International Observations of Monetary Policy Periods

By

Yamin S. Ahmad

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University of Wisconsin – Whitewater
Department of Economics
4th Floor Carlson Hall
800 W. Main Street
Whitewater, WI 53538

Tel: (262) 472 -1361

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Yamin Ahmad †

University of Wisconsin-Whitewater

Abstract

I identify twenty-one observations of monetary policy periods within six of the G7 countries, following the spirit of the Narrative Approach used by Romer and Romer (1989). Statistics are used to characterize the state of these economies from the 1970's until 2001. Major historical events and narrative evidence are then used as a guide to identify these monetary policy periods, which reflect the stance of monetary policy at central banks during those events. The significance of these monetary policy periods are then assessed using various approaches. The results overwhelmingly find that movements in interest rates during the policy periods are significant. Moreover, these identified periods are found to reflect exogenous policy actions undertaken by monetary authorities.

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† Department of Economics, University of Wisconsin-Whitewater, 800 W Main St, Whitewater WI 53190
Email: ahmady@uww.edu, Homepage: http://facstaff.uww.edu/ahmady/
Tel: (262) 472 5576, Fax: (262) 472 4683

1 Introduction

The last decade has seen a resurgence of interest in the development of a new class of monetary model. This renewed interest arises from the hope that one can quantitatively address the numerous questions arising from the monetary experiences of the industrialized countries over the last three decades. What led to the inflationary experience of many countries during the 1970s and the exchange rate crises during the early 1990s? Could monetary policy have been used potently? What kind of policies should central banks follow in the likelihood that shocks occur causing these types of events to recur? How should central banks react to such shocks that hit the economy?

Any hope of answering these types of question relies on researchers having a clear idea of the transmission mechanism of a monetary policy shock. In particular, a large part of the literature in monetary economics has devoted itself to identifying monetary policy shocks as well as examining the resultant effects from the transmission of such shocks. However, the question of an appropriate methodology of identifying monetary policy shocks remains an open one. Recent research has seen two markedly different approaches in attempting to identify monetary policy shocks. The first approach is characterized by utilizing historical narrative evidence to identify the stance, or a change in the stance, of monetary policy. This approach was popularized by Friedman and Schwartz (1963) and later by Romer and Romer (1989). The second approach identifies monetary policy shocks as the exogenous component of a monetary policy rule being followed by a central bank. Earlier work by Bernanke & Blinder (1992), Strongin (1995) focus on measuring monetary policy innovations. Later work by Christiano, Eichenbaum & Evans (1996,1999), Bernanke & Mihov (1998a,b) use vector autoregressions to identify the resultant movement in interest rates arising from an exogenous monetary policy shock and examine their impact on key variables like output, prices and inflation.

This paper considers a slightly different question compared to the works above. However, the nature of the question is in the same spirit as those works above, in trying to identify whether a monetary policy action arose from an exogenous shock or an endogenous attempt to affect real activity. Simply put, the question posed in this paper is: historically, have central banks changed

interest rates significantly in the presence of exogenous monetary (and non-monetary) shocks? It is in this regard that this paper assesses the extent to which interest rates moved as a result of an intended policy action and asks whether that movement is statistically significant? No attempt is made to identify the resultant *effects* of a policy shock on the economy, since there is a large literature that has already examined this.[1]

The approach taken here follows the spirit of the narrative approach used by Romer and Romer (1989, 1994, 2002) in an attempt to identify periods of *monetary policy interventions* across six of the G7 countries. The idea behind this approach involves examining narrative evidence over the last three decades. This is done to try and identify periods in time where the central bank's stance on monetary policy can be clearly identified and resultant movements in interest rates can be attributed to a monetary policy action. The methodology used in this paper is twofold. First, historical events, like the OPEC oil shocks are used as a guide to help identify periods when the central bank would be following either tight or expansionary monetary policy. Second, narrative evidence from these times are then reviewed for documentary evidence indicating the actual stance of monetary policy at that time. Having identified these particular periods, the paper tries to assess their significance by examining the movement of interest rates during these periods.

This type of approach in identifying monetary policy periods has two clear advantages. First, the approach, by its very nature, is inherently nonparametric. The identification methodology does not require formal modeling of operating procedures within central banks. As pointed out in Bernanke and Mihov (1998a), this means that the approach is potentially robust to changes in the operating structure at central banks which may have changed over the course of the last three decades. In addition, the use of historical records provides additional evidence of the intentions of policy makers. Hence, it can potentially account for sources of monetary disturbances that arose due to large shifts of monetary policy that were not driven in part by endogenous policy making, where the central bank was attempting to affect the real side of the economy.

[1] Several studies have examined the issue, most notably Christiano, Eichenbaum and Evans (1999, 2005) and Fuhrer (2000). Some recent examples include Avouyi-Dovi and Matheron (2007), Meier and Muller (2006), Ahmad (2005).

Second, this approach is not subject to the criticism that befalls monetary models that utilize VARs to identify monetary policy shocks. This criticism voiced by Rudebusch (1998) argues against using VARs to identify monetary policy shocks, since within VARs, a shock is a change in the monetary policy instrument (- either the interest rate or money supply) that is orthogonal to all other variables included in the VAR. Rudebusch (1998) argues that if the VAR contains all relevant variables, then pure monetary shocks should be minimal and unimportant. Simply put, what matters is the nature of the monetary policy reaction and not the residual shocks. It is precisely in this sense that this paper utilizes the narrative approach (and not the VAR approach) in trying to examine if interest rates moved significantly as a result of central banks' actions to actual (or perceived) shocks. Were changes in interest rates somehow 'significant' enough so that they are able to be statistically distinguished from the usual movements in interest rates arising from endogenous monetary policy actions?

A big disadvantage of this type of approach is the subjectivity that is involved within the identification process. This is because there is no formal rule which can be used in applying the methodology to determine whether a monetary policy intervention has occurred from looking at the historical evidence. However, the main disadvantage with this approach arises from the difficulty in disentangling endogenous and exogenous components of a monetary policy action. This critique was voiced by Leeper (1997), who showed that an identification issue arises due to an inability to separate out the usual response of monetary policy to the economy from the response of the economy to monetary policy. In his paper, Leeper (1997) examined the dates identified by Romer and Romer (1989, 1994) and used a logit model to see the extent to which those events were predictable from standard macroeconomic variables. His finding showed that the policy dummy was highly predictable. A final disadvantage to note is that no distinction is typically made to distinguish the degree of a policy change - that is whether a policy action is only mildly contractionary, or severely contractionary.[2]

However, despite these disadvantages, the appealing aspect of the narrative approach is the use of additional information based upon policy makers intentions and the monetary policy actions which

[2] One study that has attempted to distinguish the severity of monetary policy actions is by Boschen and Mills (1991). They construct a monthly index which attempts to distinguish whether the Fed's policy in each month was a strong, mild or neutral action. However, the subjectivity and endogeneity problems are likely to be more severe there.

occurred based upon policy maker's perceptions of any exogenous shocks at that time. As mentioned earlier, the paper abstracts from identifying the effects of a policy change on the economy. Instead, the hope here is that the results of this paper will provide an alternative way to look at the black box that is the transmission mechanism of monetary policy, with a view towards separating out the exogenous and endogenous components. If the reader is convinced by the arguments regarding the validity of the monetary policy periods identified within the paper, then further research can be done to examine the effects of monetary policy on the economy within periods where exogenous policy actions were taken.

Hence, the final part of the paper attempts to assess the significance of the identified policy periods in three ways. The first is to try to determine if there was a significant change in interest rates during these monetary policy periods. This is done by estimating an equation incorporating the nominal interest rate and including dummy variables for the particular identified periods. The importance of the policy periods are then determined by examining the significance of the coefficients on the dummy variables. Second, additional evidence is found by estimating Taylor type reaction functions and testing for structural breaks at the identified policy periods. This is done using tests where the breakpoints are known, as well as where they are not known. Finally, I address the criticism by Leeper (1997) and check whether these policy periods can be predicted from standard macroeconomic variables.

The rest of the paper proceeds as follows. The next section provides a list of events over the last three decades that are used to try and identify monetary policy periods later on in this paper. I attempt to place these events in the context of the current economic conditions at the time by providing a general narrative description of the state of the economies in the majority of the G7 countries. The paper then proceeds by examining documentary evidence from the identified events within these subperiods to try and isolate episodes of monetary policy interventions. Finally, the last section assesses the importance of these identified monetary policy periods.

2 Historical Evidence Concerning The State Of The Economy

There have been some major historical events that have occurred over the last three decades, which led central banks to adopt a clear stance for monetary policy. Some often cited examples of these events are the OPEC oil shocks within the 1970's, the ERM crisis in the early 1990's, the Asian Crisis in the late 1990's. Within these episodes, many central banks were openly implementing monetary policy in the pursuit of some prior objective. This section attempts to identify these types of events that occurred in Canada, France, Italy, Japan, the United Kingdom and in the United States over the last thirty years.[3] This is done by breaking up the last thirty years into subperiods and then looking for any notable events that occurred during these subperiods. Looking at events within subperiods also allows these events to be put in the proper context of the general economic conditions within the countries at that time. To that end, this section also examines the average movements of some key variables in order to try and summarize the general types of policies implemented by authorities during that time.

Following Goodhart[4] (1989), the last three decades are arbitrarily divided up into five periods in order to examine the general movements in key variables over these time periods. The choice of picking specific episodes where the central bank's stance on monetary policy is able to be clearly identified, can be found after these descriptions. The subperiods within the last three decades considered here, are: (i) 1970:1 to 1978:4; (ii) 1979:1 to 1982:4; (iii) 1983:1 to 1989:4; (iv) 1990:1 to 1992:4; (v) 1993:1 to the end of the sample for the respective country. Table (1) displays the mean growth rates for nominal and real gdp and consumption, along with annualized means of inflation, money market rates and a relevant monetary aggregate over different samples periods. Hence, it is possible to draw a few common themes faced by these countries by examining the average movements of the aforementioned variables over the last three decades. What follows was

[3] I do not incorporate Germany, which would complete the G7 block of countries, since I was unable to obtain reliable consumption data prior to German reunification. The consumption data is used later in the paper to examine whether interest rates moved significantly as a result of monetary policy actions.

[4] Goodhart (1989, pg. 297) breaks up history into the following four categories: (i) The Shift of Policy towards Monetarism up till 1979; (ii) The High Tide of Monetarism, 1979-82; (iii) The Return to Pragmatism, 1982-85; (iv) The increasing concern with Exchange Rate Regimes, 1985 onwards. Here we additionally consider the 1990-1992 period for the European countries, and the last decade from 1993 onwards.

examined by Goodhart (1989) in much greater detail up to the late 1980's than what is highlighted here.

The intention within this section is to merely give a general flavour of the conditions in some of these countries during these time periods and highlight some notable events which occurred in countries during this time. The choice of specific episodes chosen as monetary policy periods can be found after these general description of some major events which occurred.

