C·I·R·P·É·E

Centre Interuniversitaire sur le Risque,
les Politiques Économiques et l'Emploi

Cahier de recherche/Working Paper **16-04**

A Stable 4% Inflation Could Get Canadians One Half Million More Jobs

Pierre Fortin

Avril/April 2016

Fortin : Department of Economics, University of Quebec (Montreal)
fortin.pierre@uqam.ca

Background paper in support of presentation at the Bank of Canada Seminar "Towards the 2016 Renewal of the Bank of Canada's Inflation-Control Target" held in Ottawa in November 2015. I am very grateful to Bank of Canada management for providing this opportunity of reflecting on the inflation-control strategy. I thank Robert Amano, José Dorich, Deputy Governor Timothy Lane, Angelo Melino, Rhys Mendes, Kevin Moran, Stephen Murchison, Lise Pichette, Christopher Ragan and William Robson for their help, comments and suggestions. The views expressed are purely my own.

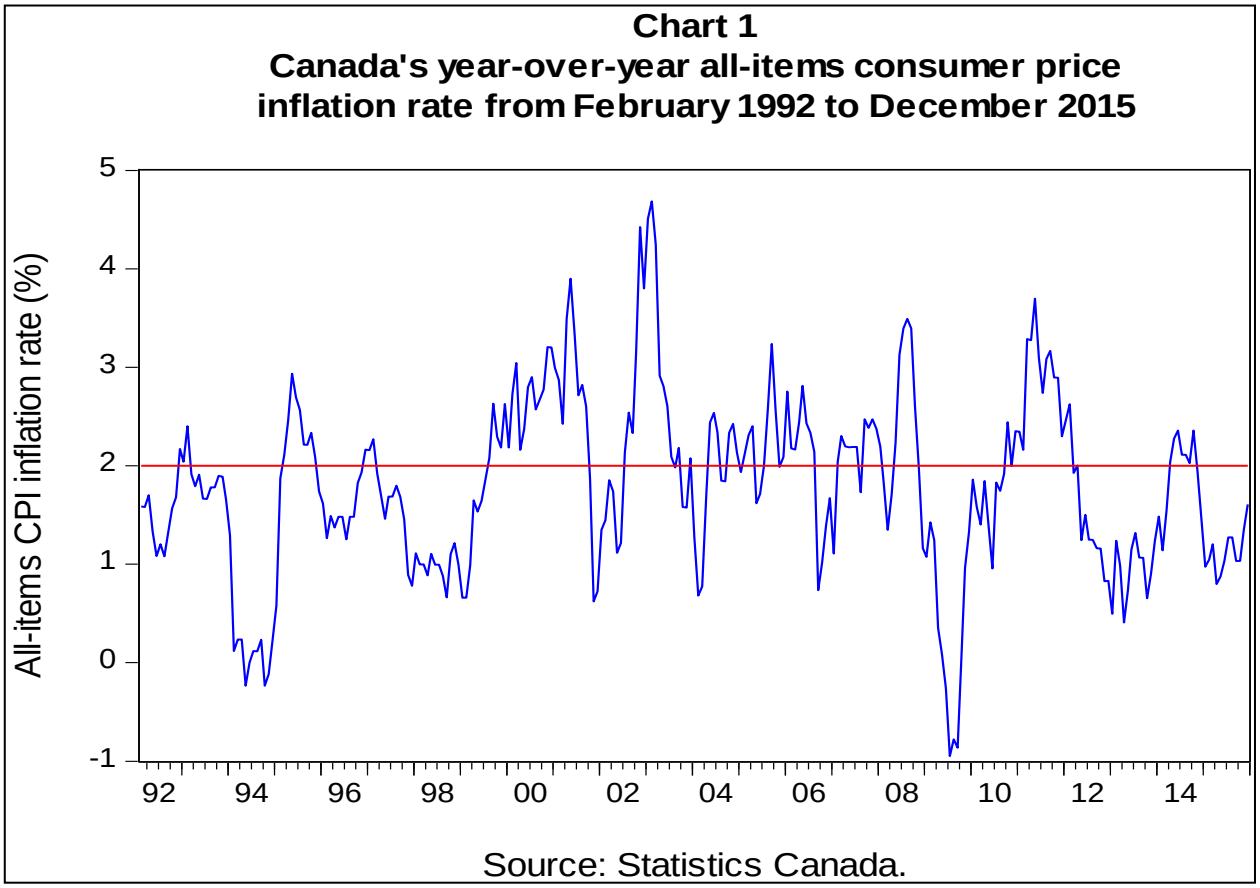
Abstract:
The Inflation-Control Agreement between the Government and the Bank of Canada is reviewed and renewed every five years. In this paper, I propose that the upcoming 2016 agreement increase the inflation target by 2 percentage points, from the current 2% to 4%. I first note that the room to stimulate economic activity and employment when the Bank of Canada judges that it is needed has narrowed dangerously in the past 25 years. I argue that the only fully effective means of freeing the Bank from the operational straightjacket into which it has fallen is setting the inflation target at 4% instead of 2%. I then report of evidence that the strong resistance of Canadian employers and employees to money wage cuts generates a significant permanent trade-off between inflation and unemployment at the macro level when inflation is less than 5%. Combining these two strands of observations, I conclude that moving to 4% inflation would generate about one half million more permanent jobs for Canadians and, over time, add some $50 billion per year to domestic income.

Keywords: Inflation target, zero lower bound, anchoring of expectations, downward nominal wage rigidity, Bank of Canada, inflation-control agreement, monetary policy.

JEL Classification: E5, E6, H3, J3.

Introduction

Since the first Inflation-Control Agreement between the Government and the Bank of Canada in February 1991, the Bank has been able to keep the CPI inflation rate within the control range of 1 to 3% set around the official target of 2%. According to Chart 1, the headline CPI inflation rate has averaged 1.8% over this time interval.[1] In her November 2014 speech in Calgary, Deputy Governor Côté stated that the Bank's flexible inflation-targeting regime had served Canadians well by providing "a beacon and an anchor" to guide economic decisions. Any change to the system now would have to be solidly justified. In her own words, "the bar for change is high."



[1] In any given month, the year-over-year inflation rate reported in the Chart is the percentage change of the all-items CPI relative to the same month of the previous year. Between February 1992 and November 2015, the monthly standard deviation was 0.9 percentage point around the 1.8% average. Between January 1974 and November 1983, mean inflation had been five times as high (9.5%) and the standard deviation around it twice as large (2.0 points). In the inter-recession period from December 1983 to December 1990, the standard deviation was 0.52 point around a mean inflation rate of 4.4%.

Keeping inflation at a low level within a specified 2-point-wide range is a good arrangement. There remains to determine at what level of inflation to position the whole apparatus. This has to be revised periodically, this time at the end of 2016, in the light of new events and knowledge.

I am going to argue that adjusting the control range upward somewhat would be highly beneficial on net for the welfare of Canadians. The benefits would by far exceed the costs. I find the related evidence that has developed in the eight years since the 2008-09 recession started compelling. To be specific, I will suggest that the mid-point of the control range be increased to 4% from the current 2%. I am not a trailblazer on this. I will just add my name to those of respected economists such as Olivier Blanchard et al. (2010), Laurence Ball (2013) and Paul Krugman (2014), who have all made a similar suggestion recently.

The paper has two parts. Part I first notes that the room for monetary stimulus needed by the Bank of Canada when it finds it necessary to support aggregate demand has narrowed dangerously in the past 25 years. It develops the argument that the only fully effective option that can free the institution from the operational straightjacket into which it has fallen is setting the central bank's inflation target at 4% instead of 2%. Then, after showing that inflation is better anchored in long-term expectations today than 25 years ago, Part II presents evidence that the strong resistance of Canadian employers and employees to nominal wage cuts generates a significant, policy-relevant permanent trade-off between inflation and unemployment when inflation is less than 5%. One implication is that moving to a 4% inflation target would generate several hundred thousand more permanent jobs for Canadians.

More specifically, I show in Part I that the room for monetary stimulus available to the Bank of Canada has suffered from a two-sided squeeze in the past 25 years. The "neutral" real level of the policy interest rate below which monetary policy can be stimulative when needed has decreased, while the lowest real level that can be attained has increased. The room to manoeuvre between ceiling and floor has shrunk from some 9 percentage points in the 1980s to less than 4 points today. This drop is not inconsequential. I calculate that if the range of interest rates available for monetary stimulus had been only 4-point wide – instead of 9-point or wider – in the 34-year period 1958-1991, the lower bound on the policy interest rate would have been binding 19% of the time. This is not a negligible frequency.

I go on to observe that from 2009 to 2015 the policy interest rates followed different time paths in the United States and in Canada. In the United States, the Federal Reserve kept the federal funds rate to the floor. In Canada, however, the overnight financing rate was increased to 1% in 2010 and kept at this level until the economy fell into recession at the beginning of 2015. I explain this evolution by underlining the fact that the Bank's conventional measure of potential GDP collapsed in 2008-2011, so that, from 2011 on, the recovery was seen as nearly complete even if, until 2015, actual real GDP remained 4% below the path that potential GDP would normally have continued to follow had there been no recession in 2008-2009.

I then argue three things. First, the Bank's conventional potential GDP was trapped by a mechanical downward bias and the "hysteretical" scarring effects of the Great Recession, leading the Bank to believe there was full recovery while there actually was not. Second, even if the Bank had tried to fill the 4% gap between actual output and the projected no-recession potential, it would have been prevented to do so by the zero lower bound on the policy interest rate. Current analyses and forecasts support the view that the zero lower bound will continue to hinder the effectiveness of monetary policy in the future. Third, regulation and supervision, macroprudential measures, fiscal policy and unconventional monetary tools such as forward guidance, long-term asset purchases and negative interest rates can help monetary policy, but they cannot fully alleviate the zero lower bound constraint.

Given this set of constraints on conventional monetary policy, I turn to the remaining option, namely that of increasing the inflation target of the Bank of Canada to 4% from the current 2%. I suggest that it would be feasible, would solve the zero lower bound problem, and would bring large long-term income and employment benefits to the country on net. The permanent employment level would be about 290,000 jobs higher. It is, in my view, Canadian monetary policy's best shot at getting out of the quagmire.

Part II turns to a question that is central for monetary management: the connection between inflation and the output (or unemployment) gap – the Phillips curve. An intriguing fact is that, even if inflation was less than the 2% target rate on average in 2008-2015, there was nevertheless no plunge into deflation. This may have reinforced the Bank of Canada's view that the output was almost at potential. According to the flexible-wage "classical" view of the relation between inflation and unemployment put forward by Milton Friedman, and absent remaining cyclical factors, this would have meant that the Canadian economy had almost converged to

the unique equilibrium rate of unemployment that would be consistent with stable inflation.

Next, based on representative studies of the inflation-unemployment relation in advanced countries and on direct Canadian evidence, I try to make a judgment on whether the classical idea that there is a unique equilibrium rate of unemployment at a point where the long-run Phillips curve is vertical in unemployment-inflation plane is consistent with the events of the past five decades. The representative studies have established that in the last 30 years inflation in advanced countries has become anchored more tightly to long-term expectations and less responsive to unemployment. I show that Canadian price inflation data is consistent with these international results on stronger anchoring and weaker responsiveness to economic slack, but I find, in addition, that the long-run price Phillips curve is not vertical, but negatively-sloped at low levels of inflation.

This leads me to review the theory put forward by James Tobin that a likely cause of the non-verticality of the long-run Phillips curve at low rates of inflation is the universally-observed strong resistance of employers and employees to nominal wage cuts. I find that Canadian data is inconsistent with Friedman's classical wage flexibility hypothesis, but consistent with Tobin's resistance-to-wage-cuts hypothesis. The negative slope of the inflation-unemployment trade-off is significant around 2% inflation. Tobin was not only right, but relevant. It is simply not possible for Canada to choose its inflation target without paying attention to the long-term consequence for national unemployment. The policy implication of the result I get is that sliding up to 4% inflation from the current 2% along Canada's long-run Phillips curve could reduce the national unemployment rate permanently by 0.5 to 1.6 percentage points depending on the degree of nominal wage rigidity. The mean estimate would be a permanent increase of around 210,000 jobs.

My conclusion on the choice of inflation target is that increasing the inflation target from 2% to 4% at the end of 2016 would allow Canada to achieve two objectives with one stroke: 1) recover the room to manoeuvre that monetary policy has lost in the past 25 years, and 2) return to the 5% unemployment rates that were common in the 1950s and 1960s. Overall, a stable 4% inflation could generate one half million more jobs for Canadians on average over time. The long-run increase in gross domestic income would be in excess of $50 billion per annum.

Part I: Escaping the two-sided squeeze on stimulative monetary policy

Monetary policy impacts economic activity mainly through its control of the risk-free short-term nominal interest rate r. In Canada, this policy interest rate is the overnight money market financing rate. Changes in the short-term interest rate initiated by the central bank influence medium- and long-term interest rates,asset prices and the exchange rate in ways that depends on financial market expectations and reactions. In turn, these movements are transmitted to aggregate demand for Canadian goods and services. The pressure of aggregate demand on labour and product market capacity finally impacts on wage growth and price inflation.[2] In domestic markets, borrowers and lenders entering a transaction usually understand that the value of principal is eroded by inflation during the loan period. Hence, crucially, they are likely to make their decisions on the basis of the real interest rate ρ, which is equal to the nominal interest rate r net of the market-expected rate of inflation π^e:

$$\rho = r - \pi^e.$$

If the Bank of Canada wants to slow down aggregate demand, it can increase the policy interest rate r at whatever level is required to set the real rate ρ high enough for the purpose, given inflation expectations π^e. If the Bank wants to stimulate aggregate demand, on the other hand, it can decrease the policy interest rate so that the induced decline in the real interest rate can do the job, again given expected inflation. Since Wicksell (1898), the economic literature has called the natural real interest rate the rate ρ^n at which aggregate demand neither decelerates nor accelerates when the economy is exempt from other short-term influences. In terms now widely used, it is the neutral real interest rate at which the economy operates "at full capacity with stable inflation after cyclical forces have dissipated." (e.g., Wilkins 2014). Monetary policy will be stimulative in this context if and only if the going real interest rate is less than the natural (or neutral) real interest rate ($\rho < \rho^n$).

