How Do Middle Income Countries Fare Under Inflation Targeting?

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Abstract

Inflation-targeting regime, as a framework for monetary policy conduct, has been adopted by central banks in thirty countries. Some of these countries enjoy high incomes while others have middle incomes. In contrast to the development-based classification –often applied in the literature, thus ignoring income disparity– this study employs income-based classification in constructing the data sample. The objective is to investigate, using a panel of middle-income countries, whether inflation targeting is a good remedy for high inflation. In addition to the commonly used covariates in the literature, this study also includes in its covariate matrix the worldwide governance indicators as proxy for institutional quality.

The findings exhibit a significant reduction of inflation and its volatility among the inflation-targeting adopters compared to the non-adopting middle-income countries. The results are robust to the exclusion of high inflation episodes, and to using the alternative measures of inflation. The results are also robust to the post-estimation tests recommended for such empirical analysis.

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1. Introduction

Due to disagreements over the criterion of price stability, as mentioned earlier in the general introduction and overview section, there is no unified definition of inflation-targeting regime (ITR) in the literature. In fact, even among the IT- club members there are vast differences over the regime's definition and workings; and so no two central banks (among the IT-adopters) are alike.[1] The following are some of the multiple definitions of ITR, ranging from simple and generic to sophisticated, technical and detailed.

1.1 Definition of Inflation Targeting: In their seminal work on inflation targeting, Rudebusch and Svensson (1999) call ITR a '*commitment mechanism*' where a central bank simply commits itself by announcing an explicit inflation target. Bernanke et al. (1999, p. 4) define ITR as '*a framework for monetary policy characterized by the public announcement of official quantitative targets (or target ranges) for the inflation rate over one or more time horizons, and by explicit acknowledgement that low, stable inflation is monetary policy's primary long-run goal*.' Sherwin (2000) defines ITR as choosing the appropriate target rate of inflation, backing it up by political will, tailoring monetary policy accordingly, and setting the time horizon thereafter to achieve the target. Genberg (2001) calls ITR '*a statement of objectives*'. Schmidt-Hebbel and Tapia (2002) define ITR as: anchoring expectations, granting the central bank operational independence, having forecasting capacity, and exhibiting transparency and accountability. Truman (2003) defines ITR by listing four ingredients: an explicit goal of price stability, a numerical point or range for inflation target, a time horizon to achieving the target and an evaluation of policy objectives.

[1] Truman (2003).

These definitions clearly demonstrate the nature of ITR as being a framework that has developed through combining together monetary policy '*rule'* and '*discretion'*. It is this combination that invites both its proponents and opponents to debate the merits of ITR plausibility. While the opponents criticize ITR for polluting policy rule with discretion, thus rendering it untrustworthy and bringing back the same old issue of time inconsistency, its proponents credit the combination of rule with discretion for its flexibility in responding to short-run shocks without jeopardizing the long-run policy objective of price stability. In reality, however, adherence to strict policy rules is rare: no central bank would refrain itself from using discretionary power, particularly in the short-run when the economy bumps into hostile shocks.[2] This imbedded discretion, therefore, leads us to reiterate that ITR is a '*constrained discretion*', Bernanke et al. (1999, p. 29).

Given the brief lifespan of inflation-targeting regime (ITR), it is amazing to see the enormous body of literature devoted to studying different aspects of ITR, both theoretical and empirical, along with policy design procedures. This literature seems to exhibit a consensus on two criteria: First, if implemented successfully, ITR has advantages that outweigh the risks associated with it. Second, and more importantly, successful implementation of ITR hinges upon some institutional and structural settings that are considered as necessary preconditions for any economy prior to adopting ITR. Indeed, the early ITR adopters, mainly advanced economies, have enjoyed some of the advantages and benefits highlighted in the literature (discussed in the next section). This has led the ITR club to grow to a number of thirty countries (see Appendix 'A' for the list of these countries). These ITR club members enjoy either high income levels (13 members) or share middle income levels, both upper and lower (17 members). However, none of them is classified as a low income country (LIC). The income-based classification is important for the purpose of this study

[2] Bernanke et al. (1999)

because the previous literature has neglected the income-based classification when studying IT-adoption. Instead other classification criteria – such as 'emerging', 'developing', or 'less' and 'least developed economies'– were used for countries that are not 'advanced' or 'developed'. This, of course, resulted in having rich economies – such as Israel, Singapore, and South Korea – often grouped together with poor economies – such as Ghana, Indonesia, and Pakistan. Furthermore, since inflation acts as a flat distortionary tax, it can have far worst devastating impact on low or middle income groups – leaving them with squeezed income levels – compared to the high income groups who have the luxury of hedging against inflation. To this end, this study seems to be the first to decompose the ITR club members into two groups, and assign them to their appropriate income-based groups.[3] Subsequently, this study focuses its empirical analysis on MICs only by comparing the performance of inflation dynamics among ITR club members with that of MICs that have not adopted ITR. Moreover, this study also seems to be the first to use worldwide governance indicators as proxy for the quality of institutions.

The rest of the paper is organized as follows: Section 2 expands the introductory note on ITR, discussing advantages and disadvantages, the preconditions, and the working environment for ITR. Section 3 reviews some of the literature on theory and empirics of ITR. Section 4 describes the data and the econometric methodology used in the empirical work of this study; Section 5 presents and analyzes the empirical results; and Section 6 concludes the study.

2. Advantages and Disadvantages: Svensson (1997) believes that ITR has the general advantage of focusing monetary policy explicitly and directly on inflation. Moreover, he credits ITR for communicating the specific targets directly to the public, thus enabling them to evaluate the

[3] Roger (2009) and Gamayel et al. (2011) also mention income-based classification, but in a broad sense.

credibility of policymakers and hold them accountable in case they renege on their commitment. ITR, therefore, serves as a '*potential commitment mechanism*'. Bernanke and Mishkin (1997) hail ITR as the most interesting development in the history of monetary policy, as it offers answers to the time-inconsistency problem. Bernanke et al. (1999) call inflation targeting a '*superior framework*' compared to other frameworks, such as money targeting or currency targeting. They admire ITR for having the features: explicitly defined objectives, greater transparency stemming from central bank's communication of the explicit objectives and enhanced accountability, due to the fact that the general public is periodically briefed about the progress over monetary policy objectives. Moreover, Bernanke et al. (1999) also credit ITR for protecting price level from the 'pass through' of unexpected shocks into inflation and for keeping the nominal interest rates at low levels due to low inflation expectations. Mishkin (1999) attributes two major achievements to the inflation targeting regime: first, inflation targeting has caused a significant reduction in overall levels of inflation rates; and second, it has helped to curb future inflation expectations, bringing them below the pre-inflation-targeting levels. Rudebusch and Svensson (1999) add an important feature of inflation targeting, that is, 'locking-in' future inflation expectations. They also attribute to inflation targeting the reduction in volatility of inflation rates as well as that of output gaps. Furthermore, Schaechter et al. (2000) summarize these outlined advantages of ITR over other monetary frameworks, and conclude that: ITR rejuvenates the motivations for institutional reforms that are necessary for disinflation. Gavin (2003) attributes to ITR the reduction in uncertainty about inflation, the risk of deflation and the confusion over the monetary policy stance. Truman (2003) states that ITR helps policymakers in building credibility and anchoring inflation expectations faster as compared to other monetary regimes. Goodfriend and King (2005) assign yet another advantage to ITR: its flexibility. This flexibility enables policymakers to focus on medium-to-

long-term horizons, without worrying about short-term shocks. Citing some examples of emerging economies, like Argentina and South Africa, Batini and Laxton (2007) conclude that the economic costs of policy failure under ITR are benign, in the form of a bit higher inflation, as opposed to losses stemming from policy failure under an exchange rate peg for instance, where reserve losses could engender a banking crisis or even worse, a debt crisis.[4]

Opponents of ITR cite disadvantages that impose unnecessary constraints on policymakers: ITR is an overly narrow approach, with a one-variable focus, the price level, which limits policymakers' discretion. In particular, they have no discretion with regards to output or unemployment. On one hand, commitment demands swift actions in fighting inflation; on the other hand, this aggressive approach may have some serious repercussions on output and employment. Arestis and Sawyer (2003) raise an important question, and that is whether any central bank has the ability to control inflation. For example, international supply shocks, fiscal policy, or even domestic wage negotiations could have a severe impact on inflation, but central bank has no ability whatsoever to influence these factors in any economy. Since falling output induces negative supply shocks, the ITR-pursuing central bank would only worsen the situation when tightening monetary policy to contain inflation. Nonetheless, this critique seems to address one aspect of ITR, which is strict inflation targeting (SIT); but there are hardly any central banks that practise SIT. In fact, the vast majority of ITR adopters follow what Svensson (1997) calls flexible inflation targeting (FIT) where the central bank has the discretion to assign different weights to inflation, output gap, or unemployment, etc. Other skeptics criticize ITR for granting too much discretion to central banks, leading to 'moving the goalposts' phenomenon, thus endangering the credibility of central bank.[5]

[4] For a comprehensive look on advantages and risks associated with ITR, see Bernanke and Woodford (2005).
[5] This is a valid critique, however, as mentioned earlier, under FIT the central bank can target a wider range.

Yet some others point to the fact that most of the ITR club members were experiencing higher inflation rates prior to adopting ITR, which hints at the appropriateness of ITR only for economies that suffer from higher inflation rates. This critique stems from the view that ITR is a disinflationary tool. However, there is a consensus among proponents of ITR that it is not a stabilizing policy, instead ITR helps 'lock in' the already gained low levels of inflation rates. ITR, therefore, could do more harm than good if implemented as a disinflation tool in an economy which is experiencing higher inflation rates.[6] Another disadvantage attributed to ITR is that it is a replacement for other nominal anchors, specifically an exchange rate regime: a central bank cannot have multiple anchors at the same time, so it must adopt a free-floating exchange rate mechanism. Opponents argue that for MICs, leaving the exchange rate unguarded – in face of speculative attacks, supply shocks, and abrupt capital flows – is a recipe for disaster, resulting in extreme volatility propagating into the macro-economy. To address this issue, there are IMF-supported programs that are designed to help those planning to adopt ITR through the transitory phase. Besides, neither ITR nor any other policy framework can refrain central banks from intervening in face of speculative attacks.

2.2 Working Environment for ITR and MICs:[7] Inflation targeting is a '*state of the art*' framework that demands sophisticated facilities throughout different stages of implementation including quality data collection, modeling and forecasting, policy design, communication and evaluation. Quality data on advanced- and high-income countries are readily available through the public domain. For middle-income countries, unfortunately, data accessibility is an obstacle where data are either not available at all, or if available, the quality is seriously compromised and only

[6] Sims (2004).
[7] This section draws upon Hammond (2012).

annual (often with missing) observations are available. Moreover, policy decision-making requires the ability to build models that truly represent the economy. Absent this ability, policymakers would simply rely on replicating the popular dynamic stochastic general equilibrium (DSGE) models which were originally built for an advanced economy. They neither represent the settings of MICs, nor can their assumptions be justified. In addition, Mishkin (2011) calls ITR a communication strategy that should go beyond the announcement of an inflation target. Instead, it requires a proper functioning channel in the form of a vibrant financial sector having a web of financial intermediaries as well as fully developed equity and bond markets. It also requires that firms and households have an uninterrupted access to these markets. Finally, once policy objectives are explicitly defined and communicated, policymakers must understand and face repercussions in case of reneging on their commitments. This may be true in advanced- and high-income countries, but it still remains a dream in middle-income countries.

