Credit controls did matter. An evaluation of monetary policy during France's Golden Age, 1945-1973.

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Abstract : This paper uses a 'narrative approach' to identify monetary policy restrictions in postwar France and then estimate their impact in a VAR. From 1945 to 1973 the main instrument of temporary restrictive policies was direct credit controls, rather than the 'conventional' discount rate. Information from the archives of the Central Bank allows to identify the duration of each credit control episode and to state that they were exogenous to output. Estimations of the monetary policy reaction function confirm this exogeneity. Credit control mattered significantly and its effects on industrial production and unemployment were very long lasting. Accounting for the duration of the monetary restrictions considerably reduces the estimated delay of the response of output to a shock. The Impulse response functions show a pattern very similar to the one observed in Romer and Romer (1989, 2004) about monetary policy in the US (1970-1996), despite the sample, the country and the type of monetary policy being all quite different. The 'narrative approach' also proves more successful than any other VAR estimation with different measures of monetary policy over this period.

A subsample analysis then points out that the delay of the response of production is longer and the effect of monetary policy is weaker over 1947-1958 than over 1958-1973. I show that less effective credit controls can partly explain the overall weaker effect while the lag is mainly explained by the development of liquid savings in the 1960s that has allowed better consumption smoothing. Finally, I propose a method to eliminate the endogeneity of credit control to inflation, using the information about policymakers views and expectations. This new measure eliminates a major part of the delay of inflation response.

'There is no case, whatsoever, for direct controls on credit'.
Milton Friedman, 1980.[1]

'By the middle of 1950, in the comparatively hopeful days before the Korean crisis, France had attained reasonable internal stability and had approached an acceptable international balance. In the rehabilitation and stabilization of the French franc, credit controls have been an essential instrument, but France's experience with them has remained almost unnoticed on this side of the Atlantic.'
M.A.Kriz, *American Economic Review*, 1951.

As emphasized some decades ago by the debate between Milton Friedman and James Tobin, the estimation of the effects of monetary policy on output requires a relatively exogenous measure of monetary policy. Much effort was directed then to an adequate identification of exogenous monetary policy shocks. At the end of the 1990s, a broad consensus has emerged considering that the choice of an adequate series - non borrowed reserves or the money market rate for example - and careful structural identifications in a VAR are able to solve most of the problem (Bernanke and Mihov, 1998, Christiano, Eichenbaum and Evans, 1999). On the other hand, Romer and Romer (1989, 1994, 2004) have developed a narrative approach, in the spirit of Friedman and Schwartz (1963), claiming the necessity for a careful historical analysis in order to identify exogenous monetary restrictions. Since the former approach mostly assumes that monetary policy has only one instrument, the narrative approach is much more suited when central banks do not act in a 'one instrument-one rule' way.
But the 'narrative approach' has strong requirements. In particular, it needs a great amount of qualitative information and enough pieces of evidence in order to prove the exogeneity and the adequacy of the measure and to avoid subjective bias. The measure of the shocks then largely depends on the information available to the researcher (the Greenbook forecasts used by Romer and Romer, 2004, is a good example) and is not likely to be easily extended to different countries or periods. Furthermore, the 'narrative

[1] Quoted in Batini and Nelson (2005), p.57.

approach' faces three major issues. First, this approach requires that monetary policy must be sufficiently homogeneous over a long period, even though it can take into account several instruments used by the central bank. Indeed, if the central bank keeps changing its instrument and its objectives, no comparison and no long run statistical analysis is possible. Second, the sample must be relatively free of other big exogenous shocks or major shifts in the economic situation. For example Hoover and Perez (1994) criticized Romer's work for not being able to separate the effect of monetary policy from the effect of oil shocks. In a more general way, Mojon (2008) has shown -with a VAR approach - that the estimated results of the impact of monetary policy differ radically depending on the sample choice. In particular, Mojon shows that traditional results of the VAR literature on the US disappear if one does not include the Great Inflation of the 70's in the sample. As a consequence, an adequate choice of the period may be as important as the choice of the measure of the shock.[2]. Third, as already recognized by Romer and Romer (1989), the narrative approach often lacks information about the duration of monetary policy restrictions or expansions. Indeed, while a series of interest rates or reserves is continuous and can be introduced as such in the VAR, the narrative approach identifies discrete episodes that are most of the time introduced as dummy variables in the econometric model (Romer and Romer, 1989, 1994, Ramey, 2009) without specifying the duration of the shock. The reasons is that the restrictive effect of a rise in the bank rate does not necessarily last until the Central Bank decreases its rate. But the lack of information on the duration of the shock may have important consequences. Indeed, if a central bank raises its discount rate by 2%, the impact of this policy on the economy is not only caused by the initial shock but also by the fact that the cost of credit remains high for several periods.

These three problems are in fact common to the identification of monetary policy shocks and fiscal policy shocks (Ramey and Shapiro, 1998, Romer and Romer, 2009, Ramey, 2009), and their extent is still difficult to estimate since the research has solely focused on US post-war economy up to now.

The first goal of this paper is to assess the relevancy of the 'narrative approach' when this method is applied to a different country and a different period from previous studies and when the three main problems identified above are addressed. I use the fact that

[2]Bagliano and Favero (1998) also pointed out that only VAR models estimated on a single monetary regime feature parameters stability and do not show signs of mis-specification

from 1948 to 1973, during France's highest period of growth, French monetary policy was defined in a homogeneous way : credit policy. Thus every monetary restriction worked through temporary direct credit controls. Contrary to a conventional discount rate policy, it is then possible to identify the duration of the monetary restrictions because for each episode we know how long the controls were effective and when they were repealed. But after 1973, the nature of French monetary policy changed : direct credit controls became less strict but permanent until 1984, the bank rate was used more systematically and the policy became less independent because it needed coordinating with other European countries. Furthermore, from the end of 1973, France faced big supply shocks and stagflation. For these reasons it would be inappropriate to extend the same method and to apply the same identification procedure after 1973. Then, using an extensive amount of archives from the central banks, I show that these controls were implemented in response to inflation and trade deficit and were thus relatively exogenous to other economic variables. A simple estimation of the reaction function of the Central Bank confirms this statement.