However, if the central bank cannot decrease the nominal short-term interest rate r below some effective lower bound r^l, the real interest rate will be bounded

[2] An enlightening description of the transmission of monetary policy in Canada is still Governor Thiessen's 1995 HERMES-Glendon Lecture.

from below. Since $r \geq r^l$ implies $\rho = r - \pi^e \geq r^l - \pi^e$, there will be a floor $r^l - \pi^e$, as well as a ceiling ρ^n, on the extent to which the real interest rate ρ induced by monetary policy can be stimulative:

$$r^l - \pi^e \leq \rho < \rho^n.$$

What is the effective lower bound r^l for r? In a frictionless galaxy, r^l should be zero. Intuitively, it looks right to assume that the short-term nominal interest rate will not be negative because people will normally prefer holding their cash, which yields zero interest, to investing it at a negative interest rate. However, in practice the alternative of holding cash has storage, insurance and inconvenience costs that may justify a modest payment to a financial institution for keeping it. This implies that the effective lower bound r^l on the short-term nominal interest rate r could be a small negative percentage. The European Central Bank and the central banks of Denmark, Sweden and Switzerland have recently experimented with negative policy interest rates of the order of -0.25 to -0.75%, and the Bank of Japan has now announced (January 2016) that it will try it. Federal Reserve Chair Yellen and Bank of Canada Governor Poloz have indicated that they could push short-term rates below zero if the economy was under severe pressure. After mentioning that the Bank had earlier thought it could not cut its policy rate below $r^l = 0.25\%$, the Governor said that he now believes the effective lower bound to be around $r^l = -0.5\%$ (Poloz 2015b).

1.1 The room for monetary stimulus has shrunk in the past 25 years

Table 1 presents a summary of available estimates for the lower bound r^l, inflation expectations π^e and the neutral real rate ρ^n, as well as the resulting lower and upper bounds limiting the room for monetary stimulus in Canada over the three periods 1983-1991, 1992-2007 and 2008-2015. These are not absolutely precise estimates, but they should be of the right orders of magnitude.

The key message from Table 1 numbers is that stimulative monetary policy has suffered from a two-sided squeeze in the past 25 years. The neutral real policy interest rate ρ^n has declined by some 2.5 percentage points, from 4% in 1983-1991 to 1.5% in 2008-2015, while the effective lower bound $r^l - \pi^e$ on the real policy rate has increased by some 2.75 points, from -5% to -2.25%. As a result, the estimated size of the range of interest rates available for monetary stimulus ($\rho^n + \pi^e - r^l$) has shrunk by about 5.25 points, from 9 percentage points in 1983-1991 to 3.75 points

in 2008-2015. The room to manoeuvre in case a stimulus is needed would be less than half as large today as it was 25 years ago.

Table 1. Estimated two-sided squeeze on the room for monetary stimulus, Canada, 1983-1991, 1992-2007 and 2008-2015

	1983-1991	1992-2007	2008-2015
Estimated neutral real policy interest rate (ρ^n)	4%	3%	1.5%
Plus: Average market-expected rate of inflation (π^e)	4.5%	1.75%	1.75%
Equals: Estimated neutral nominal policy interest rate ($\rho^n+\pi^e$)	8.5%	4.75%	3.25%
Minus: Effective lower bound for the nominal policy interest rate (r^l)	-0.5%	-0.5%	-0.5%
Equals: Estimated size of range of policy rates available for monetary stimulus ($\rho^n+\pi^e-r^l$)	**9 p.p.**	**5.25 p.p.**	**3.75 p.p.**
Effective lower bound for the real policy interest rate ($r^l-\pi^e$)	-5%	-2.25%	-2.25%

Note: P.p. stands for percentage points. The policy interest rate is the overnight money market financing rate. Mendes (2014) has produced an estimate of the neutral real policy interest rate ρ^n of about 3% before 2009 and 1.5% since then; for 1983-1991, I set it at 0.75 p.p. above the estimate of Laubach and Williams (2015) for the United States. This choice of Canadian "premium" reflects the long-run differential between Canadian and U.S. short-term rates. For each period, the average market-expected rate of inflation π^e is the actual average of the all-items CPI inflation, assuming that expectations are not biased over a long-enough period. The effective lower bound r^l follows the indication given by Governor Poloz (2015b) that it could be around -0.5%.
Source: Calculations based on Statistics Canada and Bank of Canada data.

1.2 If enforced during 1958-1991, the current (near) zero lower bound on the nominal policy interest rate would have been binding 19% of the time

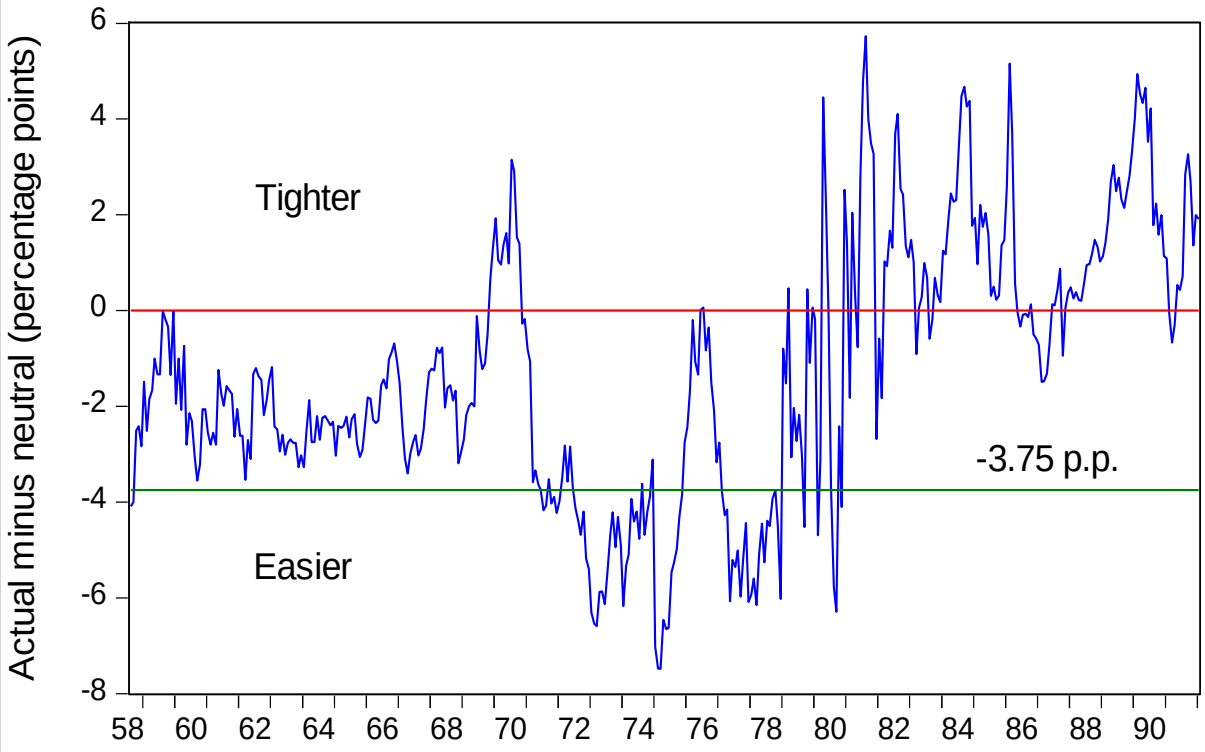
The reason we should worry that the room for monetary stimulus has shrunk is because the less it is possible to decrease the policy rate below the neutral level in case of need, the smaller the impact of monetary easing on output and employment and the more frequent and longer-lasting zero lower bound episodes will be.

One way of judging how binding the reduction in the room for monetary stimulus can be is to look at the historical experience of the 34-year period between 1958, when the Canadian money market had just acquired its maturity, and 1991, when the current inflation targeting regime was launched.[3] A natural indicator of

[3] A number of researchers have tried to answer this question with the help of calibrated dynamic stochastic general equilibrium models of the New Keynesian variety (e.g. Coibion et al. 2012),

the degree of tightness or easiness of monetary policy is the difference $\rho - \rho^n$ between the actual and neutral levels of the real policy rate. Abstracting from third influences, monetary policy can be said to be "tight" or "easy" depending on whether $\rho > \rho^n$ or $\rho < \rho^n$. According to Table 1 results, in any given month $\rho - \rho^n$ could be a negative number as low as -9 percentage points under the conditions of 1958-1991, but it could not have been less than -3.75 points under the squeezed policy rate interval after 2007. Hence, counting the months with $\rho - \rho^n < -3.75$ points in 1958-1991 gives an estimate of the frequency with which the zero (or -0.5%) floor would have been binding for monetary policy in this period.

Chart 2
Indicator of tightness or easiness of monetary policy based on the difference between the actual and neutral levels of the short-term interest rate, Canada, August 1958 to January 1992



Sources: Calculations based on Statistics Canada and Bank of Canada data.

but their results are highly model-dependent. Ambler concluded his 2008 survey of the costs of inflation by warning that "the quantitative importance of the impact of inflation on economic welfare depends on how nominal price and wage rigidities are modelled, which varies widely across different types of New Keynesian models." See also the critical survey by Maovreidis et al. (2014). Given the high degree of model uncertainty, my preference goes to relying on direct historical evidence.

How much time over this 34-year period did the short-term interest rate spend more than 3.75 points below its neutral level? The answer given by Chart 2 is: 75 months out of 402, or 19% of the time – not a negligible frequency.[4] This essentially occurred during the decade of the 1970s, with inflation averaging 9%.[5] The real interest rate could then go deep into negative range without any danger that the nominal rate hit the zero floor. If inflation had been around 2% the Bank of Canada could not have reduced the real rate to these low levels because the nominal rate would have been blocked at zero (or -0.5%).

1.3 From 2009 to 2015, the time path of the policy interest rate in Canada has not been the same as in the United States

Has the zero floor on the policy rate been binding since the onset of the Great Recession? The answer to this question is easy in the case of the United States, but more complicated in the case of Canada. One can see in Chart 3 that the time path of the nominal policy interest rate has not been the same in the two countries.

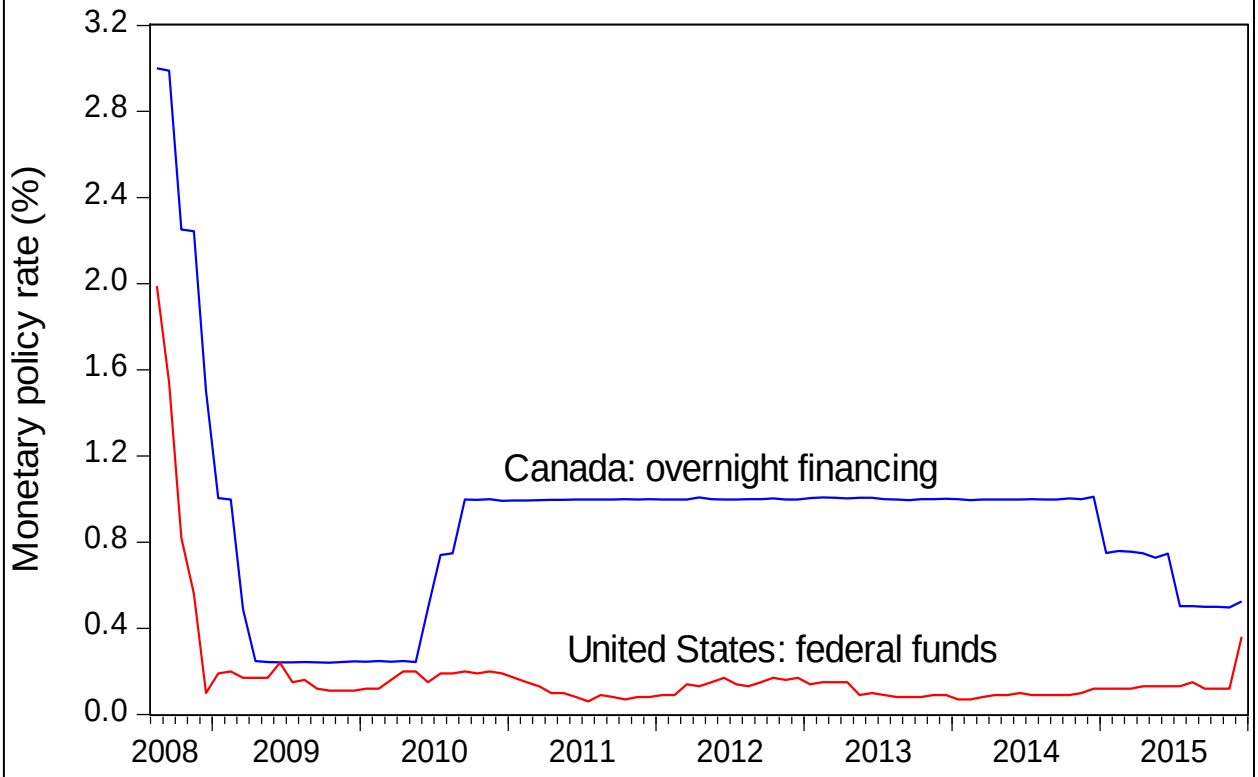
South of the border, the binding nature of the zero floor on the policy rate is clear. For example, Rudebusch (2009) calculated that the Federal Reserve's response to the crisis in 2008-2009 deviated significantly from its normal reaction function. He showed that, if the Fed's behaviour had been similar to what it had been in previous decades in such circumstances (following its "Taylor rule"), the nominal federal funds rate would have fallen to -5%. But since it could not be negative, the decrease was stopped at +0.10% at the end of 2008. The chart indicates that it was then kept between 0.10 and 0.20% until December 2015. There can be no doubt that the zero floor was binding in the United States over 2009-2015.

[4] The actual short-term interest rate used in the chart is the rate on 1-month prime commercial paper from 1958 to 1974 and the overnight money market financing rate from 1975 to 2015. Each month, the expected rate of inflation is approximated as the increase in the consumer price index between 7 months earlier and 5 months ahead. The neutral real short-term interest rate is set at a premium of 0.75 percentage point above the estimate of Laubach and Williams (2003; 2015) for the United States.

[5] The skeptical reader will immediately observe that the 1970s were a very special decade. Homework: can you name a decade over the past century that was not "very special"?

In contrast, over the same period Canada's policy rate was held around 1% most of the time. The Bank of Canada may not have felt that its actions were constrained by the zero lower bound. The nominal overnight rate was decreased to 0.25% in 2009, but re-increased to 1% in mid-2010 and kept there until the beginning of 2015. Only then, with falling oil prices obviously leading to a recession, was the policy rate decreased again, to 0.5%.

Chart 3
Monetary policy rates in Canada and the United States, August 2008 to December 2015



Sources: Bank of Canada; U.S. Federal Reserve.

