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Canada's Pioneering Experience with a Flexible Exchange Rate in the 1950s: (Hard) Lessons Learned for Monetary Policy in a Small Open Economy

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Abstract

This paper revisits Canada's pioneering experience with floating exchange rate over the period 1950–1962. It examines whether the floating rate was the best option for Canada in the 1950s by developing and estimating a New Keynesian small open economy model of the Canadian economy. The model is then used to conduct a counterfactual analysis of the impact of different monetary policies and exchange rate regimes. The main finding indicates that the flexible exchange rate helped reduce the volatility of key macroeconomic variables. The Canadian monetary authorities, however, clearly did not understand all of the implications of conducting monetary policy under a flexible exchange rate and a high degree of capital mobility. The paper confirms that monetary policy was more volatile in the post-1957 period and Canada's macroeconomic performance suffered as a result.

JEL classification: E32, E37, F31, F32, N1
Bank classification: Exchange rates; Economic models

Résumé

Les auteurs réexaminent l'expérience novatrice à laquelle le Canada s'est livré de 1950 à 1962 en laissant flotter sa monnaie. En vue de déterminer si le régime de changes flottants offrait la meilleure solution au Canada des années 1950, ils construisent et estiment un nouveau modèle keynésien de petite économie ouverte représentatif de l'économie canadienne. À l'aide de ce modèle, ils procèdent à une analyse contrefactuelle des effets de plusieurs politiques monétaires et régimes de change. Leurs résultats révèlent que le taux de change flottant permit de réduire la volatilité de variables macroéconomiques clés. Cependant, les autorités monétaires de l'époque ne saisissaient pas, de toute évidence, l'ensemble des implications qu'avaient un régime de changes flottants et un haut degré de mobilité des capitaux sur la conduite de la politique monétaire. Le travail des auteurs confirme que la politique monétaire fut moins stable après 1957 et que la situation macroéconomique du Canada s'en trouva dégradée.

Classification JEL : E32, E37, F31, F32, N1
Classification de la Banque : Taux de change; Modèles économiques

Reflections on Canada's Exchange Rate and Monetary Policies: 1950-62

Milton Friedman:

"…floating rates are not a guarantee of sensible internal monetary policy. … All floating rates do is make it possible for you to have a sensible internal monetary policy without considering the rest of the world."

"The reason Canada went off floating rates [in 1962] was because they were working so well, and their internal monetary policy was so bad."

Milton Friedman (1967, p. 122)

Robert Mundell:

"Whether insulation is achieved or not depends on the precise behaviour of the monetary authorities"

"*...the tight monetary policy … suggests a faulty understanding of how the advantages of a flexible exchange rate system can be exploited*."

Robert Mundell (1964, p. 82 and p. 85)

James Coyne (Governor, Bank of Canada, 1955-61):

On the definition of "tight monetary policy":

"To the extent that the phrase might be taken to imply a contraction in the availability of money, it is not applicable. In this sense of the phrase there has never been a 'tight monetary policy' in Canada…."

James Coyne (1958, *Bank of Canada Annual Report 1957*, p.15)

"[I] have always felt a special responsibility as Governor …to protect the value of the Canadian dollar."

James Coyne (July 10, 1961 testimony before the Canadian Senate, p. 340)[1]

[1] The Canadian Senate defeated the Government bill declaring the position of Governor of the Bank of Canada vacant on July 14, 1961; nonetheless, Coyne resigned immediately thereafter.

1. Introduction

On September 30 1950, the Canadian government took the bold step of allowing the Canadian dollar to float, which meant leaving the Bretton Woods par value system less than five years after its establishment.[2] This action marked the beginning of the first policy experiment with a flexible rate by an industrialized country in the postwar period.[3] Canada's decision to adopt a flexible exchange rate in 1950 was bitterly criticized by the IMF because Canada was a founding and integral member of the IMF and the Bretton Woods system, and IMF officials were concerned that other member countries might follow suit. Milton Friedman, in contrast, cited the Canadian situation in the late 1940s as one highly amenable to floating in his famous 1953 article "The Case for Floating Exchange Rates".[4] In this article, he argued that a floating exchange rate provides two key benefits -- insulation from external shocks and monetary independence. Canadian officials subsequently used Friedman's article and these arguments as an intellectual justification for their choice of exchange rate regime.

Despite the fact that Canada's flexible exchange rate remained remarkably stable for more than 10 years (indeed, perhaps it was too stable), the experiment ended in May 1962 amidst a storm of controversy over the recent management of domestic monetary, exchange rate and fiscal policies. This political uproar forced the resignation of James Coyne, the Governor of the Bank of Canada. His dismissal over his conduct of monetary policy was unprecedented among industrial countries and it initiated far-reaching reforms to clarify the relationship between central banks and governments, their political masters.[5] Furthermore, the relatively poor performance of the Canadian economy and the

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[2] The floating rate period actually began the following Monday on October 3, 1950. Canadian commercial banks established an interbank market for foreign exchange over the weekend.

[3] Earlier experiences with floating include the U.S. Greenback 1862-1878; Austria-Hungary 1896-1914; and the U.K. 1931-1939.

[4] Although the essay was written in 1950, Friedman had in 1948 engaged in a radio debate at the University at Chicago with Deputy Governor Donald Gordon and Professor W.A. McIntosh (Queen's University) in which he strongly advocated that Canada float rather than impose currency controls to protect reserves. Powell (2005) provides further details.

[5] The Bank of Canada Act was amended so that in the event of a disagreement over monetary policy, the government would have to issue and publish a directive to the Governor and the Governor would be forced to resign.

controversy over monetary and fiscal policy served as the inspiration for Mundell's contribution to the Mundell-Fleming model.[6] [7]

Friedman's view of the Canadian experience with a floating exchange rate over this period is neatly summarized by the second quote given above: the flexible rate was successful to the extent that it behaved much as Friedman had expected given the fundamentals, but that its ultimate demise was due to misguided monetary policy. James Coyne, on the other hand, felt his monetary policies were anything but misguided; he was committed to low inflation and maintaining the value of the dollar. Although these two goals could be simultaneously achieved with a tight monetary policy, such a policy was often inconsistent, especially in the short run, with achieving a full employment level of output when the economy experienced export and fiscal demand shocks.

The purpose of this paper is to revisit Canada's experience with a floating rate from 1950-62 to re-evaluate the conduct of monetary policy under a flexible exchange rate and a high degree of capital mobility. Such reconsideration is timely because the implementation of monetary policy under a flexible exchange rate and mobile capital is an important issue in a world where more and more small open economies are adopting floating rates and global financial markets are becoming more integrated. In particular, the role of the exchange rate in the transmission of monetary policy, the appropriate response of monetary policy to exchange rate movements and the choice of a nominal anchor are critical monetary policy questions. In this regard, useful lessons can be drawn from Canada's early experience with floating rates. In addition, Canada's decisions in 1950 and 1962 to change exchange rate regimes provides useful insights in the debate on the choice of exchange rate regimes, which has been revived recently in the international policy arena for emerging market countries, for potential euro zone members and also

[6] See Gordon (1961) for a detailed analysis of the Bank of Canada's controversial monetary policies during the Coyne era. Mundell's research on the small open economy model and the assignment problem were motivated by Canada's monetary and fiscal problems. Mundell's research clearly showed that under a flexible exchange rate, tight monetary policy and expansionary fiscal were inimical to a full employment level of output in a small open economy. See Mundell (1964) and Bordo, Gomes and Schembri (2007) for further details.

[7] The ruling Diefenbaker Conservative government was elected in 1958 in a landslide; it was defeated in the 1963 election primarily because of Canada's poor economic performance stemming from mistaken monetary and fiscal policies.

with respect to Canada's current adherence to a floating exchange rate coupled with explicit inflation targets versus some form of credibly fixed exchange rate with the U.S. dollar.[8]

The paper makes an important contribution to the earlier literature on Canada's flexible exchange rate experience in the 1950s by developing and estimating a dynamic general equilibrium model of the Canadian economy in order to conduct a counterfactual analysis of the impact of different exchange rate and monetary policies, in particular the monetary policy of James Coyne, on the performance of the Canadian economy. The theoretical model is largely based on the recent work of Gali and Monacelli (2005) and is estimated using Bayesian techniques as in Smets and Wouters (2003) and Lubik and Schorfheide (2007).

Two counterfactual experiments are conducted. The first assumes that the monetary policy of the period until 1956 (the "pre-Coyne" period) is maintained throughout the sample period and the second assumes that Canada remained on a fixed exchange rate over the 1950─62 period rather than adopting a floating rate. The adoption of the pre-Coyne monetary policy would have reduced the volatility of output and interest rates by allowing the inflation rate to adjust more fully to endogenous shocks. Had the pre-Coyne monetary policy been in place throughout the sample period, it is likely that Canada would not have returned to the Bretton Woods par value system in 1962, only to abandon it for good in 1970. The second experiment shows that had Canada remained on a fixed exchange rate and essentially followed U.S. monetary policy over this period the volatility of output and inflation could have increased significantly. Thus, even though the monetary policy in the post-1957 ("Coyne") period is found to be highly volatile, it was still better than having a fixed exchange rate.

The paper also considers the following specific questions related to the Canadian dollar: What explains the behaviour of the floating Canadian dollar over this period, and in particular, its remarkable stability? How well did it reflect movements in underlying fundamentals? Did the floating exchange rate insulate the Canadian economy from

[8] For references on the recent debate in Canada see Lafrance and Schembri (2003).

external shocks? Was the apparent stability due to the absence of shocks? These questions are addressed in the historical narrative section of the paper and as well as by simulation results derived from the estimated DSGE model.

The unique Canadian experiment with a flexible exchange rate sparked extensive research, most of which was published in the 1960s and early 1970s in an era when the Bretton Woods par value system was undergoing severe strains and debates raged about feasible alternatives.[9] This earlier literature on the Canadian experience focused on the merits of floating exchange rates by analyzing whether the regime's performance was satisfactory in terms of the stability of the exchange rate, the overall macroeconomic performance of the Canadian economy, the ability of the flexible rate to provide insulation from external shocks, and the amount of monetary independence actually achieved under the flexible rate regime. Following Friedman's arguments on stabilizing speculation, much of the research focused on the first issue, the stability of the exchange rate and the role of short-term capital movements. The consensus opinion from this research was that, on the whole, the Canadian experience was successful, and this finding was used to make the case for generalized floating and the dismantling of the par value system between 1971 and 1973.[10]

Our general conclusion is similar to that of the older literature in the qualitative sense that our research indicates that Canada's flexible rate performed reasonably well in terms of helping the Canadian economy adjust to shocks. Its effectiveness in this regard was hindered by monetary and fiscal policies that sometimes prevented this adjustment because the Canadian authorities did not fully understand the impact of their policies in an environment of a flexible exchange rate and capital mobility. Our results are generally consistent with Friedman's and Mundell's opening quotes: namely, that the Canadian floating rate experiment demonstrated that a flexible rate combined with a sensible monetary policy allowed the exchange rate to play a stabilizing role in the face of external asymmetric shocks; as a result, Canada's economic performance over approximately the first half of the period, 1950-56, was reasonably good. Over the second

[9] See Yeager (1976) for a useful critical survey of the older literature.
[10] The United Kingdom and West Germany also considered the adoption of a floating rate in the 1950s, but, in the end, both decided against it.

half of the period, 1957-1962, however, the evidence indicates monetary policy under Governor Coyne was sometimes too tight and the government reacted to the growing output gap by expanding fiscal policy which only made matters worse. The resultant high unemployment set in motion the political unrest that led to Coyne's departure. Had Coyne's monetary policy focused solely on maintaining low and stable inflation, rather than also attempting to achieve a strong Canadian dollar and other goals, the outcome would have been superior.[11] Coyne and other Canadian officials, however, were not alone in their mistaken beliefs about the effects of monetary and fiscal policies under a flexible exchange rate and capital mobility because they were not well understood until the pioneering work of Mundell and Fleming.[12]

In the next section of the paper, we review the history of Canada's exchange rate and monetary policy experience in the 1950s and the debates over the floating exchange rate regime and the conduct of monetary policy. In Section 3 the behaviour of the floating Canadian dollar is examined in more detail. In Section 4 a DSGE model of the Canadian economy is developed, then estimated and used to conduct counterfactual exercises. The final section provides some concluding remarks on lessons learned from Canada's floating rate experience.

2. Historical Background

In this section, we provide an overview of Canada's exchange rate and monetary policy experience from 1950 to 1962. In particular, we summarize the historical experience and highlight the key issues. Monetary policy in Canada over this period was primarily directed by the Bank of Canada, which was established in 1935 by the Bank of Canada Act. The Act, however, did not clearly define the independence of the Bank of Canada over the conduct of monetary policy. This lack of clarity would become a significant political issue toward the end of the floating rate period as pressure on the government for a change in the direction of monetary policy mounted. Graham Towers

[11] Coyne also wanted to reduce Canada's "dependence" on foreign capital (Coyne's words). There is some evidence that he used tight monetary policy by trying to raise domestic savings rates in a failed attempt to reduce such inflows.

