The Importance of Sound Monetary Policy: Some Lessons for Today from Canada's Experience with Floating Exchange Rates since 1950

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ABSTRACT

In this paper we revisit the Canadian experience with floating exchange rates since 1950. Canada was a pioneer in successfully adopting a floating exchange rate during the Bretton Woods pegged exchange rate regime. Since then, most advanced countries have followed the Canadian example.

A key finding of our paper based on historical narrative and econometric analysis is that economic performance under floating depended on its monetary policy performance as Milton Friedman originally argued in his seminal 1953 article making the case for floating exchange rates. Canadian monetary policy achieved low and stable inflation once it adopted inflation targeting as a nominal anchor. Also, Canada's floating exchange rate provided it with a modicum of insulation from external shocks, especially commodity price shocks that influenced both the level and volatility of the real exchange rate over the past three decades. The Canadian experience with floating (along with that of other small open economies such as Australia, New Zealand and Sweden) combined with inflation targeting became a global model for sound monetary policy.

Key words: floating exchange rates, commodity price shocks, insulation, sound monetary policy

JEL Codes: E32, E52, F31, F32, N1

1.Introduction

It is now 50 years since the breakdown of the Bretton Woods International Monetary System (BWS). The Bretton Woods par value system of adjustable pegged exchange rates with capital controls was an era of rapid economic growth and relatively low inflation (Bordo, 1993). Its operation depended on the members following the rules of the IMF Articles of Agreement. Once the world fully recovered from the devastation of World War II, the de facto gold dollar standard based on the U.S. dollar as the primary international reserve asset broke down between 1968 and 1973 with the opening of international capital markets and the growing inability of the United States to maintain price stability while attempting to sustain the system.

One of the key tenets of the BWS was that members had to maintain pegged exchange rates into U.S. dollars and could only change their par values under special circumstances, such as a large supply shock. Floating exchange rates were not an option. Yet Canada, one of the charter members of the BWS, broke the rules in 1950 and successfully floated its exchange rate for 11 years under continuous IMF protest. It then went back to the par value system from 1961 to 1970 and has continually floated since then. The Canadian experience as a pioneer floater provided an example for other countries that followed its lead in the 1970s after the collapse of the BWS.

In this paper we revisit the Canadian experience with floating from 1950 to the present. A key finding of the paper is that economic performance in Canada under floating depended on its monetary policy performance, as Milton Friedman originally argued in his seminal 1953 article (Friedman 1953). In the 1970s and 1980s especially, Canadian monetary policy led to similar inflation rates and economic performance as that of other advanced countries (with the principal exception of Germany and Switzerland). By the end of the 1990s, with the adoption of inflation targeting (hereafter IT), Canada's inflation rate declined significantly. Using annual data since 1950, Canada's average inflation rate was historically higher than the U.S.'s beginning in the 1950s until the 1990s when IT was introduced. Since then, Canada's average inflation has been lower than in the U.S. Average real GDP growth in Canada has also been lower than in the U.S.

in four of the seven decades of data since the 1950s.[1] The large drop in average real GDP growth over the decades is also visible but this may be explained by structural factors (e.g., productivity performance, demographic changes) not directly linked to the type of exchange rate regime (e.g., Goodhart and Pradhan, 2020). Hence, broadly speaking and as Friedman had posited, Canada's floating exchange rate regime provided it with a modicum of insulation from external shocks, especially commodity price shocks that influenced both the level and volatility of the real exchange rate over the past three decades.

The Canadian experience with floating (along with that of other small open economies such as Australia, Sweden, and New Zealand) and inflation targeting also became a model for the conduct of monetary policy in emerging countries. Many such countries which adopted floating exchange rates and IT have subsequently greatly reduced their inflation rates (Bordo and Siklos, 2021).

In this paper we detail Canada's historical experience with floating exchange rates in Section 2. Section 3 provides empirical evidence on the performance of monetary policy in Canada across policy regimes in comparison to the US, Canada's large neighbor and principal trading partner.[2] This comparison is based on using the metric of the Taylor rule. However, we also consider some econometric exercises to investigate how well the floating regime insulated the Canadian economy from external shocks via the exchange rate as well as a counterfactual that asks whether the combination of IT, and a floating exchange rate, yielded any benefits for the conduct of monetary policy.

We find that the adoption of IT implies, on average, fewer changes in the policy rate while the same response is more pronounced when there is a surge in inflation.[3] We interpret this result as

[1] An appendix provides a Table that displays decadal inflation and real GDP growth rates for Canada and the US.
[2] Since the 1870 exports and imports as a percent of GDP, a standard indicator of trade openness, have typically fluctuated between 40 and 50%. Since IT was introduced, together with the North American Free Trade Agreements, openness has varied between 50 and 70%. Paralleling these developments has been the rise in economic and financial globalization since the 1970s. See, for example, https://kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html.
[3] Even under floating regimes central banks are aware that different types of shocks (e.g., demand, supply, portfolio rebalancing, geopolitical) can influence the exchange rate and, depending on the central bank's response, the policy rate. Hence, even if the central bank sets policy domestically under a floating regime it must still identify the type of external shock. See, for example, Freedman (1995) and Dodge (2005).

being consistent with the hypothesis of greater central bank credibility where a floating exchange rate, combined with a sound monetary policy regime, that is, one that generates low and stable inflation without compromising real economic performance, provides relatively greater autonomy to set the stance of monetary policy. The latter is usually interpreted to mean that the government sets the goal of monetary policy while the central bank is free to pursue a clearly articulated goal with the policy instruments at its disposal. Needless to say, the success of any policy regime likely also depends on more than just monetary policy and the exchange rate. We acknowledge that a sound fiscal policy, financial stability and a well supervised regulatory regime also play supporting roles.[4] However, necessary conditions must include the right combination of monetary and exchange rate policies. The paper concludes with a summary and policy lessons.

2. Historical Narrative

2.1 Overview

Canada was the first country to float its exchange rate in the post-war period, leaving the Bretton Woods par value system in September 1950.[5] Canada's actions were very controversial at the time and were counter to the establishment view that floating would lead to instability (e.g., see Helleiner, 2006; Siklos, 2009). Canada's decision was in part encouraged by Milton Friedman's famous essay: "The Case for Floating Exchange Rates" (Friedman, 1953).[6]

Friedman's arguments are directly relevant for supporting the notion that a floating exchange rate can only succeed if it is accompanied by a sound monetary policy. His case for floating argued: (1) that it would give the monetary authorities policy independence; and (2) that floating would insulate the domestic economy from external shocks. Canada floated from September 1950 to June 1962. Its experience for most of that period was a relatively good one in spite the fact that the 1950s was a tumultuous decade. However, Friedman warned that, for floating to be

[4] Thus, for example, it no doubt helps that there were no systemic banking crises in Canada since 1950 (or ever, Bordo, Redish and Rockoff 2016)and only four banks failed in the 1983-1985 period. See, for example, Laeven and Valencia (2018), and the data base on global financial crises at https://www.hbs.edu/behavioral-finance-and-financial-stability/data/Pages/global.aspx.
[5] Canada, the UK and other countries also floated their exchange rates in the 1930s.
[6] Friedman first made the case for Canada to float in a radio show in 1949 (Powell, 2005; Friedman, 2000).

successful, it had to be embedded in a stable monetary policy framework. As Friedman (2000, p. 414) pointed out several decades later: "...floating rates are not a guarantee of sensible internal monetary policy….The reason Canada went off floating rates was because they were working so well, and their internal monetary policy was so bad." The significance of this caveat has tended to be lost in the subsequent literature on the costs and benefits of floating exchange rates (e.g., Dellas and Tavlas (2018) is an exception). Canada's monetary policy was stable for the first 6 years of the first float but for the last 5 years, as we shall see, overly tight and erratic monetary policy led to poor economic performance leading to abandonment of the float in 1962 in the face of a currency crisis.

The first floating episode was followed for 8 years with a restored Bretton Woods peg of $62.5US in June 1962. Canada's economic performance in the 1960s as a small open economy under fixed exchange rates featured the beginning of the Great Inflation echoing the experience of the US. With the breakdown of the BWS, Canada floated for a second time in 1970. It has subsequently done so until the present day.[7]

Canada's exchange rate performance since 1970 went through several phases reflecting the prevailing monetary policy regime: high inflation in the 1970s and the unsuccessful adoption of monetary aggregate targeting in 1975; the breakdown of monetary targeting in 1982, followed by the shadowing of the US dollar and importation of the 1979 Volcker inflation shock; the introduction of formal inflation targeting in 1991, which was then followed by a long period of stable monetary policy. During most of this period Canada was hit by a series of large commodity price shocks whose effects on inflation were muted by the floating rate. In what follows we describe each of these episodes in greater detail and present empirical evidence that supports Friedman's contention that, at least for Canada, the floating exchange rate regime has been the correct policy choice.

[7] Identifying exchange rate regimes has been a preoccupation of many academics and institutions over the decades. For example, Ilzetzki, Reinhart, and Rogoff (IRR; 2019) is the latest is a long list of attempts to define de facto or de jure exchange rate regimes for many countries. The Bank of Canada (e.g., see Murray, Schembri, and St-Amant, 20003) would disagree with IRR who have labeled the $C as a managed float, at least until the last few years. Part of the difficulty stems from whether central bank intervention in foreign exchange markets reflects attempts to influence the level or volatility of the exchange rate (e.g., see Rogers and Siklos, 2003). In what follows, we treat the $C as belonging to the floating exchange rate category of regimes.

2.1 The Early Experience: 1950 to 1970

After World War II, Canada, a founding member of the IMF, set its par value at $1.00 US. This parity however quickly led to a large balance of payments deficit leading to a devaluation to $.90 US in 1949.[8]

Heavy capital inflows from the United States in 1949-50, to finance the development of Canadian raw materials consequent upon rearming for the Korean War, led to a large balance of payments surplus, burgeoning international reserves, and money supply and inflationary pressure (6% in 1950). In the face of this large, US propelled, demand shock, the Government of Canada requested from the IMF a temporary departure from the peg. This was grudgingly granted but, over time, the float became less than temporary and lasted for 12 years.[9]

Canada's performance under floating turned out to be extremely good for the first 6 years. The Canadian dollar was remarkably stable trading in the range of around $0.96-$1.05 CAD/USD (see Sikos (2009), Figure 1 reproduced in the appendix) and both real (real growth and unemployment) and inflation performance was as good as or better than in the U.S. (see Siklos (2010), Figure 1 reproduced in the appendix)**.** This favorable macro experience could in large part be attributed to the countercyclical monetary performance of the Bank of Canada under Governor Graham Towers. Bordo, Dib, and Schembri (2010) explore the history and motivations for the return to floating in the 1950s in greater detail. Schembri (2008) also provides a good summary of Canada's floating regime during the 1950s while Siklos (2009) argues that exchange market intervention and the threat of intervention did play a small role in exchange rate developments during that decade.

In January 1955, Towers was replaced by James Coyne. More so than his predecessor, Coyne was most focused on price stability[10] and also had strong reservations about both foreign

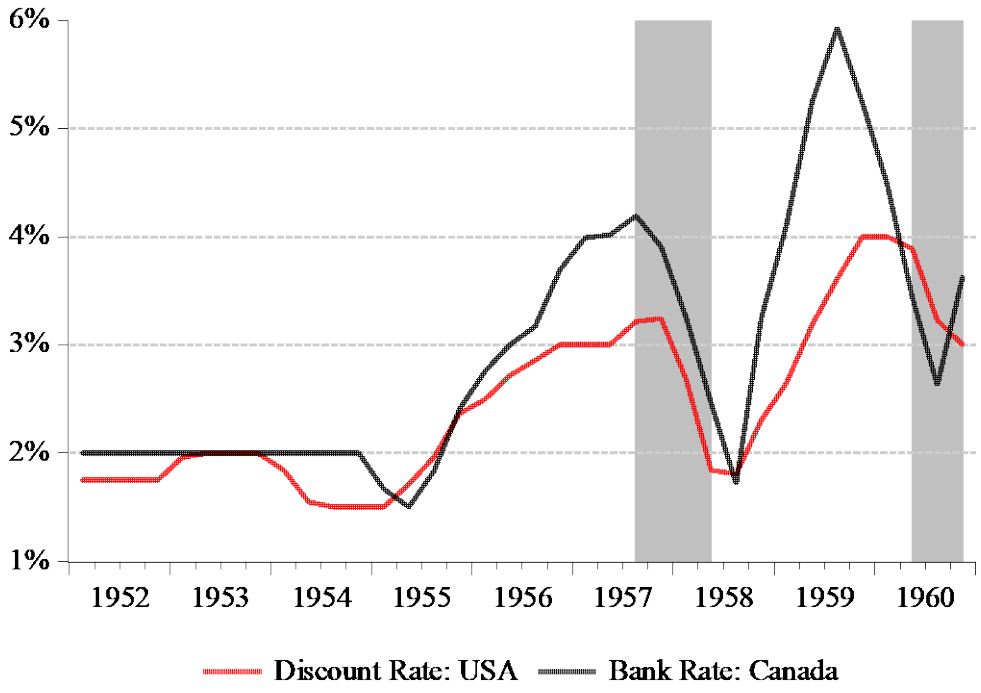
[8] Canada followed the UK and many other countries in devaluing their initial parities (Bordo, 1993).
[9] Despite continuous pressure by the IMF to get back to the par value system (Bordo, Gomez, and Schembri 2010).
[10] Price stability was never formally defined though it is not too far-fetched to argue that it was thought to be an inflation rate close to zero. Biases in the estimation of the CPI were not well understood during the 1950s. The

ownership of Canadian assets and capital inflows from the U.S. He believed that keeping interest rates high would stimulate domestic savings to substitute for the foreign flows. He did not understand the economics of a floating exchange rate with an open capital account.[11] During the 1957-58 recession, and for two more years, Coyne kept monetary policy much tighter than was the case at the Federal Reserve throughout much of the second half of the 1950s (see Figure 1). This led to both lower growth and higher unemployment than in the US (see Siklos, 2010). It also encouraged additional capital inflows and an appreciation of the Canadian dollar to well above parity. This, in turn, reduced exports and encouraged imports weakening aggregate demand. After the recession monetary policy still was tight relative to the US and, at the same time, expansionary fiscal policy pushed interest rates and the exchange rate higher negatively impacting the real economy.