The reason that the Bank of Canada raised its policy rate to 1% in mid-2010 is not difficult to understand. In mid-2010, there were initial signs that a robust recovery from the recession was en route, with real GDP increasing at an annual rate of almost 5% in 2009Q4 and 2010Q1. Core consumer price inflation[6] had

[6] The Bank of Canada's core consumer price index, called "CPIX", excludes eight of the consumer price index's most volatile components as well as the effects of changes in indirect

firmed up and was projected to remain near 2% through 2012. The Bank expected the economy to return to full capacity by mid-2011 and found it appropriate to put an end to the exceptional guidance it had given on the likely future path of the policy rate and to lessen the degree of monetary stimulus (*MPR*, April 2010, 1-2).[7]

1.4 From 2011 on, the Bank of Canada's conventional measure of potential GDP was giving the signal that the economic recovery was almost complete

From then until the beginning of 2015, the Bank found no reason in output and inflation data and forecasts for reversing the 2010 increase in the policy rate. It was kept at 1%. On output, real GDP was thought to have almost fully recovered from 2011 on, so that no need for further monetary stimulus was felt. On inflation, except for sporadic peaks and troughs in specific markets, it looked like the rate of increase in the core CPI index had stabilized. It was showing no tendency to slow down. This seemed to confirm that the economy was functioning near its potential.

Was the Bank's interpretation of output, inflation and other quantity and price data the correct one over 2010-2014? There is no question that it was honest, but it may have been incorrect.

In all likelihood, the remaining economic slack in 2010 and later was understated by the indicators the Bank relied upon. In addition, as I will argue in Part II below, the response of inflation to the shortfall of output and employment was probably weakened by the "anchoring" of inflation expectations and the strong resistance of nominal wages to being cut. These considerations make it arguable that the policy rate in Canada should have been held to the floor as it was in the United States instead of being increased to and maintained at 1% throughout the period.

The evidence that the Bank likely underestimated the remaining slack in 2010 and later is contained in Chart 4. The chart gives a picture of Canada's real economic performance per working-age person between 2007 and 2015.[8] Actual real GDP (the blue line) is compared to two different estimates of potential GDP. One (the red line) is a projection of the path that potential GDP could have

---

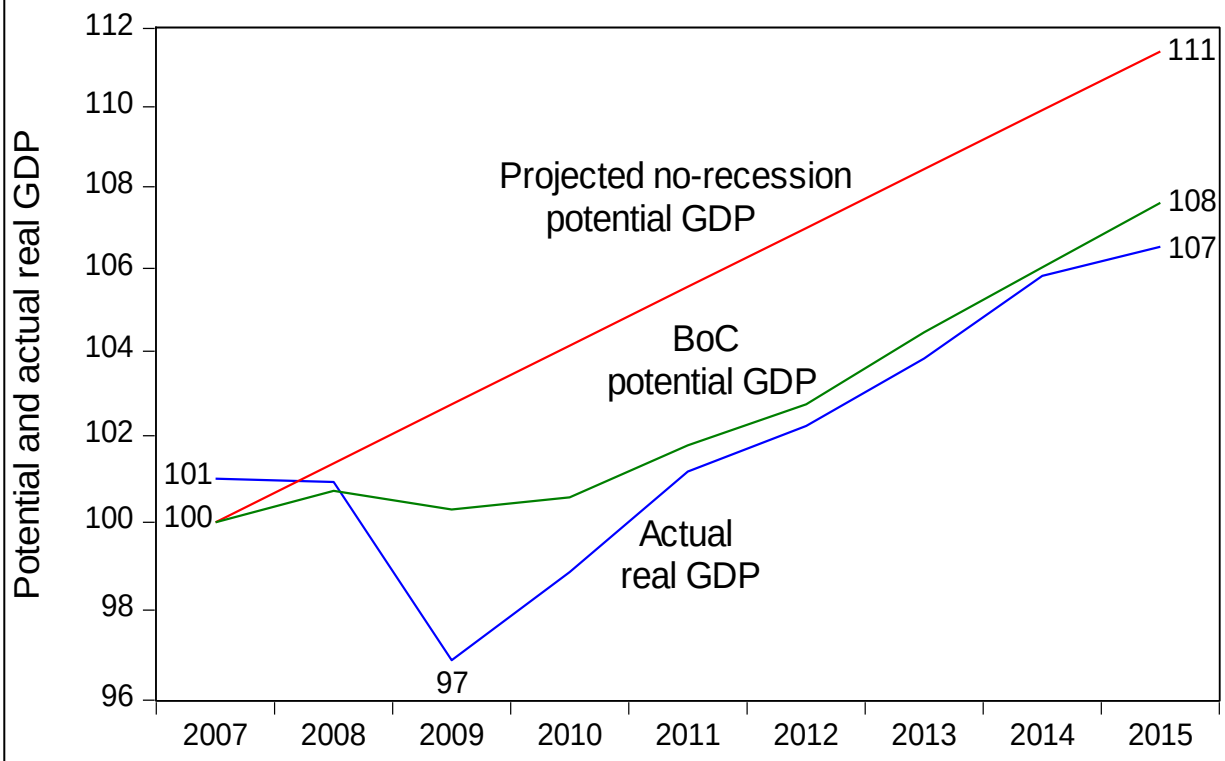
taxes on the remaining components. It is closely monitored in the short run by the Bank as an operational guide to better capture the underlying trend of inflation.

[7] Thereafter, *MPR* will refer to the Bank's periodical *Monetary Policy Report*.

[8] The reason for the focus on GDP per working-age person instead of total GDP is that I want to free analysis from the distorting effect that the declining growth rate of the working-age population (defined here as the 15-64 age group) has had on economic growth.

continued to follow if there had been no recession in 2008-2009.[9] The other (the green line) is the "conventional" measure of potential GDP published periodically by the Bank of Canada.[10] The percentage difference between actual real GDP (blue) and this conventional measure of potential (green) is the Bank's traditional measure of the output gap.

Chart 4
Projected no-recession potential GDP, Bank of Canada conventional potential GDP and actual real GDP PER PERSON AGED 15 TO 64, Canada, 2007-2015 (2007 potential GDP = 100, semi-log scale)



Source: Calculations from Statistics Canada and Bank of Canada data.

[9] This "projected no-recession potential GDP" is constructed as follows: starting at the same level as the Bank's conventional measure of potential GDP in 2007, it grows at a constant annual rate, which is equal to the average growth rate of the Bank's conventional measure over the period 2000-2007. Per working-age person, this earlier average growth rate had been 1.4 % per year. Given that Statistics Canada projects the working-age population to increase by 0.3% over 2015-2018, an average growth rate of 1.4% for potential GDP per working-age person implies a growth rate of 1.7% for potential GDP in the future.

[10] To be specific, I calculate the Bank's conventional measure of potential GDP for any given year as the average of the quarterly values that are reported for that year in the April *Monetary Policy Report* of the following year.

The chart makes clear why the Bank thought the economic recovery was nearly complete in 2011. Basically, in 2009 its conventional measure of potential GDP collapsed in sympathy with the drop in actual output. As a result, even if the recovering GDP was still far below the no-recession trend in 2011, it was drawing close to the Bank-estimated potential. The output gap between the blue and the green line shrank to a mere -0.5% and did not change much in the following years. Real GDP grew in parallel with the no-recession potential, remaining about 4% below it until the 2015 recession.

1.5 The fall in the Bank of Canada's conventional measure of potential GDP in 2008-2011 was due to its mechanical downward bias and to the "hysteresis" trap

So, the question is: why did the Bank's conventional measure of potential GDP fall and remain so much below the no-recession potential through the entire 2009-2015 period, suggesting that the recovery was almost complete all along and that no further monetary stimulus was needed?

There are two reasons. First, following recessions, the Bank's conventional measure – the green line – tends to be biased downward by construction. It combines "mechanical filters", which are essentially sophisticated moving averages of the data, and judgment-based conditioning economic relationships. Many researchers have warned that this methodology makes it hard to avoid building the cyclical drop in output into the estimated potential and thereby understating the actual shortfall from potential (e.g., Krugman 1998; Pichette et al. 2015). The drop in actual real GDP below trend in 2009 resulted from a collapse in aggregate demand. It does not make much sense, as the trajectories in Chart 4 imply, that 42% of it could be accounted for by a fall in the aggregate supply of human and material resources that the conventional measure of potential GDP is supposed to capture. This was clearly the work of the mechanical filters, which arguably had little to do with the behaviour of true potential GDP.[11]

[11] The Bank is not unaware of this problem. It admits having a hard time disentangling cyclical and structural factors (e.g., Wilkins 2014). Following efforts by its researchers (Zmitrowicz and Kahn 2014; Pichette et al. 2015), it now publishes a new "structural" measure of potential GDP. This new measure was about 1% higher than the conventional measure in 2015 (*MPR*, October 2015, 19).

There is a second reason. After a while, underestimating potential GDP and allowing the shortfall in actual output to go on may become self-fulfilling. The economy can get trapped in a slump because persistently-low aggregate demand destroys part of aggregate supply. "Hysteresis" effects take hold, which truly reduce potential. Evidence is accumulating in the recent literature that, if allowed to persist, a deep recession such as that of 2008-2009 can have long-lasting scarring effects that are destructive of aggregate supply. Skills depreciate, labour force withdrawals increase, the worker/job matching process deteriorates, fixed capital formation and investment in R&D slow down, good emerging firms fail, and so on (e.g., IMF 2009; Reifschneider et al. 2013; Ball 2014; Blanchard et al. 2015). These longer-term effects can add significantly to the short-term costs of recessions.

The presence of significant hysteresis effects caused by recessions has one straight implication for monetary policy: it should move as quickly and aggressively as possible to contain the recessions immediately when they start. This is the best way to prevent the longer-term deterioration of economic prospects and stop income and job losses from accumulating.[12] But once the damage is done, the central bank would be well not to hesitate to "push the economy against the limits of its capacity to signal the need for additional investments and to draw workers back into the labour force." (Wilkins 2015) This is directly echoing the advice Arthur Okun (1973) once gave about the need to nurture a "high-pressure" economy.

1.6 The Canadian slump of 2009-2015 has been very costly, but at any rate the zero lower bound would have prevented monetary policy to surmount it

Has attacking a recession with stimulative macroeconomic policy early on actually worked in the past? An IMF (2009) study of 88 recessions following financial crises in advanced and emerging economies over the past 40 years has answered this question affirmatively. Its systematic finding has been that "economies that apply countercyclical fiscal and monetary stimulus in the short run to cushion the downturn after a crisis tend to have smaller output losses over the medium run."

[12] Blanchard et al. (2015) rightly point out that "to the extent that some recessions are caused by an underlying decrease in growth, there is instead the risk of overestimating potential output during and after the recession, [which] may lead to too strong a response of monetary policy." However, even granted that there was restructuring going on, for example in the automotive and forestry sectors, it is highly unlikely that the 2008-2009 Canadian recession was caused by a significant fall in aggregate supply that would have escaped the vigilance of the Bank of Canada.

If the projected no-recession potential GDP (the red line in Chart 4) is the appropriate reference for non-inflationary full employment, one is compelled to conclude that the costs of the 2008-2015 slump in Canada have been very large. In 2015, the loss of income would have accumulated to some $625 billion since 2008.[13] Furthermore, the job shortfall in 2015 can be estimated at about 290,000.[14]

Could the Bank have closed this sticking 4% gap between the blue and the red line within a reasonable time horizon after 2010? No. This would have been impossible in view of the lower bound at zero interest rate. According to a rough calibration of the dynamic relation between real GDP and the short-term interest rate (Ball 1999), it would have taken a decrease of 4 percentage points in the interest rate in 2011 to do the job in one year, or a decrease of 2.5 points to complete it in two years.[15] The lower bound at zero (or -0.5%) would have kept this from happening.

1.7 The zero lower bound on the policy rate is likely to continue to hinder the effectiveness of monetary policy in the future

Now, what are the odds that Canadian monetary policy will be constrained by the lower bound on the policy rate in the future? They are important for two reasons.

First, with low interest rates worldwide, advanced economies are vulnerable to greater risk-taking on the part of households and businesses (Bean et al. 2015; Poloz 2015a). This raises the probability of occurrence of system dysfunctions,

---

[13] Calculated as follows: for every year multiply the vertical difference between the red and the blue lines by the 15-64 population, sum over 2008 to 2015, and multiply the result by the baseline 2007 potential GDP expressed in 2015 dollars.

[14] The estimated 290,000 job shortfall requires two assumptions. First, I take the equilibrium rate of unemployment in 2015 to be 5.9%. This is the average level reached by unemployment in the second half of 2007 – the lowest before the Great Recession. A 5.9% unemployment rate could be slightly inflationary in 2007, but likely not in 2015 in the wake of demographic change. At 7.1% in 2015, actual unemployment was 1.2 percentage points higher than this structural level. Second, I use 0.20 as the elasticity of the labour force participation rate with respect to changes in the employment rate. This is somewhat on the low side of the structural estimate by Fortin and Fortin (1999). It follows that the employment loss associated with an increase in unemployment from 5.9% to 7.1% must be about 17,946,600 x $((0.941/0.929)^{1.25} - 1) = 290{,}000$ jobs. Here, 17,946,600 is the 2015 employment level, and $1.25 = 1/(1 - 0.20)$.

[15] The Ball calibration is for the U.S. economy. If applied to the Canadian economy, the overall effect would be similar, with a larger fraction coming from the stimulative effect of an exchange rate depreciation.

particularly arising from excessive leverage, and of lengthy slumps with the policy rate constrained by the (near) zero lower bound (Reinhart and Rogoff 2014; Romer and Romer 2015).

Second, according to current forward real interest rates on long-term bonds, market participants do not seem to expect a rebound of real risk-free short-term interest rates in the United States in the next ten years. Most recent reviews of the factors behind the 30-year decline in the global neutral real interest rate agree and find it unlikely that a significant reversal of past trends will happen soon (e.g., IMF 2014; Blanchard et al. 2014; Mendes 2014; Rachel and Smith 2015; Summers 2015). Even those who are less pessimistic (e.g., Bean et al. 2015; Hamilton et al. 2015) warn that a reversal is highly uncertain.

If the global neutral real interest rate stays low as expected, it will tend to keep national neutral real rates (ρ^n) low for many years to come. In Canada, absent any big surprise on the domestic front, the size of the range of policy rates available for monetary stimulus ($\rho^n + \pi^e - r^l$) will stay about the same as reported in Table 1. The monthly probability that interest rate policy will be constrained by the zero lower bound in situations where stimulative monetary policy is needed will not be smaller in the future than it was in the past. Managing this kind of risk will remain a serious challenge for the Bank of Canada.

