317	326	317	314	314	314

Note:
P-Values in parenthesis

Variable definitions:
AD: Absolute deviation of inflation respect to target
ABS: Absolute value
NER: Nominal exchange rate variation
OILG: Deviation of oil prices with respect to their trend
SPREAD: EMBI spreads for sovereign debt