Does Inflation Targeting Promote Economic Efficiency and Growth?

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Abstract

Inflation targeting, as a monetary-policy framework, is said to promote economic efficiency and growth. Yet, when evaluating the macroeconomic performance of inflation-targeting regime, the existing literature only emphasizes the dynamics of inflation and the costs associated with taming inflation. There is hardly any assessment of the claim of efficiency and growth. To fill up this gap, and to measure the causal impact of inflation-targeting adoption on economic efficiency, we compare the dynamics of output growth and long-term unemployment between countries that have adopted inflation targeting and the non-adopting countries. Our findings seem to refute the efficiency claim, and paint a bleak picture of inflation targeting: when compared to the countries that did not adopt inflation targeting, there is a significant reduction in the average growth rate among the inflation-targeting adopters by over ½ percentage point. Additionally, long-term unemployment significantly rises among the inflation-targeting countries by almost 2 percentage points as compared to the non-adopters. These results are robust to both the exclusion of the outlier observations and to the sensitivity tests recommended for such analysis.

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3.1 Introduction

'*Economic theory and evidence both support the idea that low and stable inflation promotes economic growth and efficiency in the long run……Thus inflation targeting, perhaps together with other fiscal and structural reforms, can help create an environment in which the economy can prosper,*' (Bernanke et al., 1999, pp.297-298).

It has been almost three decades since inflation targeting (IT), as a monetary-policy framework, was first adopted by the Reserve Bank of New Zealand in 1989. Ever since many other countries – both advanced and not-so-advanced – have followed New Zealand in adopting IT. The US was the latest and the 30th country to join the IT-member club in 2012.[1]

Inflation targeting can be defined as a monetary policy regime that candidly commits itself to a low and stable inflation rate, as its primary policy objective, in the medium-to-long run, by amalgamating the monetary policy rule and the policy-makers' discretion.[2]

Much has been researched and documented about inflation targeting over the past two decades or so. There has been some criticism, but IT has mainly garnered praise from academia and policymakers alike. A common theme, or claim, that stands out throughout the literature is that inflation targeting promotes economic efficiency and growth by stabilizing inflation and locking-in inflation expectations.[3] Numerous studies have been carried out to assess the macroeconomic performance of inflation targeting, and this assessment often suffices to studying either the dynamics of inflation or the costs attached to reducing inflation, the so-called sacrifice ratios. No doubt that the inflation-targeting regime has been a successful story in combating inflation and

[1] For a complete list of these thirty countries, refer to Table 6.1 in section 6.
[2] Bernanke et al. (1999) call IT a '*constrained discretion*'.
[3] See Svensson (1997), Bernanke et al. (1999) and Mishkin (2011).

volatility. The question, however, arises as to whether the scope of IT is limited to fighting inflation and its volatility only. Should countries be persuaded to adopt IT simply because it can help them fight inflation? In fact, the literature cautions against using IT as a disinflationary tool.[4] Accordingly, IT has much more to offer than simply combating inflation. After all, many countries have successfully contained inflation without adopting IT.[5] The main argument in favor of the IT-adoption rests on the claim that inflation targeting promotes economic efficiency, by achieving and then safeguarding macroeconomic stability, which is necessary for long-term economic and employment growth. This argument, although it might appear to be intuitively appealing to a majority of economists, has not been backed by much concrete empirical evidence thus far. As mentioned above, in order to gauge IT's performance as a monetary policy framework, most of the empirical literature only looks at inflation and its volatility. Some authors go a bit farther and compute the expected costs – also referred to as sacrifice ratios – attached to taming the inflation. However, there seems to be a wide gap in the IT literature when it comes to verify its core claim, which states that inflation targeting promotes economic efficiency. There is no assessment of what happens to the main macroeconomic indicators, such as economic growth and unemployment, in the medium-to-long run after a country opts for the IT adoption. Are the IT- adopting countries better-off, the same, or worse-off when compared to the non-IT adopters in terms of output growth and job creation?

As for measuring the so-called sacrifice ratios of disinflation, a possible objection can be raised against using sacrifice ratios as a performance gauge for inflation targeting: [6] One cannot judge

[4] See Bernanke et al. (1999).
[5] See Ball and Sheridan (2003).
[6] For example, Ball (1994) and Bernanke et al. (1999) compute the sacrifice ratios for the early IT adopters.

IT's success or failure by simply looking at these sacrifice ratios, particularly since the 1970s and 1980s were marred with persistently higher rates of inflation, and most of the early IT adopters were experiencing high inflation rates, so the sacrifice ratios computed from the data samples during these two decades should not translate in success or failure of inflation targeting . More importantly, as we will see in the following pages, the methodology of computing these ratios has come under some serious criticism.

The literature on inflation and growth shows that low and stable inflation rates over the long run are considered to be conducive to economic and employment growth. Hence, it seems that an appropriate way to gauge the success of inflation targeting, which claims to stabilize inflation, would be to compare the performance of two macroeconomic variables, growth and employment, between the adopters and the non-adopters over the past two and a half decades of IT's appearance. Indeed, this is precisely the objective of our study: We want to check whether there is any empirical evidence supporting the claim that inflation targeting promotes efficiency. This is done by comparing output growth and unemployment rates among the IT adopters and the non-IT adopters.

The rest of the paper is organized as follows: Section 2 presents a brief review of the anti-inflation or the inflation-averse attitude. Section 3 summarizes the formal work on inflation targeting that highlights the connection between inflation expectations and macroeconomic stability. Section 4 reviews the literature in three different segments: first, the link between an independent central bank and macroeconomic stability; second, monetary policy design under inflation targeting and its impact on macroeconomic stability; third, the impact of monetary policy on economic and employment growth. Section 5 summarizes the costs associated with disinflation, and a brief

discussion of the so-called sacrifice ratios. Section 6 presents and explains the sample and methodology. Section 7 offers the empirical results and analysis. Section 8 concludes the study.

3.2 The Inflation-Averse Attitude

The aversion to inflation is not specific to the monetary-policy framework of IT. In fact, long before the birth of IT, some of the most illustrious economists were already advocating macroeconomic policies that could tame both the level and the volatility of inflation, since inflation volatility is often said to be the real culprit behind the uncertainty that causes macroeconomic instability.

Almost a century ago, Knut Wicksell proposed a monetary framework that was similar to the present-day inflation-targeting regime, '*So long as prices remain unaltered the banks' rate of interest is to remain unaltered. If prices rise, the rate of interest is to be raised; and if prices fall, the rate of interest is to be lowered; and the rate of interest is henceforth to be maintained at its new level until a further movement of prices calls for a further change in one direction or the other*,' (Wicksell 1898, p. 189).[7]

John Maynard Keynes specified the inflation expectations as the real culprit that shrouds the uncertainty in a macro-economy, '*For it is not the fact of a given rise of prices, but the expectation of a rise compounded of the various possible price movements and the estimated probability of each, which affects money rates,*' (Keynes,1924, pp.21-22).

Friedrich Hayek also highlighted the role of inflation expectations in creating problems for central bankers: '*Monetary policy is then faced with an unpleasant dilemma. In order to maintain the degree of activity it created by mild inflation, it will have to accelerate the rate of inflation, and*

[7] For more on the Wicksellian theory and the modern central banking, see Secceraccia (1998).

will have to do so again and again at an ever increasing rate every time the prevailing rate of inflation comes to be expected,' (Hayek, 1976, p.97).[8]

Later, monetary economists, such as Miguel Sidrauski, also held inflation expectations responsible for causing a great deal of uncertainty in the economy, '*The increase in the rate of inflation, in turn, raises the rate of change in the expected rate. The increase in the rate of change in the expected rate further increases the actual rate, and the possibility of having a self-generating acceleration in the rate of inflation is not at all remote*,' (Sidrauski, 1967, p.805).