1.8 A greater diversity of well-coordinated policy instruments will be helpful, but will not fully alleviate the zero lower bound constraint on monetary policy

So, what do you do? You go back to basics and follow Jan Tinbergen's (1952) and Robert Mundell's (1962) advice on policy instruments. You add, you coordinate, you diversify, you follow comparative advantage.

First, recent history has made central bankers keenly aware that the current long period of low interest rates has increased the probability of occurrence of episodes of excessive risk-taking and asset-price bubbles. They now feel obliged to pursue not one, but two policy objectives: macroeconomic stability and financial stability. Following the Tinbergen rule, if the two objectives are to be achieved successfully, two coordinated policy tools are required. In addition, according to Mundell's rule of comparative advantage, interest rate policy is better suited to deal with macroeconomic stabilization, while regulation, supervision and targeted macroprudential actions are more effective lines of defence against systemic financial risks (Wilkins 2014; Poloz 2015a; Bean et al. 2015).

Second, when monetary policy cannot be sufficiently stimulative because the policy rate is constrained by the zero floor or has to respond to systemic emergency, fiscal policy needs to stage a comeback in the macroeconomic stabilization picture. However, fiscal-monetary coordination is difficult. Governments do not have the same degree of independence, flexibility and understanding of business cycles as central banks. As Romer (2012) has pointed out forcefully, many voters identify deficits with fiscal profligacy and find them morally offensive however depressed the economy is. Even if one agrees with the recent literature that the fiscal multiplier is significant in slumps (e.g., DeLong and Summers 2012), budget politics may prevent large and rapid increases in spending.[16]

Third, necessity being the mother of invention, the response of central banks to the two-sided squeeze on the room to cut interest rates has been to diversify their means of intervention. The three main "unconventional" monetary policy tools considered so far are forward guidance, large-scale asset purchases and negative interest rates.[17]

The first tool, forward guidance, was used by the Bank of Canada in 2009. The conditional commitment was made to keep the overnight financing rate at 0.25% for a year as long as the outlook for inflation did not change. The Bank's post facto evaluation of this use of forward guidance is that "it provided more certainty about the path of future short-term rates and reduced the risk premium built into longer-term rates." (Poloz 2015b; for a favourable assessment, see Woodford 2012) Other central banks have tried to reassure market participants that future interest rate increases will be measured and gradual.

The second unconventional tool is large-scale asset purchases – also called "quantitative easing" – by the central bank. Despite the label "unconventional", it is not a new idea,[18] but since the 1950s stimulative monetary policy has normally relied on purchases of short-term assets by the central bank (Thiessen 1995). The

[16] Meeting this challenge is not impossible, witness the simple explain-and-implement strategy adopted by the Liberal Party in the 2015 Canadian election. It was successful in convincing voters that a temporary increase in federal deficits based on infrastructure spending was desirable at that juncture.

[17] Governor Poloz mentions a fourth unconventional instrument that he calls "funding for credit." In his words, "the idea is to make sure that economically important sectors continue to have access to funding even when the supply of credit is impaired." (Poloz 2015b)

[18] In the 1960s, the U.S. Federal Reserve engaged in a major debt management exercise called Operation Twist, which involved large-scale purchases of long-term assets.

induced decrease in short-term interest rates in turn influences longer-term rates, asset prices and the exchange rate, with effects on aggregate demand and output. Quantitative easing means that the central bank is now out to influence longer-term interest rates through direct purchases of longer-term (public and private) assets instead of forcing its influence on long-term rates to work only through the indirect channel of short-term asset purchases. This is a natural way of getting longer-term rates to decrease and move economic activity forward even if short-term rates are stuck at the zero lower bound.

Existing evidence suggests – unsurprisingly – that recent large-scale asset purchases by central banks such as the U.S. Federal Reserve, the European Central Bank, the Bank of Japan and the Bank of England have been effective at lowering longer-term interest rates (Bean et al. 2015; Reza et al. 2015).[19] Potentially adverse effects on financial stability could be dealt with by combining quantitative easing with macroprudential measures. However, there remain concerns about the uncertainties of the transmission mechanism, the consequences of persistently low long-term interest rates, the size and stability of central bank balance sheets, international spillover effects, and the intrusion of politics into central bank decisions (Bernanke 2012; Rachel and Smith 2015; Evans et al. 2015).

The third unconventional tool is the possibility for a central bank of cutting its policy interest rate below zero, which means that the effective lower bound r^l on the nominal rate is no longer zero, but some negative number ($r^l < 0$). Again, what makes small negative interest rates possible is that the cost of holding cash may justify a modest payment to a financial institution for keeping it. Negative policy rates between -0.75 and -0.25% have already been observed in Europe, and they have been announced in Japan. Both Chair Yellen and Governor Poloz have recently indicated that negative interest rates are "on the table." While in 2009 the Bank of Canada thought that the lower bound on the overnight financing rate was about 0.25%, it now estimates that it may be about -0.5% (Poloz 2015b).

The practical question is: assuming negative interest rates are viable, can they improve the capacity of traditional monetary policy to manage employment, output and inflation? In its 2013 review of European experiments with negative interest rates, the Monetary Policy Committee of the Bank of England answered this question negatively. It was worried that a negative policy rate would induce significant substitution into cash over time and would have adverse consequences on the supply of credit, so that the transmission of monetary stimulus to the real

[19] So far, the Bank of Canada has not engaged in a program of quantitative easing.

economy would be more muted than normal (Bean 2013). Although they remain open to the possibility, Bank of Canada researchers have made similarly cautious observations. The recent experience of European banks with negative policy rates suggests that transmission to lending and deposit rates is less powerful than when policy rates are positive, because commercial banks are less likely to fully pass through declines in the rates. The researchers have concluded that it is not known yet whether negative policy interest rates are a viable policy tool over an extended period of time and how long policy rates could stay negative without disrupting markets or causing a surge in the demand for cash (Jackson 2015; Witmer and Yang 2015).

Unconventional monetary tools were never meant to replace traditional policy based on the management of short-term rates and to fully alleviate for the zero lower bound constraint. They seem to have been helpful, within limits. It is probably prudent to view them not as substitutes, but as complements to be used with caution in case of need. But macroeconomic policy cannot spend 20% of the time on spare tires. The main challenge remains how to relieve conventional monetary policy from the two-sided squeeze in which it is entrapped between a high floor due to the low inflation target and a falling ceiling due the long-term decline in the neutral real short-term rate.

1.9 Increasing the inflation target to 4% would solve the zero lower bound problem and bring large long-term income and employment benefits on net

There are three ways of extending the size $\rho^n - (r^l - \pi^e)$ of the range of policy rates available for monetary stimulus: decrease r^l, raise ρ^n or increase π^e. Decreasing the effective lower bound r^l would involve such measures as eliminating cash and allowing only electronic currency, on which negative interest rates could be levied easily. We will perhaps see this technological change in some future, but for the time being voters would clearly not accept it. Raising the neutral real short-term interest rate ρ^n would require measures that would change the saving-investment balance: slow down saving, accelerate investment and growth. One can think of many levers that can affect this balance, from demographics through education, public investment in infrastructure, innovation policy, taxation, income redistribution, and so on. This is a long-term challenge. In the short term, the only reasonable option is that of increasing the central bank's inflation target π^*, which is the main attractor of inflation expectations π^e.

Increasing the Bank of Canada's inflation target from 2% to 4% would reduce the lower bound $r^l - \pi^*$ for the real policy interest rate by two percentage

points. Following Table 1 taxonomy and numbers, this lower bound would go from -2.25% to -4.25% and the total room for stimulus $\rho^n - (r^l - \pi^e)$ would increase from 3.75 points to 5.75 points. I calculate that, with this wider moving space in 1958-1991, the policy rate would have hit the zero barrier only 5% of the time instead of 19%.

If the permanent inflation rate had been 2 points higher at the beginning of the 2008-09 recession, the Bank of Canada could have reduced the policy interest rate by 2 more points below its neutral value. According to Ball's (1999) calibration, this could have increased real GDP further by about 3.5% after 2 years. With this additional room available, the gap between actual GDP and the projected no-recession potential GDP (Chart 4) could have been closed by 2011 instead of persisting until today. The stakes are high. I have calculated above that the accumulated costs of the 2008-2015 slump in Canada could amount to some $625 billion in lost domestic income and that this implied a 290,000 job shortfall in 2015. These orders of magnitude imply that the benefits from raising the inflation target to 4% and dealing effectively with a recession of the size that struck Canada in 2008-09 would be substantial. And because the nominal policy rate would then almost never hit the zero floor, there would be rarely any need to call upon fiscal policy, long-term asset purchases or other extraordinary tools to offset the deficiencies of conventional monetary intervention.

On the cost side, there is a vast literature dealing with the distortionary tax that an increase in inflation can impose on holding cash, the unwanted shifts in income and wealth it produces when ill-anticipated, the uncertainty and confusion it generates about present and future relative prices, and the harm it does to saving and investment due to its interaction with less-than-fully-indexed tax and pension systems. However, this literature has not produced evidence that increases in inflation within the 0 to 4% range can harm the economy significantly, and redistributive measures could be designed to compensate obvious losers.

All considered, the resulting transitional and permanent economic and social costs of increasing the rate of inflation by 2 points from the current 2% level to the 4% level of the 1980s pale before the large long-term benefits it would generate in income and employment.

Part II: The anchoring of inflation expectations and the resistance to nominal wage cuts

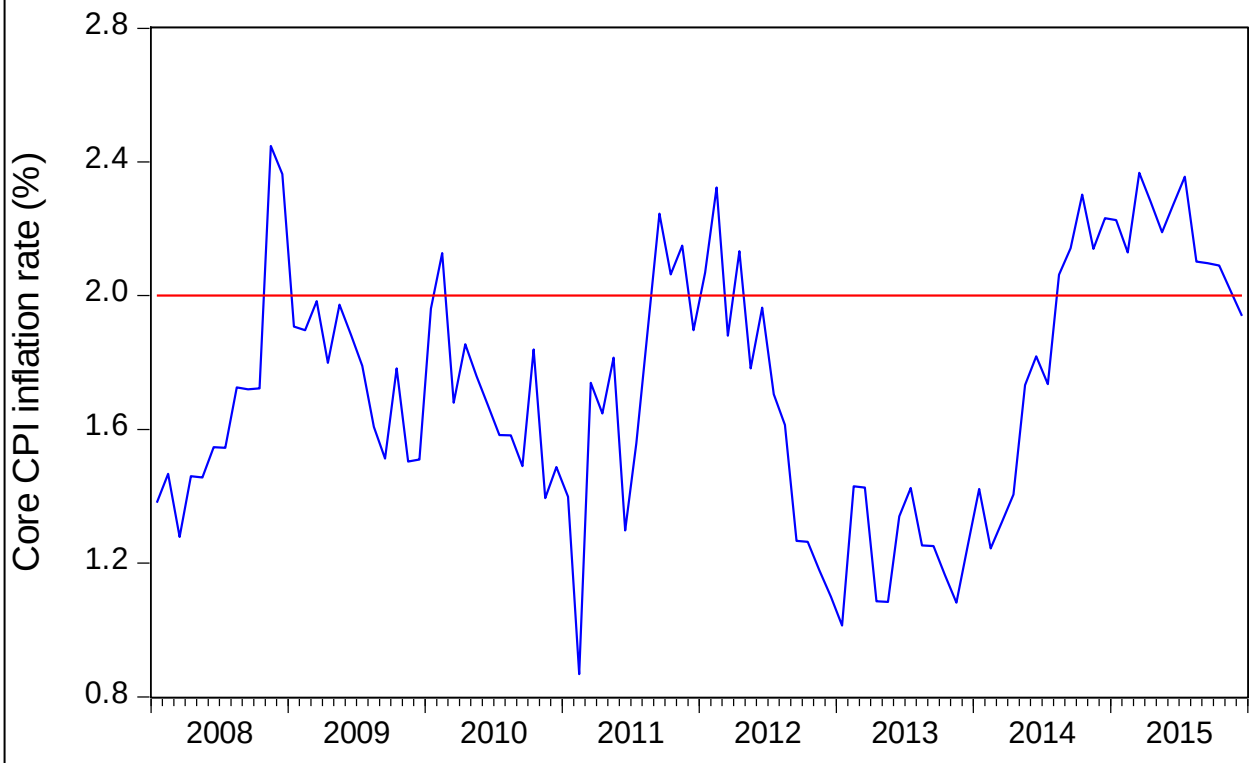
Part I has just concluded that the remaining option of increasing the inflation target of the Bank of Canada from 2% to 4% would be feasible, would solve the zero lower bound problem, and would bring large long-term income and employment benefits on net. It is Canadian monetary policy's best shot at getting out of the quagmire.

It is now time to focus the discussion on a central element in the picture: the connection between inflation and unemployment.

2.1 In 2008-2015, 2% inflation looked more like a ceiling than a target, but there was no plunge into deflation

Chart 5 begins by showing that, over the 8-year period 2008-2015, core CPI inflation averaged 1.7% in Canada. It spent 74% of the time below 2%. Although special circumstances may have been at work, it looks like the Bank of Canada did not fulfill its pledge that its approach to inflation targeting would be symmetric, in the sense that it would be "equally concerned about inflation rising above or falling below the 2% target." (Bank of Canada 2011) The Bank seems to have regarded 2% inflation as a maximum instead of a target that is to be achieved on average. This reinforces my earlier argument that monetary policy was not aggressive enough to close the output gap and that, instead of being raised and maintained at 1%, the overnight financing rate should have been kept to the floor just as the U.S. federal funds rate was (see Chart 3). A lower policy rate in Canada would have brought actual real GDP closer to potential and pushed inflation closer to 2% on average.

Chart 5
Canada's year-over-year core consumer price (CPIX) inflation rate from January 2008 to December 2015



Source: Statistics Canada.

On the other hand, Chart 5 suggests that there was no tendency for inflation to decline continuously to 1%, 0% and finally fall into a deflation trap. Specific shocks sometimes lowered it near 1% and sometimes raised it to 2%, but in the final analysis it hung around 1.7% without trending clearly upwards or downwards. According to the "classical" view of the relation between inflation and the output gap, such a situation of stable inflation on average could be interpreted as evidence that the output gap had been closed and that the Canadian economy was operating near or at its non-inflationary potential.

I do not know whether this is how the Bank of Canada interpreted the stability of inflation on average over 2010-2015. What I want to argue, though, is that this "classical" view of the relation between inflation and unemployment is

most likely incorrect given the fierce resistance that employers and employees oppose at all times to money wage cuts.

