

Inflation Targeting in Canada: A Critical Analysis

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Introduction

Since its adoption in 1991 inflation targeting has remained the guiding policy of the Bank of Canada. The adoption of inflation targeting was to bring about a higher standard of living to Canadians, by increasing productivity, output, and minimizing the high costs of inflation. Examining the theoretical as well as empirical evidence in favour of inflation targeting we find the results mixed at best, unobservable at worst. In this paper we will scrutinize the history, theory, and evidence presented in favour of inflation targeting in Canada. Section 1 will discuss a brief history of inflation targeting in Canada as well as its theoretical underpinnings. Section 2 will discuss the transmission mechanism of monetary policy. Section 3 will examine the perceived costs of inflation and the real costs of foregone output. Section 4 will discuss productivity under the current regime and use a simple model to examine the validity of the Bank's concerns. Section 5 will discuss financial stability within inflation targeting. Section 6 will discuss the overall efficacy of inflation targeting and recap the evidence. Lastly, we will make some general remarks concerning the overall performance of inflation targeting in Canada.

A Brief History of Inflation Targeting, from Monetarism to Wicksell

As the Bank of Canada regularly states in one form or another, “The objective of monetary policy is to preserve the value of money by keeping inflation low, stable and predictable. This allows Canadians to make spending and investment decisions with more confidence, encourages longer-term investment in Canada's economy, and contributes to sustained job creation and greater productivity. This in turn leads to improvements in our standard of living.” (Bank of Canada, 2015). To understand the Bank of Canada's fixation with inflation we have to go back some 40 years to the period of high inflation in the Canadian economy in the late 1970s and early 1980s.

After allowing the Canadian dollar to freely float, the Bank was in search of a nominal anchor to guide monetary policy action (Freedman, 2003). “Before 1975 the intermediate variables used as policy guides in Canada were interest rates and credit conditions, with bank liquidity sometimes used as a proxy for credit conditions. Since 1975 intermediate targets have been set in terms of a narrow, monetary aggregate.” (Thiessen, 1982, p. 101) The economic theory behind this policy was the Monetarism as practiced by Milton Friedman. “If, as Friedman suggested, inflation was always and everywhere a monetary phenomenon, a gradual deceleration

in the rate of money growth would eventually squeeze it out of the system.” (Thiessen, 2000, p. 11).

In practice the monetary aggregate chosen by the Bank was M1, whose growth according to the Bank ultimately could be controlled through restrictions in the supply of base money, “by restricting the supply of base money relative to its demand, push-up short-term interest rates and cause people to economize on their use of non-interest bearing transactions balances.” (Thiessen, 1983, p. 102). Thus the goal of managing the demand for M1 through higher interest rates would over the long run bring down aggregate demand (and thereby money demanded) back into line and control the growth of nominal spending (Thiessen, 1983, p. 102).

This monetarist-inspired policy of controlling M1 failed for several reasons. By and large the inability to control monetary aggregates was blamed on the breakdown of the money-demand function. This occurred via financial innovation, deregulation and changes in the interest rate elasticity of some types of bank accounts (Freedman, 1995 & 2003). Other issues included the incapacity to manage the effects of the exchange rate on inflation and the lack of a suitable monetary aggregate replacement to M1. This ultimately led to the Bank abandoning monetary aggregates, although former governor of the Bank, Gerald Bouey would continue to famously insist that, “We did not abandon M1, M1 abandoned us” (Thiessen, 2000, p. 13).

Abandoning monetary aggregates left the Bank of Canada without a clear nominal anchor (Laidler & Robson, 2004). Although this left the Bank’s actions “eclectic and hard to read” (Laidler & Robson, 2004, p. 10), this did not imply that the Bank was groping in a void; but rather that price stability would continue to be the end goal. This position was solidified by the Bank’s Governor John Crow in 1988, “Monetary policy should be conducted so as to achieve a pace of monetary expansion that promotes stability in the value of money. This means pursuing a policy aimed at achieving and maintaining stable prices [...] because inflation creates distortions, output will be higher over time in conditions of price stability than in those of inflation” (Crow, 1988, p. 4-5). It has since been argued, in hindsight, that the Bank continued to strive towards this goal even during the interregnum between formal policy frameworks (Freedman, 1995).

Alternative frameworks, such as nominal income targeting, were considered though never adopted (Freedman, 2003). Instead inflation targeting was formally adopted in early 1991. The reasons behind adopting inflation targeting as the Bank’s formal policy were varied. For Bank officials the short-term economic situation provided a large impetus to adopt a new coherent

policy framework. The rise in oil prices after the 1990 Iraqi invasion of Kuwait, as well as the introduction of the GST sparked concerns about another rise in inflation and inflation expectations to levels not seen since the early 1980s (Freedman, 1995, pp. 20-21).

Several long-term benefits were also identified as the reason for inflation targeting. The issue of central bank time-inconsistency might be solved by committing the Bank to public targets (Thiessen, 2000). Other benefits identified include: reducing investment uncertainty, lengthening planning horizons and improving fairness (Colleti & O'Reilly, 1998). Ultimately it was argued that these benefits would lead to a reduction in economic fluctuations accompanying the business cycle, greater economic efficiencies, and improvements in productivity (Seccareccia & Lavoie, 1996).

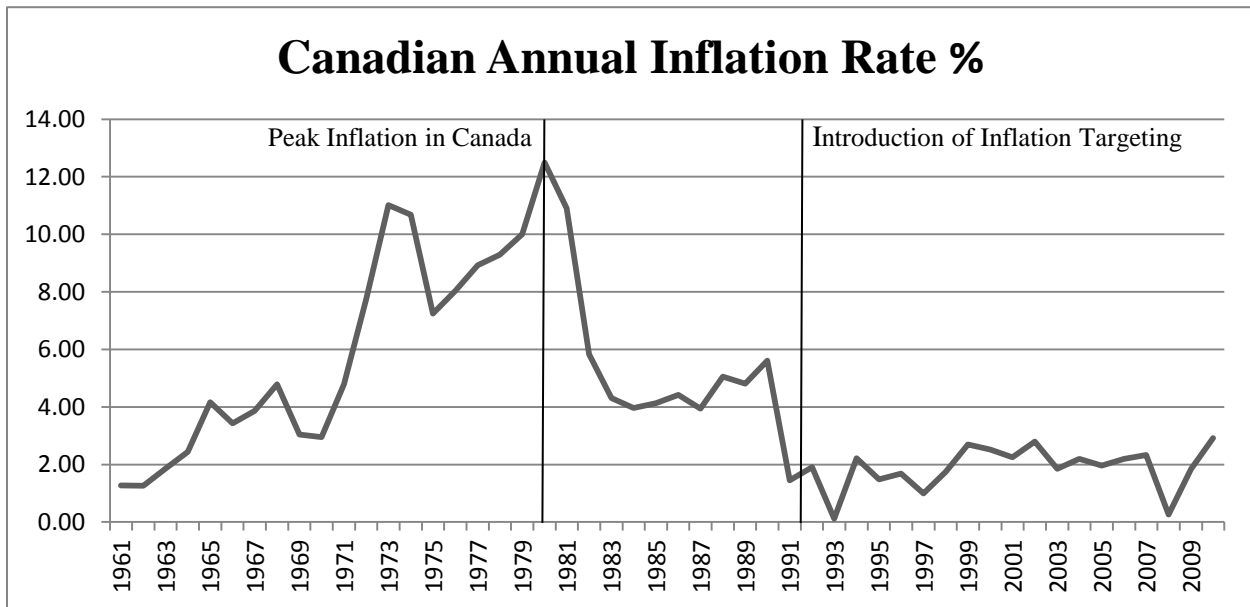
With these arguments in mind in February 1991 the Bank of Canada in concert with the Department of Finance set out their agreement on inflation reduction (Bank of Canada, 1991). The formal agreement specified that inflation would be targeted for gradual reduction until 'price stability', was reached (Bank of Canada, 1991, p. 5). Targets were set at three percent year-over-year change in the CPI for the end of 1992, two and one-half percent by the middle of 1994 and two percent by the end of 1995 (Bank of Canada, 1991). Due to the volatilities in the consumer price index, both in terms of measurement and one-time fluctuations, "the targets should be regarded as the midpoints of a target band of plus or minus one percentage point" (Bank of Canada, 1991-03, p. 6). The target of two percent as the midpoint of a band has not changed to this day, despite wording in the original agreement that further reductions would occur afterwards (Bank of Canada, 1991).