[12] Haberler (1937) developed many of the ideas that were later formalized by Mundell and Flemming. See Bordo and James (2001) for more details.

served as Governor of the Bank of Canada for the first 20 years of its existence from 1935-1954. He was succeeded by James Coyne who was eventually forced to resign by the government in July 1961, six months before the end of his seven-year term, essentially over differences between Coyne and the government concerning domestic economic policy, including fiscal and commercial policy as well as monetary policy.

Both the U.S. Federal Reserve and the Bank of Canada have a relatively diffuse legal mandate, but compared to the Federal Reserve, the Bank of Canada was much less transparent in the years immediately after World War II. The ultimate responsibility for Canadian monetary policy rested solely with the Governor and so, in contrast to the Federal Reserve, there are no minutes from meetings to explain the process by which monetary policy decisions were reached.[13] Information was provided via the Bank's annual report, speeches by the Governor, parliamentary testimony and a limited number of other publications. Moreover, unlike the Federal Reserve, the Bank did not consistently employ a small set of well-defined indicators/intermediate targets for monetary policy such as free reserves in the banking system.[14]

In our review of the annual reports of the Bank of Canada, speeches by the governor and secondary sources, it appears that monetary policy over the period was guided by the principles of maintaining low inflation and relatively stable output growth. In addition to measures of inflation and economic activity, the Bank also considered a variety of other indicators such as commercial bank cash reserves, market interest rates, and measures of aggregate liquidity such as bank loans. The notion of an intermediate target does not appear initially, but later short-term market interest rates are used as the Bank Rate, the rate at which chartered banks can borrow from the Bank of Canada, is linked to the Treasury Bill rate. The implementation of monetary policy changed over the period as financial markets developed. Initially, moral suasion and quantitative restrictions on commercial bank lending were used and then open market operations and changes in the Bank Rate became the preferred instruments to influence short-term market interest rates.

[13] Although the monetary policy at the Bank of Canada has become much more transparent, the Governor remains solely responsible for its conduct.
[14] See Romer and Romer (2002).

The Canadian federal government was responsible for exchange rate policy and made the decisions to change the exchange rate parity rates and the exchange rate regime after World War II.[15] To some extent these decisions were more transparent than the monetary policy decisions of the Bank of Canada because they were debated in Parliament. Although the government (Department of Finance) and the Bank of Canada had different responsibilities in terms of economic policy there was regular consultation between them, especially on exchange rate and monetary policy.

Prelude: 1946-50

Canada allowed its currency to float in October 1950 after two unsuccessful attempts to establish a sustainable Bretton Woods par value. In July 1946, the Canadian dollar was revalued from a wartime discount with the U.S. dollar to parity. It soon became evident that this rate was too high and beginning in 1948 official reserves began to decline with the consequent deflationary pressure. In September 1949, Canada followed the U.K. and 30 other countries and devalued its currency back to the pre-July 1946 level of U.S 90.9¢. International economic conditions, however, soon changed in favour of Canada's exports and this rate became too low; there were strong capital inflows beginning in 1949 and continuing into 1950 (reflecting the demand for Canadian resources for the Korean War, which began in June 1950) and these led to a significant increase in international reserves, bank reserves, and the money supply. To offset this inflationary pressure, the authorities decided to float the Canadian dollar rather than try to pick another par value only to find out, as in 1946 and 1948, that it was no longer appropriate. The decision to float was presented as a temporary move, presumably with a return to the par value system once a new 'fundamental equilibrium' had been reached.[16]

[15] The federal government also is responsible for international reserves, which are held in the Exchange Fund Account, and thus, for foreign exchange market intervention as well. The Bank of Canada, as the financial agent for the government, actually performs the intervention.

[16] In a speech on October 20, 1952, the Conservative Minister of Finance, Douglas Abbott, said, "At some future time conditions may develop in Canada in which it would be appropriate to establish a fixed rate of exchange for the Canadian dollar". See Binhammer (1964, p. 639) and Yeager (1976, p. 544) for further details.

1950-51: Transition to a Free Float

Figure 1 shows that over the next 18 months the Canadian dollar appreciated markedly from 90.9¢ to $1.02, a 12% increase. This rapid appreciation has largely been explained as a consequence of continued massive capital inflows - largely FDI from the U.S. to develop Canada's natural resources (Yeager 1976, p. 544) as shown in figure 2. The Korean War boom was associated with very rapid real growth (see figure 3), which put upward pressure on Canadian interest rates and provided further support for the appreciating currency.

When the floating rate period started in October 1950, foreign exchange controls were still in place in Canada and an active market for short-term government securities did not exist, neither did an overnight market for reserves. Chartered banks rarely borrowed from the Bank of Canada and so the Bank Rate, which was perhaps the most visible instrument of monetary policy, was largely ineffective in influencing monetary conditions. For example, in October 1950, it was raised to 2% from 1.5% and it remained at that level until February 1955, when it was reduced back to 1.5% (Figure 5b). As a consequence, monetary policy was also conducted through various forms of open market operation involving government securities and government deposits held by the chartered banks, and by moral suasion and direct regulation to influence the volume of chartered bank lending.

In this vein, special direct restrictions on consumer and bank credit were adopted in 1950 and 1951 to help the Bank cope with the abrupt inflationary pressure stemming from the Korean War expansion in the United States. The U.S. expansion also caused commodity prices to rise sharply which induced a huge capital inflow into Canada (See figure 2 and 8); this inflow not only forced Canada to adopt a floating rate, but also served to greatly expand the money supply. In addition, the prices of many Canadian products, which are commodity based, also increased; although the Canadian dollar appreciated over this period, the appreciation did not offset the effect of the U.S. dollar

commodity price increase. CPI inflation was 6% in 1950 and rose to over 10% in 1951 (figure 4), and much of it was driven by food prices.[17]

1952-56: The Textbook Case

The 1952-56 period was the heyday of the floating regime; the Canadian dollar traded at a substantial premium relative to the U.S. dollar (figure 1) and FDI-driven capital inflows continued (figure 2). With the exception of the 1953-54 recession, growth continued to be high, inflation remained relatively low, and monetary policy and the exchange rate were generally countercyclical.

By the end of 1951, inflationary pressure was waning. Exchange controls were lifted in December 1951, and direct restrictions on consumer and bank credit were removed in 1952.[18] The economy grew rapidly in 1952, yet CPI inflation turned slightly negative, as the price level had stabilized after the decline in commodity prices from their peak in 1951. In 1953, inflation was virtually zero, and the economy grew more slowly, especially in the latter half of the year.

The Bank of Canada took several important steps in 1953 towards encouraging the development of a broad and active market in treasury bills by shifting from a biweekly to a weekly auction, increasing the range of maturities to 273 days and by entering into purchase and resale agreements with dealers of government securities. This latter innovation along with the change to the Bank Act in 1954, which raised the primary (i.e., noninterest bearing) reserve requirement from 5% to 8%, spurred the establishment of a day-to-day loan market among the bank and investment dealers as banks became more interested in managing their reserves and the investment dealers were able to use the purchase and resale agreements to obtain cash from the Bank of Canada. Banks were also allowed to enter the residential mortgage market.

The period of slow growth in Canada, which began in the second half of 1953, in part as a result of reduced defense expenditures on both sides of the border, continued

[17] Inflation is measured year over year from December.
[18] Canada was the second country after the United States to remove exchange and capital controls after WWII. Indeed, the removal in 1951 restored the situation to what it was before WWII. See Powell (2005) for further details.

through most of 1954 and inflation remained close to zero. Interest rates also remained relatively low and so in February 1955 the Bank Rate was reduced to 1.5% because the Bank felt that this rate should be more "flexible and bear a closer (but not fixed) relation to other short-term interest rates".[19] Indeed, this change marked the beginning of more frequent use of the Bank Rate as an instrument of monetary policy.

The Canadian, and, to a lesser extent, U.S. economies, grew strongly through the rest of 1955, 1956 and into 1957. Investment boomed in both countries and in Canada it was centred on the development of natural resources. The new investment required higher imports, which were financed by large inflows of foreign direct investment. As aggregate demand grew, inflation pressures began to mount and for the first time in the floating rate period, the inflationary pressure was domestic in origin. Although inflation was again almost zero in 1955, it jumped to 3% in 1956. The Bank reacted by offering increased resistance to the expansion in bank credit through open market sales. As a result of the higher demand for credit for investment, market interest rates rose and the Bank Rate was increased repeatedly: 5 August 1955 to 2% and then to 2.25% and 2.75% on 12 October and 18 November 1955. Because the banks were making more use of the lending window to meet reserve requirements, the increases were affecting interest rates at the short term. Meetings with the banks were held in September and November 1955 to moderate the "excessive" use of bank credit by some borrowers. The banks also agreed to maintain voluntarily, starting 31 May 1956, a minimum liquid asset ratio (cash, Bank of Canada deposits, day-to-day loans and treasury bills) of 15% to deposits in addition to the 8% primary reserve requirement. In 1956, the Bank Rate was again raised on three occasions until it reached 3.5 % by October. In November, the decision was made that the Bank Rate would float and be equal to 25 basis points more than the Treasury bill rate established at the weekly auction and at the end of 1956, the Bank Rate closed at 3.92%, which represented an increase of almost 250 basis points over less than 23 months.

Over the 1950-56 period, monetary policy seemed to be reasonably effective in stabilizing the Canadian economy against the inflationary pressures stemming from the

[19] Quote taken from a public statement by the Bank of Canada February 14, 1955 and published in the 1955 Annual Report (p.7).

Korean War and then less so during the recession that occurred after the war ended. The exchange rate also moved in a countercyclical fashion. (See Figures 1 and 3) Graham Towers retired as Governor of the Bank of Canada at the end of 1954 and James Coyne began his tenure in January 1955. Although the economy continued to grow from 1956 into 1957, higher interest rates and a stronger dollar, which had appreciated by almost 7 percent over 1955 and 1956 to a premium of 4 U.S. cents by end of 1956, were starting to have an impact. These were the seeds of the later controversy surrounding the conduct of Canadian monetary policy.

1957-60 Deteriorating Performance and Questionable Policies

In 1957, the economy began slowing down after more than two years of rapid growth. Because this slowdown was marked by a sharp increase in the rate of unemployment, from 4% to 7% (See Figure 7), observers began to question the wisdom of Canadian monetary policy, especially as the Bank continued to tighten monetary conditions until August of 1957 with the Bank Rate rising to 4.33% and the Canadian dollar appreciating to a peak of US$1.06 at the same time. This further tightening seemed unwarranted since the signs of a slowdown were apparent as the inflation rate started to decline early in 1957 and ended up the year at 2.2%, down from 3% in 1956.

These criticisms were further supported by the fact that the Canadian economy seemed to slow well before the U.S. economy indicating that the source of the adverse shock was not foreign, but domestic (i.e., tight monetary policy). Indeed, Canada's economic performance during the 1957-58 recession was probably worse than that of the United States as growth was slower and unemployment higher. Controversy also swirled around the money supply figures provided in the 1957 Annual Report. Gordon (1961, 11) argued that the Bank broke with IMF data reporting guidelines and used a "shallow statistical trick" to hide the fact that money supply had, in fact, increased over the last four months of the year by four times less than the Bank reported in the 1957 Annual Report. Indeed, the tone of the 1957 Annual Report (and subsequent Annual Reports while Coyne was Governor) changed; they became more defensive and responded

directly to criticisms with phrases such as "there has never been a tight monetary policy."[20]

The Bank also argued that the increase in the unemployment rate was due to structural factors, in particular, the rapid growth of the labour force because of massive immigration and a higher labor force participation rate. The structural argument, which can be interpreted as an increase in the natural rate of unemployment, should not be immediately dismissed. The unemployment rate in the United States also increased by almost the same amount as the recession deepened into 1958. Although the United States was not the recipient of the same degree of immigration, the two countries shared a similar demographic profile and were undergoing comparable socio-economic changes that likely had similar effects on labour force participation and other aspects of the labour market behaviour. Hence, it would not be unreasonable for the natural rate of unemployment to have increased in both countries.

The trough in the recession in both countries was reached in the spring of 1958 and large scale monetary expansions helped both economies recover quickly; interest rates in Canada fell as the Bank Rate declined from 3.92% at the end of 1957 to a low of 1.91% in July of 1958. These monetary expansions were mainly the result of efforts in both countries to convert or rollover into longer maturities government bonds that were issued to finance WWII defense expenditures and were coming due shortly.

The central banks intervened to keep interest rates low to make the new issues look more attractive to private investors. As both economies rebounded in the second half of 1958, interest rates rose sharply to levels that existed at the beginning of year, especially in Canada as the recovery there was much stronger. In the 1958 Annual Report, the Bank blamed the higher interest rates on higher expected future inflation (investor "inflation psychosis", p. 3). The Bank argued that these expectations were based on the facts that inflation in 1958 was slightly higher than in 1957 (2.5% versus 2.2%) despite the trough of the recession being in 1958 and that the Canadian federal and provincial governments were running "large-scale" fiscal deficits. The critics, however,

[20] Bank of Canada 1957 Annual Report (p. 15).

blamed the higher rates on monetary policy that was too tight. Since neither side had the benefit of Mundell's later work, neither recognized that under a floating rate, expansionary fiscal policy would also contribute to higher interest rates and a stronger Canadian dollar. The currency appreciated by roughly 2% in 1958 and remained at a substantial premium to the U.S. dollar.