Figure 1 Central Bank Interest Rates During the 1950s: Canada and the US

question of the precise meaning of price stability would return as a subject of debate in the early years of IT (see below) and any desire to agree on a definition would eventually be dropped from the target agreements between the Canadian government and the Bank of Canada (e.g., see Laidler, 2020).

[11] This was later developed by Robert Mundell. Mundell, of course, became well known for his theory of optimal currency areas (Mundell, 1961). In that seminal article he explicitly mentions the Canadian experiment with floating exchange rates during the 1950s and acknowledges the possibility that "…a failure of the Canadian experiment would cast doubt only on the effectiveness of a flexible exchange system in a multiregional country, not on a flexible exchange system in a unitary country." (op.cit., p. 664)



Note: Data from Siklos (2010). Shaded areas are NBER recession dates from NBER chronology (https://www.nber.org/research/data/us-business-cycle-expansions-and-contractions).

These policy choices led to the resignation of Coyne in a most controversial way as Governor in 1961.[12] He was replaced by Louis Rasminsky.[13] In the face of continued high unemployment and a strong Canadian dollar, the Minister of Finance, Donald Fleming, in June 1961 requested that the Bank of Canada use its exchange market intervention tools to depreciate the Canadian dollar. This led to a speculative attack on the Canadian dollar leading to a free fall, a subsequent rescue package of 1 billion USD by the IMF and the US, and a commitment to return to the IMF par value system at a new parity of $62.5US in June 1962 (e.g., see Friedman, 2000).

Floating exchange rates worked well for Canada when monetary policy was stable until 1956. As Friedman had exposited, when the Bank of Canada shifted to a tighter stance in 1957, economic

[12] See Powell (2009), and Siklos (2010) on the Coyne affair. The Coyne era did, however, see the introduction of an interest rate instrument to set the stance of monetary policy. This was a novel policy at the time. We return to this episode below.

[13] Rasminsky's appointment also led to greater autonomy for the Bank of Canada. A directive was added to the Bank of Canada Act stipulating that the government was responsible for directing a change in the objective of monetary policy. Otherwise, the Bank was responsible for the conduct of monetary policy. See Powell (2009), and Siklos (2010).

performance greatly suffered. Had the Bank of Canada maintained the policy stance that it had followed from 1950 to 1956 in the subsequent 5-year period, Canada's economic performance would have been not much different than in the first period. Indeed, Canada may not have had to abandon its floating exchange rate in 1962. Counterfactual analysis based on a DSGE model of the Canadian economy for the 1950-62 period makes the case (Bordo, Dib, and Schembri 2010). Siklos (2010) points out, using real time data, that a combination of inexperience with an interest rate instrument and concerns about the stance of fiscal policy contributed to an excessive tightening of monetary policy. The Coyne era was also notable because the Governor began to communicate with the public through speeches, an almost unheard-of activity, that were controversial and harshly criticized in the press and, eventually, by the politicians of the day.

After Canada returned to the par value system, as a small open economy it largely imported the economic performance of its much larger neighbor to the south., The 1960s saw the beginning of the Great Inflation in the U.S. (Bordo and Orphanides, 2013). Beginning in 1965 the Federal Reserve, under Chairman McChesney Martin, began following an expansionary monetary policy to accommodate the massive fiscal expansion of the Lyndon Baines Johnson administration to fund the Vietnam War and the Great Society. During this period, governments and central banks (The Fed and the Bank of Canada) also shifted to a Keynesian stance based on the Philips Curve favoring reduced unemployment at the expense of higher inflation. Thus, Canada both imported inflation from the U.S. and followed similar pro inflation monetary policies.

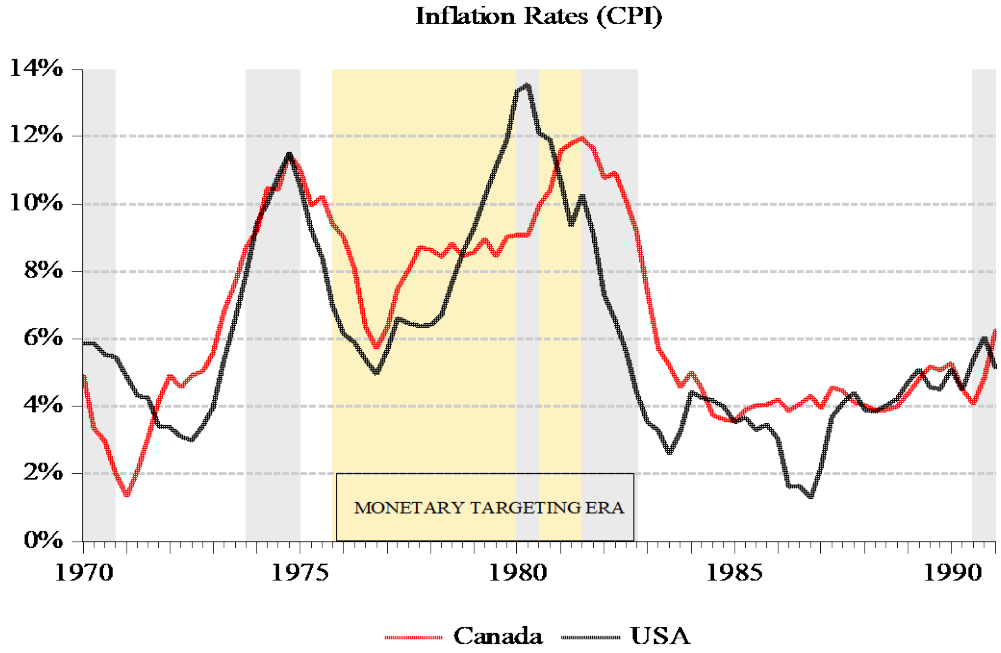
In the face of U.S. inflation, the Bretton Woods system began to unravel in 1968. By 1970 the problem of US exported inflation became so dire that Canada, later followed by other advanced countries, abandoned the pegged Bretton Woods exchange rate system (Bordo, 1993).

In Canada, just as in 1950 at the start the Korean War, a large US driven demand shock for Canadian resources led to massive capital inflows, a burgeoning balance of payments surplus, a surge in money growth and a runup in inflation (Schembri, 2019). As in 1950 the Canadian monetary authorities abandoned the fixed parity and returned to floating.

2.3 **Canada's experience with Floating Without An Inflation Target: The Great Inflation and its Aftermath, 1970-1991**

After returning to a floating exchange rate, inflation remained the major economic problem facing Canada. Like the U.S. and the U.K., the Canadian authorities adopted wage and price controls in 1975. And like the other countries the controls only temporarily reduced inflation and were phased out by 1978 (e.g., see Wilton, 1984). Canadian monetary policy in the early 1970s was even more expansionary than in the US (inflation rose from a low of 1.3% in 1971Q1 to a peak of 11.5% by 1974Q4). Following a decline to 5.7% in 1976Q4 the second oil price shocks would lead to a rise in inflation to another peak of 12% in 1981Q3 (see Figure 2). Moreover, as in the US and the UK, the Bank of Canada accommodated the commodity price shocks following the Arab Oil embargo in 1973. This made inflation worse (Crow, 2002).

Figure 2 Inflation Rates in Canada and the US: After Bretton Woods and Before IT



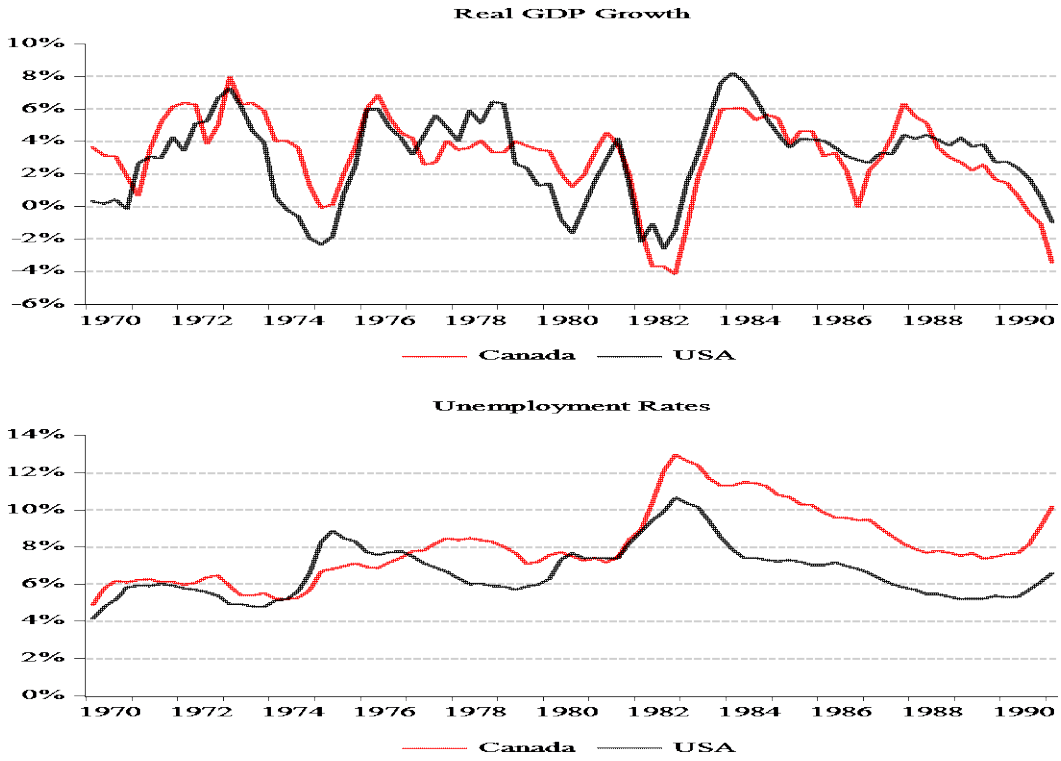
Note: Inflation is annual based on quarterly data from sources listed in Figure 1 and the appendix.

In 1975 the Bank of Canada adopted an M1 monetary targeting framework. The Bank was to follow a policy of gradually reducing their money growth targets and thereby reducing inflationary expectations without harming the real economy. Each year the Bank would announce new lower target ranges. The strategy of the Bank was to use its interest rate tool to deliver its monetary target based on the assumption of a stable money demand function. As such, the presumption that money growth would respond passively, given prevailing interest rates, was inconsistent with the aim to actively control money growth. The problem the Bank faced was that the M1 demand for money function that the Bank staff used kept shifting in unpredictable ways so that the Bank kept missing its targets. This reflected financial innovation in response to variable inflation. As it turned out while the money growth target ranges were being reduced, inflation stayed persistently high (See Figure 2 and Bernanke and Mishkin (1992), Table 3; Laidler, 1999; Courchene, 1977; Howitt, 1986). Finally, in late 1982, the Bank abandoned money growth targeting.

Over this period Canada's economic performance was generally worse than the U.S (see Figure 3). Most visible are the persistently higher unemployment rates in Canada beginning in the later

1970s. Institutional factors (e.g., the relative generosity of unemployment insurance plans) may be partly to blame although U.S. real GDP growth was also consistently better over the same period (e.g., see Card and Riddell, 1993; Riddell, 2005). Again, as Friedman argued, flexible exchange rates work best with sound money.[14] After the abandonment of monetary targeting the Bank shifted to a policy of shadowing the USD/CDN dollar exchange rate.[15] The Bank adjusted its policy rate to prevent U.S. Canadian interest rate spreads from widening.

Figure 3 Real GDP Growth and Unemployment Rates in Canada and the US During the Great Inflation Era



[14] Central bank autonomy and a clear and accountable objective for the central bank are widely accepted as institutional pre-requisites for delivering best practices in monetary policy. Gordon Thiessen, who was Governor of the Bank of Canada during the formative years of IT (1994-2001) provides additional details in his 'Lectures' (Thiessen, 2001).