The Road To Monetarism (1970 - 1978)

During the 1970's, many central banks pursued expansionary monetary policy to try and stimulate their respective economies. This type of accommodative policy led to high levels of inflation. As can be seen from table (1), the first subperiod, 1970 to 1978, is characterized by large monetary growth, high levels of inflation, negative real interest rates and greater than average growth (as compared to the entire sample) across most countries. The only exception is the United Kingdom, where real output growth over this sample stood at 2.41% mildly below the average for the entire sample of 2.49%, where the large average is due to the strong growth occurring in the UK in the late 1990's. Real interest rates in the UK were on average about -3.43% with growth in the monetary aggregate at 14.66%.

Whilst many argued that the low growth arose from the adverse supply shocks arising from the oil related crisis in 1973 (and this again reappeared later in 1979 during the second oil crisis), most countries followed the apparent success of West Germany and Switzerland in recovering from the 1973 crisis by overtly adopting "quasi-monetary" (Goodhart, 1989) policies in the form of monetary targets. These countries were followed by the United States and Canada in 1975 and by the United Kingdom, France and Australia by 1976. Japan didn't follow suit till 1978 when it publicly announced the future path of M2, and even then it was termed a monetary 'target' (Tamura, 1987).

In the second half of the 1970's, nominal interest rates remained below the inflation rate (see figures 1(a) - 1(f)) in an attempt to boost output growth. As such, inflation was not lowered much beyond

that achieved in the post 1973 deflation and inflationary expectations persisted. This was to be the backdrop to the subsequent, second oil crisis of the 1970's.

The Pinnacle of Monetarism (1979 - 1982)

The second oil shock occurred in 1979 and was preceded by the overthrow of the Shah of Iran, which led to international fears of an oncoming oil shortage. The price of crude oil more than doubled by the beginning of 1980 and this was amidst growing fears of long term inflation for the US. It was at this time that the newly appointed Chairman of the Federal Reserve Board, Paul Volcker made an announcement regarding the control of monetary policy for the US that was to prove vitally important. On Saturday, October 6th 1979, the Fed moved from controlling the Federal Funds rate to controlling non-borrowed reserves and claimed nominal interest rates would be determined by market forces and vary within wide unpublished limits. Table (1) shows that nominal interest rates were much higher from 1979 to 1982. Within this period, real output growth appears to be much lower and very close to zero for Canada, the UK and the US, and this is mirrored in real consumption growth. High inflation can be seen across all the countries, with Italy reaching 17.16%, but real interest rates are in general, positive and fairly large in some countries.

In essence, this announcement by Paul Volcker, absolved the Fed of the unpopular increases in the nominal interest rates which had limited the Fed's ability to vary the rates amidst political pressures and uncertainty and thus left them free to pursue anti-inflationary policies. The secondary consequence of this act was the adoption, by many other major countries, of stricter deflationary policies in order to gain anti-inflation credibility. The other concomitant event during 1979 was the establishment of the European Monetary System (EMS) which came into place with eight of the nine members of the European Economic Community participating. The exception was the UK which did not join until 1990. The central feature of the EMS was an Exchange Rate Mechanism (ERM) where these eight countries made a concerted effort to coordinate exchange rate movements and maintain a peg with the German Deutschmark. Initially there were frequent realignments between 1979 to 1983, but eventually the exchange rate mechanism ended up with virtually fixed rates by 1987.

The concurrent set of events in the UK were that by 1980, the UK had just become a major oil producer with the discovery of the North Sea Oil, and this led to the downgrading of inflationary expectations. Despite this, nominal interest rates were still augmented, and along with the credibility of Mrs. Thatcher's anti-inflation policies and commitment to monetarism, led to a large rise in the UK's nominal and real exchange rate (Buiter & Miller, 1982). The UK maintained its tough anti-inflation stance in the face of increasing political pressure which arose as a result the effect of the rise in the real exchange rate. The misalignment of the pound over 1980-82 had a severe impact on the UK manufacturing sector, lowering industrial production and increasing unemployment.

The US, in the meantime, allowed interest rates to adjust according to market pressures, and as a result, volatility of short term money growth rates and long term interest rate dramatically increased. However, as Goodhart (1989) points out, the Fed did get close to the annual target for money growth, and in doing so, established their credibility for combatting inflation. Thus the general inflationary conditions of the 1970's paved the way for the general deflationary conditions of the 1980's as many countries implemented stricter monetary controls in the implementation of policy.

The Instability of Velocity (1983 - 1989)

After the inflationary years of the late 1970's and the early 1980's, the adoption of stricter monetary controls allowed central banks to gain anti-inflation credibility. The data from this decade suggested the mid to late 1980's was characterized by a recovery in real output growth, despite falling nominal output growth, as can be seen in Table (1). However, the evidence from real consumption growth appears to be mixed. Nominal interest rates and inflation appears to have fallen compared to their values in the previous period as the central banks gained credibility, and this can be noted in figures 1(a) to 1(f). However, behind all this, it became apparent for the authorities in many countries that the demand for money and velocity had become increasingly harder to predict[5]. As can be seen in Table (1), for most countries, the monetary aggregate was growing at a slower rate than nominal income. The basic intuition can be seen by thinking in terms of the Quantity equation written in

[5]Some examples where velocities still appeared to be follow the trend are West Germany and France (Deutsche Bundesbank, 1985)

terms of growth rates. There the sum of the growth rates of money and velocity equals the growth rate of nominal income. Hence, if nominal incomes are growing faster than money growth, velocity is growing too. For the UK, the upward growth of velocity had been present since the 1960's, and as Goodhart (1989) notes:

"This historical trend, quite naturally, provided the main basis for choosing the target rates of growth of £M3 ... But as time went by, it became increasingly difficult for the authorities to believe they fully understood, or could predict, the path of velocity, and/or the demand for money..." (Goodhart, 1989, pp 305 - 306).

This led the monetary authorities in the UK to consider a broader definition of the monetary aggregate and other variables when deciding the stance of monetary policy and on how to move interest rates. For the UK, authorities began to look at a range of monetary measures, some real variables and also some more direct measures of domestic inflation. However, they increasingly began to focus on exchange rate fluctuations over a period of time. Again, as Goodhart (1989, pp 307) notes, "*It was no accident that the main occasions from 1981 through 1986 on which interest rates were jerked upwards, ... all coincided with periods of pound weakness on the forex market*".

The US and Canada faced similar experiences with regards to the growth of their key monetary aggregates. The Fed viewed disturbances to the demand for money as being temporary and kept M1 as the main target up till 1981. However, with increasing unpredictability of velocity, the Fed moved to consider a broader range of indicators and monetary targets. Canada and Australia switched from monetary targeting to discretionary interest rate adjustment and appeared to have some success as velocity fell. In Japan, although there were unpredictable increases in the demand for money, real output growth outstripped all other countries by far.

In the late 1980's, worries over the predictability of domestic velocity and increasing concern over exchange rate misalignments led several countries like the UK and Canada to focus monetary policy towards achieving exchange rate stabilization with neighbor countries. As mentioned above, in Europe, the realignments of national exchange rates with the Deutschmark in the ERM grew

less frequent and by the late 1980's, had become practically fixed. Although the major economies were experiencing booms with a recovery in real output growth, this foreshadowed the fear of rising inflation towards the end of the 1980's and countries began pushing up nominal interest rates (see figures 1(a) - 1(f)). For the UK, the difference between the domestic interest rates and the German interest rates made capital inflows profitable, and investors held the expectation that the Bank of England would intervene to maintain the peg. The scale of inflows did succeed in this respect as the Bank of England was forced to intervene. This led to a period where the UK balanced interest rate adjustments against exchange rate adjustments so as to put pressure on nominal incomes. However, output continued to grow, and worsening inflationary pressures led authorities to raise interest rates quite sharply. These were the conditions just prior to Britain's entry into the ERM.

The Exchange Rate Crises in Europe (1990 - 1992)

Characterized in Table (1) by very low real output growth rates, the US, Canada and Europe fell into a recession in 1990. Nominal interest rates (as can be seen in figures 1(a)-1(f)) are also very high for the European countries. In the midst of this, was the UK's decision to join the ERM, motivated at least partially by its failure to meet its monetary targets in the face of balancing interest rates and exchange rates.

Earlier in the year, on October 3rd, West Germany was reunited with East Germany and Germany (as a whole) became part of the EC. The East German Ostmark was replaced by the Deutschmark in the ratio of 1 DM for 2 OM for business and large personal holdings, and 1:1 for small personal holdings.[6] The German government stimulated the German economy to try and help the former East Germany catch up with the West. However, this proved to be excessive and led to inflationary pressure. To offset this pressure, the Bundesbank pursued a high interest rate policy and the other countries were forced to raise interest rates too, in order to maintain the peg with the Deutschmark and keep exchange rates stable. Despite the political pressure by those countries hit worst by the recession to lower interest rates and stimulate demand, all the countries committed to maintaining the exchange rate. However, for the UK, Italy and France, and some other countries,

[6] Source: Glyn Davies (1996), pp 452, 577-578

this commitment was not seen as credible. As a result they were subject to a speculative attack. For the UK, Italy, along with Ireland, Spain and Portugal, this occurred in 1992. For France it was in 1993.

The British and Italian authorities proceeded by raising interest rates and offering very high rates of return on short-term instruments. This deepened the recessions in these countries and made the fixed exchange rate unpopular. As a result, in September 1992, both the UK and Italy abandoned the ERM. They floated their exchange rates which depreciated, and they stimulated domestic demand by lowering interest rates. The devaluation boosted net exports, and increased domestic demand led to a faster recovery from the recession.

The Recent Boom (1993 - 2001)

The speculative attack on France occurred a little later in 1993. The French authorities also raised short term interest rates, much higher than those in the UK and Italy. They managed to successfully defend against the speculative attack, but the cost of the high interest rates and increased uncertainty meant greater unemployment and low growth for France. As a result of the speculative attacks, the ERM was then reorganized with increased widths of the currency bands so as to preserve the system.

The final period in Table (1) from 1993 till 2000 for most countries, shows an increase in real output growth for all countries except Japan, where both real output growth and real consumption growth have been falling during this period. Deflationary pressures initially started in Japan around 1994 and worsened after the effects of the Asian crisis were felt in 1997. The fall in real output growth has been by far the greatest, and has led the Bank of Japan to try and stimulate demand by lowering money market rates and this can be seen in Table (1), where nominal interest rates in the 1990's are much lower, 1% on average, compared to the full sample average of 5.06%. However, this has proved ineffective as lowering interest rates even nearly to zero has had very little impact on the economy. This had led some to question whether Japan is facing a traditional Keynesian type of liquidity trap because of the impotency of monetary policy.

For the other countries, and in particular for the UK, US and Canada, both inflation and money market rates have also fallen over this period below the average in the entire sample. The fall in these growth rates has been accompanied by strong growth without inflationary pressure or expectations of inflation. In the case of the US, the boom has been sustained from the mid 1990's even up to the recent past. The other notable event which occurred in Europe was the formation of the European Monetary Union (EMU). The formation of the currency union was planned in stages ever since its conception from the Werner Report in 1971. The convergence criteria, set out in the Maastricht Treaty entered into force in November 1993. Stage II occurred in 1994, whilst Stage III was initiated in January 1999 where the eleven member countries adopted the Euro. In February 2002, member countries began to phase out their national currencies.

