THE NARRATIVE APPROACH FOR THE IDENTIFICATION OF MONETARY POLICY SHOCKS IN A SMALL OPEN ECONOMY

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ABSTRACT

This paper reviews 22 years of UK monetary policy (1971-1992) using official record from the Quarterly Bulletin of the Bank of England. A definition of policy shocks, which allows for the exclusion of cases of interest rate increases, which were unrelated to the monetary policy objectives, is used. The empirical analysis shows that output displays the usual hump-shaped response after a shock to the policy indicator but adjustment to pre-shock levels is slow. Other variables also display theory-consistent behaviour. Based on this policy indicator monetary policy is found to cause very limited output fluctuation in a four year horizon. The policy indicator is found to outperform the intervention rate as a measure of policy.

Keywords: monetary policy shocks, narrative approach, UK
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1. Introduction

In the past, studies of the effects of monetary policy led to the conclusion that monetary policy is an exogenous source of output swings and that, therefore, its primary task should be to minimize the uncertainty associated with exogenous money shifts and to provide an environment of monetary stability.[1] The mandates of modern central banks certainly reflect this principle, but even if it is not explicitly stated in their mandates, most central bankers do take account of output developments when making their monetary policy decisions. The problem faced by central bankers can be seen under this light as one of keeping balance between the objectives of maintaining price stability and supporting economic activity.

The core issue of this paper is to study the effects on economic activity of monetary policy actions that aim at reducing inflation, but also to give some insight into the transmission mechanism and the connection between monetary policy and the money market, by examining effects on further variables, like short- and long-term interest rates, monetary aggregates etc.

The effects of monetary policy are usually examined in the framework of structural VAR models. This methodology is appealing due to the fact that the results in the form of impulse responses of variables to a policy shock provide many insights in an easily readable form. However, it comes at the cost of the imposition of a set of often disputable restrictions for the identification of policy shocks. The narrative approach aims to circumvent "statistical" identification problems faced by the structural VAR literature, while keeping the expositional framework. Identification of policy episodes relies exclusively on the study of monetary policy record. A policy dummy is constructed and an unrestricted VAR framework is used to estimate the effects of a policy shock on other variables.

This paper aims to develop the narrative approach[2] framework in three ways. The first is its extension to an open economy with the choice of the UK. All studies using the narrative approach refer so far to the United States. Thus an evaluation of the approach by a comparison of cross-country results has not, so far, been possible. This comparison becomes even more compelling since the United States is a large

[1] *"Monetary policy can prevent money itself from being a major source of economic disturbance",* Friedman (1968).

[2] The term dates back to Romer and Romer (1989) although the methodology was used in Friedman and Schwartz (1963).

closed economy whose monetary policy decisions are not guided by external goals. For the monetary authorities in small open economies, it is a luxury to ignore developments abroad when taking policy decisions, especially against the background of ever increasing international capital flows. The definition of policy shocks is therefore adjusted to take account of possible exchange rate related inflationary pressures.

The second contribution relates to the attempt to improve the narrative approach methodology by choosing a transparent definition of policy episodes, consisting of four clear and easily verifiable preconditions. This aims at deflecting somewhat the usual criticism of the approach, namely that it is too judgmental. Finally, the use of a step-dummy instead of an impulse dummy for monetary policy episodes is a technical improvement to the framework, which allows for the duration of an episode to be taken into account – central banks rarely enact a policy change in one go.

The narrative methodology is applied to the UK from 1971, when "Competition and Credit Control" was introduced until 1992, when the UK abandoned the Exchange Rate Mechanism. In Part 2 the literature on the narrative approach is reviewed. After a brief overview of the UK monetary policy framework and few methodological notes, policy episodes that occurred during the period are discussed in Part 3. In Part 4 empirical results for the effects of monetary policy are considered. Shocks to the policy dummy appear to give theory-consistent results (persistent fall in prices and money, hump-shaped response of output with a slow recovery pace). Monetary policy appears to cause only a limited part of the fluctuations in output in a four-year horizon. The results are remarkably robust to a number of specifications. Finally, Part 5 concludes.

2. Review of the literature

The issue of estimating the effects of negative, i.e. restrictive, policy has received a lot of attention in the literature. Romer and Romer (1989) claimed that it is possible to estimate the effects of such shocks on output, because the intention of the authorities when they shift to a more restrictive policy is to reduce inflation. On the contrary, when monetary authorities shift to a less restrictive policy this is done to support economic activity. But because the economy possesses self-recovery

mechanisms it is difficult to discern the part of the increase in economic activity due exclusively to monetary policy. Therefore they identify only negative policy shocks. This is the common case in the literature for the additional reason that the available econometric tools cannot estimate at the same time positive and negative shocks.

Two different methodologies have been used to study the effects of restrictive monetary policy: the empirical and the narrative. The empirical literature[3] starts from the principle that systematic monetary policy is endogenous and therefore the only way to identify the effects of monetary policy is to isolate exogenous monetary policy shocks and estimate their impact on a number of endogenous variables. This is usually done in the context of structural VAR models. To do this a monetary policy indicator needs to be selected (so that shocks to this "indicator" represent monetary policy shocks) and a monetary policy reaction function needs to be specified. Both are sources of potential caveats.

There is no such thing as *the* indicator of monetary policy, especially over long periods of time, when central banks change their targets, instruments and operational techniques. Even if there was one, it is possible that it will not capture exclusively policy intentions. A rise in a monetary aggregate may indicate a shift in money demand rather than in money supply and an increase in some short-term interest rate might be explained by market expectations rather than by policy shifts. Moreover, because of policy lags it might take some time until the monetary policy indicator fully reflects the policy intentions. The specification of a policy reaction function also poses some problems. The monetary authorities look at a range of indicators, whose relative weight might change from one meeting of the decision-making bodies to the next. Moreover, the mismatch between current data used at the time of a decision and revised data available to the analyst, when estimating a policy rule, might be a source of considerable bias.

An alternative way to explore the effects of monetary policy is to use official record (monetary policy minutes, press releases, reports) to identify distinct shifts in monetary policy and understand the intentions of the monetary authorities. Using this methodology a monetary policy indicator can be constructed. Shocks to this indicator represent shifts in monetary policy with the intention of changing the direction of the economy. The narrative approach is not free from caveats. As a matter of fact its most

[3] A good review of this literature can be found in Christiano et al. (1999).

obvious relative advantage, i.e. the room for judgment it leaves to the researcher and the possibility to cross-check a variety of pieces of evidence, has been stressed as a potential disadvantage. This can be eliminated if a clear definition of policy shocks is used to limit the scope for arbitrary classifications.

Moreover, the mapping of a complex concept like a "monetary policy shock" into a dummy variable means a substantial loss of information in the estimation of possible effects of monetary policy. Shocks differ in intensity and duration and this affects the results they produce. Therefore, the narrative approach should not be considered the ideal methodology for the precise measurement of monetary policy effects but it certainly provides a benchmark against which more sophisticated statistical methods should be evaluated.

To tackle the question of arbitrariness, different definitions of monetary policy shocks have been used in the previous literature. Friedman and Schwartz (1963) define a monetary policy shock (or a *"crucial experiment"*) as any *"policy steps of major magnitude which cannot be regarded as necessary or inevitable economic consequences of contemporary changes in money income and prices"*. It follows that for them monetary shocks characterize situations in which a monetary policy action was unexpected (too much exaggerated or not enough pronounced) given available signals about general economic conditions.

Romer and Romer (1989) identify as a monetary policy shock any contractionary policy change which the Fed undertakes with the intention of reducing inflation, even though acknowledging the fact that it will lead to a "growth recession". This is precisely the type of situation which is interesting from a monetary policy perspective, i.e. when the monetary authorities decide to intervene to change the course of the economy. Can they do it and at what cost?

Potts and Luckett (1978) created a binary measure of monetary policy (0 – tight, 1 – easy) depending on whether the intention of the Fed was to slow down or boost economic activity. Finally,[4] Boschen and Mills (1991, 1995) generated a discrete measure of monetary policy stance taking five different values {-2, -1, 0, 1, 2}, where -2 indicates a very tight policy stance, while 2 indicates a very loose policy stance. Like the Romer dates, their indicator is based on Federal Open Market

[4] Other monetary policy indicators for the US have been constructed by Poole (1971), Uselton (1974) Kimelman (1981). In a more recent paper Romer and Romer (2004) use information about the targeted Federal Funds Rate to overcome the difficulty arising from discrepancies between monetary policy intentions and actions.

Committee (FOMC) minutes, but it is a more informative measure of monetary policy, since it differentiates the stance according not only to direction but also size.

Christiano, Eichenbaum and Evans (1999) compare the Boschen and Mills index and the Romer dates as indicators of monetary policy to the federal funds rate that has also been proposed in the literature (see Bernanke and Blinder, 1992). They find that the qualitative results of a shock to the latter two indicators are quite similar, although the estimation of responses to Romer dates is not as accurate (possibly due to the existence of only very few such dates) and they seem to exacerbate the response of output to a monetary policy shock. The Boschen and Mills index-shocks on the other hand cause delayed responses compared to the other two measures and give rise to a price puzzle, which casts some doubt on the identification scheme generating them. Indeed Boschen and Mills do not distinguish between endogenous responses to the economic situation and exogenous disturbances.

The literature on the narrative approach has so far been restricted to an analysis of the US monetary policy. A particularity of the US is that it is a large economy, whose currency is used as an international reserve currency and as a global means of financial transactions. The policy of the Fed is not driven by exchange rate considerations and the Fed does not have to follow policy moves by other central banks. This is, however, not the case for a small open economy.

In a small open economy the exchange rate, representing the external value of a currency, is another means available to monetary authorities for the implementation of their policy. At the same time it operates as a constraint on policy: in small open economies, especially when no exchange controls apply, interest rate differentials cannot be sustained for a long time without exchange rate fluctuations, which themselves can affect the course of the economy.

As a constraint on policy the exchange rate determines how much capital inflow will be available to finance a current account deficit at a given international interest rate structure. The exchange rate as a transmission mechanism of policy works through the current account. A depreciation leads (at least in the short-term) to an improvement in the current account and supports aggregate demand, just as a fall in interest rates or an increase in the money supply leads to an increase in aggregate demand through domestic channels. Therefore the external as well as the internal value of the currency becomes relevant. The importance of the exchange rate as an indicator of monetary policy stance is reflected in the construction of monetary

conditions indexes.[5] When a currency depreciates the MCI points to a looser policy stance because the depreciation can lead to expansion of output through its effect on the current account. This in turn can lead to increased inflationary pressures. But it also creates inflationary pressures directly through higher import prices. Similarly the appreciation of a currency depresses exports and aggregate demand (and therefore indirectly it dampens inflationary pressures) but it also helps in keeping inflation low as it makes imports cheaper. Thus, it makes sense to consider the exchange rate in the identification of policy shocks.

3. Identification of monetary policy shocks

3.1. The Bank of England and the conduct of monetary policy

As already noted, the period with which this paper is concerned is marked by four distinct changes in the monetary policy framework in the UK, which reflected both the changing global economic environment and a change in views about the goals and conduct of monetary policy. Up until 1971, UK monetary policy relied predominantly on direct lending controls. In 1971, direct lending controls were abolished and a more market-oriented policy framework based on lending ceilings for the banking system as a whole was introduced. This change was partly reversed at end-1973 when the Corset (an indirect type of lending ceilings) was put in place. In 1976, monetary targets were introduced, which were replaced by an increasing focus on exchange rates in 1987 and an explicit intermediate exchange rate target in 1990. Finally, in 1992, after the exchange rate turbulence, the ERM was abandoned and inflation targeting adopted. As a matter of convenience the period under review is divided in what follows in three sub-periods: 1971-1975, 1976-1986 and 1987-1992, the four milestones being the abolition of direct lending controls, the introduction of a monetary target, the (unofficial – in the beginning) introduction of an exchange rate target and the launch of inflation targeting.[6]

3.1.1 First period: 1971-1975

[5] The monetary conditions index (MCI) is constructed as a weighted average of the change in interest rates and the change in the exchange rate, where the weights reflect the relative effects of interest rates and exchange rates on aggregate demand. By some central banks (e.g. the Canadian) it is used as an operational target.