2.2 According to the "classical" view of the inflation process, there is a unique equilibrium unemployment rate and the long-run Phillips curve is vertical

Start with the macroeconomic relation between inflation and unemployment, known as the "Phillips curve" (Phillips 1958). According to the "classical" view of this relation formulated by Friedman (1968), there is no possibility of getting unemployment to decrease permanently by allowing inflation to increase permanently. If unemployment is held permanently below a critical level that Friedman called the "natural" rate, inflation will increase without limit. And if unemployment is held permanently below this critical level, inflation will decrease without limit, including into negative range (deflation). Hence, the only unemployment rate that is consistent with a stable rate of inflation is this natural rate. I will follow the custom of calling Friedman's theory the accelerationist theory and his natural rate the NAIRU – the "non-accelerating-inflation rate of unemployment."

The theory sees this unique equilibrium rate of unemployment as depending on structural factors that may change over time, but independent from permanent inflation. You cannot get permanently lower unemployment by trying to stabilize inflation at a permanently higher level. The absence of a long-run relationship between inflation and unemployment can be pictured as a line that is vertical at NAIRU level in unemployment-inflation plane. The long-run Phillips curve is a vertical line.

If true, the accelerationist theory simplifies the work of central banks. Once the low, stable and predictable inflation rate they aim for is achieved and cyclical forces have run their course, the unemployment rate will have taken care of itself. It will have converged to the NAIRU. Central banks that operate under an inflation target regime need not be concerned directly with the unemployment rate over the medium to long run. They simply move the policy interest rate to influence the labour and output gaps in the direction required to keep the rate of inflation on target over time.[20]

[20] The Bank of Canada has repeatedly emphasized that its commitment to inflation targeting is compatible with some flexibility on timing (e.g., Bank of Canada 2011; Lane 2015).

2.3 In the last 30 years, inflation in advanced countries has become anchored more tightly to long-term expectations and less responsive to unemployment

A number of contemporary authors have recently called this classical view of the inflation process into question, at least when inflation is less, say, than 5% or so (e.g., Tobin 1972; Akerlof et al. 1996; Fair 2000; Yellen and Akerlof 2006; Hall 2011). Contrary to what should be expected if the classical theory were valid, since the early 1990s inflation in the 0-to-5% range in advanced economies does not seem to have been very responsive to long stretches of high unemployment.

Three recent episodes in North America are illustrative. First, in the six years 1992 to 1997 Canada's national unemployment rate averaged 10%. This was 2 to 3 points higher than anyone's guess of what the NAIRU was at the time. However, core CPI inflation remained unchanged near 2%. Second, in the five years 2010 to 2014, Canada's unemployment rate averaged 7.4%. This was 1 to 1.5 points higher than any reasonable recent estimate of the NAIRU. But as Chart 5 has shown, core CPI inflation did not trend downwards. Third, in the United States over 2008-2015, the unemployment rate averaged 7.6%, which was significantly higher than the widely-held NAIRU of 5%. But core CPI inflation stayed around 1.7%.[21]

Beyond this simple look at the data, what is the take of formal statistical analysis? To see what is involved, it is useful to write the inflation equation – the Phillips curve – as follows:

(1) $\pi_t = a\pi^e_t + (1\text{-}a)\pi_{t-1} - bu_t + z_t$.

Here, π_t and π_{t-1} are the rates of CPI inflation in the current and past years t and t-1; π^e_t is the market-held expectation of long-term inflation; u_t is the unemployment rate; and z_t is the sum of other influences on inflation such as labour and product market structure, institutions and policies, the relative prices of capital and tradable goods, taxation, and so on. I focus on two key parameters. Parameter a captures the weight markets put on expected long-term inflation π^e_t (influenced by the inflation target being pursued, if any) relative to recently experienced inflation π_{t-1}. It can be viewed as the degree of anchoring of inflation to long-term expectations. Parameter -b measures the extent to which inflation responds

[21] Yellen and Akerlof (2006) give many more such examples from advanced economies during the Great Depression and the 1990s. They broadly make the same observation.

(negatively) to changes in unemployment in the short run. It is the slope of the short-run Phillips curve.

Statistical studies by the IMF (2013) and Blanchard et al. (2015) have recently examined the evolution of Phillips curves based on equation 1 in 20 advanced economies over the 55-year period 1960-2014. Their findings are representative and reflect an emerging consensus on the evolution of inflation dynamics in the past half-century. Succinctly put, a has increased and b has decreased.

As many others, the IMF and Blanchard et al. studies find that in most countries the degree of anchoring to long-term expectations a is greater today than in the 1970s and 1980s.[22] This is consistent with more central bank independence and the adoption of inflation targeting regimes across advanced economies. Businesses and households seem more inclined to expect that the central bank will hit its target. They pay less attention to the recent experience of inflation (see also Cunningham et al. 2010; Yetman 2015).[23] The implication is that positive or negative shocks to inflation arising from various sources leave a smaller and less persistent imprint on actual inflation today than in the past.[24] Central banks, including the Bank of Canada (e.g., Côté 2015), recognize that this by itself makes it easier to keep inflation on target without resorting to excessive monetary stimulus or restraint in the short run.

The IMF and Blanchard et al. studies also find that the slope of the short-run Phillips curve b is smaller today than before 1990. The immediate response of inflation to changes in unemployment is more muted in most countries. The implication of this result for monetary policy goes in a direction opposite to the

[22] Following Theil's (1966) suggestion, a direct test of the degree of anchoring of inflation expectations π^e to the target rate of inflation π^* consists of regressing π^e on π^* and π_{t-1}. Based on median inflation expectations extracted from the Bank of Canada's quarterly Business Outlook Survey over 2001-2015, the result is that inflation expectations in Canada would have been 75% anchored to the 2% target.

[23] Contrary evidence is reported for New Zealand by Kumar et al. (2015). The Canadian experience seems to have been different.

[24] To see this, consider a situation where markets expect long-term inflation to coincide with the central bank's inflation target π^*. Substituting π^* for π^e_t in equation 1, it follows that a unit one-year shock on z in year t = 0 will have a multiplier effect $\Delta\pi_t = (1\text{-}a)^t$ on the inflation rate π_t, for t = 0, 1, 2, 3, … The more businesses and households trust the central bank to maintain π^*, the larger a and the smaller the size and persistence of this multiplier effect on future inflation $(1\text{-}a)^t$ will be. Note that this result does <u>not</u> depend on the exact level of π^* that is targeted. It would hold if the trusted target was 4% instead of 2%.

first. It means, first, that trying to stabilize inflation may require larger movements in unemployment today than in the past, thus making the work of central banks more difficult; and second, that the weak responsiveness of inflation to high unemployment can easily trick central banks into believing that the economy has reached full equilibrium with output at potential and unemployment at NAIRU level. On net, the total effect of greater anchoring and flatter Phillips curves on the difficulty of stabilizing output, employment and inflation may vary from country to country.

These findings do not do away with the accelerationist theory, according to which the long-run Phillips curve is vertical at a unique NAIRU in unemployment-inflation plane. On the one hand, it can be seen from equation 1 that, if inflation is at rest in the long run and z is purified from short-term influences, then $- bu + z = 0$ and the classical NAIRU $u^* = z/b$ is established. This holds whatever the degree of anchoring and the trusted target rate of inflation are.[25] On the other hand, if b falls, the NAIRU z/b will rise. There will be a parallel shift of the vertical long-run Phillips curve to the right in unemployment-inflation plane. This is consistent with the accelerationist theory, which admits structural change in u^*.

2.4 In addition to conforming to international results, Canadian price inflation is inconsistent with classical theory and the vertical long-run Phillips curve

Is Canadian data consistent with the IMF-Blanchard results? Yes. To show this, I characterize the inflation process in Canada by the slightly more general form:

$$(2) \qquad \pi_t = \kappa[a\pi^e_t + (1-a)\pi_{t-1} - bu_t + z_t],$$

of which equation 1 is a special case corresponding to $\kappa = 1$. The parameter κ can be thought as a general "contraction" parameter affecting all determinants of inflation uniformly.[26]

Table 2 assembles the evidence. It is based on estimation of equation 2 with annual Canadian data for the 42-year period 1973-2014. Estimation results are

[25] This remains true if the short-run Phillips curve is nonlinear, as in Dupasquier and Ricketts (1998) or Laxton et al. (1999), in other words if the linear form - bu +z in equation 1 is replaced by a nonlinear function f(u, z). In that case, the unique NAIRU is found by solving the equation $f(u, z) = 0$ for $u = u^*$, which will be independent of both the degree of anchoring and the targeted rate of inflation.

[26] Take the expression and the symbol as coming from the German word *kontraktion*.

permitted to differ across three subperiods that are delineated according to the fall of mean inflation over time: 9.2% in 1973-1982, 4.6% in 1983-1991, and 1.8% in 1992-2014. Changes in anchoring and contraction are thus allowed to occur simultaneously, but independently over time. The left-hand variable π_t is the all-items CPI rate of inflation. On the right-hand side, π^e_t is a measure of expected long-term inflation, π_{t-1} is a one-year lag on π_t, u_t is the unemployment rate of men aged 25 and over,[27] and z_t is lumped into the regression constant, except for the effect of a dummy variable that captures the impact of wage-price controls under the Anti-Inflation Board of 1976-1978.

Two main results stand out. First, the degree of anchoring a has moved from decade to decade, reflecting the passage from moderate inflation before 1973 to high and volatile inflation in 1973-1982, to moderate inflation again in 1983-1991, and to low inflation under the targeting regime since 1992. Anchoring of inflation to long-term expectations has become nearly complete in 1992-2014.

Second, the contraction parameter κ is estimated with a high degree of precision across the three subperiods 1973-1982, 1983-1991 and 1992-2014. The estimated slide of κ from 100% in 1973-1982 to 72% in 1983-1991 and to 54% in 1992-2014 implies that, as the rate of inflation declined across these subperiods, its response became more and more muted to changes in <u>all</u> its determinants, and not only to changes in unemployment.[28] The whole inflation equation seems to have gone through a process of <u>general contraction</u> from the high inflation period of the 1970s to the moderate inflation period of the 1980s, and to the low inflation period of the 1990s and 2000s. The decreased sensitivity of inflation to unemployment -κb – from -0.49 in 1973-1982 to -0.35 in 1983-1991 and to -0.27 in 1992-2014 – is a phenomenon that has been captured by studies such as IMF (2013) and Blanchard et al. (2015). In equation 2 and Table 2 results, it is just one consequence of the general contraction of the wage Phillips relation.

[27] Reliance on the unemployment rate for men aged 25 and over aims at minimizing the effects of changes in the Unemployment (renamed Employment) Insurance Act, which seem to have mainly affected young and female workers (Fortin et al. 2001).

[28] The hypotheses that κ has not decreased in 1983-1991 relative to 1973-1982, and in 1992-2014 relative to 1983-1991, are both statistically rejected (with p-values = 0.003 and 0.056, respectively).

Table 2. Estimated equation for the annual change in the all-items consumer price index, Canada, 1973-2014

	Subperiod		
	1973-1982	1983-1991	1992-2014
All-items CPI inflation (π) Mean (Standard deviation)	 9.19 (1.53)	 4.57 (0.67)	 1.80 (0.71)
Estimated coefficients			
Contraction parameter (κ)	1.00	0.72 (0.09)	0.54 (0.10)
Degree of anchoring (a)	0.69 (0.20)	0.14 (0.24)	1.00
Weight of expected long-term inflation (κa)	0.69 (0.20)	0.10 (0.17)	0.54 (0.10)
Weight of one-year lagged inflation ($\kappa(1-a)$)	0.31 (0.20)	0.62 (0.20)	0.00
Slope of short-run Phillips curve ($-\kappa b$)	-0.49 (0.15)	-0.35 (0.13)	-0.27 (0.11)
Regression constant (κz)	4.66 (0.96)	3.35 (0.81)	2.54 (0.64)
Wage-price controls of 1976-1978	-2.52 (0.88)	…	…
Summary statistics	1973-2014		
Standard error of regression	0.99		
Adjusted R^2	0.90		

Note: Equation 2 is estimated by nonlinear least squares with 42 annual observations and 7 estimated coefficients: 2 for contraction κ, 2 for anchoring a, and 1 each for slope b, constant z and 1976-1978 wage-price controls. Parameter κ is normalized at 1.00 in 1973-1982. The estimate of parameter a is constrained to 1.00 in 1992-2014 after checking that its unconstrained estimate (slightly) exceeds this upper bound. Numbers in parentheses are standard errors. 1% is taken as 1.0. Inflation is defined as the annual log change in the average of the price index for the year (x 100). For 1973-1991, π^e_t is the simple 5-year moving average of all-items CPI inflation, lagged one year; for 1992-2000, it is the 6-year ahead mean forecast of inflation at the end of the previous year from Consensus Economics; and for 2001-2014, it is the 2-year ahead median forecast of CPI inflation at the end of previous year from the Bank of Canada's Business Outlook Survey. (Results are nearly identical if the Consensus Economics series is used for the entire period 1992-2014.) I have experimented with various potential supply-side influences that are part of z_t. The only survivor has been the dummy variable for wage-price controls, which is set to 0.5 in 1976 and 1 in 1977 and 1978.
Source: See text.

This constitutes prima facie evidence against the accelerationist theory that the long-run Phillips curve is vertical at a unique NAIRU in unemployment-inflation plane. In a long run with $\pi_t = \pi_{t-1} = \pi^e_t$ and with z_t freed from cyclical influences, equation 2 reads:

(3) $\pi = [\kappa/(1-\kappa)](-bu + z)$.

As long as $\kappa < 1$ is satisfied, as in 1983-1991 and 1992-2014, the long-run relation between π and u is not a vertical line, but has a finite negative slope $-\kappa b/(1-\kappa)$ and a finite intercept $\kappa z/(1-\kappa)$. Furthermore, when κ declines, as was the case from 1973-1982 to 1983-1991 and from 1983-1991 to 1992-2014, the slope flattens and the intercept decreases.[29] Basically, $\kappa < 1$ means that the pass-through of expected long-term inflation and past-year inflation into actual inflation is incomplete. As a result, permanent changes in unemployment and structural factors have permanent effects on inflation, and these effects remain finite instead of degenerating into unending price acceleration or deceleration as in accelerationist theory.[30]

The results in Table 2 confirm that the Canadian data of the past four decades are consistent with the findings of the IMF (2013) and Blanchard et al. (2015) about the rising degree of anchoring and the flattening of the short-run Phillips curve. But it is also the case that they are inconsistent with the accelerationist theory of the vertical long-run Phillips curve. The data suggest that the long-run Phillips curve is steeper than the short-run curve, but still negatively-sloped.