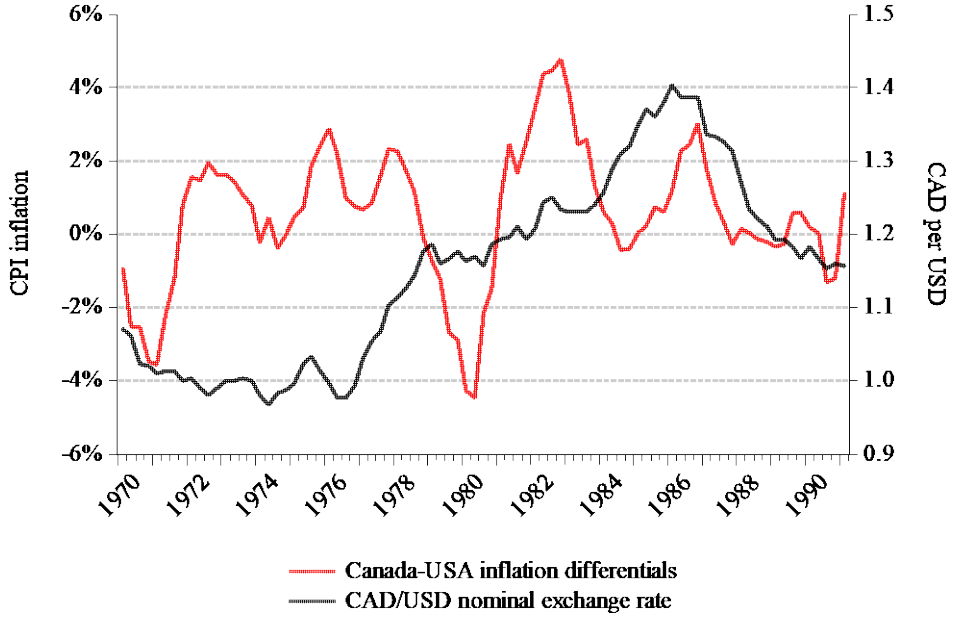
[15] Bernanke and Mishkin (1992, inter alia pages. 188 and 198) explicitly suggest that Canada had an objective of maintaining a stable exchange rate . While policy makers clearly kept an eye on exchange rate developments and the Bank of Canada intervened in the foreign exchange market during the 1970s and early 1980s there does not seem to have been an exchange rate objective as such. Instead, as in earlier eras of Canada's monetary history, inflation was the main concern and other means to influence exchange rates in the form of financial repression via limitations on certain types of interest rates were more prominent (e.g., see Powell (2005), p. 71-84).

Note: Data are from FRED (Federal Reserve Economic Data, St. Louis Fed), Statistics Canada, and Bank of Canada. Inflation is the annualized rate of change in the CPI.

In 1979 Paul Volcker began his shock therapy to break the back of US inflation and inflationary expectations. The policy was to quickly reduce non-borrowed reserves and allow interest rates to freely rise. By 1981 interest rates reached double digits. This policy led to two consecutive very serious recessions from 1979 to 1983 and a drastic decline in inflation.[16]

The Bank of Canada targeted the Canadian US short-term interest rate spread in this period and, hence, de facto imported the US disinflationary shock (Crow, 2002; see Figure 4). The Canadian dollar also steadily depreciated from around par to a peak of about $1.40C to $1US by the mid-1980s before appreciating though never coming close to par again. Although Canada had a recession in this period, like the U.S, the floating exchange rate partially offset some of the pain (Schembri, 2002).

Figure 4 Inflation Differentials and the Nominal Exchange Rate During the Great Inflation Era



[16] The recession of 1981 was a serious one but was exceeded, at least as measured by real per capita GDP declines ,by other recessions. See Cross and Bergevin (2012). Excellent and detailed accounts of this period are provided by Laidler and Robson (1993, 2004).

Note: See Figure 3. Exchange rates are from International Financial Statistics (online), International Monetary Fund. The differential is Canada's inflation rate less the US inflation rate.

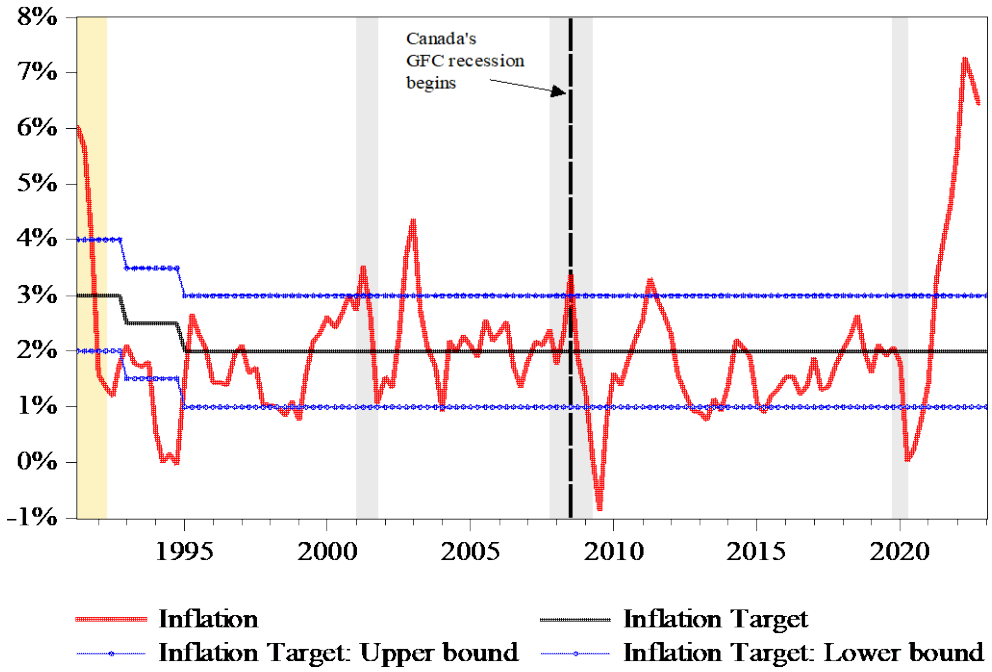
2.4 Inflation Targeting 1991 to the Present

In February 1991, Canada introduced inflation targeting.[17] Previously, in 1988, Governor John Crow made the case for the Bank of Canada to adopt a price stability objective, although the seeds of the IT idea in Canada came from the Department of Finance not the Bank of Canada (see Crow, 1988 and Laidler, 2020). At the time Governor Crow suggested that targeting the variable that the Bank ultimately seeks to determine would act as a good nominal anchor for inflationary expectations. Indeed, OECD inflation expectations data (not shown) reveals that, since at least 1993, inflation expectations in Canada have been consistently lower than in the US. It would also provide a transparent framework for central bank communication. The target, known originally as an inflation reduction target, was to be reduced gradually from 4 % to 2 %.[18] For the next three decades the Bank of Canada has had remarkable success in hitting its targets and inflation has stayed close to its 2 % target (see Figure 7).

[17] Canada was following the lead of New Zealand which had successfully introduced an inflation target in 1989. Other small open eocnomies, notably Australia and Sweden would soon adopt similar inflation control regimes. See, for example, Siklos (2017).

[18] The adoption of IT was accompanied by considerable controversy in Canadian academic and policy circles. For example, Fortin (1996, 1999) claims evidence that the new regime led to a significant economic downturn while Freedman and Mackelm (1998), both of the Bank of Canada, countered that monetary policy alone cannot explain the economic 'slump' of the early 1990s. The decision to introduce an inflation reduction target was in anticipation of the completion of a search for a definition of price stability. A formal definition was not agreed to. Instead, the regime evolved to the current inflation target of 1-3% in headline inflation in place since 1995.

Figure 5 The Inflation Record Under Inflation Targeting in Canada: 1991-2023



Note: shaded areas are recession dates for Canada from the C.D. Howe Institute (https://www.cdhowe.org/council/business-cycle-council). Inflation target ranges are from Bank of Canada. Also, see the text.

2.5 Commodity Price shocks

Canada's adherence to floating exchange rates since the 1970s helped insulate it from major commodity price shocks. Canada as a small open economy, where commodities are the largest share of international trade, is highly sensitive to global changes in the price of oil and other commodities.[19] The floating rate acts as a buffer so that, in theory, when foreign commodity price shocks (oil and other commodities) occur, one price, the exchange rate adjusts instead of

[19] The exchange rate is relevant when discussing commodity prices since these are set in USD. The Bank of Canada's model of the evolution of the Canada/U.S. dollar exchange rate identifies the key determinants as: changes in the real price of oil, changes in the real price of other commodities and the Canada/U.S. short-term interest rate differential (Amano and Van Norden, 1989a, 1995).

prices of domestic goods and services.[20] In the face of nominal rigidities that would have significant effects on real output. Friedman called this the daylight savings time (DST) effect.[21]

Considerable evidence marshalled by the Bank of Canada (Schembri, 2019; and references therein) shows that being on a float significantly buffered a number of the large commodity price shocks that occurred from 1970 to the present (also see Djoudad, Gauthier, and St-Amant, 2000).

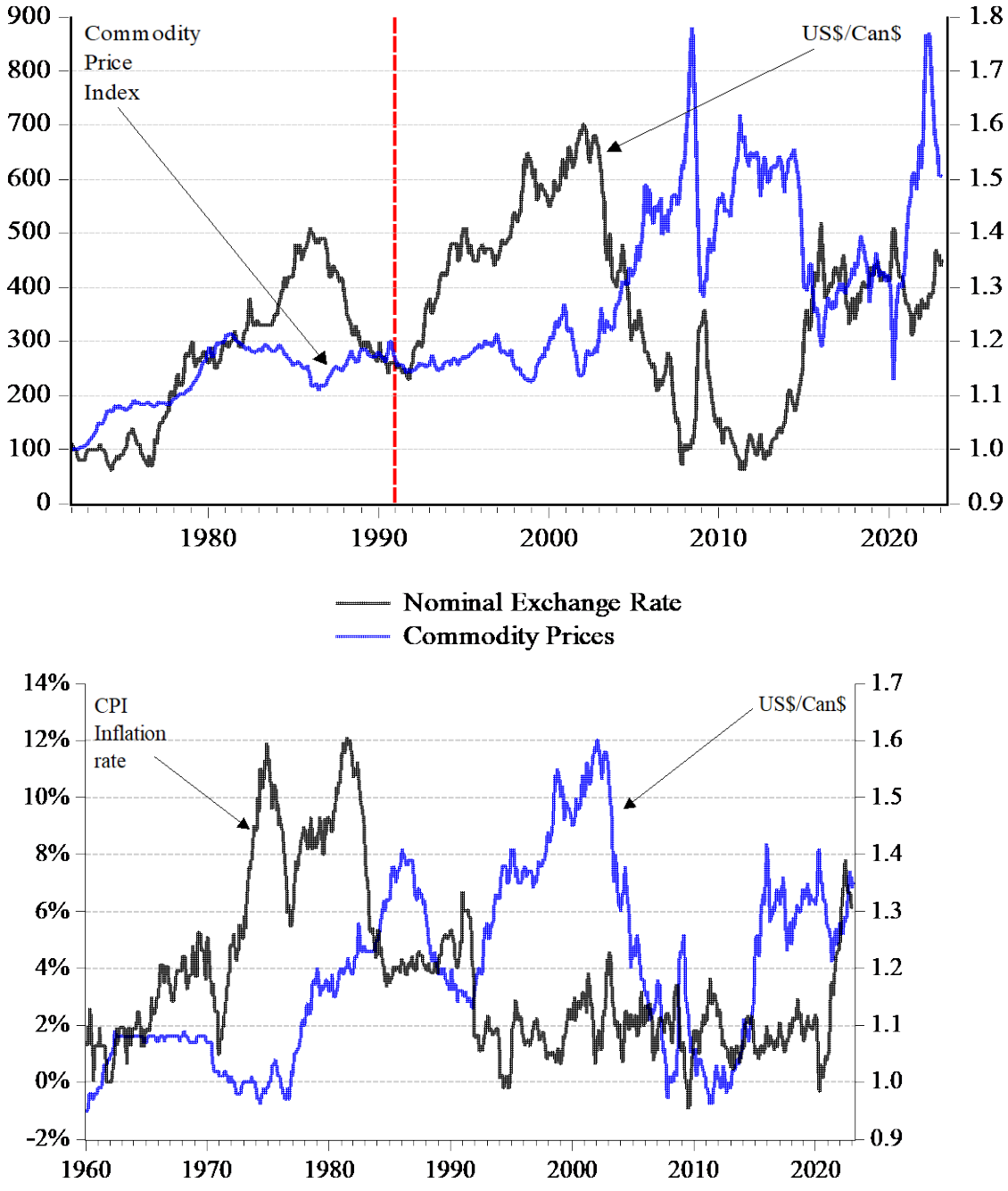
First, as mentioned above, a key feature of the Great Inflation of the 1970s were the massive increases in the global prices of oil and other commodities in 1973-1974. Canada was hit by these shocks but a significant appreciation of the C$ prevented the shocks from entirely passing through to domestic prices and output (see Figure 6). A second big commodity shock occurred in 1986 with a huge decline in the price of oil. Schembri (2019) shows that depreciation of the C$ offset much of that shock. A bounce back in oil prices in 1989 was somewhat shielded by appreciation of the C$. Third, the Asian crisis of 1997 led to a massive fall in the price of oil and other commodities that Canada exports. A depreciating c$ helped insulate the domestic economy.

Finally, with a decline in the price of oil in 2014 -15 the floating exchange rate largely buffered the domestic economy. As seen from Figure 6, commodity prices became much more volatile beginning in the early 2000s around the time when commodity markets became more financialized (e.g., see Cheng and Xiong, 2014). However, the exchange rate responded as it should and, despite this volatility, inflation remained firmly inside the target range, at least until the aftermath of the COVID-19 crisis.

[20] While Canada is a net commodity exporter its balance of trade has not always been in surplus.

[21] Friedman introduced the DST idiom as follows: "The argument for a flexible exchange rate is, strange to say, very nearly identical with the argument for daylight saving time. Isn't it absurd to change the clock in summer when exactly the same result could be achieved by having each individual change his habits? All that is required is that everyone decide to come to his office an hour earlier, have lunch an hour earlier etc. etc. But obviously it is much simpler to change the clock that guides all than to have each individual separately change his pattern of reaction to the clock, even though all want to do so. The situation is exactly the same in the exchange market. It is far simpler to allow one price to change — namely the price of foreign exchange — than to rely upon changes in the multitude of prices that together constitute the internal price structure." (Friedman, 1953, p. 173).