Thomas Sargent in his influential studies of the hyperinflation episodes during the 1920s in Europe also laments the role of inflation expectations in acting as 'fuelling the fire'.[9]

Robert Barro advocates a strong anti-inflationary monetary policy, and suggests that a high degree of inflation variance is always accompanied by higher rates of inflation, hence arguing that it is more efficient to focus on the inflation variance to tame a persistent inflation.[10]

In addition to the academia, monetary policymakers were also wary of inflation and its expectations long before the revelation of inflation-targeting regimes. For example, the former Chair of the US Federal Reserve, Paul Volcker, has advocated an anti-inflationary monetary policy that not only reduces the current rate of inflation but also tames inflation expectations, saying that: '*Inflation feeds in part on itself, so part of the job of returning to a more stable and more productive economy must be to break the grip of inflationary expectations.'* [11]

The above statements are just a small sample of similar statements that could be found throughout the literature. They clearly exhibit the belief of macroeconomists and policymakers in the

[8] For more on Hayek's view on central banking, see Ferris and Galbraith (2006).
[9] Sargent (1982)
[10] Barro (1996)
[11] In a statement before the Joint Economic Committee of the U.S. Congress on October 17, 1979.

paramount role that inflation, its volatility and its expectations play in achieving macroeconomic stability, which is a necessary condition for a prosperous economy.

3.3 The Theory of Inflation Targeting

In light of the previous section's recommendations coming from the best-known members of the economics discipline, the formal work on IT has maintained that anchoring (or locking-in) inflation expectations was the best thing that monetary policy could do to help stabilize inflation and its volatility over the medium to long run.[12]

When reviewing the formal work on IT, it seems obvious that the key objective of an inflation-targeting regime is to lock-in inflation expectations. We briefly discuss here the objective function of an IT-central bank and the optimal monetary policy under an IT-mandate, as presented in detail by Clark et al. (1999), and by Orphanides and Williams (2005). For simplicity, we analyze the model with the perfect information assumption. Thus, inflation can be thought of as being determined by the following Lucas-type supply function (an augmented Phillips curve), which also considers agents' expectations about the inflation based on the previous period.

$$\pi_{t+1} = \alpha\, E\,(\pi_{t+1}) + (1 - \alpha)\,\pi_t + \beta\, y_{t+1} + \varepsilon_{t+1} \quad (1)$$

where π_{t+1} is the inflation rate, $E\,(\pi_{t+1})$ represents the agents' inflation expectations, y_{t+1} is the output gap, the deviation of the real GDP from its potential, $(Y - Y^P)$, and ε_{t+1} is the error term. The parameter α can take any value between [0, 1], and $\beta > 0$. The output gap, y_{t+1}, is determined by the following aggregate demand curve that has a policy effect, x_t, (after one lag).

[12] See for example, Svensson (1997), who uses the term 'inflation forecast targeting' because, in his view, policymakers do not have control over inflation; instead they try to influence the inflation expectations of agents.

$$y_{t+1} = x_t + \eta_{t+1} \quad (2)$$

$$x_t = -\gamma\,(r_t - r^{N}) \quad (3)$$

where x_t is the current gap between the short term real interest rate, r_t, and the natural interest rate, r^{N}, and parameter γ is the policy choice parameter. However, as mentioned earlier, the monetary policy under an IT-mandate regards inflation expectations as the main source of uncertainty. Therefore, an IT-central bank considers the variance between the current and the target rate of inflation as the gauge that determines its optimal response. As a result, equation (3) can be modified, and rewritten in terms of the variance of the current inflation and its target rate:

$$x_t = -\gamma\,(\pi_t - \pi^{T}) \quad (4)$$

where x_t can be thought of as the monetary policy rule under an inflation-targeting mandate.[13]

Given these settings, the objective function of an IT-central bank is to minimize the loss:

$$L = (1-\lambda)Var\,(y_t) + \lambda\,Var\,(\pi_t - \pi^{T}) \quad (5)$$

The parameter λ can take any value between [0, 1], and $Var\,(\ldots)$ is the unconditional variance.

The solution to this model is the following optimal monetary policy, denoted by γ^{OMP}, assuming that the central bank is an explicit inflation targeter that cares only about the inflation volatility (the policy parameter λ takes the value of 1), and ignores the volatility of the output gap.[14]

$$\gamma^{OMP} = (1-\alpha)\,/\,\beta \qquad (5)$$

The optimal reaction function of an IT-central bank in equation (5) clearly states that the response is positively related to the ratio $(1-\alpha)\,/\,\beta$, and this response is greater in the case of a persistent

[13] Orphanides and Williams (2005, pp.206).

[14] A general solution to this type of model is basically the variance that can be traded-off among the inflation and the output gap, depending on the policymaker's preferences; see Orphanides and Williams (2005).

departure of the actual inflation rate from its target rate, thus '*justifying a strong interest in price stability*' in the words of Barro (1996, p.7).

3.4 The Macroeconomic Effects of Monetary Policy

According to the IT literature, the macroeconomic effects of monetary policy can be traced to a single channel: the inflation expectations. The decisions of households and firms are greatly influenced by the inflation expectations, which are in turn a function of both the level and the variability of the present and the past inflation. In this context, macroeconomic stability depends solely on inflation expectations. In what follows, we discuss how the inflation-targeting regime empowers a central bank in designing a policy that will manipulate inflation expectations and bring about macroeconomic stability, thus providing a fertile ground for the economy to grow and flourish.

3.4.1. An Independent Central Bank and Macroeconomic Stability: '*Indeed, the evidence is that economies with independent central banks enjoy lower rates of inflation than other countries, with no higher volatility in employment and output,*' Bernanke et al. (1999, p.312).

A central feature of the monetary-policy framework under inflation targeting is central bank independence. In fact, a key requirement for any central bank prior to IT adoption is that it must be granted autonomy so that it can design and implement its goals and instruments free from any political influence or interference. The literature is filled with studies on the significant impact of central bank independence for macroeconomic stability. For example, Rogoff (1985) builds a theoretical model, as an extension of the earlier formal work, on central bank independence. The aim of his theoretical work is to find the optimal degree of commitment that can be placed on a monetary target, such as the money supply, real interest rates or the trade-off between the variance

of inflation and output growth. His findings reveal that policymakers who are inflation-averse tend to discard the variance of output growth and unemployment. This is because they believe that price stability is the catalyst to macroeconomic stability, which ultimately leads to growth and employment; so any loss in the output or employment as a result of the strict adherence to contractionary monetary policy will be recovered once the economy rebounds. Similarly, Alesina and Summers (1993) also study the central bank independence and its impact on macroeconomic performance. They state several reasons for which they expect central bank independence to improve the overall macroeconomic performance: a central bank that is not influenced by politicians can set goals and objectives in the best interest of the economy, and this in turn alleviates uncertainty, which translates into more economic stability and less risk for investors. In their view, policymakers seem to agree that inflation and its volatility cause distortions, rent-seeking behavior and higher risk premiums, which all together hinder the performance of an economy. Therefore, if policymakers are allowed to apply their discretionary powers, regardless of any political opposition, then they would try to mitigate these adverse effects in order to improve economic performance.

In addition, on the empirical front, Alesina and Summers (1993) also compare the performance of a rule-based versus a discretion-based monetary policy, by examining the dynamics of inflation. They find that there exists a significant negative relationship between central bank independence and the dynamics of inflation. They also find that the monetary policy designed by a non-politically-influenced central bank can tame inflation more efficiently than a monetary-rule based and politically-influenced central bank. Given their findings, they conclude that the payoff stemming from central bank independence in the form of lower rates of inflation and lower inflation volatility is far greater than the anticipated loss in output, which in their view is non-

existent. A key recommendation of their paper, for the countries that struggle in taming the inflation, is to adopt discretion-based monetary policies by letting their central banks free from any political influence, and by avoiding the strict rule-based monetary policies.

Another study by Debelle and Fischer (1994) also examines the impact of central bank independence on inflation and its volatility, as well as output growth and its volatility. Their findings suggest that central bank independence appears to be a *free lunch* for two reasons: First, the central bank independence helps in winning the battle over inflation by taming both inflation and its volatility. Second, this fight against inflation, in the presence of central bank independence, does not come at the cost of output loss or of increased output volatility. Down (2004), however, disagrees with the notion of central bank independence being a *free lunch*. He contends that the assumption that the central bank's autonomy bears no costs is a flawed assumption, particularly when an autonomous central bank implements a costly contractionary monetary policy just to curb inflation. The costs associated with a disinflationary policy under an independent central bank are much higher as compared to a politically-influenced central bank, because the latter takes into account the sensitivity of the disinflation costs.

3.4.2 Monetary Policy Design and Macroeconomic Stability: *'The ultimate objective of Canadian monetary policy is to promote good overall economic performance. Monetary policy can contribute to this goal by preserving confidence in the value of money through price stability. In other words, price stability is a means to an end, not an end in itself,'* (Bank of Canada, 1995, p.3).