Then I introduce a dummy variable - that takes the value 1 for the months when monetary policy is officially restrictive - in a simple VAR and present the estimated impact of exogenous monetary restrictions on output through impulse response funtions (IRF). The effect on industrial production starts after two months and reaches a peak around 25 months, while the effect on unemployment is more delayed (10 months) but also maximum around 25 months. Surprisingly the response of production is very similar to the one observed in Romer and Romer (2004) about monetary policy in the US (1970-1996), despite the sample, the country and the type of monetary policy being all quite different. These findings suggest that the very long-lasting effect of monetary policy is a robust fact that should be replicated by formal models. Regarding the delay of the response to the shock, I find that accounting for the duration of the shock reduces considerably the lag of the impact in the impulse response function. This result thus sheds light on the 'timing' problem identified in Romer and Romer (1989, 2004) and Ramey(2009). Finally, I show that no VAR using conventional measures of monetary policy (discount rate, money supply, foreign bank rate) over this sample is able to generate robust and relevant results. These findings confirm the necessity of the narrative approach in order to study 'non conventional' measures of monetary policy.

The second goal of this paper is to assess the importance of monetary policy during France's highest period of growth, sometimes considered as the Golden Age (*les Trente Glorieuses*) although it is often described as passive and ineffective. In so doing, I also intend to evaluate the evolution of the delay and strength of the responses to monetary shocks over time. Studies of French growth (Carré, Dubois and Malinvaud, 1972, Sicsic and Wyplosz, 1996) have pointed out that monetary policy could have played a role in the business cycle but none of them have tried to estimate its effect. Also, direct credit controls are often dismissed for theoretical and normative reasons (Friedman, 1960, 1980)[3] but few studies have attempted to estimate their real effects on the economy. Estimations computed in this paper clearly show that monetary policy through credit controls did matter even though their overall effect on output were not so strong. In particular, two years after a shock, the industrial production index is only 1,5% below the level it would have reached without the monetary restriction, which is low compared to standard estimations of the impact of US monetary policy during the following period (1970-2000). However, this number is rather high if we take into account that industrial production over 1948-1973 experienced constant growth without high volatility. A variance decomposition analysis shows that around 10% of the variance of production, and 20% of the variance of unemployment are explained by monetary policy over the period, thus highlighting the large influence of this policy on the French business cycle.

But the previous results are not all identical accross periods. Indeed, impulse response functions show that the impact of monetary policy is weaker and more delayed after 1958. This is true not only of industrial production but also of investment and consumption. The weaker efficiency of credit controls on credit after 1958, as shown by IRF, can explain the weaker effect on output but not the delay of the impact. A more precise analysis shows that the delay of the response of investment can be explained by the delay of the response of mid term credit, a part of which had been exempted from controls in 1968. Conversely, I interpret the delay of the response of consumption as a greater ability of households to smooth their consumption in the 1960s than in the 1950s. Indeed, households' savings (especially liquid savings) were scarce after the war and started to rebuild only at the end of the 1950s. IRF show that the saving rate is not affected by monetary restrictions before 1958 while it falls significantly after, proving

[3]Schreft (1992) made the case for welfare improving credit controls, but his model cannot account for their effect on inflation and output.

that households used savings to smooth their consumption over the period 1959-1973. This results highlights the importance of the 'consumption channel' of monetary policy which is often neglected in current studies. Finally, I investigate the impact of monetary policy on prices. In order to address the endogeneity problem of monetary restrictions to inflation, I use a new series of shocks obtained from the residuals of the estimation of the reaction function of the central bank (that is the part of the shocks left unexplained by the variables of the reaction function). Inflation responds quite rapidly and strongly to a shock on this new measure, thus eliminating partly the usual price puzzle.

First I will describe briefly credit policy in France from 1945 to 1973 and then provide a detailed analysis of the six episodes of credit restrictions. Records, letters and notes from the central banks help determine what the instruments and the objectives of policymakers were, and thus, to which economic variables these decisions were exogenous or endogenous. An estimation of the Central Bank reaction function in the spirit of Clarida, Gali and Gertler (1998, 2000) assesses the direction of causation. Second, I present estimations with monthly data of the impact of monetary restrictions on production and unemployment, check robustness and compare with several other measures. Then, I use quarterly data of many economic variables in order to further investigate the change of the impact of monetary policy across periods. Finally, I discuss the estimation of the impact on inflation and provide a new measure relatively free of endogeneity to prices.

1 Definition of monetary restrictions

1.1 Principles and instruments of credit control

In the years after World War II, most European countries faced two main economic problems : the economy (especially industry) needed to reconstruct, inflation was very high and kept rising. Governments reacted in different ways, some as Belgium or Italy implemented very restrictive stabilization plans in 1947 while others delayed the stabilization. In France, no rigorous stabilization happened before the end of September 1948 when fiscal discipline and a restrictive monetary policy were jointly decided[4]. At this date, the

[4]The Banque of France forced the Government to impose this rigorous policy. For a comparison of stabilization plans between France and Italy, see Casella and Eichengreen (1993).

French central bank decided to control quantitatively banking credit in various ways in order to fight inflation pressures. Compared to foreign experiences[5] the two main features of French monetary policy were first that credit control episodes were designed to be temporary and second that quantitative measures (not only qualitative) were taken. Indeed, by October 1947 France first imposed qualitative restrictions on credit that consisted in telling banks the sectors that deserved priority. But they were not sufficient to stop inflation, as stated by the National Credit Council, "qualitative measures are too soft to have an effect on inflation and are only designed to organize a better allocation of credit." (29 September 1948). Thus, by 29 September 1948, the Banque de France decided to implement quantitative measures.[6]

The doctrine that credit was the main source of inflation is a fundamental feature of postwar French monetary policy. In this sense, there was clearly a 'credit policy' (i.e policy which emphasizes rates of interest and availability of credit) rather than a 'money policy' (i.e policy concerned with the quantity of money) as defined by Milton Friedman (1969). The conviction that credit control should be used only temporarily in order to avoid damages on the competition mechanisms is a second important feature. It is well expressed, among others, in a letter from the Governor of the Banque de France to the Finance Minister on 6 February 1958 : "Needless to say that these measures should not be considered as irremovable. They are conceived at a general economic level in response to a specific situation, and the stabilization of credit will need to be changed in one way or another when the factors of this situation evolve. In the long-term, if nothing is done, limitations on banking credit would probably lead to rents of situation that would distort the normal rules of a competitive sector."