The advantages of ITR certainly outweigh its pitfalls, but there is a caveat to reaping these advantages: some preconditions for institutional and structural environment are necessary prior to adopting ITR. Bernanke et al. (1999) and Mishkin (1999) dub them as 'necessary conditions', while Schaechter et al. (2000) call them 'foundational blocks'. They are: central bank independence (CBI), a free-floating exchange rate regime, and the absence of fiscal dominance. In addition, there are also some secondary conditions, such as developed and fluid financial markets, facilities for data collection, modeling, forecasting, transparency and accountability.

Central bank independence (CBI), as noticed above, comes at the helm of adopting ITR. There is a decent amount of literature on CBI, and so there are different interpretations of CBI as well. Some refer to it as central bank autonomy, where the central bank acts as an agent implementing what has been mandated to it by the political leadership through legislation. Others interpret CBI

as independence from political influence in every aspect, including recruitment, financial, and policy independence. Nevertheless, the majority of authors agree on two interpretations of CBI: Goal independence and instrument independence. The goal refers to setting up single or multiple goals, such as price stability, output growth and unemployment, while the instrument refers to policy tools, such as short-term interest rates, quantitative easing (QE) or credit easing (CE).[8]

The second necessary condition for ITR adoption is the divorce from currency targeting (thus letting the exchange rate float freely) and from aggregate money targeting, in order to avoid a multiplicity of anchors. The latter anchor can be, and in fact has been, neglected by most central banks. The former, however, is linked to the economy's balance of payment, and neglecting it would invite serious repercussions. For a small open economy, and with the presence of external dominance, a free-floating exchange rate is an open invitation to speculators that may lead to a spiral of volatility in the capital flows. This would cause more harm to the stability of the price level than any good resulting from the ITR adoption.

The third and last necessary condition is the absence of fiscal dominance along with financial and external dominance. Fiscal dominance can be defined as an excessive growth of money supply stemming from the central bank's monetization of the central government's fiscal deficits. Rich economies tend to have a broad tax base and developed financial markets that help them avoid excessive indirect taxation or an excessive monetization of the fiscal deficits. Moreover, seigniorage seems to play a minimal role in revenue generation among rich economies. This is not true for middle-income countries where the tax base is very limited, and where seigniorage is considered a major source of revenues. MICs also suffer from financial dominance and external

[8] For more on the CBI, see Barro and Gordon (1983).

dominance. The former points to a weak financial structure that mainly comprises commercial banks while the latter hints at threats to the economy coming from external shocks.[9]

In addition to these necessary conditions, a successful implementation of ITR requires sophisticated data collection and modeling facility, fluid and developed equity and bond markets (that would channel the policy propagation and would also alleviate financial dominance), and the institutional capacity for accountability and transparency. These can be called the sufficient conditions that can help in reaping fully the advantages and benefits of ITR.

The early adopters of ITR, mainly advanced and rich economies – the subject of the studies that enlist the advantages of ITR – have indeed enjoyed good quality institutions that promote transparency, rule of law, freedom of expression and accountability. These economies also exhibit decent structural balance, in addition to being equipped with the state-of-the-art facilities in almost every aspect of life. It is noteworthy here that compromising on the institutional and structural requirements may turn advantages into disadvantages if ITR is adopted under unbalanced sectoral structures or under the infancy of institutional development. Following is a summary of stylized macroeconomic facts among MICs – the subject of this study – compared with the stringent conditions put forth in the literature for ITR adoption:[10]

Most MICs resemble the small open-economy model. They are open to trade (as measured by the ratio of exports/imports to GDP), are price taker, face exogenous terms of trade (TOTs) and have a constrained balance of payments (BOPs). Given these macroeconomic facts, the optimal choice for MICs will be a managed (dirty) float or a pegged exchange rate regime. Another worrisome

[9] For more on fiscal dominance and inflation, see Nachega (2005).
[10] These features are a summary of chapter 1 from Agenor and Montiel (2009).

feature of MICs is the extremely weak fiscal regime (measured by the low ratio of tax revenues to GDP). Because of this drawback, governments do not rely solely on their thin tax base for revenue generation. Instead they often resort to deficit monetization and seigniorage as revenue generating tools. In addition, indirect taxation – in the form of VATs, import tariffs, and import duties – is considered a quick fix for revenue shortages. Furthermore, the financial system is mainly dominated by the banking sector where poor regulation and public ownership coupled with corruption exacerbate the inefficiencies of this sector. Equity markets are also at the infant stage, and long-term bond markets are almost non-existent. Policy uncertainty resulting from the instability of the policy regime has often led to crises, such as currency substitution, flight of capital, exchange rate crises, the collapse of private investment, etc. To sum up, instability, fluctuations, uncertainty, and volatility appear to be the hallmark of MICs.

2.3 Which Price Index to Target? There are a number of price indices that are used to gauge price levels in an economy, such as the consumer price index (CPI), the producer price index (PPI) and the GDP deflator. Among the three, the CPI is considered as the most appropriate index due to the general public's interaction with it on a daily basis, and due to the fact that policymakers have minimal manipulating power over it. CPI can be further divided into two indices: the headline CPI, which takes into account all consumption goods and services, and the core CPI, which excludes the volatile goods, such as food and energy products. The earlier ITR adopters were using core CPI for their policy design purpose, but at present, all 30 central banks of the ITR-member countries use both the core and headline CPI to set their policy-related inflation target.

It is a common practice among advanced industrial economies to have a separate agency for data collection that acts semi-autonomously and independently from the influence of the central bank. This practice, though rarely followed in MICs, is strongly recommended by the IMF for those

intending to adopt ITR, as well as for those already adopted ITR but do not have an independent data-collecting entity.[11] An alternative to CPI is either PPI or GDP deflator. Since the PPI is an intermediate price index that eventually shows up in the final goods price, and can be easily manipulated, it is not recommended for policy consideration. The GDP deflator on the other hand is less familiar among the general public, and its data collection is often less frequent. Using GDP deflator, therefore, may degrade the transparency and credibility of the central bank, the two requirements that are paramount for a successful ITR. This study does employ GDP deflator as an alternative measure of inflation, but only for the purpose of robustness check.

3. Literature Review

The bulk of the literature covers practical aspects of ITR, empirical and analytical, perhaps due to the fact that ITR '*does not represent an ironclad policy rule*' in the words of Bernanke and Mishkin (1997). Instead, ITR is a framework that can be tailored to policymakers' objectives. In what follows, a brief discussion is presented on the theoretical and empirical aspects of ITR.

3.1 Theoretical Underpinning of ITR: Earlier theoretical models of monetary policy used either game theory settings or principal-agent model settings, perhaps due to the inherent presence of 'rule versus discretion' element, which bred time-inconsistency problems. This time-inconsistency created mistrust between policymakers and agents, so the equilibria stemming out of these models were often non-cooperative Nash equilibria.[12] In the seminal works of Kydland and Prescott (1977) and Barro and Gordon (1983) for example, central bank's objective function is considered to minimize the expected loss function:

[11] Schaechter et al. (2000).
[12] For a summary and account of the theoretical literature on ITR, see Walsh (2010) and Woodford (2003).

$$L^C = \lambda\,(y_t - y^P) - \tfrac{1}{2}\,(\pi_t - \pi^T)^2$$

where y_t is the output at time t, y^P is the potential output, π_t is the inflation rate and π^T is the target rate of inflation.

As for agents, both households and firms, their objective is to minimize their own loss function:

$$L^A = E\,(\pi_t - \pi^e)^2$$

where π^e denotes the agents' expectations about the inflation rate. In this simple model, we observe two different objective functions which could be attributed to the presence of time- inconsistency problems. On one hand, agents find their expectations as the optimum, while on the other hand, policymakers are tempted to cheat with the 'surprise element'.

After the birth of ITR in 1990, most studies continued using the above framework. The following theoretical model is taken from Svensson (1997, p. 4):

$$\pi_{t+1} = \pi_t + \alpha_1\, y_t + \alpha_2\, x_t + \varepsilon_{t+1}$$

$$y_{t+1} = \beta_1\, y_t - \beta_2\,(i_t - \pi_t) + \beta_3\, x_t + \eta_{t+1}$$

$$x_{t+1} = \gamma\, x_t + \theta_{t+1}$$

where π_t is the inflation rate at time t, y_t is the output, x_t is an exogenous variable, i_t is the policy interest rate and ε_t, η_t and θ_t are i.i.d. shocks.

An ITR central bank would choose a sequence of policy interest rates ($\{i_\tau\}^{\infty}_{\tau=t}$) in order to minimize its loss function: $E_t \sum^{\infty}_{\tau=t}\ \delta^{\tau-t}\, L\,(\pi_t)$

where E_t represents the central bank's expectations based on the information available in the current period and δ is the discount factor. A particular period loss function can be written as:

$$L(\pi_t) = \tfrac{1}{2}(\pi_t - \pi^T)^2$$

where π^T represents the target rate of inflation. So the central bank's objective is to minimize the sum of discounted expected deviations of inflation from its target rate. The solution to this minimization problem is: $\pi_{t+1|t} = \pi^T$

which implies that the central bank would set the policy interest rate at time *t* such that the inflation rate in the next period would equal the target rate of inflation.

This model shows the objective function of an ITR central bank having a single goal of price stability. However, for the central banks with multiple goals such as inflation and output stabilization, Svensson (1997) modifies the same model by simply adding another term for the output and its deviation from the potential output:

$$L(\pi_t, y_t) = \tfrac{1}{2}[(\pi_t - \pi^T)^2 + \lambda (y_t - y^P)^2]$$

$$E_t \sum_{\tau=t}^{\infty} \delta^{\tau-t} L(\pi_t, y_t)$$

where y^P represents the potential output and $0 < \lambda < 1$. In this modified version, the central bank seeks to minimize the sum of discounted expected deviations of both inflation and output from the target rate of inflation and the potential output respectively. Based on the solution to his model above, Svensson (1997) recommends calling ITR an 'inflation forecast targeting', because whether agents build their expectations on past or present data, the policymakers do not have control over the past or present state of inflation, they can only control the future inflation rate by influencing the expectations of the agents.

As for the criticism directed towards the central bank's objective function, the reaction function and its deviations between targets and actual variables, Svensson (1999) offers a detailed

explanation in response to the confusion they create: a targeted variable, he explains, in ITR theoretical settings, such as inflation, output, or unemployment, may portray the central bank's reaction function as being restricted to responding only to deviations relative to the target goal and the targeted variable. In reality, central banks have access to, and use, a lot more information than simply the deviations. Hence, the apparent look of the objective functions may be misleading, since central banks are supposed to be targeting the underlying determinants of a targeted variable, and not the variables. He continues to suggest that even under SIT (strict inflation targeting), central banks should respond to both inflation and output, and not only inflation (Svensson, 1999, pp. 622-623). Moreover, Rudebusch and Svensson (1999) interpret inflation targeting as an objective function of the central bank where deviations between the actual and target inflation rates are assigned some weight. This is referred to as the flexible inflation targeting (FIT).

The hallmark feature of most of theoretic work in monetary policy is the functional form of the central bank's loss function, which is almost always in quadratic form, in addition to the assumption of perfect information stemming from rational expectations.[13] We have also seen that discretion and time-inconsistency both render monetary policy either ineffective or imply that the central bank would renege on its commitment by fooling the agents with a 'surprise element'.