An independent central bank can design its monetary policy in a way that the inflation expectations of households and firms are anchored around a specific target. By announcing a target

rate of inflation, an inflation-targeting central bank basically offers an open and transparent commitment, and can be held accountable in the case of reneging. This commitment can have a significant impact on anchoring inflation expectations. For instance, Levin et al. (2004) investigate the role of an inflation-targeting regime in anchoring inflation expectations as well as stabilizing output volatility. Their sample consists of 12 advanced economies and 13 emerging economies. Among the advanced economies, the five IT-adopters – Australia, Canada, New Zealand, Sweden and the UK – outperform their counterparts in the sense that inflation expectations are anchored, i.e., there is no correlation between the inflation forecasts and lagged inflation. As for the emerging economies, they find that the adoption of IT has helped in bringing down inflation and its volatility, although, expectations do not seem to be anchored in those economies. In the same way, Orphanides and Williams (2005) show formally that the strict adherence to an explicit inflation target can lead the economy to perform superbly, thus stabilizing the two most important macroeconomic indicators: inflation and output. They argue that the strict inflation-targeting regime can break up persistency in both inflation and its volatile variance from the target, which in turn safeguards against '*costly stagflationary episodes*' in the future. Another attribute that Orphanides and Williams (2005) commend the IT adoption for is the transparent communication of an explicit numerical inflation target, which clearly conveys to the public what is the ultimate inflation objective of the policymakers. Their theoretical findings point to a greater impact of policymakers' communication and vigilance in locking-in inflation expectations and stabilizing the overall macro-economy.

One can deduce from the above analyses that an IT-central bank would have the ability to combat inflation and its volatility more efficiently compared to the non-IT-central banks. According to the literature on inflation targeting, the central bank independence, transparency, clearly committed

and announced goals and objectives, and accountability to the public are all hallmarks of the inflation-targeting regime.

3.4.3 Monetary Policy and Growth: '*A priority for low long-run inflation derives not so much from a belief in its intrinsic value relative to other goals such as full employment and economic growth, but from theory and evidence suggesting that monetary policy encourages employment and growth in the long run mostly by controlling inflation*,' Goodfriend (2005, p. 323).

There are different accounts of an aggressive monetary policy that seeks price stability, and the overall impact of such policy on growth and employment.

For example, Alesina and Summers (1993) study the relationship between inflation and output growth. Although they find a significant negative relationship between these two variables, they caution that if monetary policy puts too much emphasis on price stability as its main objective, in the form of low inflation rates and a low variance of inflation, it can only achieve its objective by diminishing output growth and exacerbating unemployment.

Barro (1996) also finds a significant negative relationship between inflation and output growth, and shows that an expansionary monetary policy that induces an increase of 1% in the inflation rate can cause a reduction of 0.4% to 0.7% in real GDP over the long run. He throws his support behind a strong policy stance on fighting inflation and its volatility, in order to mitigate their dire impact on output growth in the long run.[15]

Moreover, Dollar and Kraay (2002) present evidence on how monetary policy can induce growth by showing that macroeconomic stability breeds price level stability, while this stability in turn spurs per-capita income growth by providing a healthy environment and opportunities for low-to-

[15] Barro (1996) actually mentions that a 10% increase in the inflation rate causes a reduction of 4 to 7% in real GDP.

middle income families to enhance their output and income. They suggest a strong positive relationship between tight monetary policy and growth, as well as employment. In the same way, Loayza et al. (2002) study growth and its determinants in Latin America and Caribbean. They proxy macroeconomic stability by two variables, the variance of inflation and that of output. Their findings suggest that macroeconomic instability in the form of higher rates of inflation and a volatile output have adverse effects on economic growth.

Finally, Lopez (2005) highlights the important role that monetary policy can play in contributing towards the economic welfare of a society. First, stability brought about by monetary policy is the key determinant of economic growth. Although stability alone cannot guarantee the provision of a superior growth performance, however, the opposite of it, instability, for sure does erect a barrier to any prospects of economic growth. Lopez (2005) gives two examples of how the absence of macroeconomic stability can become detrimental to economic growth: Bolivia suffered an uncertain and volatile price level, an average rate of 100% annual inflation, during the first half of the 1980s, which coincided with a drastically negative 4.3% rate of annual growth on average. Likewise, Zambia experienced an average rate of inflation above 100% annually during the first half of the 1990s, which hammered its annual growth rate to the negative territory of 3.5%. These two examples show the devastating effect of macroeconomic instability and uncertainty on economic welfare. Second, and perhaps more importantly, macroeconomic policy is the main driving force behind the income distribution in any given economy. Lopez (2005) goes on to state that inflation is thought to have an adverse impact on income distribution by distorting the purchasing power of the low-to-middle income households. A macroeconomic policy in the form of inflation targeting for example can produce the desired welfare outcomes by stabilizing and safeguarding the households' purchasing power, according to Lopez (2005).

3.5 The Cost of Disinflation

This section discusses the costs attached to both inflation and reducing it, or disinflation. There are numerous studies that analyze the costs attached to inflation. Briault (1995) presents a comprehensive survey of these studies on both the costs of inflation and the costs of taming it (disinflation). In addition to the normal costs, such as menu costs and shoe-leather costs, Briault divides the literature into two types. First, there are studies that have developed models on expected (anticipated) inflation. In these models, inflation is shown to act as a tax on currency balances that results in a welfare loss. Second, there are studies that have developed models based on unexpected inflation. The costs attached to unexpected inflation are shown to be the redistribution costs, decision-taking costs, the impact on the relative price movements, etc.

As for the costs of disinflation, the experience of the 1970s and 1980s suggests that price level stability commands sacrifice in the form of a loss in output and employment. This trade-off between inflation and output, and between inflation and employment, is called the *sacrifice ratio*.

3.5.1 Sacrifice Ratios: Gordon and King (1982, p. 206) define the sacrifice ratio as a measurement of '*the output loss required to eliminate permanently one point of inflation*.' Ball (1993, p.18) interprets the sacrifice ratio as, '*the total output losses during disinflation, measured as a percent of a year's output, to the decrease in inflation*.' He considers this ratio, between the loss in annual GDP and the corresponding reduction of inflation, as the price of reducing inflation by one percentage point. A more precise definition of the sacrifice ratios is given by Bernanke et al. (1999, p. 254) as the '*measures of the loss of output or employment that an economy must sustain in order to achieve a reduction in inflation*.' Finally, an inclusive definition is given by Down (2004, p. 401) who states that '*the sacrifice ratio is the cost, in terms of either output or unemployment, of*

a point reduction in inflation. It thus measures the relative cost of a reduction in inflation: the higher the ratio, the greater the relative cost.'

Okun (1977) was perhaps the first study to investigate what later became known as the sacrifice ratio, that, the trade-off between inflation and output or the sacrifice that an economy would have to make in order to curb inflation. His findings, which were based on surveys of the US economy, suggest unbelievably high sacrifice ratios: a total loss of almost 10% of the gross national product (GNP) in the US against a permanent reduction of 1% in the rate of inflation. Okun's findings were subjected to sharp criticisms, and were dubbed as *pessimistic* by academia and policymakers alike, and the subsequent empirical studies refuted Okun's findings. Among them are three influential studies: Gordon and King (1982) who use a vector autoregressive (VAR) approach to measure the sacrifice ratio for the post-war data of the US national accounts over the period 1947-81. They find that the sacrifice ratio for the US is about half of what Okun (1977) proposed.

Sargent (1982) is the second study that examines the European hyperinflation episodes of the 1920s, and the macroeconomic policies that brought down those hyperinflations, in four countries: Austria, Germany, Hungary and Poland. His comparison of the output growth between the pre and the post era of the hyperinflation episodes in all four countries reveals that the output losses arising from a reduction in inflation were minor as compared to the Okun's findings.

The third seminal work in this vein is by Romer and Romer (1989). They study a series of episodes of the post-war monetary disturbances in the US. These episodes reveal that the US Federal Reserve, in its fight against a persistent inflation, '*deliberately'* followed very strict contractionary monetary policies that resulted in recessions. Each one of these deliberate recession-inducing policies created a sharp decline in US industrial output, which fell by 12% on average while the

unemployment shot up by 2% on average. These negative effects started to arise immediately, but their severity appeared with a lag, taking about 7 to 8 quarters to reach their maximum value. Moreover, they also find that the impact of these negative effects was persistent, and the economy showed little signs of recovery or rebound towards the pre-shock levels, in contrast to what is usually claimed in the literature.