The French Central Bank had been nationalized in 1945 and remained dependent of the Treasury and the Government over the whole period. Most of the important measures were discussed between policymakers from the Ministries and from the Banque of France. It sometimes led to conflicts as in 1948, 1952 or 1957. Thus monetary policy cannot be isolated from the political context and bargaining between the Banque and the Government. Government financing was a big issue all over the period. Within the Banque

[5]Experiences of credit controls during European recovery are still not well known. Hodgman(1972, 1973) and OECD (1973) furnished a good overview. Jonung (1993) presents an evaluation of the Sweden case.

[6]Hereafter, I translate all the quotations from the archives of the Banque de France from French to English. Original quotations are available on demand.

de France, the National Council of Credit was in charge of the implementation of credit control and the Commission of Banking Control supervised the banks . The sources that I used are primarily the records of the weekly sessions of the General council of the Banque of France (denoted as PVCG), the deliberations of the sessions of the National Council of Credit (denoted as CNC), and various notes and letters from the archives of the central bank.

From September 1948 to 1973, the French Central Bank used four types of instrument in order to stabilize the economy : the discount rate, minimum reserves requirements (of treasury bonds, of medium term credit, and then obligatory reserves after 1967), quantitative discount ceilings (with penalty discount rates for banks exceeding the maximum allowed), and quantitative ceilings on bank-credit expansions (after 1958).

Thus, if the discount rate of the Banque of France had been one mean of credit control, it had never been the major one. Indeed policymakers knew that the price elasticity of credit demand was very weak because the banks were structurally indebted toward the central bank. Hence French central bankers used it mainly for 'its psychological effect'[7]. The discount rate was also often used to follow international rates (i.e the US rate) in order not to discourage capital inflows. Simple estimations of Taylor rule following Clarida, Gali, Gertler (1998, 2000) show that the discount rate does not respond to any economic variable over the period, except the US bank rate (results not reported here). Policy makers considered it as a 'qualitative' instrument, as opposed to direct credit control, named 'quantitative', which imposed ceilings on discount or credit expansions.[8]

Quantitative credit control could not have been efficient without abilities to supervise banks and the development of a large collection of banking credit statistics. The tools of credit supervision were established in October 1947 when qualitative (selective) credit control was implemented in order to allocate credit in high priority sectors. In a letter to the President of the Association of Professional bankers (10 October 1947), the Governor of the central bank explained why credit control was essential to defend French economy and how banks had to declare each month the amount of credit they granted to each sector. Sanctions (impossibility to use rediscounting at the Bank of France) would be applied to banks that did not declare their amount of credit or gave out false numbers. Threat on discount facilities was an efficient mechanism since, as stated above, banks

[7]This statement is notably expressed in PVCG, 30 September 1948. and Baumgartner, 11 octobre 1951, p.511, 11 avril 1957, p.278

[8]Notably expressed by the Governor Baumgartner , PVCG, 11 october 1951).

used rediscounting at the Banque de France rather than the money market.

1.2 Identification procedure

Despite the central bank used several instruments simultaneously and these instruments evolved over the period, I argue that monetary policy followed one homogeneous principle : in order to fight inflation, credit must be rationed directly by quantitative means. While ceilings on credit or on discount, and minimum reserves were deemed quantitative instruments, the discount rate was deemed 'qualitative'. Given the instruments used and the intentions of policymakers, it is possible to identify whether monetary policy was restrictive or not, that is whether credit was controlled quantitatively or not. Indeed, in the records of the Banque (official records as well as notes and deliberations), all these instruments, including the discount rate, appear in the same category : Credit Policy (*Politique du Crédit*). At each meeting, the Council General of the Banque discussed and stated whether credit policy should be restrictive or not.

According to policymakers themselves the discount rate could only have a psychological effect, not a 'practical' and effective one. Thus, *a priori*, I do not consider a rise in the discount rate, without any qualitative restrictive measure on credit, as a genuine instance of restrictive policy. I use the fact that the beginning and the end of credit control episodes are usually easy to identify (quantitative measures were imposed and then repealed). Nevertheless, before the 1958 episode, that is the first time ceilings on the expansion of credit were implemented, the ends of the episodes are more difficult to figure out because not all the previous measures were repealed. Nevertheless, the sources that I used (deliberations of the General Council and of the National Credit Council, as well as various internal notes) provide many indications that help to figure out when the Central Bank considered that the restrictive policy ended.

Besides the duration of the episodes, the aim of the 'narrative' identification procedure is to state as precisely as possible what the instruments and the objectives of each monetary restriction were . Consequently, it will be possible to state which economic variables central bank's decisions were endogenous or, on the contrary, exogenous to.

1.3 Six restrictive episodes

30 September 1948 - 8 June 1950 The first episode of credit control occurs in a context of political instability. In order to force the government to adopt fiscal and credit restrictions, the Banque of France raises its discount rate by 1 % on 2 September, without much effects, and finally decreases it on 30 September by 0,5% since credit control measures had been approved by the government and the National Council of Credit. The objective of the quantitative control of credit was clear : fighting against inflation by reducing the growth rate of credit. Among the reasons to reduce inflation was a government credibility problem : the inflation tax (seignoriage) was so high that the government deficit had lost all credibility. These arguments were expressed clearly in a letter of the Governor where he suggested what the Prime Minister (*Président du Conseil*) should say to the Parliament (Septembre 17th) to defend the credit policy.
This new policy had two main objectives (29 September, preparoty notes for the CNC) " The aim of this policy is twofold. First it must limit the expansion of credits in order to reduce the development of monetary facilities. Second, it must guarantee to the Treasury the resources that it has the right to expect from the banking system." Thus, the fight against inflation was also a reallocation of private credit toward public credit. The commitment of the Government to maintain its demand of credit in a non inflationary way was thus a fundamental component of this policy.
The measures, considered as excessive by many bankers (cf CNC 29 September and letters), were the following : a lower limit on government securities owned by banks (*planchers d'effets publics*) equal to 95% of each bank's amount in September 1948, and an obligation for each bank to devote 1/5 of its new loans to government bonds. Furthermore, the CNC devoted great attention to the new systematic application of rediscount ceilings to banks : the individual ceiling applied to each bank in 1949 is determined by the nominal amount of the ceiling in september 1948 plus 10% (expected inflation).
The ending date of this episode is more gradual and thus not as obvious as for the next ones. All along 1949, the Banque de France kept insisting on the importance of these measures (cf PVCG ; 1st September), and at the beginning of 1950, The French monetary authorities have, in fact, encountered considerable resistance in implementing the restrictive credit policy. A relaxation, mainly based on lifting the ceilings on commercial bank rediscounting at the Bank of France, had been repeatedly advocated in the Parisian financial press and by certain business groups. In April 1950, the National Assembly,