[6] The "Corset" (1973-1980) does not qualify as a sub-period of its own, as it was more a measure taken to correct the weaknesses of the monetary policy strategy, than a change of the strategy *per se*.

In the period up to 1971 the role and conduct of monetary policy reflected the broad ideas laid down in the Radcliffe Report (1959). Monetary policy was considered primarily as a means of demand management. Its effectiveness was thought to depend on the extent to which it could cause changes in the relative structure of interest rates due to portfolio shifts. In the end monetary policy was thought of as affecting market liquidity and, consequently, economic activity.

From 1965 until 1971, the operation of monetary policy was based on direct lending controls, which were implemented by means of precise lending ceilings for individual financial institutions. The operational framework of monetary policy in this period was complemented by the cash and liquidity ratios, which applied to London and Scottish clearing banks. The authorities could make liquidity ratios vary by calling upon the clearing banks for Special Deposits. This allowed them better control over both the availability of bank funds for loans and the short-term interest rates. London and Scottish clearing banks also agreed to pay a fixed rate on deposits and adhered to a minimum rate charged on advances.

Lending controls, in combination with the other institutional provisions, induced credit rationing on behalf of the banks and hence prevented lending rates from assuming a market-clearing role. Moreover, due to controls on bank lending borrowers were redirected to other, not necessarily more efficient, finance sources which were not subject to control, so that a process of disintermediation took place. Therefore, they were thought of as not only impeding competition between banks, but also creating distortions in the financial system in general.

In 1971 a document published by the Bank of England ("Competition and Credit Control") marked a significant change of attitude as to the way monetary policy should be implemented. Three major reforms were staged on this occasion:

– Direct lending controls were abolished in an attempt to lift barriers in the banking system competition. However, between 1973 and 1980 an alternative system of controls called "the Corset" was occasionally put in place to slow down the expansion of bank lending when there was deemed to be excess liquidity in the economy.[7] The "Corset" provided for a maximum allowed growth of banks' interest-bearing liabilities. In case the limit was exceeded, banks were required to place an ever higher ratio of their excess liabilities in non-interest bearing deposits with the

[7] The Corset ("supplementary special deposits scheme") was put in place three times: December 1973 – February 1975, November 1976 – August 1977 and June 1978 – June 1980.

Bank of England. The "Corset" allowed for transfers of deposits between banks, so that the maximum limit of deposits growth applied for the banking system as a whole and not for individual banks.

– The Bank of England sought to influence broad money and hence its counterpart, total bank lending, by varying the base rate. This represents a change in the practices of the Bank of England, since, instead of manipulating banks' assets, it shifted to controlling banks' liabilities. Given an exogenous money supply controlled by the central bank, changes in interest rates would change money demand and consequently the amount of money held by the public. In order for such a *liquidity effect* to exist there must be some substitutes for money.[8]

– A minimum reserves ratio was introduced. Banks were required to hold 12.5 per cent of their sterling liabilities with the Bank of England in a special form of liquid assets. The Bank of England could convert these assets to cash by lending to the banks or through open market operations. In addition the Bank of England could ask banks at any time to place "Special Deposits" with it. Special Deposits in effect allowed the Bank to vary the minimum reserves ratio and affect the liquidity condition of banks.

To sum up, the changes in the operation of monetary policy in 1971 were in the direction of enhancing banking system competition and affecting banks' resources (deposits) rather than their uses (lending).

3.1.2 Second period: 1976-1986

From July 1976 the Bank of England started publishing targets for the growth rate of broad money (£M3).[9] The targets referred to the next financial year. For 1976 a specific target, for following years target ranges were published. Towards the end of the period also medium-term targets were set, covering a time span of three years in total. Later on, from March 1982, targets for narrow money (M1) and very broad

[8] If money has no substitutes then its interest rate elasticity will be zero and the rate of interest will not appear in the money demand function (this is the extreme monetarist case).

[9] The monetary aggregates published by the Bank of England include the following:

- M0 (monetary base): notes and coin
- M1 (narrow money): M0 + sight deposits at banks
- £M3, M3 after 1987 (broad money): M1 + time deposits at banks
- PSL2, M5 after 1987 (very broad money): £M3 + deposits with building societies – long-term deposits with building societies + other short-term £-denominated assets held by the public – other adjustments.

money (PSL2) were also published. Finally, from March 1984 targets for the monetary base (M0) were introduced.

In publishing an official target for the rate of growth of broad money the aim was to tie down the expectations of market participants as to the evolution of the instrument of monetary policy, i.e. the Bank rate. Furthermore, in the context of high inflation the monetary targets as an intermediate target of policy lent credibility to the anti-inflationary commitment of the Bank. The monetary targets were met only 5 times in this 11 year period. Especially after 1983 and until 1987 monetary growth was much more rapid than the targets set by the Bank of England. This excess growth seemed to be driven mainly by a rapid growth in (non-interest-bearing) sight deposits held with banks. In fact towards the end of the period target ranges for sterling M3 were suspended twice, in October 1985 and October 1986.

The publication of monetary growth targets represented a major shift of focus of monetary policy. The attempt to control the growth rate of monetary aggregates as a means of controlling inflation was based on the idea that inflation is a monetary phenomenon. Consequently, this change in the monetary policy framework of the UK, which began in the previous period and was completed in this period, represented a shift away from viewing monetary policy as a form of demand management to a more monetarist view of the economy.

3.1.3 Third period: 1987-1992

The policy framework with intermediate monetary targets has not proved to be successful in an environment of changing financial structures and behaviour, which undermined the stability of the money demand. Despite the fact that the primary objective of monetary policy, i.e. combating inflation, was met, with inflation falling from above 20% in mid-70s to below 10% by 1982, the Bank of England failed to meet the intermediate targets. This combined with the frequent revision of the target and even the redefinition of the aggregate targeted, in turn created confusion and uncertainty.[10]

[10] As Governor … emphasized in the 1992 Loughborough University Banking Lecture:

> "…One might think that this would not have mattered if the final objective was being achieved. In one sense this is right. The problem was that our repeated failure to achieve the intermediate targets undermined public confidence in the policy framework as a whole, including our continuing commitment to low inflation, and that clearly was important given that the final objective was to reduce uncertainty about the future."

In the 1987 Budget no broad monetary target was set for the following financial year. Instead domestic monetary policy increasingly focused on the exchange rate of the pound, especially after the Louvre Accord of the G-6 in February 1987, according to stability between key exchange rates was to be preserved. Between March 1987 and March 1988 an unofficial cap of DM 3.00/sterling was put in place.[11] Finally an exchange rate target was adopted *de jure* as a nominal anchor when it joined the ERM in October 1990. This happened at a time when European countries imported credibility for their counter-inflationary policies by tying their currencies to the D-Mark, given the German tradition of low inflation.

However, soon domestic economic conditions in the UK started to diverge from those in Germany and the pound could only be held in the corridor defined by the ERM through strong intervention in the exchange market. Finally, in September 1992 the UK, unable to sustain increasing downward pressure on the pound, abandoned the ERM and adopted a policy framework of immediate inflation targeting based on an inflation forecast prepared by the Bank of England.

3.2. Definition of policy episodes

To proceed with the identification of policy episodes, it is essential to put down a definition, which, on the one hand, excludes cases of market-led changes to interest rates or liquidity and, on the other hand, does not fail to include all those policy actions which constituted policy shocks. The narrative approach involves a great deal of personal judgment by the researcher. Therefore a sound definition of policy episodes not only helps in the process of their identification but it can also help discharge criticism of bias.

The first clarification which needs to be made is what we mean by monetary policy. In this paper "monetary policy" refers to all actions of the monetary authorities that have the intention of reducing inflation, when they consider that it is too high. Mistakes of the monetary authorities, i.e. unintended policy shifts, situations in which the monetary authorities respond to other shocks (unrelated with their implicit or explicit targets) or situations in which the central bank pursues an accommodative policy, are not considered.

[11] See Pemperton (1991).

The Friedman and Schwartz (1963) definition confines policy shocks to situations in which monetary policy does not respond to the domestic economic or financial situation but to other events, unrelated to the immediate or intermediate policy objectives. These kinds of "shocks" apart from being rare and temporary are also of limited economic interest, because they are reversed as soon as the special circumstances under which they arose are left behind. Moreover, their effects cannot be identified in a meaningful way, because monetary policy will wish to counteract the possible effects of the shock by correcting it, or adjusting to a policy stance compatible with the economic situation, after the shock.

On the contrary what makes more sense from an economic point of view is to consider situations where the monetary authorities use the instruments available to them to pursue the goal of monetary stability, internal (i.e. low inflation) and external (i.e. exchange rate stability). From identifying the effects of this kind of policy shocks there are some answers to be got to interesting questions. Most importantly to the questions of a) whether monetary policy affects output (as a by-product of reducing inflation) and if so, whether the effects are long-lasting or temporary; b) whether the hyperactivity of monetary authorities themselves causes swings in economic activity; and c) whether, to what extent and with what lags, monetary policy affects prices.

In this paper only negative policy shocks are considered, i.e. shocks that lead to a more restrictive policy stance. There are four basic common characteristics about policy shocks that we identify: a) there is a large increase in central bank rates; b) the adjustment to a higher level of interest rates is gradual and long-lasting; c) additional restrictive policy measures are taken; and d) there are statements by bank officials that the aim of the policy shift is to reduce inflationary pressures resulting from the domestic monetary situation or from exchange rate instability. An increase in the official rates alone cannot be an indicator of policy shocks, since increasingly throughout the period official rates respond to market conditions. The last three characteristics are used to ensure that policy changes are not temporary, but stem from the determination of the authorities to enact a shift in the course of the economy to fulfil their objectives.

Evidence on monetary policy episodes is found in the Quarterly Bulletin of the Bank of England, which, besides the regular economic and monetary analysis and the analysis of financial markets, includes articles on topical issues and speeches by Bank officials. The most interesting speech from a monetary policy perspective is the

Mansion House speech, delivered by the Governor at the annual dinner (usually every October) of the Lord Mayor of the City of London to the members of the financial community. It is customary on this occasion for the Governor to outline the reasons for the policy stance followed by the Bank in the previous year and the prospects for the following.

Study of statements by Bank officials or excerpts from the Quarterly Bulletin explaining the reasons that led to action suggests that during the 22 years under review the Bank of England usually resorted to interest rate increases (frequently accompanied by additional measures in the money market) for three types of reasons: First, because the domestic monetary conditions were considered as fostering inflationary pressures. Second, because exchange rate weakness was interpreted as resulting from a loose monetary policy stance and could cause inflationary pressures. Third, because of sterling weakness caused by external factors, e.g. the strength of the dollar, developments in oil prices or global financial markets turbulences, which led to a trend for increasing interest rates. Policy shifts due to this third reason are close to the Friedman and Schwartz definition. They are of a temporary nature and are quickly reversed. Therefore they are not classified as monetary policy episodes.

3.3. Identification of policy shocks: 1971-1992

In the period under review there are four cases of policy tightening, which can be identified as policy episodes based on the definition given above.

- June 1972-December 1973: an increase of 8 percentage points
- April to October 1976: an increase of 6 percentage points.
- November 1977 to November 1979: an increase of 12 percentage points.
- June 1988 to September 1990: an increase of 7 percentage points.

In all of these cases interest rates increased sharply and over a fairly long period of time (sometimes short spells of falling rates are included, but the trend of the interest rates is rising). The characteristics of each policy episode and the reasons which led the monetary authorities to take corrective action are discussed below. It should be noted that the duration of the interest rate increases need not necessarily coincide with the duration of the policy episode, because of the potential for the monetary authorities to take additional measures or because interest rate increases in

the beginning or the end of the period can be due to other factors unrelated with the objectives of monetary policy.

June 1972-December 1973: At the beginning of the 1970s and about a year after the abolition of lending controls it had become clear to the authorities that there was excess liquidity in the market and that there was a need for higher interest rates. But due to the weak state of the economy, an increase in interest rates did not come until June 1972, when a run on sterling caused by expectations of a deteriorating external position of the UK led the Bank of England to raise the Bank rate by 1 percentage point (22 June). Sterling, which at this point was participating in the European Community intervention mechanism (the "snake"), was left to float freely the next day, while extra exchange controls were put in place. Due to severe pressures on banks' liquidity, the Bank installed a facility for the purchase and resale of short-dated gilts.

