

**IS INFLATION TARGETING RELEVANT?**

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## INTRODUCTION

Is inflation targeting relevant? The reader should keep this question in the back of his/her mind throughout this paper, since it is hoped that the latter will provide useful insights. Since it was first introduced in 1990, inflation targeting (IT) has been a hot button issue among economists. Many believe that they have finally found the right approach to address the price instability problem which had followed them for years. Proponents of IT have argued that it reduces inflation variability, and locks in expectations of low inflation, which reduces the inflationary impact of macroeconomic shocks. Whether this is the case or not is yet to be seen, and this is precisely the point of our study. An adequate amount of time has elapsed since the introduction of inflation targeting; our study should produce the most accurate results on the subject to date. The debate among the proponents and opponents of inflation targeting has existed for as long as inflation targeting itself. This paper is only another piece of the debate.

This study attempts to assess the effects of inflation targeting on inflation performance. We examine six countries, three countries who adopted inflation targeting (Canada, Australia, and Norway), and three non inflation targeting countries (Germany, Japan, and the U.S.A.), with a more in depth look at the Canadian case. Obviously economic performance varies greatly across each individual country; however all have experienced a stable decline in inflation over the past 20 years. Prima facie evidence is therefore weak to suggest that inflation targeting improves performance as measured by the behaviour of inflation.

Looking only at the data from inflation targeting countries, it is easy to see why proponents argue the way they do. If we look at their inflation performance before, and after the adoption of inflation targeting, we see that their performance on average improved between these time periods; inflation fell and became more stable. However the non inflation targeting countries experienced a similar result within the same time period, hence our skepticism. These findings imply that better performance likely resulted from an external influence other than targeting. Our analysis in the latter half of this paper will corroborate these findings.

The rest of this paper will comprise of 8 sections. Section 2 describes the methodology that central banks use to carry out the inflation targeting policy, and section 3 is a review of the existing literature on the subject. The literature review presents the argument in favor of inflation targeting; but it also presents a lot of evidence to discredit the effectiveness of IT. This study will add to that evidence, and strengthen the case against the need for inflation targeting. Sections 4 and 5 describe the model and sample used in our empirical analysis. Our analysis is based on the significance of a dummy variable in our model representing the effect of inflation targeting on the core consumer price index. Section 6 expands on the interpretation of the dummy variables, taking into account the importance of anchoring expectations on the success of targeting. Finally we present our results in section 7, which will be almost an extension of the literature review, and in section 8 we present some concluding remarks regarding our analysis, and our results.

## METHODOLOGY

Price stability and inflation control have long been a priority for the Bank of Canada, particularly since the inflation problems of the mid 1970's. In 1975 the Bank of Canada introduced a program in which M1 growth would be targeted, with gradually falling targets, in order to solve the inflation problem (Lavoie and Seccareccia 2006, p. 45). Monetary Policy can produce effects in the economy only in the short run, thus by targeting M1, inflation is affected indirectly from expansions or recessions, due to monetary policy.

The loss of public confidence in policy regimes that target monetary aggregates has forced the central bank to look for a more credible nominal anchor (Research Department, Central Bank of Brazil 2000, p. 1).

If we now fast forward to 1991 when the Bank of Canada explicitly adopted inflation targeting as their monetary policy regime, price stability came to the forefront of policy objectives. Inflation targets in Canada, set at 1-3%, are jointly determined and announced by both the Government of Canada and the central bank. The Bank of Canada, however, is the sole entity responsible for meeting the inflation targets (Bernanke et al. 1999, p. 115). Inflation targeting refers to a system in which monetary policy decisions are made, implemented and communicated according to a clearly stated inflation target (Bergevin 2007, p. 1). The following section provides a detailed analysis of the Bank of Canada's operations in targeting inflation. An understanding of the policy is necessary for the understanding of the faults, and analysis of the said policy.

Inflation targeting is a monetary policy regime in which a central bank attempts to keep inflation in a declared target range, mainly by adjusting interest rates. Three key components exist in carrying out inflation targeting; the first is the policy instrument, the target band for the overnight interest rate, the second is the relationship between interest rates and aggregate demand, and the third component in inflation targeting is the relationship between aggregate demand, inflation expectations and inflation. The overnight rate is the interest rate at which major financial institutions borrow and lend one-day, or “overnight”, funds among themselves (Bank of Canada (BoC) 2008). The central bank carries out monetary policy by influencing short-term interest rates, by manipulating the overnight target band.

Changes in the target for the overnight rate influence other interest rates, such as those for consumer loans and mortgages (Monetary Policy Division 2008, BoC).

Interest rates and aggregate demand are inversely related, that is, an increase in the interest rates (influenced by the Bank of Canada policy) decreases overall demand for loans, and consumption of durable goods. Empirical evidence for Canada suggests that short-term interest rates are of greatest significance for aggregate demand (Longworth 2000, p. 39). A significant component of the Bank of Canada’s view of this monetary policy regime is the effect of excess demand on the rate of inflation. Therefore, changes in interest rates work through their effect on the output gap, or capacity utilization, to influence the inflation rate over time (Longworth 2000, p. 39). If, for example, inflation was too high, the central bank would take action to increase the interest rate, by increasing the overnight target band. As interest rates increase, consumer, and aggregate

demand decreases and, as basic supply and demand analysis dictates, as demand decreases, inflation slows down, or falls. Basic economic theory is therefore on the side of the Bank of Canada. This process by which the central bank conducts its monetary policy is also known as the Taylor rule, from (Taylor 1993), where:

$$\dot{i}_t = \Pi_t + \mathbf{r}^*_t + \alpha_x(\Pi_t - \Pi^*_t) + \alpha_y(y_t - \tilde{y}_t)$$

According to the rule both  $\alpha_x$  and  $\alpha_y$  should be positive ( $\alpha_x = \alpha_y = 0.5$ ). In the above equation,  $\dot{i}_t$  is the target short-term nominal interest rate (overnight rate),  $\Pi_t$  is the rate of inflation as measured by the GDP deflator,  $\Pi^*_t$  is the desired, or target, rate of inflation,  $\mathbf{r}^*_t$  is the assumed equilibrium, or natural, real interest rate,  $y_t$  is the logarithm of real GDP, and  $\tilde{y}_t$  is the logarithm of potential output (Taylor 1993). Therefore looking at Taylor's equation, any deviation in output or inflation is compensated by an adjustment to the overnight rate, which restores stability. The central bank forecasts the future path of inflation, and the forecast is then compared to the target rate. The difference between the two determines the adjustment needed to be taken by the Bank of Canada. The Bank of Canada uses forecasts to perform monetary policy because of the assumption that prices are sticky. By forecasting inflation, the central bank is able to act now to potential future deviations from the target rate, and prices will have enough time to adjust to the Bank of Canada's actions. To a rational individual, this monetary policy practice would seem very plausible, and clear-cut. The empirical investigation of this practice will be discussed in the latter half of the paper, where the validity of this process will be greatly challenged.

As mentioned earlier, accountability, and transparency of the central bank is key to the success of the monetary policy.

Accountability is a central feature of the inflation-targeting regime in Canada, but the central bank is more accountable to the public at large than the government. Indeed, a central and increasingly important feature of Canada's framework is a strong commitment to transparency and to the communication of monetary-policy strategy to the public (Bernanke et al. 1999, p. 116).

The central bank's inability and the lack of public confidence in the 1970's policy of targeting M1 monetary aggregates forced the central bank to abandon such policies. Confidence in any monetary policy from the public makes for a smoother implementation, and therefore the chances of success are greatly heightened.