Who was right, the Bank or its critics? Inflation in 1959 fell to 2.0% from 2.5% in 1958 despite the fact that the strong recovery continued in Canada through to till the end of 1959. Either the Bank was right that Canadian investors were suffering from inflation psychosis and simply overestimated inflation in 1959 or it was the Bank that suffered from inflation psychosis and tightened monetary policy in the expectation of a rise in inflation, which did not materialize. The evidence seems to point to the latter as the Bank continued to push up short-term interest rates over the first eight months of 1959 (the Bank Rate increased by 257 basis points from 3.85% to 6.41% over this short period), without much evidence of any significant inflationary pressure. A significant spread developed in Canada-U.S. interest rates, especially in the first half of 1959, and the dollar appreciated further in 1959 by another 1%. The unemployment rate fell during 1959, but remained higher than the U.S. level.

It seemed that the Federal Reserve also feared higher future inflation in 1959 and 1960, and it increased its discount rate as well, but less dramatically than the Bank of Canada. The impact of this tightening was felt in 1960 as both economies grew more slowly and inflation fell to 1.3 percent in Canada. The unemployment rate increased sharply from 6.5% at the beginning of 1960 to 8.7% by the end of the year. In the 1960 Annual Report (pp. 15-16), the Bank attempted to shift the blame for the slower growth and higher unemployment from its own policies to "serious structural distortions and inadequacies in the Canadian economy" and argued that more employment and output could be created by measures aimed at reducing the current account deficit (e.g., raising tariffs, encouraging higher domestic savings and less government spending.) For Coyne, the most significant inadequacy was Canada's "undue" dependence on foreign capital that arose, in his view, because of excessive domestic spending (p.7, Annual Report 1958). Thus he felt it was not appropriate to provide easier access to credit to encourage

further excesses. He, however, failed to recognize that higher interest rates only served to make Canada a more attractive destination for foreign capital. Indeed, the Bank of Canada's deliberate pursuit of a tight monetary policy increased interest rate spreads, as Canadian short-term rates rose well above their U.S. counterparts (see figure 5a), and this caused portfolio capital inflows to increase to more than offset declines in FDI relative to the levels seen during the Korean war period, when commodity prices were strong and Canadian natural resources were in high demand (figure 2). Coyne's views on Canada's economic inadequacies and the tight monetary policy that he implemented in order to address them were heavily criticized by the academic community (Gordon, 1961).[21]

The rising unemployment rate and Coyne's contentious arguments, which were repeated in several speeches in 1960 and 1961, embarrassed the government and created substantial political pressure to remove Coyne. In May of 1961 the government reacted by introducing legislation to declare the position of the Governor of the Bank of Canada vacant.

In summary, the Bank of Canada's tight monetary policy in the last half of the floating rate period was excessive; the Bank's overarching fears of higher future inflation never materialized because the Bank did not understand the effectiveness of monetary policy under a floating exchange rate and high degree of capital mobility. Tighter monetary policy served to appreciate the exchange rate and lower inflation by reducing economic activity and the cost of imported goods. In addition, these systematic inflation forecast errors may have been due to two factors: inadequate appreciation of the growth in potential output caused by investment and labour force growth, and the fact that the private sector's inflation expectations were often much better grounded than the Bank's.

1961-62 Transition to a Pegged Exchange Rate

With the resignation of James Coyne, Louis Rasminsky became Governor. Rasminsky accepted the position conditional on a clarification of the responsibility for

[21] Coyne's views on Canada's excessive dependence on foreign capital were consistent with the growing political backlash against FDI and the perceived growing U.S. domination of the Canadian economy during this period.

monetary policy between the central bank and the government that he drafted, known as the directive principle. This principle stated that under normal circumstances the Bank of Canada was responsible for monetary policy, but if a conflict between the Bank and the government arose, the government was required to issue a specific directive to the Governor which would be published in the *Canada Gazette* (the record of the Parliament) and the Governor would have to resign. The government accepted the principle and it was incorporated into the 1967 revision to the Bank of Canada Act. The directive principle was an important achievement because it clearly specified the independence of the central bank for monetary policy and the procedure to be followed in the event of a conflict between the central bank and the government. The extraordinary forced resignation of a central bank governor and the adoption of the directive principle had an impact on policies governing central banks in the rest of the world as the principle was adopted in several other countries, including Australia.[22]

Unfortunately, Rasminsky's accomplishment with the directive principle was overshadowed in his first year of office by the government's bungled attempts to reflate the economy and depreciate a floating rate that eventually brought about an exchange rate crisis, which required IMF intervention. In response to the relatively high unemployment, the government's 1961 budget promised a host of expansionary fiscal policy measures. In his budget speech of June 19, 1961, the Minister also declared his desire to see a depreciation of the Canadian dollar (not comprehending that the expansionary fiscal policy would have the opposite effect.) To this end, the Bank of Canada was instructed to begin official sales of Canadian dollars from the Exchange Fund Account, which were not sterilized, and this caused the money supply to expand. The Canadian dollar soon declined from a premium of approximately 1% on the U.S. dollar in July of 1961 to a discount of CDN 3¢ less than two months later (see figures 1, 5 and 6). Additional intervention in September 1961 led to a further drop in the Canadian dollar to a 5¢ discount. This was followed several months later in April 1962 by a speculative attack on the dollar. To stem the free fall, the government announced a devalued peg at 92.5¢ U.S. Speculation continued unchanged, however, and it took an austerity program and an

[22] For a survey of the experience in other similar central banks, see Tuladhar (2005).

IMF/U.S./UK rescue of slightly more than U.S. $1 billion in June 1962 to restore stability.

Many observers view this episode as the consequence of the Minister of Finance's clumsy attempt to influence the value of the dollar. The change in strategy from laisser-faire to manipulation led to a change in market sentiment that precipitated a currency crisis and a much greater depreciation than was initially sought.

3. The Behaviour of the Exchange Rate

This section focuses on two issues: the remarkable stability of the Canadian dollar over the floating period, 1950-62, and the related issue of whether this relatively stable exchange rate actually helped insulate the Canadian from external shocks. Over the 12 year period, the dollar fluctuated in a narrow range of 13¢ U.S., from a low of U.S. $ 0.93 in early 1950 to a peak of U.S. $1.06 in August 1957. If we focus on the core period, 1952-60, the range was much smaller, only 6¢ U.S., from U.S. $1.00 in early 1952 to U.S. $1.06 in August 1957. Moreover, high frequency fluctuations were very mild and orderly. Over the whole period, the average day-to-day change was 0.08 percent and only 5% of the daily changes over the whole floating rate period exceed one quarter of a percent (Poole 1967).

Several explanations have been put forward to rationalize the exchange rate's stability. Many attributed it to stabilizing speculation by agents who believed that movements in the rate were temporary (Poole 1967, Marsh 1969, Yeager 1976). This evidence was seen as being consistent with the original assertion by Friedman (1953) that speculation under a floating exchange rate would necessarily be stabilizing in order to be profitable. Others attributed it to the coincidence of Canadian with U.S. cyclical positions and monetary policies (Hawkins, 1968, p. 31) (see figures 3, 4 and 5a).

It has also been argued that official intervention operations served to stabilize the value of the Canadian dollar, but the literature has concluded that official intervention did not play a significant role in stabilizing the nominal exchange rate. Although the Exchange Fund Account was used to intervene often in the 1952-60 period – the degree of intervention was limited and simply offset short-run fluctuations to maintain an orderly

foreign exchange market (Plumptre 1970, p.4). Net monthly changes in official reserves were less than 20 million dollars in the majority of months when intervention occurred (Wonnacott 1965, Yeager 1976, Report of the Royal Commission on Banking and Finance 1964, Binhammer 1964).

Several observers, including Plumptre (1970, p. 6), argue that the relative stability of the floating Canadian dollar was due, in part, to the absence of large shocks during this period.[23] This is a plausible argument because for most of this period, Western European countries were rebuilding from the devastation of the Second World War and the two North American economies were content to produce and sell them what they needed, lend them the money to pay for it, and also to absorb much of their surplus labour. Thus, it was a period of growth and relative prosperity. Evidence provided in the next section of the paper from the estimated DSGE model indicates that the structural shocks experienced by the Canadian economy during the floating rate period in the 1950s were generally smaller than those found in subsequent decades.

In summary, the Canadian dollar was relatively stable over this period, not only because shocks were relatively small and to some degree common to both the Canadian and U.S. economies as evinced by the close correlation of their business cycles, but also likely because capital was relatively immobile globally (capital flows between Canada and the United States were the glaring exceptions). In addition, it is important to recognize Canada was the only major industrialized country that was floating at this time – all other major countries had pegged rates to the U.S. dollar.

In addition, to giving the domestic authorities control over monetary policy, the other main benefit of a floating rate is its ability to shelter the domestic economy from external shocks. As noted earlier, the Canadian floating rate was very stable, when compared to recent experience of the industrialized countries, and this was despite two sizable recessions. This stability has led some observers to conclude that Canada's

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[23] Plumptre (1970) also notes that when the Canadian dollar floated in 1930s, its movements were relatively stable as well.

experience in the 1950s did not provide overwhelming evidence on the postulated insulation properties of a floating rate. Wonnacott (1965) compares exchange rate movements with price level changes and shifts in unemployment and concludes that the evidence that the flexible rate provided insulation from external shocks is mixed at best. McLeod (1965) reaches a similar conclusion for price movements; he argues that Canadian inflation performance was about the same as that of the United States over the floating rate period.

Unfortunately, the qualitative bivariate analysis that these authors conduct is incomplete and does not provide an adequate counterfactual analysis. In particular, it is likely that exchange rate adjustment to movements in U.S. export demand was hindered by weakly countercyclical domestic monetary policy. Mundell (1964), McLeod (1965), and Dunn (1971) argue that Canadian monetary policy was much less countercyclical than U.S. monetary policy in the two coincident recessions of 1953-1954 and 1957-58 (figure 3). Not only was the response of Canadian monetary policy and short term rates weaker, but also slower (figure 5a). The fact that the peak to trough movements in output over these two business cycles was larger in Canada than in the United States (figure 3) is consistent with this view. Consequently, the Canadian dollar tended to appreciate when the U.S. authorities eased monetary policy earlier and more aggressively than their Canadian counterparts, and as a result, the exchange rate appeared not to provide much insulation for the Canadian economy in the face of U.S. economic slowdowns and reductions in export demand.

The impact of this higher interest differential was felt by the Canadian dollar. Because there was a high degree of capital mobility between Canada and the United States, there is much evidence that indicates that the Canadian dollar was very sensitive to the short-term interest rate differential in the 1950s.[24] Thus, the tighter Canadian monetary policy in the second half of the floating period held the Canadian dollar above parity with the U.S. dollar, thus reducing the domestic and world demand for Canadian-produced traded goods and slowing economic activity.

[24] See for example, Caves and Reuber (1971).

To analyse further the impact of this apparent shift in monetary policy on the Canadian economy, we conduct a counterfactual analysis in the next section of the paper.

4. Counterfactual Analysis

In this section, we conduct two counterfactual experiments to examine the economic impact of Canadian monetary and exchange rate policies in the 1950s. The first involves eliminating the apparent shift in monetary policy that took place over the second half of the sample by maintaining the monetary policy that prevailed in the first half throughout the floating rate period. The second experiment consists of assuming that the fixed exchange rate parity of 1950 is not abandoned in favour of a flexible exchange rate. To perform these experiments we proceed in the following steps: firstly, we develop a small theoretical DSGE model of the Canadian economy, secondly, we estimate the key parameters using a Bayesian technique, thirdly, we econometrically extract the shocks that prevailed during this period, fourthly, we conduct the experiments by modifying the monetary and exchange rate polices as required and then simulating the model, adding back the shocks that actually took place and finally by calculating and comparing the variances of the key macroeconomic variables in the data with those generated by the model with the counterfactual policies.

The model

We use a structural small open economy model for Canada, similar to the one used in Lubik and Schorfheide (2007), which is a simplified version of Gali and Monacelli (2005).[25] The log-linear model consists of an IS equation for a small open economy, a New-Keynesian Philips curve equation, an equation determining the nominal exchange rate, and a Taylor-type monetary policy rule. We assume that the evolution of

[25] See Gali and Monacelli (2005) for a detailed derivation of the model. The full specification of our model is given in Appendix 5.

the terms of trade is exogenous and the economy is disturbed by four additional domestic and world shocks.[26]

As shown in Gali and Monacelli (2005), the consumption Euler equation leads to the following IS-curve equation for a small open economy:

$$y_t = E_t y_{t+1} - [\tau + \alpha(2-\alpha)(1-\tau)](R_t - E_t \pi_{t+1}) + \rho_A dA_t$$
$$+ \alpha[\tau + \alpha(2-\alpha)(1-\tau)]E_t \Delta q_{t+1} + [\alpha(2-\alpha)(1-\tau)/\tau]E_t \Delta y^*_{t+1}; \quad (1)$$

where $0 < \alpha < 1$, is the share of imports in domestic consumption, which is a natural measure of the degree of openness of the economy, and $\tau > 0$ is the intertemporal elasticity of substitution. Note that if $\alpha = 0$, equation (1) reduces to its closed economy variant. The endogenous variables y_t, R_t, and π_t denote aggregate output (normalized for technological growth)[27], the nominal interest rate, and the consumer-Price- Index (CPI) inflation rate, respectively; while the exogenous variables, dA_t, Δq_t, and y^*_t, denote the technological growth rate, changes in terms of trade, and world output, respectively. The terms of trade, q_t, is defined as the relative price of exports in terms of imports and we assume that its first difference form, Δq_t, evolves exogenously, because Canada is assumed to be a small open economy.