In August 1972, when it was clear that the expansionary fiscal policy stance along with the acceleration in bank lending after the abolition of lending controls had caused undesirably loose monetary conditions, the Bank issued qualitative guidance to banks regarding their lending. Between October and December 1972 the Bank intervened on several occasions in the Treasury Bill market to raise the Treasury Bill rate. The restrictive nature of the Bank's policy in this period was underlined by their decision to suspend the Minimum Lending Rate (MLR) formula and raise the MLR by 1.75 percentage points in November 1972. The total increase in the MLR in this seven-month period was 4 percentage points. In addition to the interest rate increases the Bank made two calls for special deposits amounting to 3% of banks' liabilities. These measures were intended to absorb increased liquidity resulting from an expansive fiscal policy stance and to slow down bank lending. Therefore it can be said that this seven-month period in 1972 constitutes a policy episode.

In the first half of 1973 the monetary authorities considered that the measures taken in the last seven months were sufficient or even more restrictive than necessary and slightly relaxed policy with the intention of correcting their previous stance, while remaining restrictive. But in late-May and June 1973, the effective exchange rate of the sterling depreciated again, as a deterioration of the external position of the UK was widely expected. Between July and November 1973 the Bank raised the MLR by

5.5 percentage points on three occasions[12] and made another two calls for special deposits amounting to an additional 3% of banks' eligible liabilities. Moreover the Bank issued qualitative guidance for banks' lending business and imposed a ceiling on the interest rate paid by banks for new small deposits to reduce the funds available to them for lending. In December the Corset was introduced with a grace period up until July 1974. Hire-purchase term controls were also reintroduced and banks were asked to apply similar terms to consumer lending. These measures were severely restrictive and aimed at reducing both sides of banks' balance sheets. The introduction of the Corset in particular and the other additional measures taken in December suggest that the authorities desired to control the pace of credit expansion by banks but they were no longer willing to allow interest rates to rise beyond the level they stood at in December 1973. Therefore this month signifies the end of this round of *active* policy tightening.

April to November 1976: Between March and April 1976 nervousness in the markets ahead of the Budget and the change of prime minister put sterling under pressure despite the narrowing of the current account deficit. It depreciated by almost 7% in two months. Official intervention in foreign exchange markets had eroded the Bank's reserves and negotiations for an IMF loan started. The Bank reacted to the erosion of the value of the currency, which undermined the combat of inflation, raising the minimum lending rate by 6 percentage points between end-April and early-October 1976. The relevant increase in the *ex post* real interest rate was far higher, reaching more than 8 percentage points. In July money targets were introduced for the first time and monetary policy was assigned a more prominent role in the combat of inflation (as part of the plan to meet the terms for the IMF loan). In September and October calls for special deposits amounting to a total of 3% of banks' eligible liabilities were made. Both calls followed the suspension of the MLR formula and sharp increases in the MLR (by 1.5 percentage points in September and by 2 percentage points in October). Finally, the Corset, which had been deactivated in February 1975, was reintroduced in November 1976. It should be noted that, like in the previous policy episode, the monetary authorities first proceeded with interest rate

[12] There was only a temporary easing of 25 basis points in October.

increases and when the interest rate level was deemed too high for it to be increased further they took alternative measures.

Although the need to preserve the exchange rate of sterling appears to have been the major preoccupation of the Bank of England which led to the increase in interest rates in 1976, the increase was appropriate also given domestic monetary conditions. The Bank needed to convince economic agents about its commitment to keep money growth within the published range and inflation low. Therefore, this episode constitutes a policy episode of the sort that we are trying to identify in this paper.

November 1977 to November 1979: In the course of 1977 substantial inflows into sterling had pushed sterling market rates down to the lowest levels since 1971. At the same time the Government's intervention in foreign exchange markets led to excess increases in the money stock. Thus the authorities were faced with two conflicting objectives: keeping the exchange rate of sterling from further appreciating and keeping money growth under control. The decision taken in October 1977 to allow sterling to move more freely meant that the Bank could keep interest rates high even with foreign exchange inflows. Thus, in November 1977 a series of increases in the minimum lending rate started, which, with small interruptions, lasted until the end of 1979. The increase in the MLR in November 1977 reflected the wide-spread view that with the relaxation of external pressures on sterling and money stock rising faster than the target, a higher interest rate level would be appropriate.

In the period from April 1978 until February 1979 the Bank used a series of measures (interest rates increases, qualitative guidance to banks, the Corset) to contain the rate of growth of the money supply which had overshot its target. Fiscal policy had been rather loose with a high public sector borrowing requirement leading to a rapid increase in sterling M3. The total increase in the MLR from November 1977 until February 1979 amounted to 9 percentage points. A temporary relaxation in interest rates was recorded in the pre-election period of March-May 1979 due to an improvement in confidence and significant capital inflows. However, the authorities were reluctant to allow interest rates to fall too much. Moreover, throughout that period the Corset was active. Therefore, this short interval is not treated separately. Until June 1979, when a new round of interest rate increases began, the interest rate was still 5.5 percentage points higher than before the tightening.

In a second stage the Bank tightened further its monetary policy in June 1979. This round of policy tightening lasted until November 1979. The objective this time was explicitly stated to be the combat of inflation. Moreover, in the pursuit of this objective the Bank was not reluctant anymore to sacrifice economic growth, i.e. the goal was to shift aggregate demand back.

In conclusion, the period from November 1977 until November 1979 is a rather long spell of restrictive policy. The reason for this was the determination of the monetary authorities to combat inflation by reducing the rate of monetary expansion and the rate of growth of demand.

June 1988-September 1990: The appreciation of sterling due to the weakening of the dollar and the need to provide liquidity after the stock market upheaval in October 1987, led to inappropriately (as was retrospectively judged by the monetary authorities) low interest rates in the first half of 1988. But by June a new round of policy tightening began in view of the emerging setback in the process of achieving lower inflation. Against a background of strong domestic demand, even in the aftermath of the stock market crash, the economy was deemed to be growing at an unsustainable pace and a backward shift in aggregate demand to restrain inflationary pressures was considered appropriate. Although signs of overheating were evident even earlier (and were in fact underestimated, as statistical evidence published throughout 1989 proved) the policy actions were delayed by the strength of the sterling.

This round of policy tightening is characterised by its long duration, which demonstrates the determination of the authorities to enforce an adjustment to lower inflation rates. Although the last increase in the policy rate was recorded in October 1989 (a total increase of 7.5 percentage points), it took another year until interest rates came back on a downward course. In October 1990 the Bank of England cut its policy rate by 1 percentage point in the event of sterling ERM entry. The rate remained unchanged at this slightly lower level until February 1991 when it resumed a downward path.

3.4 Discussion of non-policy shocks

Among the periods of increasing interest rates mentioned there are a few short spells of tight policy, which bear some of the common characteristics of policy

episodes but have not been classified as such. These are periods during which the increase in interest rates was market-driven or the Bank was forced to act against its own assessment of inflationary pressures. Apart from official statements which suggest that the increase in interest rates was not necessary to reduce inflationary pressures, the Bank did not undertake any further measures of restrictive policy on these occasions and soon after the turbulence which caused them was over, the policy actions were fully reversed. Several such examples from the period under review are discussed.

Apart from the 1975 incident all other non-policy shocks took place in the 1980s. A general observation for this period should be made. In many instances financial market pressures which forced the Bank to accept higher interest rates were out of their immediate control. However, uncertainty in UK financial markets must have been fostered by an ambiguity as to the targets of monetary policy, which undermined confidence in the commitment to contain inflation. Already in the early 1980s it had become clear that the monetary authorities were looking increasingly at the exchange rate and less so at monetary aggregates as an input to policy decisions. This was done more by necessity rather than choice since it was widely recognized that there were extensive distortions in monetary aggregates caused on the one hand by innovations and changes in financial structures, which obscured the boundaries of "money", and, on the other hand, by industrial disputes. However, increased reliance on the exchange rate against a background of erratic movements in international exchange markets became itself a source of confusion. In this environment the abolition of the MLR and the adoption of a more market-based approach for the determination of short-term rates might have deprived the markets of a direct signalling device of the intentions of the monetary authorities. On the contrary there is a strong impression on many occasions that the monetary authorities were following market signals (or were unable to reliably resist market pressures) instead.

May-October 1975: In 1975 the UK economy was in deep recession. At the same time inflation, although on a declining trend due to the Government's pay policy, hovered around 20% hampering its international competitiveness. There was a favourable interest rate differential between the UK and other major economies due to the expansive policies led abroad. But in May, foreign monetary authorities started raising interest rates and the UK authorities in order to preserve the interest rate

differential allowed interest rates to rise by 2.5 percentage points between May and October 1975. No additional policy measures were taken in the same direction. This move took place at a point in time when recession was keeping the growth of both bank lending and money within target. Moreover, the authorities did not wish to depress further the economy. Since the policy actions were not consistent with the domestic monetary situation the Bank intervened to lower interest rates immediately after external pressures subsided. Therefore, this incident is not included as a policy episode for the purposes of this paper.

August-October 1981: From end-August until end-October 1981 the UK authorities allowed interest rates to increase by a total of 3.125 percentage points. The increase in interest rates was mainly market-driven. In the summer of 1981 the Bank was confronted with increasing uneasiness in the markets owing mostly to the tight policy being implemented in the US, which left UK interest rates at a disadvantage. This resulted in fears of a further weakening of sterling, while at the same time the evolution of monetary growth was obscured by Civil Service dispute-related distortions. The Bank, mainly for fear of the implications of a possible weakening of the sterling for inflation, allowed a relatively moderate increase in interest rates, but leant against further pressures as soon as the US rates started easing. It should be noted that in August 1981 the Bank changed its money market operations. It abandoned the announcement of the MLR and replaced discount lending with open market operations. The Bank would conduct these operations with reference to a non-disclosed interest rate band to permit greater flexibility in the determination of short-term interest rates. Therefore slight moves of interest rates in both directions should not necessarily be interpreted as policy-induced.

This period of increasing interest rates is too short to be characterised as a monetary policy episode and the increase too limited, especially given the change in the Bank's money market intervention techniques to introduce greater flexibility in short-term rates. Moreover, the fact that the authorities did not take any further measures to re-inforce the rise in interest rates and that instead they allowed for their quick deceleration once market sentiment was restored allows the conclusion to be drawn that this was a market-driven change and it should not be characterised as a policy episode.

November 1982-January 1983: This period constitutes a short interval of rising interest rates mostly due to uncertainty in exchange markets which led to pressures on sterling. This happened against a background of generally balanced monetary conditions and a favourable domestic environment for policy. Inflation had resumed its falling path and domestic demand appeared strong, while the PSBR turned out unexpectedly low, money grew within target and bank lending had eased off. In January and March the Bank intervened in the money market to ease banks' liquidity pressures and short-term rates fell again in March 1983.

May, July 1984: A small interest rate increase in May 1984 was prompted by rising uncertainty triggered by fiscal and other developments in the US, which undermined confidence. However, after this increase the Bank *"leant against the subsequent spasmodically strong upward market pressures with the aim of moderating the rise in interest rates"*. Towards the end of June after some technical adjustments in its dealing rates which could have triggered pressures for further upward pressure on interest rates the Bank made an official statement that there was *"no need on monetary policy grounds for any general increase in the level of domestic interest rates"* [QB, vol. 24, p. 322].

The official dealing rates increased twice more in July driven mostly by the need to support market confidence, which was weak due to mixed monetary developments. *"The authorities acted to resist the resulting upward pressure on interest rates, as they had in earlier months, but the strength of the pressure was such that there were nevertheless sharp and unwelcome increases in interest rates and bond yields in July"* [QB, vol. 24, p. 318].

January 1985: The weakness of sterling, reflecting the strength of the dollar and concerns about a possible fall in dollar oil prices rather than loose monetary conditions, prompted a market-driven increase in interest rates on 14 January. The interest rates increased further on 28 January reflecting concerns about oil price developments in view of the OPEC meeting. *"The authorities considered that to have sought to resist these pressures would have unsettled the markets further, and risked accelerating monetary growth"* [QB, vol. 25, p. 25]. The total increase in the Bank's dealing rate in January 1985 was almost 4.5 percentage points. However, the short period of this policy change and the fact that the Bank did not take any additional

restrictive measures and that interest rates decreased after market confidence was restored supports the decision not to include it in the list of policy episodes.