Figure 6 Commodity Prices and Exchange Rates in Canada Under Inflation Targeting



Note: Data are from the Bank of Canada. The commodity price index is constructed by the Bank of Canada (https://www.bankofcanada.ca/rates/price-indexes/bcpi/). Also see Figure 6.

3. Empirical Analysis

In this section we first evaluate Canada's monetary policy performance from 1950 to the present. Second, we provide evidence on the insulation properties of floating exchange rates in the Canadian experience. Third, we provide evidence about whether floating exchange rates mute the effects of commodity price shocks. Finally, we extend the framework to evaluate the performance of a sample of advanced small open economies that had floating exchange rates and then adopted inflation targeting policies compared to a sample of similar countries that retained a pegged exchange rate and, generally, did not formally target inflation.

3.1 Evaluation of Canadian Monetary Policy

Friedman (1953) argued that the key to successful floating was sound monetary policy. We can evaluate Canada's monetary performance across these historical regimes by comparing the policy interest rate generated by a Taylor rule (1993) to the actual policy rate. After all, the debate over policy rules is also a debate about what constitutes sound monetary policy. In addition to using the Taylor rule to evaluate Canada's monetary policy performance over time and across regimes we can do the same exercise for the US, its much larger neighbor and key trading partner over the identical historical period.

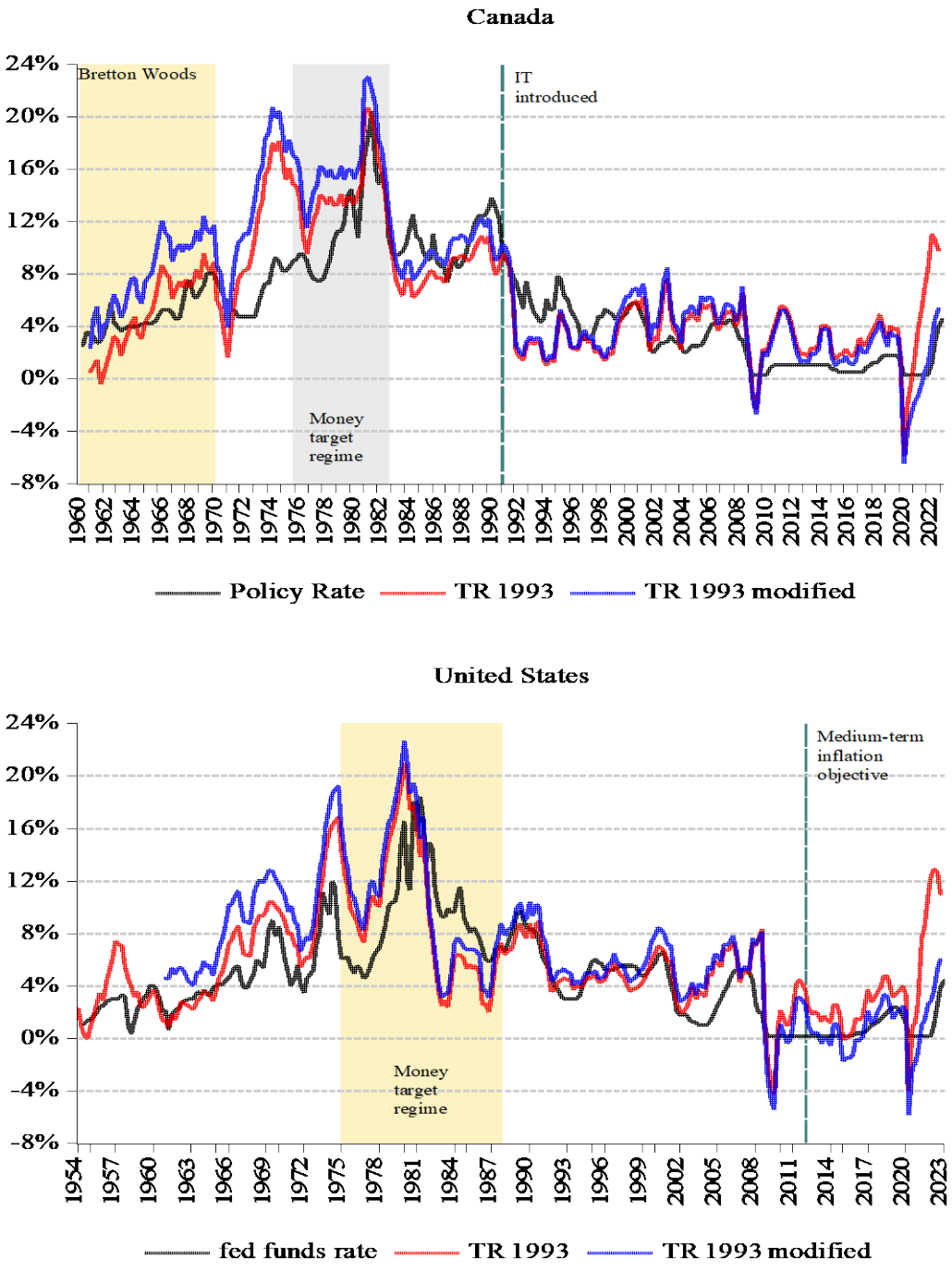
Sound policy would be seen in minimal deviations between these two rates, and by whether policy was following the Taylor principle (e.g., also see Hofmann and Bogdanova, 2012). As Taylor (1999, p.320; also see Taylor 1979) argues: "One monetary policy rule is better than another monetary policy rule if it results in better economic performance according to some criterion such as inflation or the variability of inflation and output." Accordingly, the appropriate response to an inflation shock is to raise the real interest rate. Hence, the central bank's policy rate must increase by more than the increase in inflation.

Siklos (2010) made a comparison between Canadian and US monetary policy using the Taylor rule for the period 1950 to 1961, the first Canadian float. What he found was that, in the first half of the period, before James Coyne became governor, monetary policies in both countries performed fairly closely, a finding similar to Bordo, Dib and Schembri (2010). But beginning in

1957, the Bank of Canada generally kept its policy rate too high relative to what the Fed was doing which led to weaker economic performance (see Figure 1). Figure 8 (a), however, shows that the policy rate in Canada in the second half of the decade deviated substantially more from the Taylor rule (1993) prescription than its neighbor to the south. This reflected Governor Coyne's tighter inflation stance and concerns over capital inflows and FDI.[22]

[22] Data for the 1950s are not, strictly speaking, comparable to ones since 1960 in part because there was no central bank policy rate of the kind introduced beginning in the 1960s. Hence, we separately estimate notional policy rules (i.e., ones that meet the Taylor rule prescription) for the 1950-1959 period from those beginning in 1960. In Canada, the notional policy rate influenced short-term Treasury bills while, for the U.S., the discount rate is used. See Siklos (2009, 2010) for more details. For a broader historical overview of the Coyne Affair, see Powell (2009).

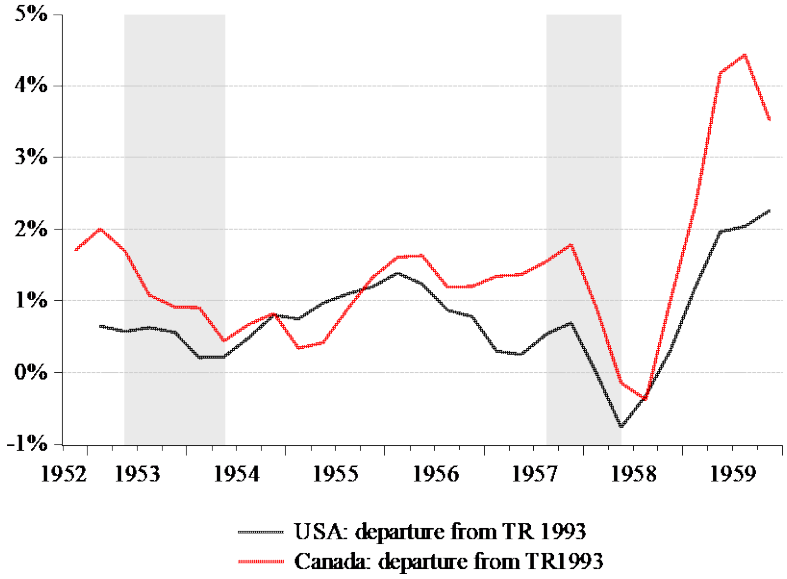
Figure 7 Notional Taylor Rules and Policy Rates Since the 1960s



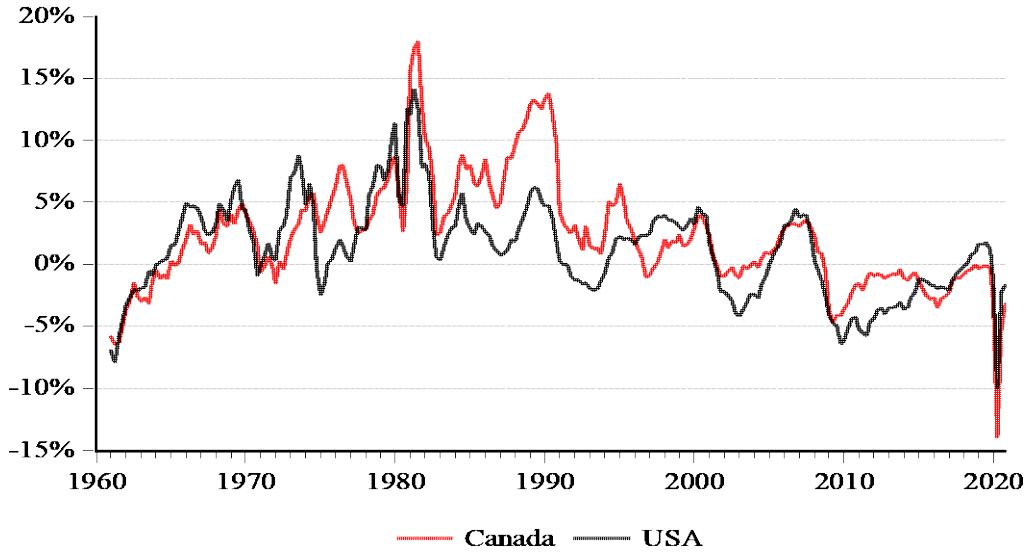
Note: fedfunds is the US Federal Reserve's policy rate. TR 1993 is , as in Bordo and Levy (2022), $r^*+\pi^*+1.5(\pi_t-\pi^*)+0.5GAP_t$. TR 1993 modified is the same as TR 1993 except that r* is time-varying. In both cases, $r^*=2\%$, and $\pi^*=2\%$.

Figure 8 Deviations from Notional Taylor Rules: Canada and the US Compared

(a) The 1950s



(b) Since the 1960s



Note: deviations from Taylor rule are $i_t - i_t^{TR}$ where i_t is the central bank policy rate, and i_t^{TR} is the notional policy rate following the Taylor rule as defined in Figure 9. A positive number indicates a policy rate that exceeds the TR recommendation; a negative value indicates a policy rate below the recommended one.

Figure 7, based on a different set of data compares Canadian and US monetary policies from 1960 to the present using the Taylor rule. We used two variants of the Taylor Rule for each country, following the approach of Bordo and Levy (2022). They are: the original Taylor rule with a neutral real interest rate (i.e., r*) at 2% , and a modified Taylor rule with a time varying r*.

Looking over the whole period, the policy rate diverged for both countries the most from the Taylor rule during the Great Inflation period from about 1965 to 1983 and the least during the Great Moderation period from the mid 1980s to before the Global Financial Crisis. This agrees with a large body of research (e.g., see Orphanides, 2003; Hofmann and Bogdanova, 2012)). However, since the GFC, deviations from the Taylor rule in Canada were generally greater than for the US.

In the 1960s when both countries adhered to their BWS pegs the policy rates were below the Taylor rule in Canada and the US indicating a pro-inflationary stance. In the 1970s the negative gap between the policy rate was even greater in both countries. Through much of that period Canadian monetary policy was even more inflationary than in the U.S. Both countries followed monetary targeting strategies from the mid 1970s and in neither one was it successful in reducing inflation (Bernanke and Mishkin, 1992). The fact that both countries now had floating exchange rates didn't seem to make much difference since both were following poor monetary policies. One key difference was during the Volcker shock period from 1979 to 1983 where the Taylor rule comparison suggests that Canadian monetary policy was less tight than its southern neighbor, perhaps reflecting the shock absorber role of the floating exchange rate as Crow (2002) argued.

In the Great Moderation period from the mid 1980s to before the GFC deviations from the Taylor Rule in Canada (see Figure 10(b)) generally exceeded that in the U.S. and the differences are clearly visible until the mid-1990s. Since the GFC, the monetary policy stance of the two countries were more similar although Canadian monetary policy appears to be more expansionary in the years before the pandemic. Hence, throughout the period since IT was introduced (1990) Canada's monetary policy looks much more like the Fed's than in earlier

policy regimes. However, during the time the 1-3% inflation target range was agreed to (in 1995), until the 2020 pandemic, Canada's monetary policy was frequently closer to the notional Taylor rule than its US counterpart (viz., 1996-2000, and 2015-2019). Indeed, in terms of the Taylor principle, inflation and output volatility have both been much smaller since IT was introduced in Canada relative to the period when the BWS was in place (not shown). Since the Pandemic of 2020 the policy stances of the two countries are very close. Both engaged in massive fiscal and monetary expansions.

