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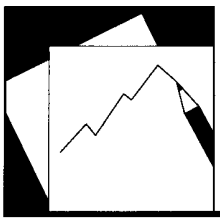

IMF Working Paper

In Search of Successful Inflation Targeting: Evidence from an Inflation Targeting Index

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Abstract

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In a first attempt to treat inflation targeting (IT) as a continuous variable, we construct IT subindices for 21 full-fledged ITers on three dimensions: flexibility, transparency, and explicitness. Comparing flexibility and transparency we find that (1) the impact of flexibility on both the mean and variation of inflation is more quadratic than that of transparency; (2) after adding the transparency index, the impact of flexibility is no longer significant. The significant and negative association between transparency and the level and variation of inflation is confirmed when we check for robustness by controlling for disinflation stage, subsampling, instrumental variable estimation, and principal component analysis (PCA).

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I. Introduction

Inflation targeting (IT) has shown increasing promise as the new generation of monetary policy framework ever since New Zealand first adopted it in 1990. Burgeoning research is recording the practice and reviewing the performance of IT central banks ("ITers" henceforth). The work by Neumann and Hagen (2002), Truman (2003), IMF (2005), Vega and Winkelried (2005), among others, painted more or less a success story for IT.[1] In fact, no country has ever dropped IT after adoption, and an increasing number of countries are embarking on IT, despite the ongoing debate and reservations of certain academics.[2]

With the increasing popularity of IT, a lowest common denominator, if no consensus, of what constitutes IT is forging among central bankers and academics (c.f., section 2). But no international best practice has emerged. In fact, the "flexibility" of IT as a monetary policy framework is often cited as a primary reason for its resilience and viability (e.g., Roger and Stone, 2005; Svensson, 1999).[3]

It is well recognized in recent literature that IT is *multi-faceted* strategy and set of procedures and the practices vary across central banks. Economists have not yet agreed on how to label this diversity. Carare and Stone (2006), for example, divided IT regimes into three subcategories: full-fledged IT, implicit IT, and IT lite. They classified the U.S., the European Central Bank (ECB), and Japan as implicit ITers. Truman (2003), in contrast, dubbed the three big economies "G-3", a special group that are not ITers and yet achieve well-anchored inflation expectations. A closer reading into central bank laws and publications reveals that divergence is the norm rather than exception. This is true even among the more homogenous group of so-called full-fledged ITers. For instance, such countries as Armenia, Colombia, Greece, Iceland, and South Korea write IT explicitly in their central bank acts; many others, like Brazil, the UK, and Israel, have published numerous government decrees regarding IT but fall short of legislating the regime. Thus, there is a de jure and de facto distinction among ITers. There are other important differences in terms of target design, reaction horizon, transparency, and accountability. These differences become more apparent with implicit ITers and central banks having gone through disinflation whilst instituting IT.

While recognizing the vast diversity of IT practices, empirical research continues to treat ITers as homogeneous. Inflation targeting is recorded as a binary variable, i.e., either one or zero, in virtually all econometric work comparing ITers with non-ITers – name just a

[1] A notable exception is Ball and Sheridan (2005), in which the superior performance of ITers was attributed to "regression to mean". However, the authors stated clearly that "our results do not provide any argument *against (italics original)* inflation targeting, for we have not found that it does any harm".

[2] Sims (2003), for example, suspected that adoption of inflation targeting simply reflected a lack of viable alternatives.

[3] The meaning of "flexibility" depends on the context. It can refer to the fact that inflation targeting even in its "strictest" form, with a zero weight on output gap in a quadratic loss function, still takes into account output in its reaction function (Svensson, 1997). In this sense, inflation targeting is always "flexible"; it is never strict inflation only. In a more practice-oriented context, flexibility also refers to the latitude that IT regimes enjoy in bringing inflation on target. The latter interpretation applies in this paper.

few, the empirical work by Ball and Sheridan (2005), Mishkin and Schmidt-Hebbel (2007), and IMF (2005). Much as announcing an inflation target does not make a central bank an ITer, there are institutional arrangements and attributes that matter more for inflation performance than does the tag of IT. Yet no research has made an effort to ascertain and quantify, if possible, the impact of such institutional underpinnings.

This research attempts to fill the void by posing and answering key questions of both theoretical and operational relevance to current and potential ITers. First, do different institutional arrangements and attributes matter for the performance of an IT regime? What are the most important ones? Second, how flexible can flexible inflation targeting be in terms of target design, and, is there an optimal degree of flexibility or transparency? Our contribution is twofold. First, it contributes to the growing literature of IT evaluation by treating IT as a continuous variable on important dimensions such as institutional arrangements, target design, and transparency and accountability. It does so by first establishing a framework of constructing an IT index based on an emerging consensus on what constitutes IT. Second, and more importantly, it sheds light on vital policy debate for potential ITers eager to imitate and emulate, e.g., whether to make the regime as explicit as possible in terms of institutional arrangements; whether to make the regime as flexible as possible in deciding on a point target or a target range and choosing between a relatively short and long target horizon; and whether in principle to aim to have as much transparency as possible.

The rest of the paper is organized as follows. Section 2 first provides a brief literature review and discusses the framework of constructing IT indices on related and yet distinct dimensions of the regime. Section 3 tests empirically the validity of the newly minted indices and presents a horse race between flexibility and transparency among all IT regimes. Section 4 provides robustness checks using factor analysis, subsampling, and instrumental variable estimation. We conclude in Section 5 and offer some policy reflections. Tables, figures, and a brief theoretical review of factor analysis are provided in the appendices.

II. Literature Review and the Construction of an IT Index

A. What Constitutes Inflation Targeting?

Even after almost two decades of inflation targeting, confusion persists on exactly how to define the term. Kuttner (2004) noted that there are two alternative ways, not mutually exclusive, to think about IT: the first is in terms of the observed characteristics of the policy framework, and the second is in terms of policy rule. The second approach, spearheaded primarily by Svensson (1997, 1999), treats IT as an optimal policy rule derived from a "reasonably explicit objective function." Woodford (2004) and Walsh (2002) also described IT in terms of optimal targeting rules.[4]

[4]The word "rule" can be a source of confusion itself, especially when used in the context of inflation targeting. Kuttner (2004) made two useful distinctions. The first is between *optimal* and *ad hoc* rules, with

Bernanke et al.,(1999), in the first cross-country review of IT practices, advocated that IT is best described as a "framework" rather than a "rule." In a similar vein, Truman (2003) observed that "inflation targeting in practice involves both more and less than a *reaction function* characterizing a monetary policy regime". This research takes the practical angle and views IT as a monetary policy framework. Even from the pure practical perspective, however, prominent writers differ in what constitutes IT:

- Mishkin (2000) posited that inflation targeting encompasses *five* main elements: (i) the public announcement of medium-term numerical targets for inflation; (ii) an institutional commitment to price stability as the primary goal of monetary policy, to which other goals are subordinated; (iii) an information-inclusive strategy in which many variables, and not just monetary aggregates or the exchange rate, are used for deciding the setting of policy instruments; (iv) increased transparency of the monetary policy strategy through communication with the public and the markets about the plans, objectives, and decisions of the monetary authorities; and (v) increased accountability of the central bank for attaining its inflation objectives.
- Truman (2003) summarized *four* principal elements of IT: (1) price stability as the goal of monetary policy; (2) a numerical target or sequence of targets to make the framework operational; (3) a time horizon over which the target or the targets are to be met, and 4) an associated approach for evaluating whether the objective or objectives have been achieved.
- Svensson (1997, 1999) originally emphasized the role of inflation forecasting. Today, for Svensson (2007a), the essential elements of IT are *three-fold*: (a) an announced numerical inflation target; (b) an implementation of monetary policy that gives a major role to an inflation forecast and has been called "inflation-forecast targeting"; (c) and a high degree of transparency and accountability.

It is worth pointing out that the point of deviation of Svensson's definition is that a single or hierarchical mandate is no longer a necessary condition for IT. Svensson's related work (1997, 1999, 2001) also showed in detail the consistency of inflation targeting with a dual mandate.

Despite the aforementioned divergence in defining the term IT, a lowest common denominator, if not a consensus, exists for recognized ITers. IT as a monetary policy regime must have a well-defined inflation target, be it a point or a range, with institutional arrangements to support its achievement, and a high degree of transparency and accountability. The centerpiece of IT is to establish and maintain well-anchored inflation expectations via central bank transparency and accountability.

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the former referring to rules derived from explicit optimization problems and the latter often linked with the Taylor rule or the inflation forecast-based (IFB) rule. The second distinction is between *targeting* and *instrument* rules. Targeting rules are specified entirely in terms of the targets of monetary policy (inflation and output); instrument rules are defined in terms of the optimal setting of the monetary policy instrument, typically the short-term interest rate under the central bank's control.

B. A Framework for Constructing an IT Index

Our proposed framework of constructing an inflation targeting index consists of three related and yet distinct dimensions: target design, transparency and accountability, and institutional arrangements. Each of the three dimensions has a corresponding subindex, namely, *flexibility*, *transparency*, and *explicitness*, which in turn is built upon various components of the IT regime.