To respond to this theoretic shortcoming, two studies came out at the same time: First, Orphanides and Williams (2004) substitute the perfect information assumption with an imperfect information assumption (learning models). They show that a monetary-policy regime whose sole objective is the control of inflation – such as ITR – reduces costs associated with imperfect information. Moreover, having imperfect information would also facilitate learning and the formation of

[13] Mishkin (2011) blames these two features for the possible failure of the '*Science of Monetary Policy*' in the wake of the recent 2008 financial crisis.

inflation expectations. Second, Cogley and Sargent (2005) introduce uncertainty into three competing models of the Phillips curve, and show that a central bank updates its probabilities assigned to the three models prior to choosing the appropriate model and sets the level of inflation rate accordingly. They also solve the '*timing puzzle*' – of the US Federal Reserve's sitting idle over the higher inflation rates of 1970s – by using recursive Bayesian techniques and showing that posterior probabilities, though, were in favor of the Lucas–Sargent model during the 1970s. However, the Fed did not implement their recommendations due to the fear of a downside risk for employment (Solow–Samuelson interpretation of Phillips curve).[14]

3.2 Empirical Literature on ITR: The earliest account of empirical evidence on ITR came in Bernanke and Mihov (1996) who ask the question, and investigate it empirically 'What Does the Bundesbank Target?' Interestingly, the Bundesbank of Germany has always been officially a money targeter, and it never adopted ITR. But the authors employ a structural VARs approach and use the Lombard rate (the Bundesbank policy rate) as the policy indicator to study the system's response: a positive innovation to the forecast of inflation rates leads to a contractionary policy response by the Bundesbank, as witnessed in the rise of the Lombard rate. In addition, they also show that the forecast for output growth declines, while the money growth rate falls on one-to-one ratio with the inflation rates. They conclude based on their empirical findings that the policy actions reveal that the Bundesbank behaves like an inflation-targeter, and not as a money-targeter. Clarida et al. (1998) estimate the monetary policy reaction functions for central banks of two groups of countries: Germany, Japan, and the US (G3), and UK, France, and Italy (E3). Their empirical findings exhibit that the G3 central banks have been pursuing an implicit inflation targeting regime since 1979, which explains their success in terms of taming inflation better than

[14] For more on this fear, see Forder (2014).

other industrial economies. The E3 central banks on the other hand are simply influenced by the actions and policies of the Bundesbank of Germany. They conclude that based on the success of the G3 central banks, inflation targeting as a nominal anchor seems to be superior to other anchors such as money targeting or exchange rate targeting.

Cecchetti and Ehrman (1999) investigate the degree of inflation-variability aversion among a sample of 23 economies (both advanced and developing): Nine of these economies had adopted ITR while the remaining 14 had not. Their findings suggest a revealed preference of policymakers – in both ITR adopters and non-adopters – for reducing inflation variability at the expense of output variability. Johnson (2002) uses experts' surveys on inflation for a sample of eleven industrial economies (both ITR adopters and non-adopters). His results suggest that ITR helps to reduce inflation expectations. Neumann and Van Hagen (2002) compare the performance of inflation and interest rates in nine economies, six having adopted ITR and three without ITR. They select two major commodity shocks of the 1970s and 1990s, and then conduct a comparative analysis of inflation dynamics among the two groups, dividing the sample into pre and post shocks periods. Using difference-in-differences approach, they find that ITR has helped the adopters to curb inflation rates. More importantly, it has helped policymakers in communicating clearly the low-inflation objectives to the public. They also calculate the Taylor rules for the ITR adopters and conclude that there is a convergence pattern among the two groups towards the low average inflation rates. A similar study is carried out by Ball and Sheridan (2005) but with an extended sample of 20 economies: seven that adopted ITR in early 1990s and 13 non-adopters.[15] They also employ the difference-in-differences methodology. Using quarterly data spanning over 20 years, they investigate the dynamics of inflation, interest rates, and output growth. Their results show a

[15] Both studies have the same title: "Does Inflation Targeting Matter?"

better performance by ITR adopters as compared to the countries that did not adopt ITR. However, the authors call this enhanced performance to be misleading due to the '*regression to the mean*' phenomenon. Once they control for the mean reversion, there is no difference in the performance of the two groups, leading the authors to conclude that inflation targeting does not matter!

Some of the above mentioned empirical studies have been criticized for a technical and common shortcoming, namely the self-selection bias problem. To address this criticism, Vega and Winkelried (2004) were the first to employ the treatment effects methodology to control for self-selection bias. Using the propensity score matching estimation, they analyze the treatment effects on those countries that adopted ITR and compare them with those that did not adopt ITR. The results confirm a significant reduction in inflation rates and inflation volatility among the countries that adopted ITR. One seemingly shortcoming in this study is that their dataset includes 109 countries –rich, poor, developed, developing and the least developed– all in one sample as if they were a homogeneous group, regardless of the extreme heterogeneity in the counterfactuals. Lin and Ye (2007) also apply the same methodology on a sample of advanced economies to study the inflation dynamics and compare the ITR adopters (the treatment group) with the non-adopters (the control group). Their results do not show any significant effects of adopting ITR, and they conclude, in line with Ball and Sheridan (2005), that ITR is a mere '*window-dressing*' policy that has no significant effect on the dynamics of inflation.

Interestingly, subsequent studies that examined data from developing and emerging economies have found the opposite, and encouraging results for ITR adoption. Batini and Laxton (2007) extend the analysis of Ball and Sheridan (2005) to a larger but different sample of 42 emerging economies: 13 of them are ITR adopters and the remaining 29 are non-adopters. Out of these, 22 are in the JP Morgan Emerging Markets Bond Index. They apply the same methodology of

difference-in-differences, as in Ball and Sheridan (2005), to study the performance of ITR adopters before and after the adoption, and compare them to the non-adopters. Their findings suggest that the ITR adoption leads to a reduction in inflation, inflation volatility, and inflation expectations. They run several robustness checks to confirm that their findings are robust. In the same vein, another study by Goncalves and Salles (2008) extends the analysis of Ball and Sheridan (2005) to a larger and different sample of 36 emerging economies: 13 of them are ITR adopters and the remaining 23 are non-adopters. They study the difference in macroeconomic performance of the two groups via a diff-in-diffs approach. Their sample includes annual observations from 1980 to 2005. The results indicate a large significant reduction in both inflation and output growth variability for the ITR adopters compared to the non-adopters. Their results are also robust to controlling for 'mean reversion'. They conclude that, as opposed to the conclusion of Ball and Sheridan (2005), inflation targeting does matter for emerging economies. Lin and Ye (2009) also study the effects of ITR adoption among developing countries, but using a different methodology: they evaluate the treatment effect of ITR using a variety of propensity score matching methods. Their dataset includes 52 developing countries (13 of them ITR adopters) for the years 1985 to 2005. They find a significantly larger reduction in inflation and its volatility among ITR adopters compared to the non-adopters. Finally, De Mendonça and De Guimarães e Souza (2012) use a much wider sample than their predecessors, 180 countries, and compare the ITR effects between the adopters and non-adopters over a period spanning from 1990 to 2007. They split their sample into two groups: advanced and developing countries. Using a propensity score matching estimation methodology, they obtain encouraging results for developing countries in the form of a significant reduction in inflation rates thanks to ITR adoption. For advanced countries, they do not find any advantage due to the ITR adoption.

4. Empirics

4.1 Data: Since the focus of this study is middle-income countries (MICs), we draw our country sample from the World Bank's latest income-based classification table. To enhance the quality of our analysis, the countries with too many missing observations, or those classified by World Bank as small states (SST) and fragile and conflict-affected states (FCS) are dropped, thus restricting our sample to 59 MICS only: 17 of them have adopted ITR (the 'treatment' group), and the remaining 42 MICs are non-adopters (the 'control' group). This income-based grouping is important for our empirical analysis because it satisfies the often violated assumption of 'selection on observables' (also referred to as imbalance in the observed confounders). Our dataset includes the governance indicators as well, in addition to the common covariates, thus reducing the bias stemming from 'selection on non-observables' or imbalance due to the non-observed confounders such as institutional quality. To illustrate this point, I have reproduced Table 1.1, from Lin and Ye (2009), showing their country sample and the World Bank's classification of the countries in 2008. By examining the list of Table 1.1, we can see that among the treatment group, for instance, the Czech Republic had been a high-income country enjoying per capita income of US$21,820, along with Israel and South Korea (at US$25,930 and US$24,750 per capita incomes respectively). As for the control group, the per capita incomes for Hong Kong (US$44,050) and Singapore (US$48,520) do not justify their grouping with countries such as Jamaica, and Cape Verde that are classified as small states and have far less per capita income levels (under US$4,000), or countries that have been subjected to sanctions and conflicts such as Iran and Syria. It may, therefore, seem implausible to evaluate the relative dynamics of inflation using countries where there are stark differences in terms of per capita income or quality of institutions. It is precisely this concern that

led me to use an income-based classification when constructing a country sample for the treatment and the control group in this study. Table 1.2 lists the 59 countries in our sample.

Table 1.1 Lin and Ye (2009) Sample with the WB's 2008 Income-Based Classification

Treatment Group		Control Group					
Brazil	Middle	Algeria	Middle	Hong Kong	High	Paraguay	Middle
Chile	High	Argentina	Middle	Indonesia	Middle	Romania	Middle
Colombia	Middle	Belarus	Middle	Iran	Middle	Russia	High
Czech Republic	High	Bulgaria	Middle	Jamaica	Middle	Singapore	High
Hungary	Middle	Cape Verde	Middle	Jordan	Middle	Slovakia	High
Israel	High	China	Middle	Kazakhstan	Middle	Slovenia	High
South Korea	High	Costa Rica	Middle	Latvia	High	Syria	Middle
Mexico	Middle	Croatia	High	Lebanon	Middle	Trinidad & Tobago	High
Peru	Middle	Dominican Rep.	Middle	Lithuania	High	Tunisia	Middle
Philippines	Middle	Egypt	Middle	Macao	High	Turkey	Middle
Poland	High	Estonia	High	Macedonia	Middle	Ukraine	Middle
South Africa	Middle	Georgia	Middle	Mauritius	Middle	Uruguay	High
Thailand	Middle	Guatemala	Middle	Morocco	Middle	Venezuela	Middle

Table 1.2 The Sample Countries

The Treatment (IT) Group	**The Control (Non-IT) Group**		
Albania	Algeria	Honduras	Senegal
Armenia	Angola	India	Sri Lanka
Brazil	Argentina	Jordan	Tunisia
Colombia	Azerbaijan	Kazakhstan	Turkmenistan
Ghana	Belarus	Kyrgyz Republic	Ukraine
Guatemala	Bolivia	Lao PDR	Uzbekistan
Hungary	Bulgaria	Macedonia, FYR	Vietnam
Indonesia	Cameroon	Malaysia	Zambia
Mexico	China	Mauritania	
Moldova	Congo, Rep.	Mongolia	
Peru	Costa Rica	Morocco	
Philippines	Cote d'Ivoire	Nicaragua	
Romania	Dominican Republic	Nigeria	
Serbia	Ecuador	Pakistan	
South Africa	Egypt, Arab Rep.	Panama	
Thailand	El Salvador	Papua New Guinea	
Turkey	Georgia	Paraguay	

Sources: Gamayel et al. (2011), Hammond (2012) and the World Bank (2015).

Table 1.3. The List of Variables

Variable	Description
Inflation Targeting Regime (ITR)	Binary variable used as dummy for inflation targeting regime which equals 1 for the years when a country has had ITR in place, and 0 otherwise.
Lagged CPI Inflation	Annual percentage change in the consumer price index (using Laspeyres method)
Per Capita GDP Log	Log of per capita income (GDP in constant 2005 US dollars over population)
Unemployment Rate	The total unemployment (% of total labor force, ILO estimates)
Trade Openness	The sum of exports and imports measured as % of GDP
Exchange Rate	Annual period average of national currency per SDR
Central Govt. Debt	The gross amount of central government total liabilities as % of GDP
M2 Growth	Annual growth rate of broad money, the sum of currency outside banks.
CPI Volatility	Deviation in CPI inflation of a country from the world's CPI for a specific year.
GDP Deflator	Annual growth rate of the GDP implicit deflator.