These exogenous variables evolve according to the following first-order autoregressive processes:

$$dA_t = \rho_A dA_{t-1} + \varepsilon_{At}, \quad (2)$$

$$\Delta q_t = \rho_q \Delta q_{t-1} + \varepsilon_{qt}, \quad (3)$$

and

$$y^*_t = \rho_y y^*_{t-1} + \varepsilon_{yt}, \quad (4)$$

where ρ_A, ρ_q, and ρ_y are autoregressive coefficients; ε_{At}, ε_{qt}, and ε_{yt} are random shocks normally distributed with mean zero and standard deviations σ_A, σ_q, and σ_y, respectively. The output growth rate computed from the data is defined as $\Delta Y_t = Y_t - Y_{t-1} = y_t - y_{t-1} + dA_t$, where Y_t is the logarithm of real aggregate output.

[26] All the variables in the model are

[27] Aggregate output is normalized for trend productivity growth to ensure stationarity.

We introduce price stickiness by assuming Taylor-price setting, in which only a fraction of firms producing domestic goods are allowed to change their prices each period with an exogenous probability. Under this assumption, the New-Keynesian Phillips curve is given by:

$$\pi^{d}{}_{t} = \beta E_{t}\pi^{d}{}_{t+1} + \frac{\kappa}{[\tau + \alpha(2-\alpha)(1-\tau)]}(y_{t} - y^{p}{}_{t}), \tag{5}$$

where $0<\beta<1$ is the discount factor; $\pi^{d}{}_{t}$ is Producer-Price-Index (PPI) inflation—defined as the rate of change in the index of domestic goods prices— and $(y_t - y^{p}{}_{t})$ is the output gap, and $y^{p}{}_{t}$ is potential output when prices are fully flexible. In the context of a small open economy, Lubik and Schorfheide (2007) show that potential output can be derived as a linear function of foreign output:

$$y^{p}{}_{t} = -\frac{\alpha(2-\alpha)(1-\tau)}{\tau} y^{*}{}_{t}. \tag{6}$$

The parameter $\kappa > 0$ depends on the model's other structural parameters, such as the price stickiness parameter and labor supply and demand elasticities. In the estimation, this parameter is treated as a structural parameter of the model.

Gali and Monacelli (2005) derive the following equation that relates CPI inflation, π_t, to PPI inflation, $\pi^{d}{}_{t}$, and changes of the terms of trade, Δq_t:

$$\pi_{t} = \pi^{d}{}_{t} - \alpha\Delta q_{t}. \tag{7}$$

Therefore, the equation for the exchange rate, e_t, can be derived from the definition of the CPI assuming that the uncovered interest rate parity and relative PPP always hold:

$$\Delta e_{t} = \pi_{t} - (1-\alpha)\Delta q_{t} - \pi^{*}{}_{t}, \tag{8}$$

where $\pi^{*}{}_{t}$ is the world inflation rate that evolves exogenously according to the following AR (1) process,

$$\pi^{*}{}_{t} = \rho_{\pi}\pi^{*}{}_{t-1} + \varepsilon_{\pi t}, \tag{9}$$

where ρ_π is an autoregressive coefficient and $\varepsilon_{\pi t}$ is a random shock normally distributed with mean zero and standard error σ_π.[28]

[28] Similarly, the nominal exchange rate equation (8) could be written in terms of PPI inflation as $\Delta e_{t} = \pi^{d}{}_{t} - \Delta q_{t} - \pi^{*}{}_{t}$.

The terms of trade enters in first difference form since it is changes in relative prices that affect inflation and real variables via the definition of the CPI. By opting for this specification, we are assuming that the Canadian exporters had no market power in the international markets and the prices of internationally traded goods were completely exogenous to the Canadian economy.

We assume that the Bank of Canada followed a Taylor-type rule to conduct its monetary policy. Thus, it managed short-term interest rates to respond to fluctuations of CPI inflation, output, and the exchange rate. This rule allows us to simply compare the reaction of the monetary authorities to inflation, output, and exchange rate variations during the pre- and post-Coyne periods. The monetary policy rule is described by:

$$R_t = \rho_{R1} R_{t-1} + \rho_{R2} R_{t-2} + \psi_1 \pi_t + \psi_2 y_t + \psi_3 \Delta e_{t-1} + \varepsilon_{Rt}, \qquad (10)$$

with all policy coefficients greater than or equal 0, except ρ_{R2}. The two first terms on the right-hand side are the smoothing terms introduced to match the persistence in the nominal interest rate, with ρ_{R1} and ρ_{R2} are smoothing coefficients; the terms ε_{Rt} is a zero-mean, serially uncorrelated monetary policy shock with standard deviation σ_R. It is an unsystematic component of monetary policy interpreted as an exogenous monetary policy shock. The parameters ψ_1, ψ_2, and ψ_3 measure the responses of the monetary authority to inflation, output, and nominal exchange rate variations.[29] A unique equilibrium exists as long as the sum of ρ_{R1}, ρ_{R2}, ψ_1, and ψ_3 is larger than unity. This monetary policy rule is similar to the one used in Lubik and Schorfheide (2007).

Estimation Procedure and Results

The model of a small open economy given above by equations (1), (5), (7), (8), and (10) can be solved using the Blanchard and Kahn (1980) procedure to obtain a state-space representation. Its structural parameters are estimated using the Bayesian estimation techniques that update prior distributions for the parameters using the actual data. This approach, which is described in Schorfheide (2000) and widely used in estimations of DSGE models, is system-based and fits the solved DSGE model to a

[29] We assume that the central bank reacted to the lag of the first difference of the nominal exchange rate to avoid the endogeneity problem and because we use monthly data to estimate model's structural parameters.

vector time series; and its estimation is based on the likelihood function generated by the model. In addition, prior distributions incorporate additional information into the parameter estimation.

The model has five shocks, so we use five aggregate time series in the estimation to avoid the singularity problem. The data series are monthly and consist of the growth rate of the Canadian industrial production index as a measure of real output growth, the nominal 90-day T-Bill interest rate, the CPI inflation rate, the nominal exchange rate, and the terms of trade. The CPI inflation rate measures the monthly year-over-year changes in the consumer-price index. The terms of trade is defined as the price of domestic goods in terms of foreign goods. All of the series are demeaned before estimation.

The vector of observable variables, z_t, is composed of real output growth, the nominal interest rate, the CPI inflation rate, and the first differences in the nominal exchange rate and the terms of trade. Therefore, z_t is given by

$$z_t = \left[\Delta Y_t, i_t, \pi_t, \Delta e_t, \Delta q_t\right]',$$

which is a 5x1 vector of observable variables and $Z^T = \{ z_1, \ldots, z_T \}$ represents a 5xT data matrix of T observations on z_t. The structural parameters of the model are in a 17x1 vector θ. The linear structural model can be reduced to a state-space representation for z_t. Under the assumption that all the structural shocks are normally distributed and uncorrelated, we obtain a likelihood function $L(\theta|Z^T)$ that can be evaluated using the Kalman filter described in detail in Hamilton (1994, chapter 13).

To implement the Bayesian approach, a prior distribution of the parameters is assumed with a density $p(\theta)$. The advantage of the Bayesian technique over other estimation methods is that by setting prior densities we can attach implicit weights to the prior information on the structural parameters. Then the data given by Z^T are used to update the prior distribution using the likelihood function. The posterior distribution based on Bayes theorem is:

$$p(\theta \mid Z^T) = \frac{L(\theta \mid Z^T)\, p(\theta)}{\int L(\theta \mid Z^T)\, p(\theta) d\theta}. \qquad (11)$$

The Bayesian simulation technique, described in Schorfheide (2000), generates random posterior draws of the parameters that are used in the simulation of the model. This approach allows us to estimate structural parameters of the model and at the same time extract the structural shocks.

Canada had a flexible exchange rate for the period 1950M10-1962M5. Exchange controls remained in place until the end of 1951 and an active money market was not established until 1953 (Watts, 1993). Therefore, we estimate the model over the relevant flexible exchange rate period 1952M1 to 1961M2 and over two subsamples.[30] The first is the pre-1957 period from 1952M1 to 1956M12; the second covers the post-1957 period from 1957M1 to 1961M12, which corresponds to Coyne period.[31] The estimates of monetary policy parameters in the two subsamples allow us to compare the degree of the reaction of the monetary authority to inflation, output, and nominal exchange rate fluctuations.

Table 1 shows the prior distributions assumed for the structural parameters of the model. The priors used for the monetary policy parameters are the instrumental variable (IV) estimates that do not impose the model restrictions.[32] These priors are estimated using the relevant floating rate period that covers 1952M1-1961M12. For the priors of the remaining structural parameters, β, α, τ, and κ, we employ values similar to those used in Lubik and Schorfheide (2007) for Canada.

Table 2 reports the estimation results of the monetary policy parameters. We focus our empirical analysis on the estimates of the monetary policy parameters in the pre- and post-1957 periods. The priors of the monetary policy parameters are assumed to be the same for the three samples; that is, they are treated symmetrically a priori. The prior of equal monetary policy pre- and post-1957 does not hold. Indeed, we find significant heterogeneity in the reaction of the monetary authority across the two periods. The estimates show that monetary policy did not respond very strongly to inflation and

[30] The estimation sample starts in 1952M1 because the Bank of Canada abandoned exchange control in December 1951.
[31] Since we use monthly data, there are 60 observations in each subsample.
[32] The prior for the autoregressive coefficient and standard deviations in the exogenous processes are recovered from the least-squared (LS) estimation of different laws of motion using the actual data.

output fluctuations during the pre-1957 period, as the estimates of the coefficients ψ_1 and ψ_2 are 0.06 and 0.015, respectively; while the response to nominal exchange rate changes was slightly more aggressive with ψ_3 equal 0.084. Note that the estimate of the first smoothing coefficient, ρ_{R1}, is 0.925, implying stronger persistence in monetary policy in the pre-1957 period; while the estimates of ρ_{R2} is negative and not statistically significant.

On the other hand, the estimates of policy rule parameters for the post-1957 period indicate that the monetary authority responded more aggressively to inflation, output, and nominal exchange rate variations. The estimates of the coefficients ψ_1, ψ_2, and ψ_3 are larger at 0.23, 0.06, and 0.11, respectively. The estimate of the first smoothing coefficient, ρ_{R1}, is about 0.86, implying lower persistence in monetary policy in the post-1957 period compared to the pre-1957 period. It is important to note that the estimated standard error of unsystematic monetary policy shocks, σ_R, is 0.22% in the pre-1957 period and 0.62% during the post-1957 period, indicating that monetary policy shocks, in general, were much more volatile in the post-1957 period than in pre-1957 period.

Table 3 reports the estimates of the remaining non-monetary policy parameters. The estimates values of α, τ, and κ, are very similar in the three samples, indicating some stability in the estimation of these parameters across the three periods. The estimates of these parameters are close to those estimated in Lubik and Schorfheide (2007). The estimates of the discount rate, β, are 0.9992 and 0.998 in the pre- and post-1957 periods, respectively. These monthly discount rates translate into estimated annual real interest rates of 1% and 2.4% in the two periods, respectively. These estimates imply that average real interest rates were much higher (2.4 times) in the post-1957 period compared to pre-1957 period. Technology and world output shocks are similarly persistent and more volatile in the two periods, while terms of trade and world inflation were more volatile in pre-1957 period.

Counterfactual simulations

In order to perform counterfactual simulations of the model, we need to identify and extract the historical shocks that disturbed the economy over the counterfactual period so that they can be re-introduced when the counterfactual model is simulated. For

our rational expectations model, we can use the model's state-space representation to extract a record of the structural innovations given by $\{\varepsilon_{At}, \varepsilon_{Rt}, \varepsilon_{qt}, \varepsilon_{yt}, \varepsilon_{\pi t}\}$; $t = 1,..,T$, which can then be used to simulate the model. We extract the historical shocks for the post-1957 period that covers 1957M1 to 1961M12, and for the entire floating period that runs from 1952M1 to 1961M12. The parameter estimates for the two periods reported in Tables 2 and 3 are used in this procedure. Our approach extends the methodologies used by Boivin and Giannoni (2006) and Leigh (2004) in their counterfactual analysis done for the U.S. and Japanese monetary policies, respectively. Our model is more complex and includes structural (as opposed to nonstructural) shocks.

Figure 9 shows the extracted historical shocks for the entire floating rate period. What is noteworthy from these figures is that the volatility of the extracted interest rate shocks increases in the second half of the floating rate period (which is the shaded area of the figure), reflecting the instability in monetary policy noted earlier. The volatilities of the other shocks are relatively stable throughout the period.