January 1986: Again financial market turbulence caused by falling oil prices and a prospect for a weakening of sterling led the Bank to raise interest rates by 1 percentage point in January 1986. However, as pressures for a further tightening of interest rates continued building up, the Bank signalled *"that this was not the official stance"* [QB, vol. 26, p. 28]. The increase in short-term interest rates was reversed soon after.

October 1986: Against the background of market expectations of rising interest rates primarily due to sterling weakness (related to oil price developments) and concerns about money and credit growth, the Bank attempted to reassure markets by an interest rate increase of 1 percentage point in October 1986, but resisted a further increase which was not deemed appropriate for monetary policy reasons. At his annual Mansion House speech the Governor of the Bank of England noted about the financial market turbulences in 1986: *"Recently there has been heavy speculation against sterling at a time of particular uncertainty about the outcome of meetings relating to interest rates abroad and oil prices. As in January we have refused to be rushed into hasty policy decisions by this period of market turbulence, and have acted to moderate the more erratic movements in both the domestic and foreign exchange markets"* [QB, vol. 26, p. 509].

August 1987: The strength of sterling in 1987 had led the Bank to accept lower interest rates than would be justified by domestic monetary considerations. The monetary authorities took advantage by *"the weaker tone of the markets in late July/early August* [which] *presented the opportunity to raise interest rates without prompting renewed upward pressure on sterling"* [QB, vol. 27, p. 503]. This was an one-off increase of 1 percentage point which does not represent a shift in monetary policy but an adjustment to a more appropriate stance. Therefore it is not included as a policy episode.

4. Empirical evidence

In this part the effects of restrictive monetary policy on a series of macroeconomic variables are investigated. First, some informal evidence is presented and then, following the standard procedure in this literature, a VAR analysis is performed. The series included in the VAR are the monthly growth of the index of production, retail price inflation, the monthly rates of change of M0[13] or M3, the bank intervention rate, and the monthly growth of wages.[14] The nominal effective exchange rate and the monthly change in an oil price index are included as exogenous variables in the VAR, to control for the effects of exchange rate movements and the two oil price shocks. The estimation period is 1970:1-1992:12.[15]

4.1 Informal evidence

The graphical representation of a number of key variables in Graphs 1 through 4 sheds some light both on the reasons behind the launch of restrictive policy and on the effects of such policy on output and inflation. Shaded areas correspond to the restrictive policy episodes identified in the previous part.

In Graph 1 the Bank's intervention rate is sketched along with an *ex post* real interest rate, which equals the intervention rate minus the realised annual inflation rate. The four policy episodes correspond to significant increases in both real[16] and nominal intervention rates. It is also possible to see two cases of significant rate increases (in 1981 and 1984-85), which, for reasons given in the previous part, were not identified as policy episodes. This stresses the advantage of the narrative approach compared to one which uses the Bank intervention rate to identify policy shocks: not every increase in interest rates is meant to be a restrictive policy shock. It should also be noted that for most of the 1980s the real interest rate was on an upward course,

[13] Although the choice of M0, i.e. a narrow monetary aggregate, might have some qualifications there are two studies, one by Nelson (2000) and one by Janssen (1998) which rationalize its use in a baseline VAR. Nelson used M0 for the time period 1961-1999 to show that the money stock provides information about economic activity not present in short-term real interest rates. This would be a reason to include M0 in a VAR study of the UK transmission mechanism. Janssen estimates a money demand for M0 for the period 1972-1997 using an error-correction model. Even without including proxies for financial innovation the model passes the specification tests which are standard in this literature and establishes a long-run cointegrating relationship between M0 and key economic variables, among which output. Moreover, since 1984 M0 was an officially targeted aggregate.

[14] See data appendix for a description of the variables.

[15] For the specification using M3 sample period is 1972:07-1992:12.

[16] The one exception is the significant fall in the ex post real interest rate recorded in 1979 (during the third episode) due to the acceleration of inflation during that year because of the sharp increase in oil prices.

because after the disinflation attempt of the end-1970s inflation was falling faster than interest rates.

The annual inflation rate is sketched in Graph 2. The first point to note from this Graph is that all four policy episodes occurred when inflation was on a strong upward course. What is even more interesting is that the policy episodes ended before the peak in inflation was reached and inflation fell sharply only after some time lag. The lags between the end of the policy episode and the fall in inflation decrease as we move towards the end of the period under review.[17] Apart from the obvious policy lags, this observation would be consistent with a gradual gain of credibility which made policy more effective in reducing inflation. Alternatively it could mean that with the passage of time the authorities became more committed to combatting inflation and would not ease policy until its effects on costs and prices became evident. It is also remarkable that every single disinflation occurred after a policy episode in the period under review.

In Graph 3 the sterling effective exchange rate is sketched against the annual growth rate of M0 and M3. From the Graph it is possible to see that in all four episodes the very beginning of the episode is marked by a downturn of the effective exchange rate index. Especially the 1976 episode was preceded by a long period of sterling depreciation. It is also interesting to note the behaviour of money aggregates during the policy episodes in the period 1976-87, when the Bank pursued a monetary target and of the exchange rate in the policy episode of the last period (1987-1992), when the Bank pursued an exchange rate target. From the Graph it can be seen that the 1976 policy episode occurred at a time when both money and the exchange rate were pointing to loose monetary policy. The broad monetary aggregate was growing at around 10% (which was however, in line with the target set in July of 1976) and sterling had depreciated considerably in the previous two years. Once again it is confirmed that exchange rate concerns were the driving force behind this policy episode. The second policy episode of this period seems to be driven more by domestic monetary conditions (as confirmed by the statements of the Bank officials), since money growth in the months previous to the beginning of the episode had accelerated, while the exchange rate was fairly stable or even on an appreciating

[17] 20 months in the first episode (but the oil price shock of 1973 has to be taken account of), 8 months in the second and 6 months in the third, while in the last spell the start in the decline of inflation coincided with the end of the policy episode.

course. The policy episode in the period of exchange rate targeting on the other hand happened at a time when the broad money aggregate was growing at a fast but declining pace and the exchange rate of sterling was appreciating. Therefore it can be said that it was not clearly driven by either the domestic monetary situation or by exchange rate concerns. The increase in inflation as shown in Graph 2 was most probably the direct driving force behind this round of policy tightening.

In Graph 4 the index of production is sketched along with its trend and cyclical components as estimated by a Hodrick-Prescott filter (λ=14400). The first important observation is that every decline in the trend of the index of production is preceded by a policy episode. In the period under review there are three declines in the trend to be seen, one in 1974-1975, one in 1979-1981 and one from 1989 until the end of the sample. In all three cases policy episodes occurred around the peak of a cycle. Only the policy episode in 1976 did not affect the trend of the index of production. This could be related to the fact that the duration of the restrictive policy round was in this case relatively small. In all four policy episodes the cyclical part of the index of production records a significant fall of between 5 and 10 per cent following the policy episode. This observation leads to the conclusion that all policy episodes affect the cyclical component of output, but the most severe ones also lead to a decline in the trend of output.

4.2 VAR analysis

The above analysis is just indicative even if it did point to sensible behaviour. In this section a more thorough analysis of the effects of monetary policy shocks is presented on the basis of the VAR methodology, which is the most common framework for the identification of monetary policy shocks and the study of their effects. In an unrestricted VAR each variable is predetermined, i.e. it is determined by lags of itself and all other variables in the system:

$$Z_t = B_1 Z_{t-1} + B_2 Z_{t-2} + \ldots + B_k Z_{t-k} + u_t \qquad (1)$$

It is assumed that the error terms might be contemporaneously correlated but they are serially uncorrelated. As a result of this assumption combined with the presence of the same regressors on all equations in the system the OLS estimate of the coefficients in (1) is consistent.

The system presented in equation (1) does not impose any constraints on the contemporaneous correlations between the endogenous variables. It is a set of reduced form equations, a representation of the end-result of a number of interactions between variables. Therefore its estimation gives little information about the transmission of policy shocks. For this reason structural VAR models are formulated as follows:

$$A_0 X_t = A_1 X_{t-1} + A_2 X_{t-2} + \cdots + A_k X_{t-k} + \varepsilon_t \qquad (2)$$

where A_0 characterises the contemporaneous correlations among the variables. Once a sufficient number of restrictions has been imposed on these correlations it is possible to identify a structure in the system (i.e. to recover the matrix A_0 from the estimates of Bi's) and then the equations in the system obtain an economic meaning. The issue of identification is intricately linked with what is probably the most important question in the study of monetary policy VAR models, namely the modelling of the monetary policy rule. There are various identification schemes used in the literature.[18]

The usual criticisms of structural VAR models are: first, that the answers they give about the transmission of monetary policy depend crucially on the identification scheme chosen; second, that they usually use as a monetary policy indicator a variable, like an intervention rate or a monetary aggregate, which can move for reasons other than monetary policy shocks; and, third, that they must specify a form for the monetary policy rule over long time periods, while monetary policy rules vary over time and sometimes involve structures much more complicated than the ones captured in the linear equations of VAR models.

The relative merit of the narrative approach is that, having already identified the monetary policy episodes without recourse to a monetary policy reaction function, one can forecast the effects of a policy shock (i.e. a shock to the episode indicator), by simply estimating an unrestricted VAR or by imposing minimal structure.

4.2.1 Results from unrestricted VAR

For the following VAR analysis a policy dummy is constructed, which takes the value 1 during an episode when monetary policy turned more restrictive and zero otherwise. This is in contrast to the Romer dummy which takes the value 1 only on the impact period of a shift in monetary policy. A monetary policy shock is captured

[18] For a review of the relevant literature, see Christiano, Eichenbaum and Evans (1999).

as a shock to the policy dummy.[19] This adjustment makes the policy dummy more informative in terms of the duration of restrictive policy and this is reflected in the fact that the standard deviation of the policy indicator variable is bigger.

The impulse responses of the baseline VAR model estimated here are presented in the first column of Graph 5. The variables included in the VAR model are the policy episodes indicator, the Bank intervention rate, M0 as a money indicator, the index of production, the retail price index and the average earnings index as an indicator of the evolution of costs. The nominal effective exchange rate and the oil price index are also included as exogenous variables. All variables apart from the policy episode indicator, the interest rate and the nominal effective exchange rate are entered in the form of monthly percentage changes. The graph presents accumulated impulse responses for all variables but the policy shock itself and the base rate, so that at any forecasting horizon the vertical axis measures cumulative changes to the *level* of each variable. The responses are to a unit shock in the policy episodes indicator. This baseline VAR regression is totally unrestricted. The only reason why the shock to the policy dummy represents a monetary policy shock is due to the prior identification with the narrative approach.

Although the precise size of the effects should not be taken too literally, as substantial information as to the size of the shocks is lost because of the categorization of policy in a dummy, the timing and direction of the effects should be reliable. Indeed, the behaviour of the main variables after a shock[20] to the policy dummy conform to the stylized facts: money, prices and wages fall persistently after a policy shock.

After 4 years money (M0) has fallen by almost 8 percentage points. Prices and wages fall almost one-to-one by about 4% in the same horizon. The index of production, after some temporary increase a year after the shock, falls by about 4% three years after the initial shock and then starts recovering. However, the adjustment to pre-shock levels is very slow and it is not even nearly complete four years after the shock. The initial increase in the index of production should not be puzzling as the

[19] In the robustness analysis results using a Romer type dummy are also reported.

[20] The impulse responses are based on a Choleski decomposition follow the ordering of the variables given in the main text. The Choleski decomposition implies that each variable is contemporaneously affected only by variables which are above it in the ordering. The placement of the policy shock in the first position means that the policy shock is contemporaneously uncorrelated with all other variables. However, it still depends on past values of the other variables in the model. This is reasonable since the Bank designs its policy as a response to domestic monetary and conjunctural conditions.

economy was always on a strong upward course at the beginning of policy episodes. This should reflect a "braking" effect, which can be removed by adding more lags to the model.