Table 1: Summary Statistics in the Pre and Post-Inflation Target Period

Year	1962-1990	1990-2011	1995-2011
Annual Real GDP Growth	4.02	2.42	2.63
Inflation Rate	5.75	2.05	2.00
Annual Labour Productivity Growth	1.93	1.23	1.18
Real Wage Growth	2.09	1.02	1.20
Note: All figures are expressed in percentage points and reflect means for the periods selected.			

Source: Source: Statistics Canada CANSIM Tables: 383-0021, 326-0021

Figure 1: Annual Canadian Inflation Rate



Source: Statistics Canada CANSIM 326-0021

On a theoretical level the adoption of inflation targeting signalled the end of any ties to monetarist ideas of controlling the money supply directly, although some influential authors with close ties to the Bank still held onto the idea that controlling base money ultimately was what influenced demand and inflation (Bank of Canada, 2001). The theoretical view about how the Bank of Canada conducted operations can be understood as a paradigm shift, away from Monetarism towards a so-called “neo-Wicksellian” mentality (Clinton, 2006). This view becomes obvious when one considers the tool with which monetary policy operates under the inflation targeting framework. Instead of attempting to control the money supply, emphasis had shifted towards the interest rate as the tool of monetary policy.

For some at the Bank this distinct shift was nothing new: “It used to be that most academic research treated money (or sometimes base) as the exogenous policy instrument under the control of the central bank. This was an irritant to those of us working in central banks, because the instrument of policy had always been the short-term interest rate, and because all monetary aggregates (beyond base) have always been and remain endogenous.” (Freedman, 2003, p. 320). This statement stands in direct contrast to what Thiessen originally stated in 1982, regarding restrictions in the supply of base money preceding rises in the interest rate. Whether or

not one agrees with Freedman, by 1999 it had become obvious that the Bank had fully adopted a Wicksellian view (Lavoie & Seccareccia, 2006).

For Clinton (2006) the evolution of this view was a four-fold process. This process began with the explicit goal of price stability, the elimination of reserve requirements, the adoption of the overnight interest rate as the policy tool, and lastly “controlling this rate around the rates on settlement accounts in 1999” (Clinton, 2006, p. 3). While only the first of these points was formally adopted prior to inflation targeting, this summary highlights several key points. These points are the importance of the clearing and settlement system, the rejection of the traditional monetarist school of thought and the elimination of reserve requirements, but most importantly was the shift in emphasis from controlling the money supply to controlling the rate of interest.

Wicksell believed that there were two central interest rates of interest in the economy what he termed the natural rate and the bank rate (Seccareccia, 1998). The natural rate was defined as the rate such that in a pure credit economy, it would “equilibrate the market for capital goods if the latter were exchanged somehow outside of the monetary system” (Seccareccia, 1998, p. 182). This interest rate has today been interpreted as the intersection of potential supply and aggregate demand curves (Clinton, 2006). Wicksell’s second interest rate defined as the ‘bank rate’ is considered the equivalent of today’s nominal interest rate set by the central bank (Clinton, 2006).

The long-run equilibrium solution was for the bank rate to be set equal to the natural rate; however, in practice this was rarely the case (Clinton, 2006). This can largely be due to the elusiveness of such a concept such as a ‘natural rate’. Perhaps in anticipation of this difficulty Wicksell proposed a simple solution. Since the natural rate is unobservable (and evolving), banks can follow the simple rule of “raising the bank rate whenever prices are rising and to reduce it whenever prices are falling.” (Seccareccia, 1998, p. 185).

Two additional caveats have emerged over time in addition to Wicksell’s contribution. First, the recognition that Wicksell’s solution was valid in an economy operating at full employment which required a concept of an output gap and second the emphasis on real-rates of interest; taken together these are both seen embodied in the famous Taylor rule of today (Seccareccia, 2008).

Freedman and Laxton (2009) go on to explain that the central banks’ procedure for setting the target overnight rate becomes rather straightforward. When demand shocks push

output above its potential, or inflation above its target, the central bank should raise real interest rates. “The interest rate response (and the resulting exchange rate response) to demand shocks in an IT environment would move both output and inflation in the desired direction (what Blanchard and Galí (2007) call a divine coincidence).” (Freedman & Laxton, 2009, p. 20).

Supply shocks (such as oil prices shocks) which move inflation and output in opposite directions, such as those seen during the 1970’s, present inflation targeting with more of a conundrum. Raising rates to combat inflation would worsen the already lower than potential output (Freedman & Laxton, 2009). In the end concerns over supply shocks can be dismissed on the grounds that so long as inflation expectations are anchored, economic agents will see through these temporary effects and supply shocks will not feed into a cumulative inflationary process. Expectations in this way play a critical role to the success of monetary policy under an inflation targeting framework (Freedman & Laxton, 2009).

These foundations of inflation targeting remain the economic theory backing inflation targeting today. In order to understand more comprehensively how the central bank is able to influence the economy, we have to examine the transmission mechanism of monetary policy. After examining the process of transmission the obscure economic underpinnings of inflation targeting’s founding theory become readily discernable.

The Transmission Mechanism

The Bank of Canada sets the policy rate of interest in order to achieve its target of 2% inflation. In Canada this policy rate is the target overnight rate of interest. In order to understand how the policy rate influences the economy in a Wicksellian framework we have to examine the transmission mechanism of monetary policy. Once we have established the formal channels with which it operates, the continued theme of emphasizing unobservable variables becomes clear.

“The Bank of Canada’s framework can be broadly characterized as one with zero reserves and which has a target for the overnight interest rate at the midpoint of a 50-basis-point operating band.” (Engert, Gravelle, & Howard, 2008, p. 1). During conventional times the Bank sets the target as the midpoint of the band, with the Bank Rate 25 basis points above the target rate at the top of the band, the interest paid on reserves at the Bank 25 basis points below at the bottom of the band. Prior to 1999 the main policy instrument used by the Bank to achieve the inflation target remained the Bank Rate until 1996, which was merely a 25 basis point mark-up

on the average yield on 3-month treasury bills at the weekly auction. Presently the target overnight rate itself is the policy instrument.