3 Picking Monetary Policy Periods

This part of the paper follows the spirit of the Romer & Romer (1989) approach to identifying monetary shocks using historical evidence. Here I seek to identify periods in time when central banks clearly adopted a particular stance for monetary policy using historical events as a guide.[7] However, a broader definition of monetary policy shocks is considered here, than that used by Romer & Romer (1989). In particular, they consider a monetary shock as "*an attempt by the Federal Reserve to exert a contractionary influence on the economy in order to reduce inflation*" (Romer & Romer, 1989, pp 134). A broader definition is used here, not limited only to monetary contractions. In particular, this section attempts to identify periods of monetary policy actions by central banks during some of the events highlighted within the previous section.

In following the spirit of the methodology involved within the narrative approach, I attempt to identify periods where central banks were actively setting monetary policy, by changing interest rates in the pursuit of their objective, e.g. reduction of inflation in the late 1970's, stabilizing the exchange rate in the early 1990's, etc. My intentions are twofold. First I identify when a monetary

[7] It should be noted that this paper takes no stance with regards to the instrument being used in the conduct of monetary policy during these episodes. Central banks changing the reserve base and allowing the money market rate to be determined by market forces, are viewed to be equivalent to setting the nominal rate and letting the reserves adjust accordingly.

policy intervention occurred. Having done so, the second step then involves trying to determine whether there was a significant change in interest rates arising from a monetary policy action and this is done in the next section.

It should be noted that in keeping with the spirit of the scientific approach, I first identify key historical events. It is at this point that I examine narrative records around the events, rather than the other way around. I seek to examine narrative evidence around some dates where I have some prior belief that monetary authorities were likely to have been conducting policy in pursuit of a clearly defined goal and see if these beliefs are bourne out and recorded in the narrative evidence. This is done in an attempt to lessen the inherent subjectivity in picking these events since I am then not simply picking events *after* reading the narrative evidence.

A multi country dataset, consisting of six of the G7 countries, is used here in the hope that a greater number of periods of monetary policy actions can be identified, rather than just considering historical evidence from only a single country such as the United States. The description of the data can be found in Appendix A and the sample periods for the countries being considered are summarized in Appendix A.4. Twenty one periods of monetary policy episodes were found across all the countries and these are summarized in Appendix A.5. The evidence for these monetary policy actions are drawn from a variety of sources and are listed next.

Monetary Policy Episodes

Canada

Canada has two identifiable episodes where the Canadian central bank visibly implemented monetary policy. The first episode for Canada, and in most of the other industrialized countries, is from the third quarter of 1979 to the second quarter of 1980. Within this period, the Bank of Canada noted that (Bank of Canada, 1979, pp 3-12): *"There is no question but that interest rates as conventionally stated are very high. In terms of our history they are at record levels."* (pg. 3). The statement continues later with:

> *"... it has now become clear ... that a substantial rise in interest rates was also needed in order to contain the rapidly expanding demand for money and credit in the domestic economy... it is my view that the actions taken by the Bank of Canada constitute a reasonable and prudent response to the potential inflationary damage that would be inflicted on the Canadian economy ..."* (Bank of Canada, Nov 1979, pg. 9).

The statements above are indicative of the stance of monetary policy within Canada at that time. They suggest that the Bank of Canada was tightening monetary policy in order to combat inflationary pressures arising from the second OPEC oil shock. This is the basis for considering this as a monetary policy period arising from the OPEC oil shock for Canada.

The second episode occurs from the third quarter of 1990 to the second quarter of 1992. Again the Governor of the Bank of Canada notes that (Bank of Canada, 1990b): *"With strong demand pressures and a monetary policy committed to resisting inflation, there has been upward pressure on Canadian short-term interest rates."* (pg 17). Furthermore, it was noted that:

> *"I want to emphasize that if the Bank of Canada had not progressively tightened monetary conditions in response to intensifying inflationary pressures, the inflation problem that we face today would have been greater still ... It is true that the Bank of Canada's actions to limit the expansion of money and credit in our inflationary environment have been one factor pushing up short term interest rates ..."* (Bank of Canada, 1990a, pg 12).

The statements above indicate that the Bank of Canada was tightening monetary policy, and this is the basis for considering this to be a monetary policy period.

France

France has three periods of monetary policy actions. The first was when the French central bank was seen to be visibly moving the money market rate from the third quarter of 1979 to the second quarter of 1980. As noted in the Economic Commentary found in the Bank of England's (henceforth BOE) Quarterly Bulletin (1980):

> *"Despite the growing signs of recession, the reduction of inflation remains the prime policy target in virtually every industrial country. As inflation rose in 1979, there was a strong increase in interest rates in all the major overseas countries."* (BOE Quarterly Bulletin, 1980, Vol. 20, No.2, pg 134)

The industrial countries referred to in the Economic Commentary are Canada, West Germany, Japan, France, Italy, the UK and the US. The statement above along with the general outlook for the economies in the industrial countries found in the Commentary (pg 119-140), were that the central banks were attempting to combat the inflationary pressure arising from the second OPEC oil shock. Thus, this statement is taken as providing evidence that the French (and other industrialized) central bank was tightening monetary policy during this episode. For France, this was partly as a result of the inflationary pressure from the second oil shock, but also from participating in the European Monetary System and joining the Exchange Rate Mechanism (ERM) (Goodhart, 1989, 1992).

The second episode of a monetary policy action taken by the Banque de France considered here is from the second quarter of 1981 to the first quarter of 1982. In May of 1981, François Mitterrand pursued reforms leading to an inflationary environment in an episode which several commentators have come to call the "Mitterrand Experiment". This led the finance ministry to tighten monetary policy. As noted in the BOE's Quarterly Bulletin:

> *"In France, ... market expectations* [were] *that the Franc would be devalued following the change in policies heralded by the election of the new government... official intervention to support the Franc was substantial, despite sharp increases in domestic interest rates."* (BOE, Quarterly Bulletin, 1981, Vol. 21, No. 4, pg 481-482)

In picking the third monetary policy period, there appears to be evidence that the Banque de France was moving the nominal interest rate during the ERM crisis from the third quarter of 1992 to the second quarter of 1993 as they responded to a speculative attack occurring on the French Franc-Deutschmark exchange rate. Several commentators have noted this and some evidence is provided in the Bank of England's Quarterly Bulletin:

> "*The French economy has experienced a period of prolonged exchange rate and interest turbulence. Market rates remained high throughout the autumn and early winter in defense of the franc's parity within the ERM.*" (BOE, Quarterly Bulletin, Vol 33, No. 1, pg 51)

Additional evidence can be found in Banque De France (1995), where they outline their intermediate objectives at that time:

> *"...* [the] *intermediate objectives are currently the exchange rate and the growth of a monetary aggregate... The August 1993 decision to broaden the fluctuation margins without changing the central* [exchange] *rates was taken to forestall speculation, but in no way modified the objective of maintaining the external value of the currency, which continues to be closely linked to the final objective of price stability."* (Banque De France, 1995, pg 12)

Italy

Italy has three identifiable episodes. Similarly to France, the first identified policy period arises partly from the second oil shock and also Italy's decision to participate in the ERM from the third quarter of 1979 to the second quarter of 1980 (see the quote from the BOE Quarterly Bulletin, 1980, above). The second identified period considered here arises from the ERM crisis which occurred during the third quarter of 1992 to the second quarter of 1993. During this time, the Italian central bank's attempted to defend the Lira-Deutschmark exchange rate during the speculative attack on its currency by raising short term interest rates. Evidence of the central bank's response to the shock can be found in a statement in the BOE Quarterly Bulletin (1992, Vol. 32, No. 4, pg 361). It stated that, *"Official interest rates were raised sharply in September in the defense of the lira."*. As mentioned before, several commentators have noted this. One example is Eudey (1995), who noted that the British, French and Italian central banks raised interest rates in defense of their respective currencies:

> *"In an attempt to attract buyers to their currencies, the British, French and Italian governments offered very high rates of return on short-term instruments denominated in their home currencies."* (Gwen Eudey, 1995, pg 318)

The final episode considered for Italy is from the third quarter of 1995 to the second quarter of 1996. The evidence supporting this shock, is taken from the BOE Quarterly Bulletin which noted that, *"In Italy, Spain and Sweden, the interest rate increase continues a period of monetary policy tightening started in the second half of last year."* (BOE Quarterly Bulletin, 1996, Vol 33, No. 3, pg 238-239). During this episode, the Italian government rejoined the ERM in Europe during the November of 1996.

Japan

Three episodes are considered for Japan. The first episode (as above for France and Italy) is from the second oil shock between the third quarter of 1979 to the second quarter of 1980. The second policy period considered here occurred from the third quarter of 1994 to the second quarter of 1995, when Japan was beginning to face deflationary pressure. The evidence is noted in the BOE Quarterly Bulletin:

> *"The Bank of Japan cuts its Official Discount Rate by 50 basis points on 8th September to a record low of 0.5%; Governor Matsushita said the easing was to prevent further spread of deflation and to secure economic recovery. The Bank of Japan also reaffirmed its intention of guiding market rates below official rates."* (BOE Quarterly Bulletin, 1995, Vol. 35, No. 4, pg 337)

The statement here is indicative of relaxed stance for monetary policy as the Bank of Japan attempted to boost output growth through monetary expansion, and mitigate any deflationary pressures. Finally, the last occurrence is from 1998, as Japan tried to stimulate its economy by lowering the nominal interest rate to near zero:

> *"... overnight rate in Japan has remained close to zero, as a result of the confirmed 'zero interest rate policy' adopted by the Bank of Japan (BoJ) in February 1999... the BoJ 'will flexibly provide ample funds and encourage the overnight call rate to move as low as possible' in order to 'assume permeation of the effects of monetary easing'."* (BOE Quarterly Bulletin, 2000, Vol. 40, No. 2, pg 144)

The last two monetary policy periods that I include here are monetary expansions which are different from the types of policy actions considered by Romer & Romer (1989). Romer & Romer (1989)

identify monetary contractions where excessive inflation led the Federal Reserve to actively pursue policy to try and influence aggregate demand. They do not attempt to identify monetary expansions because of the inherent difficulty in distinguishing the real effects of a monetary expansion, with the natural tendency of trend output to increase. More precisely, the identification problem lies in an inability to separate an increase in output arising from trend output with an increase in output arising from an expansionary shift of monetary policy. I do not attempt to address that particular problem within this paper. Moreover, examining monetary expansions (as in the last two periods proposed for Japan) are not so problematic here since this paper is attempting to assess the stance of monetary policy and its resultant implications for movements in money market and implied CCAPM rates. The documentary evidence appears to suggest that the Bank of Japan was actively pursuing expansionary policy within these periods.

United Kingdom

The UK has five identifiable episodes. The first episode identified is from the second quarter of 1976 till the first quarter of 1977. Just prior to the beginning of this episode, Sterling came under repeated pressure to depreciate. This led to a series of interest rate hikes between April to June of 1976 and a rescue package by the governors of the Group of Ten countries, Switzerland and the Bank for International Settlements which involved stand-by credit of over $5 billion. As is noted in the Bank of England's Quarterly Bulletin (BOE Quarterly Bulletin, 1976, Vol. 16, No. 3), the Governor of the Bank of England declared in his annual speech: *"... the value of sterling had by then depreciated by over 16%, in spite of substantial intervention which was reflected in an underlying reserve fall of over $3 billion."* (pg 324). When looking at the operations of monetary policy within that time, it also notes that *"Conditions in the money market were generally kept very tight."* (pg. 300).