Later studies, such as Ball (1994), Bernanke et al. (1999) and Down (2004) have applied more sophisticated techniques in computing the sacrifice ratios, which are discussed in the following.

3.5.2 Computing the Sacrifice Ratios: Ball (1994) is widely regarded as the best account of the sacrifice ratio thus far. He first determines the trend inflation for every country in his data sample as the moving average inflation rate taken from nine quarters. He chooses the quarter as peak and trough where the inflation rate has been the highest or the lowest in both the preceding as well as the following four quarters. He then considers the fall of inflation from the peak towards the trough as one episode of disinflation, provided the fall in inflation from peak to trough is at least 2 percentage points. The next step is to estimate the drop in the output due to the disinflation. A key assumption of Ball's analysis is that the output is considered to be at its trend level both before and after the trough of a particular episode. Finally, he computes the sacrifice ratio by dividing the difference between the trend and the real level of output over the change in the average rate of inflation for that particular episode. Mathematically,

$$SR = \Delta Y / \Delta \pi \qquad (6)$$

$$SR = \Sigma (y_t - y_t^T) / (\pi_t - \pi_{t-1}) \qquad (7)$$

Many studies have adopted Ball's approach in computing sacrifice ratios over the past two decades. However, Down (2004) has levelled some serious criticism at his approach, stating that

there is clearly a selection bias, since Ball considers the successful episodes of disinflation only, thus ignoring episodes where monetary policy failed in reducing the inflation rate or failed to achieve a reduction of 2% and more.

In addition, according to Alesina (1987), some important factors behind the dynamics of inflation and disinflation are the institutional setup and the political environment; omitting these factors may contaminate the empirical results.

3.6 Empirics

As the objective of this study is to compare the economic efficiency of the inflation-targeting regime, we are going to match one set of countries (the IT-adopters) to another set of countries (the non-IT adopters), and find out which group outperforms the other in output growth and the long-term unemployment. A positive and significant coefficient of our inflation-targeting dummy for the output growth will mean that the IT-adopters have outperformed their counterparts. Whereas, a negative and significant coefficient of our IT dummy for the long-term unemployment will signal a better performance of the IT-adopters over their counterparts in lowering the unemployment rate.

3.6.1 Data: The main reference for constructing our sample is Barro (1996) who includes 100 countries in his sample. Our sample differs from Barro's in two respects: First, since the objective of this empirical exercise is to draw a comparison between the IT

adopters versus the non-IT-adopters, we will have to include all the 30 countries that have adopted inflation targeting. Second, because none of the IT-adopters is a low-income country, we delete from Barro's sample the countries that are classified by the World Bank as low-income countries. In addition, to enhance the quality of our sample, we also drop countries that have too many

missing observations or that are classified as small states (SST) or fragile and conflict-affected states (FCS). Thus, we are left with 68 countries. Table 6.1 below presents all the countries in our sample, along with the income-based classification of each country and whether it is an IT or a non-IT country. Because the IT-club includes both high and middle-income countries, we had no choice but to include in our control group both high and middle-income countries as well. Among the 68 countries, we have 29 high-income countries (HICs) and the remaining 39 are middle-income countries (MICs), which further diverge into two group: 17 are upper while 22 are lower middle income countries.[16] Nonetheless, we do cluster this sample in two subsamples, high and middle-income countries, and verify whether the signs of the coefficients differ across the two clusters from the sample. The time period of our analysis spans over 25 years (1990 to 2014), the approximate age of inflation targeting, and provides ample time to evaluate the performance of IT.

Table 3.1 The Sample Countries with their Income-Based Classification

The Treatment (IT) Group (30 Countries)				**The Control (Non-IT) Group (38 Countries)**					
Country	Class	Country	Class	Country	Class	Country	Class	Country	Class
Albania	U-MIC	Moldova	L-MIC	Algeria	U-MIC	Germany	HIC	S. Arabia	HIC
Armenia	L-MIC	N. Zealand	HIC	Austria	HIC	Greece	HIC	Senegal	L-MIC
Australia	HIC	Norway	HIC	Belgium	HIC	Honduras	L-MIC	Singapore	HIC
Brazil	U-MIC	Peru	U-MIC	Bolivia	L-MIC	India	L-MIC	Sri Lanka	L-MIC
Canada	HIC	Philippines	L-MIC	Botswana	U-MIC	Ireland	HIC	Switzerland	HIC
Chile	HIC	Poland	HIC	Bulgaria	U-MIC	Italy	HIC	Tunisia	U-MIC
Colombia	U-MIC	Romania	U-MIC	Cameroon	L-MIC	Japan	HIC	Uruguay	HIC
Czech R.	HIC	Serbia	U-MIC	China	U-MIC	Malaysia	U-MIC	Vietnam	L-MIC
Ghana	L-MIC	S. Africa	U-MIC	Congo Rep.	L-MIC	Morocco	L-MIC		
Guatemala	L-MIC	S. Korea	HIC	Costa Rica	L-MIC	Netherlands	HIC		
Hungary	U-MIC	Sweden	HIC	C. d'Ivoire	L-MIC	Nigeria	L-MIC		
Iceland	HIC	Thailand	U-MIC	Denmark	HIC	Pakistan	L-MIC		
Indonesia	L-MIC	Turkey	U-MIC	Ecuador	U-MIC	Paraguay	U-MIC		
Israel	HIC	UK	HIC	Egypt	L-MIC	Portugal	HIC		

[16] To check whether our empirical findings are robust to this heterogeneity, we subject our sample to the sensitivity test proposed by Rosenbaum (2002), and the results are presented in Table 7.1.

Mexico	U-MIC	USA	HIC	France	HIC	Russia	HIC

*U-MIC indicates the upper middle-income country, L-MIC indicates the lower-middle-income country, and HIC indicates the high-income country.
Sources: Gamayel et al. (2011), Hammond (2012) and the World Bank (2015).

Table 3.2 The Variables with the Definitions

Variable	Description	Source
Inflation Targeting Regime (ITR)	Binary variable used as a dummy for inflation targeting, equals 1 for the years when a country has had ITR in place, and 0 otherwise.	Gemayel et al. (2011), Roger (2009) and the websites of various central banks and the IMF.
Output Growth	Annual percentage change in the rate of aggregate gross domestic product (GDP) at market prices based on constant 2005 U.S. dollars.	The World Bank and the OECD National Accounts Data files, downloaded from the website of the World Bank (WB).
Log of GDP	Natural log of GDP at market prices based on constant 2005 U.S. dollars.	Same as above.
Investment (% of GDP)	Gross Domestic Investment or Capital Formation, a ratio of GDP that consists of outlays on additions to the economy's fixed assets.	Same as above.
Savings (% of GDP)	Gross Savings are calculated as gross national income less total consumption, plus net transfers.	Same as above.
Trade (% of GDP)	The sum of total exports and imports (of both goods and services) as a ratio of GDP.	Same as above.
Government Size	Government final consumption including current expenditures for purchases of goods and services (including compensation of employees).	Same as above.
GDP Deflator	Annual growth rate of the GDP implicit deflator, which is another measurement of the rate of price change in the economy as a whole, in current local currency to GDP in constant local currency.	Same as above.
CPI Inflation	Annual percentage change in the consumer price index (using the Laspeyres method).	The World Development Indicators (WDIs) of the World Bank.
Long -Term Unemployment	Long-term employment is a percentage of the total unemployed with continuous periods of unemployment extending for a year or longer.	International Labor Organization, Key Indicators of the Labor Market database, downloaded from the WB WDIs.