A lot of economic problems are associated with inflation; inflation can significantly increase the risk in making investments. An announcement of monetary policy intentions well in advance allows the public to lock in their expectations of inflation for the next period when making investment decisions. Knowing that the central bank is accountable for meeting the target, the public can feel confident that inflation will not deviate from this point, and decisions can be made accordingly. How does this regime of monetary policy work in reality? This paper contests the views of the Bank of Canada, that inflation targeting does indeed have a positive influence on anchoring expectations, and consequently on the rate of inflation. In order to understand the arguments put forth in this paper, it is important to have a basic understanding of the practice which is being rejected. With an overview of the methodology used by the central bank out of the way,

we may now move on to a review of some of the existing literature on the subject of inflation targeting, before discussing the empirical results of this paper.

## **LITERATURE REVIEW**

A lot has been written about inflation targeting over the past decade, the increasing popularity of the subject stems from the increasing rate at which countries have adopted IT as their monetary policy over the last decade. The question of whether inflation targeting is effective has been debated since its inception in 1990 by New Zealand, where opinions regarding the answer are split among economists. The differences stem from the small number of countries who have adopted inflation targeting, and the short history of the framework. It will take a few years before a concrete analysis can be completed to generate the true effects of IT. The proponents of inflation targeting, like Neumann and von Hagen (2002), base their belief simply on the data of the inflation targeting countries, which suggests that the policy has been a success, at least on their own. Inflation has been within or below the target range for all targeting countries, and markedly below the average inflation levels of the 70s and 80s (Bernanke et al. 1999, p. 253).

The performance of inflation-targeting regimes has been quite good. Inflation-targeting countries seem to have significantly reduced both the rate of inflation expectations beyond that which would likely have occurred in the absence of inflation targets (Mishkin 1999, p. 595).

Economists, like Frederic Mishkin, look solely at the data when judging the success of a targeting country, neglecting the environment in which the data was taken. While the

reduction of inflation in these countries represents a genuine achievement, it is not clear whether it was the result of forces that were already established before inflation targeting was introduced, or was it the work of the new monetary policy which contributed to the success (Bernanke et al. 1999, p. 253).

As mentioned earlier, macroeconomic policy priorities have evolved from low unemployment, and GDP growth, to low inflation and price stability, as such, monetary policy has progressed accordingly to an inflation targeting regime. The cost of inflation requires the central bank to take action to minimize the adverse effects on the economy. These costs include uncertain investment outcomes and reducing the purchasing power of those who hold cash, and those with fixed incomes (Bergevin 2007, p. 2). The supporters of inflation targeting argue that these problems are substantially reduced with the adoption of targeting as a monetary policy. The rationale for inflation targeting seems to be that the economic situation would be considerably worse without the anchor provided by low inflation and inflation targeting. It is believed that targets will continue to filter the effects of international shocks which are bound to occur from time to time. According to the former governor of the Bank of Canada, Gordon G. Thiessen (1998), explicit inflation targets bring a discipline to monetary policy which is helpful in providing a more stable and predictable environment for the economic decisions of businesses and individuals.

One of the key benefits of targeting was expected to be increased transparency with respect to the objective of monetary policy, leading to a reduction of public and financial market uncertainty (Thiessen 1998, p. 420).

Empirical evidence for which IT advocates base their opinions, regarding economic performance, generally provides some support for the view that inflation targeting does improve the overall economic environment. The main conclusions of this evidence are well summarized in Mishkin (2006):

- Inflation and interest rate levels have declined since the adoption of IT;
- Output volatility has not increased since IT;
- Exchange rate pass-through seems to be attenuated following the adoption of IT;
- Inflation persistence is lower in IT countries.

These facts in themselves have led to the widespread belief that inflation targeting is indeed an advantageous monetary policy. Bernanke et al. (1999) have studied cases from several IT countries and have found that inflation targets significantly reduce inflation; furthermore, once inflation is down, it stays down. Considering the large opposition to IT, no central bank has abandoned it once introducing it as their monetary policy, thus implying that the objectives of the central banks have been fulfilled with inflation targeting. Looking only at the data, it is easy to say that inflation targeting is successful, however going beyond the most direct data, it becomes a much harder statement to make. In the next section this paper reviews literature in which the economic situation immediately prior to inflation targeting, and the performance of nontargeters are considered in addition to the data. With a more in depth analysis of inflation targeting, a more accurate depiction of the true effects of inflation targeting can be made starting with Ball and Sheridan's 2003 influential paper on the subject.

Laurence Ball, and Niamh Sheridan's 2003, *Does Inflation Targeting Matter?*, attempts to measure the effects of inflation targeting on macroeconomic performance. One of the first of its kind, this paper details how the performance of targeters compares with that of non-targeters, and whether there is a visible difference between the two over the same time period. Compared to non-targeters, Ball, and Sheridan, found that the better inflation performance is due to something other than inflation targeting.

If we examine inflation-targeting countries alone, we see that their performance improved on average between the period before targeting and the targeting period... However, countries that did not adopt inflation targeting also experienced improvements around the same time as targeters (Ball, and Sheridan 2003, p. 2).

The improvement in the performance of non-targeting countries, around the same time period as when targeting was established, suggests that something else is at play.

Inflation targeting is perhaps not as successful as the central banks would like one to believe it is.

The paper, from Ball and Sheridan (2003), examines major developed, moderate inflation economies. Starting with all OECD members as of 1990, they delete countries that did not have an independent currency before the Euro, or have experienced an annual inflation rate of over 20 percent since 1984 (such as Greece). Remaining in the sample is twenty countries, seven of which adopted inflation targeting before 1999: Australia, Canada, Finland, Spain, Sweden, the UK, and New Zealand. For each country, Ball and Sheridan, define the beginning of targeting as the first full quarter in which a specific target was in effect. The targeting period for each country is compared to two pre-

targeting periods, the first one beginning in 1960, and the second, shorter one, at 1985.

The analysis consists of comparing the seven targeting countries to the remaining thirteen countries in the sample, all of which have been lumped together.

The purpose of this paper is equivalent to that of Ball and Sheridan's (2003), however the methodology used is fairly different. This paper should act as a good compliment to *Does Inflation Targeting Matter?*, as both strive to prove the irrelevance of inflation targeting, using two different techniques. Using a differences-in-differences approach to investigating the effects of inflation targeting, Ball and Sheridan (2003), show that inflation does not differ systematically across periods, or more importantly, across targeters and nontargeters.

To learn the true effects of targeting, we must compare improvements in targeting countries to improvements in nontargeting countries (Ball and Sheridan 2003, pp. 7-8).

For the sample of twenty countries, they run the regression:

$$X_{\text{post}} - X_{\text{pre}} = a_0 + a_1D + a_2X_{\text{pre}} + \varepsilon,$$

where  $X_{\text{post}}$  is a country's value of  $X$  (inflation) in the post-targeting period,  $X_{\text{pre}}$  is the value in the pre-targeting period, and  $D$  is a dummy equal to one if the country is a targeter and zero otherwise. The coefficient  $a_1$  measures the effect on inflation from inflation targeting. Including  $X_{\text{pre}}$ , as an explanatory variable, controls for regression

towards the mean. Average inflation in the pre-targeting period is higher for targeters, than the non-targeters; in fact a switch to targeting is more attractive to countries with comparably higher inflation rates. A problem arises due to regression to the mean; poorer performers tend to do better than good performance solely because of their initial position. If inflation targeters are poor initial performers, they will improve more than nontargeters even if targeting has no effect on performance (Ball, and Sheridan 2003, p. 8). Adding  $X_{pre}$  on the right hand side thus isolates the effect of targeting on inflation, through the dummy variable. The best explanation of the above formula can be made with an excerpt from Bernanke and Woodford 2005 (pp. 255-256):

The question of whether inflation targeting has been effective in a particular country amounts to asking whether the country obtained economic benefits that it would otherwise not have enjoyed.

The solution to this problem lies in the significance of  $\alpha_1$ . The differences-in-differences estimator measures the causal effect of a shock (inflation targeting) by comparing differences in outcomes before and after the change for groups affected by the change to the same differences for unaffected groups (Lundberg 2006, p. 1). An important identification strategy is to select an unaffected country that can be used to predict what would have happened to the affected group had the shock not occurred (Angrist and Krueger, p. 21). Ideally the unaffected group would be identical to the affected group, minus the shock. A high degree of comparability between the two groups will generate the most accurate estimate of the overall affect of the shock.