We use a panel data with annual time series covering the 59 MICs over a period of 18 years from 1996 to 2013. After running regressions on the inclusive sample (1996-2013), the sample time horizon is further truncated (2001-2013) for two reasons: First, the vast majority of MICs joined the ITR club later than their rich counterparts at the beginning of 21st century. Second, the 1990s were marred with episodes of very high inflation (even hyperinflation) for some MICs, particularly economies-in-transition. This time stratification enables us to discriminate between the treatment effects of ITR adoption during the two different scenarios.

The major source of data is the World Bank's World Development Indicators. The financial indicators are from the International Financial Statistics and the World Economic Outlook of the IMF. Data from Heston and Summers (2012) are used for the comparison purpose.

The aggregate variables listed in the previous section are referred to as the observable covariates (or observables). These covariates are economic variables that broadly define a macro-economy. However, there are some unobservable covariates (unobservables) that play an equally important role – perhaps even more important than the economic variables – in a successful adoption of ITR. This was already highlighted in Section 2.3, where I discussed the pre-conditions for an ITR adoption, such as the central bank independence, credibility and accountability, the data collection,

modeling and forecasting capabilities. These unobservables are often neglected by the previous empirical studies on ITR.[16] It is noteworthy that this is the first study (to the best of my knowledge) that acknowledges the important role played by the institutions in the successful adoption of ITR.

Six Worldwide Governance Indicators (WGIs) that are employed in this study as proxy for the quality of institutions are described in Table 1.4.[17]

4.2 The Worldwide Governance Indicators (WGIs): These six WGIs are the latest version of a World Bank's project by Kaufmann et al. (2010) who look at the six dimensions of governance over the 1996-2013 period and define governance as '*the traditions and institutions by which authority in a country is exercised. This includes the process by which governments are selected, monitored and replaced; the capacity of the government to effectively formulate and implement sound policies; and the respect of citizens and the state for the institutions that govern economic and social interactions among them.*' The authors, Kaufmann et al. (2010), collected the views and opinions of ordinary citizens, experts, business community and policymakers from 32 data sources in each country. These data sources include think tanks, NGOs, international organizations, survey institutes and private corporations. Since the data on these WGIs are only available from 1996 and onward, I restrict the start of my sample's time horizon to 1996. The estimates of governance performance for each indicator range from approximately -2.5 (weak) to 2.5 (strong). However, these estimates are further transformed into the percentile ranks among all countries (that range from 0 (lowest) to 100 (highest) rank. The observations for these WGIs in the sample represent the percentile ranks among all the countries. In addition to using the six

[16] Lin and Ye (2009) use a five-year central bank governor turnover rate as an inverse proxy for the CBI, while De Mendonca and De Souza (2012) use per capita income as a proxy for the overall institutional quality.
[17] All the descriptions as well as definitions are taken from the website: www.govindicators.org.

indicators separately in the regressions, a compact index is also constructed by calculating the mean average of all six indicators, and is used in the baseline model. Moreover, Kaufmann et al. (2010) compile their dataset every two years for the first seven years, 1996-2002, and do not report the estimates for years 1997, 1999 and 2001. I, therefore, interpolated and recovered those missing observations by simply taking the mean average of the two adjacent years (pre and post years). For example, the observation for the year 1997 is just a mean average of the years 1996 and 1998, and so on.[18]

Table 1.4 The Worldwide Governance Indicators (WGIs)

The W.G. Indicator	Description
Voice and Accountability	Reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.
Political Instability	Reflects perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism.
Government Effectiveness	Reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.
Regulatory Quality	Reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.
Rule of Law	Reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.
Corruption	Reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.

Source: The Worldwide Governance Indicators, 2014 Update, www.govindicators.org

4.3 Methodology: Previous empirical work on ITR is carried out using a difference-in-differences approach, which is a variant of fixed-effects model using aggregate data.[19] To avoid

[18] Appendix 'A' lists the annual average of the six percentile ranks for all the countries. For further details on the data sources, aggregation methodology and definitions, visit: www.govindicators.org.
[19] See Ball and Sheridan (2005), Batini and Laxton (2007) and Goncalves and Salles (2008).

the self-selection bias criticism, often directed toward this approach, some authors have used the propensity score matching approach instead.[20] This study also employs the matching estimators approach. To be able to use the matching estimation methodology, the data sample must satisfy two assumptions:[21]

(*i*) The conditional independence assumption (CIA), also known as un-confoundedness assumption or selection on observables: this assumption states that once we control for all the variables in our covariate matrix for sample countries, the potential outcome, for the treated and the control groups, becomes independent of the ITR adoption. Formally this

can be written as: $(Y^1, Y^0) \perp T \mid X$

(*ii*) The overlap assumption, also known as the common support assumption: this assumption requires that our covariate matrix contains observations that can be matched with a strictly positive probability in both the treated and control groups. Formally this can be written as: $0 < \text{prob.}\ (T=1 \mid X) < 1$.

For the purpose of our analysis, and to keep in line with previous studies, two matching estimators, namely the propensity-score matching (PSM) and the nearest-neighbour matching (NNM) are estimated, in addition to a regression adjustment through inverse-probability weighting (IPW). The idea behind these estimators is to compare the performance of countries that exhibit somewhat homogeneity with regards to their covariates, but differ in the treatment: some of them have adopted ITR (the treated) and the others did not adopt ITR (the non-treated).

PSM and NNM are basically two measurement methods that check for identical or near-identical observations: the PSM estimates predict the probability of a country adopting ITR given its

[20] See Vega and Winkelried (2004), Lin and Ye (2009) and De Mendonça and De Souza (2012).

[21] Rosenbaum and Rubin (1983) call treatment assignment 'strongly ignorable' if these assumptions are satisfied. Appendix 'C' provides the results for testing of these assumptions.

covariates (propensity score), while the NNM estimates the distance among two near-identical observations (there are several options to choose from for this distance in STATA). As for the identification strategy for PSM estimators, three criteria have been applied: single match, three matches and five matches. Similarly, for NNM, three criteria have been applied: First, a narrow radius and a wide radius are applied. Second, to adjust for any bias in NNM estimator – perhaps due to a large sample – a bias correction adjustment restriction is imposed. Finally, an inverse probability weighting (IPW) regression adjustment is also applied, which takes care of the worries stemming for any model misspecification.

5. Results

5.1 The Propensity Scores: Our first task is to find out the likelihood of ITR adoption among the sample countries given the various covariates. As shown in Table 1.5 below, these results are obtained using Probit estimation model with seven different specifications. The lagged CPI inflation, unemployment and trade openness are all significantly negative: if a country has high inflation, unemployment and trade openness, it is highly unlikely that it will adopt ITR. On the other hand, income and exchange rate are significantly positive: a country enjoying high levels of per capita income is highly likely to adopt ITR. The exchange rate seems to be positively related to the ITR adoption as well. Central government debt has a significantly negative coefficient implying that a country plagued with high debt is less likely to adopt ITR. Results for the governance indicators are interesting: coefficients for regulatory quality and voice and accountability are significantly positive, while coefficient for political instability is significantly negative, confirming the important role of these institutions in the successful adoption of ITR. These results further confirm the theoretical stance and underpinning of institutional requirement for the ITR adoption.

Table 1.5 Estimates of Propensity Scores Obtained Through Probit Regressions

Inflation Targeting Regime (ITR) Dummy is the Binary Treatment Variable Used as Dependent Variable

Control Variables	Baseline Model	Adding Six Indicators	Add Debt & M2g	Dropping CPI > 100%	Dropping CPI > 50%	Dropping CPI > 25%	Truncated Sample
Lagged CPI Inflation	-4.171***	-3.892***	-2.844	-3.954***	-3.782***	-2.904*	-4.461***
	(1.217)	(1.264)	(2.169)	(1.257)	(1.374)	(1.539)	(1.512)
Log of Per Capita Income	0.698***	0.701***	1.408***	0.724***	0.725***	0.728***	0.542***
	(0.081)	(0.106)	(0.284)	(0.104)	(0.104)	(0.104)	(0.091)
Unemployment Rate	-2.127**	-2.855***	-4.013**	-2.840***	-2.833***	-2.810***	-2.463**
	(0.925)	(0.988)	(1.741)	(0.975)	(0.977)	(0.981)	(1.035)
Trade Openness (%)	-1.153***	-0.849***	-1.091**	-0.864***	-0.857***	-0.847***	-1.432***
	(0.168)	(0.204)	(0.468)	(0.195)	(0.195)	(0.196)	(0.193)
Exchange Rate/SDR	0.104***	0.140***	0.103*	0.139***	0.136***	0.136***	0.097***
	(0.024)	(0.029)	(0.063)	(0.028)	(0.028)	(0.028)	(0.026)
Regulatory Quality		5.469***	-0.946	5.568***	5.567***	5.642***	
		(0.870)	(2.196)	(0.730)	(0.729)	(0.730)	
Rule of law		-0.755	0.386				
		(0.825)	(1.608)				
Voice/Accountability		2.234***	3.344***	2.110***	2.117***	2.082***	
		(0.578)	(1.131)	(0.549)	(0.550)	(0.552)	
No Corruption		-0.386	0.705				
		(0.820)	(2.115)				
Govt. Effectiveness		1.023	2.367				
		(0.864)	(1.953)				
Political Instability		-3.606***	-2.620***	-3.797***	-3.817***	-3.874***	
		(0.534)	(1.023)	(0.516)	(0.518)	(0.520)	
CG Debt (%GDP)			-1.883**				
			(0.752)				
M2 Growth			0.256				
			(1.420)				
Institutional Quality	3.119***						4.634***
	(0.508)						(0.621)
Constant	-6.799***	-8.521***	-11.836***	-8.591***	-8.600***	-8.688***	-5.758***
	(0.636)	(0.821)	(1.898)	(0.816)	(0.818)	(0.825)	(0.708)
Pseudo R^2	31%	46%	55%	45%	45%	44%	31%
LR (Prob > χ^2)	273***	406***	163***	398***	390***	378***	230***
Observations	977	977	252	962	941	903	692

The asterisks next to the coefficients (*, **, ***) represent their significance levels of 10%, 5%, and 1% respectively.
Figures in parenthesis listed under the coefficients are Robust Standard Errors.

Due to missing observations on central government debt, this variable is dropped from the subsequent models. In addition, broad money growth and other statistically non-significant variables are also dropped. Since the 1990s were often marred with episodes of extremely high inflation rates among MICs, particularly the economies-in-transition, various specifications have been adopted to restrict observations of inflation rates to thresholds that are practised in the

literature. Frist, we drop the observations where CPI inflation is higher than 100%, 50%, and 25%. Second, we truncate the sample period before 2001. Interestingly, we do not observe any loss of significance except for some minor changes in the coefficients. These results also conform to those obtained by other studies that have employed the same methodology.

5.2 The Matching Estimators

5.2.1 Inflation: For the inflation levels, the Table 1.6 below shows results for the various estimators.[22] The first row shows coefficients for CPI inflation rates that are highly significant with a substantial magnitude. ITR adoption seems to have helped lowering inflation rates by 4 to 6 percentage points in the treatment group countries as compared with countries that did not adopt ITR. To avoid criticism for the presence of outliers in the sample, the second row shows the coefficients after dropping the outliers, and restricting the sample to observations where CPI inflation is 100% or less. Even after removing the outliers, the treatment group maintains its superior performance in combating inflation levels compared to the control group. The coefficients remain highly significant and substantial. We repeat this exercise by dropping observations where inflation rates are above 50% and 25% respectively, and find that ITR adoption has helped lower inflation by 2 to 5 percentage points relative to the control group. We finally truncate the sample period,

considering only the 2001-2013 period, and repeat the same regressions. Surprisingly, ITR adoption continues to lower inflation compared to the non-adopters. Even after removing observations where inflation is greater than 25%, we still observe significant coefficients, implying

[22] Results reported in this section are the average treatment effects on the treated (ATETs). Appendix 'B' reports the overall average treatment effects (ATEs) in population for CPI Inflation, Volatility, and GDP Deflator.

a substantial reduction in inflation rates among the treatment group compared to their counterparts in the control group.