1. Target Design (IT_1 – *Flexibility*)

The subindex of flexibility is built on four variables, each coded on a scale of 0 (least flexible) to 1 (most flexible).

- Clarity of target: point targeter vs. range targeter, and the width of the range

A critical issue in coding numerical targets is whether the level of inflation target itself matters. The level of numerical targets for point targeters or the mid-point for range targeters often changes over time (see Table 1 for details). It is especially the case for countries going through disinflation phases. They often have a declining path of inflation targets and sometimes specify only upper but not lower bounds on inflation.[5] The flexibility of inflation targeting is not so much about the level of target itself as it is about the latitude within which central banks can operate. We thus focus on the range of the target. For countries where no range is specified, we look at the range within which central banks are exempt from reporting requirements.[6]

Table 1 records that the target range in practice can be as wide as 5.0 percent (minus and plus 2.5 for Brazil between 2003 and 2006) or as narrow as 0 for a pure point targeter (e.g., Finland and Norway). A larger inflation target range will likely allow central banks more flexibility in taking other objectives into account. We hence code 1 for countries with the widest target range indicating most flexibility; 0 for a strict point target with least flexibility; and $x/5$ for countries in between with a target range of width x. The theory of IT would suggest that the clearer the target, the more concrete the commitment and the better anchored the inflation expectations. Thus, we expect to find a positive correlation between the clarity of target and the performance of inflation dynamics.

- Horizon to achieve the inflation target

[5] For the case of specifying only the upper bound, it is debatable whether this gives the central bank more or less flexibility. On the one hand, any point below the upper bound is "on target" and thus appears to give ITers more latitude. On the other hand, a clear-cut upper bound implies that central banks must by all means bring inflation under control, indicating a stringent condition. I tend to follow the latter interpretation when coding numerical targets.

[6] Roger and Stone (2005) reported that the Bank of England since 2004 has not had an explicit target range but deviations of more than 1 percent from target requires an official explanation.

Publicly declared target horizons of ITers vary from annual to multi year/medium term and from business cycle to indefinite/long term (see Table 1). The reason for such diversity may be that the optimal choice of target horizon is economy-specific and subject to factors such as the underlying transmission mechanism of monetary policy, the magnitude and persistence of shocks, and not least the preference of central bankers.[7] Batini and Nelson (2001) defined the optimal policy horizon (OPH) as the time at which it is least costly, for a given loss function, to bring inflation back to target after a shock.[8] This definition is the result of standard optimization practice along the lines of Rudebusch and Svensson (1999) and Svensson (1997, 1999). More intuitively, the OPH is the horizon-analogue of the optimal speed of disinflation – the optimal time required for the dissipation of a shock. Operationally, the OPH is given by the number of periods after a shock when inflation is back on target under an optimal rule.

A longer target horizon, *ceteris paribus,* gives the central bank more flexibility in taking other policy objectives into account without subordinating the inflation objective. We thus code 1 for indefinite horizon, indicating maximal flexibility; 0.67 for business cycle; 0.33 for multi year; and 0 for annual horizon. An annual horizon is often adopted during disinflation phases.

- Reporting requirements of target breach and escape clauses[9]

If there is no formal reporting requirement for missing the target range, central banks have more leeway to take into consideration other objectives, such as employment and financial stability. We code 1 for no target breach reporting requirement and 0 for the nine ITers (Brazil, Canada, Iceland, Israel, New Zealand, Philippines, Sweden, Thailand, and the UK) that require formal public explanations for missing the target.

The existence of escape clauses and its potential invoking may also provide central banks with extra flexibility. Escape clauses spell out in advance circumstances under which central banks are exonerated from reporting a breach of the target. Such circumstances include large adverse supply shocks and big adjustments in administered or regulated prices and often dictate a temporary accommodation of inflation disturbances. Setting the inflation target in terms of a measure of core inflation, as was pointed out by Roger and Stone (2005), often serves as an implicit escape clause. But only a few countries set their targets in terms of core inflation, and only Canada, Czech Republic, New Zealand, and South Africa have had explicit escape clauses (see Table 2 for a detailed list). We code 1 if there are escape clauses, explicit or implicit, and 0 otherwise.

[7] Using a small estimated forward-looking model of the euro area economy, Smets (2003) found that the optimal policy horizon became longer the greater the weight on other objectives such as minimizing the output gap and interest rate variability; it became shorter the higher the degree of "forward-lookingness" in the economy and the greater the slope of the Phillips curve.

[8] Batini and Nelson (2001) also used an alternative definition dubbed "optimal feedback horizon (OFH)". In contrast to "optimal policy horizon", which is a result of standard optimization, OFH views targeting expected future inflation simply as setting the policy instrument in response to deviations of future inflation from target. In other words, under OFH the inflation forecast at some specific horizon is a key input into policy-makers' decisions.

[9] These two items are also important in holding central banks accountable.

The expected sign of *flexibility* on the mean and variance of inflation is not unequivocal. On the one hand, if inflation stability is already achieved and credibility well-established, central banks can afford more ambiguity in target clarity and slower adjustment to bring inflation back to target. On the other hand, a steadfast point target and a shorter (annual) time horizon to achieve it are often adopted during the disinflation stage. The reason might be that the central bank needs to signal its resolve and establish credibility by reducing ambiguity and increasing accountability. Put simply, there is a potential endogeneity issue between flexibility and credibility (more on this later).

As Svensson (1999) noted, the speed of monetary policy instrument adjustment depends on the degree of flexibility. Flexible IT implies that shocks that drive inflation away from the target should revert at a pace that does not harm real activity too severely. Too fast an adjustment is equivalent to strict IT, which is likely in situations whereby the central bank needs to gain or strengthen credibility. With a fast adjustment, undue real volatility might emerge, whereas in the slow adjustment case either credibility is strong enough that the central bank can reap some benefits of flexibility or the nominal anchor is lost and inflation falls to the expectation trap.

2. Transparency and Accountability (IT_2 – *Transparency*)

There is no consensus on a definition of central bank transparency, let alone its measurement. Posen (2002), for example, presented six practical views of central bank transparency ranging from "reassurance" to "irrelevance." Geraats (2002) and Eijffinger and Geraats (2006) provided a taxonomy to analyze the transparency of monetary policy along five distinct aspects: *political, economic, procedural, policy*, and *operational* transparency. Although very useful, the five-way categorization may not be altogether fitting here. We feel that certain aspects, especially political transparency, stray beyond what most people understand by the term "transparency." In asking such questions as whether or not there is an explicit numerical target, it in essence applies to a target design issue. In fact, in applying the taxonomy to 37 central banks Crowe and Meade (2008) found that only economic and operational transparency are significant and bear the expected negative sign. Our proposed transparency index for ITers focuses on the forecasting aspects of an IT regime as well as central bank website coverage. Like the flexibility index, it is built on four variables, each coded on a scale of 0 (least transparent) to 1 (most transparent).

- Number of inflation reports, quantitative inflation forecasts, and publication of fan charts

If, as was argued by Blinder (2004), Woodford (2004) and Svensson and Woodford (2005), modern central banking is about managing expectations, the importance of inflation forecasting cannot be over-emphasized. All ITers now publish inflation reports (see Table 4). But the number (x) and frequency of inflation reports varies from 0 to 4 a year, which is coded accordingly as $x/4$. Other forwardlooking practices such as publication of quantitative forecasts and fan charts are equally important. They are recorded and coded as taking a binary value of 0 or 1.

- Central bank website coverage

Central bank websites play an increasingly important role in central bank communications. Heenan, Peter, and Roger (2006) documented central bank website coverage of seven items, namely, IT framework, target details, transmission mechanism, policy instruments, decision-making, policy calendar, and links to materials. We code 1 if a central bank website covers all seven items, and $x/7$ if it covers only x items.

- Reporting the interest rate path

Svensson (2007b) advocated the publication of the central bank's own policy projections – the interest rate path – as further developments to IT. "Not to publish the interest rate forecast would be to hide the most important information," he proclaimed. But only a few ITers, e.g., the Reserve Bank of New Zealand since 1997, the Norges Bank since 2005, and the Riksbank since 2007, have adopted the practice. As such, it is not yet included as part of the transparency index.

The expected sign on *transparency* is negative; i.e., the more transparent ITers are, the more superior their performance on managing inflation expectations and thus reducing the mean, variance, and persistence of inflation. There is nonetheless a possibility of too much transparency, but it is doubtful that any central bank has passed that threshold yet.[10]

3. Institutional Arrangements (IT_3 – *Explicitness or Strength of Institutional Commitment*)

- Mandate: single/hierarchical vs. dual/multiple

One approach is to record 1 for a single/hierarchical mandate and 0 for a dual/multiple mandate. Another is to follow Cukierman et al., (1992) and have a finer classification on central bank objectives.[11] Using the former approach and citing relevant articles from central bank laws, I found in a separate and yet related paper (Miao, 2007) that the mandate does matter for the performance and conduct of monetary policy. To the extent that a binary classification captures the essential difference among different types of central bank mandates, we adopt it in this paper as well.