This approach, which is transparent and often at least superficially plausible, is well-suited to estimating the effect of sharp changes in the economic environment or changes in government policy (Angrist and Krueger, p. 21).

Therefore an insignificant value of  $\alpha_1$ , suggests that the improvements observed in the targeting countries is not due to targeting itself, but is what would have occurred even if targeting was not introduced, as represented by the thirteen unaffected countries. A significant value of  $\alpha_1$ , on the other hand, implies that there is a comparative difference between the targeting and non-targeting countries in the performance of the inflation rate from the pre-targeting period to the post-targeting period. Ball and Sheridan's analysis have found that  $\alpha_1$  is indeed insignificant; the following will detail the results of that analysis.

In the opening of their paper, Ball and Sheridan (2003) ask the question, does inflation targeting matter? They find little evidence in cross-country data to suggest that targeting has any effect on inflation at all. Looking at average inflation, as measured by the annualized percentage change in consumer prices from the IMF, they find that average inflation converged to lower inflation levels of non-targeters. The inflation targeting group had experienced a higher inflation rate than the non-inflation targeting group, before targeting was introduced. The analysis uses the above equation to regress the change in average inflation, among the twenty countries, on the dummy variable and on  $X_{pre}$ . The coefficient of interest, not surprisingly, is  $\alpha_1$ , which will determine the true effect, if any, of targeting. Controlling for the effect of regression to the mean, Ball and

Sheridan (2003) found the estimated effect of targeting equal to -0.55, with a probability value of 0.14. Therefore the data from 1960 to 2005 suggests the introduction of inflation targeting as a monetary policy is ineffective in reducing inflation, according to the sample of twenty countries examined in this study. The regression had an Rsquared value of 0.9 which corroborates the strong role of regression to the mean.

The reduction in inflation variability is another phenomenon often associated with inflation targeting, Ball and Sheridan (2003) addresses this situation, and again find no valid evidence to back up this theory. They find that the standard deviations of inflation and trend inflation fall for all groups of countries during the targeting period. At all times, the standard deviations are lower for nontargeters than for targeters, they find that inflation targeting actually raises the standard deviation of inflation; thus inflation targeting has no beneficial effects (Ball, and Sheridan 2003, pp. 13-14). An important challenge for IT supporters comes from the observation that the economic environment of the 90's when IT was developed, for most countries, was generally benign, implying that the specific strategy of inflation targeting may have done little to improve monetary policy outcomes over what any reasonable strategy could have achieved (Cecchetti and Ehrmann, 2000). Ball and Sheridan conclude that countries on average improved their performance in the 90's; however there is no evidence to suggest targeters performed better than nontargeters.

The main purpose of inflation targeting is to provide a credible nominal anchor to monetary policy. Therefore the success of IT should be measured by the central banks

ability to bring inflation down to the target level. According to Pétursson (2004), the disinflation process had already begun before IT was introduced. He finds that two thirds of the 2.5% fall in inflation in the industrial countries had already been achieved in the year preceding inflation targeting. Pétursson (2004) develops a formal statistical analysis to determine the true effect of inflation targeting, using the following panel model for the sample of N inflation targeting countries:

$$\pi_{it} = \alpha_{\pi i} + \beta_{\pi} IT_{it} + \gamma_{\pi} \pi_{it-1} + \mu_{\pi} \mathbf{y}_{it-1} + \lambda_{\pi 0} \pi^a_t + \lambda_{\pi 1} \pi^a_{t-1} + \varepsilon_{\pi it}, \quad i = 1, \dots, N; t = 1, \dots, T$$

where  $\pi_{it}$  is inflation in inflation targeting country  $i$  at time  $t$ , and  $\mathbf{y}_{it}$  is output growth, in inflation targeting country  $i$  at time  $t$ , which takes into account business cycle fluctuations effects on inflation. Looking now at  $\pi^a_t$ , this represents average inflation in six non-targeting industrial countries, which captures the effect of a global disinflation trend; finally  $IT_{it}$  is a dummy variable which equals 1 from the first quarter after inflation targeting was introduced and 0 otherwise (Pétursson 2004, p. 8). The model is estimated within a sample period of 1981:1-2002:4, using different country samples. Five samples in total were estimated, however the one of interest to this paper is the final sample that Pétursson estimated, which includes the 5 industrial countries that had adopted inflation targeting prior to 1999.

The effects of inflation targeting on inflation are not found to be significant in the final country sample of five industrial countries with the longest inflation targeting history (Pétursson 2004, p. 9).

The explanation for this result is uncertain. The probable answer is that most of the inflation reduction in this sample had already occurred prior to the introduction of inflation targeting. The results therefore suggest that inflation targeting is not significantly necessary in reducing inflation in the five industrial inflation targeting countries. These findings are similar to those found in the study of Ball and Sheridan (2003), as mentioned above, who are skeptical of IT, and argue that inflation targeting had no significant influence in bringing down inflation.

Up until recently, the United States had achieved comparatively good macroeconomic performance (including low and stable inflation) without using an explicit nominal anchor such as inflation targeting. The strategy of the US consisted of the careful monitoring of potential future inflation, coupled with “preemptive strikes” by monetary policy against the threat of inflation (Bernanke et al 1999, p. 307). Over the past two decades the Fed has adopted gradually, and implicitly, inflation targeting policy procedures which has allowed it to achieve economic success. Explicit targeting is what we have here in Canada where a formal announcement is made regarding the official target range for inflation, and unambiguous accountability is put on the Bank of Canada. To a large extent, the explicit adoption of inflation targeting in the U.S. would just continue the existing approach to monetary policy developed by Volcker and Greenspan (Goodfriend 2003, p. 2). For the past two decades, the US have been experiencing good performance, with respect to inflation rate control, with implicit inflation targeting, therefore a switch to explicit targeting is unnecessary considering the good performance.

This view is not shared by all. Proponents of explicit targeting argue, despite the lack of evidence supporting IT:

The failure to adopt IT jeopardizes the ability of a central bank to deliver price stability. For example, Bernanke et al., after presenting pages upon pages of rather inconclusive evidence regarding the superiority of IT, nevertheless submit a plea for the Fed to adopt IT in the end, arguing that this is critical to secure price stability in the United States (Neumann and von Hagen 2002, p. 127).

Inflation targeting has been adopted by many central banks in order to achieve such price stability, all of whom required to build and secure credibility for low inflation. By “just doing it”, the Fed has achieved price stability, and arrived at monetary policy procedures which resembles inflation targeting. The main argument for the “just doing it” strategy is simply its demonstrated success. Inflation fell significantly in the 80’s to settle around 3% by the end of 1991, since which time it has remained stable at around that rate (Bernanke et al 1999, p. 307). Also, the year marked the beginning of the long expansion in the United States. Without explicit inflation targeting, the U.S. has achieved results similar to those countries that have adopted targeting, suggesting that there is no real need for an official target, or announcement. The foremost difference between the USA’s implicit use of inflation targeting, and the inflation targeting used by Canada, and other IT countries, is the official announcement of the target range, the enhanced transparency of monetary policy, and the increased accountability of the central bank. Curbing inflation expectations is the key goal of explicit inflation targeting, and if it can not do that then we are back to the implicit inflation targeting used by the U.S., which has proven to be successful.

In evaluating inflation targeters, a highly relevant consideration is whether the expectations of market participants concerning inflation rates have fallen together with recent actual rates (Dueker and Fischer 2006, p. 433).