after a brief debate, formally requested the government to relax the restrictive credit policy, despite the Secretary of State for Economic Affairs's warning that such a course of action would be inflationary. However, prior to the outbreak of the Korean crisis, the Government and the Bank of France avoided a relaxation of controls, with one minor exception, and the profound change in economic climate consequent to world rearmament had made the maintenance of over-all credit restrictions mandatory(Kritz, 1951). Nevertheless, there is a consensus among observers to date the shift of credit policy between April and June 1950 (Kritz, 1951, Barrère, 1951, Guillaumont -Jeanneney, 1969) because of the adoption of 3 measures : rise of ceilings on credit requiring an authorization from the Banque de France, (from 50 to 100 millions) on 27 April, rise of discount ceiling on 11 May and decrease of the discount rate on 8 June. The Governor justified the timing of this ending as follows : "The proposed measure may be unorthodox, in the sense that in the past we probably would have waited for a stronger stabilization of lending to private economy. Nevertheless, it seems that with the uncertainty about the development of production nowadays, some of us tend to adopt some pessimistic views. I do not want to break with the tradition but only to adapt it to current circumstances."(PVCG, 8 June, 1950)

Given the uncertainty regarding the end date of this episode, we will try these three months (April, May, June 1950) in the econometric analysis with monthly data (it does not differ from using quarterly data).

11 October 1951 - 17 September 1953 The reasons for credit restrictions starting October 1951 are rather clear, and were repeated widely : inflation kept rising and France was running a permanent trade deficit. Once again, the central bank pointed its finger at the growth rate of credit, accused to fuel the current account deficit (PVCG, 11 October 1951).

In order to reduce the demand for credit, two main measures were adopted : a rise in the discount rate (from 2,5 to 3%, and then to 4% on 8 November 1951) and new and more rigorous discount ceilings : banks could exceed their ceiling only by 10% and a special discount rate (*escompte D*) applied to the overruns. The Governor viewed these two measures (discount rate and discount ceilings) as complementary but gave a more effective weight to direct credit control : "Even though credit restrictions are more effi-

cient from a practical point of view, a rise in the discount rate has a greater psychological effect on the French and the foreign opinion. It clearly shows that all possible efforts will be made in order to defend the currency."
These measures were not well received by bankers and businessmen. For example, there was an interesting exchange between the Governor of the Banque of France and the President of the Chamber of Commerce of Paris (letters dated from 15, 25 October, 30 November, 8 December). The latter was complaining that the restrictive monetary policy was very dangerous for the development of production and business. The Governor answered : "I do not deny that a rigorous monetary policy is likely to cause some troubles and real difficulties to the firms, but there is no sign today (looking at the index of industrial production and the level of unemployment) that this policy has pushed the country into a crisis. [...] To tell you the truth, the difficulties that firm managers are facing today are essentially due to the recent worsening of an old inflationist situation and not to the monetary policy that has been implemented to fight it." (30 November). This exchange highlights the motivation of credit restrictions and shows that, for the French central bank, inflation was clearly the priority ; production, firm profits and unemployment were of little interest for monetary policy choices.

The end of the restrictive period occurs on 17 September 1953[9], after three weeks of negotiations between the Government and the central bank. As soon as early September, rumors were already beginning to circulate in the Press and among bankers. The central bank decreased the discount rate from 4% to 3,5% and, most of all, the National Council of Credit adopted many measures to ease banking credits : rise of discount ceilings and suppression of a half of banking tarifs. The Governor of the Banque of France considered these measures - claimed by the Government - as necessary but he also pointed out the contradictions in the Government's claims : " We must consider how difficult the Government's task is. Indeed, on one hand it wants French prices to become more competitive and the threat of a rise in wages to disappear , and on the other hand it wants the economic trend to be stronger than in the past. For this reason, one can speak of contradictory views." (PVCG, 17 september 1953, p.751)

11 Avril 1957 - 5 Février 1959

[9]There is a consensus about this shift in the literature, cf Guillaumont-Jeanneney 1969)

On 11 April 1957, the General Council of the Banque of France decided to increase its discount rate from 3% to 4% because the deficit of the balance of payments kept increasing as well as the growth rate of credit. Exchange reserves had decreased by an amount of 300 millions dollars since January 1957. This measure applied to short and mid-term credit but not to treasury bills and credit to export activities. According to the Governor of the Banque, the main justification for this increase was that it took place in a general coherent plan implemented by the Governement in order to stabilize the price level, including wage restrictions and reductions in taxes. The General Council believed that the increase of the bank rate, together with governmental measures, would have a strong psychological effect and consequently be sufficient to slow down the growth rate of credit. This increase was intended to work together with price control that the Government had implemented a few months before. Except for consumer credit (*vente à tempérament*)[10], no quantitative restrictions was imposed on credit. Nevertheless, these decisions sent a strong signal meaning that France had entered a restrictive monetary policy. On 25 April, the Banque of France also raised the discount rate for banks exceeding their discount limits.

A few weeks later, in June, the newly appointed Minister of Economics and Finance, Felix Gaillard, completely changed the orientation of the economic policy and proposed new measures. In order to decrease the government deficit, he reduced expenditures and raised taxes. In order to fight inflation, he gave up price controls that had a counterproductive effect. In order to solve the trade deficit, he decided a 'disguised' devaluation, beginning in August : purchase of foreign currencies were taxed by an amount of 20% (cf Koch, 1982, p.309 ; Feiertag 2006, p.528). Gaillard also obtained advances from the Banque (300 billion) in order to finance government policies. In counterpart of these measures, the Banque of France continued to deepen its restrictive policy. On 26 June, it imposed new restrictions on consumer credit, extended the treasury coefficient (25% of bank assets must be compounded of treasury bonds), and started new discussions with bankers in order to offset the inflationary pressures caused by the 300 billion advance : "organize limitations on credit in order to neutralize the flow of money that is going to rush into the money market as a consequence of the new advances to the State. We know that, in this matter, the limitations can be implemented by two means : reserves or

[10]Decision of the National Credit Council, 11 April 1957. The minimum initial amount for consumer credit rose from 25 to 30 %, and the duration of consumer credit decreased from 21 to 18 months for cars, and 15 to 12 months for household appliances

ceilings"(PVCG 26 juin, p.453). Then, in July, the CNC decreased discount ceilings for each bank by an amount of 10%, and the discount rate applying to banks that exceeded their discount ceilings by an amount higher than 10% (*super enfer*) increased to reach 10%. In August, in order to sustain the 'disguised devaluation', the discount ceilings decreased by 10% again and the discount rate increased from 4 to 5% (from 6 to 7 % for the so called 'enfer' rate, that is the rate applying to banks exceeding their ceiling by less than 10%). On November 28, discount ceilings are decreased by 10% once more, and the 'enfer' rate increased to 8%.