The second identified episode was during the second oil shock as the UK formally committed itself to monetarism under Prime Minister Margaret Thatcher in October 1979 and used monetary policy to fend off increasing inflationary pressures. In a speech given by the Governor of the Bank of England in 1980, the Governor said:

> *"A firm monetary policy has a central role in combating inflation, ...this task of promoting monetary stability can* [not] *always be accomplished without actions ...* [that] *are, harsh and disagreeable. I know that the present level of interest rates is bitter medicine... It is most hurtful to people committed to borrowing that they would not have undertaken had they known how high interest rates would rise."* (BOE Quarterly Bulletin, 1980, Vol. 20, No1, pg 61)

The statement above indicates the tight stance of monetary policy at that time, which was being used to fight off inflationary expectations arising from the second oil crisis and reinforce the UK's commitment to monetarism. The period considered is from the fourth quarter of 1979 to the third quarter of 1980.

The third episode considered is from the second quarter of 1988 till the first quarter of 1989. Domestic interest rates were increased four times during June of 1988 as monetary policy was tightened because of accelerating money and credit aggregates which led to inflationary pressures. These hikes in interest rates continued in subsequent quarters. Documentary evidence is shown in the Quarterly Bulletin: *"Monetary conditions were tightened during the period* [June-September 1988] *in order to exert downward pressure on inflation and domestic demand growth. "* (BOE, Quarterly Bulletin, 1988, Vol. 28, No. 4, pg 485).

The fourth episode considered here is the period of monetary tightening from the third quarter of 1990 till the second quarter of 1991. This was just prior to the period when Iraqi forces had invaded Kuwait in early August of 1990, leading to expectations of the future Gulf War and increases in the price of oil. As is noted in the Quarterly Bulletin, *"Monetary conditions in this country had tightened considerably in the months before the Iraqi invasion of Kuwait."* (BOE, Quarterly Bulletin, 1990, Vol. 30, No. 4, pg 442). It goes on to say:

> *" The tight policy stance with interest rates maintained at 15% throughout the third quarter, was reinforced by the appreciation of sterling, which was attributable in part to anticipation of ERM entry and, in the immediate aftermath of the Iraqi invasion of Kuwait, to a degree of petro-currency support."* (pg. 465).

The final episode identified for the UK was in September 1992, at the time of the ERM crisis. Britain left the ERM, unable to fend off a speculative attack on its currency, despite raising short

term interest rates to 12%. Subsequently, the Bank of England lowered interest rates to help boost the domestic economy and mitigate the effects of the crisis.

United States

For the United States, five episodes are considered. The first four of these are given by the last four observations identified by Romer & Romer (1989), through their search of the FOMC meetings. It is only the availability of data which restricts attention to four of their six monetary policy shocks within that paper. The first occurrence considered here is from mid 1967 till the end of 1968. Romer & Romer (1989) document evidence of concerns about inflation and inflationary expectations which led the Federal Reserve to tighten monetary policy. The second shock arose from the first OPEC oil shock and the period considered is from the second quarter of 1974 till the first quarter of 1975. It was in April 1974 that the Federal Reserve tightened monetary policy to fend off rising inflation occurring from the oil embargo that started in October 1973. The third and fourth responses occurred back to back in August 1978 and October 1979. Monetary policy had started to be tightened since August 1978, but in October 1978, the Federal Reserve decided much stronger measures were required to combat inflation. This led to the announcement by the chairman of the Federal Reserve Board, Paul Volcker, of a change in the instrument of monetary policy to controlling non-borrowed reserves. Monetary policy was tightened further. Thus, the periods considered are the third quarter of 1978 till the second quarter of 1979, and from the fourth quarter of 1979 till the third quarter of 1980. The fifth and final episode comes from the 1994 paper by Romer and Romer, where they identify an additional event in 1988.

4 Significance of Policy Periods

This section attempts to assess the significance of the identified monetary policy periods. The objective here is to examine and isolate changes in interest rates that can be attributed to monetary policy actions. The approach here has elements that are both similar and different to the approach adopted by Romer & Romer (1989), who tried to single out the liquidity effects of these monetary policy shocks by examining the dynamic response of output through a dummy variables approach.

The main reason for examining changes in interest rates here, is because they play a vital role in the transmission mechanism of monetary policy in recent monetary models. The standard paradigm for the analysis of monetary policy is the New Neoclassical Synthesis (NNS) framework, where nominal interest rates are assumed to reflect the stance of monetary policy within each of the countries.[8] Within the NNS framework, the transmission mechanism of monetary policy occurs through the consumption Euler equation. Consider the following standard consumption Euler equation arising from a model with power utility in preferences:

$$\frac{1}{1+i_t^*} = E\left[\beta\left(\frac{C_{t+1}}{C_t}\right)^{-\theta}\left(\frac{P_t}{P_{t+1}}\right)\right] \tag{1}$$

The interest rate, i_t^* implied by the consumption Euler equation, is assumed to reflect the stance of monetary policy and NNS models typically equate it to a money market rate. A change in the interest rate arising from a monetary policy action has an impact on expected consumption growth under the presence of nominal rigidities, and hence, has an impact on real variables like consumption and output. Thus, movements in interest rates can be associated with changes in the stance of monetary policy, given the transmission mechanism of monetary policy within NNS models. Assessing the significance of the monetary policy periods by examining interest rate movements has implications for the transmission mechanism of monetary policy within NNS models, in terms of how monetary shocks are transmitted to the economy. I utilize the transmission mechanism within the framework provided by NNS models here given its prevalence in the literature today.[9]

The basic idea in assessing the significance of the monetary policy periods can be seen as follows. Given the monetary transmission mechanism outlined for the NNS framework above, money market rates in general will differ from the implied CCAPM rate, i_t^* in equation (1). This result has been fairly well documented, from early work by Hansen and Singleton (1982), to the 'equity premium' and 'risk-free rate' puzzles by Mehra and Prescott (1985) and Weil (1989) respectively. A casual

[8] Woodford (2003) provides an excellent introduction to NNS models. Some examples of influential papers within the monetary policy literature that incorporate this framework are King and Wolman (1999), Erceg, Henderson and Levin (2000), Christiano, Eichenbaum and Evans (2005) and Canzoneri, Cumby and Diba (2006).

[9] An example of where the VAR based approach is utilized within the context of the NNS framework, is in Ahmad (2005). Ahmad (2005) examines its ability to reconcile the time series properties of consumption, inflation and interest rates for the same six countries as in this paper.

observation of this can be seen by constructing the implied CCAPM rate according to equation (1). The expectation term within the right hand side of equation (1) is generated by performing one-period ahead projections of the current information set.[10] The data used in constructing the implied CCAPM rate is described in Appendix A and Figure (2) below plots money market rates against the implied Euler equation (CCAPM) rate, for six of the G7 countries. This implied CCAPM rate in equation (1) above is constructed with the parameters $\theta = 2$ and $\beta = 0.993$ (given the quarterly data). These values are widely used in the literature in calibrating models.

Figure (2) depicts a spread that exists between the implied CCAPM rate and the money market rate in all the countries. The existence of the spread essentially reflects the risk-free rate puzzle highlighted by Weil (1989). There appears to be a systematic difference between the implied CCAPM rate and the money market rate in each country, and the plot suggests that it may be persistent. As mentioned earlier, NNS models equate the money market rate (assumed to reflect the stance of monetary policy) to the implied CCAPM rate. However, for plausible parameter values, a spread exists between the two and one interpretation of this may be that central banks are systematically driving a wedge between the two. This may be reflected to an extent within the stance they adopt for monetary policy.

One other reason for examining interest rates is because the narrative evidence of the previous section gives us some idea of the objectives of policy makers and what kind of monetary policy actions they took in the presence of exogenous shocks. Changes in interest rates that arose from monetary policy actions provide a measure of the change in the stance of monetary policy. Hence, examining the significance of interest rate movements during these identified monetary policy periods, provides an answer to the degree by which central banks changed the stance of monetary policy, and to the significance of the identified policy periods. Since the remaining goal of this paper is to assess the significance of the policy periods identified earlier in terms of the transmission mechanism of monetary policy, significant changes in interest rates arising from monetary policy

[10] More precisely, the right hand side of equation (1) is generated by assuming that consumption growth and inflation are jointly logormally distributed. I then use a VAR to generate the expectation terms by projecting one-period ahead, and the variance-covariance terms are simply obtained by picking the correct element from the variance-covariance matrix. Ahmad (2005) provides additional details.

actions by central banks would provide some evidence of the presence of (monetary policy) shocks, or perceived shocks on the part of monetary authorities.

A Dummy Variables Approach

I posit that the stance of monetary policy is systematically linked to the spread between the implied CCAPM rate, i_t^* and the money market rate, i_t, although the spread is zero within the theoretical NNS framework.[11] However, as shown above, a persistent spread exists between the two rates empirically for plausible parameter values, and the stance of monetary policy may reflect the extent to which the two rates differ. This provides an avenue to assess the significance of the monetary policy periods identified before, through a dummy variables approach.

Let d_t be a dummy variable representing a monetary policy action taken within the identified monetary policy period. The dummy variable is equal to 1 in the quarter of an identified monetary contraction and -1 in the quarter of an identified monetary expansion. Defining the interest rate spread as $m_t \equiv i_t^* - i_t$ and adopting a simple linear relationship between the spread and the dummy, yields:

$$m_t = \alpha + d_t + u_t \tag{2}$$

In the equation above, α is a constant and u_t is a serially correlated error term. Incorporating a dummy variable allows us to check whether the stance of monetary policy during periods of monetary policy interventions can be systematically linked to the spread, and whether it contains useful information regarding the spread. u_t is likely to be serially correlated because the dummy variables are non zero, only in the identified quarters. However, there is no reason to believe that the monetary policy actions only lasted one quarter, and this is due to the inherent difficulty in identifying the end of a monetary policy action arising from a monetary policy intervention. The observed persistence of the spreads in figure (2) makes it likely that u_t will be serially correlated.

[11] In a recent paper, Canzoneri, Cumby and Diba (2006) document evidence that this spread may be systematically linked to the stance of monetary policy.

The equation that is estimated, is:

$$\begin{aligned} m_t &= \alpha_0 + \alpha_1 d_t + u_t \\ \text{where } u_t &= \rho u_{t-1} + \eta_t \end{aligned} \tag{3}$$

where η_t is white noise. In the equation above, α_1 should be negative. This is because a monetary contraction, represented by a positive dummy, is associated with an increase in nominal interest rates - i_t, which would cause a decline in the spread, m_t. Hence, one would expect the coefficient on the dummy variable to be negative.