Using survey data, it has been found that expected inflation still lags actual inflation, by as much as 18 months. When controlling for the level of variability of past inflation, Johnson (2002) finds that neither the variability of expected inflation nor the average absolute forecast error falls after the announcement of targets. Inflation expectations play a large role in the latter half of this paper, where this result becomes very important. With expectations remaining mostly unchanged after targeting is announced, the monetary policy in Canada is very similar to that of the United States, where they perform inflation targeting-like techniques without a formal announcement. A formal announcement is meant to shift inflation expectations downwards. The failure of this suggests that the central bank would be just as well off if applying the implicit method. With Canada being similar to the US in economic performance and economic activity over the past 20 odd years, the effect of an explicit inflation target is insignificant considering the inability to anchor expectations. The benefit of implicitly following inflation is the lack of pressure for the central bank to maintain a certain target range, and allows them the flexibility to focus on other variables, such as output and employment as well.

Recent economic performance in the United States acts as a good example to the flexibility of the implicit inflation targeting regime. Presently, the Federal Reserve is fighting to keep the economy from declining in the midst of immense blows from the housing and credit crises, while trying to maintain low inflation. Since then the housing

market had worsened, credit problems have intensified, and the job market has deteriorated. Bernanke (2008) said that the combination of bad news has made people and businesses more cautious about spending and investing, further weakening the economy (China Daily 2008, chinadaily.com). The Central bank started lowering the key interest rate in September of 2007, and in a span of eight days in January, they lowered interest rates 1.25 percentage points in an attempt to reverse the economic downturn. According to the chairman of the Fed, Ben Bernanke, the priority now is to shore up the economy, going as far as to lowering interest rates further to strengthen economic growth if need be.

The Federal Reserve is ready to lower interest rates again to brace the wobbly economy even as zooming oil prices spread inflation (Chairman Ben Bernanke 2008, from China Daily, chinadaily.com).

Without an explicit inflation target, the Federal Reserve is not tied down by a rigid monetary policy framework. They are able to attend to less favourable economic conditions, even in the face of inflation, because there is no formal inflation obligation for the Fed to abide by. We have already discussed that implicit inflation targeting yield similar results than those from explicit targeting, this example shows the added benefit of flexibility with the implicit targeting regime, which the explicit regime lacks.

Thus far we have mainly looked at literature which disregard inflation targeting as an effective monetary policy based on evidence from nontargeting countries over a similar time horizon. Direct evidence of the ineffectiveness of IT from an inflation targeting country has yet to be discussed. This will be the discussion of the following paragraph.

University of Ottawa professor Ronald G. Bodkin, along with Ángel Enrique Neder, in

2003, performed a very simple tentative evaluation of inflationary targeting in Canada during the 1990's; similar to the analysis performed in this paper, which will be discussed shortly. In their analysis, they compare the performance of the Canadian economy during the periods 1980-1989, and 1990-1999 with respect to the rate of unemployment, real GDP growth, and the rate of inflation. This paper is only concerned with the latter effect. If the inflation rate were significantly changed from the first time period to the next, then a certain portion of this change should be ascribed to the new monetary policy regime (Bodkin and Neder 2003, p. 346). It was found that between 1983 and 1989 average inflation in Canada was about 3.9%, whereas from 1993 to 1999 it was 1.1 percent. The periods of 1980-1982, and 1990-1992 were discarded from the sample due to the fact that these were recession years. Common sense and the Bank of Canada would lead one to believe that inflation targeting has made a contribution to this change in the inflation rate. This conclusion, according to Bodkin and Neder (2003), is ambiguous in that other factors have not been accounted for. The recessions in the periods of 1980-1982, and 1990-1992 appear to have been effective in reducing the rate of inflation between the 80's and 90's. The 1980's recession reduced inflation from double-digits to around 4 percent annually, whereas the recession of the 90's reduced inflation further by two, or three, quarters percentage points (Bodkin and Neder 2003, p. 346). Thus an alternative view of the inflation targeting debate: monetary policy's contribution to inflation reduction in the 90's was mainly through manufacturing recessions at the appropriate times. The role of inflation targeting as a monetary policy regime was at best secondary (Bodkin and Neder 2003, p. 346). The introduction of the North American Free Trade Agreement in 1994 corresponds to the inflation targeting period in Canada, which should

have resulted in a less inflationary setting. Therefore the role of inflation targeting in reducing inflation is again seen as secondary. The evidence suggests that the change in policy has been mainly a secondary influence on the reduction in inflation, whereas a weaker Canadian economy with higher rates of unemployment and lower growth rates are the key to the lower rate of inflation.

This study will conduct its own empirical analysis of the overall effect of inflation targeting. A rigorous review of the existing literature acts as a good introduction to the results of this study. Using different techniques, these independent studies, from an assortment of economists, all reach similar conclusions. Inflation targeting is not as effective in reducing inflation as the central banks of the IT countries would argue it is. Lower inflation, according to the literature, is a result of just a natural process, that is, what would have occurred with or without inflation targeting, and the data over the past two decades seems to corroborate this theory. The public announcements of targets, the inflation reports, and the enhanced independence of central banks are not important factors in reducing inflation. This paper will add an extra dimension to the argument against inflation targeting, which combined with the existing criticism, discussed above, should strengthen the position that IT is irrelevant. The next section will introduce, and describe, the model and sample used in this study, which will lead to the discussion regarding the results.

## MODEL

Following basic economic theory, we develop a model in which prices, measured by core CPI, are a function of both supply (costs) and demand side effects. We use the core consumer price index, rather than the headline CPI, because it is the core CPI that the Bank of Canada uses to measure the success of inflation targeting. The domestic price level is a markup over unit labour costs, import prices, and cost of raw materials. Using the Bank of Canada, and the Conference Board of Canada's inflation model as a reference, this paper assembles the most fitting variables which affect prices, and performs a regression to estimate the true effect of inflation targeting on the evolution of the inflation rate. From all the possible variables available, we settle on the equation below, which we believe to be the best representation of the price function.

$$d\log\text{CPI}_t = \alpha_0 + \alpha_1\text{CU}_t + \alpha_2d\log\text{ULC}_t + \alpha_3d\log\text{IPI}_t + \alpha_4d\log\text{CRM}_t + \alpha_5\text{Dummy}_t + \varepsilon_t$$

Again CPI is the core consumer price index (excluding food, and energy), CU is the capacity utilization, ULC is the unit labour cost, and IPI represents the import price index. CRM is the cost of raw materials, and the dummy is equal to one in all periods when inflation targeting is in effect, and 0 otherwise. The first difference of the logs of the variables represents the growth rates of these variables. For example,  $d\log\text{CPI}_t$  (first difference of log CPI) symbolizes the growth rate of the core consumer price index, which effectively corresponds to the inflation rate. Capacity utilization represents the demand side effect on prices. The rates of capacity use are measures of the intensity with

which industries use their production capacity. Capacity use is the percentage of actual to potential output (Monetary Policy Division 2008, Bank of Canada). An increase in the capacity utilization rate signifies an increase in aggregate demand, which subsequently puts upward pressure on prices. On the costs side of the price equation is unit labour costs, and the cost of raw materials. Unit labour cost is the labour cost per unit of output; on the other hand, the cost of raw materials measures the prices paid by Canadian manufacturers for key raw materials and the CRM is an early measure of inflation according to the Bank of Canada. Finally, imports act as a substitute to domestically produced goods, and a cost to manufacturers who import inputs for production. Its price has an array of effects, from production costs to domestic demand.