Table 1.6 Average Treatment Effects on the Treated (ATET) for CPI Inflation

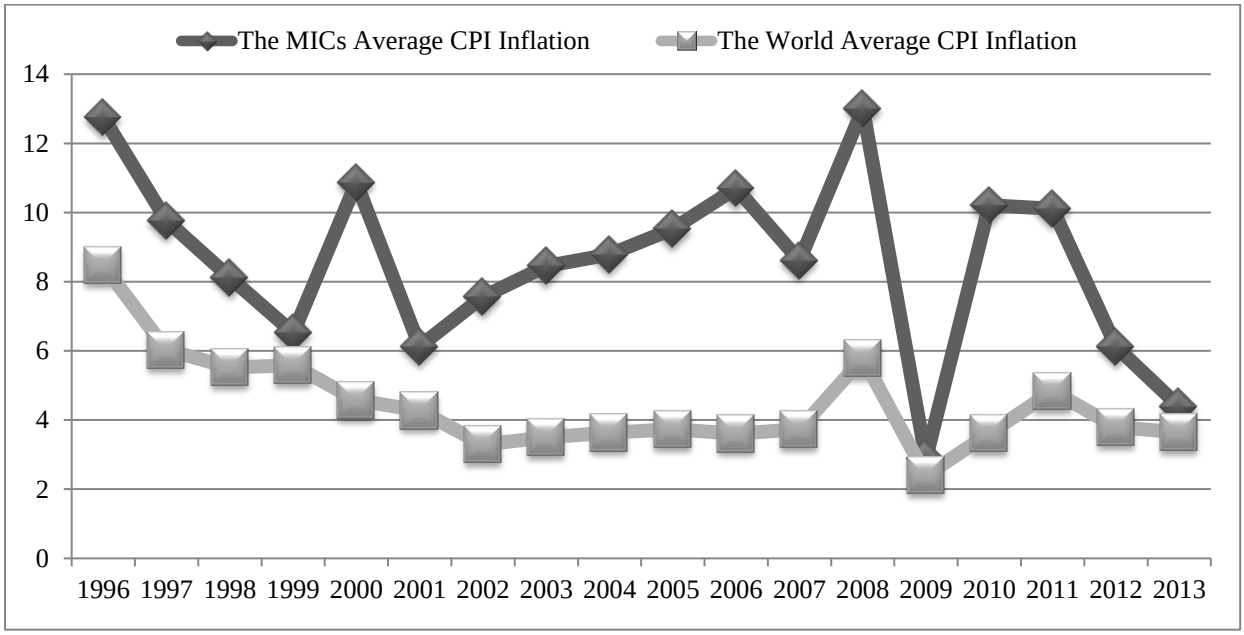
	Propensity Score Matching (PSM)			Nearest Neighbor Matching (NNM)			Regression Adjustment
Model ↓ Estimator →	Single Match	Three Matches	Five Matches	Narrow R=.01	Wide R=.05	L. Sample Bias Adj.	IPW Reg. Adjustment
Inclusive Sample (1996-2013)	-.0419***	-.0376***	-.0418***	-.0561***	-.0632***	-.0477***	-.0358***
	(.0122)	(.0086)	(.0089)	(.0109)	(.0118)	(.0119)	(.0070)
Confining CPI Inflation to 100 %	-.0241***	-.0377***	-.0429***	-.0537***	-.0561***	-.0515***	-.0294***
	(.0084)	(.0097)	(.0095)	(.0109)	(.01089)	(.0110)	(.0056)
Confining CPI Inflation to 50 %	-.0261***	-.0240***	-.0233***	-.0518***	-.0538***	-.0506***	-.0196***
	(.0068)	(.0050)	(.0050)	(.0103)	(.0102)	(.0104)	(.0048)
Confining CPI Inflation to 25 %	-.0232***	-.0248***	-.0226***	-.0391***	-.0400***	-.0383***	-.0138***
	(.0060)	(.0048)	(.0047)	(.0105)	(.0104)	(.0104)	(.0046)
Truncated Sample (2001-2013)	-.0294***	-.0257***	-.0232***	-.0263***	-.0296***	-.0204**	-.0162***
	(.0052)	(.0044)	(.0046)	(.0053)	(.0053)	(.0096)	(.0048)
Confining CPI Inflation to 100 %	-.0293***	-.0257***	-.0232***	-.0182**	-.0208**	-.0200**	-.0162***
	(.0052)	(.0044)	(.0046)	(.0089)	(.0098)	(.0098)	(.0048)
Confining CPI Inflation to 50 %	-.0256***	-.0253***	-.0218***	-.0161*	-.0185**	-.0183**	-.0139***
	(.0050)	(.0042)	(.0046)	(.0088)	(.0095)	(.0095)	(.0045)
Confining CPI Inflation to 25 %	-.0270***	-.0238***	-.0209***	-.0078	-.0094	-.0138**	-.0104**
	(.0047)	(.0046)	(.0055)	(.0064)	(.0063)	(.0062)	(.0043)

The Coefficients are for CPI Inflation, the Outcome Dependent Variable, while Outcome Independent Variables are Income; Unemployment; Trade; XR; and Institutional Quality. Treatment Variable is Inflation Targeting Regime (ITR) Dummy.

Note: The asterisks next to the coefficients (*, **, ***) represent their significance levels of 10%, 5%, and 1% respectively. Figures listed under the coefficients in parenthesis are Robust Standard Errors.

5.2.2 Inflation Convergence: We now analyze the impact of ITR adoption on the convergence of inflation rates among the IT adopters to the world's average inflation rates over the same period. Different studies define convergence differently. For this study, we computed a country's annual inflation rate minus the world's average annual inflation rate for that specific year. A significant negative coefficient implies convergence, whereas a significant positive coefficient signals divergence.

Figure 1.1. The Average Rates of CPI Inflation



Source: The World Development Indicators of the World Bank.

As Figure 1.1 shows, on average, CPI inflation has been in a worldwide decline since 1996, the beginning of our sample period. We, therefore, compare the performance of the treatment group in terms of these worldwide average inflation rates. The results are shown in Table 1.7 above. As with inflation levels, ITR adoption has also helped the inflation rates among the IT adopters to converge to the world's average rates during the same period. The coefficients in Table 1.7 are highly significant with substantial magnitudes throughout various model specifications. Of course, when we remove the outliers or truncate the sample period, we do observe a drop in magnitude from around 5 percentage points to around 3 percentage points. Nonetheless, the ITR adoption has led the inflation rates among the IT adopters to converge to the world's average inflation rates. These results also confirm the hypothesis of 'convergence' of inflation rates, among the ITR club, to those of world's average inflation rates suggested by Neumann and Von Hagen (2002).

Table 1.7 Average Treatment Effects on the Treated (ATET) for Inflation Convergence

	Propensity Score Matching (PSM)			Nearest Neighbor Matching (NNM)			Regression Adjustment
Model ↓ Estimator →	Single Match	Three Matches	Five Matches	Narrow R=.01	Wide R=.05	L. Sample Bias Adj.	IPW Reg. Adjustment
Inclusive Sample (1996-2013)	-.0378***	-.0321***	-.0358***	-.0449***	-.0520***	-.0379***	-.0297***
	(.0119485)	(.0084)	(.0087)	(.0102)	(.0111)	(.0102)	(.0069)
Confining CPI Inflation to 100 %	-.0198**	-.0321***	-.0369***	-.0424***	-.0446***	-.0409***	-.0232***
	(.0081)	(.0095)	(.0093)	(.0100)	(.0100)	(.0101)	(.0055)
Confining CPI Inflation to 50 %	-.0223***	-.0188***	-.0174***	-.0403***	-.0421***	-.0399***	-.0136***
	(.0061)	(.0047)	(.0049)	(.0094)	(.0093)	(.0094)	(.0047)
Confining CPI Inflation to 25 %	-.0178***	-.0187***	-.0162***	-.0282***	-.0291***	-.0286***	-.0079*
	(.0056)	(.0046)	(.0046)	(.0090)	(.0088)	(.0088)	(.0045)
Truncated Sample (2001-2013)	-.0297***	-.0253***	-.0224***	-.0188**	-.0224**	-.0215**	-.0168***
	(.0050)	(.0046)	(.0047)	(.0087)	(.0093)	(.0092)	(.0047)
Confining CPI Inflation to 100 %	-.0295***	-.0253***	-.0225***	-.0188**	-.0210**	-.0211**	-.0167***
	(.0050)	(.0046)	(.0047)	(.0087)	(.0095)	(.0095)	(.0047)
Confining CPI Inflation to 50 %	-.0254***	-.0247***	-.0211***	-.0166**	-.0186**	-.0193**	-.0145***
	(.0046)	(.0045)	(.0047)	(.0086)	(.0093)	(.0092)	(.0045)
Confining CPI Inflation to 25 %	-.0269***	-.0236***	-.0200***	-.0085	-.0098	-.0150**	-.0109**
	(.0045)	(.0047)	(.0051)	(.0064)	(.0063)	(.0063)	(.0042)

The Coefficients are for Inflation Volatility, the Outcome Dependent Variable; Outcome Independent Variables are Income; Unemployment; Trade; XR; and Institutional Quality. Treatment Variable is Inflation Targeting Regime (ITR) Dummy.

Note: The asterisks next to the coefficients (*, **, ***) represent their significance levels of 10%, 5%, and 1% respectively. Figures listed under the coefficients in parenthesis are Robust Standard Errors.

5.2.3 Robustness Checks: Though our results seem robust to various model specifications as well as exclusion of outlier observations, we perform another robustness check by employing the GDP deflator as an alternative to the CPI inflation. No central bank in the ITR club, or even non-ITR adopters, takes into account the GDP deflator for monetary policy considerations. However, since MICs exhibit small open economy characteristics, and because the GDP deflator has been recommended as an alternative to CPI by Schaechter et al. (2000), it is worth checking the performance of ITR adoption in terms of maintaining stability of the GDP deflator, in addition to CPI inflation and its volatility. The results for the average treatment effects of ITR adoption on lowering the GDP deflator are presented in Table 5.4. They are pretty much in line with those obtained earlier for the CPI inflation and its volatility. The magnitudes and significance levels of

the coefficients across all the estimators exhibit a resemblance to those of the CPI inflation and volatility. These results support the overall significant role of ITR adoption in combating GDP deflator inflation rates among the treatment group compared to the control group. When the inclusive sample is used, we observe that the ITR adoption has helped countries bringing the GDP deflator down by about 4 percentage points across different estimators. When we drop the outliers where inflation observations are above 100%, 50%, and 25%, we notice that the magnitude weakens although it is still significant. Similarly, when we truncate the sample at year 2001, there does not seem to be any loss of significance or magnitude, implying that the ITR adoption has been greatly helpful in lowering the growth rate of the GDP deflator.