The presence of serially correlated residuals is a problem, since it violates the standard classical assumptions of regression theory regarding the disturbance, or error term, u_t. The essence of the problem is that classical regression theory requires that disturbance terms be orthogonal to regressors, and that they not be correlated with either their own lags, or with other disturbance terms. Estimating equation (3) through standard OLS would yield inefficient estimates, since the unconditional residual, u_t, is correlated with its own lagged value. This can be seen more easily by incorporating u_t into equation (3), which yields the following after rearranging:

$$m_t = \alpha_0 (1 - \rho) + \rho m_{t-1} + \alpha_1 d_t - \rho \alpha_1 d_{t-1} + \eta_t \tag{4}$$

where m_{t-1} contains i^*_{t-1} defined by the lagged version of equation (1). Estimating equation (3) instead of equation (4) would mean that the lagged values of m_t and d_t were omitted, generating the inefficiency.

The methodology used here to account for the autocorrelation in the residuals, is to estimate equation (3) by GMM, which yields consistent estimates of the coefficients, given an assumption about the process generating u_t: I assume that u_t is an AR(1) process. The GMM methodology involves estimating the coefficients using moment conditions which are written as orthogonal conditions between the residuals of the regression equation and a set of instrumental variables.

The number of instruments must be greater than, or equal to, the number of moments in order to be able to identify the parameters (i.e. the coefficients to be estimated).

The choice of instruments is an important one, since the results are sensitive to the set of instruments used. In particular, the timing of any variable used as an instrument is important since equation (3) contains terms dated at both periods t and $t-1$. From equation (4), any feasible instrument chosen, would have to be correlated with $m_{t-1},\ d_t$ and d_{t-1} yet uncorrelated with η_t. The specific set of instruments used in the estimation procedure were four lags of real consumption growth, interest rates, inflation, real gdp growth and the dummy variable.[12] By construction, it is easy to see that these variables are correlated with the set of regressors in equation (4). More precisely, the lags of consumption and output growth, inflation and interest rates are correlated with m_{t-1}, whilst the lags of the dummy variable are a valid instrument for itself. They are also uncorrelated with the residual, η_t, since none of the variables are dated in period t and η_t is the innovation to u_t *within period t.* Hence, they are valid instruments.

Equation (3) was also separately estimated with the dummy leaded and also lagged. This was done to account for delays by monetary authorities in reporting any monetary policy actions taken (- leaded dummy), or if the monetary policy action was subsequently taken after an announcement (- lagged dummy). All the results are summarized in Table (2) and the consumption, price and interest rate data used in the estimation is described in Appendix A. Although the individual coefficients have no clear behavioral interpretation, their significance and sign are of importance. Thus in the discussion that follows, I focus on the latter two rather than on the magnitude of the coefficients themselves.

Table (2) shows that the coefficient on the dummy variable is significant for all the countries, but not consistently for the same dummy. For example, the results show that the contemporaneous dummy and the lead dummy are significant for Canada and Italy, whilst the lagged dummy and contemporaneous dummy are significant for France. As mentioned above, one possible reason for

[12] It should be noted that the actual consumption growth, real gdp growth and inflation between period $t-1$ and period t are defined as $\left(\frac{C_t}{C_{t-1}}\right), \left(\frac{Y_t}{Y_{t-1}}\right)$and $\left(\frac{P_t}{P_{t-1}}\right)$ respectively. It is the lags of these variables that are included in the list of instruments within the GMM estimation procedure.

this would be either delays in reporting, e.g. for Canada and Italy, or monetary policy actions taken subsequently after the announcement, e.g. for France. With the exception of Japan, the sign on the dummy is negative, as we would expect, and consistent across the three versions. For Japan, the sign on the lagged dummy is significant, and of the correct sign. However, the sign on the lead dummy is also significant but incorrectly signed (the contemporaneous dummy is positively signed but insignificant). Furthermore, the results of the Hansen's J-statistic, which under the null hypothesis tests the validity of the overidentifying restrictions, finds insufficient evidence to reject the null.

Hence, the results from the estimation with the exception of Japan, seem to provide clear evidence that the identified monetary policy periods were somewhat significant. The significance of the dummy variable would suggest that the stance of monetary policy during these periods were somehow significant in affecting the spread between the interest rate implied by the consumption Euler equation and money market rates. In particular, the significance of the dummy would indicate an increase in the intercept of the interest rate equation given by equation (3), during these 'monetary policy periods'. One interpretation of this is that interest rates were higher during these periods due to exogenous monetary policy actions, since a change in the stance of monetary policy would be reflected in the instrument of monetary policy - the nominal interest rate. This evidence supports the narrative evidence seen in the earlier section, that central banks moved interest rates in a way that was statistically significant during these monetary policy periods.

An Alternative Approach

As mentioned in the introduction, one criticism that the reader might have of the interpretation of the shocks in the previous section is that, are they really monetary policy shocks? The inevitable question that follows is to ask what exactly is being identified within these policy periods, as one might argue that these events are not independent of the real economy in the sense of a 'VAR' -type monetary policy shock. The policy periods identified earlier represent a combination of regime changes to the central bank's reaction function -(e.g. Volcker in October 1979, and Mitterrand in 1981-2), reactions to extreme economic events (like large changes in inflation), or new policies that

lead monetary authorities to alter their usual behavior.

In order to address this criticism, I consider an alternative interpretation for the monetary policy periods, and look for any evidence of regime changes within the reaction function of central banks. The approach here involves estimating Taylor type reaction functions such as the one below for every country:

$$i_t = \beta_0 + \beta_1 \pi_t + \beta_2 (y_t - y^*) + \beta_3 \Delta s_t + \varepsilon_t \tag{5}$$

where π_t is inflation, $y_t - y^*$ represents the output gap, and s_t represents the nominal effective exchange rate. Although exchange rates are not usually included in estimated Taylor rules within the literature, I include the change in the exchange rate within the estimation here to reflect the extent to which central banks set monetary policy with an exchange rate target in mind.[13] In addition, I do not include foreign interest rates in the Taylor reaction function above since that would lead to additional collinearity between the regressors (more specifically, the exchange rate). In the estimation, I utilize data on nominal effective exchange rates obtained from the IMF's *International Financial Statistics* Database.

Having estimated equation (5) for every country, I then proceed to test for breakpoints at the identified monetary policy periods and employ two types of econometric tests. The first tests whether the data supports the existence of breaks at the identified monetary policy periods, using statistical tests designed for examining known breakpoints. In addition, I search for breaks that may have occurred at other times using statistical tests for unknown (multiple) breakpoints. The first set of tests for known breakpoints was done for the individual dates as well as all the dates jointly for each country. This involved partitioning the data into subsamples based on the identified policy periods, and then computing the Chow breakpoint test by comparing the sum of squared residuals obtained by fitting a single equation to the full sample with the sum of squared residuals obtained when fitting a separate equation to each subsample.

[13] The change in the exchange rate is incorporated rather than the level of the exchange rate given the nonstationary nature of exchange rates.

Table (3) shows the results from the tests with a known breakpoint for every country. The reported F-statistic is the result from the Chow Breakpoint test and shows that these identified monetary policy periods are jointly significant for every single country. When looking and testing the individual dates, the results show that the identified monetary policy periods are individually significant in all the countries with one exception: the United States in 1967:3. Hence with the exception of this date in the United States, the results overwhelmingly support the idea that interest rates changed in a statistically significantly manner at these points in time for these countries.

The second set of tests employed allows the data to show if any breakpoints exist, by not assuming that the dates of any breakpoints are known à priori. This provides an additional check to see if the monetary policy periods identified earlier coincide with any breakpoints suggested by the data itself. The procedure for testing for multiple unknown breakpoints was developed by Bai and Perron (2003). Their procedure involves partitioning the sample into all possible sets of $b+1$ subperiods and obtaining the particular set that minimizes the residual sum of squares. Their $\sup F$ test statistic then tests the null hypothesis of $m = 0$ breaks against $m = b$ breaks. In order to select the number of breaks in the data, they suggest examining the results from a sequential break test that they develop as well as using two information criteria. In their sequential break test, they test the alternative hypothesis of $b+1$ breakpoints against the null of b breakpoints using the minimized sum of squares. In addition, they compute the Bayesian Information Criterion (BIC) and a modified Schwarz Criterion (LWZ) proposed by Liu et al. (1997), which they suggest to use to select the number of breaks in the data. I ran all tests, testing for a maximum number of five breakpoints for each country. Following the suggestion by Bai and Perron (2003), I used 10% of the sample period as a buffer between breakpoints.

Table (4) shows the results for the multiple-unknown breakpoint test by Bai and Perron (2003). Panel A reports the summary results on the number of breaks found in the data. The sequential procedure by Bai and Perron (2003) and the BIC detect the same number of breaks for every country with the exception of the US. The LWZ criterion finds the same number of breaks as the sequential procedure and the BIC for Canada and France, but fewer breaks for the remainder (with the exception of the US, where it finds the same number as the BIC). Bai and Perron (2003) suggest

that in selecting the number of breaks, the BIC works well when actual breaks are present but less so under the null hypothesis of no breaks. The LWZ criterion works better when no breaks are actually present, but less so when actual breaks are present. Moreover, all the breakpoints that are detected are found to be highly significant. Hence, the results in Panel A would suggest that multiple breaks were detected in the data for all countries.

Panel B reports the order in which the breaks were detected from the sequential tests. Since Bai and Perron's (2003) procedure recommends using a buffer of observations between breakpoints, several of the identified monetary policy periods were untestable once a breakpoint was detected in the vicinity of an identified monetary policy period. The first episode for France, along with the last episodes for Italy and Japan were untestable. For France and Italy, this was because a breakpoint was detected at 1981:1 and 1993:1 respectively. For Japan, the final episode was untestable due to a lack of viable observations with which to test from. Despite this, thirteen of the eighteen testable monetary policy episodes that are identified earlier in this paper are detected. They either show up as a breakpoint, or fall within the 95% confidence intervals for the breakpoints that are found. The five periods which were testable, but were not detected were from the UK and the US. Overall, the results here would indicate a significant change in the stance of monetary policy at central banks at these dates due to shocks or perceived shocks.

Predictability of the Policy Periods

This final section asks the question: to what extent could these identified monetary policy periods have been predicted à priori? In his 1997 paper, Leeper extended Shapiro's (1994) work to estimate a logit model for the Romer' dummy using standard macroeconomic variables. His key finding was that the Romers' dummy variable was highly predictable: the average predicted probability that the dummy equaled one in the seven identified months was 0.43. Hence, he argued that the policy shifts that the Romers identified could not represent changes in policy makers behavior unrelated to economic developments, but were rather, the endogenous response of policy to the economy.