- Exchange rate arrangement: free floating to hard peg (Reinhart and Rogoff, 2004)

[10] For whether in principle there can be too much central bank transparency, see, among others, Mishkin (2004), "Can central bank transparency go too far?"

[11] They assigned a numerical value of 1 if price stability is the major or only objective in the charter, and the central bank has the final word in case of conflict with other government objectives; 0.8 if price stability is the only objective; 0.6 when price stability is one goal, with other compatible objectives, such as a stable banking system; 0.4 if price stability is one goal, with potentially conflict ing objectives, such as full employment; 0.20 if no objectives stated in the bank charter; and 0 if stated objectives do not indude price stability.

Adoption of an IT regime entails subordinating exchange rate goals to the objective of price stability. We code 1 for completely free floating, 0.5 for managed floating, and 0 for a peg. But full-fledged ITers have converged in this aspect as well.

- Central bank independence (instrument independence) and monetary policy decision-making mechanism[12]

A disproportionate amount of weight should be given to instrument independence given the fact that ITers are converging on aspects such as establishing monetary policy committees (MPCs), setting a single/hierarchical mandate, and intervening less and less in foreign exchange markets. To the extent that the Cukierman index (Cukierman et al., 1992, 2002) already covers important aspects of the central bank mandate and decision-making mechanism, we use the central bank independence index as a proxy for IT_3. We obtain central bank independence data from Simon and Guillen (2005) for up to 2000 and from Crowe and Meade (2008) for the year of 2003 and onwards.

The expected sign of the subindex of *explicitness* is negative. The more explicit ITers become, the stronger the institutional commitment to it, and the better their performance in terms of reduction in the mean, variance, and persistence of inflation.

We could have added an additional subindex ranking the credibility of different IT regimes. It could potentially cover items such as whether inflation expectations are well-anchored or not, whether an ITer has a good track record of meeting targets, and whether a central bank possesses necessary IT infrastructure, e.g., research and forecast capacity. But some of the items appear to be performance criteria themselves. Credibility, even if treated separately from inflation performance, clearly hinges upon attributes that are already included in the subindices of *flexibility*, *transparency* and *explicitness*.

Each of the three subindices takes the form of $IT_i = \sum \omega_i * I_i$, where ω_i is the subjective and mostly equal weight for different attributes. The only exception is that two of the four elements in the *flexibility* subindex, namely reporting requirements and escape clauses, receive only half the weights assigned to the other two. The reason is based on the observation that they are seldom invoked in practice. Notice that each individual attribute I_i is coded on a scale of 0 to 1. As such, each subindex IT_i is normalized to 1 and is comparable across different dimensions. In view of the uncertain impact of target design (*flexibility*) on inflation dynamics, it may be more meaningful to separate the index of flexibility from that of transparency and central bank independence.

III. Data and Econometric Analysis

The main question we address in this section is whether more explicit (strict) or transparent ITers differ from their more implicit (flexible) or less transparent

[12] The only two ITers that do not have a full-fledged committee are Israel and New Zealand; but they operate under a shadow committee (Miao, 2008).

counterparts? To this end we retrieve panel data in annual frequency for 21 full-fledged ITers spanning the full course of inflation targeting eras, including the stage of disinflation. Before conducting the panel analysis, we plot average inflation and average variation of inflation over the full sample period against our flexibility and transparency indices for selected ITers.[13] Figures 1 and 2 demonstrate that both transparency and flexibility are negatively associated with average inflation. Figures 3 and 4 present the scatterplots between the variation of inflation and transparency and flexibility. While the negative association between transparency and inflation variation is salient in Figure 3, the relationship for flexibility appears to be more quadratic. In addition to cross-section data plots, we test in the next subsection the validity of the newly minted indices.

A. The Validity of the Subindices on Flexibility and Transparency

We run parsimonious fixed effects estimations of the following two equations using robust and clustering options and controlling for nonspherical errors. This in effect down-weights sample outliers and gives White-corrected standard errors.

$$\sigma^{\pi}_{it}/\sigma^{y}_{it} = \alpha_{it} + \delta_1 * Flexibility_{it} + countrydummies + timedummies,$$

$$\sigma^{\pi}_{it}\ /\sigma^{y}_{it} = \alpha_{it} + \gamma_1 * Transparency_{it} + countrydummies + timedummies,$$

where σ^{π}_{it} and σ^{y}_{it} are variations in inflation and growth for country i at time t, derived from the standard deviation of the five-year rolling averages of inflation and growth, respectively.

If the IT indices are well constructed, the relative variability of inflation vis-a-vis growth should be smaller in a more transparent and more stringent IT regime, as the theory of IT would suggest. We thus expect to find a negative coefficient on transparency and a positive one on flexibility. The transparency index indeed carries the expected negative sign (-1.79) and is significant at the 1% level with a t-ratio of -2.96. Barring further refinement of the index and the data on inflation and growth variability, however, the flexibility index has a negative coefficient -0.98 and is almost significant at the 5% level with a t-ratio of -2.04, which is contrary to the prior. This points to the viability of the story that relatively credible and well-established ITers can afford more flexibility such as an indefinite horizon to bring inflation back to target.

An alternative explanation might be that 15 countries in the sample have gone through disinflation phases, in which inflation variation is often large relative to growth variation due to the reduction of inflation from double digits to single digits.[14] Rerunning the regression on the subsample consisting of postdisinflation phases does lend partial support

[13] Brazil, Colombia, and Hungary are treated as outliers and excluded from graphical studies because they had financial crises and run-up inflations in the middle of the sample period.

[14] Going through disinflation often entails giving relatively less weight to growth variation. But the variation of inflation is still much larger in magnitude given the double digit level of inflation to start with.

to this explanation. It yields a positive coefficient 0.27, although not significant with a t-ratio of 0.55, suggesting that high flexibility is indeed associated with large relative inflation variability.

B. Does IT Matter? Is There an Optimal Degree of Flexibility or Transparency?

Here we investigate inflation dynamics, i.e., the mean (annual level), variance, and persistence of inflation, among different types of ITers. We first fit simple fixed effects estimation of the mean inflation without including control variables X other than our own constructed IT indices.

$$\pi_{it} = \alpha_i + \beta * X + \delta_1 * IT_{it} + \delta_2 * IT_{it}^2 + timedummies,$$

where π is the inflation rate and X denotes the vector of other control variables.

Preliminary results indicate the following pattern: (1) both flexibility and transparency indices carry negative signs and are both significant at the 1% level (see Table 5 specifications 1 and 5); and (2) the impact of flexibility is more quadratic, with the quadratic term almost significant at 10% level; but transparency does not show signs of diminishing returns (see Table 5 specifications 2 and 6). This pattern of results also holds when we estimate a New Keynesian type Phillips curve after adding output gap and inflation expectation, proxied by lagged inflation, as controls (see Table 5 specifications 3 and 6).

The significant negative sign of flexibility warrants further explanation as the theory of IT would indicate otherwise. As discussed in section 2, the negative correlation between flexibility and mean inflation may simply reflect the fact that well-established ITers, often with lower level of inflation, can afford more flexibility. We therefore regress reduction in inflation on the flexibility index:

$$\Delta\pi_{it} = \alpha_i + \beta * X + \delta_1 * Flexibility_{it} + timedummies,$$

where $\Delta\pi_{it} = \pi_{it} - \pi_{i,t-1}$ is the increase (negative of reduction) in inflation. This returns a positive coefficient 2.91 and is significant at the 5% level with a t-ratio of 2.61, which confirms the *a priori* that more stringency is associated with increasing inflation reduction.

We now estimate the equation of inflation variability:

$$\sigma_{it}^{\pi} = \alpha_i + \beta * X + \delta_3 * IT_{it} + \delta_4 * IT_{it}^2 + timedummies,$$

where σ^{π} is the variation of inflation and X denotes the vector of other control variables. The variation of growth is included as a control per the theory of inflation-output variability trade-off (Taylor, 1979). The aforementioned pattern of results again holds (see Table 6 specifications 1-3). Note that the effects of transparency become even more pronounced (significant at the 1% level) in reducing inflation variation.

An intriguing finding emerges from fitting the New Keynesian Phillips curve with added flexibility index and its squared term. The relevant coefficients (Table 5 specifications 3 and 4) suggest that the optimal degree of flexibility ($Flexibility^*$) lies around 0.7. This number is derived from first order conditions as $Flexibility^* = -\delta_1/2\delta_2$. It corresponds to the flexibility index of IT frontier countries such as Canada (after 1995), Chile (after 2001), New Zealand, Norway, and Sweden (see Table 3).