Post-1999, the system relies on the fact that the payment and settlement system must ultimately settle on the books of the Bank of Canada. Large financial firms and banks make up the members of the Large-Value Transfer System (LVTS). All LVTS participants have an account at the Bank of Canada, which lists their settlement balances. During operations during the day, participants may engage in transactions with each other and the Bank of Canada can know with certainty the financial position of each participant. During normal times, the Bank of Canada will usually target a zero level of excess balances in the financial system. (Lavoie & Seccareccia, 2006). Thus settlement balances and by extension reserves are themselves set at zero, completely independent of the interest rate.

If at the close of business any LVTS participant is in deficit or surplus they are encouraged to borrow (lend) between each-other at the announced target rate if they are in deficit (surplus). This target rate is reinforced by the fact that the Bank of Canada will lend or borrow at the extreme ends of the band. In this way, the bank constrains LVTS agents within the band and can achieve the over-night target rate (Engert, Gravelle, & Howard, 2008). If the underlying rate deviates too much from the target, the Bank may engage in repo and reverse repo operations to reinforce the target; in practice this is rarely necessary (Lavoie & Seccareccia, 2006).

By this process the target-rate becomes the shortest interest rate in the financial system, the embodiment of the Wicksellian concept of the bank rate. In addition, it is argued that through the Bank's influence on this rate, all other interest rates along the yield curve will be influenced by this base rate (Engert, Gravelle, & Howard, 2008). Ultimately then the base-rate is "anchored" by the central bank while other rates will be influenced by this rate in addition to other economic considerations (Thiessen, 2000). Thus the change in rates along the yield curve may not be effected one-for-one. Some authors question the evidence presented by the Bank on the links between interest rates, finding such evidence lacking at best (Rowley & Visano, 2004).

The transmission of monetary policy operates through several 'official channels'. First, the effect on the spectrum of interest rates hampers (or helps) the economic agent's ability to access credit. Second, asset prices will have an inverse relationship with the direction of the rate change. This will influence agents through a wealth channel. Third is the change in the exchange rate which corresponds positively to the interest rate. The last official channel is "the effect of

changes in interest rates on people's expectations of future interest rates, growth, and inflation" (Bank of Canada, 2012). Each of these channels will effect demand and, through changes in the output gap, influence the level of inflation.

Certain channels have become emphasized more than others post-implementation. For instance, the exchange rate channel has seen a great deal of evolution, from being actively interfered with in the form of currency interventions to its present state of being allowed to freely float (Lavoie & Seccareccia, 2006). This largely can be attributed to the fact that the inflation rate and exchange rate cannot both be controlled through one monetary instrument (Lavoie & Seccareccia, 2006).

Initiatives from the Bank since inflation targeting was adopted indicate an increasing emphasis on formalizing the importance of this expectations channel. From a focus on fixed announcement dates, enhanced communication, transparency and accountability all in the name of achieving price stability. These are all accompanied by an increase in the emphasis placed on inflation expectations and their role in the inflation generating process.

As Jenkins (2004) notes, "First and foremost, we want to anchor expectations about future inflation to our 2 per cent target." And that "communication has become another vital tool in the implementation of monetary policy. [...] Canadians are now more confident that inflation will be kept near the 2 per cent target." (Jenkins, 2004, p. 63). Examining the Bank of Canada's use of forward guidance during the financial crisis also serves to remind observers of "the fundamental importance of effective communications." (Carney, 2013, p. 15). This is predominantly due to the Bank's claim that inflation expectations remained anchored at 2% during the crisis and that its policy measure of forward guidance helped to lower long-term interest rates (Carney, 2013).

Of these four effects what is most noticeable is the stress the bank places on the unobservable expectations channel of monetary policy transmission (Rowley & Visano, 2004). Although initially this channel of expectations was not emphasized as the key channel it has since received widespread attention in the Bank of Canada literature. This fixation with unobservable variables is a consistent theme in inflation targeting literature.

Unfortunately constructing models which measure expectations is an extremely difficult process as expectations cannot be directly observed among other difficulties (Rowley & Visano,

2004). In addition the Bank relies on extreme lags in policy implementation and horizons of its goals (Lavoie & Seccareccia, 2006). These lags both have the effect of giving policy makers a fair amount of freedom between policy action and its impact which creates uncertainty and insulates the Bank from levels of criticism (Lavoie & Seccareccia, 2006). Given the length of time and weakness of the linkages within the transmission mechanism then, “the chain from a change in the central bank discount rate to the final target of the rate of inflation is a long and uncertain one.” (Arestis & Sawyer, 2004, p. 56).

The foundation of Wicksellian theory rests on the notion of an unobservable natural rate of interest around which short-run deviations may occur. The transmission process involves many unobservable factors including: output gaps, notions of unobservable inflation expectations and a long, uncertain transmission process. When these two are combined with largely unobservable or miniscule costs of inflation, one is led to question if monetary policy is truly as scientific as it claims to be.

Perceived Costs of Inflation

The Bank of Canada objective is to “preserve the value of money by keeping inflation low, stable and predictable” (Bank of Canada, 2015). The Bank believes this is the best contribution to economic well-being that monetary policy can provide. As inflation targeting advocates note “*in the long run*, the inflation rate is the only macroeconomic variable that monetary policy can affect.” (Bernanke, Laubach, Mishkin, & Posen, 1999, p. 10). Thus, the goal of price stability is something the Bank believes it both can and should strive to accomplish. In a large part the reason for targeting inflation is based on the perceived high costs of inflation. However, these costs are at best elusive and at worst non-existent. In this section we will identify some of the costs associated with high inflation and evaluate whether concerns over these costs is warranted.

The first cost caused by inflation which central bankers are concerned about is the category of so called ‘shoe-leather’ costs. These are summarized nicely by Pakko (1998), “In an effort to minimize the effect that inflation has on eroding the purchasing power of money, people have to spend more time and effort protecting the value of their nominal assets—wearing out their shoes on the way back and forth to the bank.” (Pakko, 1998, p. 37). Such costs cannot

easily be measured or observed but are still used as justification against even moderate to low levels of inflation (Pakko, 1998). In an economy where a large portion of economic transactions requires cash, such a cost could represent a large portion of GDP.

However, on a practical level the argument of ‘shoe-leather’ costs seems to hold little sway in the modern economies of today. The results of technological innovation surrounding money, such as debit cards and credit cards, means that the impact of ‘shoe-leather’ costs is most likely an insignificant portion of economic activity (Smithin, 1994). Recent data from the Bank for instance, continues to show the decline in cash holdings and a shift towards electronic means of payment (Henry, Huynh, & Shen, April 2015).

Although technological change has shifted the means of payment away from cash; financial innovation in the form of additional interest bearing accounts which keep pace with inflation, effectively means that “money itself is ‘indexed’” (Smithin, 1994, p. 159). Similarly, the argument for ‘menu costs’ suffers from the same weaknesses as ‘shoe-leather’ arguments. (Smithin, 1994, p. 160) Finally, even if such benefits were judged to be observable their likely magnitude would be small, especially in a relatively low inflation country such as Canada (Colleti & O'Reilly, 1998).