In attempting to address this critique within this the context of this paper, I follow Leeper's (1997)

methodology and estimate a logit model for the monetary policy periods identified here within this paper. The list of macroeconomic variables I use to estimate the logit model is denoted by $x_t = (Y_t, \pi_t, i_t, M_t)'$, where Y_t represents the (log) of real GDP, π_t represents the inflation rate, i_t represents the money market interest rate and M_t represents the log of high powered money. Since this paper identifies both monetary expansions in addition to contractions, I construct a dummy variable for each country consisting of an event. The event represents either a monetary contraction or an expansion, which equals one only in the period that it occurs and zero elsewhere. Following Leeper (1997), the expectation of the dummy variable conditional on the information set Ω_t is given by:

$$E\left(d_t|\Omega_t\right) = F\left(\beta_0, \beta\left(L\right) x_t\right) \tag{6}$$

where $F\left(.\right)$ is the logistic function and $\beta\left(L\right) = \beta_1 L + ... + \beta_k L^k$ and β_0 is a constant term. The current information set, Ω_t, contains only variables dated $t-1$ and earlier, which follows the convention used by Leeper (1997). For each country, I considered $k = \{1, ..., 4\}$ to be plausible values for the number of lags to incorporate in (6), given that the data was in quarterly format. k was selected using an information criterion such as the Akaike information criterion.[14]

The results are reported in table (5) and in figure (3), which plots the predicted values of the dummy from equation (6). The vertical lines mark the dates of the actual events identified. As can be noted in table (5), the average probability predicted across the events are all low, with the exception of the UK. The only predictable set of events appear to be in 1979 for Canada and the UK, and in 1990 for the UK. However, the results for the UK and Canada appear to be sensitive to the number of lags specified. In particular, if I set $k = 2$ instead of 3 for the UK, then the average probability of an event occurring fell to 0.196. This was also true of Canada, where if I set $k = 1$, the average probability fell to 0.094. Overall, the results here would indicate that these identified monetary policy periods consist of exogenous actions by the monetary authority in response to an actual shock or perceived shock, rather than an endogenous response due to economic activity.

[14] Romer and Romer (1997), in a reply to Leeper's (1997) paper showed that his results were sensitive to the number of lags incorporated within equation (6), particularly as a result of overfitting. I use the Akaike information criterion to select the number of lags, k, so that I may avoid overfitting equation (6).

5 Conclusions

This paper identifies twenty one monetary policy periods in the spirit of the narrative approach that was first pioneered by Friedman & Schwartz (1963) and later popularized by Romer & Romer (1989). Using historical events as a guide, I examined narrative historical evidence for the last three decades across six of the G7 countries and found some periods in time where a central bank's stance on monetary policy was clearly able to be identified. The narrative evidence reflects both policy makers intentions and their perceptions of the state of their economy that led them to adopt a particular stance, or change their stance on monetary policy. I then examined movements in interest rates in order to see if they can be attributed to the change in the stance of monetary policy, and not purely as a result of endogenous policy actions attempting to affect the real side of the economy.

In analyzing movements in interest rates, I assessed the significance of the monetary policy periods through two alternative approaches. The first was a dummy variables approach which is similar to that of Romer and Romer (1989). However, I focus on examining the effect of a change in the stance of monetary policy on interest rates in terms of the transmission mechanism of monetary policy within the New Neoclassical framework, instead of looking at the liquidity effect on output. This involved using GMM to estimate an interest rate spread equation that incorporated a dummy variable for the identified monetary policy periods. The alternative approach involved looking for breakpoints in the reaction functions of central banks at the identified monetary policy periods.

The results from both approaches overwhelmingly finds that a change in the monetary policy stance during these policy periods was significant. Moreover, additional evidence suggests that these policy periods were not predictable à priori from standard macroeconomic data. The main conclusion that can be drawn from these results is that a change in the stance of monetary policy, based upon policy makers perceptions of exogenous monetary policy shocks, has historically had a significant impact on interest rates on several occasions over the course of the last three decades. The results of this paper are intended to provide an alternative way to think about identification in the monetary policy literature that abstracts from attempting to identify the effects of a shock

on the economy. If the reader is convinced to some extent by the arguments within the paper regarding the validity of the monetary policy periods, then the intended contribution of this paper is to provide researchers with the first step of looking at the *effects* of monetary policy actions on the economy during periods of exogenous monetary policy actions. In this manner, we may be able to uncover a little more about the black box that belies the transmission mechanism of monetary policy.

Appendix

A The Dataset

The dataset consists of quarterly data on the following variables for each of the countries: nominal and real nondurable goods and services along with their deflators; nominal and real GDP again along with their deflator; nominal effective exchange rates for each country, a monetary aggregate; and a money market rate. The sources are presented as follows:

A.1 Interest Rates, Exchange Rates and Monetary Aggregates

Interest rate data are obtained from the following sources: *OECD Main Economic Indicators* for France and Italy; *OECD Economic Indicators Database* for Canada and the United Kingdom. These data are all quarterly. Interest rate data for Japan was provided by John Rogers and comes from the *International Financial Statistics (IFS) Database*. The US data is obtained from the *Federal Reserve Statistical Release* within the historical data section. The data is monthly and so converted to quarterly by taking three month averages. Data on nominal effective exchange rates was also obtained from the IFS database. The monetary aggregates for all the countries with the exception of the US is also obtained from the OECD's *Main Economic Indicators*. US monetary aggregates are obtained from the *Federal Reserve Statistical Release* and again the data is converted to quarterly by taking three month averages.

A.2 Consumption, And GDP Data

Both the consumption and GDP data are quarterly data. They include both nominal and real consumption spending on nondurable goods and services along with their implicit deflators, and nominal and real GDP along with their price deflators. These are obtained from the *OECD Quarterly National Accounts* for Canada, France, Italy and Japan. The data for the OECD *Quarterly National Accounts* use the fixed-weight standard of the 1993 SNA and base years vary

according to country. For the UK, the data is obtained from the UK's Office of National Statistic's *Quarterly National Accounts*. For the US, the data is obtained from the Bureau of Economic Analysis' *National Income and Products Accounts*. However, the US data is chain weighted which ensures that the prices used to compute the values are never too far out of date.

A.3 Price Data

For Canada, France, Italy and Japan, and the UK the nominal (real) nondurable consumption goods and services are summed to create nominal (real) consumption, and the price level is the implicit deflator between the nominal and real consumption series. However, for the US, the chain-weighted components are not additive. To create the consumption based price index, the nominal expenditures on nondurable goods and services are summed to give nominal expenditures on consumption. Similarly, each of the individual nominal expenditure series on nondurables and services are divided by their implicit price deflators and these real based measures are summed to give real consumption expenditure. The nominal consumption based series is then divided by the real consumption based series to yield the consumption based price index.

A.4 Country Table

The following table, Table A1, gives the start and end dates of the common sample of all the variables:

Country	Time Period
Canada	1962:1 - 2000:2
France	1977:4 - 1998:2
Italy	1974:4 - 1998:3
Japan	1970:1 - 1999:1
United Kingdom	1969:1 - 2000:4
United States	1964:3 - 2000:4

Table A.1: Data Sample

A.5 Episodes of Monetary Policy Shocks

This table summarizes the episodes where the central banks in these countries were observed to be moving the interest rate in their conduct of monetary policy.

Country	Episodes Of Monetary Policy Periods		
Canada	1979:3-1980:2	1990:3 - 1991:2	
France	1979:3-1980:2	1981:2 - 1982:1	1992:4 - 1993:3
Italy	1979:3 - 1980:2	1992:3 - 1993:2	1995:3 - 1996:2
Japan	1979:3 - 1980:2	1994:3 - 1995:2	1998:2 - 1999:1
United Kingdom	1976:2 - 1977:1 1990:3 - 1991:2	1979:4 - 1980:3 1992:3 - 1993:2	1988:2 - 1989:1
United States	1967:3 - 1968:2 1979:4 - 1980:3	1973:4 - 1974:3 1988:4 - 1989:3	1978:3 - 1979:2

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Figures

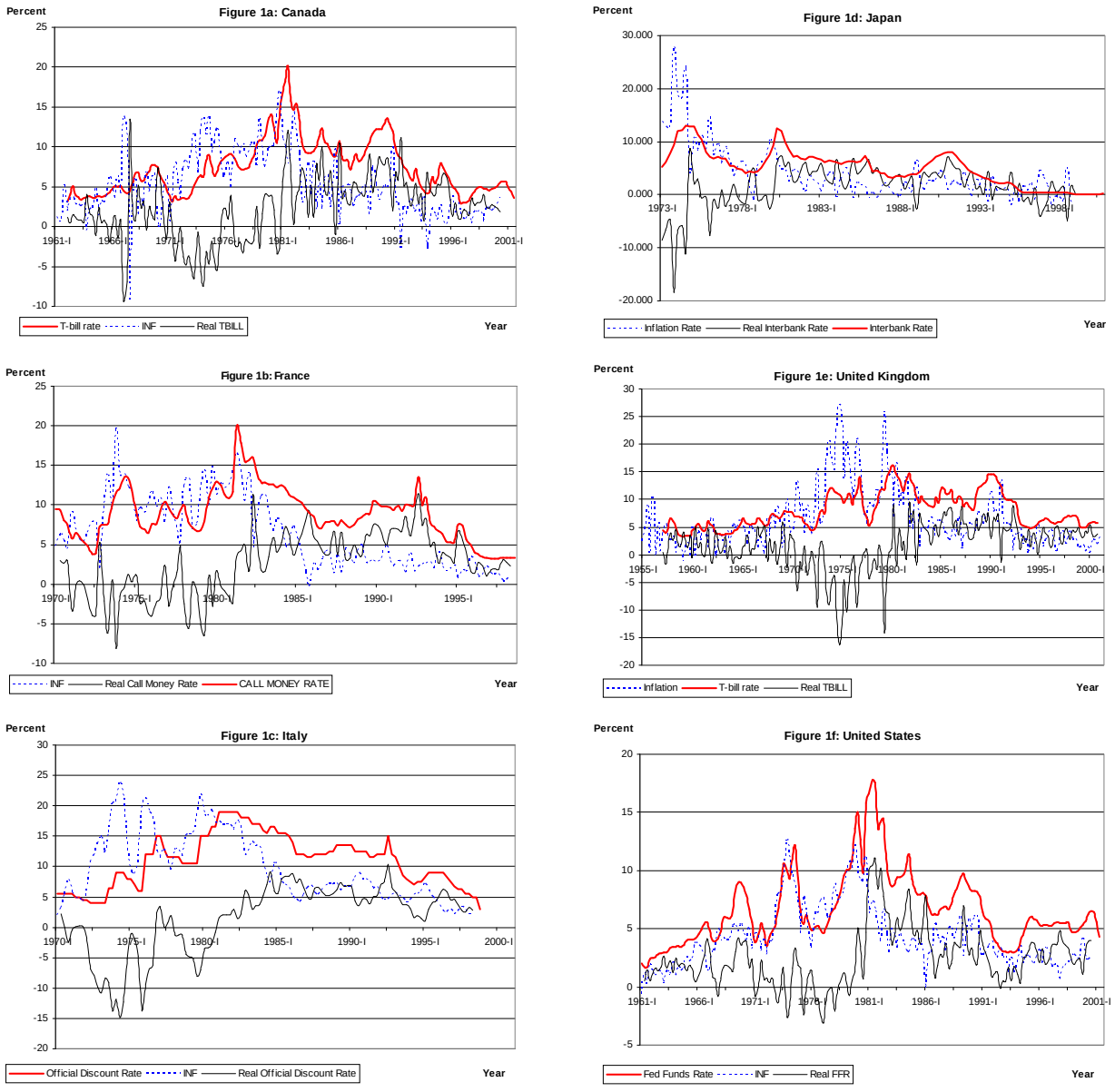
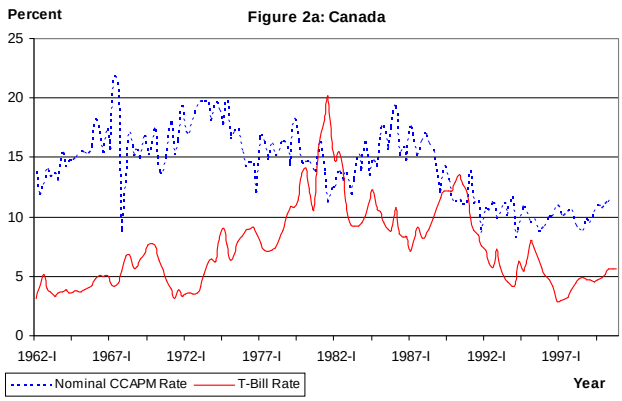
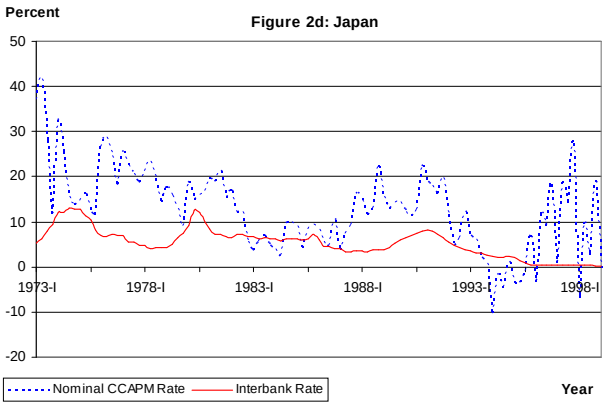
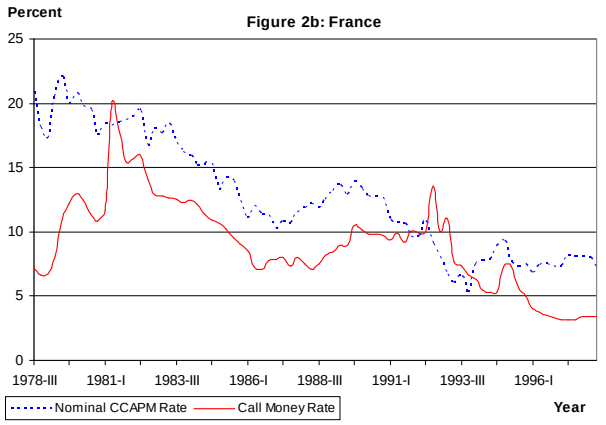
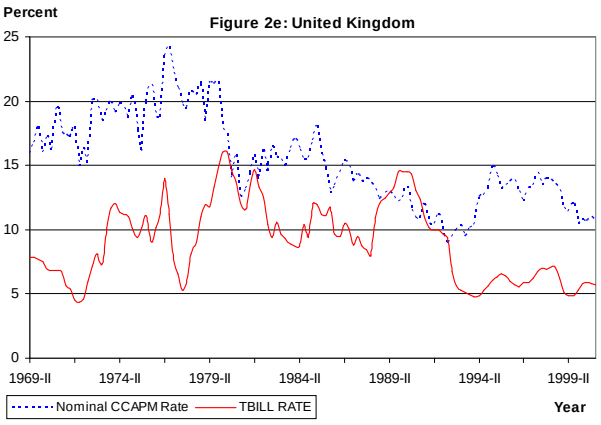