2.5 Strong resistance to nominal wage cuts is the "prime suspect" that can generate a negatively-sloped long-run Phillips curve at low rates of inflation

If these results are to be useful for monetary policy, they must be given an evidence-based interpretation. The increased degree of anchoring is simple enough to understand, but the empirical failure of accelerationist theory is still in need of an explanation. The question is: what, in the past three decades, has caused the major contraction of the whole Phillips curve that has made inflation significantly less responsive to high unemployment and has prevented expected long-term inflation and past-year inflation to be fully passed through into actual inflation? Why did κ fall by nearly 50% from 1973-1982 to 1992-2014, and what is the connection, if any, with the fact that inflation simultaneously fell from 9% to 2% between these periods?

[29] This follows from the fact that, as κ decreases, $\kappa/(1-\kappa)$ decreases too. According to the estimation results in Table 2, equation 3 was $\pi = 12.0 - 1.25u$ in 1983-1991 and $\pi = 5.5 - 0.59u$ in 1992-2014. This suggests convexity of the long-run Phillips relation in the making. However, the standard errors around these numerical estimates are too large for the elbow of the convexity to be identified with reasonable precision.

[30] If $\kappa < 1$, the long-run slope $-\kappa b/(1-\kappa)$ is steeper than the short-run slope $-\kappa b$, but still finite yet.

The Phillips curve literature has proposed a clear explanation of the effect of unemployment and the feedback of past and/or expected inflation on actual inflation. Basically, from the founding articles of Meidner and Rehn (1951), Phillips (1958), Lipsey (1960) and Samuelson and Solow (1960) down to the most recent textbook treatments (e.g., Blanchard and Johnson 2014), authors have viewed these effects on inflation as working mainly through wage bargaining. The fact that price and wage adjustments are synchronized over time is additional evidence that price changes are linked to wage changes (see Klenow and Malin 2011). Decreased responsiveness of price inflation to its determinants as identified by Table 2 results would broadly reflect decreased responsiveness of aggregate wage growth to the same determinants. Wage behaviour is therefore the first place to search for an explanation of the joint contraction of the determinants of inflation that Table 2 results have identified as inflation was trending down from 1973-1982 to 1992-2014.

Between these two periods in the Canadian business sector, average price inflation went down from 9% to 2% and average nominal wage growth from 10% to 3%. Switching from prices to wages, how could wage growth oppose increasing resistance to declining further as it was approaching zero? There is vast microeconomic and psychological evidence that workers regard pay cuts as hostile and unfair unless made to save their firms, and that firms are in turn reluctant to cut wages and to replace existing workers by others, willing to work for less, for fear of losing their good employees and suffering a serious drop in morale and productivity among their remaining employees. They would rather cut jobs than wages (Kahneman et al. 1986; Bewley 1999; Amirault et al. 2013).

Furthermore, the phenomenon of downward resistance to nominal wage cuts has been found to be extensive and persistent in advanced countries. There is considerable international and intertemporal evidence of a spike in the distribution of individual nominal wage changes at zero, with the spike becoming larger as inflation declines. Dickens et al. (2007) have summarized this evidence by scrutinizing a sample of 360 annual wage change distributions from 31 different datasets covering 16 OECD countries over the period 1972-2003. They found that an average of 28% of non-positive wage changes were actually pure nominal wage freezes. Wage freezes remain frequent even when unemployment has been high and inflation low for a long period of time (see Daly and Hobijn 2014 for the United States). Over the 31-year period 1982-2012 in Canada, 86% of first-year non-positive wage changes in large private-sector settlements were freezes, and this percentage showed no sign of declining during the past twenty years of inflation targeting (Fortin 2015).

The existence and persistence of downward nominal wage rigidity now seems to be an acknowledged stylized fact of labour markets in advanced countries (e.g., Yellen 2012; IMF 2013). But what impact does it have on the inflation process at the macro level? In his 1972 presidential address to the American Economic Association, James Tobin derived the consequence for the Phillips curve of adding to Friedman's classical model the simple constraint that nominal wages can never be rolled back. He showed that such a hard zero lower bound constraint on wage changes at the micro level destroys the accelerationist property at the macro level. The long-run Phillips curve is no longer vertical at some unique NAIRU for every inflation rate. As the economy approaches the low-inflation range, downward nominal wage rigidity "bends" the long-run Phillips curve to the right and away from the classical verticality that may exist at higher inflation rates. In the low-inflation range, less and less permanent inflation entails more and more permanent employment above the classical NAIRU.

Why is this so? As inflation declines to low values, the entire distribution of firm-level nominal wage changes moves down with inflation. A rising fraction of wage changes hit the zero wall and end up being wage freezes instead of wage cuts. (How many depends on the dispersion of the distribution of these wage changes.) The spike of the distribution of individual wage changes at zero rises. But with more and more frozen nominal wages not responding to increases in unemployment, the downward pressure exerted on aggregate wage growth and inflation by higher unemployment becomes weaker and weaker. This forces the central bank to manoeuvre monetary policy so as to bring unemployment to the higher and higher levels needed to achieve and maintain every additional point of inflation reduction.

Tobin's reasoning leads to a Phillips curve that explains aggregate wage growth: a <u>wage</u> Phillips curve instead of a <u>price</u> Phillips curve such as I have discussed above. It could look like the following:

$$(4) \qquad w_t = \kappa[a\pi^e_t + (1\text{-}a)\pi_{t-1} - bu_t + g^e_t + x_t] \,,$$

This equation explaining aggregate wage growth w_t is similar to equation 2 above, except for the last two terms, g^e_t and x_t. The term g^e_t reflects the fact that expected productivity growth g^e is an important determinant of wage demands and offers. The term x_t is the sum of other influences on wage growth such as labour and product market structure, institutions and policies, past changes in real wages,

past changes in the terms of trade, union power, taxation and so on. It is analogous to, but will partly differ from, the term z_t in equation 2.

The form of equation 4 for wage growth parallels that of equation 2 for price inflation in two respects. First, long-term inflation expectations π^e_t, past-year inflation π_{t-1} and the unemployment rate u_t appear as determinants of both wage growth in equation 4 and price inflation in equation 2. Second, there is a contraction parameter $\kappa \leq 1$ in equation 4 as well as equation 2. This parameter determines what fraction (between 0 and 100%) of expected long-term inflation and past inflation will be passed through into wage increases, and how responsive wage growth will be to changes in unemployment and all other influences on the outcome of the wage bargain.

The specific contribution of Tobin's narrative is to interpret the contraction parameter κ in equation 4 as the fraction of individual wage changes that are <u>not</u> already constrained at zero and hence can respond to a change in any of the usual determinants of wage growth. The interpretation of κ in equation 4 is therefore that it declines, and therefore the Phillips curve becomes flatter, when the labour market is more heterogeneous – the dispersion of wage changes being wider – and when wage growth and inflation fall into the low range. In particular, the implication for the inflation-unemployment trade-off is that it is negatively-sloped and convex in both the short and long runs.

2.6 Canadian evidence on wage growth is consistent with the hypothesis of strong resistance to wage cuts and inconsistent with classical wage flexibility

There is no defect in the logic of Tobin's theory. But this alone does not establish its actual quantitative relevance at the macro level. The theory has been criticized on a number of empirical grounds. First, although the assumption of "strictly no wage decrease" was made by Tobin as a theoretical simplification meant to help intuition and bring out the implications, it was an obvious simplification of reality.

Second, Tobin's no-wage-cut assumption applies only to job stayers subject to standard wage policies, while actual measures of aggregate wage changes w_t from surveys also reflects what happens to job switchers, to the net flow of entry into and exit from employment, and to firm-level readjustments pertaining to relative wages of personnel, work hours, nonwage benefits, promotion policy, merit and performance pay and so on (e.g., Akerlof et al. 1996; Farès and Lemieux 2001; Shafir et al. 1997; Crawford and Harrison 1998; Lebow et al. 2003; Elsby 2009; Daly et al. 2012).

Third, the observed spike at zero wage change could result not only from downwardly rigid wages, but also from some rounding at zero of small wage increases or decreases and from decisions by employers not to adjust wages upward or downward if current wages are still broadly appropriate. This observation based on "menu costs" of declaring or adjusting wages was made by Card and Hyslop (1997) and Crawford and Harrison (1998), among others.

Fourth, estimates of the contraction parameter κ should take account of variations in both inflation and the dispersion of wage changes, because the two can have opposite, and possibly offsetting, effects on κ, as when the dispersion become less pronounced at the same time as inflation is falling.[31]

At the end of the day, whether the long-run wage Phillips curve is vertical à la Friedman or negatively-sloped and convex à la Tobin is an empirical question. Three attempts at resolving this question as implied by equation 4 with Canadian data are Crawford and Wright (2001), Stark and Sargent (2003), and Fortin (2015).

Crawford and Wright (2001) studied changes in base wage rates in large private-sector unionized settlements between 1978 and 1999. They found that the dispersion of wage changes around mean fell as inflation trended downward over the sample period, and that menu-cost effects made the spike at zero wage change somewhat larger. Each of these features, but mainly the narrower dispersion of wage changes, reduced the estimated effects of downward nominal wage rigidity on the contraction parameter κ and worked against the Tobin view. They concluded that downward nominal wage rigidity was there, but that its economic significance was "relatively small" if inflation was held at 2 per cent. In other words, their view was that Tobin's theory was valid, but in practice irrelevant because the Phillips curve began to bend at an extremely low rate of inflation. Their results supported the Bank of Canada's view that it should not be too concerned with the damage downwardly rigid wages were causing to employment and that the 2% inflation

[31] In addition, a few Canadian researchers have debated on whether downward nominal wage rigidity deprives the economy from the "grease" that permits relative wage adjustments, and impacts negatively on employment at the micro level (e.g., Simpson et al. 1998; Farès and Hogan 2000). This sort of debate cannot determine whether downward nominal wage rigidity has an impact at the macro level. The relevant macroeconomic question is whether the downward resistance of nominal wages forces the central bank to use monetary policy so as to keep the unemployment rate at a higher level in order to establish and maintain the inflation rate on target. The answer to this question can be affirmative even if the distortion of the real wage structure does not harm employment at all at the micro level (Akerlof and Dickens 2007).

target should be maintained. More than ten years after the study had been published, the Bank was still citing the study as evidence that the effects of downward nominal wage rigidity did not appear to be economically significant in Canada (Bank of Canada 2011).

The main difficulty with the Crawford and Wright study is that the universe of large unionized firms on which they relied accounted for only 7 per cent of total private employment in Canada and was clearly not representative of the Canadian labour market. One eye-catching characteristic of these large unionized firms in the study is that the dispersion of wage changes ended up to be three times smaller than the average dispersion in the large number of national datasets examined by the International Wage Flexibility Project (Dickens et al. 2007), and five times smaller than the dispersion reported by Lebow et al. (2003) for the U.S. labour market. The very small wage-change dispersion in the Crawford and Wright sample could be explained by factors such as the strong resistance of large unions to increases in wage differentials across bargaining units. There is little doubt that wage changes are much more dispersed among the other 93% of Canadian private-sector workers that are employed in smaller or non-unionized firms, but were not part of the Crawford and Wright study. This raises a major difficulty because the study's small estimated wage change dispersion is the major reason that it found downward nominal wage rigidity to be practically irrelevant for employment unless inflation was below 2%.

Stark and Sargent (2003) was another attempt at estimating a Canadian wage Phillips curve with downward nominal wage rigidity along the lines of equation 4. These authors studied wage changes based on a representative macropanel of provincial labour markets over the period 1981-1999. Their wage variable was average weekly earnings. As Crawford and Wright, they did not adjust for hours worked per week and nonwage benefits were excluded. But they were careful to take determinants of structural unemployment such as various changes in social programs into account. They did not impose a priori that the Tobin model of no wage cut was true, but they tested its validity against the classical model of no resistance at all to wage cuts by embedding the two models in a more general one in which the lower bound of nominal wage changes could be any negative number and not necessarily zero as in the strict Tobin story. In this representative panel of the entire Canadian labour market, the dispersion of wage changes was estimated to be twice as large as in the union base-wage settlements studied by Crawford and Wright. The estimated lower bound of wage changes was a small negative number, so that the Tobin version of the Phillips curve fitted the data much more tightly than its classical competitor.

In Fortin (2015), I have tried to expand the direct evidence about the wage Phillips curve by estimating an equation for the change in total hourly compensation of all jobs in the Canadian business sector with annual macrodata over the 56-year period 1956-2011. As Stark and Sargent, I did not assume that the hard Tobin assumption of strictly no wage cut was true. Instead, I tested its validity against various possible degrees of resistance to wage cuts (from 0% to 100%) by freely estimating the degree of "thinning" of the distribution of nominal wage changes below zero. In this scheme, the Friedman and Tobin theories become polar cases corresponding to zero thinning (no resistance at all to wage cuts) and 100% thinning (no wage cut allowed), respectively. Also tested in the context of equation 4 were the wage-price controls of 1976-1978, determinants of structural unemployment such as the 1996 reform of employment insurance, the relative importance of terms-of-trade changes, and the direct feedback of recent wage changes on current wage decisions as suggested by Okun (1978) for the United States and observed in Canada by Amirault et al. (2013).

The main outcome of the tests I have performed is that reality is much closer to Tobin's view of the world with strong resistance to nominal wage cuts than to Friedman's classical construct with full wage flexibility. The data strongly reject the classical model. Relative to the latter, the estimated Tobin or near-Tobin variety also has the statistical advantage of greater parameter stability and significantly better ex ante forecasts through the post-1991 period of official inflation targeting. Contrary to the results obtained by Crawford and Wright with their sample restricted to large unions, the dispersion of wage changes estimated with data for the entire Canadian labour market is close to the average found in other advanced economies –as should perhaps be expected – and has not declined in the past 25 years. It is large enough to support the conclusion that the macroeconomic effects of downward nominal wage rigidity matter significantly, that the Canadian long-run Phillips curve is negatively-sloped and convex, and that keeping the rate of inflation at 2% has significant permanent unemployment costs for Canada.