C. A Horse Race Between Different IT Components

We now run a horse race between the two important components of the IT index: flexibility and transparency. Both indices are included in the same equations for estimating the mean inflation and variation of inflation.

$$\pi_{it} = \alpha_i + \beta * X + \gamma_1 * Flexibility_{it} + \gamma_2 * Transparency_{it} + timedummies,$$

$$\sigma^{\pi}_{it} = \alpha_i + \beta * X + \gamma_3 * Flexibility_{it} + \gamma_4 * Transparency_{it} + timedummies,$$

In the mean inflation equation, flexibility is no longer significant, but transparency remains significant at the 1% level (Table 5 specification 7). In the inflation variation equation (Table 6 specification 3), transparency continues to be significant at the 1% level and with expected negative sign; but flexibility turns barely significant at the 10% level. The sharp contrast demonstrates that all that matters in the aggregate IT index is transparency and accountability.[15] The ultimate question is not so much the label of IT as the substance on these important dimensions.

IV. Robustness Checks

A. Principal Component Analysis (PCA)

We have been assigning subjective and mostly equal weights to different components of the flexibility and transparency indices of inflation targeting. For example, the weight somewhat arbitrarily given to target horizon is equal to that of target range and to the

[15] A single-minded mandate and central bank independence could also potentially explain the performance and conduct differences between ITers and non-ITers, the focus of my previous paper (Miao, 2007). This paper focuses on attributes that distinguish ITers from each other. Given that ITers converge on mandate (only a few still have dual/multiple mandates), on committee decision-making (all except two), and on other important independence parameters, the independence index is not entered in the horse race.

combined weight of reporting requirements and escape clauses. There is nonetheless a possibility that certain attributes may be more important than others. Target horizon, for instance, may carry more weight than is assigned given that escape clauses and reporting requirements are seldom invoked and target range is not always binding.

One alternative to adjust for the subjectivity of constructing an index is to let the data decide relative weights. Factor analysis (e.g., Stock and Watson 1989, 2002; Bai and Ng, 2002) enables us to detect the most important components of IT while automatically correcting for potential multicollinearity among the different attributes of the indices. The resulting factors, the principal components, are latent variables that are linear combinations of different underlying attributes. The factor loadings associated with the linear combinations will be alternative weights for the newly constructed indices. Banaian, Burdekin, and Willett (1998) used PCA to examine the role played by 15 of the attributes of central bank independence in the Cukierman index. They found that most appear to have an insignificant or a positive rather than a negative relationship with mean inflation rates.

To conduct the factor analysis, we refine the indices and include annual observations on the following nine attributes: target range, target horizon, reporting requirements, escape clauses, number of inflation reports, forecasts, fan charts, central bank website coverage, and central bank independence. Three eigenvalues of the correlation matrix are greater than one (see the screeplot in Figure 5). The scree test associated with the plot also suggests that the optimal number of common factors is three. We thus retain three principal components, with each one uncorrelated to any other.

The first principal component (Z_1) is the one that matters most and is usually referred to as the "general" factor. The factor loadings associated with Z_1 are the weights. It is noticeable that roughly equal weights are assigned to different underlying attributes except for reporting requirements and escape clauses (see Table 7). The sum of the loadings (in absolute terms) of these two items, however, is almost equal to that of other attributes, especially those of target horizon and target range. This coincides with our *a priori* assumption in assigning only half weights to these two attributes in constructing the flexibility subindex.

Regressing both the level and the variation of inflation on Z_1, Z_2, Z_3, and a full set of country dummies, we find that only Z_1 is significant at the 5% level and carries the expected negative sign (see Table 8). Not surprisingly, all the explanatory power resides with the first principal component. The drawback with the PCA, however, is that components other than the first, e.g., Z_2, Z_3, are usually hard to interpret. Thus it might be preferable to work with some related and yet more interpretable variables, $F's$, that are linear combinations of the $Z's$. $F's$ become more interpretable in the sense that each F is highly correlated to a specific subset of the underlying attributes. We can therefore employ the "orthogonal rotation" technique and construct three new factors, each significantly associated with certain underlying attributes and yet not correlated with one another.

The factor loadings associated with the three rotated components $F_{1,}F_{2,}$ and $F_{3,}$ and the correlation coefficients between these components and the nine underlying attributes of IT are reported in Tables 9 and 10. It is noticeable that the No.1 factor is mostly significantly correlated with the following three attributes in the transparency subindex, e.g., number of inflation reports, quantitative forecasts, and publication of fan charts. Using the rotated components $F_{1,}F_{2,}$ and F_3 as regressors and including country fixed effects and other controls, we find that F_1 is significantly and negatively associated with both the level and the variation of inflation across different specifications (see Table 11). The rotated factor F_3, which is predominantly correlated with central bank website coverage, is also significantly and negatively associated with the variation of inflation (Table 11 specifications 3 and 4).

B. Subsampling

As a further robustness check, we divide the full sample of 21 ITers into two groups. The first consists of 13 emerging market economies; the second is composed of 8 industrial countries. The same pattern of results as highlighted in section 3 holds in the subsample of emerging market economies, but not in the group of industrial countries (Table 12). This contrast of results should not be too surprising since the differences of IT practices among emerging economies are much larger than those among industrial countries. Noticeable intragroup heterogeneity withstanding, it is worth emphasizing that there is an even larger intergroup difference in terms of flexibility and transparency. The intergroup heterogeneity also explains the significant deterioration of the goodness-of-fit in the two subsamples compared to the full sample. Precisely because of both the intergroup and the intragroup heterogeneity, however, the search for attributes of successful inflation targeting becomes even more meaningful.

Another caveat is that some ITers (15 of 21) have gone through the process of disinflation while moving toward de jure or more full-fledged IT. To control for potential confounding effects due to disinflation, we add a dummy variable indicating the phase of disinflation. It aims to test the robustness of our story of the irrelevance of flexibility and the importance of transparency in a subsample closer to a natural experiment. The results (Table 13) indicate that, after controlling for disinflation, transparency remains significant in reducing inflation variation across both subsamples and the full sample.

C. Endogeneity

The estimates of the impact of transparency might be subject to endogeneity bias. So might the results for flexibility, although the sources of endogeneity could differ. For flexibility, potential endogeneity might be due to simultaneity or reverse causality. A significant and positive association between inflation dynamics and flexibility can be observed among stable ITers. It can be interpreted either as that flexibility leads to

superior performance of inflation dynamics; or, the other way around, that superior track record compensates for the potential credibility loss from increased flexibility. For transparency, the sources are more likely to be omitted variables or unobservables relegated to the error term. To account for the possibility of an endogeneity problem due to either reverse causality or omitted variables, we run two-stage least-squares (2SLS) regressions with heteroskedasticity-consistent standard errors of the following form:

Second Stage: Inflation *or* Variation of Inflation $= \delta_{2SLS}[Flexibility] + \beta X + u$; and

Inflation *or* Variation of Inflation $= \delta_{2SLS}[Transparency] + \beta X + u$

First Stage: Flexibility $= \alpha$[Instruments]$+\gamma X + v$; and

Transparency $= \alpha$[Instruments]$+\gamma X + v$

The error terms in the first and second-stage regressions are v and u respectively. X is a set of included exogenous variables, meaning they are exogenous variables that are included in second-stage regressions. Instruments, often dubbed excluded exogenous variables, are adopted to extract the exogenous components of the flexibility and transparency index. Notice that included exogenous variables X can be part of the instruments, but the instruments should have at least one variable that is exogenous and excluded from the second-stage regression.

Potential instruments for flexibility include inflation history (10-year lagged inflation), neighbors' flexibility, and political economy aspects of central bank operation. Promising instruments for transparency include education (tertiary school enrollment rate), development of stock markets (10-year lagged market capitalization as a percent of GDP), and neighbors' transparency. Current education level and lagged stock market development are chosen because of the plausible thesis that the more educated the public and the more advanced the financial markets, the more pressure there will be on central banks to be transparent.[16] Neighbors' transparency and flexibility are also potential instruments because they are unlikely to be correlated with omitted variables of a foreign country and yet very likely influenced by a neighboring country's inflation targeting practice due to peer pressure or spillover effects. In fact, we do observe clustering of IT and similar degrees of transparency and flexibility among "neighbors" (see Tables 3 and 4). Notice that one's economic neighbor is likely to be, but not necessarily, its geographic neighbor. Factors such as historical and linguistic links and development stage also matter. Taking all these factors into account, we could divide the 21 ITers into five neighborhoods, e.g., developed Anglo-Saxon countries (Australia, Canada, New Zealand, and the UK); Nordics (Finland, Iceland, Norway, and Sweden); emerging Europe (Czech Republic, Hungary, Israel, and Poland); Latin America (Brazil, Chile, Colombia, Mexico, and Peru); and other emerging markets (Korea, Philippines, South Africa, and Thailand).