Despite a positive effect on the balance of payments, these restrictive measures did not prove to be sufficient in order to stabilize inflation. As expected, the progression of short-term credits fell in the 3 and 4th quarters of 1957, and credit from the Banque of France also decreased for the first time since 1955. But inflation in the third semester 1957 reached 2,8%, the highest level since December 1951. (cf CNC, deliberation , 7 February 1958). For these reasons, the Banque of France decided to adopt a stricter policy that would definitely stabilize internal demand and inflation. Adopted on 5 February 1958, this new measure - ceilings on credit expansion - marked a departure from the previous credit control policy : limitations not only applied to discount ceilings or reserves but directly to the growth rate of credit. Hence the new decision of the CNC forced banks to increase their credit to the economy in the same percentage as in the last quarter of 1957 (+ 3%, provided that banks furnish justifications). Banks which exceeded this percentage could be kept from discounting facilities. The motives were well stated in letters from the Governor to the Economy and Finance minister, and to the President of Professional Bankers (12 February 1958) : "Regarding private credit, a relentless action had been carried out for long in order to fight inflationist pressures. The measures taken in 1957 have led to a serious slowdown of the growth of banking credits. But these credits have nevertheless continued to grow a little bit. Thus, in order to maintain the ongoing effort, it seems necessary to adopt new measures to stabilize the amount of credit directly ." This new policy, called *encadrement du crédit*[11] (official limits on credit expansion) was thus more rigorously defined than previous broad measures of credit control. Nevertheless, as stated by the Bank Governor, this new instrument did not break continuity with the previous policy ; it carried on the restrictive monetary policy started in April 1957

[11] This expression is sometimes said to have been coined by Valerie Giscard D'Estaing, when he became Secretary of State for Finances in 1959.

without changing its nature. Pressures from the IMF and EUP had a strong influence on these decisions (PVCG, 5 February 1958, Feiertag 2006).
This official quantitative credit control ended on 5 February 1959. Before this date, there had been two small changes in the policy. In July, because there were too many banks exceeding their discount limits, the *enfer* and *super enfer* rates decreased to their 1957 level. And in October, the discount rate fell from 5% to 4,5%. This small decrease was not intended to change the nature of monetary policy : it was just a response to the amelioration of the trade balance. The Governor clearly excluded to ease the 'quantitative' restrictions (that is to rise discount ceilings or to abolish ceilings on the expansion of credit), for economic as well as political reasons : despite the recent success of the General de Gaulle, foreign countries were still wary of the French political situation and it would have been premature to ease monetary policy. (PVCG, 16 octobre 1958). At the end of December, some influent policymakers , including Jacques Rueff, required the rise of the bank rate, in order to create a psychological effect over foreign countries. The reason was the launch of the new French franc in January 1959. But the Banque de France argued that the rate was already sufficiently high compared to other countries (2,5 % in the USA, 4% in West Germany and England. In February, the discount rate fell to 4,25 % and, most of all, ceilings on credits expansion were abolished, sending a strong signal toward the end of the monetary restriction . The reasons for such a measure were first a balance of payment surplus, second the need to increase mid-term credit to finance public and private investment. From February to April, monetary policy then became clearly expansive (decrease of the discount rate, rise of discount ceilings).

28 February 1963 - 24 June 1965 On 28 February 1963, the Banque of France reestablished an official ceiling on the expansion of banking credit (*encadrement du crédit*). As stated during the General council of the Bank, the reason for such a restriction was that 'there was an abnormal rise of flows in the money market threatening the internal and external equilibrium of the currency'. Thus, while banking credits have increased by 17,4% in 1962, monetary authorities stated that the total growth rate of credit in 1963 must not exceed 12%. In September 1963, this limit was changed to 10% (from September 1963 to September 1964). The treasury coefficient was also increased, from 32 to 35 %, and then to 36% in May. The 10% limit on credit was reconducted in September 1964 for one year, but in June 1965, the Banque prematurely ended this

official credit control. According to the Governor, ending this measure before September was a strong signal because 'this reglementation would have been maintained if the monetary situation had remained the same as it was until recently'. The justification is as follows : "The suspension of credit control (*encadrement du crédit*) is essentially justified by the fact that banks have recently managed to maintain quite easily their credit in the limits that have been imposed. [...]It seems that the moment is well-suited to end these measures because, even though they may not disturb banking activities in general anymore, they cause some malfunctionings because they apply to all kinds of companies and thus create some rents and discourage the dynamism of more active firms. There is no maintaining measures that would, in a way or another, lead to a sclerosis of the economy."(PVCG, 24 June 1965)."(PVCG, 24 June 1965)

Because this restrictive episode was mainly due to inflationary pressures rather than balance of payments problems, the discount rate only played a minor role. He was raised from 3,5 to 4% in November 1963 and decreased to 3,5% in April 1965.

(3 July) 12 November 1968 - 27 October 1970

Due to a new large trade deficit, the Banque of France increased its discount rate from 3,5% to 5% on 3 July 1968. The reason is straightforward : "the state of our foreign reserves. In such a situation, it is not possible to maintain interest rates clearly inferior to those prevailing on international money market - especially the US market and the Euro-Dollar market - anymore, [...] The interest rate must be increased in order to stop the haemorrhage" (PVCG, 3 July 1968). It is the first time since World War II that a decision regarding the interest rate is taken without any further considerations on credit or on inflation. Contrary to April 1957, the National Credit Council is not involved, and this decision does not take place in a broad context of fiscal and credit restrictions. The signal sent by the Banque de France was not intended to announce the beginning of a restrictive monetary policy, but to show to foreign investors that the French Central Bank and the Government would defend the value of the currency. Furthermore, given the weak elasticity of banking credit to the discount rate, this decision alone was not likely to affect prices, credit and production.