Table 1.8 Average Treatment Effects on the Treated (ATET) for the GDP Deflator

	Propensity Score Matching (PSM)			Nearest Neighbor Matching (NNM)			Regression Adjustment
Model ↓ Estimator →	Single Match	Three Matches	Five Matches	Narrow R=.01	Wide R=.05	L. Sample Bias Adj.	IPW Reg. Adjustment
Inclusive Sample (1996-2013)	-.0386*** (.0122)	-.0398*** (.0093)	-.0442*** (.0095)	-.0336*** (.0115)	-.0393*** (.0122)	-.0140 (.0124)	-.0355*** (.0081)
Confining CPI Inflation to 100 %	-.0217*** (.0082)	-.0423*** (.0104)	-.0436*** (.0098)	-.0324*** (.0116)	-.0330*** (.0110)	-.0151 (.0110)	-.0291*** (.0071)
Confining CPI Inflation to 50 %	-.0171** (.0078)	-.0240*** (.0072)	-.0248*** (.0066)	-.0373*** (.0106)	-.0381*** (.0102)	-.0184* (.0103)	-.0211*** (.0063)
Confining CPI Inflation to 25 %	-.0182** (.0081)	-.0268*** (.0071)	-.0262*** (.0066)	-.0353*** (.0118)	-.0368*** (.0117)	-.0183 (.0116)	-.0178*** (.0063)
Truncated Sample (2001-2013)	-.0411*** (.0145)	-.0471*** (.0099)	-.0431*** (.0094)	-.0276** (.0110)	-.0286*** (.0100)	-.0196* (.0102)	-.0230*** (.0062)
Confining CPI Inflation to 100 %	-.0413*** (.0145)	-.0471*** (.0099)	-.0431*** (.0094)	-.0277** (.0110)	-.0279*** (.0102)	-.0195* (.0105)	-.0230*** (.0062)
Confining CPI Inflation to 50 %	-.0445*** (.0152)	-.0455*** (.0099)	-.0416*** (.0096)	-.0260** (.0109)	-.0255** (.0101)	-.0175* (.0103)	-.0208*** (.0060)
Confining CPI Inflation to 25 %	-.0427*** (.0148)	-.0428*** (.0110)	-.0401*** (.0118)	-.0210** (.0107)	-.02120** (.0101)	-.0161 (.0103)	-.0179*** (.0060)

The Coefficients are for GDP Deflator, the Outcome Dependent Variable; Outcome Independent Variables are Income; Unemployment; Trade; XR; and Institutional Quality. Treatment Variable is Inflation Targeting Regime (ITR) Dummy.

Note: The asterisks next to the coefficients (*, **, ***) represent their significance levels of 10%, 5%, and 1% respectively. Figures listed under the coefficients in parenthesis are Robust Standard Errors.

6. Concluding Remarks

Earlier studies on inflation targeting had inconclusive verdicts on IT's performance. Later studies, however, show that when it comes to developing and emerging economies, IT can be a good remedy against chronic inflation and its volatility. All of these studies use the development-based classification when constructing their country samples, thus neglecting the vast divide of income levels among these countries. This may lead to biased results due to the 'selection-on-observables' problem often stemming from grouping together units that exhibit extreme heterogeneity in their covariates. In addition, these studies also ignore the role of institutions when assessing the impact of IT-adoption.

By adhering to an income-based, rather than a development-based, classification, this study addresses the 'selection-on-observables' problem. Moreover, this study seems to be the first one to use the World Governance Indicators as proxy for institutional quality to investigate the impact of IT-adoption on combating inflation.

Our findings suggest that the middle-income countries can benefit from IT-adoption in their fight against inflation. The results show a significant reduction in inflation rates among the IT-adopting MICs when compared to their counterparts over the same period. In fact, the estimated coefficients are significant and substantial: IT-adoption has helped MICs lower inflation by 4 percentage points more than the non-IT adopting MICs. IT adoption also helped the inflation rates converge to the world's average inflation rates. The results are robust to the exclusion of outliers, and to the use of alternative measure of inflation, the GDP deflator. More importantly, the results also confirm the pivotal role that institutions can play – particularly regulatory quality, voice and accountability and political stability– in bolstering policymakers' efforts to combat inflation.

7. References

Agénor, P-R. and Montiel, P., 2009, *Development Macroeconomics* (Princeton University Press).

Arestis, P. and M. Sawyer, 2003, "Inflation Targeting: A Critical Appraisal," Levy Institute Working Paper No. 388 (New York, Levy Economics Institute of Bard College).

Ball, L., 1993, "How Costly Is Disinflation? The Historical Evidence," *Business Review*, Federal Reserve Bank of Philadelphia, Issue Nov, pages 17-28.

Ball, L. and N. Sheridan, 2005, "Does Inflation Targeting Matter?" NBER Working Paper No. 9577 (Cambridge, Massachusetts, National Bureau of Economic Research).

Barro R. J. and D.B. Gordon, 1983, "Rules, Discretion and Reputation in a Model of Monetary Policy," NBER Working Paper No. 1079 (Cambridge, Massachusetts, National Bureau of Economic Research).

Batini, N. and D. Laxton, 2007, "Under What Conditions Can Inflation Targeting Be Adopted? The Experience of Emerging Markets," in *Monetary Policy Under Inflation Targeting*, ed. by Frederic Mishkin and Klaus Schmidt-Hebbel (Santiago, Central Bank of Chile).

Bernanke, B.S. and I. Mihov, 1996, "What Does Bundesbank Target?" NBER Working Paper No. 5764 (Cambridge, Massachusetts, National Bureau of Economic Research).

Bernanke, B. and F. S. Mishkin, 1997, "Inflation Targeting: A New Framework for Monetary Policy?" *Journal of Economic Perspectives,* Vol. 11, No.2, pp. 97-116.

Bernanke, B. and M. Woodford, 2005, *The Inflation-Targeting Debate* (Chicago, University of Chicago Press).

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

Carare, A. and M. R. Stone, 2006, "Inflation Targeting Regimes," *European Economic Review* Vol. 50, pp. 1297–1315.

Carson, C., C. Enoch and C. Dziobek, 2002, *Statistical Implications of Inflation Targeting*, (Washington, International Monetary Fund).

Cecchetti, S.G. and M. Ehrmann, 1999, "Does Inflation Targeting Increase Output Volatility? An International Comparison of Policymakers' Preferences and Outcomes," NBER Working Paper No. 7426 (Cambridge, Massachusetts, National Bureau of Economic Research).

Clarida, R., J. Gali and M. Gertler, 1998, "Monetary Policy Rules in Practice: Some International Evidence," *European Economic Review* Vol. 42, pp. 1033-1067.

Cogley, T. and T.J. Sargent, 2005, "Drifts and Volatilities: Monetary Policies and Outcomes in the Post-WWII US," *Review of Economic Dynamics* Vol. 8, pp. 262–302.

De Mendonça, H.F. and G.J. De Guimarães e Souza, 2012, "Is inflation targeting a good remedy to control inflation?" *Journal of Development Economics* Vol. 98, pp. 178–191.

Ford, Gerald. 1974, "Address to a Joint Session of the Congress." The American Presidency Project. http://www.presidency.ucsb.edu/ws/?pid=4694# (accessed January 3, 2015).

Forder, J., 2014, *Macroeconomics and the Phillips Curve Myth (*Oxford, Oxford University Press).

Gasper, V. and F. Smets, 2000, "Price Level Stability: Some Issues," *National Institute Economic Review* No.174.

Gavin, W.T., 2003, "Inflation Targeting: Why It Works and How To Make It Work Better," FRB Working Paper No. 2003-027B (St. Louis, Federal Reserve Bank of St. Louis).

Gemayel, E., S. Jahan and A. Peter, 2011, "What Can Low-Income Countries Expect from Adopting Inflation Targeting?" IMF Working Paper (Washington, International Monetary Fund).

Genberg, H., (2001), "Asset Prices, Monetary Policy and Macroeconomic Stability," *De Economist*, Vol. 149, No. 4, pp. 433–453.

Gonçalves, C.E. and J.M. Salles, 2008, "Inflation Targeting in Emerging Economies: What do the Data say?" *Journal of Development Economics*, Vol. 85, pp. 312–318.

Goodfriend, M. and R. King, 2005, "The incredible Volcker Disinflation," *Journal of Monetary Economics* Vol. 52, pp. 981–1015.

Hammond, G., 2012, *State of the Art of Inflation Targeting*, Handbook No. 29 (Bank of England, Centre for Central Banking Studies).

Heston, A., R. Summers and B. Aten, 2012, Penn World Table Version 7.1 (Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania).

Johnson, D.R., 2002, "The Effect of Inflation Targeting on the Behavior of Expected Inflation: Evidence From An 11 Country Panel," *Journal of Monetary Economics*, Vol. 49, pp. 1521-1538.

Kaufmann, D., A. Kraay and M. Mastruzzi, 2010, "The Worldwide Governance Indicators: A Summary of Methodology, Data and Analytical Issues," World Bank Working Paper No. 5430 (Washington, World Bank).

Kydland, F.E. and E.C. Prescott, 1977, "Rules Rather than Discretion: The Inconsistency of Optimal Plans," *The Journal of Political Economy*, Vol. 85, No. 3, pp. 473-492.

Lavoie, M., 2009, "Taming the New Consensus: Hysteresis and Some Other Post-Keynesian Amendments," in *Macroeconomic Theory and Macroeconomic Pedagogy*, ed. by Giuseppe Fontana, Mark Setterfield (London, Palgrave Macmillan).

Lin, S. and H. Ye, 2009, "Does Inflation Targeting Make a Difference in Developing Countries?" *Journal of Development Economics,* Vol. 89, pp. 118–123.

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

Mishkin, F.S., 1999, "International Experiences with Different Monetary Policy Regimes," *Journal of Monetary Economics,* Vol. 43, No. 3, pp. 576–606.

Mishkin, F.S., 2011, "Monetary Policy Strategy: Lessons from the Crisis," NBER Working Paper No. 16755 (Cambridge, Massachusetts, National Bureau of Economic Research).

Nachega, J-C., 2005, "Fiscal Dominance and Inflation in the Democratic Republic of the Congo," IMF Working Paper No. 221 (Washington, International Monetary Fund).

Neumann, M. J. M. and J. Von Hagen, 2002, "Does Inflation Targeting Matter?" *Federal Reserve Bank of St. Louis Review,* Vol. 84, No.4, pp. 127-148.

Orphanides, A. and J. Williams, 2004, "Imperfect Knowledge, Inflation Expectations, and Monetary Policy" in *The Inflation-Targeting Debate,* ed. by B. Bernanke and M. Woodford (Chicago, University of Chicago Press).

Roger, S., 2009, "Inflation Targeting at 20: Achievements and Challenges," IMF Working Paper (Washington, International Monetary Fund).

Rosenbaum, R., Rubin, B., 1983, "The Central Role of the Propensity Score in Observational Studies for Causal Effects," *Biometrika* Vol. 70, pp. 41–55.

Rudebusch, G. D. and L. E. O. Svensson, 1999, "Policy Rules for Inflation Targeting", in *Monetary Policy Rules,* ed. by J. B. Taylor (Chicago, Chicago University Press).

Schaechter, A., M.R. Stone and M.D. Zelmer, 2000, *Adopting Inflation Targeting: Practical Issues for Emerging Market Countries,* IMF Occasional Paper No. 202 (Washington, International Monetary Fund).

Schmidt-Hebbel, K. and M. Tapia, 2002, "Inflation targeting in Chile," *North American Journal of Economics and Finance,* Vol. 13, pp. 125–146.

Setterfield, M. 2006, "Is Inflation Targeting Compatible with Post Keynesian Economics?" *Journal of Post Keynesian Economics,* Vol. 28, No. 4, pp. 653-671.

Sherwin, M., 1999, "Inflation Targeting: 10 Years On", New Zealand Association of Economists Conference: http://www.rbnz.govt.nz/research_and_publications/speeches/1999/0077458.html (accessed January 4, 2015).