The most convincing argument which central banks have against inflation is the distortions it creates on the tax system (Ragan, 1998). An un-indexed tax system would see notable benefits from a low inflation environment (Colleti & O'Reilly, 1998). This is primarily due to the fact that inflation causes “bracket creep” and tax distortions which would be minimized in a low inflation environment (Colleti & O'Reilly, 1998). In addition taxation on capital gains or other investment income is based on the nominal rate of interest instead of real rates of returns, which implies investors will have to pay an additional ‘inflation tax’ (Kryvstov & Mendes, 2015). Smithin (1993) notes that all of the costs so far identified could be solved simply through indexing. However, the Bank of Canada views such a solution as undermining credibility and the hard-earned unobserved benefits of anchored inflation expectations (Colleti & O'Reilly, 1998). As soon as inflation is tolerated expectations would become unhinged and would feed into a cumulative inflationary process (Colleti & O'Reilly, 1998).

Another cost of inflation is the shortening of the planning horizon of contracts, especially with regards to labour negotiations and financial instruments (Colleti & O'Reilly, 1998). Inflation targeting is said to be a major contributor to reductions in “cyclical fluctuations in

unemployment for workers in all age and educational categories.” (Macklem, 2012, p. 2). Even if this is the result of a variety of policy results, it is still argued that price stability and inflation targeting likely played a major role in creating the environment for such improvements to take shape (Macklem, 2012). This is in direct contrast to typical neo-classical economic assumptions which would imply that the ability to adjust their wages downwards during periods of contraction would allow workers to more likely keep their job.

The rosy view of employment since the 1990’s is disingenuous and misses longer term trends within the labour market. Although there has been a reduction in employment variability, this is largely not due to the policies of a pro-labour environment. Largely, this is the result of an ‘income policy of fear’, heightened by globalization and the continuing erosion of unions and real-wages (Cornwall, 1990) & (Seccareccia & Lavoie, 2010). As former Federal Reserve Chairman Alan Greenspan noted, “Today, one can point to five- and six-year contracts--contracts that are commonly characterized by an emphasis on job security and that involve only modest wage increases. The low level of work stoppages of recent years also attests to concern about job security” (Greenspan, 1997). Despite inflation targeting, such fears were realized for many workers in the aftermath of the 2008 financial crisis.

When considering the costs of inflation it is important to note that many of these variables are unobservable or miniscule, yet the real cost of disinflation policies, namely higher unemployment, is a very real concern. As Smithin (1993) highlights “experience has shown that the pain of the recessionary periods required for disinflation is severe, [...] the time path of an economic variable, such as the unemployment rate [...] may depend crucially on its own past history. [...] the slogan of ‘short-term pain for long-term gain’ completely ignores this issue” (Smithin, 1994, p. 154).

While this view has been prevalent in heterodox economic circles for a long time, in the wake of the great recession such concerns are beginning to emerge in the mainstream (Summers, 2014). Many authors at the Bank now allow for the possibility of hysteresis (Kryvstov & Mendes, 2015), although as one would expect such influence only enters into the Bank’s calculations as a dampening effect on potential output. Consequently the presence of hysteresis is not a problem which can be solved in the long run through monetary policy (Bernanke, Laubach, Mishkin, & Posen, 1999).

Ultimately many of the chief architects and supporters are forced to admit that “obtaining direct empirical confirmation of a link between inflation and the overall economic performance of the economy is very difficult.” (Bernanke, Laubach, Mishkin, & Posen, 1999, p. 18). Although inconvenient, this fact has not deterred central bankers from continuing to insist on the unobservable benefits of inflation (Ragan, 1998). Unfortunately, the Bank’s case of trading off unobservable costs of inflation against observable costs of unemployment may have contributed to negative economic repercussions which persist today. This serves as a call for a more inclusive view within monetary policy, with attention paid to unemployment as well as inflation. Such a view need not be incompatible with inflation targeting (Setterfield, 2013).

Inflation Targeting and Productivity

No benefit which inflation targeting was to deliver has proven more false than the promised gains in worker productivity. The Bank readily takes ownership of this failure, “Indeed, over the longer term, productivity growth has the greatest potential to boost prosperity. Regrettably, it is also where our performance has been the worst.” (Macklem, 2012, p. 14). The performance of productivity in Canada has languished far below that of the United States and has remained a puzzle for many economists at the Bank (Macklem, 2012).

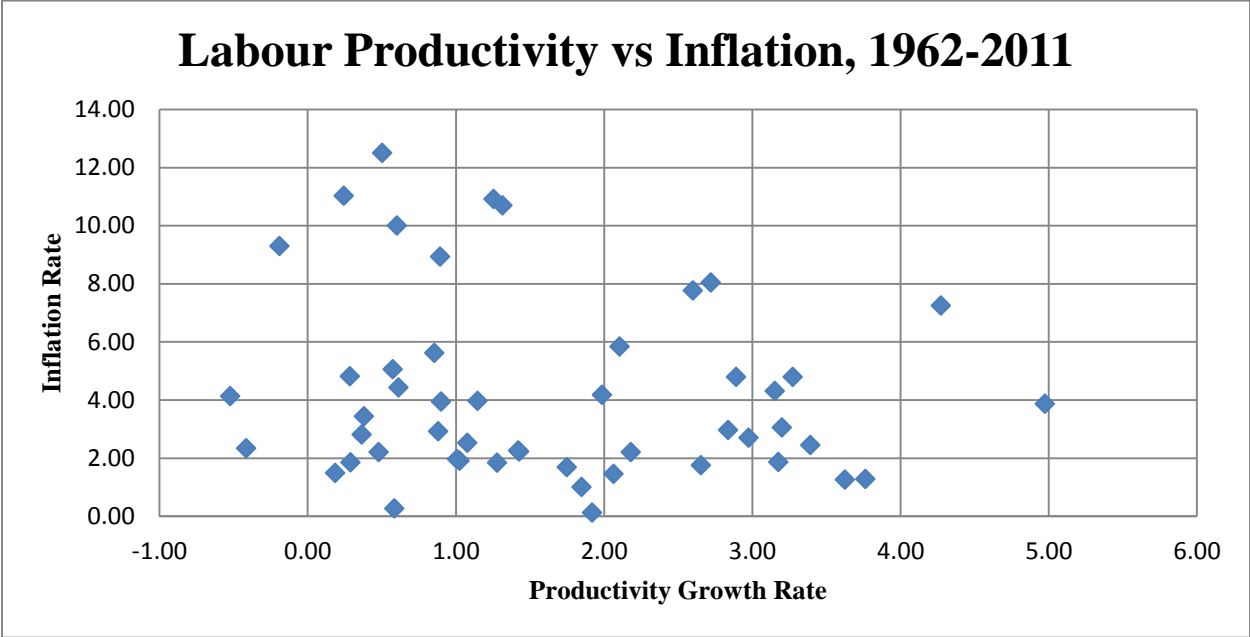
The relationship between inflation and productivity is largely based on the influential 1982 paper written by Jarrett and Selody. Among the key findings of this paper is that: “the implied multiplier of a one percentage point increase in inflation is a 0.31 percentage point decline in the rate of growth of productivity” (Jarrett & Selody, 1982, p. 366). Further findings include that the entire slowdown in productivity in the late 1970s could be explained entirely by the high rates inflation which preceded it (Jarrett & Selody, 1982). The implication of these results would be that a massive productivity gains could be achieved through inflation reduction.