The effect of productivity on inflation is accounted for in unit labour costs, as unit labour costs show us how much output we produce relative to wages. If wages rise but productivity rises faster, unit labour costs actually decrease. Unit labour costs show the combined effect of changes in productivity and wages on the cost of production (Department of Finance 2008, Canada). Former governor of the Bank of Canada, Gordon Thiessen, was under the belief that inflation and productivity are negatively related, and low inflation will induce a higher rate of growth of productivity. According to Peter Jarret and Jack Selody (1982) (taken from Seccareccia and Lavoie (1996)) inflation is the single and most important explanatory variable in explaining slow (or negative) productivity growth. Because CPI is our dependent variable, this leads to the potential simultaneity problem of the regression. If in fact this relationship truly exists, then CPI and unit labour costs are determined simultaneously within the model. Unit labour costs

are an endogenous explanatory variable rather than exogenous, thereby presenting a problem with OLS results. Mario Seccareccia and Marc Lavoie, professors at the University of Ottawa, look at the empirical evidence and find that this so called relationship between inflation and productivity does not exist. They cite the example of the time when the rate of growth of the CPI remained at a postwar low (at a 0.2 percent annual level in 1994, and 2% average annual average in 1995). The Bank of Canada's faith in the supposed productivity gains continued even though the positive expected effect on productivity had not occurred. Thus over the postwar period this relationship is nonexistent (Seccareccia and Lavoie 1996, pp. 537-538). Considering that there is little evidence to suggest that a negative relationship exists, between inflation and productivity, we assume that there is no simultaneity problem in the model. Therefore, we may continue with a normal OLS estimation of the above equation.

An accurate specification of the model is extremely important in order to assure that the coefficient estimation of the dummy variable is an accurate depiction of its true value. The existing literature on inflation targeting suffers from the problem of having a fairly limited sample in their analysis, to a point where the accuracy of their findings has been questioned. Because this paper allows for almost 20 years to elapse since inflation targeting was introduced in Canada, we capitalize on a long enough time period to assess the true effects of IT, using the above mentioned equation.

## SAMPLE

This section describes the countries in our sample, and the targeting, and non-targeting periods which we examine. This study is primarily concerned with the consequences of Canada's inflation targeting regime. However, in order to strengthen our case that IT is an insignificant policy; we examine and compare the inflation experience of six countries, 3 targeters, and 3 non-targeters, over the same time period. The targeting countries are Canada (1991), Australia (1994), and Norway (2001), and the non-targeting countries include Japan, Germany, and USA. The years in parentheses beside the targeting countries represent the year in which inflation targeting was introduced. The United States, as we have discussed in detail earlier, does follow anti-inflation policies, however does not announce an official inflation target. The situation in Germany is unique with respect to the other countries; on January 1, 1999 the European Central Bank (ECB) assumed responsibility for monetary policy in the Euro area. Up until 1999, Germany was operating under the monetary policy of the Bundesbank. The "just doing it" policy, similar to that of the US, was in effect, where inflation control was their main priority. However, they were flexible enough to take care of economic shocks without being concerned with an inflation target (Clarida 1996). A shift in monetary authority can lead to a significant change in monetary policy. As such using Germany in the analysis may be inappropriate, if monetary policy does indeed change, the change will not be considered in the regression, and the results would be flawed. Luckily, the ECB's monetary policy objective is similar to that of the Bundesbank, where price stability is the top priority. Using interest rates as their policy instrument, the ECB does not significantly

change the monetary policy landscape in Germany. Consequently, the data should be fairly consistent throughout the entire period, and the regression should not be radically affected by the change in monetary authority.

The empirical analysis investigates the performance of inflation throughout these six countries from 1980 to 2007. We use quarterly data for countries where available, and annual data for those where quarterly data are not available. Using time series data, especially with macroeconomic variables, runs the risk of experiencing nonstationarity within the data. Accordingly, before conducting the regression analysis, for each country, we must test and correct for this problem.

Most economic variables that exhibit strong trends, such as GDP, consumption, or the price level, are not stationary and are thus not suitable in the ordinary least squares regression, since it lacks good asymptotic properties. A nonstationary process is one in which the characteristics, such as the mean, or variance, of a variable consistently change over time. In many cases, stationarity can be achieved through simple differencing or other simple transformations. The conventional t and F tests would tend not to reject the hypothesis of a relationship when, in fact, there might be none; known as the spurious regression problem associated with nonstationary data. The general result at the corner of these findings is that conventional linear regression, ignoring serial correlation, of one random walk on another is virtually certain to suggest a significant relationship, even if the two, are in fact independent (Greene 2008, p.742). In other words, regression results

based on nonstationary data may be misleading. The trend stationary process from Greene (2008),

$$Z_t = \mu + \beta t + \varepsilon_t, \quad \varepsilon_t \text{ is a white noise process}$$

appears to be a reasonable characterization of many macroeconomic time series variables, such as the ones in our model. Clearly this results in a strongly trended, nonstationary series, represented by  $\beta t$ , and it is not surprising that regressions involving such variables almost always produce significant relationships. The strong correlation would seem to be a consequence of the underlying trend, whether or not there is really any causal relation at work (Greene 2008, p. 743). Observing a significant value for our dummy variable, when in reality there is no relationship, would obviously be a big problem for our paper, thus we must test each variable for stationarity of the data, and correct for nonstationarity where applicable. The augmented Dickey-Fuller test is used on the variables of our model to test whether the series are stationary or not. For all countries, with the exception of Canada,  $\text{dlogCPI}$  was found to be mildly trended and required first differencing to render the series stationary. The  $\text{dlogCPI}_t$  is said to be integrated of order one, designated  $I(1)$ , because taking the first difference produces a stationary process.

To complete the model, we add two lagged values of CPI to the right hand side of the equation to correct for autocorrelation. In most cases, in the presence of autocorrelation, the OLS estimator is still unbiased and consistent, but inefficient (Day 2008, p. 2). An inefficient estimator implies an imprecise estimator, and with the analysis which we are

performing it is unacceptable not to be accurate. Thus correcting for autocorrelation necessarily increases the confidence in our estimators. The end result is a correctly specified model in which the coefficient values reflect what is hopefully the true relationship between the dependent variable and the independent variables.

### **INTERPRETATION OF THE DUMMY VARIABLE**

Expectations play an important role in economic activity. Many of the actions of households, firms, and policy-makers depend on how they expect economic conditions to develop. Inflation expectations are of special interest for inflation targeting central banks. They trigger economic decisions such as the setting of prices and wages, and can influence consumption and investment decisions. Through such decisions, inflation expectations can feed directly and indirectly into inflation itself (Ranchhod 2003, p. 50). If economic agents believe that the central bank will react to deviations of inflation from the inflation target, their inflation expectations are more likely to be anchored at levels consistent with the target of the central bank. In such cases, price and wage setting behaviour would tend to be unresponsive to temporary fluctuations in inflation, according to Ranchhod (2003). The anchoring of inflation expectations thus becomes a significant component in measuring the success or failure of inflation targeting.

Many central banks have adopted inflation targeting based on the belief that an explicit, and clearly communicated target, would be a strong effort, which would help anchor

long-run inflation expectations. Credibility, transparency, and accountability become increasingly significant, as the central banks understand that the success or failure of curbing expectations depend greatly on these factors.

The central objective of inflation targeting is not to reduce inflation itself, but to reduce the expectations of inflation, by implementing credible, and transparent monetary policy.

High inflation fuels future expectations of even higher inflation. To anchor inflation expectations, a central bank adopts the inflation targeting policy by making a promise to contain inflation inside announced bounds. With a trustworthy central bank, there is no reason to expect high inflation in the future, even if inflation is high today. Similarly, there is no reason to expect deflation in the future, even if inflation is very low today. As a result, for very high and very low levels of inflation, inflation targeting weakens the link between realized and expected inflation (Korenok and Radchenko 2006, p. 1).