So far, our results have been interpreted in terms of calibrated Taylor rules. The existing literature has frequently estimated policy rules, often allowing for interest rate smoothing in recognition of the possibility that changes in the monetary policy stance occur gradually. In addition, there have also been suggestions that central bank's objective functions might incorporate determinants other than the inflation or the output gap such as exchange rates, credit expansion, to give but two examples (e.g., see Asso et. al. 2007, 2010; Filardo et. al., 2022).

Table 1 presents a series of Taylor rule estimates controlling for changes in the exchange rate and credit growth, proxied here by the credit to GDP gap, to influence the setting of the policy rate.[23] Two sets of estimates are shown. The first three columns of coefficient estimates are based on historically determined dates when a regime change took place. Hence, Taylor rules are shown for the IT sample from 1999 to 2022.[24] Next, estimates are provided for the BWS era (1962-1970) and the monetary targeting period with the absence of any monetary anchor that immediately followed the end of Bretton Woods (1970-1990). The next set of columns repeats the same exercise but lets the data speak for themselves by estimating Taylor rules with allowance for multiple structural breaks relying on the Bai and Perron statistical tests (Bai and Perron, 1998; 2003). The notes to the Table provide estimation details and (Newey-West)

[23] As constructed by the BIS. See https://www.bis.org/statistics/c_gaps.htm?m=2670. While Taylor rules that are not augmented with additional variables remain most common there are good theoretical reasons, supported by subsequent empirical evidence, to consider an exchange rate variable, especially for a small open economy, and credit, expansion as determinants of the policy rate. See, for example, Ball (1999) for the exchange rate, and Curdía and Woodford (2010) for the role of credit. Empirical support is found, for example, in Batini, Harrison, and Millard (2003), and Schularick and Taylor (2012).

[24] Data availability for some series (viz., credit to GDP gap) does not allow us to go back before 1990. However, estimates that exclude the credit to GDP gap produce comparable conclusions for the coefficient estimates of the remaining variables.

standard errors are in parenthesis. For some estimates we also permit the neutral real interest rate (the constant term in the standard Taylor rule specification) to be time-varying. The latter is proxied is estimated via a Kalman filter as others have also done.

Table 1 Estimated Extended Taylor type Rules

Sample	91Q1-22Q4	62Q2-70Q2	70Q3-90Q4		62Q2-22Q4	62Q2-68Q3	68Q4-74Q3	74Q4-80Q4	81Q1-92Q3	92Q4-12Q1	12Q2-22Q4
	IT Full	BW: ER target	Post BW Pre IT: Monetary target		Full sample: No breaks	Regime 1	Regime 2 Break 1: 68Q4	Regime 3 Break 2: 74Q4	Regime 4 Break 3: 81Q1	Regime 5 Break 4: 92Q4	Regime 6 Break 5: 12Q2
Determinants											
Expected inflation	**.081 (.034)***	**.319 (.139)@**	**.146 (.039)***		***.364 (.050)****	**.515 (.063)***	**.194 (.054)***	**.560 (.111)***	**.562 (.083)***	**.940 (.013)***	**.273 (.059)***
Output Gap	**.152 (.026)***	.009 (.134)	**.243 (.084)***		***.097 (.030)****	.092 (.107)	-.046 (.106)	.014 (.130)	-.077 (.030)	.006 (.005)	**.076 (.006)***
Nominal exchange rate depreciation	.002 (.007)	**.172 (.068)@**	-.045 (.030)		*-.006 (.005)*	**.065 (.016)***	**.151 (.041)***	-.024 (.019)	-.008 (.024)	-.005 (.001)	**-.008 (.003)@**
Credit/GDP Gap	**-.006 (.003)+**	.192 (.450)	**.047 (.023)@**		***.004 (.001)****	**.118 (.012)***	**.034 (.017)@**	**.049 (.035)**	**-.021 (.010)@**	.001 (.00003)	-.0002 (.001)
Interest Rate Smoothing	**.868 (.032)+**	**.507 (.141)***	**.809 (.071)***		***.489 (.072)****	.048 (.091)	**.709 (.069)***	.044 (.120)	**.245 (.137)***	**.029 (.010)***	**.735 (.103)***
Constant	**.581 (.313)***	-1.715 (7.79)	**-.984 (.587)+**	r_t*	***.489 (.074)****	**.673 (.113)***	**.171 (.085)@**	**.540 (.082)***	**.857 (.129)***	**.969 (.011)***	**.176 (.055)***
R^2	.95	.88	.90		*.98*	.994					
F(p-value)	501.29(.00)	40.19 (.00)	136.72 (.00)		*-202.02*	-63.42					
Equilibrium Coefficient Estimates											
Inflation	.614	.647	.764		*.712*	.515	.667	.560	.744	.968	1.03
Output Gap	1.152	0	1.272		*.189*	0	0	0	0	0	.287
Nominal exchange rate depreciation	0	.346	0		*0*	.065	.519	0	0	0	-.030
Credit/GDP Gap	.045	0	.246		*.008*	.118	.117	0	-.028	0	0
r*						.673	.588	.540	1.135	.998	.664

Note: Data are quarterly. Estimated via OLS. r* is the estimate of the neutral rate using a Kalman filter (see Siklos, 2021). Breaks are selected using the Bai-Perron test with a maximum of 5 breaks, a significance level of 0.05, 15% sample trim, with the null of K+1 vs K breaks. The output gap is estimated via a one-sided HP filter with a 1600 smoothing parameter. Expected inflation is obtained from OECD economic Outlook forecasts (semi-annual converted to quarterly with Catmull-Roll interpolation) for the 1993Q1-2021Q4 sample. Gaps in data are constructed from US Livingstone semi-annual Survey data for the US used to generate a forecast of inflation for Canada. The forecast model assumes that Canadian expected inflation is determined by a constant, US inflation, and an AR(1) parameter. The coefficient estimates are then applied to Canada's inflation rate. *, @, + signify statistical significance at the 1, 5, and 10% levels. Equilibrium estimates are the coefficient estimate divided by (1- interest rate smoothing coefficient). For the cases where breaks are estimated the log likelihood is given.

The results are broadly consistent with the ones based on the simple calibrated versions of the Taylor rule shown in Figure 7. Nevertheless, the estimated rules also generate some interesting additional insights about the conduct of monetary policy in Canada over the past few decades. First, it is only during the IT era that the Bank of Canada set the stance of monetary policy as recommended by the Taylor principle. The equilibrium coefficient estimates shown in the bottom portion of Table 3 are statistically not different from ones over the 1992-2022 period (see last two columns of the Table). The Bank of Canada does not evince any reaction to the output gap when breaks in the Taylor rule are estimated except for the 2012-2022 period, that is, post-GFC. However, when dates dictated by policy regimes are examined, the output gap response is significantly higher than the response to inflation in both the post BWS and IT samples. These results provide scope for understanding how, based on the calibrated Taylor rule results discussed previously, the Bank of Canada deviated from the Taylor rule recommendations.

There is some evidence that real exchange rate changes and credit gaps influenced the setting of policy rates. For example, an exchange rate depreciation led to a tightening of monetary policy. This is consistent with a depreciation of the currency leading to greater inflationary pressure that needs to be countered via a higher policy rate. Otherwise, any response to real exchange rate fluctuations is economically insignificant.[25]

The Bank of Canada is generally seen as responding to a positive credit gap by raising the policy rate in the pre-IT era but not since the GFC. However, the magnitude of the response is typically dwarfed by the impact on the Bank of Canada policy rate of the inflation and output gaps. While this may reflect a lack of concern over financial stability or inflationary implications of credit growth since the GFC, an alternative interpretation is that monetary policy focused on responses that more directly impact inflation. Inflation, as seen from Figure 5, has tended to fluctuate near the bottom of the IT range over much of the post-GFperiod. Post-GFC, the influence of macroprudential policies, not captured in the results shown in Table 1, may also have played a

[25] A plot in the appendix shows the evolution of real and nominal exchange rates in Canada since 1960. During the BWS the peg consisted of a narrow fluctuation band for the nominal exchange rate. However, there was an adjustment period between 1960 and 1962 when the CAD depreciated prior to entering the narrow band prescribed un the BWS.

role as did the fact that responsibility for financial stability is a responsiblity shared with other agencies in Canada.

Finally, the degree to which interest rate smoothing is practiced is highly dependent on the sample period examined. There is considerably more evidence for smoothing in the IT era than at other times. However, it must be remembered that almost half of the time IT has been in place there were major crises that limited the scope for central banks to change policy rates especially since inflation rates tended to be well below their target.[26] Instead, many central banks considered here introduced unconventional monetary policies.[27] There is considerably less smoothing during the BWS while smoothing during the inter-regnum between Bretton Woods and IT, which includes the period of monetary targeting, is comparable to smoothing practiced during IT.

3.2 Additional Econometric Evidence

Below we provide three additional sets of results in support of the main arguments in the paper. First, that floating exchange rates help insulate the Canadian economy against foreign shocks; second, that a floating exchange rate mitigates or can blunt the impact of commodity price shocks on inflation; third, that the combination of a floating exchange rate and a sound monetary policy, in the form of inflation targeting, provides relatively more autonomy to conduct an independent monetary policy.

To address the impact of exchange rate shocks we begin with a simple macro-model consisting of five variables and estimated via a vector autoregression (VAR). The standard reduced-form VAR is written:

$$\boldsymbol{X}_t = k + \boldsymbol{A}(\boldsymbol{L})\boldsymbol{X}_{\boldsymbol{t-1}} + \boldsymbol{\epsilon}_{\boldsymbol{t}} \qquad (1)$$

[26] As this is written, IT has been in place for 33 years. It has been 15 years since the GFC, followed by the European Sovereign Debt Crisis, and COVID (i.e., 2008 to 2022).
[27] Canada's experience with unconventional monetary policy only came during the COVID crisis.

Where $\boldsymbol{X}$ is a vector of time series, $\boldsymbol{A(L)}$ are the coefficient matrices, and $\boldsymbol{\epsilon}$ is the error term with the usual zero mean constant variance properties. Exogenous variables can also be added to equation (1) but this did not impact our conclusions.[28] In the empirical results that follow:

$$\boldsymbol{X} = [\tilde{y}, \pi, \tilde{\varepsilon}, \tilde{f}, \tilde{m}] \qquad (2)$$

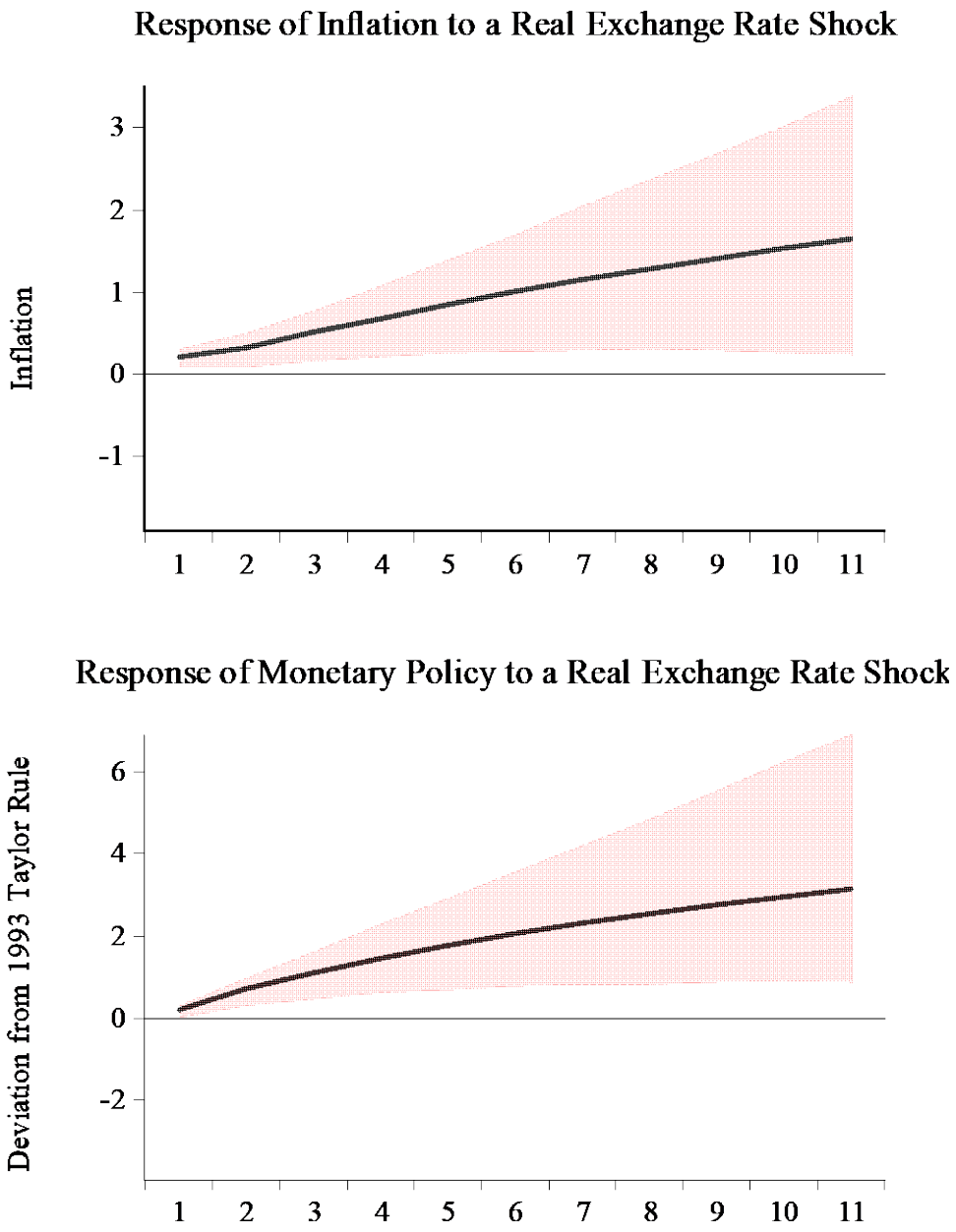
The model consists, respectively, of the output gap, CPI inflation, the real exchange rate gap, a proxy for fiscal policy estimated from the deviations from trend in real government consumption expenditures, and a monetary policy variable defined as deviations from a Taylor rule (Taylor, 1993) but allowing for a time-varying neutral real interest rate (i.e., r_t^*). The appendix provides additional details on the construction of some of these variables. Other than for the addition of a fiscal policy variable, or how monetary policy is assumed to impact the real and nominal sides of the economy, equation (2) is standard. We are interested in the impact of a real exchange rate shock on inflation alone. Hence, to conserve space, only select impulse responses are shown. In addition, we employ a Cholesky decomposition such that shocks to the output gap affect all the other variables contemporaneously while monetary policy shocks do not contemporaneously impact the other variables in the model. It should be noted that changing the order of the fiscal variable and placing the real exchange rate shocks before the monetary policy shock does not impact the conclusions discussed below. Moreover, since we are not interested in "identifying", say, aggregate demand versus aggregate supply shocks, no additional restrictions are imposed. More generally, our estimates are simply intended to illustrate how real exchange rate shocks behave during the BWS era versus when a floating exchange combined with IT is in place.[29] When nominal exchange rates are pegged, shocks to the real exchange rate stem from relative price changes, including commodity prices but the nominal exchange rate channel is closed. Under a float both real and nominal sources dictate the size of real exchange rate shocks.