We conduct two counterfactual experiments, over both the post-1957 and entire floating rate periods. The first counterfactual simulation imposes the pre-1957 monetary policy over the post-1957 period, as well as over the entire sample period; this experiment is called the pre-1957 MP model. With this counterfactual simulation, we investigate what would have happened to the Canadian economy had the pre-1957 monetary policy been in place during the second half of the sample period. It is important to note that the pre-1957 monetary policy consists of two components. The systematic component represented by the monetary policy rule and the unsystematic component represented by the estimated structural interest rate shocks. Both are incorporated into the counterfactual simulation. The second counterfactual experiment assumes that instead of having a flexible rate, Canada had had a fixed exchange rate for the entire sample and for the post-1957 period only; this experiment is called the Fixed NER model. This is an interesting experiment because some it could be argued that given the observed instability of monetary policy during the Coyne period, Canada might have been better off had it had a fixed exchange rate. In this simulation, we assume that the goal of monetary policy

is to keep the exchange rate fixed; thus, Canadian interest rates are assumed to equal U.S. rates.[33]

Before examining the impacts of these counterfactual simulations on the volatility of the key macroeconomic variables, it is important to note from the outset that conducting counterfactual experiments in economics is problematic because a controlled experiment is impossible. To conduct the simulation, we must assume that some of the parameters remain constant, when in fact we know that some would likely have changed had a different monetary policy or exchange rate regime been in place because agents would have re-optimized. Thus, by leaving the parameters unchanged we are biasing the volatilities upwards in the counterfactual simulations because agents would have likely acted in a way to mitigate welfare-reducing volatility. [34]

In conducting the counterfactual experiments, we simulate the estimated models with the new assumptions regarding the conduct of monetary and/or exchange rate policies. We also incorporate the extracted historical structural shocks in an attempt to duplicate the actual economic circumstances that occurred during the sample periods. In the case of the pre-1957 monetary policy counterfactual experiment, we do not employ the structural interest rate shocks from the post-1957 period, but use simulated shocks that have the same characteristics as the shocks that occurred during the pre-1957 period. This allows us to incorporate the unsystematic component of monetary policy, as was discussed earlier.

Table 4 reports the second moments, the standard errors in percentage, of the simulated series of the key variable in the counterfactual experiments and compares them to the data. Panel A of Table 4 gives the results for the post-1957 period, while Panel B of Table 4 reports the results for the entire floating period. (These results are also illustrated with the plots in figures 10 and 11.) In the case of the pre-1957 monetary

[33] In both counterfactual experiments, we use the same estimates of the model's structural parameters as estimated over the entire floating or post-1957 periods including the monetary policy parameters. The only exception is that the parameter ψ_3, the coefficient on the exchange rate in the monetary policy rule, is set equal to 5, in the second experiment to reflect the commitment to maintain the fixed exchange rate.
[34] We have also conducted counterfactual simulations using the estimates of the model's parameters obtained from the entire sample period and there are no significant changes in the main results.

policy experiment, the volatility of output *falls* in both samples relative to the actual data. This finding is significant because the assumption of unchanged parameters biases upward the volatility of output in the experimental results. Although the volatilities of nominal interest rates are roughly the same, the volatility of inflation is higher reflecting the less aggressive inflation coefficient in the estimated pre-1957 monetary policy rule. Moreover, the volatility of the exchange rate is also higher which reflects the fact that under the pre-1957 policy rule there is more scope for the flexible exchange rate to adjust to structural shocks thereby helping to stabilize output. Because this model is linearized around steady state values, our comparison is based solely on second moments, but in fact, the different monetary policies also likely affected the level of output growth in the steady state. In particular, interest rates were generally much higher during the post-1957 period (See Figure 5b). Hence, had the pre-1957 monetary policy been in force, unemployment would have lower, and output growth higher.

Under the second counterfactual experiment of a fixed nominal exchange rate, the volatilities of all the variables (except the exchange rate) increase dramatically. Although these volatilities are biased upwards given the assumption of unchanged parameters, they suggest that the flexible exchange rate regime was successful in stabilizing the Canadian economy, even during the post-1957 period when monetary policy was more volatile.

Table 5 reports volatilities and autocorrelation functions of key simulated variables (output, the nominal interest rate, inflation, and the first difference of the nominal exchange rate) and compares them to those observed in the data. This exercise is another way of evaluating the performance of our model. For the three estimated periods, the model generates volatilities that are close to those in the data. This close fit occurs because all these series are used in the estimation of the structural parameters of the model. In addition, the simulated autocorrelations of the three estimation periods are very close to those observed in the data, except for the exchange rate in the post-1957 period. These results indicate that the model largely captures the salient features of the data.

Finally, to address the issue of whether the remarkable stability of the Canadian dollar during the floating rate period was due to the relative absence of sizable structural shocks, the model was used to extract structural shocks for subsequent floating rate decades. Table 6 compares the volatilities of these extracted structural shocks across these periods. The key finding is that the volatilities of the shocks during the 1950's were generally lower than those experienced during the periods 1972M1-1981M12, 1982M1-1911M12, 1992M1-2001M12, the main exception being the world output shock. Interestingly, the volatility of unsystematic monetary shocks was relatively low in the 1950s and this level of stability is almost being attained during the most recent inflation targeting period in Canada.

5. Concluding Remarks

The purpose of this paper has been to revisit Canada's pioneering experience with floating exchange rate over the period 1950─1962 and to reconsider the evidence and extensive commentary with the benefit of 40─50 years of improvements in the tools of economic analysis and in our understanding of how monetary policy works in an open economy. Our goal is to draw useful lessons for the conduct of monetary policy today. One key observation is that Canada's floating exchange rate in the 1950s behaved very much like the exchange rate today; it was driven largely by interest rate differentials and by commodity prices. The interesting question is whether the floating rate was the best option for Canada in the 1950s. There is little doubt that in September 1950, when the Canadian dollar was under incredible pressure to appreciate, the float was the correct choice because it removed the speculative pressure that pegged rates often induce and it sheltered Canada from U.S. inflationary pressures.[35] Our counterfactual analysis indicates that relative to a fixed exchange rate, the flexible rate helped reduce the volatility of key macroeconomic variables, despite the fact the Canadian monetary authorities clearly did not understand all of the implications of conducting monetary policy under a flexible exchange rate and a high degree of capital mobility.

[35] Mexico, in contrast to Canada, maintained a pegged rate and the inflation rate increased sharply to double-digit levels. See Murray et al. (2003) for more details.

The other counterfactual experiment suggests that had monetary policy not changed during the Coyne period, the Canadian economy would likely have performed much better. The policy was not only more volatile, but also produced higher interest rates. Consequently, output was more volatile and growth was likely slower because higher interest rates also generated a more appreciated exchange rate. This misunderstanding of the conduct of a monetary policy under a floating rate, unfortunately led to the demise of this regime.

Nonetheless, Canada's floating exchange rate experience in 1950s was a very useful policy experiment; it demonstrated (and inspired Mundell to show theoretically) that monetary policy is a relatively powerful policy instrument under a floating rate; it also showed that for a flexible rate to work effectively as a stabilizing mechanism, as Friedman argued, monetary policy should not be the source of economic disturbances, but should work in tandem with the exchange rate to facilitate adjustment.

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Appendix 1: Data for DSGE Model

Nominal Exchange Rate: Calculated as the monthly average of the daily CDN$-US$ noon spot rate as reported by the Bank for International Settlements.

Real Exchange Rate: Calculated as the nominal CDN$-US$ exchange rate deflated by Canadian and U.S. CPI data.

Nominal 90-Day T-Bill Interest Rate: Prior to 1962, the Canadian T-Bill interest rate is calculated as the average yield determined by auctions for 90-Day Treasury Bills. From 1962 onwards, the variable is simply the 90-Day T-Bill rate. All Canadian data are taken from Statistics Canada. The US T-Bill rate is the 3-month market yield as reported by the Bank for International Settlements.

CPI Inflation Rate: The year-over-year percentage change in the headline consumer price index as measured by Statistics Canada and the U.S. Dept. of Labour. The indexes are rebased to the year 1997.

Terms of Trade: The price of exports over the price of imports, taken from Statistics Canada.

Industrial Production Index: The Canadian data consist of two series that are spliced together. For months prior to 1971, data are taken from Statistics Canada. After 1971, all data are obtained from the IMF's International Financial Statistics. U.S. Data for all periods are taken from the Bank for International Settlements. The indexes are rebased to the year 1997.

Commodity Terms of Trade: The price of commodity exports over the price of commodity imports, taken from Statistics Canada.

Unemployment Rate: Canadian data are obtained from hard copies of the Labour Survey published by Statistics Canada. U.S. data are taken from hard copies of the Bureau of Labour Statistics' Household Data publication.

Appendix 2: Log-linearized DSGE Equilibrium System

$$y_t = E_t y_{t+1} - [\tau + \alpha(2-\alpha)(1-\tau)](R_t - E_t \pi_{t+1}) + \rho_A dA_t$$
$$+ \alpha[\tau + \alpha(2-\alpha)(1-\tau)]\rho_q \Delta q_t + [\alpha(2-\alpha)(1-\tau)/\tau](\rho_y - 1)y^*_t; \quad \text{(A2.1)}$$

$$\pi^d_t = \beta E_t \pi^d_{t+1} + \frac{\kappa}{[\tau + \alpha(2-\alpha)(1-\tau)]}(y_t - y^p_t); \quad \text{(A2.2)}$$

$$y^p_t = -\frac{\alpha(2-\alpha)(1-\tau)}{\tau} y^*_t; \quad \text{(A2.3)}$$

$$R_t = \rho_{R1} R_{t-1} + \rho_{R2} R_{t-2} + \psi_1 \pi_t + \psi_2 y_t + \psi_3 \Delta e_{t-1} + \varepsilon_{Rt}; \quad \text{(A2.4)}$$

$$\Delta e_t = \pi_t - (1-\alpha)\Delta q_t - \pi^*_t; \quad \text{(A2.5)}$$

$$\pi_t = \pi^d_t - \alpha \Delta q_t; \quad \text{(A2.6)}$$

$$\Delta q_t = \rho_q \Delta q_{t-1} + \varepsilon_{qt}; \quad \text{(A2.7)}$$

$$\pi^*_t = \rho_\pi \pi^*_{t-1} + \varepsilon_{\pi t};, \quad \text{(A2.8)}$$

$$dA_t = \rho_A dA_{t-1} + \varepsilon_{At}; \quad \text{(A2.9)}$$

$$y^*_t = \rho_y y^*_{t-1} + \varepsilon_{yt}; \quad \text{(A2.10)}$$

$$\Delta Y_t = y_t - y_{t-1} + dA_t. \quad \text{(A2.11)}$$

Table 1:
Prior distributions of the structural parameters of the model

Parameters	Domain	Density	Mean	St Dev.
ψ_1	IR^+	Gamma	0.1	0.04
ψ_2	IR^+	Gamma	0.03	0.02
ψ_3	IR^+	Gamma	0.10	0.04
ρ_{R1}	[0,1)	Beta	0.90	0.05
ρ_{R2}	(-1,1)	Normal	0.0	0.03
σ_R	IR^+	InvGamma	0.5	Inf.
β	[0,1)	Beta	0.999	0.0005
α	[0,1)	Beta	0.25	0.05
τ	[0,1)	Beta	0.5	0.05
κ	IR^+	Gamma	0.5	0.05
ρ_A	[0,1)	Beta	0.5	0.05
ρ_q	[0,1)	Beta	0.2	0.06
ρ_y	[0,1)	Beta	0.94	0.05
ρ_π	[0,1)	Beta	0.7	0.05
σ_A	IR^+	InvGamma	1.3	Inf.
σ_q	IR^+	InvGamma	1.0	Inf.
σ_y	IR^+	InvGamma	1.5	Inf.
σ_π	IR^+	InvGamma	0.8	Inf.

Table 2:

Posterior distribution of the monetary policy rule parameters

Parameters	Definition	Entire Floating Period	Pre-1957: Period	Post -1957: Period
ψ_1	Inflation coefficient	0.147 (0.0268)	0.060 (0.012)	0.230 (0.043)
ψ_2	Output coefficient	0.049 (0.025)	0.015 (0.011)	0.061 (0.033)
ψ_3	Exchange rate coefficient	0.134 (0.029)	0.084 (0.038)	0.110 (0.032)
ρ_{R1}	First smoothing coefficient	0.874 (0.053)	0.925 (0.038)	0.862 (0.063)
ρ_{R2}	Second smoothing coefficient	-0.037 (0.028)	-0.020 (0.028)	-0.037 (0.029)
σ_R	Standard deviation of policy shocks in %	0.51 (0.05)	0.22 (0.03)	0.62 (0.07)

Note: The standard deviations are underneath in parentheses.

Entire Floating Period covers 1952M1—1961M12. Pre-1957 period covers 1952M1—1956M12, while Post-1957 period covers 1957M1—1961M12.