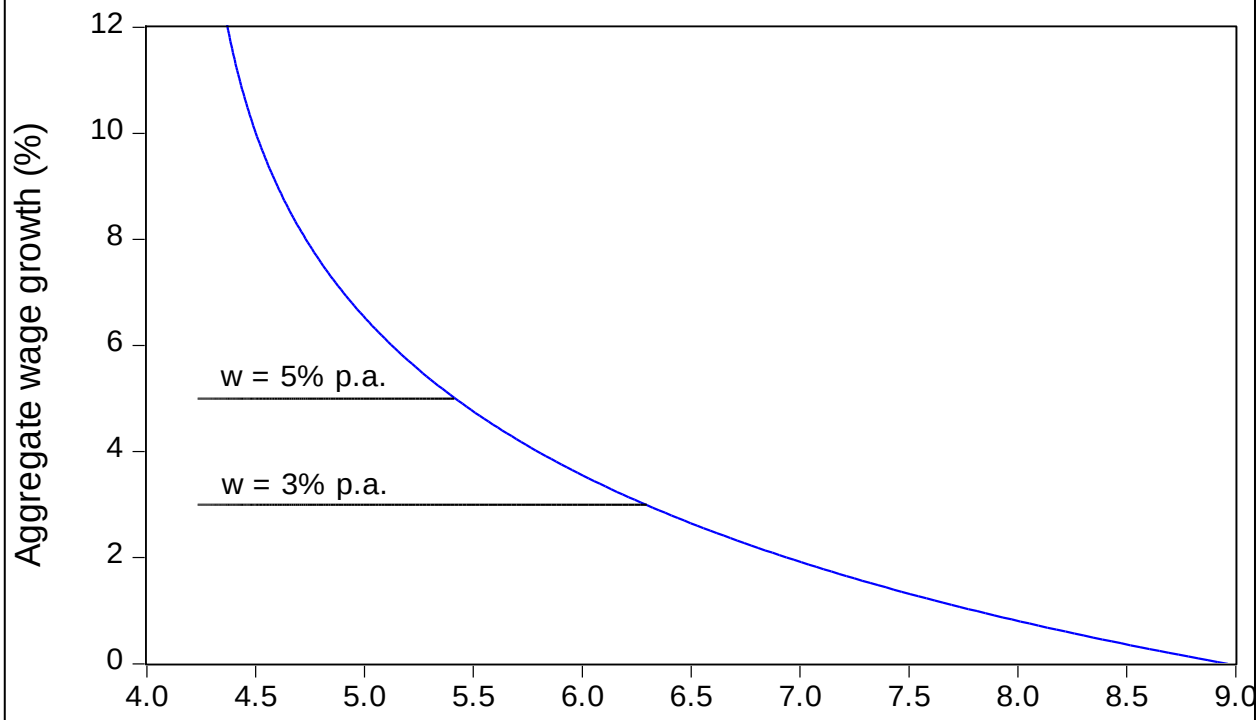
2.7 Sliding up to 4% inflation along Canada's long-run Phillips curve could earn the country around 210,000 more jobs permanently

Chart 6 and Table 3 show that these costs are large. The chart pictures the wage Phillips curve that is estimated in Fortin (2015) under the assumption that the degree of thinning of the distribution of individual nominal wage changes below zero is 75% ("moderate"). As suggested by Friedman, this curve is perfectly vertical at a permanent unemployment rate of about 4.25% for wage growth rates above 10 to

12%. As wage growth decreases below this range, it "bends" progressively to the right and becomes negatively-sloped and convex, significantly so when inflation is less than 5%. Lower and lower permanent wage growth is "purchased" at the cost of higher and higher permanent unemployment. For example, if nominal wages increase at the annual rate of 3%, as they did on average over 1992-2014 with price inflation at 1.8% and productivity growth at 1.2%, the permanent unemployment rate is estimated to be 6.3%. In the event that nominal wage growth would be raised to 5%, which would be the case if the inflation target was increased by 2 percentage points, the permanent unemployment rate would fall by 0.9 point, going down to 5.4%.

Chart 6

Estimated long-run wage Phillips curve showing the trade-off between aggregate wage growth in the business sector and unemployment under moderate downward nominal wage rigidity, Canada, 1956-2011



Source: Fortin (2015).

Table 3. Estimated permanent rate of unemployment in Canada under different hypotheses on the permanent rate of nominal wage growth in the business sector and the extent of downward nominal wage rigidity (percentages)

Extent of downward wage rigidity	(1) Wage growth = 3% p.a.	(2) Wage growth = 5% p.a.	(2) - (1) Difference
Full (100% thinning)	7.6%	6.0%	-1.6 p.p.
Moderate (75% thinning)	6.3%	5.4%	-0.9 p.p.
Light (50% thinning)	5.4%	4.9%	-0.5 p.p.

Source: Estimated wage Phillips curves in Fortin (2015).

These results for moderate downward nominal wage rigidity (75% thinning) are reproduced on the second line of Table 3. The table also reports what the permanent unemployment rates corresponding to 3% and 5% annual wage growth would be if, instead of moderate, downward nominal wage rigidity was full (100% thinning, as in the strict Tobin story) or light (50% thinning). It is seen that a 2-point increase in nominal wage growth would reduce permanent unemployment by an estimated 0.5 to 1.6 points depending on the degree of rigidity. These numbers should obviously be treated with caution and taken as orders of magnitude, not as precise estimates. The key point is that they are not inconsequential, keeping in mind that a 0.9-point decrease in the permanent unemployment rate in Canada translates into a permanent increase of about 210,000 jobs.[32]

Conclusion

I have argued that, by increasing the inflation target from 2% to 4% by mutual agreement at the end of 2016, the Government and the Bank of Canada would allow the country to achieve two objectives with one stroke: 1) recover the room to manoeuvre that monetary policy has lost in the past 25 years, and 2) return to the 5% unemployment rates that were common in the 1950s and 1960s.

By how much would this raise the level of national employment in Canada? In the first case, removal of the effective lower bound on the central bank policy rate would have allowed stimulative monetary policy to regenerate 290,000 jobs after the Great Recession of 2008-2009 instead of being forced to keep employment quasi-

[32] This assumes that the elasticity of the labour force participation rate with respect to the employment rate is 0.20 as in note 14. In 2015, the employment gain associated with a decrease in unemployment from 5.9% to 5.0% would be about 17,946,600 x $((0.950/0.941)^{1.25} - 1)$ = 215,000 jobs, where 17,946,600 is the 2015 employment level, and 1.25 = 1/(1 - 0.20).

permanently below the pre-recession trend. In the second case, sliding up towards 4% inflation along the long-run inflation-unemployment trade-off – the long-run Phillips curve – would ease the constraint that widespread resistance to wage cuts imposes on employment at a very low inflation rate like 2%. This would allow the creation of about 210,000 more jobs permanently. Adding it all up implies that a stable 4% inflation could lower the national unemployment rate to about 5% and generate one half million more jobs (= 290,000 + 210,000) for Canadians on average over time. In 2015 terms, the resulting long-run increase in gross domestic income would be in excess of $50 billion per annum.

At the same time, I have indicated that the literature on the costs of increases in inflation within the 0 to 4% range has not produced evidence that they would harm the economy significantly. There would be large net benefits.

A vitally important implication of the results I have presented is that the central bank cannot be exclusively concerned with stabilizing inflation. This, for two reasons. First, as I have reported, contemporary research makes it increasingly clear that deep recessions entail significant long-duration hysteresis effects. Their presence means that the central bank should move quickly and aggressively to contain recessions generated by drops in aggregate demand immediately when they start, in order to prevent the longer-term deterioration of economic prospects and stop income and job losses from accumulating. The Bank of Canada keeps emphasizing that its inflation-targeting policy is flexible, particularly "regarding the most appropriate horizon over which to return inflation to target." It is clearly not an "inflation nutter." (Bank of Canada 2011; Macklem 2014; Lane 2015) But it is highly desirable that the connection between being flexible and the need to combat hysteresis effects early on in recessions be made explicitly.

The second reason that the concern about inflation should not be exclusive is that there exists a negatively-sloped long-run Phillips curve describing a trade-off between permanent inflation and permanent unemployment. Consequently, the choice of the inflation target cannot be made independently of the choice of the unemployment rate toward which the economy will converge in general equilibrium. The Bank should clarify where it stands in this respect.

An understandable concern of central bankers about raising the inflation target from 2% to 4% is that they would risk the credibility and reputation it took them so much time and effort to earn from the 1970s to the 1990s. They worry that, given the positive correlation between levels and variability of inflation in past history, it would be more difficult to tie down expectations at 4%. In particular, it

could be harder to anchor inflation expectations at 4% than at 2%, because people could interpret the move from 2 to 4% as the first step of a return to an escalation to 6%, 8% and so on, as took place in the 1960s and 1970s.

However, Canadian evidence from the 1980s does not support the idea that inflation would be less stable if it averaged 4% instead of 2%. Between 1992 and 2015, the standard deviation of the monthly year-over-year all-items CPI inflation rate was 0.9 percentage point around the 1.8% mean. Was volatility higher in the 1980s when the inflation rate averaged 4.4% in the inter-recession period 1983-1990? No. The standard deviation around mean then was 0.5 point, that is, twice as small as in 1992-2015. A positive association between the level and variability of inflation is therefore not a necessity.[33]

In fact, the most sensible interpretation of the 1980s is that the tough recession period of 1980-1982 established the credibility of Chairman Volcker and Governor Bouey very solidly around inflation rates of 4 to 4.5% for the rest of the decade. In addition, with inflation-averse independent authorities now at the helm of central banks, the danger that the move from 2% to 4% would degenerate into further unstoppable increases in inflation seems remote. The fear that it would be more difficult to anchor inflation at 4% than at 2% does not have much evidence going for it in recent North American history.

Politics is another concern. A proposed increase of permanent inflation to 4% could be rejected by voters because they dislike inflation. Many believe that inflation erodes their purchasing power and redistributes income and wealth arbitrarily and unfairly (Shiller 1997). Partly, this reflects money illusion, since we know that increases in price inflation are usually covered by increases in nominal wage growth of similar orders of magnitude. But partly, there would be real costs for some groups – persons on fixed incomes like pensioners, for example.

Putting the benefits against these costs, one way of dealing with the hurdle is for the Bank to adopt the simple and transparent "explain-and-implement" strategy recently followed by the Trudeau government concerning the need for a temporary increase in federal deficits. Given the very large net benefits from a 2-point increase of the rate of inflation, the intelligent government response would be to introduce redistributive measures to compensate groups of obvious losers instead of opting for the status quo.

[33] I always wonder about the competence of people who think they have discovered a causal relation simply because they read a correlation between two endogenous variables.

As Modigliani (1986) and Bean et al. (2015) have pointed out 30 years apart, it is no doubt also true that "there is social value in people being able to follow the simple heuristic that the average price level increases very slowly." However, 4% inflation is not hyperinflation, and Canadians can count on its inflation-averse independent central bankers to prevent inflation to continue to increase above 4%. In addition, the 4.4% mean inflation that Canada experienced in the 1980s was more stable than the 1.8% of 1992-2015. There is also value in a moderate and stable rate of inflation, especially if it is accompanied by a significant reduction in unemployment that is sure to benefit most to the more vulnerable workers of Canadian society.

Finally, between the two polar cases of keeping the inflation target at 2% or increasing it to 4%, could the Inflation-Control Agreement of 2016 go only part of the way? Definitely. The inflation target could be increased to 2.5%, 3%, or 3.5% instead of 4%. It is doubtful that the width of the control range, which is currently ±1 percentage point around the targeted mid-point of 2%, could be reduced though, because it reflects the Bank's judgment that it is needed in order to accommodate random, uncontrollable short-term variations in inflation. But the range could be widened, say, to 3 points. For example, an increase of target to 3% could be accompanied by a control range going from 1.5% to 4.5%. Naturally, it should be understood that over time an increase of the mid-point target to less than 4% would bring proportionally smaller net benefits for jobs and incomes.

References

Akerlof, George, and William Dickens. 2007. "Unfinished business in the macroeconomics of low inflation: a tribute to George and Bill from Bill and George." *Brookings Papers on Economic Activity*, no. 2, 31-46.

Akerlof, George, Willam Dickens, and George Perry. 1996. "The macroeconomics of low inflation." *Brookings Papers on Economic Activity*, no. 1, 1-59.

Ambler, Steven. 2008. "The costs of inflation in New Keynesian models." *Bank of Canada Review*, Winter 2007-2008, 5-14.

Amirault, David, Paul Fenton, and Thérèse Laflèche. 2013. "Asking about wages: results from the Bank of Canada's Wage Setting Survey of Canadian companies." Discussion paper 2013-1, Bank of Canada, Ottawa, February.

Ball, Laurence. 1999. “Efficient rules for monetary policy.” *International Finance*, vol. 2, no. 1, April, 63-83.

Ball, Laurence. 2013. “The case for 4% inflation.” *Central Bank Review*, Issue 13/2, Central Bank of the Republic of Turkey, 17-31.

Ball, Laurence. 2014. “Long-term damage from the Great Recession in OECD countries.” *European Journal of Economics and Economic Policies: Intervention*, vol. 11, issue 2, 149-160.

Bank of Canada. 2011. *Renewal of the Inflation-Control Target. Background Information*. Ottawa, November.

Bank of Canada. Various issues. *Monetary Policy Report*. Ottawa.

Bean, Charles. 2013. “Note on negative interest rates for Treasury Committee.” Bank of England, London, UK, May.

Bean, Charles, Christian Broda, Takatoshi Ito, and Randall Kroszner. 2015. “Low for long? Causes and consequences of persistently low interest rates.” Geneva Reports on the World Economy 17, International Center for Monetary and Banking Studies, Center for Economic Policy Research Press.

Bernanke, Ben. 2012. “Monetary policy since the onset of the crisis.” Speech at the Federal Reserve Bank of Kansas City Economic Symposium, Jackson Hole, Wyoming, August.

Bewley, Truman. 1999. *Why Wages Don’t Fall During a Recession*. Cambridge, MA: Harvard University Press.

Blanchard, Olivier, Eugenio Cerutti, and Lawrence Summers. 2015. “Inflation and activity: two explorations and their monetary policy implications.” *IMF Working Paper*, WP/15/230, November.

Blanchard, Olivier, Giovanni Dell’Ariccia, and Paolo Mauro. 2010. “Rethinking macroeconomic policy.” *IMF Staff Position Note*, no. 10/03, February.

Blanchard, Olivier, Davide Furceri, and Andrea Pescatori. 2014. “A prolonged period of low interest rates?” In C. Teulings and R. Baldwin (eds.), *Secular*

Stagnation: Facts, Causes, and Cures. A VoxEU.org eBook, Center for Economic Policy Research, London, UK, 101-110.

Blanchard, Olivier, and David Johnson. 2014. *Macroeconomics*. Fifth Canadian Edition. Toronto: Pearson Education.