The results of Jarrett and Selody (1982) are highly questionable at best. Even some of the Bank’s own researchers were sceptical of such findings noting: “This is especially clear when we consider, for example, the Canadian disinflation from 1990 to 1996, from a reasonably steady 5 per cent to a reasonably steady 2 percent. Is there a believable mechanism at work that could convert this 3-point disinflation into a permanent increase in the productivity growth rate of three-quarters of a percentage point?” (Ragan, 1998, p. 10). While intuitively the findings may

be unappealing, other issues such as robustness, co-integration and cyclical nature of the results cast further scrutiny on these results (Ragan, 1998). As can be seen in Figures 2 and 3, the negative relationship between productivity and inflation in the Canadian context is not apparent except in the period of 1973-1983.

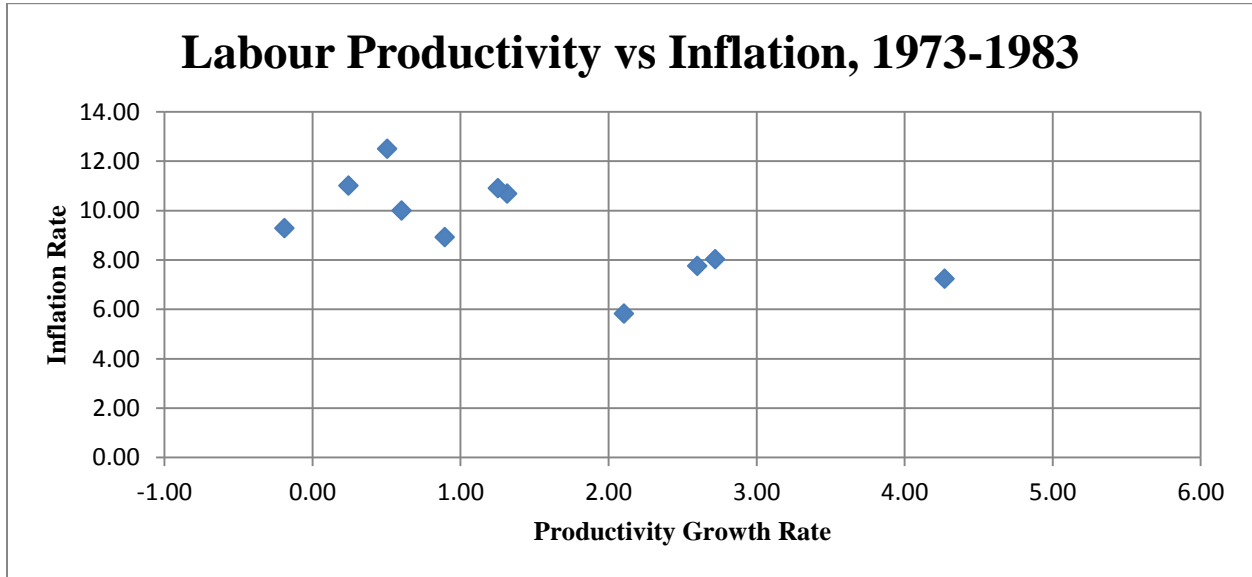
Additional productivity weakness can be observed when comparing Canada against a historically non-inflation targeting nation such as the United States. Wilkins (2014) notes that although many advanced economies have experienced productivity slowdowns, Canada has fallen behind relatively to other nations, and that labour productivity will likely only recover to slightly above pre-crisis levels. Although Wilkins does not believe the negative productivity effects to be long lasting, there is some recognition that hysteresis may be present in the labour market. This, she concedes, has resulted in potential growth now forecast as lower than pre-crisis levels (Wilkins, 2014). As a result the Bank is now forced to officially recognize the potential for unemployment as potentially having sustained negative effects on output and inflation (Kryvstov & Mendes, 2015).

Figure 2: Labour productivity measured against inflation



Source: Statistics Canada CANSIM Tables: 326-0021, 380-0017, 383-0010, Authors Calculations

Figure 3: Labour productivity measured against inflation, during the stagflation period



Source: Statistics Canada CANSIM Tables: 326-0021, 380-0017, 383-0010, Authors Calculations

A Proposed Simple Linear-Regression Model

i) Model:

In order to examine the influence of inflation on labour productivity we can construct a relatively simple linear-regression model with the following reduced form:

$$Prod_t = \beta_0 + \beta_1 Prod_{t-1} + \gamma_1 Inf_{t-1} + \gamma_2 Rwage_{t-1} + \gamma_3 Capu_t + \varepsilon_i$$

Where $Prod_t$ refers to the labour productivity growth rate at time t, $Prod_{t-1}$ is the lagged value of labour productivity growth rate. Inf_{t-1} Represents the annual rate of inflation lagged one period. In addition a measure of capacity utilization is included in our equation to account for the position of the economy within the economic cycle. Structuring the equation in this way allows us to see if the direction of causality implies that productivity is adversely affected by inflation.

We have also included the variable, $Rwage_{t-1}$, which denotes the annual growth rate of the real wage lagged for one period. The inclusion of the real wage variable is due to evidence that indicates periods of higher productivity are associated with higher levels of the real wage. Storm and Naastepad (2012) for instance find a “significant impact of real wage growth on productivity

advance” (Storm & Naastepad, 2012, p. 108). In order to ensure that the causality runs from higher real wages to productivity we lag this variable.

ii) Data:

The data we will use follows the methodology for calculating productivity and real wages from Sharpe et al. (2008). The data is annual Canadian data which we have extended from 1962 to 2011. The productivity measure is defined as Real GDP divided by hours worked, using 2002 chained dollars. From this measure we then could calculate the annual productivity growth. This measure of productivity is useful in that it represents overall economic activity in terms of overall work put into the economy. Our measure of inflation is computed by using the Consumer Price Index with 2002 as the base year. The CPI has advantages compared to the GDP deflator in that GDP is often revised, whereas the CPI is not. The real-wage is defined as total compensation for all jobs, per hour worked, in 2002 dollars, deflated by the CPI. This method of real-wage calculation can be understood as “consumption wages” (Sharpe, Arsenault, & Harrison, 2008, p. 1). In addition, we will include a measure of slack in the economy, represented by the capacity utilization rate. All data will be in percentage terms so as to ensure data uniformity.

The key variable of interest for us is the coefficient associated with the inflation rate. If the hypothesis of inflation having a negative effect on labour productivity is valid, we would expect to see a large negative coefficient associated with our inflation term. Other predicted results include a strong positive relationship between real-wage growth and productivity, as well as a positive relationship between capacity utilization and productivity. As slack in the economy contracts this should induce businesses to invest and thus increase capacity and productivity.

iii) Estimation:

Prior to estimation we conducted augmented Dickey-Fuller unit-root tests on the variables to ensure that they were stationary. Both the inflation rate and capacity utilization were found to be non-stationary and so were first differenced. All other variables included were found to be stationary. Next the Akaike-Information-Criterion was then used to determine the appropriate number of lags for the dependant variable which was found to be one. The model was then regressed using Ordinary Least Squares.