It is also interesting to compare the response of the policy dummy itself and the interest rate, which is the tool for the communication and implementation of changes in policy. The policy dummy returns to its pre-shock level (i.e. to zero) about 20 months after the initial impulse. The interest rate increases for about 10 months after the shock and then starts decreasing, but it does not reach pre-shock levels for another 25 months. This finding confirms, first, that episodes identified here are not circumstancial changes of policy, but persistent attempts to change the course of the economy, and therefore they are reversed only very slowly; and, second, that it is possible for policy to remain restrictive while interest rates are past their peak. This can be attributed to the additional policy measures, which the Bank usually took when it considered that interest rates should not rise further but it did not wish to loosen its policy stance either.

Another interesting result comes from the variance decomposition (Table 2), which shows that only up to 9% of the variance in the index of production in a horizon of 48 months[21] is due to policy shocks. This is much smaller than estimates based on innovations in monetary aggregates or interest rates and provides some evidence against the case that monetary policy causes large exogenous swings in output.

4.2.2 Choleski decomposition

The evidence from the unrestricted VAR suggests theory-consistent effects of shocks to the policy dummy and this is an indication for the success of the identification using the narrative approach. However, there might be some scope for further improving our inference regarding the effects of the policy dummy on the other variables by imposing some structure on the unrestricted model. In particular, although shock to our monetary policy dummy is uncorrelated with lags of endogenous variables contemporaneous correlations among error terms are not restricted (i.e. the covariance matrix of the error terms is not diagonal). This means

[21] Increasing the horizon to 100 periods does not affect the result.

that what is identified as a monetary policy shock could be a response of the policy dummy to a shock in one of the other endogenous variables, e.g. in prices.

The Choleski decomposition appears to be the least restrictive set of constraints on the coefficients of A_0, which solves this problem. It assumes that each variable in the system is contemporaneously affected only by variables which are above it (in practice this is implemented by imposing a lower triangular form for A_0) and it imposes a diagonal covariance matrix for the error terms of the unrestricted model. A reasonable assumption in this case would be that the policy dummy should be first in the ordering, so that they are not affected by contemporaneous shocks to other variables in the model. This could be supported by the existence of information lags in monetary policy. The first variable to be hit then by a shock to the policy dummy would be the intervention rate, which changes contemporaneously as a response to the decision of the monetary authorities to shift to a more restrictive policy stance. This would have an impact on M0 as it would immediately affect operational balances of banks with the Bank which are a part of M0. Reduced liquidity would lead to less aggregate demand and economic activity, which would cause downward pressures on prices and on wages. Therefore a reasonable ordering of the variables in the Choleski decomposition version of the VAR would be: policy dummy, base rate, M0, index of production, prices, wages.

The results for a one standard deviation shock to the policy dummy using the Choleski decomposition and this ordering is given in column 1 of Graph 6. The results are remarkably similar to the ones reported for the unrestricted VAR. Moreover alternative placements of the policy dummy in the Choleski ordering do not change the results as reflected in columns 2 and 3, where the policy dummy has been placed in the middle and in the end, respectively. The robustness of the results to the imposition of a Choleski structure and to different orderings of the policy dummy in it provide some further evidence of successful identification: the effects of a shock on the policy dummy "survive" the imposition of alternative sets of restrictions.

4.2.3 Robustness analysis

A series of further robustness tests are undertaken to check whether these results are compromised by the choice of variables or policy episodes. In the second column of Graph 5 the impulse responses of the same VAR using the constructed M3 aggregate instead of M0 are presented. The use of M3 does not in general change the

qualitative results as to the effects of a policy shock on output, wages and prices. The response of the money aggregate itself is, however, puzzling. M3 rises in the immediate aftermath of a shock for more than a year and then continuously falls. Four years after the shock money is about 5% below its pre-shock level. A possible explanation for such a finding could be that not enough lags have been included to capture the dynamics of money, which was rising rapidly before most of the episodes identified here. In any case this "broad money puzzle" should not be reason for concern since the series has been assembled from pieces of monetary aggregates with different coverage and therefore it is not necessarily a reliable measure of broad money.

In column 3 of Graph 5 results using a Romer type dummy of policy shocks rather than a policy episode dummy[22] are reported. The results confirm that the use of a step-dummy instead of a Romer-type dummy represents a substantial improvement in the empirical framework. The use of the step dummy implies a relatively short-lived effect on interest rates, a permanent but small decrease in M0, a smaller and much more short-lived response of the index of production and virtually no response for prices and wages.

The results of three more specifications are reported in Graph 7. In the first the policy dummy excludes the 1976 episode. There are two reasons why the 1976 episode might be questioned. It was not only the shortest of the four policy episodes identified, but it was also clearly driven by growing exchange rate pressures at a time when there was not equally clear and compelling evidence from the domestic front. The impulse responses plotted in the first column of Graph 7 confirm that the results of the baseline model are not driven by the inclusion of the 1976 episode. Inclusion or exclusion of the episode makes hardly any difference to the shape of the impulse responses.

In the previous versions of the model the nominal effective exchange rate and the monthly percentage change in oil prices are included as exogenous variables (i.e. they are not determined endogenously in the model and only their contemporaneous values appear in each equation). The inclusion of the nominal effective exchange rate seems warranted since it was one of the variables targeted by the Bank for a

[22] This means technically that instead of using a step-dummy, taking the value one throughout an episode the Romers would use a "shock" dummy, taking the value one only on the first period of the launch of a more restrictive policy.

substantial period of time in the sample and it was frequently the reason for policy action even before the introduction of exchange rate targeting. The inclusion of the oil prices intends to control for the effects of oil price shocks on prices. Thus, there are good reasons for both variables to be included in the model, however the Granger causality tests run did not reject the hypothesis of their exogeneity (the related probabilities of the Chi-squared statistic were 0.2418 for the effective exchange rate and 0.1217 for the percentage change of commodity prices) and therefore they were used only as exogenous variables. Even so, in column 2 the impulse responses to a policy shock in a model in which these two variables are allowed to be endogenous are plotted. The effects on the two variables themselves are not clear. In a time horizon of four years both oscillate around zero. Effects on money and output remain virtually changed. However prices appear to rise for almost two years before starting to fall again and so do wages.

Finally in column 3 the impulses of a specification including the Treasury Bill rate instead of the intervention rate and a long-term government bond yield are reported. Again the effects on other variables remain roughly the same. The Treasury Bill rate demonstrates a response very similar to that of the intervention rate. This is sensible since the two rates moved closely together and for a long period were linked by a formula. The effects on the long-term rate is less clear. It oscillates at a level higher than the pre-shock for about three years and then it returns to lower levels.

4.2.4 Comparison with alternative models

A final test for the policy indicator identified using the narrative approach would be to compare its effects against those of other measures of policy shocks proposed in the literature. Bernanke and Blinder (1992) proposed that shocks to the Federal Funds Rate should be used for the evaluation of the effects of monetary policy in the United States. Transposed to the United Kingdom this would suggest the use of the intervention rate (Bank rate, minimum lending rate and dealing rate) in a monetary policy VAR.

In Graph 9 the impulse responses to a shock in the intervention rate in three versions of such a VAR model are presented. The first column corresponds to an unrestricted VAR model, while the second and the third correspond to structural models applying the Choleski decomposition, with the intervention rate placed in the first and last place respectively and the rest of the variables ordered as before. The

results in the three columns are remarkably similar. The most striking differences compared to the baseline model with the policy dummy are the quick recovery of output, which reaches pre-shock levels in less than four years after the shock, and the presence of a "price puzzle". Prices increase, albeit marginally and fall to below their pre-shock levels only after more than two years. This is a finding often associated with VAR identification of policy shocks and it points to a failure of the identification scheme applied. Bearing in mind that the model includes the monthly percentage change of the oil price index, which is frequently used in the literature precisely because it removes the price puzzle,[23] the failure becomes even more evident.

Mountford (2002) has estimated a structural VAR for the UK using the Uhlig (2001) sign restriction methodology for identification. Here again the monetary policy shock is captured by a shock to the interest rate equation. His results also show that monetary policy shocks account for only 5% of output fluctuations in the short- and long-run. However, he also shows that a shock to the interest rate causes a rather long-lived response of GDP, which does not return to its pre-shock levels up to 10 years after the shock.

5. Conclusions

In this paper the narrative approach developed by Romer and Romer (1989) is adapted so that it can be applied to a small open economy. The United Kingdom is an interesting case study, as over the years both the monetary policy framework and the monetary policy strategy changed to take account of changes in financial structures and advances of economic thought regarding the role of monetary policy. Under changing monetary regimes identification of monetary policy shocks using a structural VAR model is questioned. The study of policy record provides a more informative tool for the understanding of the actions of monetary authorities.

Two characteristics of monetary policy actions are unchanged throughout the sample period. First, the monetary authorities launched restrictive policy only in periods when aggregate demand was growing. Second, in deciding about the launch of a restrictive policy both domestic monetary considerations and exchange rate developments were taken into account. However, when indications from the two sources of information were in conflict, changes in policy were short-lived. Only

[23] For example in Christiano, Eichenbaum and Evans (1999).

when pressures on the exchange rate stemmed from concerns on the domestic monetary conditions, did the monetary authorities decide to engage in long periods of restrictive policy.

An evaluation of the effects of monetary policy shocks with the use of an unrestricted VAR model confirms the stylised facts regarding their transmission. The shock dies out after a bit more than a year and it causes a persistent decrease in the monetary base, a hump-shaped response of output with the maximum effect about three years after the initial shock, while prices and wages do not move some time but after approximately three years record a persistent and approximately one-to-one decline. These results are broadly unchanged in the robustness analysis.

An important result comes from the variance decomposition of output, which shows that only up to 9% of output fluctuations in a 4-year horizon are due to monetary policy shocks. Thus the case against "active" monetary policy on the grounds that it affects output dynamics is not supported by the results presented in the paper. Finally the simple policy dummy constructed using the narrative approach appears to outperform the intervention rate in the identification of monetary policy shocks, providing support for the identification methodology applied.

DATA APPENDIX

***Y_t*:** Monthly changes of the index of production data for statbase. Contains index data (2001=100) for total production (Mining & Quarrying, Manufacturing and Electricity/Gas/Water). Source: Office for National Statistics.

***P_t*:** Monthly changes of the Retail Prices Index (1987=100). Source: Office for National Statistics. Index levels are available since January 1976. But 12-month changes of the index are available since 1948. The index level has been calculated back to 1971 and monthly changes have been calculated for the period 1971-1992.

***I_t*:** This is the Bank intervention rate monthly average (business days only). Until September 1972 the bank rate is reported. This was replaced by a minimum lending rate in October 1972. The latter was replaced by the minimum band 1 dealing rate (which is a discount rate), since 20 August 1981.

***W_t*:** The monthly percentage change in the Average Earnings Index (2000=100) for the whole economy. Source: Office for National Statistics.

***$M0_t$*:** The monthly change in the narrow money aggregate M0 (average monthly amount outstanding), which includes total sterling notes and coin in circulation outside the Bank of England and operational deposits of banks with the Bank of England. The data are seasonally adjusted. Source: Bank of England.

***$M3_t$*:** This is a synthetic data series constructed on the basis of two seasonally adjusted series. The first is the UK M3 aggregate for which data are used until the end of 1986. This series has three breaks (April 1973, May 1975 and November 1981) due to the inclusion of new institutions in the definition of "banks". Using the monthly changes and the break period for which both "old" and "new" data are available the break-adjusted levels of the series are calculated. The second series is the UK estimate of the EMU M3 aggregate, reported after January 1987. The coverage of the two indices is different. The UK M3 aggregate includes M0 and time and sight deposits at banks, while the UK estimate of the EMU M3 includes currency in circulation (M1), overnight deposits (M1), deposits with agreed maturity up to 2 years (M2), deposits redeemable at notice up to 3 months (M2), repurchase agreements, money market fund shares/units and money market paper and debt securities up to 2 years. This latter series is partially estimated by the Bank of England as the UK reporting system does not comprise the maturity breakdown necessary for the EMU M3 aggregate to be precisely calculated. The compilation of the break-adjusted series used here is done by using the level of the EMU M3 estimate for January 1987 and calculating it back using the monthly rates of change of the UK M3 aggregate. The monthly percentage changes of this synthetic monetary aggregate are used in the VAR. Source: Bank of England.