Therefore inflation targeting must necessarily lock in expectations in order for inflation targeting to be considered successful, and a reduction in realized inflation is not good enough. After reviewing the Bank of Canada's briefing Note in 1991, Bernanke et al. (1999) observe that inflation targets were the tactic chosen to reduce inflation expectations and to bring the declared goal of Canadian monetary policy to fruition. At an Atlanta based conference, in 2002, the then governor of the Bank of Canada, David Dodge, confirmed this view of inflation targeting by stating that:

with no explicit target, there was still little understanding of monetary policy and no focus for inflation expectations; and

The experience of the 1970s and 1980s left both the government and the central bank sensitive to the havoc wreaked by high and unstable inflation rates and thus moved them away from the notion of trying to directly fine-tune short-run output and employment levels. By 1990, there was therefore a growing shared desire to create a policy that would provide a better anchor for inflation expectations... Overall, it became increasingly evident through the last decade that the inflation target deals with expectational problems

David Dodge therefore explains that providing a better anchor for inflation expectations is priority number one for inflation targeting. Therefore, the central bank would advocate that after just a couple of years of targeting, expectations would tend to be affected very little by what was happening to actual inflation rates. For example a shock in the price of raw materials, or the import price index, would not result in a drastic price increase from producers because long-term expectations are not affected, according to the central bank. This understanding of inflation targeting is extremely important in the interpretation of the dummy coefficient in our model.

The significance of the dummy variable represents the success or failure of the inflation targeting regime. The preceding discussion on expectations has changed the understanding of both the success and failure of inflation targeting, and as such the explanation of the dummy variable has also changed. Because success is measured by anchoring long-term inflation expectations, a significant  $\alpha_5$ , from our model, implies that inflation targeting is indeed successful in curbing inflation expectations. However, if  $\alpha_5$  is insignificant then IT has failed to anchor long-term expectations and, as a result the

new monetary policy regime would not significantly influence the evolution of the inflation rate.

## RESULTS

To what extent are the improvements in performance observed in countries that have introduced inflation targeting the direct result of the change in policy, as opposed to other causes? The following section will present the findings of this study, and should strengthen the argument against inflation targeting. We find little evidence that suggests IT has the effect of anchoring expectations. The regression below presents the results concerning inflation targeting in Canada.

Dependent Variable: DLOGCPI  
 Method: Least Squares  
 Sample (adjusted): 3 105  
 Included observations: 103 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CU	0.000206	5.11E-05	4.023461	0.0001
DDLOGIPI	-0.030888	0.027835	-1.109662	0.2699
DLOGULC	0.232794	0.052438	4.439440	0.0000
DLOG_COMMODITY_PRICES	-0.004577	0.008753	-0.522926	0.6022
DUMMY	-0.001146	0.002098	-0.546002	0.5863
LAGCPI1	0.003601	0.000977	3.684759	0.0004
LAGCPI2	-0.003730	0.000970	-3.843746	0.0002
R-squared	0.645148	Mean dependent var		0.007862
Adjusted R-squared	0.622970	S.D. dependent var		0.006662
S.E. of regression	0.004091	Akaike info criterion		-8.094614
Sum squared resid	0.001607	Schwarz criterion		-7.915554
Log likelihood	423.8726	Durbin-Watson stat		1.894538

The dependent variable is, again, the growth rate of the core consumer price index. The growth rate of the import price index is found to be nonstationary, and thus, is first differenced to correct for the problem. As you can see from the Durbin-Watson statistic, the adjustments eliminate the problem of autocorrelation as well, since a value of 2 implies no autocorrelation. The commodity price index, which includes energy prices, is inserted into the regression as an approximation of the cost of raw materials. We see that at the 10% significance level, both capacity utilization, and unit labour costs have a significant effect on the inflation rate, however the variable of interest, the dummy, does not. The probability value of 0.5863 for the dummy coefficient indicates that the role of inflation targeting is extremely insignificant in reducing inflation. The result is the same at any significance level. Looking back at our interpretation of the dummy coefficient we may conclude that inflation targeting is not a successful policy for anchoring inflation expectations. This suggests that the announcement of a transparent target, well in advance, does not effect the behavior of the public, and they still form expectations based on current inflation rates. Inflation targeting does not effectively reduce the inflationary pressure of an economic shock. Inflationary shocks will have adverse effects on the price and wage setting behaviour of agents, on consumption and investment decisions, and consequently on inflation rates itself; since the expectations, and responsiveness of economic agents to inflationary shocks is unaffected by IT.

In such circumstances (inflationary shock), expectations of higher inflation are likely to be reflected in higher wage demands and prices, and may lead to a bringing forward of consumption

expenditure, exacerbating inflationary pressures (Ranchhod 2003, p. 50).

The behaviour of economic agents are important in reducing, and maintaining a low level of inflation. Adjustments in expectations should lead to a more stable behaviour of inflation. The regression shows that inflation targeting is not significant in curbing expectations, and thus something else must be at play. The facts are that over the past two decades, inflation has indeed decreased, and has remained fairly low. Since inflation targeting had nothing to do with it, according to our analysis, there must have been some external influence within the same time period as inflation targeting. Our current economic situation would exist, whether Canada had adopted inflation targeting or not.

Even if the adoption of inflation targeting does not improve moderate inflation expectations, it is possible that the adoption of inflation targeting might alter the dynamics of the inflationary process. For example, as the commitment to price stability by the central bank becomes established, the responses of actors in the economy to inflationary shocks may change (Bernanke et al. 1999, p. 275). The Chow test is a test of model stability. It is often used to determine whether the independent variables have different impacts on different subgroups of the sample. In this context we can test whether the coefficient vector changes after the introduction of the inflation targeting policy in 1991. We test to see if the relationship between the dependent and independent variables change since the introduction of inflation targeting. We split our regression into two subgroups, the first group contains data from 1980 to 1990, the pre-targeting period, and the second group is the post-targeting period, from 1991 to 2007. The null and

alternative hypotheses to test whether all the coefficients differ across the different subsamples are:

H<sub>0</sub>: The coefficient vector is the same for both subsamples, i.e.,  $\alpha_1 = \alpha_2$ , where  $\alpha_1$  and  $\alpha_2$  are the coefficient vectors for the first and second subsamples respectively.

H<sub>1</sub>: The coefficient vector is not the same for both subsamples; i.e.,  $\alpha_1 \neq \alpha_2$ . At least one coefficient differs across subsamples.

The Chow test is an F test, which compares the sum of the squared errors between the two subgroups and the original regression (Day 2008, p. 16).

$$F = \frac{(e'_x e_x - e'_1 e_1 - e'_2 e_2)/k}{(e'_1 e_1 + e'_2 e_2)/(n-2k)}$$

Where  $e'e$  is the sum of squared errors,  $k$  is the number of restrictions, which is 4 in our case, and  $n$  is the total sample size.

Chow Breakpoint Test: 42

F-statistic	1.715122	Probability	0.126340
Log likelihood ratio	11.03496	Probability	0.087302

The results show that we cannot reject the null hypothesis that the coefficient vector is the same for both subsamples. The variable coefficients are consistent throughout the sample period. Inflation targeting does not change the relationship between the CPI and the independent variables. Had one, or more, of the variable coefficients changed, it would imply that the announcement of an inflation target changes the way in which

economic agents respond to inflationary shocks (change in expectations), as such the causal relationship of our model changes. The result of the Chow test thus strengthens the confidence in our regression results. Taken together these results make a strong case against the effectiveness of inflation targeting in Canada.

The reader should now have a firm grasp of the influence of inflation targeting on the Canadian economy. We expand our analysis in the following section to include two other inflation targeting countries, and three non-inflation targeting countries. Comparing the outcomes of the three IT countries to the three, similar, non-IT countries over the past 20 odd years allows us to observe whether our results from Canada carry over to the international experience. The table below compares the outcomes of the dummy variables for Canada, Australia, and Norway, to USA, Germany, and Japan. As we have discussed in our literature review, all countries experience better inflation performance over the 27 year period; however the table will show whether inflation targeting countries were just a little bit better.