Sims, C., 2004, "Limits to Inflation Targeting", in *The Inflation-Targeting Debate,* ed. by B. Bernanke and M. Woodford (Chicago, University of Chicago Press).

Svensson, Lars E. O., 1999, "Inflation Targeting as a Monetary Policy Rule," *Journal of Monetary Economics,* Vol. 43, pp. 607-654.

Svensson, Lars E. O., 1997, "Inflation Forecast Targeting: Implementing and Monitoring Inflation Targets," *European Economic Review,* Vol. 41, pp. 1111-1146.

Truman, E.M., 2003, *Inflation Targeting in the World Economy* (Washington, Institute for International Economics).

Vega, M. and D. Winkelried, 2004, "Inflation Targeting and Inflation Behavior: A Successful Story?" (Unpublished: Munich Personal RePEc Archive Paper No. 838).

Walsh, C., 2010, *Monetary Theory and Policy* (Cambridge, MIT Press).

Woodford, M., 2003, *Interest and Prices: Foundations of a Theory of Monetary Policy* (Princeton, Princeton University Press).

Appendix A

Table 1.9 IT-Club Members with The Income Levels, Adoption Date and Targets

Country	Income Group	Adoption Date	Inflation Target	Country	Income Group	Adoption Date	Inflation Target
Albania	Middle (U)*	2009	3% ±1%	Moldova	Middle (L)	2010	3% ±1%
Armenia	Middle (L)*	2006	4% ±1.5%	N. Zealand	High	1989	1%–3%
Australia	High	1993	2%–3%	Norway	High	2001	2.5% Point
Brazil	Middle (U)	1999	4.5% ±2%	Peru	Middle (U)	2002	2% ±1%
Canada	High	1991	1%-3%	Philippines	Middle (L)	2002	4.0% ±1%
Chile	High	1999	3% ±1%	Poland	High	1998	2.5% ±1%
Colombia	Middle (U)	1999	2%–4%	Romania	Middle (U)	2005	3% ±1%
Czech Rep.	High	1997	2% ±1%	Serbia	Middle (U)	2009	4.0% ±1.5%
Ghana	Middle (L)	2007	8.7% ±2%	S. Africa	Middle (U)	2000	3%–6%
Guatemala	Middle (L)	2005	4.5% ±1%	S. Korea	High	1998	3% ±1%
Hungary	Middle (U)	2001	3%	Sweden	High	1995	2%
Iceland	High	2001	2.50%	Thailand	Middle (U)	2000	3.0% ±1.5%
Indonesia	Middle (L)	2005	4.5% ±1%	Turkey	Middle (U)	2006	5.0% ±2%
Israel	High	1997	1%–3%	UK	High	1992	2%
Mexico	Middle (U)	2001	5.0% ±1.5%	USA	High	2012	2%

*(U) indicates Upper Middle Income and (L) indicates Lower Middle Income Levels. Sources: Gamayel et al. (2011), Hammond (2012) and the websites of the IMF, the World Bank and some major central banks.

Table 1.10 The Quality of Institutions in the MICs (The Mean Ave. of the Six WGIs)

Year→ Country↓	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13
ALB	24	25	26	26	26	30	34	33	37	35	37	41	44	46	45	44	42	44
DZA	17	15	14	14	14	19	23	25	27	33	29	26	25	23	24	22	23	24
AGO	8	6	4	4	4	6	8	10	10	11	13	12	15	15	16	15	16	15
ARG	57	56	55	54	53	43	33	39	38	44	43	43	40	38	41	43	40	39
ARM	34	34	34	34	34	38	41	45	42	42	40	41	42	44	42	43	46	47
AZE	14	15	15	16	16	17	18	22	19	23	22	22	24	26	24	23	22	28
BLR	28	27	26	25	25	22	20	23	17	18	18	20	23	23	19	18	23	24
BOL	44	47	50	47	45	42	39	38	33	28	31	31	30	29	32	32	31	32
BRA	51	51	51	53	55	56	56	54	52	50	49	49	51	54	56	55	54	51
BGR	42	47	51	53	55	57	59	57	59	59	59	59	57	59	60	59	58	57
CMR	14	16	18	19	19	18	17	22	20	21	20	20	19	21	19	20	18	19
CHN	38	37	36	37	37	35	33	36	36	35	36	36	38	37	35	36	35	36
COL	33	34	35	34	33	34	35	36	39	38	41	42	42	41	42	45	43	43
COG	11	9	7	9	10	12	14	15	16	12	12	12	12	14	15	16	15	15
CRI	70	73	76	74	72	72	72	70	69	66	66	66	66	69	70	68	71	71
CIV	42	38	35	27	19	18	17	12	9	8	9	10	10	13	12	13	18	21
DOM	44	40	36	39	41	42	42	36	37	38	40	39	39	38	36	38	40	42
ECU	33	34	35	30	25	26	26	26	26	25	21	22	21	20	22	24	26	31
EGY	43	42	41	42	42	39	37	36	36	37	32	35	36	38	35	29	28	23
SLV	34	37	40	42	43	43	43	44	48	46	47	46	46	48	49	50	47	47
GEO	17	19	22	24	25	21	17	27	33	37	43	46	48	49	51	53	56	58
GHA	42	42	42	46	50	48	45	49	49	51	55	53	54	55	55	56	55	55
GTM	28	30	33	32	32	32	33	30	31	29	30	31	32	32	31	32	30	30
HND	24	30	35	34	32	32	31	31	32	30	29	32	30	30	29	32	28	27
HUN	77	79	81	80	80	81	82	81	79	79	79	78	76	72	72	73	70	70
IND	44	44	44	45	46	44	43	44	44	47	46	45	45	44	43	42	40	41
IDN	34	27	21	25	29	26	24	22	26	28	32	35	36	35	35	36	38	40
JOR	52	53	55	55	54	51	47	53	54	53	51	53	52	52	50	50	49	47
KAZ	20	24	27	26	24	24	23	28	26	32	31	33	36	38	35	31	30	29
KGZ	33	35	37	34	31	30	29	25	23	18	18	19	21	19	22	23	24	24
LAO	28	26	25	22	19	17	15	9	13	13	16	17	18	16	18	19	22	24
MKD	30	32	33	32	32	32	33	37	43	40	44	46	50	51	49	49	51	51
MYS	66	63	60	60	61	61	62	64	65	65	61	61	57	56	61	60	61	62
MRT	44	43	42	42	42	46	50	46	38	38	33	31	21	24	21	23	23	22

MEX	43	45	46	49	51	52	53	53	52	50	49	47	45	46	46	46	48	47
MDA	48	47	46	40	35	33	31	31	29	33	35	36	36	36	38	42	42	41
MNG	53	52	52	52	53	56	60	55	51	49	48	47	46	44	44	45	45	47
MAR	50	53	56	52	49	47	45	43	47	40	41	42	40	43	45	42	43	42
NIC	33	34	35	34	32	35	37	37	37	35	32	30	29	29	28	30	31	32
NGA	13	13	14	15	16	13	11	12	11	16	16	16	18	16	16	16	16	16
PAK	23	24	25	22	20	21	22	23	19	21	25	23	21	19	20	18	18	19
PAN	52	56	60	58	56	56	56	53	55	52	53	54	57	56	55	56	54	54
PNG	36	34	32	33	33	31	29	25	24	21	24	26	25	25	27	28	28	28
PRY	28	24	19	17	15	16	17	20	20	22	21	23	25	26	29	30	28	28
PER	43	44	45	43	40	41	42	41	41	39	40	40	42	41	45	46	44	44
PHL	50	51	53	47	42	42	42	40	36	41	37	37	37	36	35	37	40	43
ROM	51	49	47	46	44	48	51	50	53	52	55	55	56	57	57	57	54	57
SEN	45	44	43	45	47	50	53	48	51	49	43	39	43	39	36	39	45	47
SRB	15	14	13	13	14	22	29	31	38	35	42	42	44	46	47	49	48	49
ZAF	63	62	61	62	62	62	62	62	64	63	64	62	61	59	60	60	58	59
LKA	43	43	42	42	43	46	48	47	45	41	42	42	40	39	40	42	42	41
THA	59	60	61	62	62	60	58	55	53	51	44	44	43	44	43	44	44	44
TUN	50	51	52	52	52	52	52	53	52	49	51	50	49	49	48	46	45	44
TUR	44	41	38	42	46	44	43	48	49	52	51	51	51	51	51	51	51	50
TKM	21	18	16	15	13	12	11	11	9	10	8	11	14	13	11	11	13	13
UKR	28	25	23	22	22	24	26	28	29	34	35	35	35	30	32	30	31	25
UZB	12	11	9	10	11	10	9	9	8	6	8	10	11	12	11	11	11	12
VNM	36	35	35	34	34	33	32	33	32	36	35	36	34	35	33	35	35	36
ZMB	28	31	33	32	31	31	31	34	34	30	35	38	40	39	38	42	45	45

Note: The numbers represent the percentile ranks among all countries that range from 0 (lowest) to 100 (highest) rank.

Table 1.11 Average Treatment Effects (ATE in Population) for CPI Inflation

	Propensity Score Matching (PSM)			Nearest Neighbor Matching (NNM)			Regression Adjustment
Model ↓ Estimator →	Single Match	Three Matches	Five Matches	Narrow R=.01	Wide R=.05	L. Sample Bias Adj.	IPW Reg. Adjustment
Inclusive Sample (1996-2013)	-.1243***	-.1267***	-.1241***	-.1251***	-.1291***	-.1301***	-.1363***
	(.0449)	(.0446)	(.0446)	(.0445)	(.0445)	(.0446)	(.0531)
Confining CPI Inflation to 50 %	-.0299***	-.0324***	-.0293***	-.0330***	-.0357***	-.0381***	-.0302***
	(.0067)	(.0045)	(.0045)	(.0043)	(.0040)	(.0040)	(.0051)
Confining CPI Inflation to 25 %	-.0194***	-.0215***	-.0182***	-.0200***	-.0221***	-.0248***	-.0183***
	(.0061)	(.0041)	(.0038)	(.0039)	(.0037)	(.0037)	(.0046)
Truncated Sample (2001-2013)	-.0268***	-.0319***	-.0283***	-.0262***	-.0274***	-.0340**	-.0337***
	(.0068)	(.0052)	(.0052)	(.0053)	(.0053)	(.0054)	(.0061)
Confining CPI Inflation to 50 %	-.0168***	-.0232***	-.0197***	-.0175***	-.0202***	-.0248***	-.0230***
	(.0058)	(.0040)	(.0040)	(.0042)	(.0041)	(.0041)	(.0045)
Confining CPI Inflation to 25 %	-.0126***	-.0188***	-.0154***	-.0116***	-.0140***	-.0195***	-.0179***
	(.0057)	(.0038)	(.0038)	(.0036)	(.0034)	(.0034)	(.0041)

The Coefficients are for CPI Inflation, the Outcome Dependent Variable, while Outcome Independent Variables are Income; Unemployment; Trade; XR; and Institutional Quality. Treatment Variable is Inflation Targeting Regime (ITR) Dummy.

Note: The asterisks next to the coefficients (*, **, ***) represent their significance levels of 10%, 5%, and 1% respectively. Figures listed under the coefficients in parenthesis are Robust Standard Errors.