***XR_t*:** The monthly average of the effective exchange rate index (1990=100). Source: Bank of England.

***CP_t*:** The average crude price index composed by the UK brent (light), Dubai (medium) and West Texas Intermediate, equally weighted.

***MP_t*:** The monetary policy index, where a 1 is put in all months where monetary policy was actively restrictive (i.e. June 1972-December 1973, April-November 1976, November 1977-November 1979 and June 1988-September 1990) and a 0 otherwise.

***$TBrate_t$*:** Series 11260C..ZF... (Treasury bill rate) from the IFS statistics.

***$Bondyield_t$*:** Series 11261...ZF... (Govt Bond Yield: Long-Term) from the IFS statistics.

Table 1: Selection of official statements on the reasons for policy actions

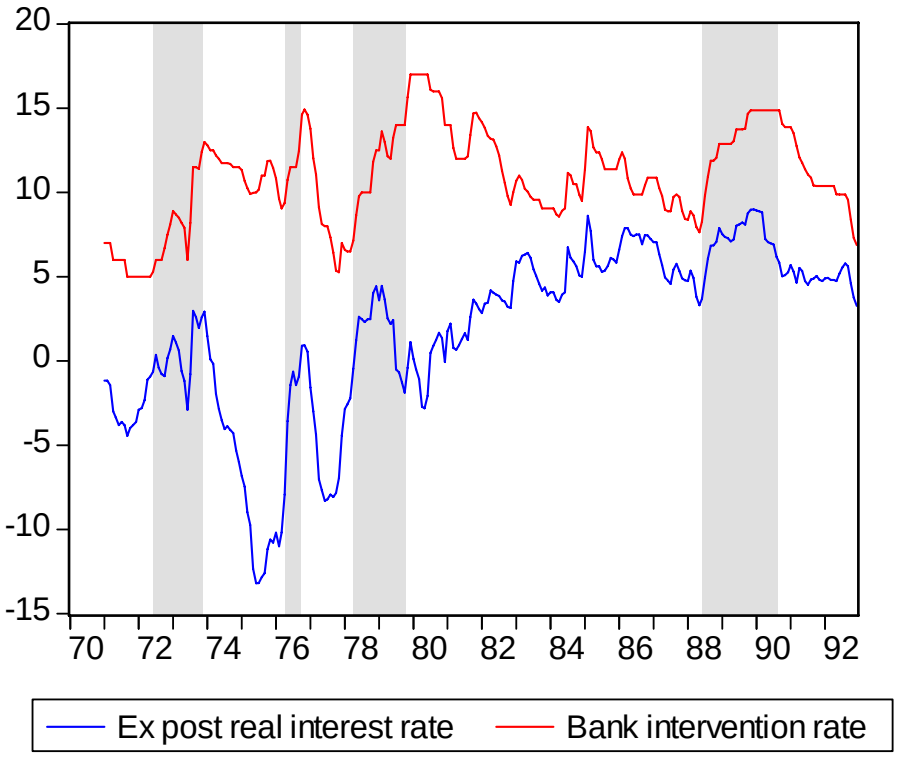
Period	Statements
June 1972 - December 1973	"*The move was seen as consistent with the official monetary policy objective of restraining the growth in the money stock – which was currently very rapid – to a rate which was adequate, but not excessive, to finance the 5% annual rate of expansion in real output expected at the time of the Budget."* [QB, vol. 12, p. 315] *"…we did then* [end of the second quarter of 1972] *shift sharply to a considerably more restrictive policy … However, I am not confident that we have now done enough to ensure that monetary expansion will moderate to the desired extent in coming months. There are certain features ahead…, which could lead to a renewed acceleration in monetary expansion. We will need to be vigilant and active to prevent this."* [QB, vol. 12, p. 517] *"There was no case for a further fall in the rate for balance of payments reasons and it would have worked against the Government's anti-inflationary measures. We therefore called for further Special Deposits which, together with some expenditure of exchange, brought about a sharp upward shift in short-term rates in London. The shift achieved our primary objective of stabilizing the sterling exchange rate and was also, in my judgment, appropriate to the domestic situation where a more restrictive policy was required. …For moderation in the rate of growth of the economy and in the pace of inflation requires moderation in the pace of monetary expansion"* [QB, vol. 13, p. 476]. *"The tightening of monetary policy in November* [1973] *followed other adjustments of policy undertaken in the light of the needs of the economy at that stage ...it was made clear that the aim of the government policy ...was to secure continuing expansion at a more moderate and sustainable rate ...the further large call for Special Deposits should help to moderate monetary expansion and an unduly rapid growth of bank lending."* [QB, vol. 13, p. 417].
April-November 1976	*"... to restrain the growth of bank lending to the private sector within the bounds set by the 12% target; and to secure adequate official sales of public sector debt to the general public, so as to neutralise the creation of liquidity arising from the public sector deficit and thereby also moderate the rate of monetary expansion... The current stance of monetary policy will have to continue for the time being. But it is far from costless, and if interest rates remain so high for long, they will begin to be a powerful deterrent to investment, only now showing signs of recovery"* [QB, vol. 16, p. 454]. *"Our greatest requirement is that we should put a stop to the debilitating erosion in the value of our currency, external and internal"* [QB, vol. 16, p. 454].
November 1977 - November 1979	*"The action taken underlines the determination of the authorities to maintain firm monetary control"* [QB, vol. 18, p. 502]. *"Some argue that we are free to choose between defeating inflation and satisfactory growth. My case is that we no longer have such a choice. Inflation has got far too serious. Until we have got inflation under control, we cannot secure satisfactory economic growth. It might be possible to achieve a short-term spurt in activity. But while inflation persists at anything like its present pace, fiscal or other means of demand stimulus are unlikely to produce sustainable gains in activity and employment. They would, however, undoubtedly exacerbate inflationary pressure"* [QB, vol. 19, issue 4, p. 407].
June 1988- September 1990	Policy actions in the summer of 1988 intended to give *"the clear message that monetary policy was directed at achieving a slowdown in the growth of domestic demand and at restraining inflationary pressures"* [QB, vol. 28, p. 485]. *"…fears of recession gave way to a realisation that growth, in particular of domestic demand here, was continuing at an unexpected and unsustainable rate, and that monetary policy should be tightened to head off growing inflationary pressures"* [QB, vol. 28, p. 507]. *"the strength of sterling at the beginning of this year …delayed the appropriate rise in interest rates"* [QB, vol. 28, p. 507].

Table 2: Variance decomposition of the policy indicator and the monthly percentage change in the index of production

Average of periods	Variance decomposition of PS					
	PS	*BASERATE*	*GRM0*	*MY*	*MP*	*MW*
1-3	96.52	1.37	0.50	1.45	0.08	0.07
4-6	86.12	8.30	1.35	1.70	0.52	2.00
7-9	76.92	15.91	1.05	1.19	3.19	1.74
10-12	67.28	22.90	0.92	1.01	6.45	1.43
13-15	61.68	28.37	1.09	0.96	6.53	1.38
16-18	56.50	33.90	1.02	0.95	6.30	1.33
19-21	51.59	38.35	1.03	1.00	6.56	1.48
22-24	47.61	41.56	1.02	1.76	6.55	1.50
25-30	44.18	42.99	1.12	3.71	6.54	1.45
31-36	43.21	40.11	1.38	5.53	7.65	2.12
37-42	43.34	38.42	1.47	5.97	8.46	2.35
43-48	43.30	37.93	1.53	6.32	8.59	2.33

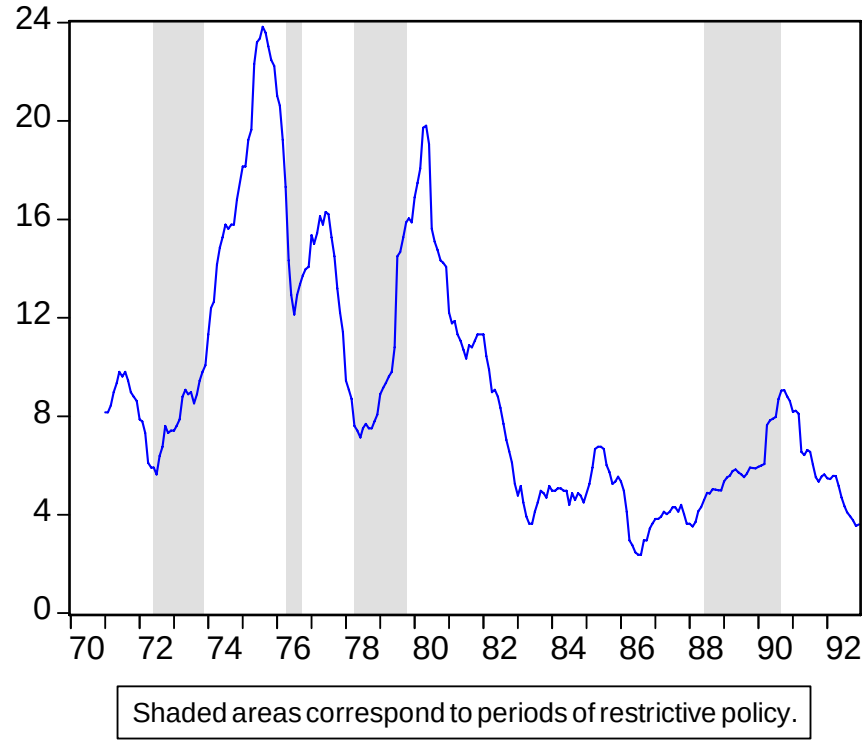
Average of periods	Variance decomposition of MY					
	PS	*BASERATE*	*GRM0*	*MY*	*MP*	*MW*
1-3	0.25	1.04	0.32	97.37	0.00	1.01
4-6	0.76	2.05	4.46	80.82	3.68	8.23
7-9	1.61	4.96	7.65	71.60	5.44	8.75
10-12	2.07	5.60	10.44	67.41	5.37	9.11
13-15	3.77	6.24	10.43	63.39	6.68	9.50
16-18	5.89	6.57	10.23	60.19	6.78	10.33
19-21	7.02	6.86	11.68	56.93	7.36	10.13
22-24	7.40	7.06	12.08	55.98	7.31	10.17
25-30	7.75	7.39	12.52	54.92	7.33	10.10
31-36	8.52	8.15	12.69	53.35	7.28	10.01
37-42	8.80	8.66	12.65	52.45	7.26	10.17
43-48	8.87	8.91	12.76	52.01	7.28	10.18

Graph 1: UK intervention rates and *ex post* real interest rate

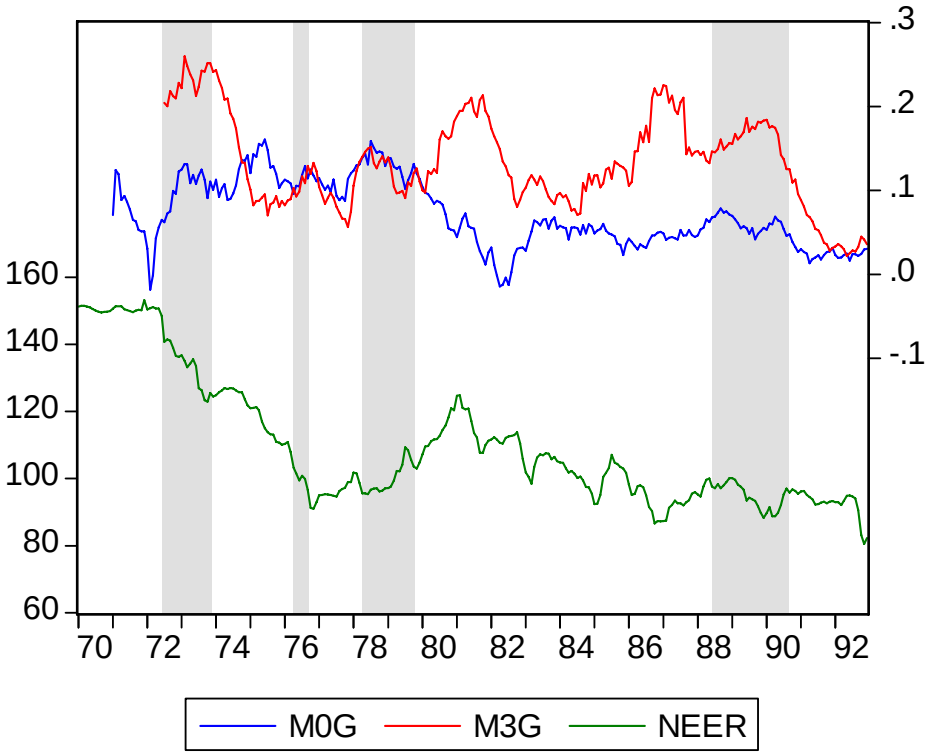


Graph 2

UK annual inflation rate (1971-1992)