We can test the validity of the proposed instruments using the over-identifying restriction (OIR) test. The OIR-test has as its null hypothesis that the instruments can be excluded

[16] Lagged financial market development is adopted to avoid contemporary correlation between error term and current financial depth because the latter is often cited as an important monetary policy transmission mechanism. A relatively large lag, 10 year, is chosen because of the observed high persistency of financial depth within time spans of a few years.

from the second-stage regression. The test yields a Lagrange multiplier test statistic that under the null hypothesis is distributed Chi-squared (m), where m is the number of OIRs. The degree-of-freedom m equals the number of excluded exogenous variables minus the number of endogenous variables included as regressors in the second-stage regression. The results of the second-stage regressions and OIR-tests are reported in Table 14. The proposed instruments for transparency appear to be valid as the null hypothesis can't be rejected at the 5% significance level.[17] The extracted exogenous component of transparency remains significant in reducing both the variation and the level of inflation in virtually all specifications. It still retains the expected negative sign in the one specification that it is not significant. Comparing the coefficients of transparency in Table 14 with those from corresponding specifications in Tables 5, 6, and 13, it appears that the instrumental variable estimation actually strengthens the magnitude of the impact of transparency. Corresponding Hausman tests, however, fall short of proving that the differences are statistically significant.[18]

V. Avenues for Future Research and Reflections

A. The Credibility and Flexibility Trade-off

A potential trade-off with inflation targeting, as previously mentioned, is that with increased flexibility there is more risk of losing credibility. Less flexibility (more stringency) is often desirable during disinflation phases for the sake of establishing credibility and thus well-anchored inflation. However, the other side of the same coin is that with credibility well-established, central banks can afford and often desire more flexibility in taking other objectives into account. As is observable in the data, target horizons tend to lengthen when inflation stabilizes; whereas annual target horizons are commonly used in disinflation. To put it differently, central banks with well-established IT regimes may face different credibility and flexibility trade-off curves. Follow-up research might plot the track record of meeting targets, a proxy of credibility, against our constructed flexibility index and ascertain whether there is indeed a trade-off, and whether ITers at different stages are facing different trade-off curves.

[17] Proposed instruments for flexibility, e.g., 10-year lagged inflation and neighbors' flexibility, also can't be rejected under the OIR-tests. However, they appear to be weak instruments and fail to reject the null in both the weak identification and the underidentification tests across different regression specifications. The results are thus not reported here but are available upon request.

[18] The Hausman test has as its null hypothesis $p\lim(\delta_{OLS} - \delta_{2SLS}) = 0$ and the test statistic H is calculated as $H = \frac{(\delta_{OLS} - \delta_{2SLS})^2}{(S.E.(\delta_{2SLS}))^2 - (S.E.(\delta_{OLS}))^2}$. Under the null hypothesis, H follows a Chi-square distribution with degree of freedom one. The test results should be taken with great caution for two reasons. First, the Hausman test often has a low power as there is no explicit alternative hypothesis. Second, it may be subject to the "small sample" problem here due to limited number of observations.

B. Final Reflections

What is IT? And why move to IT? For the U.S. and some others, the question is whether moving to full-fledged inflation targeting would matter much for the conduct and performance of monetary policy. Put differently, is announcing a target and having a single/hierarchical mandate really necessary for well-anchored inflation expectation? The Fed's current regime appears to have successfully obtained one of the most important benefits ascribed to a regime based on explicit guidelines. U.S. financial markets and the public do not seem to be overly bothered by the lack of an explicit number, and inflationary expectations are well anchored.[19]

For emerging ITers, the question is different, but similar policy implications can be drawn from the findings of this study. If, as we have demonstrated, the ultimate hallmark that differentiates a more successful ITer from its less successful counterpart is the subindex of transparency and accountability, then the ultimate question is not so much the label of IT as the substance of increased central bank transparency and accountability.

VI. Appendices

A. Appendix 1 – Factor Analysis

Let X_{it} be the observed data for the ith cross-section unit at time t, for $i = 1, ..., N$, and $t = 1, ..., T$. Consider the following factor representation of data:

$$X_{it} = \sum_{j=1}^{k} \lambda_{ij} F_{jt} + \varepsilon_{it}, \qquad F_{jt} = F_{jt-1} + u_t$$

where λ_{ij} is a factor loading coefficient associated with factor F_{jt}.

The number of common factors k is estimated by solving the following optimization problem:

$$V(k) = \min_{\Lambda, F^k} (NT)^{-1} \sum_{i=1}^{N} \sum_{t=1}^{T} (X_{it} - \lambda_i^k F_t^k)^2$$

$$s.t. F'F/T^2 = I_k$$

[19] Blinder and Reis (2005), among others, hinted that inflation targeting might institutionalize monetary policy decision-making and thus overcome reliance on personality. Other potential benefits of moving to full-fledged IT include that IT changes the dynamics of inflation and this change of dynamics can't be otherwise achieved in a non-IT or implicit IT regime.

where F is the vector of common factors, $F_t = (F_{1t}, F_{2t}, ..., F_{kt})$, $\Lambda = (\lambda_1, \lambda_2, ..., \lambda_N)'$, and $\lambda_i' = (\lambda_{i1}, \lambda_{i2}, ..., \lambda_{ik})$.

$$\Lambda' = \hat{F}X/T^2$$

In deciding the optimal number of common factors, we can employ criteria involving penalty functions proposed by Bai and Ng (2002). The column components of the Λ' matrix are the estimated eigenvectors corresponding to the k largest eigenvalues of the $T \times N$ matrix XX'.

Once the number of common factors and the eigenvalues are identified, we restrict ourselves to those components that are associated with an eigenvalue greater than one. We then regress this subset of factors against the mean and variance of inflation in the sample. As a next step, we back out the attributes of IT indices from the common factors and re-estimate the equations of mean and variance of inflation.

B. Appendix 2 – Tables and Figures

Table 1. Flexibility of IT and Target Design

Country	Adoption Date	Target Horizon	Point Target (in percent)	Target Range (in percent)	Code for Target Horizon	Code for Target Range
Australia	Apr. 1993	Business cycle	None	2–3	0.67	0.2
Brazil	Jun 1999	Annual/multi-year	4.0 (2003)	+/- 2.0	0	0.8
			3.75 (2004)	+/-2.5(2003-06)	0.33	1
Canada	Feb. 1991	Annual/multi-year (1991-	2	1–3	0.33	0.4
		Indefinite (from 1995)			1	0.4
Chile	Sep. 1999	Annual (1999–2000);	3	2–4	0	0.4
		Indefinite (from 2001)			1	0.4
Colombia	Sep. 1999	Annual (1999–2001)	5.5 (2003)	5–6 (2003)	0	0.2
		Annual/long-term	3.0 long term		0.5	0.2
Czech	Jan 1998	Annual/multi-year	Declining	+/- 1	0.33	0.4
Finland	Feb. 1993–	Indefinite	2.0 by 1995	None	1	0
Hungary	Jun 2001	Annual/long-term	3.5 (2003/04)	+/- 1	0.5	0.4
			2.0 long-term		0.5	0.4
Iceland	Mar. 2001	Multi-year (2001–03)			0.33	0.6
		Indefinite (from 2004)	2.5	+/- 1.5	1	0.6
Israel	Jun 1997	Annual (1997–2003)	None		0	0.2
		Indefinite (from 2003)		1–3 (from 2003)	1	0.4
Korea	Jan 2001	Annual/med-term		2.5–3.5	0.33	0.2
Mexico	Jan 2001	Annual (2001–02)		Ceiling	0	0
		Annual/long term	3.0 (2003)	+/- 1 (2003)	0.5	0.4
New Zealand	Mar. 1990	Annual/multi-year (1990-1992)	None	Path from 3–5 to 0–2 (1992–96)	0.33	0.4
		Indefinite (1992–2002)		0-3 (1997-2001)	1	0.6
		Business cycle (2003		1–3 (from 2002)	0.67	0.4
Norway	Mar. 2001	Indefinite	2.5	None	1	0
Peru	Jan 2002	Indefinite	2.5	+/- 1	1	0.4
Philippines	Jan 2002	Annual	None	4–5 (2004)	0	0.2
Poland	Oct. 1998	Annual/med-term	Under 4	Varying range		
		(1999–2003)	3.0 (2003)	(1999–2001)	0.33	0
		Indefinite (2004 onward)	2.5 (2004	+/- 1 (from 2002)	1	0.4
South Africa	Feb. 2000	Annual/med-term	None	3–6 (2004/2005)	0.33	0.6
				revised from 3–5	0.33	0.4
Spain	Jan. 1995– Dec. 1998	Med-term	None	3.5–4 by	0.5	0.1
				0–3 (to 1997)	0.5	0.6
Sweden	Jan 1993	Indefinite	2.0	+/- 1	1	0.4
Thailand	May 2000	Indefinite	None	0–3.5	1	0.75
United Kingdom	Oct. 1992	Indefinite	None	1–4 (1992–1996)	1	0.6
			2.5	+/- 1 (from 1996)	1	0.4
			2.0 (from 04)	+/-1 1/	1	0.4

Sources: Roger and Stone (2005), Mishkin and Schmidt-Hebbel (2001), and Truman (2003).
1/ Officially, there is not a range, but deviations of more than 1 percent from target requires an official explanation.