Conversely, the rise in the bank rate (from 5 to 6%) that happened on 12 November showed a very different spirit. First, the justification of the measure was much broader and highlighted a general demand problem that monetary policy must address : "the evo-

lution of the foreign exchange market, as well as the domestic monetary situation reveal that the abundance of liquidities is not an accident but has been accepted to contribute to a new acceleration of the economy in a context of sustained expansion" (PVCG, 12 November 1968, p.785). Second, and foremost, the measures taken are not only 'qualitative' (discount rate) but quantitative. : the rate of obligatory reserves [12] rose from 4,5 to 5,5%, and new official limitations on credit were imposed (a maximum of a 4% rise from 30 September to 31 December[13]). But contrary to previous restrictive episodes, important exceptions not only applied to credit to exports[14] : mid-term credit financing housing, personal and household goods and exports were not included in the limitations. Though, according to the Governor of the Banque of France, these restrictions did not differ strongly from 1958 and 1963, because banks had always been told to impose their restrictions on loans that were not financing investment, construction and exports.
The limitations were extended in 1969 and 1970, and the same exceptions applied. Each year, the growth rate of credit could not exceed 3%. On August 1970, a lively debate took place between the Finance Minister and the Banque of France. The growth rate of credit had been stabilized but the Banque wanted to wait for several months in order to be certain of the improvement. The Minister especially argued that French monetary policy was too strict compared to foreign countries and that "main indexes show a slowdown in economic activity that would justify a slight relaxation of credit controls " (PVCG, 27 August 1970). Finally, the Banque agreed to decrease its discount rate from 8% to 7,5 % in order to get close to international standards (Germany and UK had a 7% bank rate) but insisted to maintain an official restrictive policy and credit controls (PVCG, 27 August 1970, p.494 et alii). Finally, on 27 October 1970, the ceilings on credit expansion were abolished and the discount rate decreased to 7%.

November 1972 - 1973 The last restrictive episode is the most difficult to identify because the end of 1973 is a turning point from which the way French monetary policy was implemented changed altogether. From then on, limitations on credit were not officially removed before 1984. Another reason is the important money market reform of 1971 that allowed money market rate to fall below the discount rate of the Banque of France. This measure was recommended in the influent 1969 *Report on Monetary Policy*

[12] in 1967, obligatory reserves had replaced the treasury coefficient
[13] In 1967, the rise of credit for the last quarter, was 9%
[14] The discount rate applying to credit to exports remained at only 2%

by Marjolin, Sadrin and Wormser, and would lead to the end of the discounting activity of the Banque of France in 1973. Consequently, discount ceilings were abolished in 1972 and the bank rate (then influencing the money market rate) became a penalty rate. The Banque increased slightly its rate on November 2 (from 5,75 to 6 %) in order to fight inflation, in agreement with Governement considerations, as clearly stated in the General Council : "this measure will first mean, in a symbolic way, that we have entered a period in which money will be more expensive and more difficult to obtain. Second, it will set, at a reasonable level, the penalty rate applying to banks that do not own enough assets to be traded on the money market" (PVCG, 2 november 1972). For similar reasons, the bank rate increased to reach 7,5% on 30 November. In the minds of policymakers, changes of the discount rate would have a similar effect than former dicount ceilings. Despite this strong psychological signal, no other quantitative measure was taken before 12 December 1972 when the requirement on obligatory reserves was raised and ceilings on the growth rate of credit (*encadrement du crédit*) were established again : bank lending on 3 April 1973 should not exceed by over 19 percent the lending on 5 April 1972. Since total credit had already grown by more than 12 % from April to December, 1972, this measure was really restrictive. On 28 December, the bank rate was increased to reach 8%.

For several reasons, this policy never clearly ended before 1984 but its nature radically changed at the end of 1973. What has been designed as a temporary very restrictive policy became a permanent policy far less restrictive. The reasons for such a change are clearly beyond the scope of this paper : because of economic (oil shocks and stagflation, end of the Bretton Woods system) and political factors (a new President and a new Prime Minister at the beginning of 1974), the nature of credit control radically changed in the second half of the 70's.

For these reasons, I stop my study in October 1973, before the first oil shock. Doing so, I avoid the analysis to be biased by a huge supply shock, and we take into account that this shock changed the nature of monetary policy and that our method of identification of monetary policy episodes is not relevant anymore after 1973. To make sure that the results are not biased by the fact that the sample finishes in the middle of a restrictive episode, I will show later that main conclusions are not affected by the removal of the period November 1972- September 1973.

Table 1: **Dummy variable of monetary restrictions**

Dummy variable = 1

Monthly data	alternative	**Quarterly data**	alternative
10/1948 - 06/1950	- 04/1950	4:1948 - 2:1950	-
10/1951 - 09/1953	-	4:1951 - 4:1953	-
04/1957 - 02/1959	06/1957 -	2:1957 - 1:1959	-
03/1963 - 07/1965	-	1:1963 - 3:1965	
11/1968 - 11/1970	07/1968-	4:1968 - 4:1970	3:1968 -
11/1972 - 10/1973	end in 10/1972	4:1972 - 4 :1973	end in 3:1972

1.4 Converting the episodes into dummies

Given the various instruments that have been used, there is no way to quantify these restrictive episodes except to code them as dummy variables. The information we have is thus far less precise than in Romer and Romer (2004)[15] but is better than in Romer and Romer (1989, 1994)[16] : the objectives of the episodes are quite homogeneous and, most of all, we have a start date and a finish date. Thus we can choose an equal weight for each of them and specify exactly the duration of the shock since we know exactly the length of credit restrictions caused by monetary policy. Romer and Romer (1989) wrote that they could not specify duration because, in the US case, the ends of the policies were much more gradual and then more difficult to identify. Thus the nature of the shocks we have defined is very different from Romer and Romer (1989) since their dummy only specified the initial date of the shock, but not its duration.

Following the narrative identification, I construct a benchmark series reported in Table 1, with alternative specifications that will be tested when the dates are debatable. [17]

[15]The information they have from the archives of the Fed and the way US policy was conducted allow them to regress the intended change in Fed fund rate on central bank's forecasts

[16]They use a dummy variable that takes the value 1 the month a restrictive policy is implemented, without being able to specify the duration of the restriction

[17]When a restrictive decision takes place at the end of the month (On 25th or 30th for instance), I do not code this month as a restrictive month. This assumptions is justified further below, in the discussion of the Cholesky ordering.