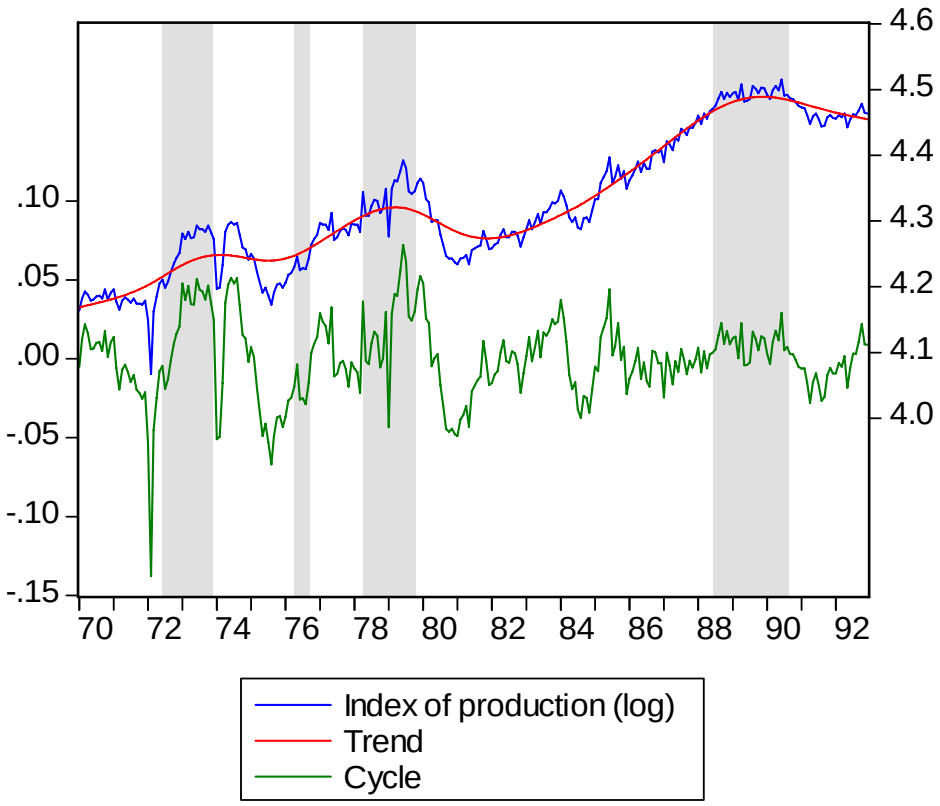


Graph 3: Monetary aggregates and nominal effective exchange rate

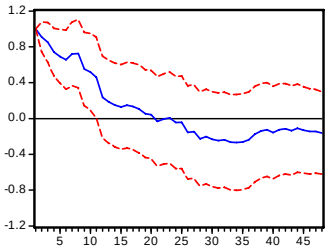
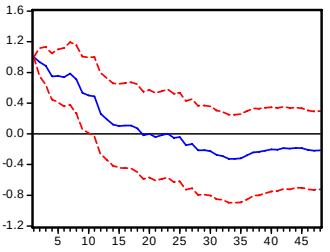
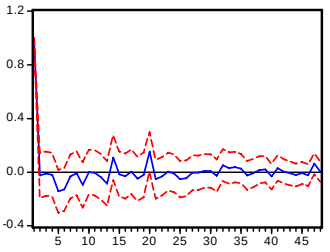
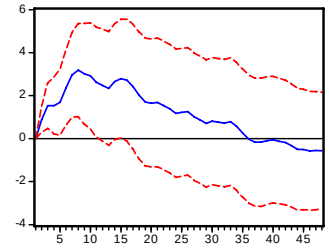
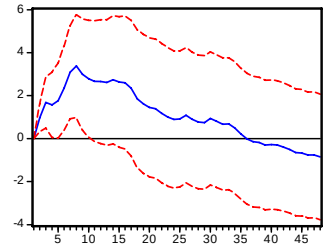
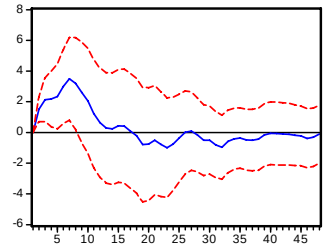
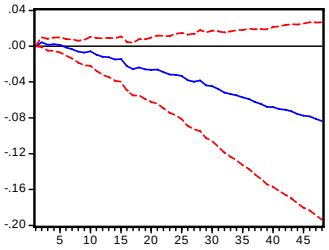
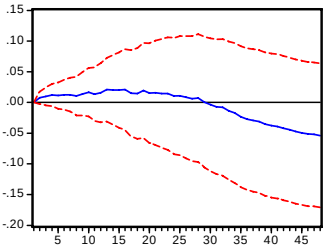
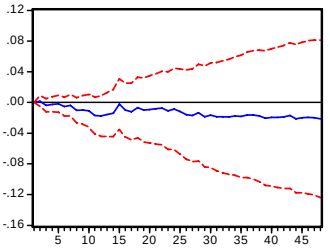
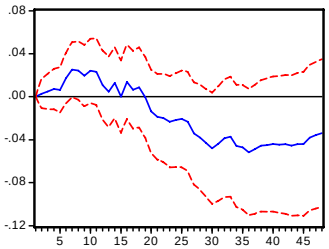
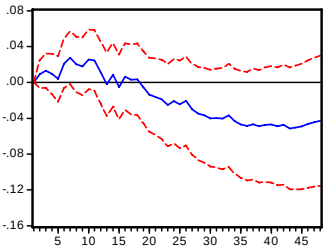
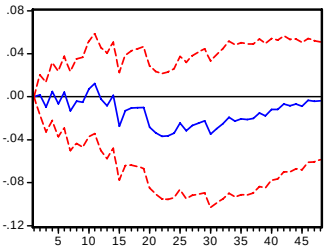
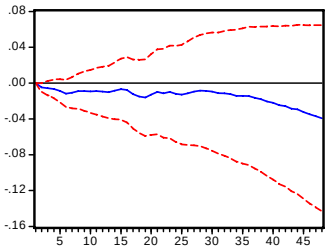
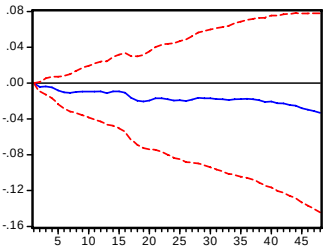
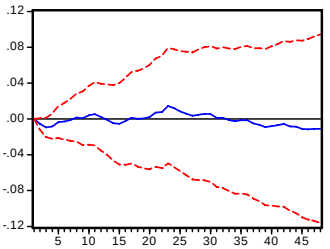
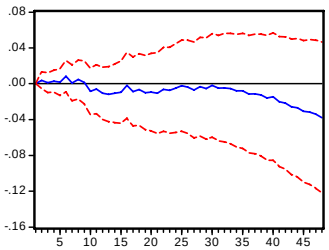
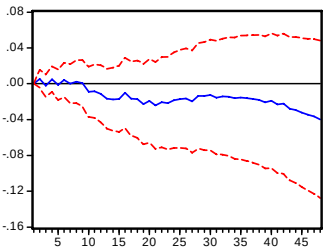
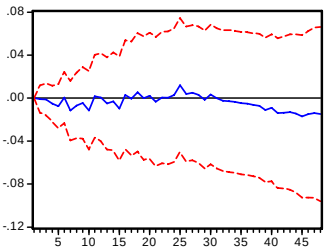


Graph 4

Index of production -- Hodrick-Prescott Filter (lambda=14400)

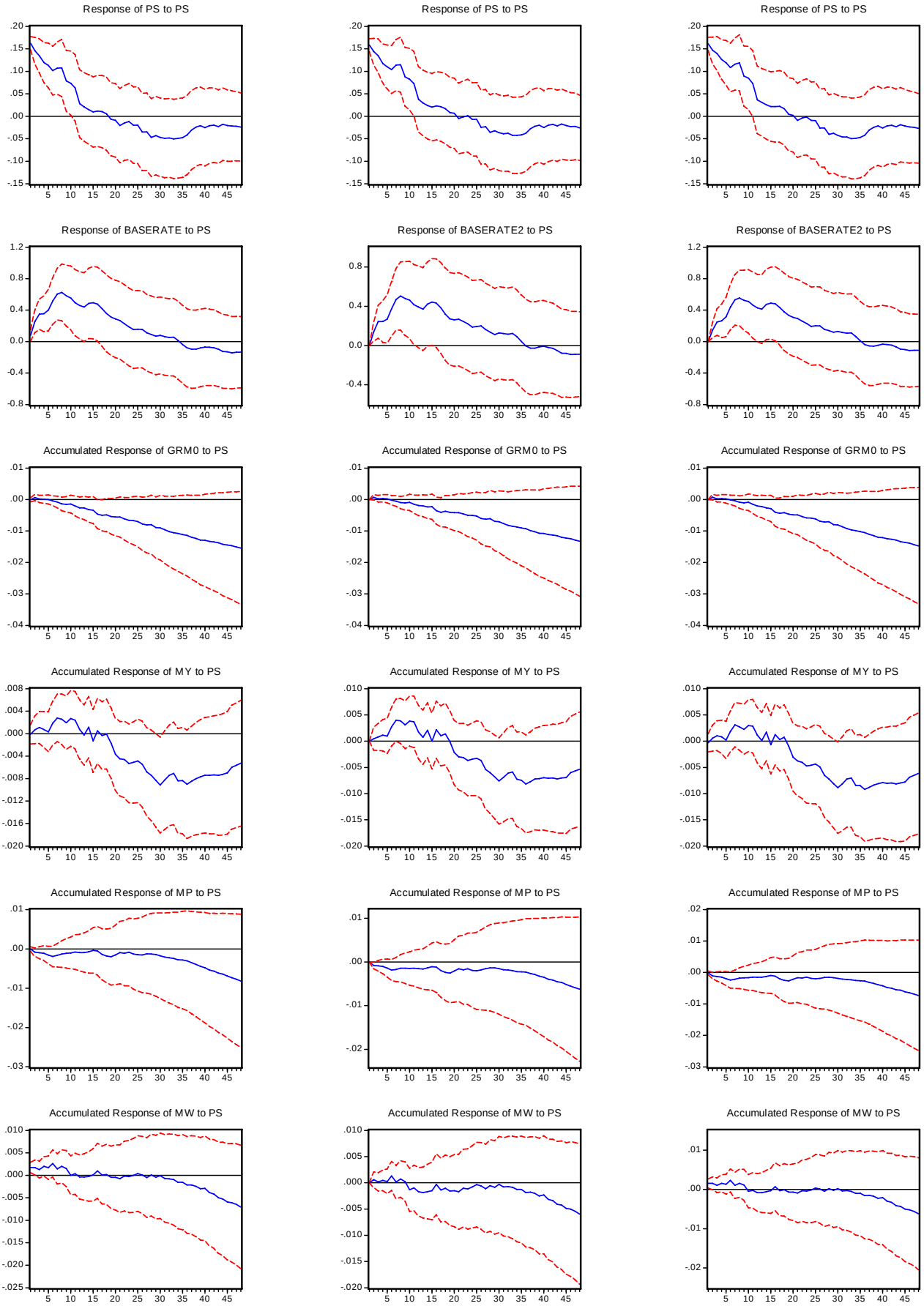


Graph 5: Unrestricted VAR, one unit shock to PS

Baseline	M3 instead of M0	Romer dummy instead of step-dummy
Response of PS to PS	Response of PS to PS	Response of PS1 to PS1
		