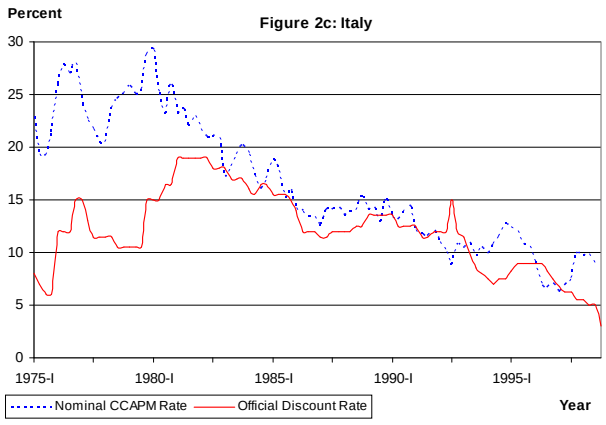
Figure 1: Money Market, Inflation and Real Money Market Rates Across Countries











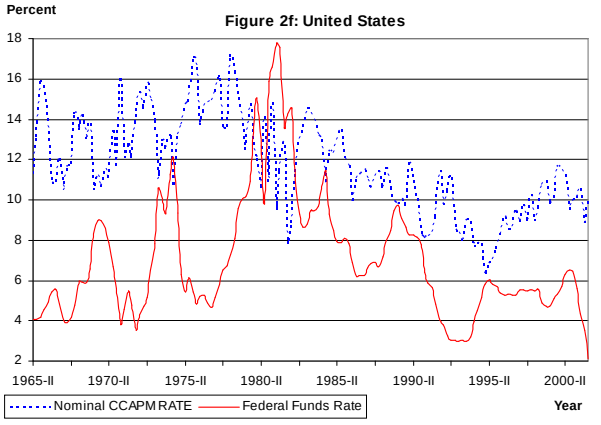


Figure 2: Nominal CCAPM Rate vs Money Market Rate Across Countries

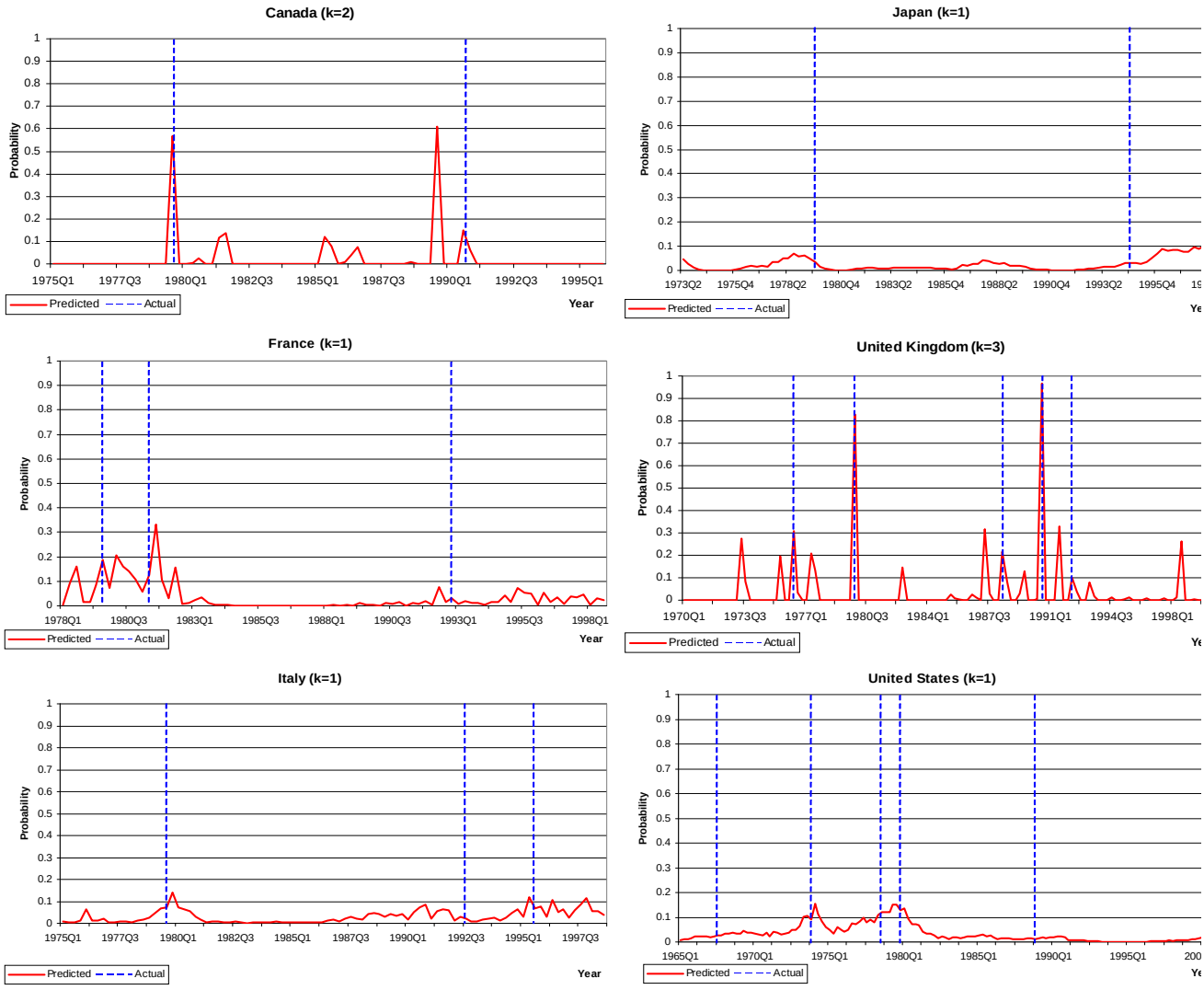


Figure 3: Prediction of Event Occuring from Logit Equation vs. Actual Event

Tables

CANADA

Year	Y	PY	C	PC	INF	MMR	MA
1962:1 - 2000:2	3.64	8.38	3.00	8.23	5.21	7.44	7.82
1970:1 - 1978:4	4.45	12.36	3.81	11.95	8.07	6.52	10.50
1979:1 - 1982:4	0.78	10.14	0.90	11.40	10.49	13.96	5.29
1983:1 - 1989:4	4.07	7.76	3.30	7.89	4.56	9.78	5.94
1990:1 - 1992:4	-0.13	1.82	1.13	4.56	3.43	9.37	4.88
1993:1 - 2000:2	3.67	5.23	2.85	4.55	1.69	4.92	10.98

FRANCE

Year	Y	PY	C	PC	INF	MMR	MA*
1970:1 - 1998:2	2.49	8.60	2.70	9.02	6.28	8.85	6.73
1970:1 - 1978:4	3.53	12.83	3.67	12.85	9.11	8.28	11.23
1979:1 - 1982:4	1.77	12.47	1.87	13.95	12.02	13.07	10.95
1983:1 - 1989:4	2.74	7.35	2.96	7.31	4.32	9.49	8.77
1990:1 - 1992:4	0.20	3.01	1.96	4.77	2.80	10.13	5.51
1993:1 - 1998:2	2.23	3.48	1.79	3.65	1.85	5.21	0.72

ITALY

Year	Y	PY	C	PC	INF	MMR	MA**
1970:1 - 1998:2	2.43	12.35	2.33	12.10	9.70	11.08	9.80
1970:1 - 1978:4	3.54	16.76	3.33	15.66	12.23	7.99	20.44
1979:1 - 1982:4	1.66	19.05	2.45	19.73	17.16	16.22	13.48
1983:1 - 1989:4	2.99	11.03	2.35	10.23	7.83	14.11	8.89
1990:1 - 1992:4	0.18	6.03	1.05	7.74	6.68	12.46	4.57
1993:1 - 1998:2	1.68	5.40	1.29	5.47	4.17	7.81	3.39