Population Growth (annual%)	Annual population growth rate based on the de facto definition of population, which counts all residents regardless of legal status or citizenship.	United Nations Population Division, downloaded from the website of the World Bank (WB).
ICRG	International country risk guide is an index of political risk developed by Howell (2001).	The PRS Group, Inc., downloaded from the website: www.prsgroup.com

3.6.2 The Determinants of Growth: The economic growth literature is enormously rich where countless authors have contributed to the formal and empirical aspects of growth. As Barro and Sala-i-Martin (2004) admit, given a large number of growth theories, there is also a large variety of proposed determinants of growth. Hence, it becomes almost an impossible task to decide on a unique set of explanatory variables to be included in growth regressions. They summarize their findings from the survey of a number of growth theories as follows. Growth is positively related to per capita GDP, the investment to GDP ratio, trade openness and rule of law; while it is negatively related to the government consumption to GDP ratio and the rate of inflation. Note that the same variables have been already used by Barro (1996) as explanatory variables in his seminal work on growth and inflation. As a result, we take Barro (1996) as a reference point for the explanatory (control) variables in our empirical model. We do, however, omit a few qualitative variables from his list, such as male schooling, female schooling, fertility rate, life expectancy, black-market premium, a democracy index and a Latin American dummy. The rationale for this omission is evident from the above mentioned summary of Barro and Sala-i-Martin (2004), who argue that these variables play no or little role. Additionally, there seems to be a consensus in the literature in considering per capita GDP as an inclusive proxy for the variables that we have omitted from Barro's list.[17] Instead, we add the IT dummy, and we replaced his rule-of-law index

[17] See for example, De Mendonça and De Guimarães e Souza (2012).

with the international country risk guide (ICRG) index. More importantly, we also employ two of the prominent variables in Solow's growth model, namely population and saving, as in Mankiw et al. (1992). However, both of these Solow variables either leave the results unchanged, or end up contaminating the significance of Barro's variables in our study. Hence, we drop these two variables from our growth regressions. We do use them subsequently for the unemployment regressions, as will be discussed later. Table 3.2 above provides a list of the variables used, with their definition and their source.

3.6.3 The Determinants of Unemployment: The literature on labor economics provides an extensive insight into the determinants of unemployment, but the discussion mainly evolves around the narrow definition of unemployment, such as cyclical, frictional, and structural unemployment, so that the emphasis is usually drawn from the microeconomic aspects of unemployment. By contrast, the macroeconomic aspect of unemployment is often linked to a broad definition of unemployment, such as the long-term unemployment or the natural rate of unemployment, the so-called NAIRU. Ours is the macroeconomic context, so we employ the macro-determinants of unemployment, such as growth, inflation, saving and population growth, as done by the majority of researchers in this field. [18]

3.6.4 Methodology: In order to match the performance of two different groups, the most appropriate econometric methodology seems to be the one that utilizes matching estimators. We use the propensity score matching technique developed by Rosenbaum and Rubin (1983). Vega

[18] See Bassinini and Duval (2006) and Dogan (2012) for a rich survey of the determinants of unemployment for advanced as well as developing and emerging countries.

and Winkelried (2005) were the first one to use this methodology in the monetary-economics literature.

Before embarking on estimation, we need to check the compatibility of our dataset to satisfy the two necessary assumptions for such an analysis:[19]

(*i*) The first assumption is the conditional independence assumption (CIA), which is sometimes referred to as the *un-confoundedness* assumption and *selection-on-observables*. Under the CIA, the potential outcome is independent of whether a country adopted ITR or not, provided that we control for all the relevant variables in our covariate matrix for both the treated and the control groups. Mathematically, the CIA assumption is written as,

$$(Y^1, Y^0) \perp T \mid X$$

(*ii*) The second assumption is the common support assumption. In order for us to match two units, the covariate matrix must contain observations that can be matched with a strictly positive probability in both the treated and control groups. Mathematically:

$$0 < \text{prob.}\,(T=1 \mid X) < 1.$$

As for the estimator, there is a variety of estimators proposed by the literature on treatment-effects methodology. We employ the nearest-neighbour matching (NNM) estimator along with the regression adjustment techniques. These estimators match the performance of the outcome variable among the two groups, the treated and the control group, via assigning propensity score to each covariate observation in the treatment group, and matching it with another observation having a similar or near-similar propensity score from the control group. The NNM estimator measures the distance between two near-identical observations (there are several options to choose

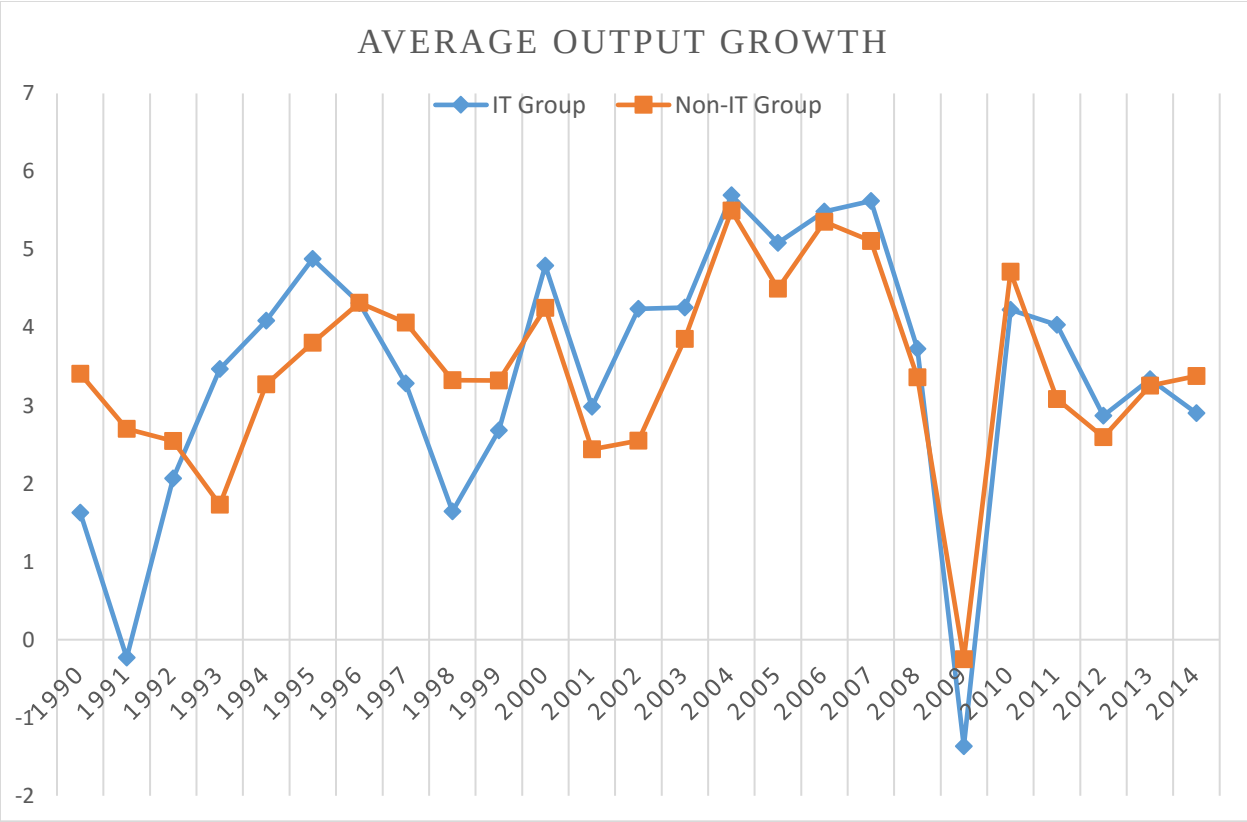
[19] Rosenbaum and Rubin (1983) call treatment assignment 'strongly ignorable' if these assumptions are satisfied.

from for this distance). For the identification strategy, four criteria have been applied. First, matching is based on a single match or multiple matches; second, matching based on different measure of the radius, a narrow and a wide radius; third, a bias correction adjustment restriction is imposed to adjust for any bias in the NNM estimator due to a large sample; fourth, a linear regression adjustment is applied, for the verification of the correct sign on the outcome coefficient.

3.7 Results

3.7.1 Output Growth: Figure 3.1 below displays the average growth rate of the two groups over the sample period. It appears that the average growth in both groups has a similar trend. But one cannot tell which group outperforms the other by simply looking at this figure alone.