Table 3:
Posterior distribution of non-monetary policy rule parameters

Parameters	Definition	Entire Floating Period	Pre-1957 Period	Post-1957 Period
β	Discount factor	0.999 (0.001)	0.9992 (0.001)	0.998 (0.001)
α	Import share	0.226 (0.041)	0.227 (0.043)	0.278 (0.047)
τ	Intertemporal elasticity of substitution	0.420 (0.048)	0.444 (0.048)	0.463 (0.049)
κ	New Philips curve coefficient	0.407 (0.043)	0.481 (0.047)	0.413 (0.044)
ρ_A	Autoregressive coefficient of technology shocks	0.514 (0.063)	0.486 (0.052)	0.507 (0.062)
ρ_q	Autoregressive coefficient of terms of trade shocks	0.175 (0.052)	0.218 (0.070)	0.174 (0.052)
ρ_y	Autoregressive coefficient of world output shocks	0.992 (0.007)	0.995 (0.004)	0.978 (0.022)
ρ_π	Autoregressive coefficient of world inflation shocks	0.611 (0.040)	0.576 (0.042)	0.660 (0.044)
σ_A	Standard deviation of technology shocks in %	0.83 (0.10)	0.79 (0.10)	0.88 (0.12)
σ_q	Standard deviation of terms of trade shocks in %	0.90 (0.06)	1.04 (0.10)	0.73 (0.07)
σ_y	Standard deviation of world output shocks in %	1.39 (0.41)	1.24 (0.42)	1.34 (0.45)
σ_π	Standard deviation of world inflation shocks in %	1.30 (0.09)	1.61 (0.15)	0.87 (0.08)

Note: The standard errors are underneath in parentheses.

Entire Floating Period covers 1952M1—1961M12. Pre-1957 period covers 1952M1—1956M12, while Post-1957 period covers 1957M1—1961M12.

Table 4:

Volatilities (Standard errors in % of data and counterfactual series)

Variables	Data	Pre-1957 MP	Fixed NER
A. Post-1957 period[a]			
Output	2.25	1.35	3.36
Nominal Interest	1.07	0.28	3.18
Inflation	1.02	1.63	1.21
Dif (Nominal exchange rate)	0.69	1.39	0
B. Entire floating period[b]			
Output	2.69	2.57	3.13
Nominal Interest	1.22	0.88	3.89
Inflation	1.77	2.09	1.83
Dif (Nominal exchange rate)	0.65	1. 54	0

Note: In Pre-1957 MP column, Pre-1957 estimated monetary policy parameters and monetary policy unsystematic shocks are used. In Fixed NER column, the parameter ψ_3 is set equal to 5.

[a] The simulations are based on the estimates of the pre-1957 period: 1957M1-1961M12.

[b] The simulations are based on the estimates of the entire floating period: 1952M1-1961M12.

Table 5:

Volatilities and Autocorrelations: Data and Estimated model

	Volatilities		Autocorrelations	
Variables	Data	Model	Data	Model
A. Pre-1957 period				
Output	2.74	2.44	0.97	0.96
Nominal Interest	0.72	0.68	0.98	0.98
Inflation	2.17	1.35	0.95	0.91
Dif (Nom. exchange rate)	0.59	0.53	0.37	0.34
B. Post-1957 period				
Output	2.25	2.31	0.91	0.89
Nominal Interest	1.07	0.93	0.90	0.89
Inflation	1.02	0.97	0.84	0.85
Dif (Nom. exchange rate)	0.69	0.77	0.28	0.43
C. Entire floating period				
Output	2.69	2.80	0.94	0.94
Nominal Interest	1.22	1.14	0.96	0.95
Inflation	1.77	1.36	0.93	0.91
Dif (Nom. exchange rate)	0.65	0.62	0.33	0.31

Note: Volatilities are measured by standard errors in %. Simulated volatilities and autocorrelations are based on the estimates of the pre-1957, post-1957, and entire floating periods as displayed in Table 2 and 3.

Table 6:

Volatilities of the shocks in different periods (standard errors in %)

Shocks	Period: 1952M1-61M12	Period: 72M1-81M12	Period: 82M1-91M12	Period: 92M1-01M12
Technology	0.86	1.24	1.20	0.72
Monetary policy	0.46	1.11	0.65	0.51
Terms of trade	0.90	2.20	0.85	2.38
World output	1.29	0.73	0.78	0.70
World Inflation	1.11	2.32	1.66	2.85

Figure 1a: Exchange Rate

Monthly Average Noon Rates
U.S. Dollars Per Unit

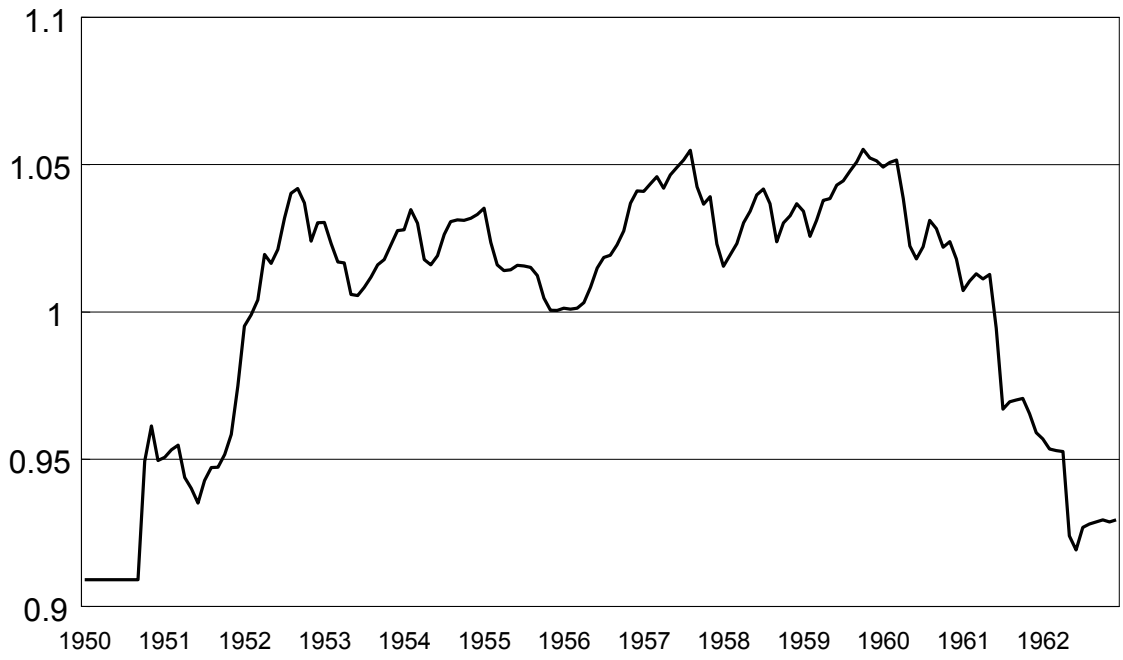
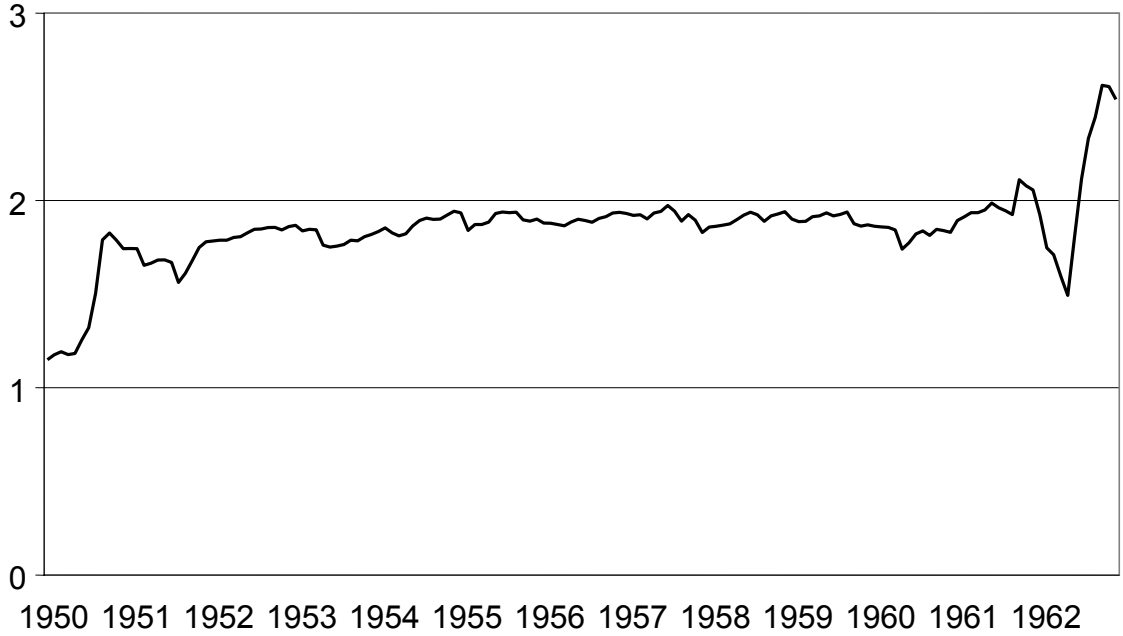


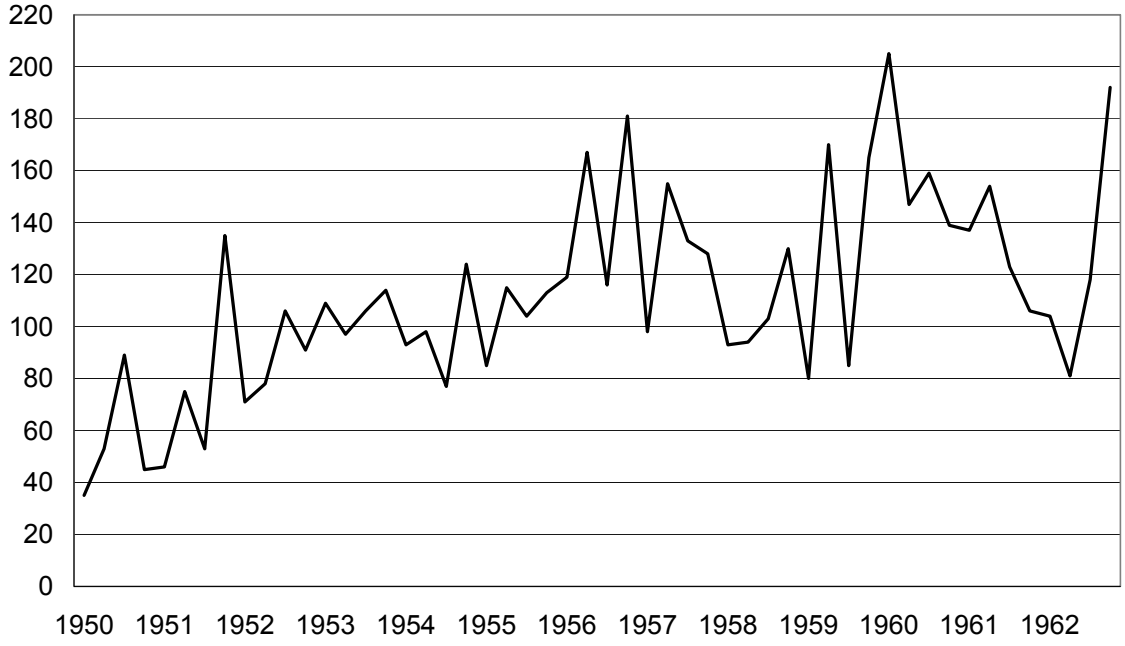
Figure 1b: Canadian Official Holdings of Gold and U.S. Dollars

Billions of U.S. dollars



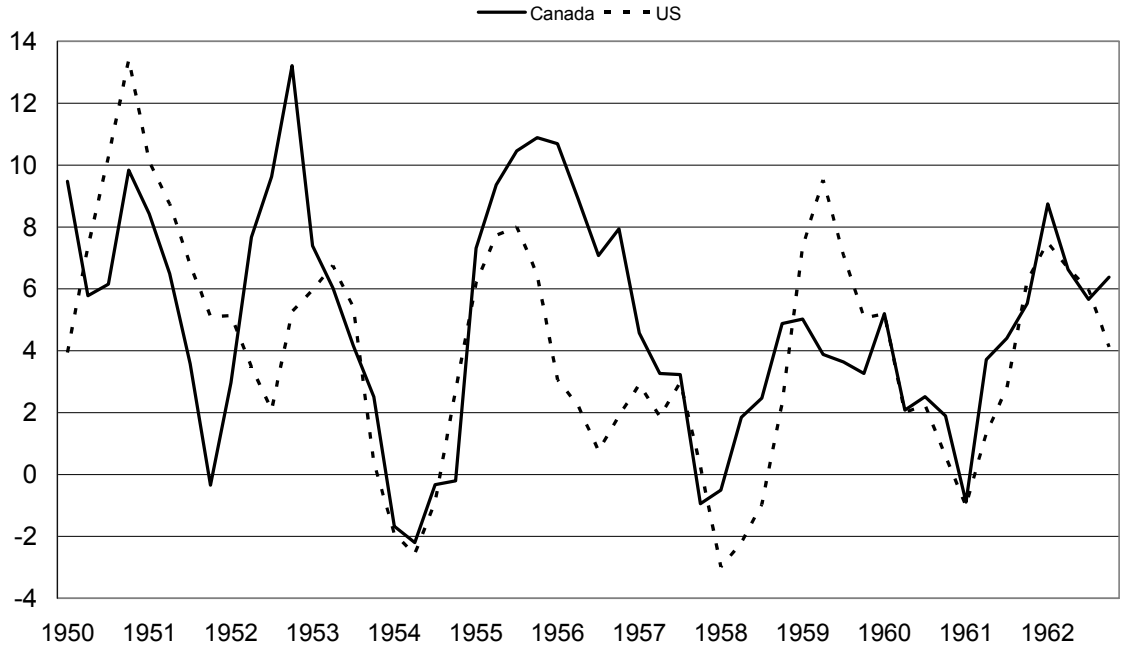
Source: Bank of Canada, Statistical Summary, Financial Supplement 1954,1958, Supplement 1960, 1963