Table 2. Formal Procedures for Target Breach and Escape Clauses

Country	Target Breach	Reporting Requirement	Escape Clauses/ Core CPI	Escape Clauses
Australia		1		0
Brazil	Public letter from Governor to Minister of Finance explaining reasons for breach, measures and timeframe to meet target.	0		0
Canada	Explanation in monetary policy report on reasons for breach, measures and timeframe to meet target.	0	Operational guide is core CPI (excludes 8 volatile components and indirect taxes)	1
Chile		1	Focus on core CPI (excludes fruits, vegetables and fuel)	1
Colombia		1		0
Czech Republic		1	Unanticipated developments in external prices, natural disasters, conditions affecting agricultural production	1
Hungary		1		0
Iceland	Public report to government explaining the target breach and measures to meet target.	0		0
Israel	The Governor is required to publicly explain deviations of expected inflation from the target of more than 1 percentage point	0		0
Korea		1	Core CPI (stripped of 49 items)	1
Mexico		1		0
New Zealand	Explanation through a policy statement reasons for deviation from medium term target, and measures to remain consistent with target.	0	Transitory fluctuations of world commodity prices, indirect taxes, natural disaster	1
Norway		1	Core CPI (excludes indirect taxes, effects of interest rate changes and extraordinary temporary developments)	1
Peru		1		0
Philippines	Open letter from Governor to President explaining reasons why inflation target was missed and measures to be adopted to return inflation to target	0	Volatility in the prices of unprocessed food, oil products, significant government policy changes	1
Poland		1	External factors, food and officially controlled prices	1
South Africa		1	Supply shocks including terms of trade, international capital flows and natural	1
Sweden	Deviations to be explained during Governor's annual appearance in Parliament.	0	Transitory and large sudden shocks, nature of shocks announced in advance (mortgage interest, indirect tax, supply	1
Thailand	Public explanation of cause of breach, policy response and timeframe needed to return to target range.	0	Quarterly average core CPI (excludes raw food and energy)	1
United Kingdom	An open letter from the Governor to the Chancellor when inflation deviates from target by over 1 percentage point.	0		0

Sources: Tuladhar (2005), Roger and Stone (2005), and central bank websites

Table 3. The Flexibility Index of Full-fledged Ites

Country	Time under Coverage	Code for Escape Clauses and Target Breach	Code for Target Horizon	Code for Target Range	Flexibility Index 1/
Australia	1993-	0.5	0.67	0.2	0.46
Brazil	1999-2002	0	0	0.8	0.27
	2003-	0	0.33	1	0.44
Canada	1991-94	0.5	0.33	0.4	0.41
	1995-	0.5	1	0.4	0.63
Chile	1999–2000	1	0	0.4	0.47
	2001-	1	1	0.4	0.80
Colombia	1999–2001	0.5	0	0.2	0.23
	2002-	0.5	0.5	0.2	0.40
Czech	1998-	1	0.33	0.4	0.58
Finland	1993-1995	0	1	0	0.33
	1996-1998	1	1	0	0.67
Hungary	2001-	0.5	0.5	0.4	0.47
Iceland	2001–2003	0	0.33	0.6	0.31
	2004-	0	1	1	0.67
Israel	1997–2002	0	0	0.2	0.07
	2003-	0	1	0.4	0.47
Korea	2001-	1	0.33	0.2	0.51
Mexico	2001–2002	0.5	0	0.2	0.23
	2003-	0.5	0.5	0.4	0.47
New Zealand	1990-1992	0.5	0.33	0.4	0.41
	1992–2002	0.5	1	0.6	0.70
	2003-	0.5	0.67	0.4	0.52
Norway	2001-	1	1	0	0.67
Peru	2002-	0.5	1	0.4	0.63
Philippines	2002-	0.5	0	0.2	0.23
Poland	1999–2003	1	0.33	0	0.44
	2004-	1	1	0.4	0.80
South Africa	2000-2003	1	0.33	0.6	0.64
	2004-	1	0.33	0.4	0.58
Spain	1995-1996	0.5	0.5	0.1	0.37
	1997-1998	0.5	0.5	0.6	0.53
Sweden	1993-	0.5	1	0.4	0.63
Thailand	2000-	0.5	1	0.75	0.75
United Kingdom	1992-1995	0	1	0.6	0.53
	1996-2004	0	1	0.4	0.47
	2004-	0	1	0.4	0.47

1/ The overall flexibility index is the average over three items, target horizon, target range, escape clauses and target breach. The code for the last item is the average of the numerical code for escape clauses and target breach from Table 2.

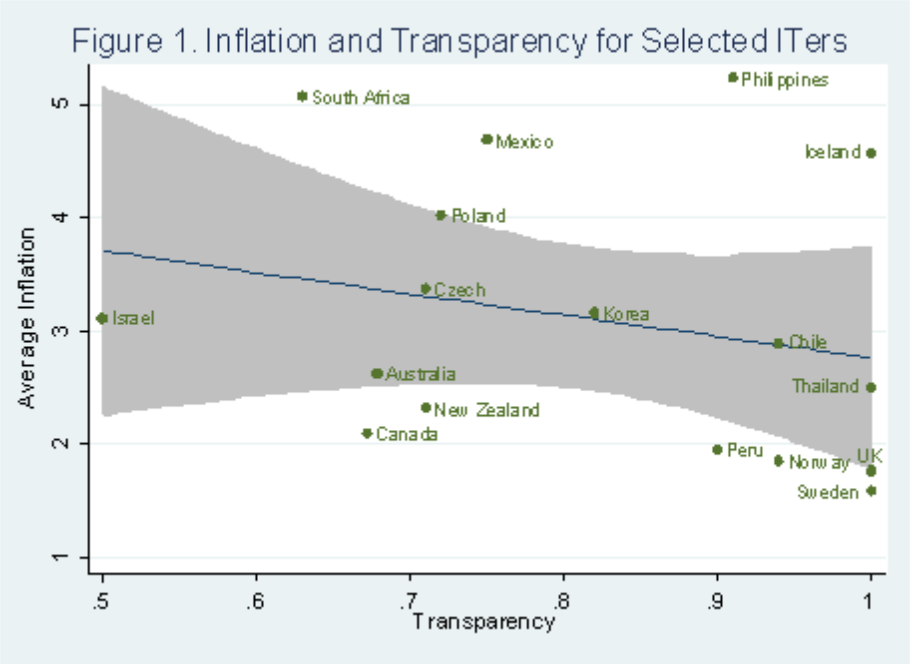
Figure 1. Inflation and Transparency for Selected ITers
Philippines
South Africa
Mexico
Iceland
Poland
Czech
Israel
Korea
Chile
Australia
Thailand
New Zealand
Canada
Peru
Norway
UK
Sweden
Average Inflation
1
2
3
4
5
.5
.6
.7
.8
.9
1
Transparency

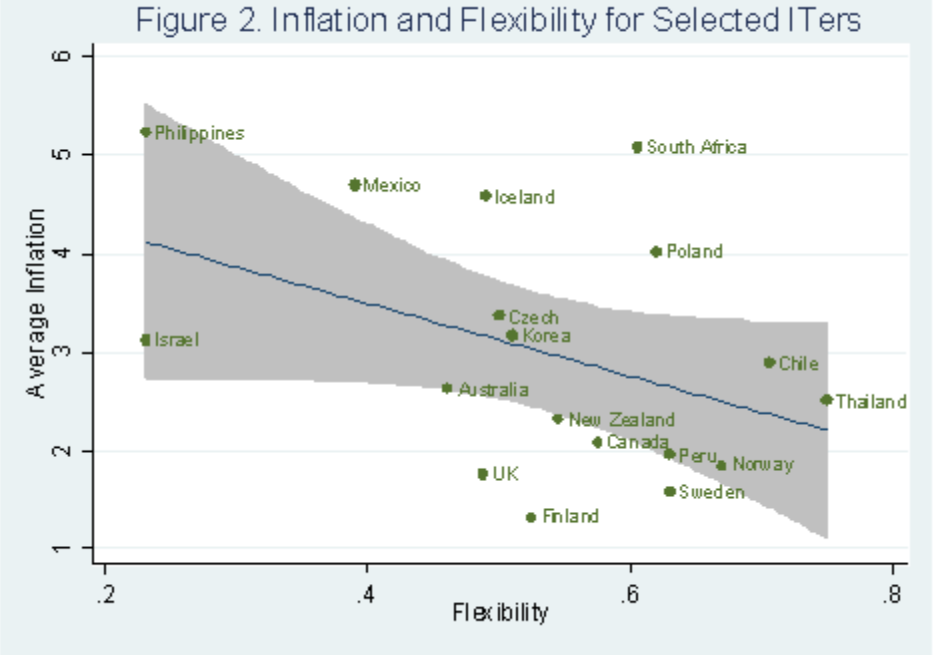
Figure 2. Inflation and Flexibility for Selected ITers
Philippines
South Africa
Mexico
Iceland
Poland
Czech
Korea
Israel
Chile
Australia
Thailand
New Zealand
Canada
Peru
Norway
UK
Sweden
Finland
Average Inflation
1
2
3
4
5
6
.2
.4
.6
.8
Flexibility