Card, David, and Dean Hyslop. 1997. "Does inflation 'grease the wheels of the labor market'?" In C. Romer and D. Romer (eds.), *Reducing Inflation: Motivation and Strategy*. Chicago, IL: University of Chicago Press.

Coibion, Olivier, Yuriy Gorodnichenko, and Johannes Wieland, 2012. "The optimal inflation rate in New Keynesian models: should central banks raise their inflation targets in light of the zero lower bound?" *Review of Economic Studies*, vol. 79, no. 4, October, 1371-1406.

Côté, Agathe. 2014. "Inflation targeting in the post-crisis era." Remarks before the Calgary CFA Society, Bank of Canada, Ottawa, November.

Côté, Agathe. 2015. "Inflation, expectations and monetary policy." Remarks before the Association québécoise des technologies in Mont-Tremblant, Bank of Canada, Ottawa, February.

Crawford, Allan, and Alan Harrison. 1998. "Testing for downward rigidity in nominal wage rates." In T. Macklem (ed.), *Price Stability, Inflation Targets, and Monetary Policy*. Proceedings of a conference held by the Bank of Canada in May 1997, Ottawa.

Crawford, Allan, and Geoff Wright. 2001. "Downward nominal-wage rigidity: micro evidence from Tobit models." Working paper 2001-7, Bank of Canada, Ottawa, May.

Cunningham, Rose, Brigitte Desroches, and Eric Santor. 2010. "Inflation expectations and the conduct of monetary policy: a review of recent evidence and experience." *Bank of Canada Review*, Spring, 13-25.

Daly, Mary, and Bart Hobijn. 2014. "Downward nominal wage rigidities bend the Phillips curve." Working paper 2013-08, Federal Reserve Bank of San Francisco, January.

Daly, Mary, Bart Hobijn, and Theodore Wiles. 2012. “Dissecting aggregate real wage fluctuations: individual wage growth and the composition effect.” Working paper 2011-23, Federal Reserve Bank of San Francisco, May.

DeLong, Bradford, and Lawrence Summers. 2012. “Fiscal policy in a depressed economy.” *Brookings Papers on Economic Activity*, Spring, 233-274.

Dickens, William, Lorenz Goette, Erica Groshen, Steinar Holden, Julian Messina, Mark Schweitzer, Jarkko Turunen, and Melanie Ward. 2007. “How wages change: micro evidence from the international wage flexibility project.” *Journal of Economic Perspectives*, vol. 21, no. 2, Spring, 195-214.

Dupasquier, Chantal, and Nicholas Ricketts. 1998. “Non-linearities in the output-inflation.” In T. Macklem (ed.), *Price Stability, Inflation Targets, and Monetary Policy*. Proceedings of a conference at the Bank of Canada in May 1997, Ottawa.

Elsby, Michael. 2009. “Evaluating the economic significance of downward nominal wage rigidity.” *Journal of Monetary Economics*, vol. 56, issue 2, March, 154-169.

Evans, Charles, Fisher, Jonas, François Gourio, and Spencer Krane. 2015. “Risk management for monetary policy near the zero lower bound.” *Brookings Papers on Economic Activity*, Spring (to appear).

Fair, Ray. 2000. “Testing the NAIRU Model for the United States.” *Review of Economics and Statistics*, vol. 82, no. 1, February, 64–71.

Farès, Jean, and Seamus Hogan. 2000. “The employment costs of downward nominal-wage rigidity.” Working paper 2000–1, Bank of Canada, Ottawa, January.

Farès, Jean, and Thomas Lemieux. 2001. “Downward nominal-wage rigidity: a critical assessment and some new evidence for Canada.” In A. Crawford (ed.), *Price Stability and the Long-Run Target for Monetary Policy*. Proceedings of a conference held by the Bank of Canada in June 2000, Ottawa.

Fortin, Mario, and Pierre Fortin. 1999. “The changing labour force participation of Canadians, 1969-1996: evidence from a panel of six demographic groups.” *Canadian Business Economics* vol. 7, no. 2, May, 12-24.

Fortin, Pierre. 2015. “The macroeconomics of downward nominal wage rigidity: a review of the issues and new evidence for Canada.” In K. Banting, R. Chaykowski, and S. Lehrer (eds.), *Thinking Outside the Box: Innovation in Policy Ideas. Essays in Honour of Thomas J. Courchene*. Montreal & Kingston: McGill-Queen’s University Press, 189-227.

Fortin, Pierre, Manfred Keil, and James Symons. 2001. “The sources of unemployment in Canada, 1967-1991: evidence from a panel of regions and demographic groups”, *Oxford Economic Papers*, vol. 53, no. 1, January, 67-93.

Friedman, Milton. 1968. “The role of monetary policy.” *American Economic Review*, vol. 58, no. 1, March, 1-17.

Hall, Robert. 2011, “The long slump.” *American Economic Review*, vol. 101, no. 2, April, 431-469.

Hamilton, James, Ethan Harris, Jan Hatzius, and Kenneth West. 2015. “The equilibrium real funds rate: past, present and future.” Working paper 21476, National Bureau of Economic Research, August.

International Monetary Fund. 2009. *World Economic Outlook*. Washington, DC, October, chapter 4.

International Monetary Fund. 2013. *World Economic Outlook*. Washington, DC, April, chapter 3.

International Monetary Fund. 2014. *World Economic Outlook*. Washington, DC, April, chapter 3.

Jackson, Harriet. 2015. “The international experience with negative policy rates.” Staff Discussion paper 2015-13, Bank of Canada, Ottawa, November.

Kahneman, Daniel, Jack Knetsch, and Richard Thaler. 1986. “Fairness as a constraint on profit seeking: entitlements in the market.” *American Economic Review*, vol. 76, no. 4, September, 728-741.

Klenow, Peter, and Benjamin Malin. 2011. “Microeconomic evidence on price-setting.” In B. Friedman and M. Woodford (eds.), *Handbook of Monetary Economics*, vol. 3A, chapter 6. Amsterdam: Elsevier.

Krugman, Paul. 1998. “It’s baaack: Japan’s slump and the return of the liquidity trap.” *Brookings Papers on Economic Activity*, no. 2, 137-187.

Krugman, Paul. 2014. “Inflation targets reconsidered.” *ECB Forum on Central Banking: Monetary Policy in a Changing Financial Landscape*. Conference Proceedings, European Central Bank, Frankfurt am Main, Germany.

Kumar, Saren, Hassan Afrouzi, Olivier Coibion, and Yuriy Gorodnichenko. 2015. “Inflation targeting does not anchor inflation expectations: evidence from firms in New Zealand.” *Brookings Papers on Economic Activity*, Fall (to appear).

Lane, Timothy. 2015. “Inflation targeting: a matter of time.” Remarks before the CFA Society of Atlantic Canada in Halifax, Bank of Canada, Ottawa, October.

Laubach, Thomas, and John Williams. 2003. “Measuring the natural rate of interest.” *Review of Economics and Statistics*, vol. 85, no. 4, November, 1063-1070.

Laubach, Thomas, and John Williams. 2015. “Measuring the natural rate of interest redux.” Working Paper No. 15, Hutchins Center on Fiscal & Monetary Policy, Brookings Institution, Washington, DC, November.

Laxton, Douglas, David Rose, and Demosthenes Tambakis. 1999. “The U.S. Phillips curve: the case for asymmetry.” *Journal of Economic Dynamics and Control*, vol. 23, no. 9–10, September, 1459-1485.

Lebow, David, Raven Saks, and Beth Anne Wilson. 2003. “Downward nominal wage rigidity: evidence from the Employment Cost Index.” *Advances in Macroeconomics*, vol. 3, no. 1, article 2.

Lipsey, Richard. 1960. “The relation between unemployment and the rate of change of money wage rates in the United Kingdom, 1862-1957: a further analysis.” *Economica*, New Series, vol. 27, no. 105, February, 1-31.

Macklem, Tiff. 2014. “Flexible inflation targeting and ‘good’ and ‘bad’ disinflation.” Remarks at the John Molson School of Business of Concordia University in Montreal, Bank of Canada, Ottawa, February.

Mavroeidis, Sophocles, Mikkel Plagborg-Møller, and James Stock. 2014. "Empirical Evidence on Inflation Expectations in the New Keynesian Phillips Curve." *Journal of Economic Literature*, vol. 52, no. 1, March, 124-188.

Meidner, Rudolf, Gösta Rehn, et al. 1951. *Fackföreningsrörelsen och den fulla syssellsättningen* [The Trade Union Movement and Full Employment]. Report to the Swedish Confederation of Trade Unions (LO), Stockholm, Sweden.

Mendes, Rhys. 2014. "The neutral rate of interest in Canada." Discussion Paper 2014-5, Bank of Canada, Ottawa, September.

Modigliani, Franco. 1986. "Second Lecture. Aggregate demand and the control of the inflationary process." In F. Bruni (ed.), *The Debate Over Stabilization Policy*, New York, NY: Cambridge University Press.

Mundell, Robert. 1962. "The Appropriate Use of Monetary and Fiscal Policies for International and External Stability." *IMF Staff Papers*, vol. 9, no. 1, March, 70-79.

Okun, Arthur. 1973. "Upward mobility in a high-pressure economy." *Brookings Papers on Economic Activity*, no.1, 207-252.

Okun, Arthur. 1978. "Efficient disinflationary policies." *American Economic Review*, vol. 68, no. 2, May, 348-352.

Phillips, William. 1958. "The relation between unemployment and the rate of change of money wage rates in the United Kingdom, 1861-1957." *Economica*, vol. 25, no. 100, November, 283-299.

Pichette, Lise, Pierre St-Amant, Ben Tomlin and Karine Anoma. 2015. "Measuring potential output at the Bank of Canada: the extended multivariate filter and the integrated framework." Discussion Paper No. 2015-1, Bank of Canada, Ottawa, January.

Poloz, Stephen. 2015a. "Integrating financial stability into monetary policy." Remarks before the National Association for Business Economics in Washington, Bank of Canada, Ottawa, October.

Poloz, Stephen. 2015b. "Prudent preparation: the evolution of unconventional monetary policies." Remarks before the Empire Club of Canada in Toronto, Bank of Canada, Ottawa, December.

Rachel, Lukasz, and Thomas Smith. 2015. "Secular drivers of the global real interest rate." Staff Working Paper No. 571, Bank of England, London, UK, December.

Reifschneider, Dave, William Wascher, and David Wilcox. 2013. "Aggregate supply in the United States: recent developments and implications for the conduct of monetary policy." *Fourteenth Jacques Polak Annual Research Conference,* International Monetary Fund, Washington, DC, November.

Reinhart, Carmen, and Kenneth Rogoff. 2014. "Recovery from financial crises: evidence from 100 episodes." *American Economic Review*, vol. 104, no. 5, 50-55.

Reza, Abeer, Eric Santor, and Lena Suchanek. 2015. "Quantitative easing as a policy tool under the effective lower bound." Staff Discussion paper 2015-14, Bank of Canada, Ottawa, November.

Romer, Christina, and David Romer. 2015. "New evidence on the impact of financial crises in advanced countries." Working paper 21021, National Bureau of Economic Research, March.

Romer, David. 2012. "What have we learned about fiscal policy from the crisis?" In O. Blanchard, D. Romer, M. Spence and J. Stiglitz (eds.), *In the Wake of the Crisis: Leading Economists Reassess Economic Policy*. Cambridge, MA: MIT Press.

Rudebusch, Glenn. 2009. "The Fed's monetary policy response to the current crisis." *Economic Letter* No. 2009-17, Federal Reserve Bank of San Francisco.

Samuelson, Paul, and Robert Solow. 1960. "Analytical Aspects of Anti-Inflation Policy." *American Economic Review*, vol. 50, no. 2, May, 177–194.

Shafir, Eldar, Peter Diamond, and Amos Tversky. 1997. "Money illusion." *Quarterly Journal of Economics*, vol. 112, no. 2, May, 341-374.

Shiller, Robert. 1997. "Why do people dislike inflation?" In C. Romer and D. Romer (eds.), *Reducing Inflation: Motivation and Strategy*. Chicago, IL: University of Chicago Press.

Simpson, Wayne, Norman Cameron, and Derek Hum. 1998. “Is hypoinflation good policy?” *Canadian Public Policy*, vol. 24, no. 3, September, 291-308.

Stark, Alan, and Timothy Sargent. 2003. “Is there downward nominal wage rigidity in the Canadian Phillips curve?” Working paper, Department of Finance, Ottawa, March.

Summers, Lawrence. 2015. “Low real rates, secular stagnation, and the future of stabilization policy.” Keynote speech to the 19th Annual Conference of the Central Bank of Chile, Santiago, November.

Theil, Henri. 1966. *Applied Economic Forecasting*. Amsterdam: North-Holland.

Thiessen, Gordon. 1995. “Uncertainty and the transmission of monetary policy in Canada.” *Bank of Canada Review*, Summer, 41-58.

Tinbergen, Jan. 1952. *On the Theory of Economic Policy*. Amsterdam: North-Holland.

Tobin James. 1972. “Inflation and unemployment.” *American Economic Review*, vol. 62, no. 1, March, 1-18.

Wicksell, Knut. 1898. *Geldzins und Güterpreise* [Interest and Prices]. Jena: Gustav Fischer Verlag.

Wilkins, Carolyn. 2014. “Monetary policy and the underwhelming recovery.” Remarks before the CFA Society in Toronto, Bank of Canada, Ottawa, September.

Wilkins, Carolyn. 2015. “Minding the labour gap.” Remarks before the Ottawa Economics Association, Bank of Canada, Ottawa, February.

Witmer, Jonathan, and Jing Yang. 2015. “Estimating Canada’s effective lower bound.” Staff Analytical Note 2015-2, Bank of Canada, Ottawa, December.

Woodford, Michael. 2012. “Methods of policy accommodation at the interest-rate lower bound.” Proceedings of the Economic Policy Symposium at Jackson Hole, Federal Reserve Bank of Kansas City, 185-288.

Yellen, Janet. 2012. “Perspectives on monetary policy.” Speech at the Boston Economic Club Dinner, Federal Reserve Board, Washington, DC, June.

Yellen, Janet, and George Akerlof. 2006. “Stabilization policy: a reconsideration.” *Economic Inquiry*, vol. 44, no. 1, January, 1–22.

Yetman, James. 2015. “The evolution of inflation expectations in Canada and the US.” Working paper no. 523, Bank of International Settlements, Basel, Switzerland, October.

Zmitrowicz, Konrad, and Mikael Khan. 2014. **“**Beyond the unemployment rate: assessing Canadian and U.S. labour markets since the Great Recession.” *Bank of Canada Review*, Spring, 42-53.