Table 1.12 Average Treatment Effects (ATE) for the Inflation Convergence

	Propensity Score Matching (PSM)			Nearest Neighbor Matching (NNM)			Regression Adjustment
Model ↓ Estimator →	Single Match	Three Matches	Five Matches	Narrow R=.01	Wide R=.05	L. Sample Bias Adj.	IPW Reg. Adjustment
Inclusive Sample (1996-2013)	-.1178***	-.1193***	-.1163***	-.1160***	-.1204***	-.1211***	-.1286**
	(.0446)	(.0445)	(.0445)	(.0444)	(.0444)	(.0445)	(.0530)
Confining CPI Inflation to 50 %	-.0238***	-.0255***	-.0220***	-.0242***	-.0274***	-.0296***	-.0230***
	(.0055)	(.0039)	(.0040)	(.0039)	(.0036)	(.0037)	(.0047)
Confining CPI Inflation to 25 %	-.0133***	-.0150***	-.0115***	-.0117***	-.0143***	-.0168***	-.0116***
	(.0050)	(.0035)	(.0033)	(.0036)	(.0032)	(.0033)	(.0042)
Truncated Sample (2001-2013)	-.0282***	-.0316***	-.0279***	-.0258***	-.0294***	-.0337***	-.0337***
	(.0057)	(.0049)	(.0049)	(.0052)	(.0051)	(.0051)	(.0059)
Confining CPI Inflation to 50 %	-.0180***	-.0230***	-.0194***	-.0170***	-.0200***	-.0244***	-.0231***
	(.0045)	(.0036)	(.0037)	(.0040)	(.0038)	(.0039)	(.0042)
Confining CPI Inflation to 25 %	-.0138***	-.0186***	-.0151***	-.0112***	-.0139***	-.0191***	-.0179***
	(.0044)	(.0033)	(.0034)	(.0034)	(.0031)	(.0031)	(.0038)

The Coefficients are for Inflation Volatility, the Outcome Dependent Variable; Outcome Independent Variables are Income; Unemployment; Trade; XR; and Institutional Quality. Treatment Variable is Inflation Targeting Regime (ITR) Dummy.

Note: The asterisks next to the coefficients (*, **, ***) represent their significance levels of 10%, 5%, and 1% respectively. Figures listed under the coefficients in parenthesis are Robust Standard Errors.

Table 1.13 Average Treatment Effects (ATE) for the GDP Deflator

	Propensity Score Matching (PSM)			Nearest Neighbor Matching (NNM)			Regression Adjustment
Model ↓ Estimator →	Single Match	Three Matches	Five Matches	Narrow R=.01	Wide R=.05	L. Sample Bias Adj.	IPW Reg. Adjustment
Inclusive Sample (1996-2013)	-.1448***	-.1470***	-.1456***	-.1419***	-.1466***	-.1472***	-.1610**
	(.0579)	(.0577)	(.0577)	(.0576)	(.0576)	(.0577)	(.0689)
Confining CPI Inflation to 100 %	-.0455***	-.0511***	-.0492***	-.0455***	-.0492***	-.0502***	-.0485***
	(.0075)	(.0066)	(.0064)	(.0057)	(.0055)	(.0057)	(.0069)
Confining CPI Inflation to 50 %	-.0329**	-.0362***	-.0339***	-.0342***	-.0379***	-.0383***	-.0347***
	(.0068)	(.0053)	(.0052)	(.0048)	(.0046)	(.0047)	(.0060)
Confining CPI Inflation to 25 %	-.0254***	-.0278***	-.0251***	-.0249***	-.0281***	-.0285***	-.0250***
	(.0064)	(.0046)	(.0043)	(.0047)	(.0046)	(.0046)	(.0057)
Truncated Sample (2001-2013)	-.0348***	-.0420***	-.0401***	-.0350**	-.0382***	-.0426*	-.0444***
	(.0080)	(.0063)	(.0062)	(.0062)	(.0060)	(.0061)	(.0068)
Confining CPI Inflation to 100 %	-.0315***	-.0387***	-.0368***	-.0320**	-.0346***	-.0390*	-.0398***
	(.0076)	(.0059)	(.0057)	(.0057)	(.0055)	(.0056)	(.0060)
Confining CPI Inflation to 50 %	-.0262***	-.0331***	-.0315***	-.0264***	-.0287***	-.0329***	-.0335***
	(.0075)	(.0055)	(.0053)	(.0052)	(.0051)	(.0051)	(.0054)
Confining CPI Inflation to 25 %	-.0226***	-.0289***	-.0274***	-.0216***	-.0241***	-.0288***	-.0289***
	(.0073)	(.0055)	(.0055)	(.0052)	(.0050)	(.0050)	(.0052)

The Coefficients are for GDP Deflator, the Outcome Dependent Variable; Outcome Independent Variables are Income; Unemployment; Trade; XR; and Institutional Quality. Treatment Variable is Inflation Targeting Regime (ITR) Dummy.

Note: The asterisks next to the coefficients (*, **, ***) represent their significance levels of 10%, 5%, and 1% respectively. Figures listed under the coefficients in parenthesis are Robust Standard Errors.

Figure 1.2 The Overlap Assumption Test – CPI Inflation

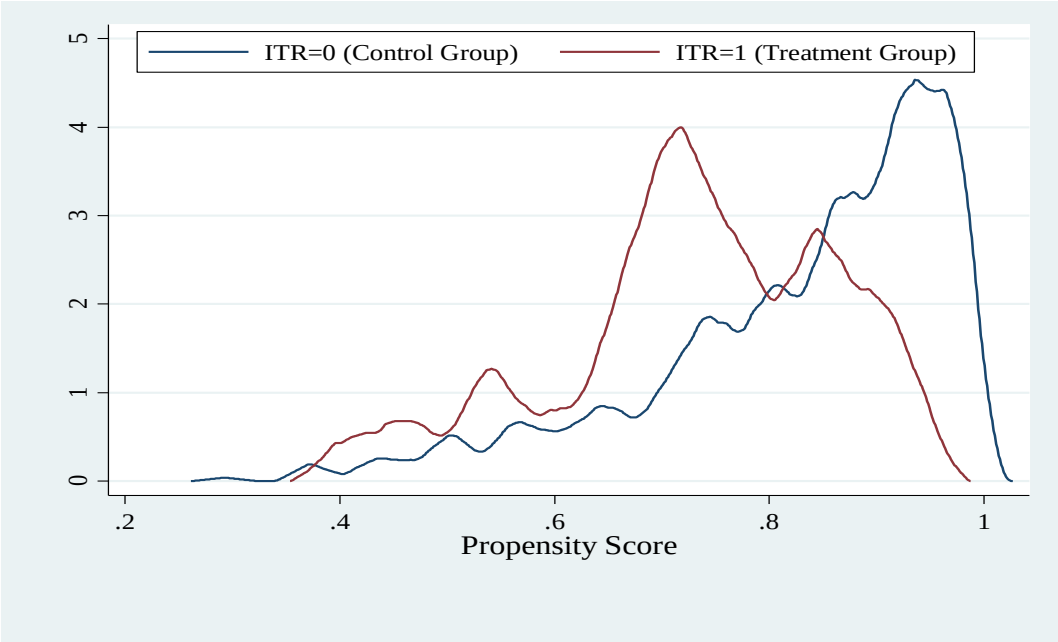


Figure 1.3 The Common Support Test – CPI Inflation

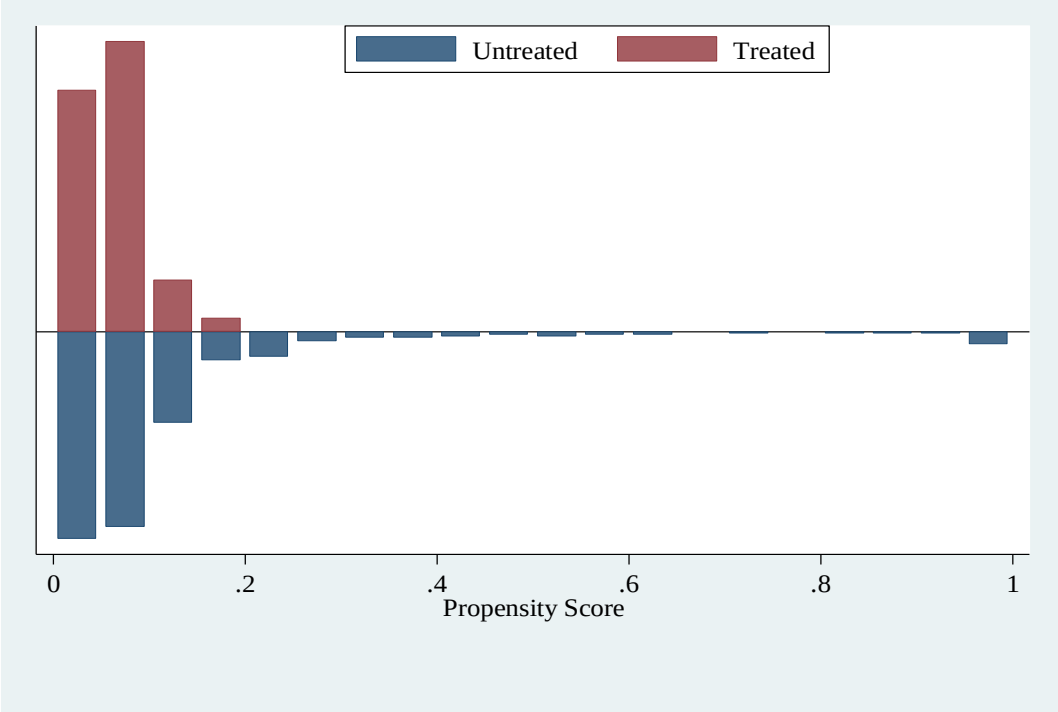


Figure 1.4 The Common Support Test – Average of Six WGIs (Institutional Quality)

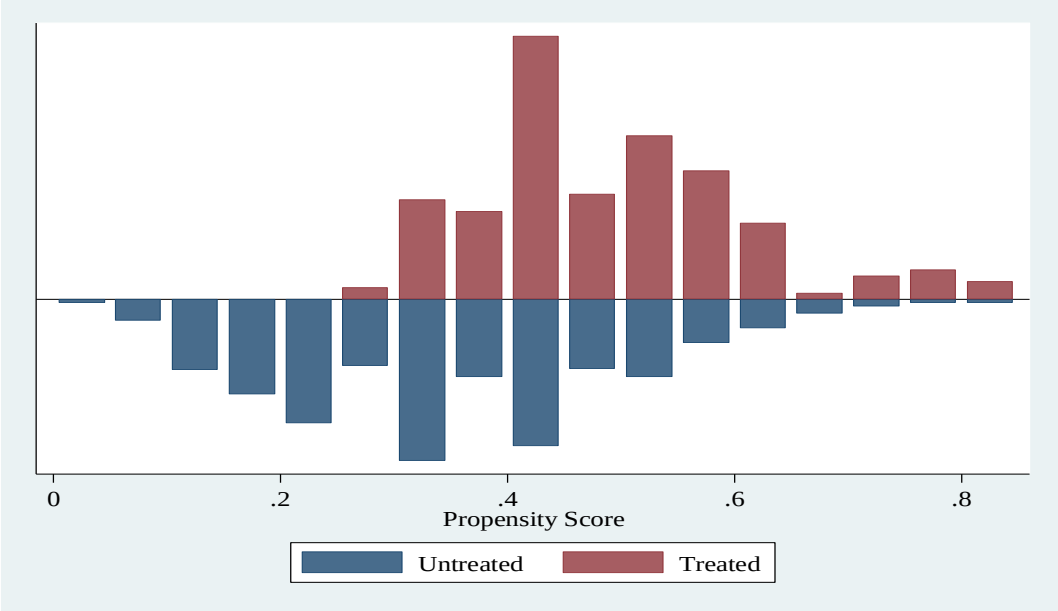


Figure 1.5 The Common Support Test – Inflation Convergence