Figure 3.1 Average Output Growth over the Sample Period (1990-2014)



To get a deeper insight into the output growth performance, we look at the regression results presented in Table 3.3. The first row displays the coefficients of the different estimators for the output growth when we use the raw sample, inclusive of the outlier observations. The negative sign on the coefficient means that the treated (IT) group has less output growth than the control

Table 3.3 Average Treatment Effects on the Treated (ATET) for the Output Growth

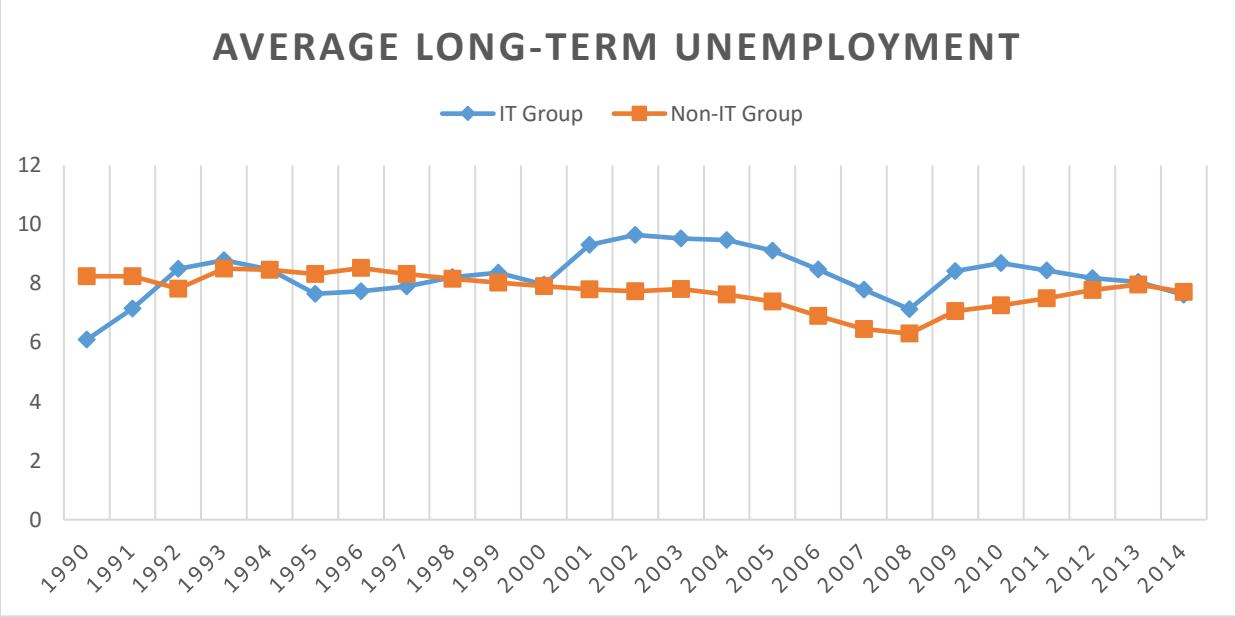
	NNM Matching Estimation				Regression Adjustment	
Model ↓ Estimator →	Single Match	Multiple Matches	Narrow Radius	Wide Radius	Large Sample Bias Adjustment	Regression Adjustment
Inclusive Sample						
Observations = 1666	-.00600* (.00341)	-.00604** (.00287)	-.00600* (.00341)	-.00597* (.00341)	-.00673** (.00339)	-.00353 (.00343)
Dropping the Outliers						
No CPI > 100 % Observations = 1636	-.00675* (.00364)	-.00622* (.00322)	-.00675* (.00364)	-.00678* (.00364)	-.00500* (.00290)	-.00744*** (.00286)
No CPI > 50 % Observations = 1603	-.00629* (.00376)	-.00592* (.00332)	-.00622* (.00375)	-.00629* (.00376)	-.00479 (.00308)	-.00775*** (.00282)
No CPI > 25 % Observations = 1544	-.00702* (.00377)	-.00628* (.00349)	-.00702* (.00377)	-.00707* (.00377)	-.00556* (.00317)	-.00691*** (.00289)
The coefficients are for the output growth (Outcome Dependent Variable). Independent variables are CPI Inflation, Log of GDP, Investment, Government Size, Trade and International Country Risk Guide (an index for political stability). The Treatment Variable is Inflation Targeting (ITR) Dummy.						
Asterisks next to the coefficients (*, **, ***) represent significance levels of 10%, 5%, and 1% respectively. Figures listed in parenthesis are Robust Standard Errors. The sample covers 25 years (1990-2014) with 1700 of observations.						

group (non-IT adopters): a significant difference of more than ½ (0.6) percentage point, implying that the non-IT countries outperform the inflation-targeting countries by more than ½ percentage point over the sample period. Economically this difference may seem negligible, but when compounded over several years, this ½ percentage point difference can translate into a vast income

disparity, as highlighted in the growth literature. The remaining three rows display the coefficients for the output growth when we delete the outlier observations. The sign and the significance of the coefficients remain the same, except that the linear regression adjustment estimator is now significant both statistically and economically.

3.7.2 Unemployment: We repeat the same exercise for the long-term rate of unemployment, as we did for output growth. We first look at the sample average rate of unemployment for the two groups as depicted in Figure 3.2 below.

Figure 3.2 Average Long-Term Unemployment over the Sample Period (1990-2014)



Prior to 1998, it looks like the IT-group has a lower rate of unemployment compared to the non-IT group. Whereas after 1998, the opposite seems to be true. Nevertheless, by just looking at the Figure 3.2 alone, one cannot judge how inflation targeting has affected long-term unemployment among the adopters compared to the non-adopters. Once again, to find out, we turn to our regression results presented in Table 3.4.

Table 3.4 Average Treatment Effects on the Treated (ATET) for the LT Unemployment

	NN Matching Estimation				Regression Adjustment	
Model ↓ Estimator →	Single Match	Multiple Matches	Narrow Radius	Wide Radius	Large Sample Bias Adjustment	Regression Adjustment
Inclusive Sample	.01255***	.01132***	.01255***	.01250***	.02036***	.02267***
Observations = 1663	(.00434)	(.00401)	(.00434)	(.00435)	(.00428)	(.00347)
Dropping the Outliers						
No CPI > 100 %	.01862***	.01848***	.01862***	.01861***	.02128***	.02705***
Observations = 1633	(.00700)	(.00620)	(.00700)	(.00699)	(.00697)	(.00346)
No CPI > 50 %	.01742***	.01528***	.01742***	.01742***	.01827***	.02773***
Observations = 1600	(.00569)	(.00532)	(.00569)	(.00569)	(.00563)	(.00346)
No CPI > 25 %	.02008***	.01569***	.02008***	.01985***	.01957***	.02853***
Observations = 1543	(.00518)	(.00483)	(.00518)	(.00516)	(.00511)	(.00346)

The coefficients are for the Long-Term Unemployment (the Outcome Dependent Variable). The independent variables are CPI Inflation, Log of GDP, Investment, Output Growth, and Trade. The Treatment Variable is Inflation Targeting (ITR) Dummy.

Asterisks next to the coefficients (*, **, ***) represent significance levels of 10%, 5%, and 1% respectively. Figures listed in parenthesis are Robust Standard Errors. The sample covers 25 years from 1990 to 2014 with 1700 observations.

The results for the long-term unemployment rate paint a bleak picture for IT-adopters. Once more, the first row displays the coefficients for the unemployment estimators obtained from the regressions of the raw dataset, which includes the outlier observations for the CPI inflation. The coefficients for the four NNM estimators are significant at the 99% confidence level, and imply that the long-term unemployment among the IT-adopting countries has worsened over the sample period, resulting in a rise of about 1.5 percentage point compared to the non-IT-adopting countries. The coefficients' magnitude rises to over 2 percentage point once we adjust for the large sample bias and the linear regression. More importantly, when we delete the outlier observations from our sample, the magnitude of the coefficients improves throughout all the specifications. These results seem to convey that inflation targeting may have had a negative impact on the labor market of the adopting countries compared to the non-adopting countries over the sample period.

3.7.3 Robustness Checks: We have already done some preliminary checks when we omitted outlier observations from our sample. Now we employ some additional checks. First, we use an alternative measurement of inflation, the GDP deflator; second, we check our dataset for the presence of any effect coming from unobserved factors due to the heterogeneous nature of the sample: finally, we cluster our sample into two sub-samples: high-income and middle-income countries, and rerun the same regressions to verify the coefficients' signs in Tables 3.3 and 3.4.

(*i*) The Effects of Unobserved Factors: The coefficients for the Rosenbaum Bounds tests presented in Appendix 'C' are all significant, implying that our results are robust to the effects of unobserved factors due to heterogeneity of the sample.