1.5 Assessing exogeneity : estimation of the monetary policy reaction function

According to what can be read in the archives, the decision to restrict credit depended mainly on the evolution of the price level and on the variation of the current account. Even if the General council expressed some considerations about industrial production and unemployment, monetary policy restrictions were not imposed in response to these variables. The question of the exogeneity of credit control to the growth rate of credit is more complex. Banking credits were controlled because they were a mean to control inflation. In other words, they were an instrument , not the final objective of the policy. If credit had grown without fueling inflation, the central bank would not have imposed controls on them. Thus, the estimation of the impact of credit control on credit may not suffer from an important endogeneity bias as with inflation or the variation of the current account.

All these assertions can be tested. Indeed, we can estimate the impact of economic variables on the decision to restrict credit with a simple forward looking reaction function inspired from Clarida, Gali and Gertler (1998, 2000). The rationale for a forward looking rule is as follows : even though members of the General council did not make decisions depending on quantitative forecasts, they looked at past value of economic variables and discussed the expected evolution of these variables with or without the intervention of the central bank. Thus, we can estimate the policy function of the central bank as follows : credit control depended on the expected inflation rate, on the expected variation of the current account and on the expected growth rate of short term credit. We also control for other variables such as expected output and expected unemployment.

$$M_t = \alpha + \beta I^e_{t+1} + \delta C^e_{t+1} + \gamma CA^e_{t+1} + \eta Y^e_{t+1} + \epsilon_t$$

where M is the dummy variable that takes the value 1 in credit control episodes, I is inflation, C is the growth rate of credit and CA is the change in the current account and Y can be the variation of industrial production or the unemployment rate.

In order to avoid endogeneity problems, the equation has to estimated by General Method of Moments (Hansen, 1982), that is the expected variables are instrumented by variables that are exogenous to the residuals. Indeed, expectations were formulated in function of the past values of the variables. As instruments, in line with the narrative

evidence, I use the past values of the right hand side variables as well as seasonal dummy variables. The assumption requires that M_t had no influence on past values of the explicative variables. I use the raw variables rather than the change from a target, or output gap, because the dependent variable is in level and the notions of targeted inflation or potential output were not used by the General Council of the Banque. Furthermore, estimations using the output gap or the difference of inflation from its trend did not produce significative results. The main assumption underlying this specification is that each period's decision does not depend on previous periods' decisions. Each quarter, the central bank wonders whether credit must be controlled or not. Thus I assume that there is no (political or administrative) cost of changes from a restrictive episode to a non restrictive episode. The alternative assumption would be to take into account the path dependency of credit control and to include lags of the variable M. Choosing this alternative, only lags of M are significant because the path dependency effect strongly supplants the decision effect. Since, here, we want to focus on the decision of M given the anticipations of economic variables, it is more coherent to investigate how much M depends on anticipations rather than on path dependency.
This estimation used quarterly data because monthly data are only available for inflation and output. 4 lags (quarters) of each variables are used as instruments. Table 2 presents the results of several alternative specifications, depending on the variables that are included. Estimations include the variation of the current account start only in 1950 and then have 90 observations, while if the CA is not included there are 103 observations.

The results clearly show a significant impact of the inflation rate and of the variations of the current account on the choice of monetary policy. The other variables are not significant and their coefficient are very weak. The coefficient of inflation is positive while the coefficient of the variation of the CA is negative. Thus the econometric estimations confirm that the French Central Bank's decisions to impose restrictions on credit where positively correlated to the expected inflation rate, and negatively correlated to the change in the current account (that is, restrictive monetary policy was implemented when the current account was worsening), but were not significantly correlated to the variation of credit and output. Since production and unemployment cannot be used to forecast the dummy variable, the criticism of Leeper (1997) toward the Romers' measure, does not apply here.

Table 2: **Estimation of forward looking reaction functions**

	Inflation	Current account	Credit	Poduction	Unemployment
(1)	0.23***			0.04	
	(.00)			(.19)	
(2)	0.21***	-0.52***	0.02		
	(.00)	(.00)	(.16)		
(3)	0.23***	-0.54***	0.02	-0.02	
	(.01)	(.00)	(.12)	(.39)	
(4)	0.25***	-0.52***	0.02	-0.02	0.01
	(.00)	(.00)	(.28)	(.23)	(.45)

Notes : significativity level: *:10% **:5% ***:1%. P-values are in parentheses.

Each right hand side variable is instrumented by 4 lags of its own past value and 4 lags of the values of other variables (from t-1 to t-4), and $M_{t-1}, M_{t-2}, M_{t-3}, M_{t-4}$.

2 Impact of monetary restrictions on production and unemployment

2.1 Estimation

I first choose to use the full information I have : the series that have been constructed is a dummy variable which takes the value 1 when there are restrictive credit controls and 0 otherwise. The main idea is then to estimate the impact of this exogenous dummy variable on output. I then introduce this variable in a VAR (vector autoregressions). Using a VAR rather than a single equation has two justifications. First since VAR are the most common tool used for estimations of the effects of monetary policy, comparisons are easier to draw with other works. Second, VAR is a way to control for the past behavior of every variables in the system, including the dummy. Thus we take into account both the path dependency of credit control decisions and the correlation between output and the dummy. In other words the VAR allow to take into account the fact that even though the decision to control credit is exogenous to output, episodes of credit control and output might be positively correlated because output moves with inflation.
Consequently, we use our narrative approach to solve the identification and the interpretation problems in the VAR. The identification problem arises because of the need to impose restrictions on the matrix to compute the impulse response functions (Choleski

decomposition) : one has to impose that the shock affects contemporaneously a variable while it affects the other one with a lag. The interpretation problem arises because, even though the impulse response function had been constructed, it is still difficult to interpret the response of a variable to a shock on another variable in terms of causality since, a priori, everything is endogenous in the VAR[18]. Thus, our knowledge that the monetary restrictions are exogenous to output help us to choose properly the Cholesky composition and, most of all, to interpret in causal terms the impulse response functions. The fact that the VAR allows the monetary restrictions to depend on output is just a control.[19]
For reasons of stationarity [20] as well as for interpretation, the output variable is in difference (percentage change). I will relax these assumptions and compare with other specifications below and in appendix A. With monthly variables, I use 36 lags ; first because it has been shown by Romer and Romer that this is necessary to use such lags to take into account fully the effects of US monetary policy, second because the AIC and BIC information criteria in our estimations in the French case have confirmed that 36 months are the most reasonable lags. With a two variables VAR , the basic specification is as follows :