The initial findings yielded results which were not consistent with the hypothesis that inflation leads to negative productivity growth. The coefficient for the first difference of the inflation rate was found to be not statistically significant from 0 at the 90, 95 or 99% confidence level (see Table 2). However, it was found to be significant at the 90% level. This would imply that we are unable to conclude that inflation negatively impacts productivity in a meaningful way.¹ Additional findings include a strong positive relationship with real-wage growth and productivity, which was expected. However, our results for capacity utilization and productivity did not prove to be statistically significant.

Table 2: Regression results

Variable	Coefficient	Robust Standard Error	T-Statistic
Lagged Productivity	0.065	0.199	0.33
Inflation	-0.098	0.107	-0.92
Real Wage	0.274	0.124	2.20**
Capacity Utilization	0.109	0.060	1.79*
Constant	0.994	0.248	4.00***

* Indicates Significance at 90% **95% ***99%

iv) Robustness:

In order to ensure the validity of results we employed several tests for robustness. In addition to conducting Dickey-Fuller tests to ensure stationarity; we conducted a Durbin-Watson test for the presence of autocorrelation. Our model was found to have a test statistic of 1.933 which allowed us to confidently reject the presence of autocorrelation. A Ramsey RESET test was employed to determine if omitted variable bias was present. However, we were unable to reject the hypothesis that there was no omitted variable bias present. In addition a variety of test statistics were calculated to examine if there was multicollinearity. Results for both the variance inflation factor (VIF) and R-squared were within traditional rule-of-thumb limits which suggested a lack of multicollinearity (see Table 3).

¹ When the regression was run again with the period of stagflation (1973-1983) only, we found that the coefficient for inflation became more significant compared with the entire sample, but was still insignificant at the 90%. See Appendix B.

Although our robustness tests indicated that our findings were consistent and unbiased, it is entirely possible that alternative measures for inflation, productivity or inflation could yield drastically different results. While this point may undermine our findings, this fact applies equally to all studies which strive to evaluate the relationship between aggregate macroeconomic measures.

Table 3: Multicollinearity Test-Statistics

Variable	VIF	R-Squared
Productivity	1.67	0.403
Inflation	1.33	0.247
Real-Wage	1.62	0.383
Capacity Utilization	1.31	0.236

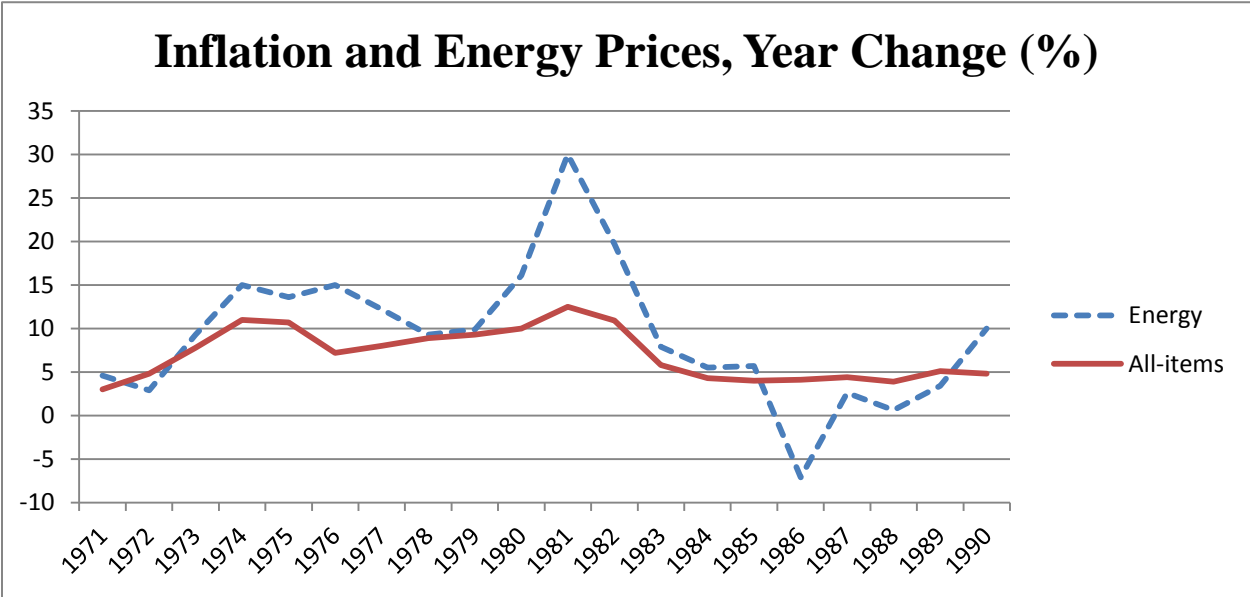
v) Conclusion:

Our findings, though limited, are consistent with what other authors have previously emphasized, namely, that the link between inflation and higher rates of productivity or growth are weak at best or non-existent (Ragan, 2000). When we repeated this empirical exercise for the period of stagflation of 1973-1983 only, we were still unable to conclude that inflation had a significant negative effect on productivity (see Appendix B). In addition, our results indicate that higher real wages were found to be a major contributor to productivity growth. While productivity has continued to increase in Canada since the major stagflation of the 1970s and 80s, real wages have not kept pace (Sharpe, Arsenault, & Harrison, 2008) Despite the promise of increased standards of living, and low levels of inflation, inflation targeting has not resulted in higher real-wages over the policy time period, despite lower levels of unemployment (Sharpe, Arsenault, & Harrison, 2008).

The period between 1973 and 1982 which is highlighted in Jarrett and Selody (1982) was one of high inflation and low productivity growth. As an alternative theory we propose that high energy prices (Figure 4) contributed to both of these factors. Such a supply shock would not be impacted by the monetary regime currently in place at the Bank of Canada, as energy prices are

determined through international market forces. Theissen has commented on this period specifically and categorized it as, “[...] the combination of generalized excess demand in the world economy and the OPEC oil cartel had sent inflation and unemployment soaring to post-war highs. Policy-makers in Canada and elsewhere were having difficulty dealing with this stagflation and were initially confused by the twin phenomena of rising inflation and high unemployment.” (Theissen, 2000, p. 11). Considering the structural turmoil of the stagflation period, it is unwise to draw far-reaching economic conclusions during this period.