<b>Inflation Targeting Countries</b>		<b>Non-inflation Targeting Countries</b>	
<b>Canada</b>	-0.001146 (0.5863)	<b>USA</b>	-0.001227 (0.2242)
<b>Australia</b>	-0.002047 (0.2760)	<b>Germany</b>	-0.006041 (0.2403)
<b>Norway</b>	-0.010167 (0.0530)	<b>Japan</b>	-0.004988 (0.1047)

The data for Canada, USA, and Australia are quarterly from 1980-2007, whereas for Norway, Germany, and Japan we use yearly data due to the lack of quarterly data. The regression results for USA, Germany, Japan, Australia, and Norway can be seen in the appendix of this paper. The negative numbers are the regression estimates for the

coefficient values of the dummy variables, and the values in parentheses are the probability values. Because USA, Germany, and Japan, never formally adopted inflation targeting it is difficult to define the dummy in this case. The dummy in this case represents an exogenous effect, or shock, on the non-IT countries which may explain the reduction in inflation since the early 90's. The dummy takes on the value of 0 for the time period of 1980-1990, and a value of 1 from 1991-2008. We use 1991 as the year in which the exogenous effect began, because it was around this time that inflation started decreasing in the non-IT countries, and it was also around the same time where a lot of countries started using the inflation targeting policy. This group thus serves as a good comparison to the IT countries. If inflation targeting were successful in anchoring expectations, and achieving price stability, our analysis would result in significant dummy coefficients for the IT countries, and insignificant coefficients for the non-IT countries. If this were the case, we would conclude that the major difference in the amount that inflation was reduced, between the IT and non-IT countries, is due to inflation targeting. This outcome is the only one in which we would conclude that inflation targeting is effective at the international level. Anything else would imply inflation targeting would not make a difference. The table shows that the dummy coefficient is insignificant for all countries, with the exception of Norway. However, we would not put much of weight on the results from Norway because they had only adopted inflation targeting in 2001, which only gives us 8 observations since that time. Not for a few years will a valid result be available for Norway. We can conclude that not only is inflation targeting not successful in Canada, but the consequences of the preceding analysis imply that this is an international result. The insignificant coefficients confirm

that the improved inflation performance over the past 20 years, in the global context, is the result of some international phenomenon, and not of inflation targeting. The central banks of inflation targeting countries are convinced that inflation targeting has had positive effect on inflation performance, and expectations, primarily because the timing of the two events. However our analysis of the six countries suggest that the timing between the adoption of inflation targeting, and the improving performance may be nothing more than coincidental.

We have established that inflation targeting has been ineffective in anchoring long term expectations through the comparison of three IT and non-IT countries over the past two decades. We have also discussed two possible outcomes of this comparison, first that inflation targeting countries have significant dummy coefficients and non-IT countries have insignificant coefficients (IT is successful), second both IT and non-IT countries face insignificant coefficients. There is another possible case, which is purely hypothetical, however very interesting nonetheless. What if all six countries had turned up significant coefficient dummies? This is intriguing because it would appear as though inflation targeting is an effective monetary policy; however the non-IT countries have experienced a similar outcome. In this hypothetical situation there is an external influence on the non-IT countries explaining the inflation reduction. However, even in this case we could not conclude that IT is effective, because it could be the same external effect which occurred in the non-IT countries. All we can conclude is that in all countries inflation had been reduced with the help of some external force. For the IT countries whether it is indeed inflation targeting or not is unknown; however it would be a fairly large

coincidence that an exogenous effect afflicted the non-IT countries around the same time as IT.

Inflation targeting is meant to reduce inflation variability by maintaining a credible target range. The maintenance of price stability is likely to be a lot more difficult when inflation expectations are not consistent with the target of monetary policy. Holding inflation consistently within the target range depends a lot on the behaviour of economic agents, which we have proved is unaffected by IT. Therefore, in the following paragraph we prove that inflation variability is also unaffected by IT. We perform a similar analysis to that of the U.S. “just doing it” example discussed in the literature review. We split the American and Canadian regression into two subgroups, a pre-targeting, and post-targeting subgroup. We then compare the change in the standard deviation of the mean dependent variable, from the pre to post targeting period, between Canada and the U.S. We do not use all six countries since the use of different sample sets for the countries may affect the standard deviation. By using quarterly data from 1980-2007 for both Canada and USA, this problem is avoided, and we should get an accurate comparison. The regression outputs for the American and Canadian subgroups can be found in the appendix to this paper. You will find that there is only a small difference in the reduction of the standard deviation of the CPI. From 1980 to 1990 the standard deviation for the Canadian inflation rate was 0.006405, and from 1991 to 2007 it was 0.003297 for a total change of 0.003108; the standard deviation in the U.S. changes from 0.004266 to 0.002281, a reduction of 0.001985. As expected inflation variability is unaffected by inflation targeting, seeing as the American standard deviation falls even more than the

Canadian case after the introduction of IT. This result is not surprising considering the same result of the “just doing it” study, reviewed earlier, and the insignificant dummy coefficient in our price equation. With expectations unaffected from inflation targeting, and lack of evidence supporting a reduction in inflation variability, it seems to be that the inflation performance, internationally, since the 90’s is most likely of its own doing.

Upon decades of worldwide steadily decreasing inflation, the question arises, why has worldwide inflation been steadily declining? Although this paper cannot tell you why in fact inflation has been decreasing, it can tell you what has not caused the reduction. Our analysis shows that inflation targeting has done nothing to alter the path of inflation since its induction in the 90’s. The international macroeconomic environment has shifted, and has become progressively more open. The new open market could have contributed to the downward trend in the international inflation rates. The presumed benefits of inflation targeting seem to reflect coincidental timing. Comparing IT countries to non-IT countries provides great insight regarding the true effects of inflation targeting.

## **CONCLUSION**

By now the answer should be obvious, nonetheless we return to the question, “Is inflation targeting relevant?”. Central banks of targeting countries would like to believe that it is, however the evidence presented in this paper tends to disagree with this view. It certainly would appear as though it had an effect considering the improved inflation performance between the pre, and post-targeting periods, among all targeting countries. However, non-

IT countries have experienced a similar inflation path, thereby suggesting that something else is occurring around the same time as the introduction of IT. Our analysis has shown that inflation targeting does nothing to curb expectations, and the inflation rate today is what it would have been in the absence of inflation targeting.

We have presented the arguments, both for and against, the adoption of inflation targeting which have fueled the debates among the two sides over the past two decades. After completing our analysis, we cannot conclude that inflation targeting does any harm to the performance of inflation; but because it does nothing to improve performance, having an explicit target may not be the best policy. The central bank is held accountable to hit the explicit target, leaving them inflexible in reacting to potential economic shocks. We described the implicit inflation targeting used by the Americans extensively in the literature review. The flexibility of an implicit target allows the Fed to attend to other issues such as unemployment, and GDP growth. Since an explicit inflation targeting regime appears to be irrelevant in improving the performance of inflation, IT countries would be better off using an implicit targeting policy to avoid the pressure associated with maintaining an inflation target.

Our study uses the largest data set, especially since the introduction of inflation targeting, than any other study of its kind, and enough time has elapsed for us to be confident about the accuracy of our results. Using the Bank of Canada and the Conference Board of Canada's inflation model as a reference, and taking from it the most appropriate variables, it adds credibility to our model and consequently credibility to the results of the

said model. Within the last ten years a lot of studies (many of which are presented in the literature review) have expressed their doubts as to the relevance of inflation targeting. Our paper is just another one of those studies. Taken together, all these authors make an overwhelming argument against the relevance of inflation targeting.