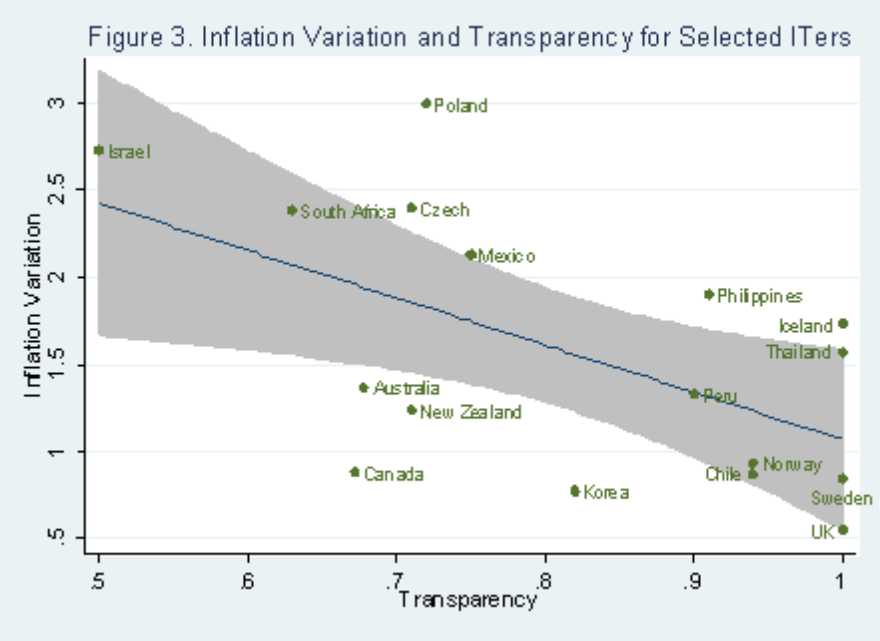
Figure 3. Inflation Variation and Transparency for Selected ITers
Inflation Variation
.5
1
1.5
2
2.5
3
Transparency
.5
.6
.7
.8
.9
1
Poland
Israel
South Africa
Czech
Mexico
Philippines
Iceland
Thailand
Australia
New Zealand
Peru
Canada
Norway
Chile
Korea
Sweden
UK

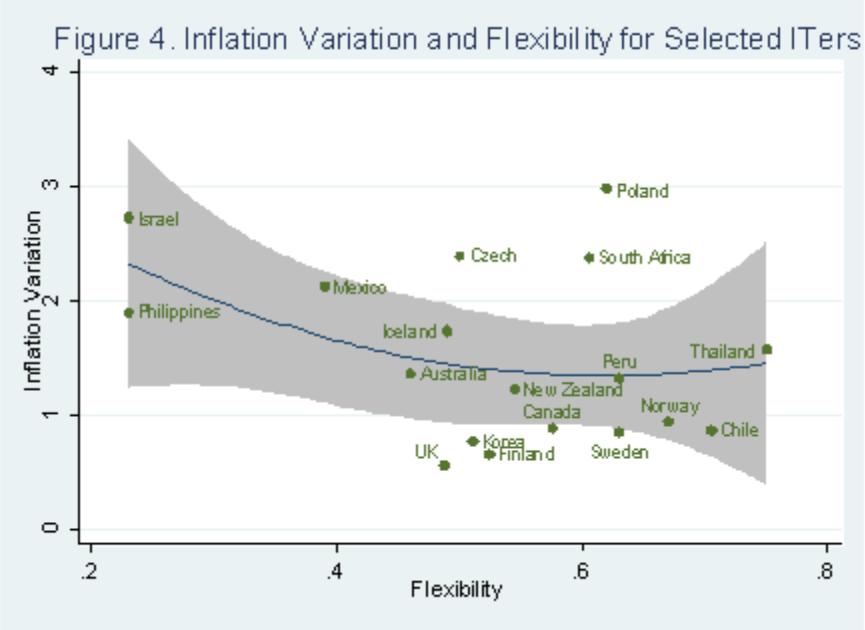
Figure 4. Inflation Variation and Flexibility for Selected ITers
Inflation Variation
0
1
2
3
4
Flexibility
.2
.4
.6
.8
Poland
Israel
Czech
South Africa
Mexico
Philippines
Iceland
Thailand
Peru
Australia
New Zealand
Canada
Norway
Chile
UK
Korea
Finland
Sweden

Table 4. The Transparency Index of Full-fledged Iters

Country	Date of Adoption	Date of First Inflation Report	Transparency of Inflation Reports and Websites				Overall Index
			Number of Reports	Quantitative Forecast	Fan Chart	Websites	
New Zealand	Mar. 1990	Apr. 1990	1	1	0	0.86	0.71
Canada	Feb. 1991	May 1995	0.5 to 2000, 1 afterwards	1	0	1	0.625 to 2000; 0.75 afterwards
United Kingdom	Oct. 1992	Mar. 1993	1	1	1	1	1
Sweden	Jan. 1993	Oct. 1993	1	1	1	1	1
Australia	Apr. 1993	May 1997	0.5 to 2000, 1 afterwards	1	0	1	0.625 to 2000; 0.75 afterwards
Israel	Jun. 1997	Feb. 1998	0.5	0 to 2000, 1 thereafter	0 to 2000, 1 afterwards	0.29	0.2 to 2000; 0.7 thereafter
Czech Republic	Jan. 1998	Apr. 1998	1	1	0	0.86	0.71
Poland	Oct. 1998	Jun. 1999	1	0 to 2002, 1 thereafter	0 to 2002, 1 afterwards	0.86	0.47 until 2002, 0.97 thereafter
Brazil	Jun. 1999	July 1999	1	1	1	0.86	0.96
Chile	Sep. 1999	May 2000	0.75	1	1	1	0.94
Colombia	Sep. 1999	Jan. 1999	1	1	0 to 2000, 1 afterwards	0.14	0.71 until 2000, 0.78 thereafter
South Africa	Feb. 2000	Mar. 2001	0.5	0	1	1	0.63
Thailand	May 2000	Jul. 2000	1	1	1	1	1
Korea	Jan. 2001	1998	0.25 to 2002, 0.5 thereafter	1	1	0.86	0.78 until 2002; 0.84 thereafter
Mexico	Jan. 2001	Mar. 1999	1	1	0	1	0.75
Iceland	Mar. 2001	Nov. 1999	1	1	1	1	1
Norway	Mar. 2001	Mar. 1996	0.75	1	1	1	0.94
Hungary	Jun. 2001	Nov. 1998	1	0 to 2000, 1 thereafter	0 to 2000, 1 thereafter	1	0.5 to 2000, 1 thereafter
Peru	Jan. 2002	Jun. 2002	0.75	1	1	0.86	0.90
Philippines	Jan. 2002	Sep. 2001	1	1	0 to 2002, 1 thereafter	0.86	0.71 to 2002, and 0.96 thereafter

Sources : Roger and Stone, 2005; Heenan, Peter and Roger, 2006; Wyplosz and others, 2003; central bank websites

Table 5. Mean Inflation and Inflation Targeting Indices

(21 ITers, 1990-2006, t values in italics)

Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	6.18	7.09	4.00	4.11	8.60	9.00	6.15
	7.03	*8.00*	*4.43*	*3.80*	*8.81*	*15.79*	*5.25*
Flexibility	-5.69***	-10.00***	-6.24**	-4.97			-0.78
	-3.33	*-2.30*	*-1.95*	*-1.32*			*-0.47*
Flexibility Squared		4.52	4.00	3.50			
		0.84	*1.18*	*1.26*			
Transparency					-6.45***	-8.03***	-3.26***
					-5.40	*-2.03*	*-2.21*
Transparency Squared						1.26	
						0.31	
Lag Inflation			0.38***	0.36***			0.29***
			8.57	*6.80*			*7.10*
Growth				-0.16*			-0.23**
				-1.98			*-2.24*
R-squared	0.16	0.15	0.50	0.49	0.18	0.18	0.32
Number of Observations	185	185	185	185	178	178	178

***reject null at 1% significance level

**reject null at 5% significance level

*reject null at 10% significance level but not 5%

Table 6. Inflation Variation and Inflation Targeting Indices
(21 ITers, 1990-2006, t values in italics)

Explanatory Variables	(1)	(2)	(3)
Intercept	2.12	3.29	3.69
	4.49	*5.15*	*5.84*
Flexibility	-2.24**		-1.71*
	-2.38		*-1.92*
Transparency		-3.06***	-2.39***
		-3.66	*-3.190*
Growth Variation	0.32**	0.43***	0.39***
	3.61	*5.27*	*5.79*
R-squared	0.26	0.25	0.32
Number of Observations	145	145	138