[28] For example, one version with exogenous variables adds lagged US monetary policy deviations from the Taylor rule recommendation and the lagged commodity price inflation for Canada. Our conclusions are unaffected.
[29] Djoudad, Gauthier and St-Amant (2000) specify a VAR that is not too dissimilar to ours. Other studies (e.g., Ha, Stocker, and Yilmakuzday, 2020; Ferrara, Metelli, Natoli, and Siena, 2021), whose focus is on the role of global versus domestic factors, or the role of fiscal policy in influencing the relationship between inflation and real exchange rates, estimate structural VARs with additional restrictions to identify these separate shocks. Our approach is less demanding of the data but, if course, is subject to the caveat that a more identification of the sources of shocks may well impact the conclusions.

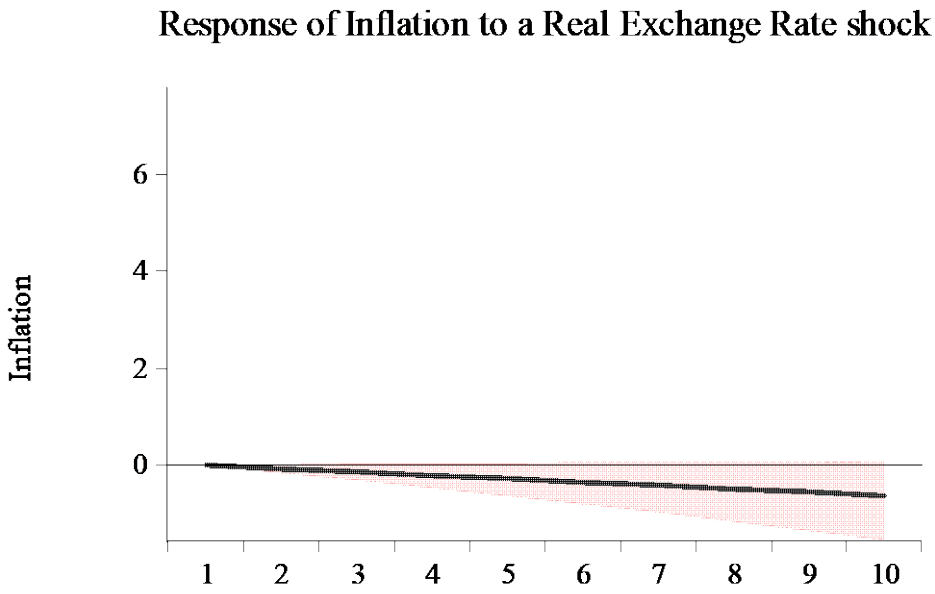
Figure 9 shows the impulse responses of inflation and monetary policy to a real exchange rate shock. Part (a) of the Figure covers the Bretton Woods period, while part (b) is derived from data since 1990 when Canada adopted IT. We observe that inflation responds positively to a real exchange rate shock during the BWS era (top portion of Figure 9(a)) while, as shown in the top portion of Figure 9(b), the inflation response to the same real exchange rate shock is statistically insignificant. Hence, there is some evidence that the exchange rate is capable of insulating against real exchange rate shocks under a floating regime. Similarly, under the BWS, a real exchange rate shock, where a positive shock signals a depreciation, prompts a wider deviation from the Taylor rule prescription, our indicator of the stance of monetary policy, while the same shock does not lead the central bank to change the stance of policy under a float when inflation is targeted (bottom of Figure 9(b)). This may also be taken as evidence that monetary policy is shielded from real exchange rate shocks under a floating system, especially when combined with IT while the same result does not carry over to a pegged exchange rate system.

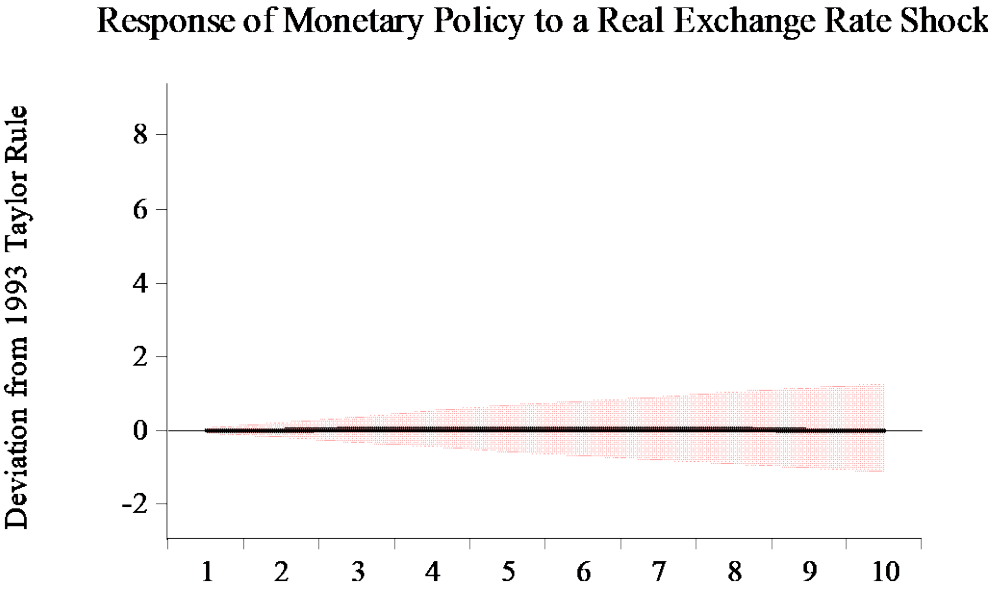
Figure 9 Real Exchange Rate Shocks, Inflation and Monetary Policy

(a) Bretton Woods Era



(b) Floating Era Under Inflation Targeting





Note: The impulse responses show the accumulated impact of a real exchange rate shock on CPI inflation and deviations of the observed policy rate from a notional Taylor rule (Taylor, 1993) with time-varying r* (neutral real interest rate). Bootstrapped confidence intervals using Kilian's unbiased approach (90%). 999 replications and 499 double replications). The sample for the Bretton Woods period is 1962.2-1970.1; for the float and inflation targeting, 1991.3-2022.4. The VARs consist of the output gap, CPI inflation, real exchange rates, fiscal policy, and monetary policy, in that order. 1 lag is used in estimation (Cholesky decomposition) based on the SIC criterion.

Next, we turn to asking about how Canada's inflation rate is influenced by commodity price shocks. Unfortunately, data limitations do not allow us to include the Bretton Woods period when we rely on the proposed specification. Only the samples when monetary targeting and the absence of an inflation anchor between the 1970s until the end of the 1980s were in place, followed by the IT regime, are considered. We employ a version of the model originally specified by Amano and van Norden (1998a, 1998b).[30] However, we allow the data to dictate when the relationship between inflation and its determinants is subject to structural breaks in the same manner as was done when estimating Taylor rules (see Table 1). The main determinants of pass-through effects include US inflation, the output gap, the rate of change in the nominal exchange rate, and commodity price inflation.

The results are shown in Table 2. The first notable result is that breaks are estimated around the time of changes in the underlying monetary policy regime discussed in this study. For example, one break occurs in 1990, thst is, shortly before the start of IT; the next break, in 1995, is dated around the time the government of Canada and the Bank of Canada agreed to an inflation target range of 1-3% that has remained unchanged since then. Previously, inflation reduction targets were in place. The final break takes place in the year preceding COVID. Other than during the COVID period, arguably an exceptional sample**,** real exchange rates have a declining impact on Canada's inflation rate. Most importantly for our argument, the period since IT is in place sees real exchange rates having a smaller impact on domestic inflation than under the inter-regnum between Bretton Woods and IT.

[30] There is a large literature dealing with the evaluation of exchange rate pass-through effects relying on a wide variety of techniques. See, for example, Sekine (2006), Jasová, Moessner, and Takáts (2016), and Ha, Stocker, and Ylmakuzday (2020).

Table 2 Estimates of Exchange Rate Pass-Through, 1973-2022

Dependent Variable: CAD_INFLATION
Method: Least Squares with Breaks
Sample (adjusted): 1973Q1 2022Q4
Included observations: 200 after adjustments
Break type: Bai-Perron tests of L+1 vs. L sequentially determined breaks
Breaks: 1990Q2, 1995Q1, 2019Q2
Selection: Trimming 0.05, Max. breaks 3, Sig. level 0.10
HAC standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
1973Q1 - 1990Q1 -- 69 obs				
C	0.050	0.219	0.228	0.820
Canada: INFLATION(-1)	0.852	0.063	13.586	0.000
USA: INFLATION(-1)	0.133	0.063	2.092	0.038
Canada: OUTPUT GAP	0.100	0.021	4.675	0.000
Canada: Exchange Rate depreciation	**0.067**	**0.021**	**3.217**	**0.002**
Canada: Bank of Canada Commodity Price Inflation	0.023	0.007	3.480	0.001
1990Q2 - 1994Q4 -- 19 obs				
C	-3.556	0.746	-4.767	0.000
Canada: INFLATION(-1)	0.498	0.093	5.373	0.000
USA: INFLATION(-1)	1.502	0.197	7.641	0.000
Canada: OUTPUT GAP	-0.099	0.077	-1.280	0.202
Canada: Exchange Rate depreciation	**0.040**	**0.054**	**0.745**	**0.457**
Canada: Bank of Canada Commodity Price Inflation	0.004	0.018	0.215	0.830
1995Q1 - 2019Q1 -- 97 obs				
C	1.213	0.184	6.612	0.000
Canada: INFLATION(-1)	0.621	0.089	6.940	0.000
USA: INFLATION(-1)	-0.269	0.109	-2.459	0.015
Canada: OUTPUT GAP	0.146	0.050	2.944	0.004
Canada: Exchange Rate depreciation	**0.035**	**0.010**	**3.559**	**0.000**
Canada: Bank of Canada Commodity Price Inflation	0.028	0.005	6.023	0.000
2019Q2 - 2022Q4 -- 15 obs				
C	0.761	0.090	8.448	0.000
Canada: INFLATION(-1)	0.539	0.110	4.907	0.000
USA: INFLATION(-1)	0.148	0.211	0.701	0.484
Canada: OUTPUT GAP	0.045	0.035	1.298	0.196
Canada: Exchange Rate depreciation	**0.153**	**0.074**	**2.077**	**0.039**
Canada: Bank of Canada Commodity Price Inflation	0.046	0.015	2.991	0.003
R-squared	0.982			
Adjusted R-squared	0.980			
S.E. of regression	0.439			
Sum squared resid	33.932			
Log likelihood	-106.391			
F-statistic	423.954			

Prob(F-statistic)	0.000			

Note: Estimated via OLS subject to structural breaks using the Bai-Perron (1998) test. Also, see notes to Table 4. Canada: INFLATION and USA: INFLATION are, respectively, CPI inflation in Canada and the US. CAD_OUTPUT GAP is the output gap for Canada. It is the mean of a one-sided H-P filtered gap (1600 is the smoothing parameter), the rate of change in real GDP, the Christiano-Fitzgerald band pass filter (filters out frequencies of 8 quarters or more), and Hamilton's filter. Exchange rate depreciation is the rate of change in the nominal exchange rate between the $C and $US, and the rate of change (quarterly annualized) in the Bank of Canada's commodity price index is also included.