(*ii*) GDP Deflator: There is hardly any central bank that does not use the consumer price index (CPI) to measure the price level. But since the literature also provides support for the use of the GDP deflator as an alternative measure of inflation, particularly in the case of data unavailability on CPI, we re-run our regressions by replacing CPI inflation with the GDP deflator.[20] This replacement has some effect on the magnitude and the significance level of our coefficients, but more importantly, we do not observe any ambiguity in the sign of any coefficient. The result tables are presented in Appendix 'C'.

(*iii*) Clusters: Table 3.1 shows that the countries in our sample are both high and middle-income countries, and this income heterogeneity may have some impact on the coefficients of the results. We, therefore, cluster our sample in two subsamples, thus dividing the countries based on their income levels, high-income countries (HICs) and middle-income countries (MICs). The results for

[20] Barro (1995) uses the GDP deflator in his sample when there are no data on CPI.

these two clusters, or subsamples, are presented in Appendix 'C'. A closer look at these results reveal an interesting story:

For output growth, we observe that the coefficients in Table 3.9 are insignificant both statistically and economically, though the sign of the coefficients remains negative across all the estimators. This implies that the inflation-targeting adoption does not seem to have a noticeably adverse effect on output growth among the IT-adopting HICs. However, the coefficients in Table 3.11 are mainly significant both statistically and economically, implying that the IT-adopting MICs have suffered a significant reduction of more than 1 percentage point in the output growth rate as compared to the non-IT adopting MICs.

For long-term unemployment, the results are interestingly different for the two clusters: Table 3.10 shows that the coefficients for the LT unemployment are significant statistically and economically: the IT-adoption by HICs has increased the rate of LT unemployment by 1.6 to 2 percentage points compared to the non-IT adopting HICs. But the coefficients in Table 3.12 are insignificant both statistically and economically, though the sign remains positive. This implies that the long-term unemployment rate does not seem to have been affected by the IT-adoption among MICs.

3.8 Concluding Remarks

The proponents of inflation targeting generally claim that, as a catalyst to price stability, inflation targeting promotes economic efficiency and growth, as in Bernanke et al. (1999, p.325): '*Price stability promotes high rates of economic growth and employment in the long run*.' But when it comes to judging the performance of inflation-targeting regime, we observe that the entire empirical work on IT is devoted to either studying the dynamics of inflation and its volatility, or to measuring the so-called sacrifice ratios.

There is a wide gap in the assessment of the core claim that inflation targeting promotes efficiency and growth. Our study fills this gap by comparing the IT-adopting countries to the non-adopters in terms of their performance as measured by output growth and the rate of long-term unemployment. Using a cross-country panel data over a 25-year horizon, we find that the IT-adopting countries perform poorly compared to the non-IT countries: There is a significant reduction in output growth among the IT-adopting countries by over ½ percentage point compared to the non-adopters. There is also a significant higher rate in long-term unemployment among the IT-adopting countries compared to the non-IT countries, to the tune of 2 percentage points.

These results seem to refute the claim of IT proponents that inflation targeting promotes economic efficiency and growth. For this claim to be valid, we should witness the opposite in our findings: the IT-adopters should be outperforming their counterparts in growth and employment, not the other way around!

However, we need to exercise some caution when interpreting these results, as they are obtained from cross-country regressions. More importantly, a negative coefficient on growth does not necessarily translate into negative growth *per se*; instead it tells us that one group has lesser growth than the other, even though both groups may have been enjoying positive rates of growth. The same logic applies to the coefficients of unemployment. Still, our findings do have some serious policy implications for the central banks that may be contemplating the adoption of inflation targeting: a more in-depth analysis, such as a case-study approach specific to the concerned country, should be carried out.

We conclude, in line with what Sims (2005) has suggested, that inflation targeting should not be '*oversold'* as a panacea to the chronic macroeconomic ills.

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Appendix C

Table 3.6 Sensitivity Test Results for the Unobserved Factors in the Entire Sample

Rosenbaum Bounds for Output Growth & Unemployment for the Various Matches

Sample Bounds → ↓	gamma*	Upper Bound Significance Level (sig+)	Lower Bound Significance Level (sig-)	Upper Bound Point Estimate (t-hat+)*	Lower Bound Point Estimate (t-hat-)*	Upper Bound Confidence Interval (CI+)	Lower Bound Confidence Interval (CI-)
The Inclusive Sample							
Output Growth	1	0	0	.0355	.0355	.0339	.0370
(1687 Matched Pairs)	3	0	0	.0199	.0505	.0180	.0522
Unemployment	1	0	0	.0721	.0721	.0702	.0742
(1693 Matched Pairs)	3	0	0	.0550	.0967	.0533	.0994
Dropping CPI >100%							
Output Growth	1	0	0	.0363	.0363	.0348	.0378
(1645 Matched Pairs)	3	0	0	.0215	.051	.0196	.0528
Unemployment	1	0	0	.0717	.0717	.0697	.0737
(1645 Matched Pairs)	3	0	0	.0547	.0955	.053	.0994
Dropping CPI > 50%	1	0	0	.0365	.0365	.0350	.0380
Output Growth	3	0	0	.0219	.0510	.0200	.0529
(1612 Matched Pairs)							
Unemployment	1	0	0	.0715	.0715	.0695	.0735
(1612 Matched Pairs)	3	0	0	.0545	.0953	.0527	.0990
Dropping CPI > 25%							
Output Growth	1	0	0	.0367	.0367	.0352	.0383
(1552 Matched Pairs)	3	0	0	.0223	.0515	.0205	.0533
Unemployment							
(1552 Matched Pairs)	1	0	0	.0710	.0710	.0689	.0730
	3	0	0	.0540	.0948	.0520	.0985

*gamma - log odds of differential assignment due to unobserved factors

sig+ - upper bound significance level
sig- - lower bound significance level
t-hat+ - upper bound Hodges-Lehmann point estimate
t-hat- - lower bound Hodges-Lehmann point estimate
CI+ - upper bound confidence interval (a= .95)
CI- - lower bound confidence interval (a= .95)

Robustness Checks (Replacing CPI Inflation by GDP Deflator)

Table 3.7 ATET (with GDP Deflator) for the Output Growth

	NNM Matching Estimation				Regression Adjustment	
Model ↓ / Estimator →	Single Match	Multiple Matches	Narrow Radius	Wide Radius	Large Sample Bias Adjustment	Regression Adjustment
Inclusive Sample						
Observations = 1666	-.00457	-.00513*	-.00496*	-.00497*	-.00292	-.03198*
	(.00361)	(.00318)	(.00292)	(.00291)	(.00359)	(.01894)
No CPI > 50 %	-.00431	-.00418	-.00497*	-.00487*	-.00173	-.00540**
Observations = 1603	(.00393)	(.00348)	(.00299)	(.00300)	(.00391)	(.00282)
No CPI > 25 %	-.00397	-.00453	-.00586**	-.00596**	-.00254	-.00622**
Observations = 1544	(.00437)	(.00369)	(.00287)	(.00288)	(.00434)	(.00278)
The coefficients are for the output growth (Outcome Dependent Variable). Independent variables are GDP Deflator, Log of GDP, Investment, Government Size, Trade and International Country Risk Guide (an index for political stability). The Treatment Variable is Inflation Targeting (ITR) Dummy.						
Asterisks next to the coefficients (*, **, ***) represent significance levels of 10%, 5%, and 1% respectively. Figures listed in parenthesis are Robust Standard Errors. The sample covers 25 years (1990-2014) with 1700 of observations.						

Table 3.8 ATET with GDP Deflator for the Long-Term Unemployment

	NN Matching Estimation				Regression Adjustment	
Model ↓ / Estimator →	Single Match	Multiple Matches	Narrow Radius	Wide Radius	Large Sample Bias Adjustment	Regression Adjustment
Inclusive Sample						
	.0137***	.01281***	.00930**	.01061**	.00175***	. 00205
Observations = 1663	(.00441)	(.00408)	(.00436)	(.00430)	(.00428)	(.00400)
No CPI > 50 %	.01044**	.01196***	.01054**	.01078**	.01466***	.00427
Observations = 1600	(.00450)	(.00436)	(.00450)	(.00489)	(.00434)	(.00441)
No CPI > 25 %	.0118***	.01354***	.01162**	.01167***	.01500***	.00362
Observations = 1543	(.00484)	(.00445)	(.00484)	(.00480)	(.00443)	(.00455)
The coefficients are for the Long-Term Unemployment (the Outcome Dependent Variable). The independent variables are GDP Deflator, Log of GDP, Investment, Output Growth, Trade and ICRG. The Treatment Variable is Inflation Targeting (ITR) Dummy.						
Asterisks next to the coefficients (*, **, ***) represent significance levels of 10%, 5%, and 1% respectively. Figures listed in parenthesis are Robust Standard Errors. The sample covers 25 years from 1990 to 2014 with 1700 observations.						