Figure 2: Direct Investment in Canada
Quarterly, Million of CND.$



Source: The Dominion Bureau of Statistics

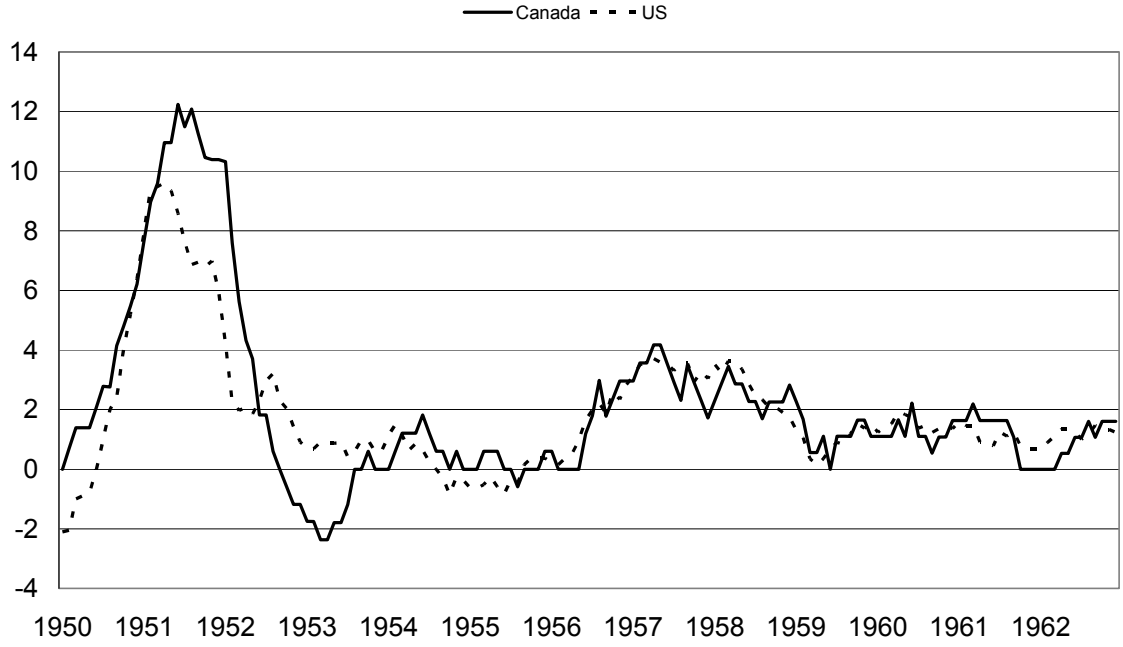
Figure 3: Real Gross Domestic Product (At 1997 Prices)
Quarterly, Year-Over-Year Growth Rate



Source: U.S. Bureau of Economic Analysis and Statistics Canada

Figure 4: Consumer Price Index

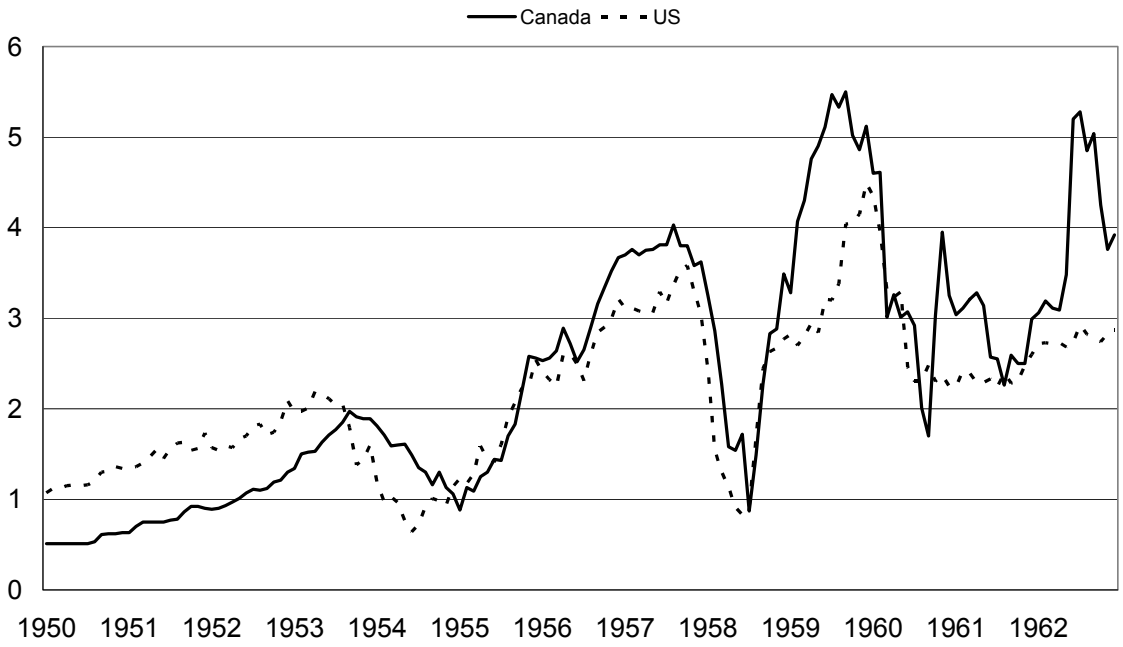
Monthly (1997=100), Year-Over-Year Growth Rate



Source: U.S. Bureau of Labor Statistics and Statistics Canada

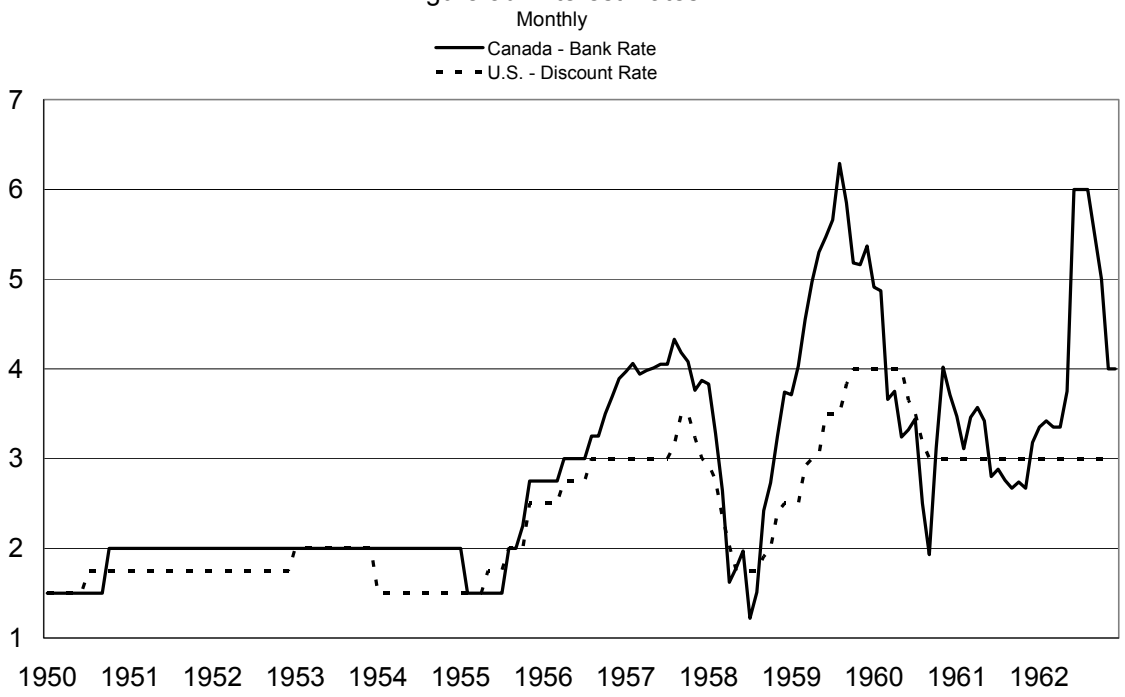
Figure 5a: 3-Month Treasury Bills Market Yields

Monthly



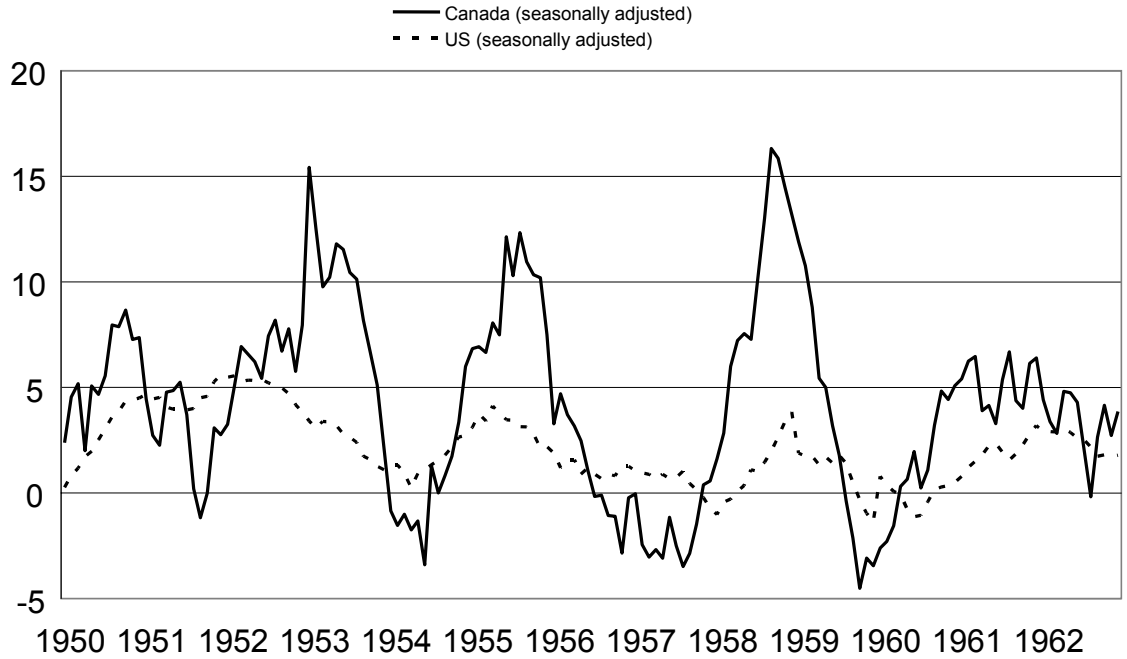
Source: Statistics Canada and Bank for International Settlements

Figure 5b: Interest Rates



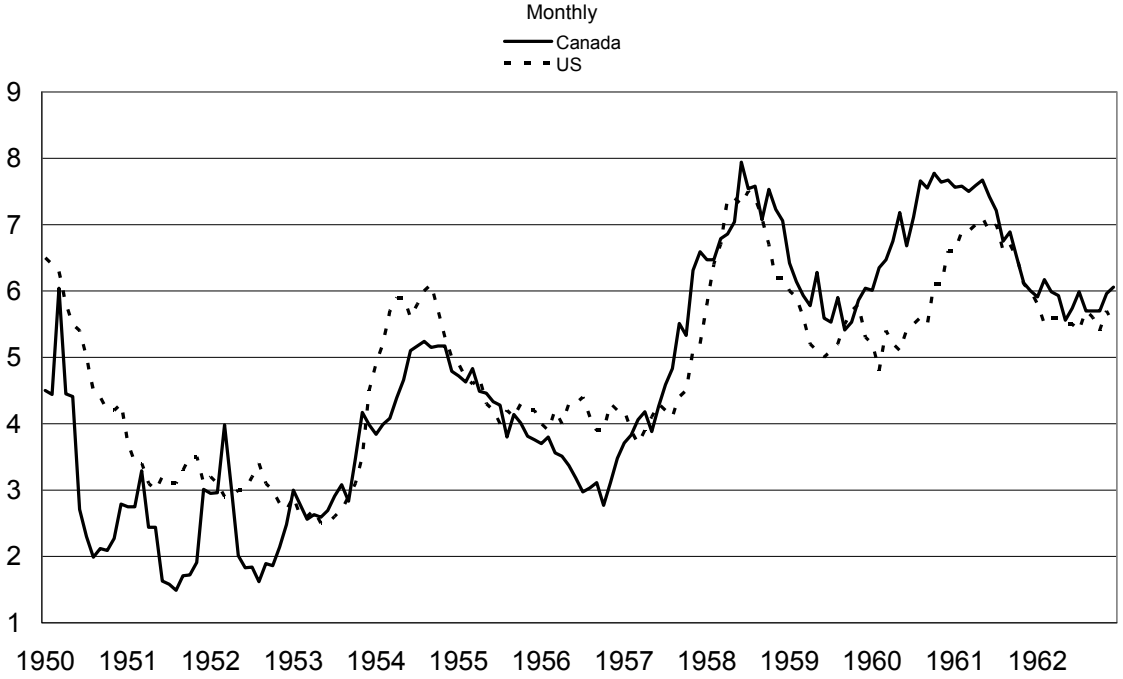
Source: Statistics Canada and Bank for International Settlements