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## APPENDIX

### Canadian Pre-Targeting Subsample

Dependent Variable: DLOGCPI

Method: Least Squares

Sample (adjusted): 3 42

Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CU	0.000193	8.33E-05	2.314080	0.0268
DDLOGIPI	-0.002031	0.084187	-0.024130	0.9809
DLOGULC	0.346703	0.083983	4.128270	0.0002
DLOGCRM	-0.020507	0.019998	-1.025431	0.3124
LAGCPI1	0.005224	0.001738	3.005534	0.0050
LAGCPI2	-0.005382	0.001746	-3.081542	0.0041
R-squared	0.503266	Mean dependent var		0.013732
Adjusted R-squared	0.430217	S.D. dependent var		0.006405
S.E. of regression	0.004835	Akaike info criterion		-7.688489
Sum squared resid	0.000795	Schwarz criterion		-7.435157
Log likelihood	159.7698	Durbin-Watson stat		2.153867

### Canadian Post-Targeting Subsample

Dependent Variable: DLOGCPI

Method: Least Squares

Sample: 43 105

Included observations: 63

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CU	0.000104	8.37E-05	1.244334	0.2185
DDLOGIPI	-0.010148	0.019678	-0.515705	0.6081
DLOGULC	0.076732	0.066054	1.161668	0.2502
DLOGCRM	-0.008867	0.008339	-1.063397	0.2921
LAGCPI1	0.002031	0.001122	1.810163	0.0755
LAGCPI2	-0.002083	0.001127	-1.847476	0.0699
R-squared	0.104340	Mean dependent var		0.004135
Adjusted R-squared	0.025773	S.D. dependent var		0.003297
S.E. of regression	0.003254	Akaike info criterion		-8.527525
Sum squared resid	0.000604	Schwarz criterion		-8.323417
Log likelihood	274.6170	Durbin-Watson stat		1.842570

**American Regression:**

Dependent Variable: DDLOGCPI

Method: Least Squares

Sample (adjusted): 3 102

Included observations: 100 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CU	8.26E-05	2.22E-05	3.716687	0.0003
DLOGIPI	0.010591	0.016737	0.632797	0.5284
DLOGULC	-0.005500	0.014102	-0.390052	0.6974
DDLOGCRM	-0.031256	0.026113	-1.196931	0.2344
DUMMY	-0.001227	0.001003	-1.223654	0.2242
LAGCPI1	-0.010348	0.001309	-7.906157	0.0000
LAGCPI2	0.010354	0.001311	7.896171	0.0000
R-squared	0.405483	Mean dependent var		-0.000132
Adjusted R-squared	0.367127	S.D. dependent var		0.003102
S.E. of regression	0.002468	Akaike info criterion		-9.103586
Sum squared resid	0.000566	Schwarz criterion		-8.921224
Log likelihood	462.1793	Durbin-Watson stat		1.880099

**Pre-Targeting Subsample:**

Dependent Variable: DDLOGCPI

Method: Least Squares

Sample (adjusted): 3 37

Included observations: 35 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CU	-0.000114	6.60E-05	-1.731314	0.0940
DLOGIPI	-0.010120	0.029661	-0.341204	0.7354
DLOGULC	0.079472	0.040937	1.941327	0.0620
DDLOGCRM	-0.044935	0.052264	-0.859776	0.3970
LAGCPI1	-0.019458	0.002786	-6.984196	0.0000
LAGCPI2	0.019807	0.002841	6.971063	0.0000
R-squared	0.649988	Mean dependent var		-0.000262
Adjusted R-squared	0.589641	S.D. dependent var		0.004266
S.E. of regression	0.002733	Akaike info criterion		-8.812100
Sum squared resid	0.000217	Schwarz criterion		-8.545469
Log likelihood	160.2118	Durbin-Watson stat		1.729532

**Post-Targeting Period:**

Dependent Variable: DDLOGCPI

Method: Least Squares

Sample: 38 102

Included observations: 65

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CU	7.73E-05	2.31E-05	3.346621	0.0014
DLOGIPI	0.023949	0.015255	1.569868	0.1218
DLOGULC	-0.022019	0.010810	-2.036882	0.0462
DDLOGCRM	-0.047114	0.022284	-2.114257	0.0387
LAGCPI1	-0.007897	0.001189	-6.640151	0.0000
LAGCPI2	0.007881	0.001189	6.629230	0.0000
R-squared	0.464658	Mean dependent var	-6.20E-05	
Adjusted R-squared	0.419290	S.D. dependent var	0.002281	
S.E. of regression	0.001738	Akaike info criterion	-9.784407	
Sum squared resid	0.000178	Schwarz criterion	-9.583695	
Log likelihood	323.9932	Durbin-Watson stat	1.797987	

**Australian Regression:**

Dependent Variable: DDLOGCPI

Method: Least Squares

Sample (adjusted): 1983Q4 2008Q1

Included observations: 98 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEMAND	7.78E-07	2.79E-07	2.784537	0.0065
DLOGULC	0.069986	0.052496	1.333189	0.1858
DLOGIPI	0.006127	0.024233	0.252836	0.8010
DLOGCRM	0.045981	0.016651	2.761445	0.0070
DUMMY	-0.002047	0.001868	-1.095900	0.2760
LAGCPI	-0.006797	0.000862	-7.887486	0.0000
LAGCPI2	0.006581	0.000849	7.749335	0.0000
R-squared	0.456874	Mean dependent var	-4.39E-05	
Adjusted R-squared	0.421063	S.D. dependent var	0.007989	
S.E. of regression	0.006078	Akaike info criterion	-7.299408	
Sum squared resid	0.003362	Schwarz criterion	-7.114768	
Log likelihood	364.6710	Durbin-Watson stat	2.193301	

**Norway Regression:**

Dependent Variable: DDLOGCPI

Method: Least Squares

Sample (adjusted): 1982 2008

Included observations: 27 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OUTPUT_GAP	0.000609	0.001225	0.497195	0.6240
DLOGIPI	-0.027936	0.073859	-0.378237	0.7089
DLOGULC	0.178941	0.091533	1.954945	0.0634
DUMMY	-0.010167	0.004972	-2.044884	0.0530
LAGCPI	-0.006574	0.001477	-4.450032	0.0002
LAGCPI2	0.006715	0.001505	4.460626	0.0002
R-squared	0.589375	Mean dependent var	-0.004100	
Adjusted R-squared	0.496051	S.D. dependent var	0.012588	
S.E. of regression	0.008936	Akaike info criterion	-6.410069	
Sum squared resid	0.001757	Schwarz criterion	-6.124597	
Log likelihood	95.74097	Durbin-Watson stat	2.074748	

**Japan Regression:**

Dependent Variable: DDLOGCPI

Method: Least Squares

Sample (adjusted): 1982 2009

Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OUTPUT_GAP	0.002959	0.001037	2.853081	0.0092
DDLOGULC	0.148746	0.075913	1.959439	0.0629
DLOGIPI	0.006034	0.012093	0.498919	0.6228
DUMMY	-0.004988	0.002948	-1.692072	0.1047
LAGCPI1	-0.005162	0.001124	-4.592066	0.0001
LAGCPI2	0.005242	0.001140	4.600414	0.0001
R-squared	0.691421	Mean dependent var	-0.001654	
Adjusted R-squared	0.621290	S.D. dependent var	0.009491	
S.E. of regression	0.005840	Akaike info criterion	-7.260601	
Sum squared resid	0.000750	Schwarz criterion	-6.975129	
Log likelihood	107.6484	Durbin-Watson stat	1.965765	

**Germany Regression:**

Dependent Variable: DDLOGCPI

Method: Least Squares

Sample (adjusted): 1982 2009

Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OUTPUT_GAP	0.002004	0.001042	1.923158	0.0675
DLOGULC	0.120473	0.062274	1.934561	0.0660
DLOGOIL_IMPORT	0.010080	0.006847	1.472309	0.1551
DUMMY	-0.006041	0.005005	-1.206873	0.2403
LAGCPI1	-0.004706	0.001410	-3.337007	0.0030
LAGCPI2	0.004838	0.001431	3.380252	0.0027
R-squared	0.535016	Mean dependent var	-0.001605	
Adjusted R-squared	0.429338	S.D. dependent var	0.009908	
S.E. of regression	0.007484	Akaike info criterion	-6.764581	
Sum squared resid	0.001232	Schwarz criterion	-6.479109	
Log likelihood	100.7041	Durbin-Watson stat	1.645539	