Table 3.9 ATET for the Output Growth among the HICs Cluster

	NNM Matching Estimation				Regression Adjustment	
Estimator → / Model ↓	Single Match	Multiple Matches	Narrow Radius	Wide Radius	Large Sample Bias Adjustment	Regression Adjustment
Inclusive Sample						
Observations = 1666	-. 00589	-.00431	-.00592	-.00544	-.01050*	-.01618***
	(.00559)	(.00464)	(.00559)	(.00546)	(.00575)	(.00449)
No CPI > 50 %	-.00051	-.00001	-.00051	-.00001	-.01006**	-.01252***
Observations = 1603	(.00413)	(.00407)	(.00413)	(.00407)	(.00512)	(.00282)
No CPI > 25 %	-.00149	-.00170	-.00149	-.00170	-.01251***	-.00997**
Observations = 1544	(.00401)	(.00402)	(.00401)	(.00402)	(.00289)	(.00419)
The coefficients are for the output growth (Outcome Dependent Variable). Independent variables are CPI Inflation, Log of GDP, Investment, Government Size, Trade and International Country Risk Guide (an index for political stability). The Treatment Variable is Inflation Targeting (ITR) Dummy.						
Asterisks next to the coefficients (*, **, ***) represent significance levels of 10%, 5%, and 1% respectively. Figures listed in parenthesis are Robust Standard Errors. The sample covers 25 years (1990-2014) with 1700 of observations.						

Table 3.10 ATET for the LT Unemployment among the HICs Cluster

	NN Matching Estimation				Regression Adjustment	
Estimator → / Model ↓	Single Match	Multiple Matches	Narrow Radius	Wide Radius	Large Sample Bias Adjustment	Regression Adjustment
Inclusive Sample						
Observations = 1663	.02111***	.0198***	.0167***	.01681***	.03467***	.01594***
	(.00513)	(.00454)	(.00544)	(.00550)	(.00528)	(.00339)
No CPI > 50 %	.02000***	.0192***	.	.02020***	.03410***	.01598***
Observations = 1600	(.00573)	(.00494)	02016***	(.00570)	(.00561)	(.00332)
			(.00568)			
No CPI > 25 %	.01954***	.0199***	.0197***	.01999***	.03400***	.01711***
Observations = 1543	(.00638)	(.00545)	(.00639)	(.00632)	(.00629)	(.00336)
The coefficients are for the Long-Term Unemployment (the Outcome Dependent Variable). The independent variables are CPI Inflation, Log of GDP, Investment, Output Growth, and Trade. The Treatment Variable is Inflation Targeting (ITR) Dummy.						
Asterisks next to the coefficients (*, **, ***) represent significance levels of 10%, 5%, and 1% respectively. Figures listed in parenthesis are Robust Standard Errors. The sample covers 25 years from 1990 to 2014 with 1700 observations.						

Table 3.11 ATET for the Output Growth among the MICs Cluster

	NNM Matching Estimation					Regression Adjustment
Estimator → Model ↓	Single Match	Multiple Matches	Narrow Radius	Wide Radius	Large Sample Bias Adjustment	Regression Adjustment
Inclusive Sample						
Observations = 1666	-.00424	-.00448	-.00424	-.00411	-.00818	-.06488
	(.00606)	(.00457)	(.00606)	(.00605)	(.00605)	(.04263)
No CPI > 50 %	-.01184*	-.01133**	-.01185*	-.01205*	-.00360	-.06280***
Observations = 1603	(.00631)	(.00521)	(.00632)	(.00376)	(.00613)	(.02325)
No CPI > 25 %	-.01060*	-.01089**	-.01064*	-.01092*	-.00049	-.06538***
Observations = 1544	(.00636)	(.00528)	(.00636)	(.00623)	(.00617)	(.02318)
The coefficients are for the output growth (Outcome Dependent Variable). Independent variables are CPI Inflation, Log of GDP, Investment, Government Size, Trade and International Country Risk Guide (an index for political stability). The Treatment Variable is Inflation Targeting (ITR) Dummy.						
Asterisks next to the coefficients (*, **, ***) represent significance levels of 10%, 5%, and 1% respectively. Figures listed in parenthesis are Robust Standard Errors. The sample covers 25 years (1990-2014) with 1700 of observations.						

Table 3.12 ATET for the LT Unemployment among the MICs Cluster

	NN Matching Estimation					Regression Adjustment
Estimator → Model ↓	Single Match	Multiple Matches	Narrow Radius	Wide Radius	Large Sample Bias Adjustment	Regression Adjustment
Inclusive Sample						
Observations = 1663	.00421	.00887*	.00402	.00462	.02326***	.00865
	(.00579)	(.00494)	(.00581)	(.00577)	(.00573)	(.00615)
No CPI > 50 %	.00621	.00838	.00621	.00585	.00400	. 01039
Observations = 1600	(.00836)	(.00609)	(.00836)	(.00826)	(.00819)	(.00688)
No CPI > 25 %	.00291	.00815	.00291	.00349	.00256	.00953
Observations = 1543	(.00985)	(.00639)	(.00985)	(.00971)	(.00968)	(.00711)
The coefficients are for the Long-Term Unemployment (the Outcome Dependent Variable). The independent variables are CPI Inflation, Log of GDP, Investment, Output Growth, and Trade. The Treatment Variable is Inflation Targeting (ITR) Dummy.						
Asterisks next to the coefficients (*, **, ***) represent significance levels of 10%, 5%, and 1% respectively. Figures listed in parenthesis are Robust Standard Errors. The sample covers 25 years from 1990 to 2014 with 1700 observations.						

Figure 3.3 The Common Support for the Output Growth

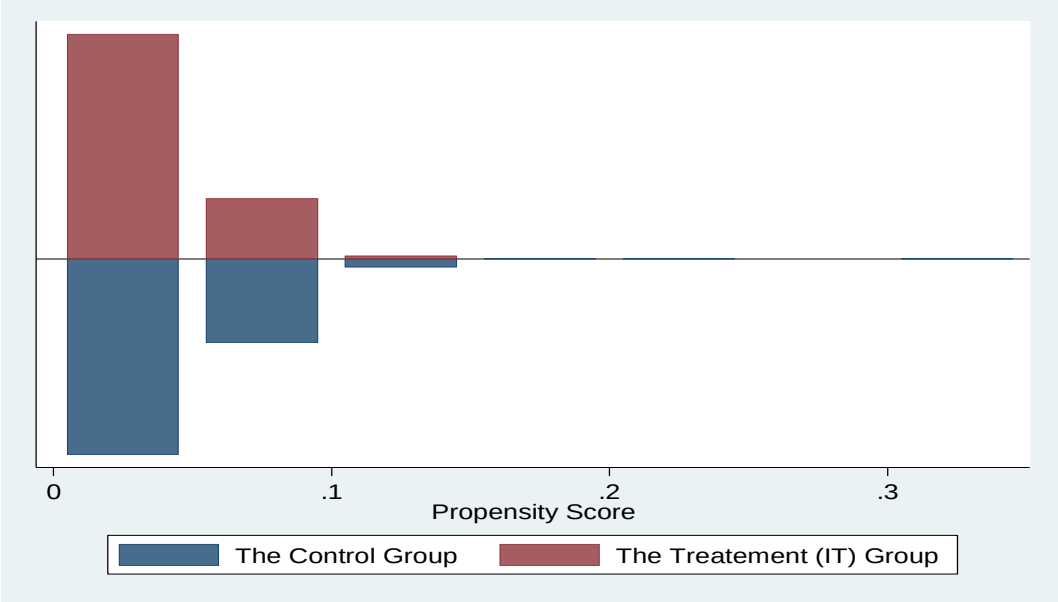

Figure 3.4 Common Support for the Long-Term Unemployment