Figure 4: Measures of comparing inflation and energy price



Source: Statistics Canada: CANSIM Table 326-0020

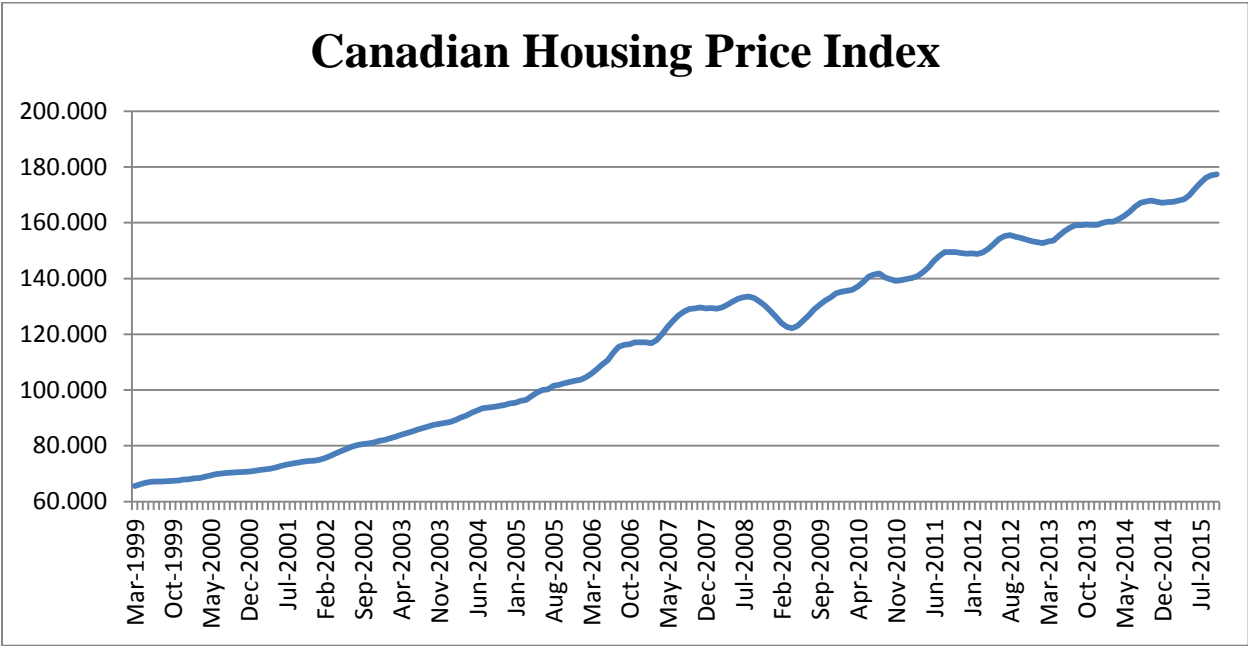
Low, stable inflation, with a blind eye to financial stability concerns.

The adoption of inflation targeting was supposed to bring along with it financial stability as stabilization in relative prices would lead to stability in financial prices. Instead, low, stable prices may have actively contributed to the worsening of the financial crisis (Carney, 2013). When one examines the initial promises of inflation targeting, financial stability remains one of its greatest un-doings. The impact of the financial crisis served to illustrate the limits of the Wicksellian policy in the face of rising asset prices and the appearance of the zero-lower bound.

One of the key benefits identified and emphasized by the Bank of Canada early in its adoption of inflation targeting was the extent to which financial services and financial innovation

behaved during high periods of inflation. One of the large costs of inflation was the perceived wasteful activity in which investors engaged in to hedge against inflation (Bank of Canada, 1995). Aside from financial activity, volatility in asset prices was at least partly blamed on speculative agents seeking to hedge against inflation. The Bank specifically highlighted several specific assets which were targeted as such hedges. These included, “real estate, gold and silver, precious gems and works of art” which were purchased specifically to protect themselves against inflation or even to make a profit (Bank of Canada, 1995, p. 22).

Figure 5: Growth in Canadian housing prices



Source: Teranet – National Bank House Price Index

The validity that asset prices, such as gold, which are determined on international commodity markets, could be dependent on Canadian inflation alone seems intuitively doubtful. Domestic assets which rely more on underlying local economic conditions, such as Canadian housing prices, may more believably be influenced by inflation. However, what is noticeable is that pre-crisis such asset prices barely entered into the Bank’s monetary policy decisions. Such asset prices were only relevant based on whether they entered into inflation calculations directly or if through the wealth channel of households they contributed to distortions related to aggregate demand and the output gap (Selody & Wilkins, 2004).

This view was not isolated to the Bank of Canada but reflected the overall belief in monetary economics that, “An aggressive inflation-targeting policy was considered sufficient to guarantee macroeconomic stability” (Gambacorta & Signoretti, 2013, p. 2). None-the-less the Bank of Canada stressed that inflation targeting presented the best policy to reduce the chances of asset-bubbles even developing (Selody & Wilkins, 2004).

Pre-crisis central bankers were content to operate as damage control agents should financial bubbles burst. This view was largely held due to the fact that bubbles were difficult to predict, monetary policy was inefficient at best and the belief that, “cleaning up after a bubble bursts is not too costly.” (Carney, 2013). Since then, there has been strong pressure for central banks to “lean against financial imbalances” as the costs from the recent financial crisis experience no-doubt had central bankers thinking otherwise (Boivin, Lane, & Meh, 2010, p. 1).

In addition to asset prices, opaqueness of financial instruments was also used as justification for inflation targeting. Specifically, “Large and frequent users of financial services have increasingly resorted to some very sophisticated techniques to limit their exposure to inflation-related risks. Examples include interest rate and currency swaps as well as futures and options contracts. The diversion of productive resources to the financial sector in an attempt to provide shelter from the effects of inflation has been substantial.” (Bank of Canada, 1995, p. 22). When one examines the underpinnings of the financial crisis both in Canada and abroad, it becomes obvious that opaqueness and lack of understanding about financial instruments contributed to the crisis (Carney, 2013).

A key example of opaque instruments contributing to the financial crisis in Canada was the case of the collapse of the asset-backed commercial paper (ABCP) market in 2007 (Chant, 2013). Trouble in the ABCP market emerged in 2007 when a domino effect of liquidity shortages froze the market, forcing the Bank of Canada to extend liquidity provisions to the market. After the initial losses were digested it appeared that financial markets were resilient enough to stand on their own and the liquidity positions were drawn down and stability appeared to be restored (Lavoie & Seccareccia, 2012).

By 2008, however, the financial crisis erupted in the United States and the Bank was once again forced to take extraordinary measures. The implemented measures included lowering

nominal rates to the zero-lower bound, forward guidance, and forms of credit and quantitative easing (Lavoie & Seccareccia, 2012). The issues surrounding the zero-lower bound and its implications for inflation targeting has received widespread attention in the inflation-targeting literature post-crisis (Kryvstov & Mendes, 2015). The inability of the central bank to lower nominal rates below the zero-lower bound when required by the Wicksellian requirement that they do so, yields yet another criticism of the Bank of Canada's theoretical framework (Lavoie & Seccareccia, 2012).

What role then did inflation targeting play in the creation of such problematic scenarios? "The crisis made painfully clear that low, stable and predictable inflation and low variability in activity [...] can breed complacency." As well, "prolonged periods of unusually low rates can cloud assessments of financial risks and induce a search for yield. [...] These tendencies are particularly marked if there is a perceived certainty about the stability of low interest rates" (Carney, 2013, pp. 10-11). The question then is was this predictable? Not so, according to the models used by the Bank prior to the crisis, "None of these dynamics of the risk-taking channel of monetary policy is possible in the standard new Keynesian models, given their simplistic treatment of financial markets." (Carney, 2013, p. 11)

While none of the new Keynesian models were able to predict the crisis, the late Hyman Minsky developed a theory which could. The "financial instability hypothesis" correctly identified that 'stability is destabilizing' (Minsky, 1982). The evolution of businesses and investors engaging in progressively riskier modes of lending and borrowing fuels the instability of the financial system. This closely follows Carney's (2013) remarks about the situation in Canada and elsewhere when, "investors stretch from liquid to less-liquid markets." (Carney, 2013, p. 10)

Another contribution which Minsky had the foresight to envision was the state of macroeconomics leading up to the crisis. Namely, "I am afraid economists can never become mere technicians applying an agreed-upon theory that is fit for all season within an institutional structure that does not and need not change". (Minsky, 1982, p. 114). The confidence in the "science" of monetary policy and faith in the end goal of inflation targeting was proven misplaced (Setterfield, 2013).