Y - Annualised % Mean Growth in Real GDP
PY - Annualised % Mean Growth in Nominal GDP
C - Annualised % Mean Growth in Real Consumption
PC - Annualised % Mean Growth in Nominal Consumption

INF - Annualised % Mean Inflation
MMR - Annualised Mean Nominal Interest Rates
MA - Annualised % Mean Growth in Monetary Aggregate

* - Data for MA For France starts from 1977:4

** - Data for MA For Italy starts from 1975:1

Table 1.b: Sample Average of Key Variables

JAPAN

Year	Y	PY	C	PC	INF	MMR***	MA
1970:1 - 1998:4	3.36	6.91	3.41	7.74	4.30	5.06	9.14
1970:1 - 1978:4	4.59	12.79	5.11	14.16	8.97	7.90	15.31
1979:1 - 1982:4	3.06	6.41	3.10	7.96	4.84	7.79	8.80
1983:1 - 1989:4	4.20	5.81	3.06	4.79	1.72	5.11	9.33
1990:1 - 1992:4	2.41	4.36	2.32	4.69	2.36	6.43	2.48
1993:1 - 1998:4	1.19	0.97	2.01	2.94	0.93	1.00	3.22

UK

Year	Y	PY	C	PC	INF	MMR	MA
1963:1 - 2000:3	2.49	9.44	2.46	9.29	6.81	8.52	11.25
1970:1 - 1978:4	2.41	14.85	2.19	14.11	11.90	8.47	14.66
1979:1 - 1982:4	0.77	12.60	1.00	12.57	11.57	13.12	15.75
1983:1 - 1989:4	3.43	8.74	4.28	9.33	5.00	10.46	14.69
1990:1 - 1992:4	-0.09	5.01	0.42	6.83	6.42	11.29	5.68
1993:1 - 2000:3	3.03	5.50	3.08	5.57	2.47	5.83	6.77

US

Year	Y	PY	C	PC	INF	MMR	MA
1959:1 - 2001:4	2.20	6.04	2.20	6.30	4.07	6.49	5.05
1970:1 - 1978:4	2.49	8.93	2.41	8.81	6.37	6.65	6.22
1979:1 - 1982:4	-0.57	6.89	0.68	8.60	7.92	13.30	7.52
1983:1 - 1989:4	3.40	6.68	2.68	6.65	3.95	8.24	7.31
1990:1 - 1992:4	0.04	3.09	0.59	4.31	3.71	5.77	8.83
1993:1 - 2001:4	2.19	4.13	2.08	4.43	2.30	5.04	1.42

Y - Annualised % Mean Growth in Real GDP
PY - Annualised % Mean Growth in Nominal GDP
C - Annualised % Mean Growth in Real Consumption
PC - Annualised % Mean Growth in Nominal Consumption
INF - Annualised % Mean Inflation
MMR - Annualised Mean Nominal Interest Rates
MA - Annualised % Mean Growth in Monetary Aggregate

*** - Data for MMR For Japan starts from 1973:1

Table 1.c: Sample Average of Key Variables continued

		Lagged Dummy: D(-1)					Contemporaneous Dummy: D					Lead Dummy: D(1)				
Country	Variable	Coefficient	Std. Error	t-Statistic	Prob.	J-Stat P-value	Coefficient	Std. Error	t-Statistic	Prob.	J-Stat P-value	Coefficient	Std. Error	t-Statistic	Prob.	J-Stat P-value
Canada	C	0.032	0.017	1.857	0.065	0.117	0.029	0.009	3.197	0.002	0.145	0.028	0.008	3.496	0.001	0.145
	Dummy	0.002	0.014	0.138	0.891		-0.057*	0.029	-1.971	0.051		-0.169**	0.075	-2.265	0.025	
	AR(1)	0.884	0.039	22.579	0.000		0.818	0.032	25.395	0.000		0.797	0.035	22.479	0.000	
France	C	0.010	0.004	2.394	0.018	0.135	0.006	0.004	1.433	0.155	0.126	0.001	0.001	1.069	0.289	0.242
	Dummy	-0.479***	0.168	-2.856	0.005		-0.300**	0.121	-2.491	0.014		-0.007	0.028	-0.255	0.800	
	AR(1)	-0.173	0.047	-3.682	0.000		-0.301	0.074	-4.057	0.000		-0.192	0.020	-9.431	0.000	
Italy	C	-0.056	0.014	-3.928	0.000	0.075	-0.041	0.019	-2.155	0.033	0.116	-0.031	0.013	-2.308	0.023	0.128
	Dummy	0.048	0.060	0.796	0.428		-0.016**	0.007	-2.385	0.019		-0.047**	0.023	-2.034	0.044	
	AR(1)	0.906	0.029	31.657	0.000		0.939	0.016	58.201	0.000		0.922	0.018	51.191	0.000	
Japan	C	0.019	0.004	4.154	0.000	0.167	0.026	0.004	5.825	0.000	0.141	0.026	0.004	5.902	0.000	0.138
	Dummy	-0.060*	0.036	-1.664	0.099		0.178	0.110	1.614	0.110		0.366**	0.156	2.342	0.021	
	AR(1)	0.138	0.105	1.319	0.190		-0.264	0.079	-3.357	0.001		-0.481	0.062	-7.715	0.000	
UK	C	0.020	0.006	3.538	0.001	0.124	0.029	0.004	7.779	0.000	0.094	0.028	0.003	10.808	0.000	0.131
	Dummy	-0.039**	0.017	-2.266	0.025		0.055	0.044	1.246	0.215		-0.139***	0.027	-5.124	0.000	
	AR(1)	0.212	0.049	4.368	0.000		0.016	0.066	0.237	0.813		0.032	0.055	0.592	0.555	
US	C	0.028	0.006	4.986	0.000	0.076	0.022	0.006	3.560	0.001	0.130	0.025	0.006	4.253	0.000	0.124
	Dummy	-0.152***	0.058	-2.610	0.010		-0.069***	0.023	-3.027	0.003		-0.101*	0.056	-1.819	0.071	
	AR(1)	0.376	0.067	5.608	0.000		0.648	0.045	14.346	0.000		0.622	0.047	13.135	0.000	

Notes:
i. The J-stat refers to Hansen's J-statistic used to test the validity of the overidentifying restrictions used in the GMM estimation.
ii. * - Significant at 10%; ** - Significant at 5%; *** - Significant at 1%

Table 2: Summary of Results From GMM Estimatation With AR(1) Error Terms

Canada		All Identified Periods	1979:3	1990:3			
	F-stat	38.061	63.545	35.534			
	(p-value)	(0.000)	(0.000)	(0.000)			
France		All Identified Periods	1979:3	1981:2	1992:4		
	F-stat	6.863	6.100	7.123	6.284		
	(p-value)	(0.000)	(0.000)	(0.000)	(0.000)		
Italy		All Identified Periods	1979:3	1992:3	1995:3		
	F-stat	27.736	27.968	30.679	6.476		
	(p-value)	(0.000)	(0.000)	(0.000)	(0.000)		
Japan		All Identified Periods	1979:3	1994:3	1998:2		
	F-stat	11.563	12.262	12.370	3.157		
	(p-value)	(0.000)	(0.000)	(0.000)	(0.017)		
UK		All Identified Periods	1976:2	1979:4	1988:2	1990:3	1992:3
	F-stat	15.238	14.027	28.725	20.539	24.434	25.991
	(p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
US		All Identified Periods	1967:3	1973:4	1978:3	1979:4	1988:4
	F-stat	9.245	0.412	2.228	26.628	31.248	10.763
	(p-value)	(0.000)	(0.800)	(0.069)	(0.000)	(0.000)	(0.000)

Table 3: Tests of Structural Breaks with Known Breakpoints in Taylor Reaction Functions

Country:	Canada	France	Italy	Japan	UK	US
Panel A: Summary						
Max # of breaks estimated	5	5	5	5	5	5
# breaks found by:[1]						
Sequential Procedure	4	3	4	3	5	5
BIC	4	3	4	3	5	3
LWZ	4	3	1	2	2	3
# matches with identified monetary policy periods[2]	2	2	2	2	3	2
Panel B: Break Details						
Break[3] (in order detected)	Canada	France	Italy	Japan	UK	US
1	1979Q2	1981Q1	1980Q4	1979Q2	1979Q3	1979Q3
	[1974Q3 1979Q3]	[1980Q1 1981Q2]	[1980Q1 1980Q4]	[1979Q1 1980Q2]	[1979Q1 1981Q4]	[1979Q2 1979Q4]
2	1970Q4	1989Q1	1993Q1	1989Q3	1972Q3	1970Q4
	[1968Q4 1971Q1]	[1988Q4 1989Q2]	[1992Q3 1993Q4]	[1988Q2 1989Q4]	[1972Q2 1972Q4]	[1970Q1 1972Q1]
3	1991Q3	1993Q1	1986Q1	1993Q3	1992Q3	1983Q1
	[1991Q1 1992Q4]	[1992Q4 1993Q3]	[1985Q1 1986Q2]	[1993Q2 1995Q2]	[1992Q2 1992Q4]	[1982Q4 1983Q3]
4	1970Q4		1975Q4		1988Q1	1991Q1
	[1969Q4 1971Q1]		[1973Q2 1976Q1]		[1987Q2 1988Q2]	[1990Q4 1991Q2]
5					1997Q2	1986Q3
					[1995Q4 1997Q4]	[1986Q1 1987Q1]
F-statistic[4]	46.16	30.94	83.50	57.58	32.16	42.13
p-value	0.00	0.00	0.00	0.00	0.00	0.00
SupF[5]	83.33	165.01	788.14	466.78	109.38	87.33
SSR	305.92	256.54	144.15	191.59	185.93	194.76

Notes:

[1] The BIC and LWZ refers to the Bayesian information criterion and the modified Schwarz criterion (modified by Liu et al, 1997). The sequential procedure was run at a 5% level of significance when testing for breaks.

[2] See Appendix A.5 for a summary of the Identified Monetary Policy Periods.

[3] The numbers in parentheses represent the 95% confidence intervals around the break dates.

[4] The F-statistic reported are from the estimation results at the given number of breaks above for each country.

[5] The SupF test reports the results from a test of no structural break (m=0) against m=b breaks.

Table 4: Tests of Structural Breaks with Unknown Breakpoints in Taylor Reaction Functions

		Canada	France	Italy	Japan	UK	US
Timeline							
Year	Quarter						
1967	3						0.025
1973	4						0.092
1976	2					0.306	
1978	3						0.122
1979	3	0.570	0.187	0.072	0.034		
	4					0.830	0.129
1981	2		0.127				
1988	2					0.217	
	4						0.012
1990	3	0.151				0.968	
1992	3			0.022		0.037	
	4		0.030				
1994	3				0.032		
1995	3			0.068			
1998	2				0.133		
Average		0.360	0.115	0.054	0.067	0.472	0.076
k		2	1	1	1	3	1
AIC		0.169	0.364	0.359	0.322	0.355	0.330
LBQ - Stat		0.050	1.177	1.025	0.404	0.902	1.849
p-value		0.975	0.278	0.311	0.525	0.825	0.174

Table 5: Predicted Probabilities from Logit Estimation