While commodity price inflation has a statistically significant impact on domestic inflation in all but one sub-sample, the impact of the coefficients is small and they are dwarfed by the impact of lagged domestic and US inflation, as well as the domestic output gap. Finally, we observe that domestic inflation has tended to become less persistent over time, though it remains statistically significant, another consequence of IT regimes.

We now conduct one final exercise which asks: if we consider the adoption of a floating regime, inflation targeting, or both, as 'treatments' then how does this impact the conduct of monetary policy?[31] For example, if one, or both, of these treatments implies greater monetary policy autonomy then, relative to countries that peg their exchange rates, this ought to translate into added scope not to change the policy rate if the float provides some insurance against exchange rate shocks.

We chose countries as belonging to the treated (T) such that their exchange rates float and a policy of inflation control is also in place.[32] The countries belonging to this group are: Australia, Canada, Norway, New Zealand, Switzerland, Sweden, and the US. All except the US are small open economies. However, the conclusions discussed below do not change if we exclude the US from the T group.

[31] A 'treatment' in this context presumes that the chosen variable (e.g., adoption of IT, or a floating exchange rate regime) is the causal variable whose impact, here on policy rate changes, we are considering. We were made aware of Brito et. al. (2021) after completing a draft of the present paper. The authors use a similar approach to investigate whether early adopters of IT (New Zealand, Canada, U.K., Sweden, and Australia) benefited from a better inflation-output trade-off than non-treated counterparts (all industrialized countries). They answer in the affirmative but do not explicitly consider the role of floating exchange rates.

[32] There are clearly varieties of inflation targeting. Switzerland, for example, is perhaps better characterized as carrying out inflation forecast targeting, while the United States, despite the explicit announcement of an inflation objective in 2012, is mandated to follow a dual objective that includes a concern for the real side of the economy. Moreover, when an inflation target range is adopted, it can differ across countries and across time (e.g., Canada, New Zealand, Sweden, and Korea) while Australia has a medium-term point target.

For the non-treated (NT) group we chose countries whose exchange rate regime is pegged or displays limited flexibility. They may or may not have a policy of inflation control.[33] The countries forming this group include: the Czech Republic, Denmark, Hong Kong, Croatia, Singapore, Iceland, and Korea. All of these economies are also considered small open economies and some of them (Czech Republic, Iceland, and Korea) are also inflation targeting economies. Needless to say, the degree to which these countries peg their exchange rates (to the euro or the US dollar) likely varies considerably. For example, Hong Kong's peg is much tighter than, say, Korea's. Korea, at least since the late 1990s, is considered to be an IT economy though whether the regime is identical to the one that prevails in the T group is debatable.[34] A similar narrative applies to the Czech Republic which, unlike Korea, is also a candidate to adopt the euro. We did experiment with excluding Korea, and the Czech Republic, and, for the most part, the results shown below, continue to hold. In any case, the results shown here treat Korea, the Czech Republic, and Iceland as having adopted IT and this has an impact on the estimated specification when both elements of a country's policy regime are considered.

To ensure a balanced sample, the data set consists of 14 countries, 7 of which are considered floaters, the remaining 7 adopted a form of pegged exchange rates. Up to 10 countries are also considered to have adopted IT.[35] Data and sample limitations constrain the number of countries that could be included in the econometric test results discussed below. Hence, the estimation period is 1995-2022, using quarterly data. What unites these countries is, presumably, their desire to deliver a sound monetary policy, which we define as maintaining low and stable inflation without compromising economic performance.

Hong Kong, Singapore, Denmark and Croatia, for various reasons (e.g., membership in the EU or imminent membership in the euro area or heterogeneity and proximity of trading partners)

[33] Arguably, any central bank would argue that its mandate includes inflation control. However, in the case where the exchange rate is not flexible, there will be a trade-off between pressure on the exchange rate and inflation. We are implicitly assuming that countries with a peg, as defined here, clearly place relatively more weight on exchange rate fluctuations over inflation performance, at least in the short-run.
[34] As Clinton et. al. (2019, Figure 1) reveal, the pursuit of IT has become much more complex since the central bank also became responsible for the maintenance of financial stability post-GFC.
[35] The appendix provides the dates of adoption of IT and exchange rate regimes.

have limited exchange rate flexibility to a greater or lesser extent. Even the Czech Republic intervened in foreign exchange markets by implementing a ceiling on the the koruna's from November 2013 until April 2017.[36]

Define m as the central bank policy instrument. To estimate the impact of the policy (i.e., choice of exchange rate regime, inflation targeting, or both, on T we use the difference in the mean of Δm (or m in the levels regression) between T and NT groups before and after D^*. D^* is the treatment effect and is set equal to 1 for the T group and 0 otherwise. Hence, for example, D=1 for Canada since 1991Q1 as this is the date that IT is formally introduced. Similarly, D=1 if the country is assumed to float (e.g., Canada), and is set 0 otherwise. When both regimes are simultaneously considered then D is defined as the product of the IT and exchange rate regime treatments. Since the evaluation takes place at the mean, the average effect of the policy between the T and NT groups is written:

$$\text{ATET}= \left(\widehat{\Delta m}_{T,t\geq D^*} - \widehat{\Delta m}_{NT,t\geq D^*}\right) - \left(\widehat{\Delta m}_{T,t<D^*} - \widehat{\Delta m}_{NT,t<D^*}\right) \qquad (3)$$

where ATET is the average treatment effect for the treated group and all the other terms have already been defined.[37]

Finally, if we add a country group fixed and time effects (θ_g, γ_t) the resulting panel model becomes

$$\Delta m_{i,g,t} = \theta_g + \gamma_t + \rho D_{g,t} + \varepsilon_{i,g,t} \qquad (4)$$

with g=1 the group that experiences the treatment while g=0 does not. Therefore, ρ represents the so-called treatment effect. Other extensions can be brought to bear including the addition of exogenous variables such as $\boldsymbol{X}_{it}, \boldsymbol{Y}_{it}$ described above. In estimating the treatment effect, we

[36] https://www.cnb.cz/en/faq/What-was-the-exchange-rate-commitment/.

[37] Ignoring subscripts that represent the countries in the data set, we can also represent the treatment effect idea in terms of a simple regression of the form, $\Delta m = \chi_0 + \chi_1(D > D^*) + \chi_2 T + \chi_3(D > D^*) \cdot T + u$, where all the terms were defined above and χ_3 captures the impact of the policy in the T group of countries introduced after time t=D^*.

condition on real GDP growth and inflation since these are the core variables that dictate how policy rates change according to the Taylor rule.

Table 3 and Figure 10 provide the main results. Table 3 shows that the adoption of IT, or a floating exchange rate regime, results in smaller changes in the policy rate relative to countries that peg or did not adopt IT. The size of the treatment effect is essentially the same in both cases. Therefore, it is not unreasonable to conclude that a sound monetary policy requires fewer policy rate changes to keep inflation at target, at least on average. This may be interpreted as evidence that monetary policy in these economies is more credible relative to the group of economies where a form of exchange rate pegging is practiced.

Figure 10 shows the evolution of the treatment effect over time. We immediately observe that, since the GFC and until the COVID pandemic, there is no statistical distinction between the T and NT groups. This likely reflects the global decline in policy rates that remained sticky near or at the effective lower bound of interest rates. We also observe that, on balance, countries that adopted IT and a floating rate required fewer changes in the stance of monetary policy between the early 1990s until the GFC. What the results cannot indicate is whether IT produced an environment that led to a better anchoring of inflation expectations and, hence, fewer changes in policy rates to maintain inflation control.[38] The anchoring question and the role of policy regimes such as IT remains unsettled (e.g., see Kumar, Coibion, Gorodnichenko, and Afrouzi, 2015; Cunningham, Desroches, and Santor, 2010; Ehrmann, 2015). Finally, notice the sharp rise in policy rate changes among the T group beginning in 2021. While this is not the place to debate whether central banks delayed their response to the post-COVID inflation shock, it is plausible that IT, together with a floating exchange rate, gave greater flexibility for those countries to eventually respond aggressively to the inflation surge when the targets were breached. Central bank autonomy, the desire to mitigate the loss of credibility due to large deviations from an inflation objective, and a floating exchange rate regime, combined to allow central banks to raise policy rates quickly and aggressively in response to a large inflation shock.[39]

[38] A fuller analysis would require expectations data covering the full IT and float samples. These are unavailable. The available data begin in the mid-1990s when both IT and the float were in place.

[39] Central banks around the world, but especially in advanced economies, responded slowly to the inflation shock that was originally thought to be temporary. Once it became clear that the surge in inflation was much larger and

Table 5 Estimates of Treatment Effects In the IT Era: 1995-2022

Dependent Variable: Change in Policy Rate	
Treatment	Estimate
IT	**-0.14 (.01)***
Cross-sections: 14	Observations: 1590
ERR	-0.12(.01)*
Cross-sections: 14	Observations: 1590
ERR1	-0.13(.01)*
Cross-sections: 14	1461

Note: Estimated via Difference-in-Difference approach. IT is a 0-1 dummy indicating whether the country in questions adopted inflation targeting. ERR and ERR1 are 0-1 dummies indicating whether the country in question has a floating exchange rate. Samples usually begin in the mid to late 1990s and the panel is unbalanced. IT is set to 1 when inflation targeting is adopted which varies across the adopters (AUS, CAD, NOR, NZL, SWE, USA). ERR assumes a single treatment date. ERR1 combines a floating regime and inflation targeting. The list of T and NT countries is also provided in the text.

To be sure the estimates presented in Table 3 and Figure 10 are mainly illustrative.[40] There may well be other conditioning factors omitted in explaining policy rate changes in the estimates presented here, including the role of quantitative easing or, more recently, quantitative tightening, and the evolution of inflation expectations. Moreover, there is a separate debate worth

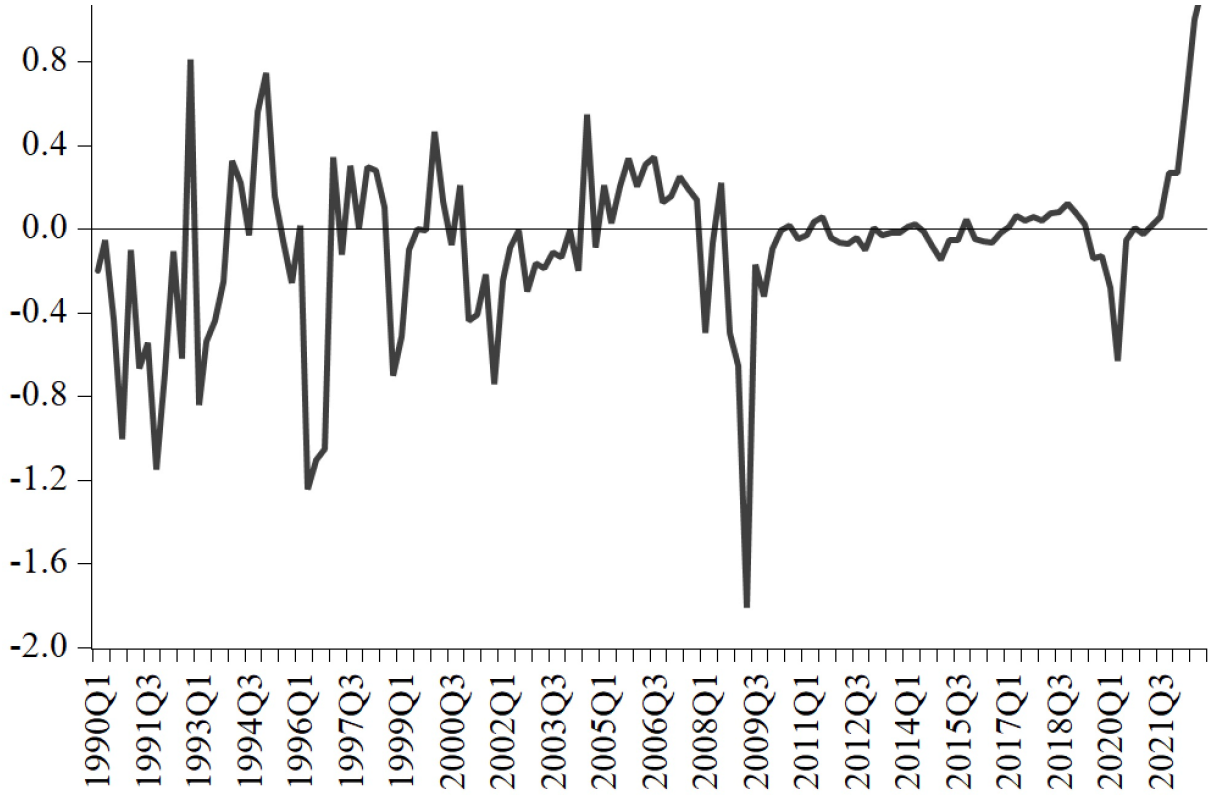
more persistent than expected, central banks responded aggressively by raising policy rates and withdrawing support via unconventional monetary policies. Central banks have struggled to provide a clear explanation for the failure to act earlier but many have emphasized the exceptional nature of the pandemic and the adjustment once countries exited the pandemic (e.g., see Kryvtsov, MacGee, and Uzeda, 2023). Nevertheless, some of these central banks have under-emphasized the accumulated and, arguably, the impact of years of ultra-low interest rates and unconventional monetary policy and did not pay enough attention to the impact of the massive fiscal expansion that occurred in 2020-2022. See Siklos (2023), and references therein.