***reject null at 1% significance level
**reject null at 5% significance level
*reject null at 10% significance level but not 5%

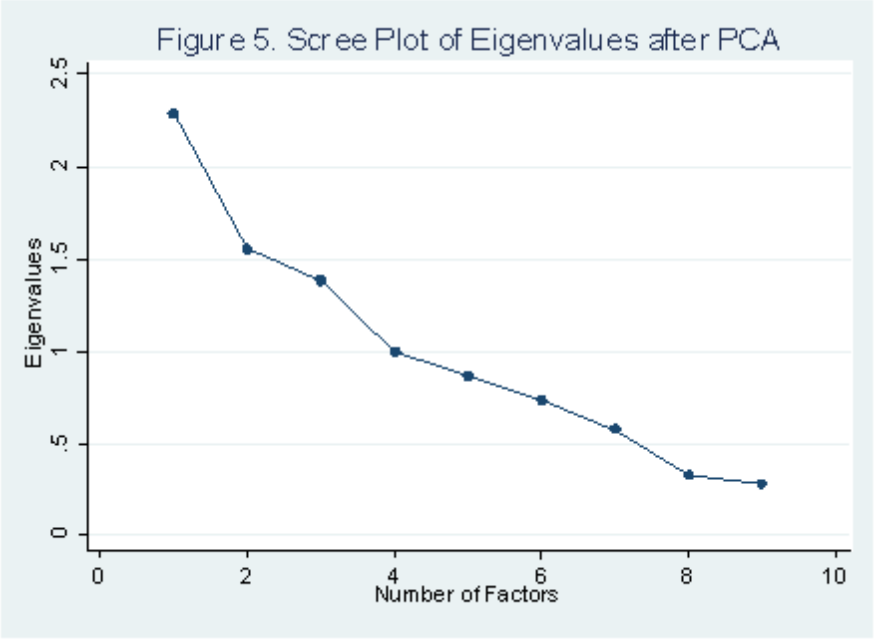

Table 7. Principal Components without Orthogonal Rotation

Principal Components (eigenvectors)				
Variable	Z_1	Z_2	Z_3	Unexplained
Horizon	0.4176	-0.1765	0.2245	0.483
Range	0.4068	-0.1637	-0.3251	0.4336
Reporting	-0.3281	0.3202	0.4510	0.313
Escape	0.1250	-0.3555	0.4881	0.4382
Number	0.4285	0.3384	0.0800	0.3934
Forecast	0.4739	0.3097	0.0069	0.3374
Fanchart	0.2648	0.3817	-0.0597	0.6084
Website	0.2418	-0.4070	0.4480	0.3311
CBI	-0.0105	0.4375	0.4377	0.4373

Table 8. Principal Components and the Level and Variation of Inflation

(21 ITers, 1990-2006, t values in italics)

	Mean Inflation		Variation of Inflation	
Explanatory Variables	(1)	(2)	(3)	(4)
Intercept	3.34	3.04	1.56	0.98
	24.30	*5.72*	*26.01*	*6.88*
Z_1	-0.84***	-0.15	-0.50***	-0.45***
	-3.49	*-0.55*	*-3.83*	*-3.59*
Z_2	0.26	-0.47	0.280	0.25
	0.55	*-0.95*	*1.34*	*1.19*
Z_3	0.27	0.93	-0.42*	-0.23
	0.41	*1.50*	*-1.73*	*-0.96*
Lag Inflation		0.33***		
		3.49		
Growth		-0.25**		
		-2.49		
Growth Variation				0.34***
				4.11
R-squared	0.11	0.30	0.28	0.34
Number of Observations	170	170	132	132

***reject null at 1% significance level

**reject null at 5% significance level

*reject null at 10% significance level but not 5%

Table 9. Principal Components with Orthogonal Rotation

Rotated Components				
Variable	F_1	F_2	F_3	Unexplained
Horizon	0.2472	-0.1304	0.4217	0.483
Range	0.2074	-0.5045	-0.0206	0.4336
Reporting	-0.0429	0.6416	0.0048	0.313
Escape	-0.0752	0.0923	0.6050	0.4382
Number	0.5499	0.0426	0.0161	0.3934
Forecast	0.5643	-0.0452	-0.0015	0.3374
Fanchart	0.4341	0.0434	-0.1704	0.6084
Website	-0.0145	-0.0177	0.6514	0.3311
CBI	0.2808	0.5497	0.0449	0.4373

Table 10. Correlations between the Rotated Factors and the Underlying Attributes

Underlying Attributes	Factor 1	Factor 2	Factor 3
Horizon	0.4408	-0.2905	0.593
Range	0.3975	-0.6922	0.1463
Reporting	-0.1864	0.8267	-0.1095
Escape	-0.0344	0.0338	0.7303
Number	0.7769	-0.0691	0.1067
Forecast	0.8120	-0.1813	0.1019
Fanchart	0.5839	-0.0117	-0.1471
Website	0.0805	-0.1274	0.8174
CBI	0.2984	0.6318	0.0115

This table presents the correlation coefficients between the three rotated principal components and the nine underlying attributes of IT regimes.

Table 11. Rotated Principal Components and the Level and Variation of Inflation
(21 ITers, 1990-2006, t values in italics)

	Mean Inflation		Variation of Inflation	
Explanatory Variables	(1)	(2)	(3)	(4)
Intercept	3.34	3.04	1.56	0.98
	24.30	*5.72*	*26.01*	*6.88*
F_1	-0.50**	-0.33*	-0.26***	-0.22***
	-2.27	*-1.81*	*-3.99*	*-3.32*
F_2	0.71*	0.47	0.090	0.18
	1.78	*1.20*	*0.41*	*0.93*
F_3	-0.28	0.88	-0.65**	-0.48*
	-0.40	*1.23*	*-2.46*	*-1.75*
Lag Inflation		0.33***		
		3.49		
Growth		-0.25**		
		-2.49		
Growth Variation				0.34***
				4.11
R-squared	0.11	0.30	0.28	0.34
Number of Observations	170	170	132	132

***reject null at 1% significance level
**reject null at 5% significance level
*reject null at 10% significance level but not 5%

Table 12. Mean and Variation of Inflation_Subsampling
(21 ITers, 1990-2006, t values in italics)

	Mean Inflation		Variation of Inflation	
Explanatory Variables	Emerging	Industrial	Emerging	Industrial
Intercept	8.25	-1.48	4.10	3.47
	5.13	*-3.64*	*6.41*	*4.28*
Flexibility	-3.2	1.95	-2.14	-1.37*
	-1.46	*0.66*	*-1.23*	*-2.13*
Transparency	-2.75*	3.35	-2.10**	-4.00**
	-1.8	*1.70*	-2.36	*-3.11*
Lag Inflation	0.14	0.09		
	1.45	*1.02*		
Growth	-0.23	-0.14		
	-1.26	*1.02*		
Growth Variation			0.37***	0.39**
			4.25	*3.01*
R-squared	0.16	0.00	0.24	0.31
Number of Observations	79	79	66	72

***reject null at 1% significance level
**reject null at 5% significance level
*reject null at 10% significance level but not 5%

Table 13. Mean and Variation of Inflation_Controlling for Disinflation

(21 ITers, 1990-2006, t values in italics)

	Variation of Inflation			Mean Inflation
Explanatory Variables	Full Sample	Emerging	Industrial	Full Sample
Intercept	2.50	2.73	2.81	7.67
	3.41	*2.91*	*1.87*	*5.06*
Flexibility	0.54	0.19	0.85	-1.93
	0.88	*0.16*	*1.57*	*-0.61*
Transparency	-2.68***	-2.55***	-3.36*	-3.66***
	-3.46	*-3.07*	*-2.00*	*-2.97*
Disinflation	1.06***	0.96*	1.15***	-0.84
	4.23	*2.07*	*5.22*	*-0.94*
Growth Variation	0.33***	0.36***	0.27*	
	4.60	*4.20*	*1.91*	
Lag Inflation				0.16**
				2.13
Growth				-0.23**
				-2.28
R-squared	0.51	0.40	0.31	0.18
Number of Observations	138	66	72	158

***reject null at 1% significance level

**reject null at 5% significance level

*reject null at 10% significance level but not 5%

Table 14. Instruments for Transparency and 2SLS Estimation

(21 ITers, 1990-2006, t values in italics)

	Annual Inflation			Variation of Inflation		
Explanatory Variables						
Transparency	-9.29**	-10.07*	-1.79	-4.13***	-3.38**	-3.91**
	-2.25	*-1.86*	*-0.43*	*-2.60*	*-2.04*	*-2.07*
Flexibility		0.85				0.02
		0.27				*0.01*
Lag Inflation			0.18			
			1.56			
Growth			-0.32***			
			-3.37			
Growth Variation					0.27	0.24
					1.27	*1.16*
OIR Test *P*-value	0.90	0.92	0.37	0.24	0.24	0.11

***reject null at 1% significance level

**reject null at 5% significance level

*reject null at 10% significance level but not 5%

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