Figure 6: Money Supply (M1)
Monthly, Year-Over-Year Growth Rate



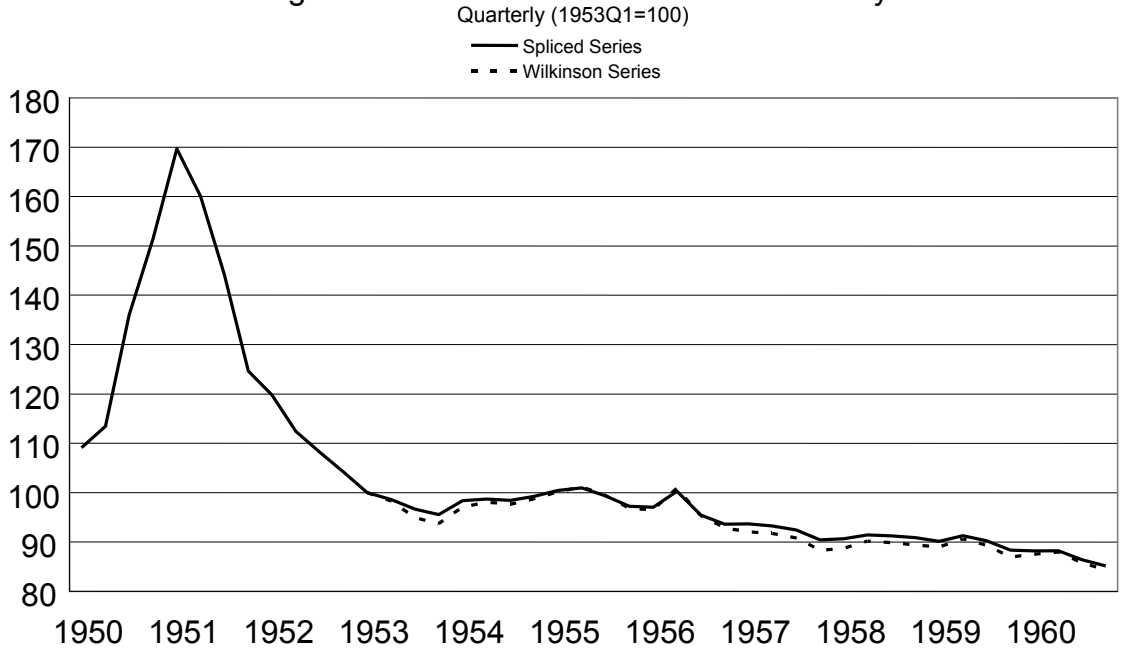
Source: UBC Department of Economics website and National Bureau of Economic Research website

Figure 7: Unemployment Rate
Monthly



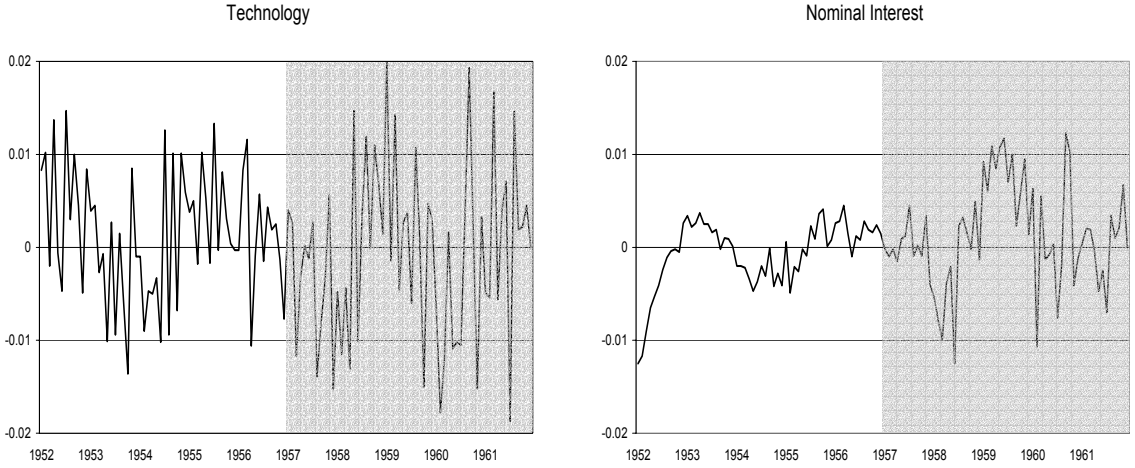
Source: Statscan hard copies of Labour Force Survey and U.S. Bureau of Labor Statistics

Figure 8: Measures of Canadian Commodity Prices



Source: Wilkinson series from Wilkinson's database of commodity prices.
Spliced series from IFS database, and Wilkinson database.

Figure 9: Structural Shocks During Entire Floating Period
(1952M1 1961M12)



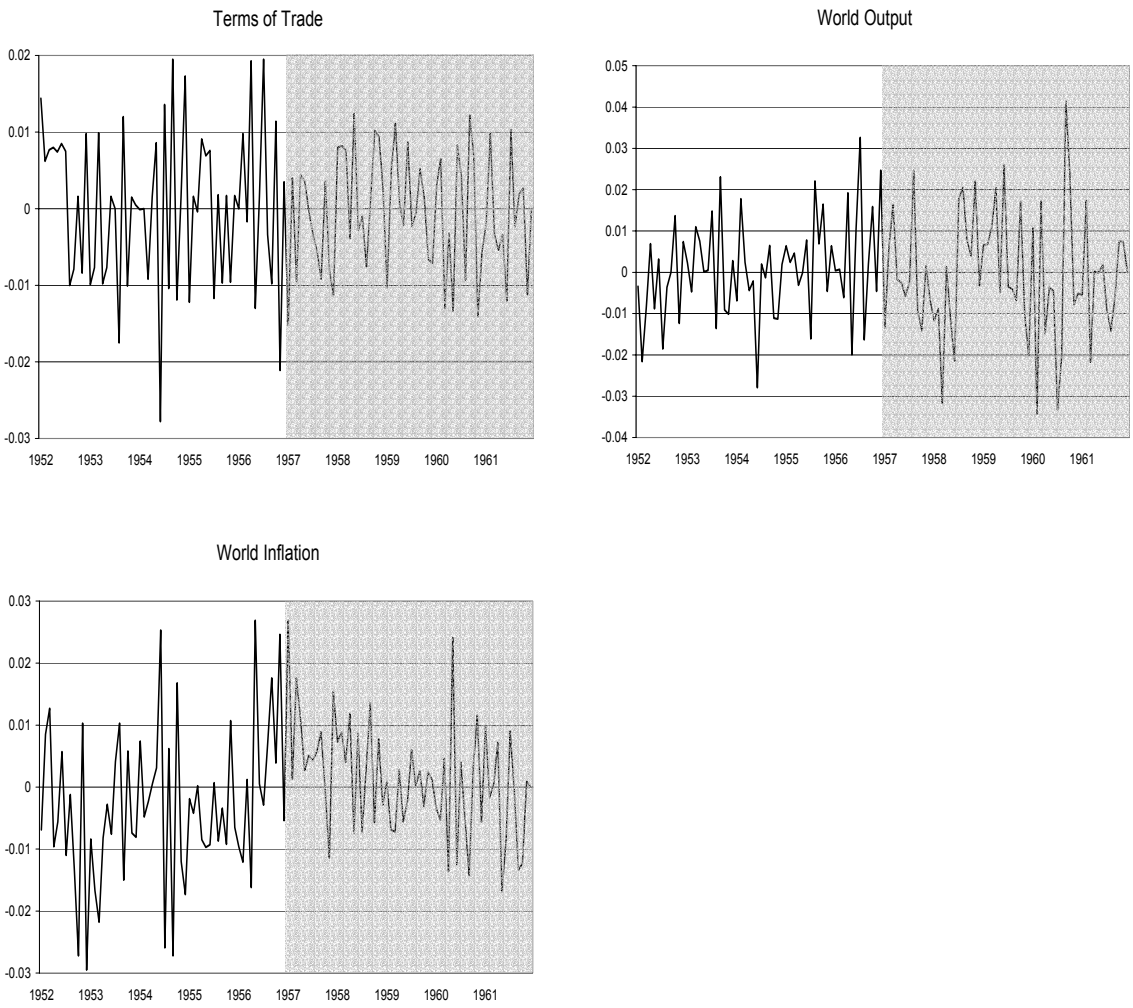
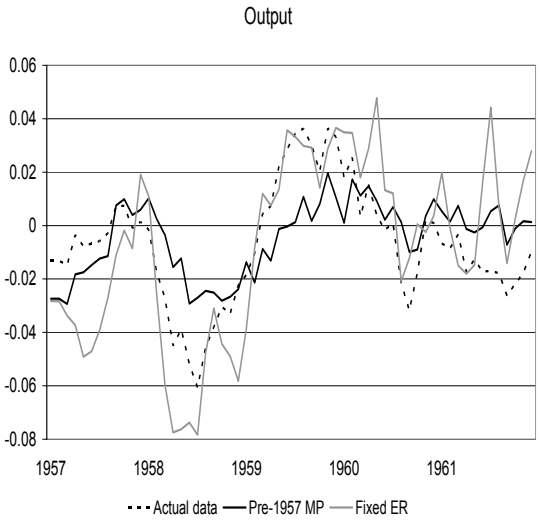
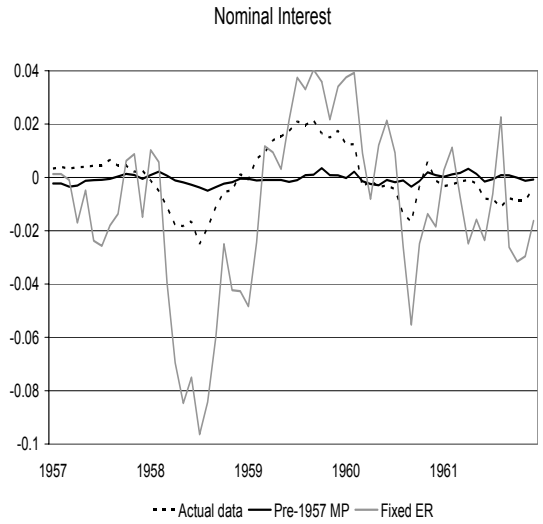
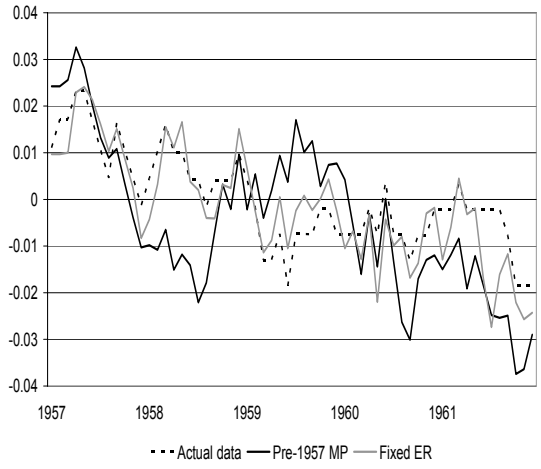


Figure 10: Data and Counterfactual Series in Post-1957 period (1957M1-1961M12)


Output
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
1957
1958
1959
1960
1961
Actual data
Pre-1957 MP
Fixed ER


Nominal Interest
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
1957
1958
1959
1960
1961
Actual data
Pre-1957 MP
Fixed ER


Inflation
0.04
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
1957
1958
1959
1960
1961
Actual data
Pre-1957 MP
Fixed ER

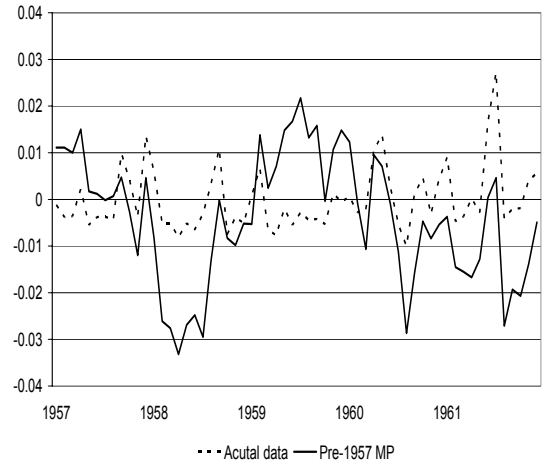

Dif(Nom. Exchange Rate)
0.04
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
1957
1958
1959
1960
1961
Acutal data
Pre-1957 MP

Figure 11: Data and Counterfactual Series in Entire Floating Period
(1952M1-1961M12)