Response of BASERATE2 to PS	Response of BASERATE2 to PS	Response of BASERATE2 to PS1
		
Accumulated Response of GRM0 to PS	Accumulated Response of GRM3 to PS	Accumulated Response of GRM0 to PS1
		
Accumulated Response of MY to PS	Accumulated Response of MY to PS	Accumulated Response of MY to PS1
		
Accumulated Response of MP to PS	Accumulated Response of MP to PS	Accumulated Response of MP to PS1
		
Accumulated Response of MW to PS	Accumulated Response of MW to PS	Accumulated Response of MW to PS1
		

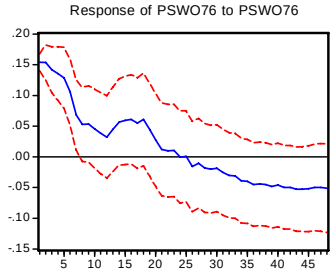
Graph 6: Choleski decomposition, one standard deviation shock to PS, ordering of other variables: GRM0, MY, MP, MW

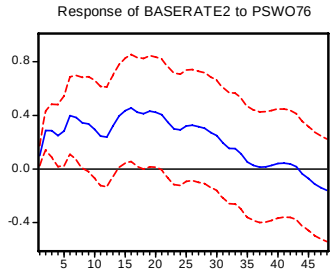
PS first | PS third | PS last

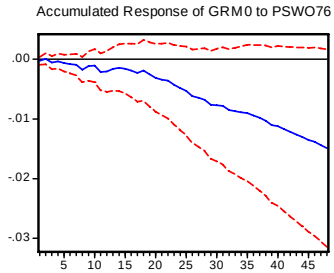


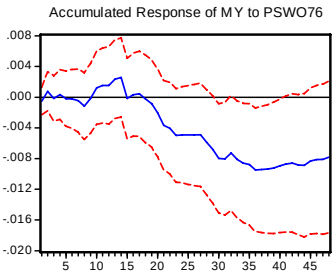
Graph 7: Choleski decompositions

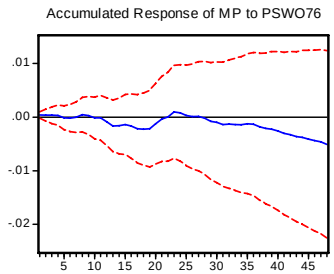
Policy shock without 1976

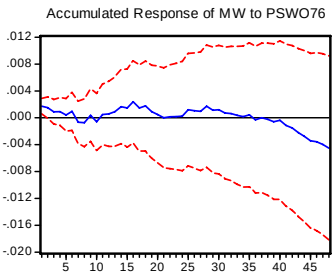




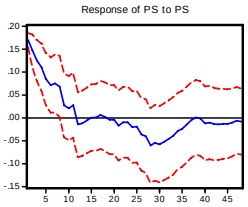


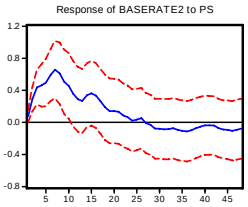


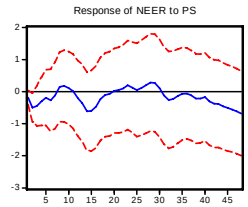


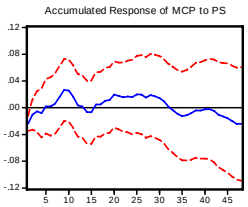


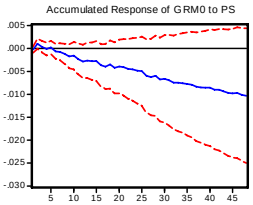
Endogenous NEER, com. prices

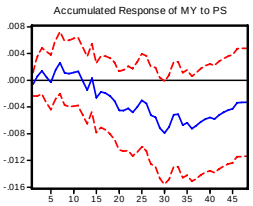


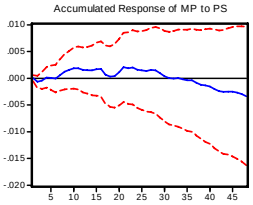


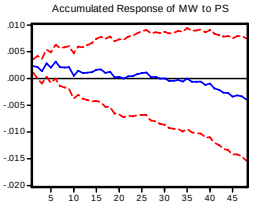




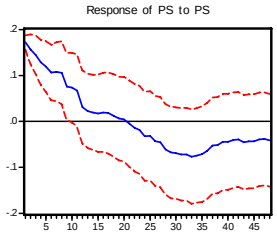


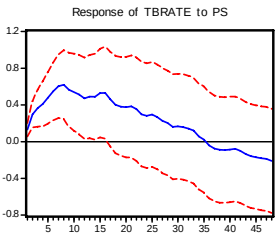


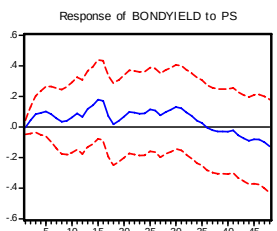


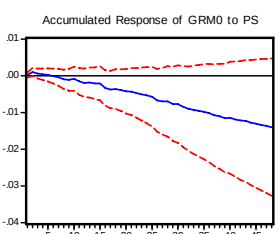


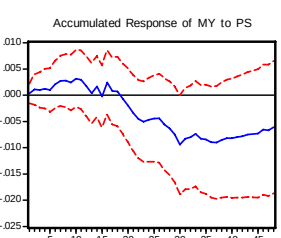
Specification with TB rate and bond yield

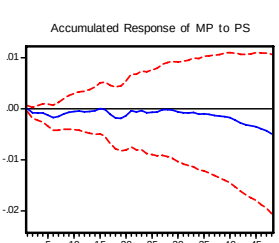


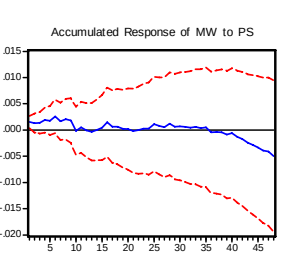




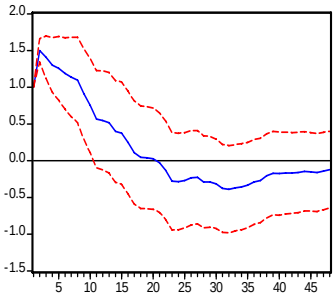
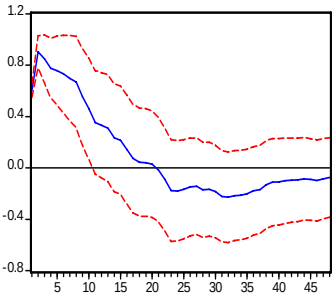
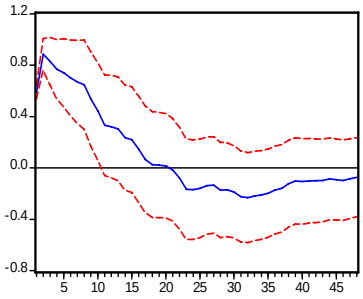
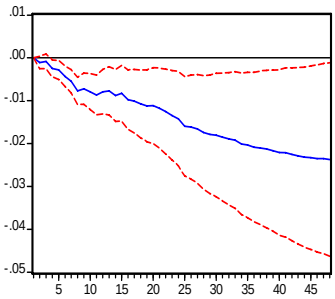
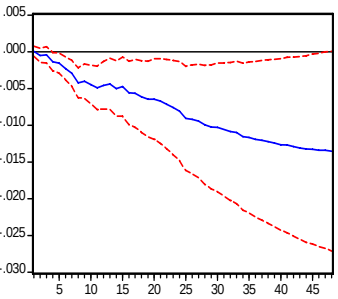
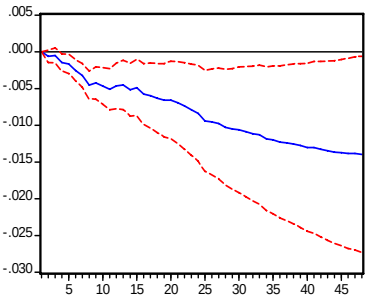
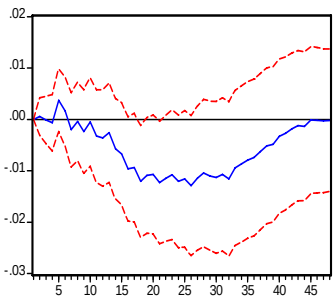
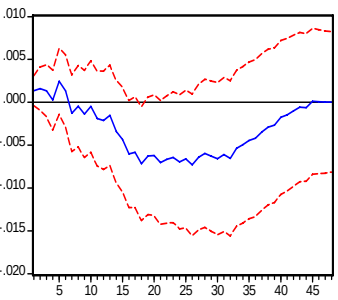
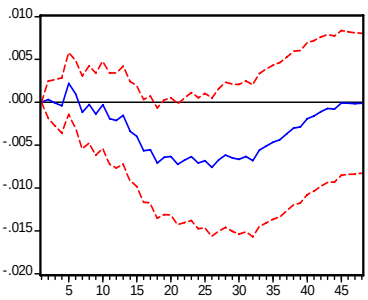
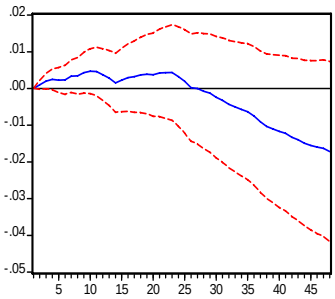
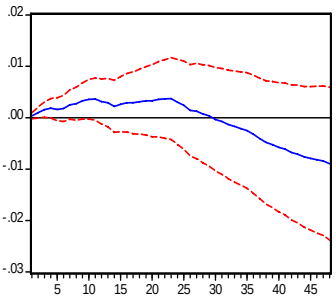
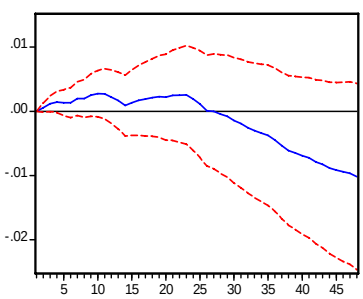
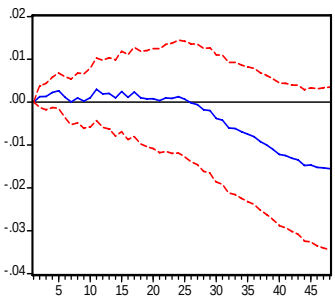
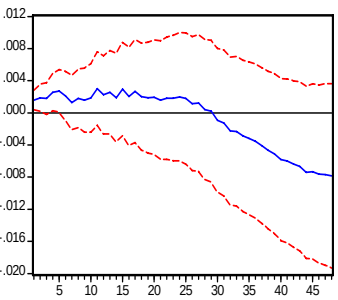
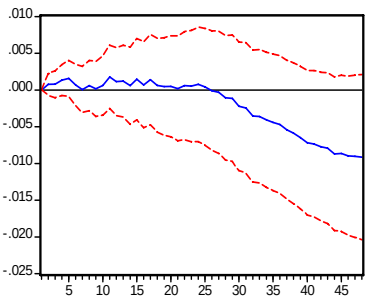








Graph 8: Specification with base rate as policy variable

One-unit shock	Choleski with base rate first	Choleski with base rate last
Response of BASERATE2 to Nonfactorized One Unit BASERATE2 Innovation	Response of BASERATE2 to Cholesky One S.D. BASERATE2 Innovation	Response of BASERATE2 to Cholesky One S.D. BASERATE2 Innovation
		
Accumulated Response of GRM0 to BASERATE2	Accumulated Response of GRM0 to BASERATE2	Accumulated Response of GRM0 to BASERATE2
		
Accumulated Response of MY to BASERATE2	Accumulated Response of MY to BASERATE2	Accumulated Response of MY to BASERATE2
		
Accumulated Response of MP to BASERATE2	Accumulated Response of MP to BASERATE2	Accumulated Response of MP to BASERATE2
		
Accumulated Response of MW to BASERATE2	Accumulated Response of MW to BASERATE2	Accumulated Response of MW to BASERATE2
		

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