If there was one positive outcome which came out of the financial crisis it was that it forced central bankers, including those at the Bank of Canada, to take financial stability concerns seriously (Poloz, 2015). The implementation of inflation targeting did not turn out to be the solution to financial issues associated with higher levels of inflation. Instead inflation targeting allowed central bankers at the Bank of Canada to become too comfortable (Poloz, 2015) and take the underlying institutional structure of the economy as given (Minsky, 1982). Furthermore the reliability of the system to handle financial imbalances both during the build-up and burst of the financial crisis was revealed to the world. What has become apparent then is that inflation-targeting has not proven to be the macroeconomic stabilizing factor that it was promised to be.

Efficacy of Inflation Targeting

If one strictly considers inflation, then by-and-far inflation targeting has been an unqualified success story in Canada (see Table 1). Inflation has remained low and close to the 2% target and inflation variability has fallen drastically. Questions remain however, both within the mainstream, and from alternative points of view to what extent inflation targeting can take credit for the low levels of inflation seen by inflation targeting nations.

Ball & Sheridan (2003) find for instance that “there is no obvious theoretical reason that inflation targeting should affect average output growth.” (Ball & Sheridan, 2003, p. 263). In addition they find that overall inflation targeting does not improve the country’s economic performance (Ball & Sheridan, 2003). In Canada’s case, it should be noted that even Bank officials note that inflation in Canada was tamed during the 1980’s (see Figure 1), prior to the implementation of inflation targeting (Lane, 2015). The downward trend in inflation was similarly echoed in many of the nations which subsequently adopted inflation targeting, leading to little indication that inflation targeting itself could take credit for such a development (Angeriz & Arestis, 2006). Furthermore, Seccareccia and Lavoie (2010) also find that the evidence on the efficacy of inflation targeting on the inflation rate is unconvincing. In addition, they find that inflation targeting has a distributional bias against labour and that an alternative policy mix would yield more efficient results (Seccareccia & Lavoie, 2010).

Focusing on the evolution of output and employment yields mixed results. Epstein & Yeldan (2009) have found that many nations have encountered a decline in rates of growth while some nations growth rates (including Canada) have remained unchanged. Although this may be

partly explained by world-wide influences, the performance of macroeconomic growth under inflation targeting remains decidedly inconclusive (Epstein & Yeldan, 2009).

Expanding these results to the international context Pollin and Zhu (2009) find that no discernable benefits are found from implementing an inflation targeting regime over other disinflation regimes. Moderate levels of inflation are associated with positive levels of growth in lower-income nations, while in OECD countries the relationship between inflation and growth is more conditional on the underlying factors driving inflation itself (whether it is demand or cost led) (Pollin & Zhu, 2009). These findings once again imply the need to focus on the underlying causes of inflation in order to derive a meaningful relationship with economic growth, if any is to be found.

Conclusion

The experience of inflation targeting in Canada has left a lot to be desired. In this paper we have covered some of the dubious theoretical underpinnings with which inflation targeting was adopted. In addition, we have contrasted the unobservable costs of inflation with the real costs of foregone output and ignorance of financial stability concerns. Links between productivity and inflation were found to be not statistically significant once the period of stagflation was removed from our regression. Moreover, the link between inflation and growth has repeatedly been found to be inconclusive at low to moderate levels of inflation.

The framework of inflation targeting led the Bank of Canada to ignore real risks and costs to the Canadian economy and in particular to the Canadian worker. It is ironic then that a policy with a stated goal of improving the economic well-being of Canadians has such dubious economic foundations. Though the Bank has recently taken into account the role of financial stability and admitted that there exists a great deal of weakness on the demand-side of the economy, greater movement to recognizing the real costs of unemployment and the output gap is needed. In this way the Bank of Canada can fulfill its goal and improve the economic well-being of Canadians.

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Appendix A: Stata Output: Lag Selection, Regression Statistics & Robustness for 1961-2011.

Selection-order criteria

Sample: 1967 - 2011

Number of obs

=

45

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-63.0909				1.15536	2.98182	3.04168	3.14241
1	-60.0998	5.982*	1	0.014	1.05799*	2.89333*	2.96816*	3.09407*
2	-59.5818	1.0362	1	0.309	1.08163	2.91474	3.00455	3.15563
3	-59.5596	.04432	1	0.833	1.13074	2.9582	3.06297	3.23924
4	-59.4609	.19733	1	0.657	1.17846	2.99826	3.118	3.31945
5	-58.8505	1.2208	1	0.269	1.20102	3.01558	3.15028	3.37691

Linear regression

Number of obs = 48

F(4, 43) = 8.22

Prob > F = 0.0001

R-squared = 0.3902

Root MSE = 1.0219

Prod	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
Prod						
L1.	.0657596	.1995279	0.33	0.743	-.3366269	.468146
dif_inf						
L1.	-.098183	.1071988	-0.92	0.365	-.3143699	.1180039
Rwage1						
L1.	.2742235	.1246131	2.20	0.033	.0229173	.5255298
dif_cap	.1089627	.0608333	1.79	0.080	-.0137193	.2316446
_cons	.9949222	.2484631	4.00	0.000	.4938486	1.495996

. estat dwatson

Durbin-Watson d-statistic(5, 48) = 1.933516

. ovtest

Ramsey RESET test using powers of the fitted values of Prod

Ho: model has no omitted variables

F(3, 40) = 2.26

Prob > F = 0.0966

Appendix B: Regression Results for the stagflation period of 1973-1983.

Below is the output when running our model for the period of stagflation. Although the coefficient for our inflation variable has become more significant, it is still not significant at even the 90% level (since it has a p-value of only 0.258). Therefore, we can conclude that even during the period of stagflation, inflation was not the primary driver of the slowdown in productivity growth.

```
Linear regression                                Number of obs =      11
                                                F( 4,      6) =      4.27
                                                Prob > F      =      0.0565
                                                R-squared     =      0.6820
                                                Root MSE     =      .96153
```

Prod	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
Prod L1.	-.4397981	.3453248	-1.27	0.250	-1.284777	.4051812
dif_inf L1.	-.1569352	.1256843	-1.25	0.258	-.4644736	.1506032
Rwage1 L1.	.3909513	.1344045	2.91	0.027	.0620755	.7198272
dif_cap	.0820717	.1121714	0.73	0.492	-.1924018	.3565452
_cons	1.682038	.579757	2.90	0.027	.2634236	3.100652

```
. estat dwatson
```

```
Durbin-Watson d-statistic( 5, 11) = 2.528199
```

```
. ovtest
```

```
Ramsey RESET test using powers of the fitted values of Prod
```

```
Ho: model has no omitted variables
```

```
F(3, 3) = 0.57
```

```
Prob > F = 0.6732
```