[40] Indeed, we are careful not to attribute a causal explanation of the link between IT, the choice of exchange rate regimes and changes in policy rates. For example, it is possible that the impact of IT changes as experience with a particular regime increases. Although a time effect is included it is possible that some bias remains in our estimates. Note also that most of the countries in the IT group adopted IT temporally close to each other and all can argue that the precise form of the IT regime differs. An extension that we did not consider is to apply the Goodman-Bacon (2021) approach because the pre and post periods are not as precisely especially for the exchange rate regime and, in some cases, the IT regime.

undertaking about the costs versus the benefits of frequent policy rate changes.[41] Nevertheless, the combination of the narrative and econometric results shown here do suggest that, at least for Canada, the combination of a floating regime and one that keeps inflation at target has delivered better inflation performance and contributes to mitigating the impact of external shocks via the exchange rate or commodity prices.

[41] There was considerable consensus that central banks acted gradually in response to shocks that required a change in the policy rate (e.g., Sack and Wieland, 2000) see although not all agreed (e.g., see Rudebusch, 2006). Future research may well ask once again about the pros and cons of gradualism in setting the stance of monetary policy.

Figure 10 Mean Changes in Policy Rates By Treatment Date



Note: Based on estimates in bold in Table 5. IT is the treatment variable.

4. Conclusions and Policy Lessons

Canada was a pioneer floater in the post -World War II era. It left the BWS par value system in 1950 and violated the rules of the 1944 IMF Articles of Agreement. Despite contemporary opprobrium, Canada's experience under floating from 1950 to 1961 achieved low and stable inflation and low unemployment in the early 1950s. But, as Milton Friedman's warned long ago, deteriorating economic conditions in the face of tighter monetary policy later in the 1950s and early 60s led to Canada's returning to the par value system in 1962.

After 1970, Canada, along with the other advanced countries, adopted floating. Its experience in the subsequent two decades was highly correlated with the performance of its monetary policy. From the 1960s's to the 1980s's Canada's inflation and real economic performance was similar to its larger neighbor to the south. With the advent of inflation targeting along with floating exchange rates in 1990, Canada's inflation rate was significantly lower than in the U.S.

Canada's float was very successful in insulating it from external commodity shocks to its real exchange rate. Again, as Milton Friedman proffered in his seminal 1953 article, floating did provide a modicum of insulation.

Empirical analysis using both notional and estimated Taylor rules backs up the narrative evidence. Deviations of the policy rate from the Taylor rule in Canada were greater than during periods of less than stable monetary policy and were no less than in the U.S. But since the adoption of inflation targeting along with its float, Canada outperformed the U.S. with respect to its inflation performance. A plausible explanation for this is Canada's adherence to a simple mandate of price stability compared to the dual mandate's focus on inflation and unemployment which prevailed in the U.S. since 1977.[42]

Moreover, an econometric analysis using the diff-in diff treatment methodology shows that a sample of IT/floating advanced countries had fewer policy rate changes in the face of an inflation shock than a sample of non-IT/ floating exchange rate countries. This suggests that the combination of floating along with IT gave these countries a degree of monetary policy independence broadly consistent with theoretical predictions. In the case of monetary policy while external shocks could not be ignored completely, decisions about the domestic stance of monetary policy could be de-coupled from ones that prevailed abroad, notably in the US.

[42] One likely cannot ignore the role played by "luck" in the sense that the Great Moderation took place when economic shocks were more muted than since the GFC (e.g., see Stock and Watson, 2003). Fiscal policy is likely another factor since Canada's fiscal position since the early 1990s, at least until the COVID crisis, was likely more in tune with monetary policy over this period. For an early exposition about the overall economic conditions during the early years of IT see Laidler (1997).

Canada, like much of the rest of the world, cannot ignore monetary policy in the US. Even if the observed conduct in both countries looks comparable at times this is because of the expectation that inflation will be low and stable. However, at both the institutional and policy levels, the Bank has been able to chart an independence course over time. Unlike the US Federal Reserve, Canada's central bank does not adhere to a dual mandate, it has experienced no systemic crises of the kind the US central bank had to contend with and, other than briefly during the 2020-22 pandemic, did not engage in the kinds of unconventional monetary policies the Fed introduced beginning in 2008, to name three salient examples. Even the recent surge in inflation in the US was noticeably higher and has, so far, taken longer to reverse than in Canada.

Our narrative historical and empirical analysis based on the Canadian experience since 1950 with floating exchange rates suggests that one key lesson for small open economies (not in a monetary union and that have sound fiscal and monetary institutions) is that floating exchange rates along with inflation targeting can achieve low and stable inflation, although there is, as always, room for disagreement (e.g., Frankel, 1999). Of course, this does not preclude the possibility that a central bank may decide to intervene when an economic crisis or other forms of identifiable or significant market disorder emerges. Indeed, even the Bank of Canada retains the option to intervene in foreign exchange markets under clearly articulated economic conditions.[43]

Our analysis also points to extensions and omitted considerations in attempting to understand the nexus between sound monetary policy and a floating exchange rate. Central banks around the world now bear the additional burden of evincing a concern for financial stability. Moreover, as the US-Canada example also illustrates, banking system differences may also play a role in the ability of the floating regime to insulate an economy against external shocks. These extensions provide ample reason for additional research on the topic of exchange rate regime choice.

[43] See https://www.bankofcanada.ca/rates/exchange/foreign-exchange-intervention/. Another inflation targeting small open economy central bank, namely the Reserve Bank of Australia, also retains the option to intervene under certain conditions. See https://www.rba.gov.au/mkt-operations/ex-rate-rba-role-fx-mkt.html.

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Appendix I: Inflation Targeting Adoption

Country	Date of Adoption
Australia	1993Q2
Canada	1991Q1
Norway	2001Q1
New Zealand	1990Q1
Sweden	1993Q1
United States	2012Q1
Czech Republic	1997Q4
Iceland	2001Q1
Korea	1998Q2

Sources: Quarterly dates obtained from actual dates in force obtained from information available at the websites of the individual central banks listed.

Appendix II – Floating Regime Adoption Dates*

Country	Date Floating Begins
Australia	1990Q1
Canada	1980Q1
Switzerland	2000Q1
Norway	2000Q1
Sweden	1992Q4
New Zealand	1990Q1
United States	1980Q1

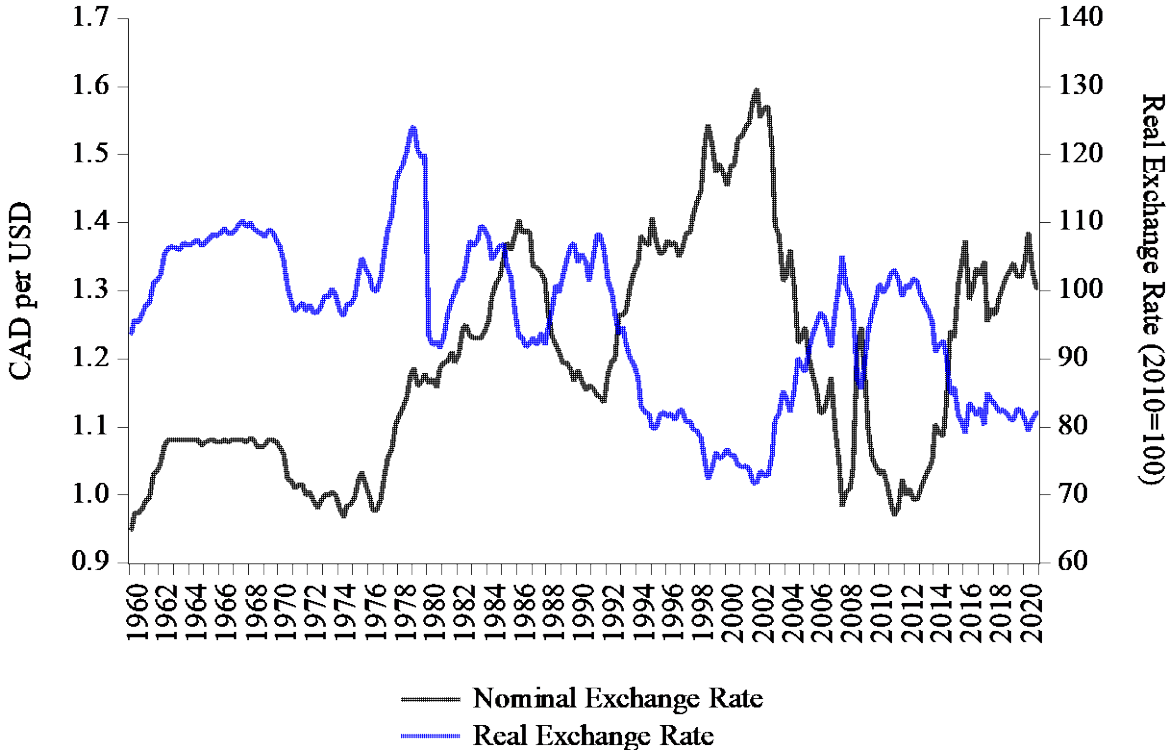
Note: * Sample for the DiD exercise begins in 1980Q1, at the earliest, due to cross-country data limitations.
Sources: whenever possible central bank websites are consulted. Dates cross-checked against the coarse classification of Ilzetzki, Reinhart, and Rogoff (2019). The most notable disagreement is Canada which is considered a managed floating until 2002Q3. It should also be noted that Switzerland, Norway, and Sweden are also considered to be managed floaters in the IIR set-up.

Appendix III – Econometric Analysis, Data Sources and Definitions

Source of Shock	Definition
ENDOGENOUS - CANADA	
Real exchange rate (ε)	Residual from an error correction model using the cointegrating relationship between US real OIL prices (WTI/CPI) and the CAD/USA real exchange rate. Lagged real exchange rate, USA-CAD and USA-GBR short-term and long-term interest rate differentials and lagged real OIL price inflation are exogenous. Follows Amano and van Norden (1995)
Inflation (π)	Annualized inflation in Headline CPI
Output gap ($\tilde{y}$)	An average of 3 approaches: (1) annualized rate of growth in real GDP; (2) One-sided HP filtered real GDP using a smoothing parameter of 51,200 (Canova, 2022); (3) a version using the Christiano-Fitzgerald (2003) filter. These are combined into ONE combined output gap measure.
Monetary policy (*mps*)	Deviations from three types of Taylor rules: (1) Taylor (1993); (2) Taylor (1999); (3) inertial Taylor (1999) as shown in FOMC Tealbook A.
Fiscal policy (*f*)	Deviations of Government real final consumption growth from trend real GDP growth. For Canada trend real GDP growth is estimated via a one-sided HP filter (smoothing = 51200) applied to real GDP. For the USA the CBO potential real GDP estimates are used.
EXOGENOUS – USA/GLOBAL	
Inflation	Same as for Canada – CPI not PCE inflation for data availability reasons
Output gap	Estimated via CBO potential output
mps	See Canada estimates: comparable USA data used
f	See Canada estimates: comparable USA data used
Commodity Prices	Bank of Canada commodity price index. Deviation from **monthly** commodity price from one-sided HP filtered (smoothing =1600) commodity prices

Samples	Historical definition	Effective
Bretton Woods	1960Q1-1969Q4	1961Q1-1970Q1 (T=37)
Float	1970Q1-2022Q4	1970Q2-2022Q4 (T=211)
Series	Availability	Mnemonic
Real exchange rate	1958Q1-2022Q4	CAD_REALXRATE
Inflation – Canada	1915Q1-2022Q4	CAD_INFLATION
Inflation - USA	1914Q1-2022Q4	USA_INFLATION
Output gap- Canada	**1961Q1**-1969Q4	CAD_OUTGAPCOMBO
Output gap - USA	1950Q1-2022Q4	USA_OUTGAP
Real OIL prices	1958Q1-2022Q4	USA_REALOIL
Short-term interest rate - Canada	1954Q3-2022Q4	CAD_TBILL
Short-term interest rate -USA	1954Q1-2022Q4	USA_TBILL
Long-term interest rate - Canada	1960Q1-2022Q4	CAD-10YR
Long-term interest rate - USA	1954Q3-2022Q4	USA_T10Y
USA-GBR short-term interest rate differential	1960Q1-2022Q4	USA_DIFFGBRST
USA-GBR long-term interest rate differential	1960Q1-2022Q4	USA_DIFFGBRLT
USA-CAD short-term interest rate differential	1954Q3-2022Q4	USA_DIFFCADST
USA-CAD long-term interest rate differential	1960Q1-2022Q4	USA_DIFFCADLT
Central bank policy rate - Canada	1960Q3-2022Q4	CAD_CBPR
Central bank policy rate - USA	1954Q3-2022Q4	USA_CBPR
Fiscal policy measure - Canada	1962Q1-2022Q4	CAD_DEVRGOVEXPG
Fiscal policy measure - USA	**1961Q1**-2022Q4	USA_DEVRGOVEXPG
Commodity prices	**1972Q1**-2022Q4	CAD_DEVBOCCOM
Economic policy uncertainty - Canada	**1985Q1**-2022Q4	CAD_EPU
Economic policy uncertainty - USA	1945Q1-2022Q4	USA_EPU
RSTAR – Canada	**1961Q1**-2022Q4	CAD_RSTARHLW
RSTAR - USA	**1961Q1**-2022Q4	USA_RSTARHLW
Inflation target – Canada	1960Q1-2022Q4	CAD_HPINFLATION
Inflation target - USA	1960Q1-2022Q4	USA_HPINFLATION
T = Number of observations		

Nominal and real Exchange Rates in Canada: 1960-2022



Note: Data from sources listed in Appendix III.