$$\Delta y_t = \alpha_1 + \sum_{k=1}^{11} \alpha_{1k} D_{kt} + \sum_{i=1}^{36} \alpha_{1i} \Delta y_{t-i} + \sum_{j=0}^{36} \alpha_{1j} M_{t-j} + \epsilon_{1t}$$

$$M_t = \alpha_2 + \sum_{k=1}^{11} \alpha_{2k} D_{kt} + \sum_{i=0}^{36} \alpha_{2i} \Delta y_{t-i} + \sum_{j=1}^{36} \alpha_{2j} M_{t-j} + \epsilon_{2t}$$

where Δy_t is the percentage change of output, M_t is the dummy variable equal to 1 in a period of credit control and 0 otherwise, and D_t is a monthly dummy[21].
As in Romer and Romer (2004, 2009) and Ramey and Shapiro (1998), my basic specification includes only two variables. The rationale is that all the other shocks affecting

[18]Identifications problems in the VAR are very well explained in Leeper (1997), Bagliano and Favero (1998), Cochrane (1998) and Stock and Watson (2001). I follow here the later paper that especially praises for an exploitation of institutional knowledge in order to solve the identification problem.

[19]in fact it does not change very much the results, reason why Romer and Romer (2004, 2009) and Ramey (2008) use both methods.

[20]As expected, stationarity tests such as Dickey Fuller and Perron's say that the dummy variable is stationary. This result is quite artificial because the dummy is , by construction, a succession of structural breaks, but is bounded, hence stationary.

[21]We have also run all the regressions in the paper with seasonally adjusted data and without the dummies. Either the adjusted series were available from the INSEE, either we estimated them using the X12 algorithm in Eviews. None of the results are sensitive to this change.

output are not systematic, are not correlated with monetary shocks and will thus be taken into account in the output lags. One important argument supporting this assumption is that there was not important oil or commodity prices shocks during the period. Thus criticisms of the narrative approach , like in Hoover and Perez (1994), and discussions about commodity prices in the VAR (Romer and Romer, 2004) are not relevant here. [22] With sufficient degrees of freedom, the results are unchanged with a 3 or 4 variables traditional VAR (see below, section 2.2). Since the general results are robust, I will lkeep using the 2 variables specification in order to save degrees of freedom when working with sub periods or with quarterly data.

In order to calculate impulse response functions, we need to make assumptions in the Cholesky decomposition. The conventional assumption (Christiano, Eichenbaum, Evans 1999) is that a monetary policy shock affects the monetary policy variable but does not affect output within the month. We think that in the French case of credit control, this assumption is debatable. When a decision is taken during the first week of the month (rise of bank rate, limitation of the growth of credit or new discount ceilings), it may affect production within the month in several ways : negatively, because in case of bank rate rise or modification of discount ceilings the impact of the measures on banks are immediate , or positively, because as soon as they know the new monetary policy rules the firms can produce more in order to prevent from next months' credit restrictions. We have no way to distinguish between these two effects, but it will be a mistake to exclude them *a priori*. Thus I allow that a shock on the dummy variable can affect output within the month if the value 1 of the dummy variable stands for a decision that has been taken at the beginning of the month. Thus, when the decision to restrict money growth has been taken at the end of the month, I do not give the value 1 to this month but only to the following months (cf Table 1). For example, for the episode starting on February 27 1963, the value of the February 1963 dummy will be zero.[23]

I interpret a shock on the dummy variable that causes this variable to increase as a restrictive monetary shock.[24]

[22] Most important would be the problems of the potential effects of wars in Indochina (1946 -1954) and Algeria (1954-1962). But, together, these wars lasted over 16 years, more than the half of the period, and thus are not temporary shocks.

[23] However the alternative assumption (a monetary shock does not affect output within the month) does not change the results in our estimations.

[24] Some problems may arise because of the introduction of an endogenous dummy variable in the VAR. Indeed, the OLS estimator may suffer from heteroscedasticity. But it seems more relevant to include the

Estimations results for the whole period are reported in *Figure 2 and 3* (figures are reported at the end of the paper, appendix B). I estimate first the impact of a shock on the percentage change of the log of industrial production and then on the percentage change of the unemployment rate. The IRF that are reported are accumulated response functions.

The standard errors are computed with Monte Carlo simulations (bootstrap) using 1000 repetitions in Eviews. I present Eviews' graphs displaying *2 standard error bands.* while the standard literature (Christiano, Eichenbaum, Evans, 1999, Romer and Romer, 1989, 2004) displays only 1 standard error band. The standard errors reported here have the same magnitude as errors in usual VAR of the monetary policy.

The responses read as follows : after 25 months, the percentage change of industrial production (Figure 2) is 1,3% (exponential of $0,22$) lower than what it would have been without a monetary shock, and the percentage change of the unemployment rate (Figure 3) is 4% higher than what it would have been without the shock.

Three features are particularly striking :

- industrial production starts to fall almost immediately, as soon as the second month after the shock. This is a sharp contrast with many studies that often find a 3-8 months delay. The effect on unemployment is much more delayed : around 10 months. Labor market institutions in France over the period (indexed wages, powerful unions) and the general low level of unemployment may furnish good explanations to the delayed response of the unemployment (Figure 3)

- both for industrial production and unemployment, the marginal impact is maximum after 25 months and vanishes around 36 months. Surprisingly this pattern is very similar to the one observed for the US by Romer and Romer (1989, 2004), despite the strong differences between the instruments of monetary policy between US and France, and despite the 'Great Moderation' is not included in the sample. As stated by Cochrane (2004), this result is important for monetary theory since current models are not able to explain these very long lasting effects. Indeed, models of monetary policy including rigidities (mainly sticky prices) can explain lags

dummy as endogeneous rather than exogeneous as in Christiano et alii (1998), especially when inflation is added to the VAR. But the interpretation of the magnitude of the shock must be done with caution because the dummy variable is considered as a continuous variable when the IRF is computed, that is the impact of a shock on the dummy is assumed to be continuous rather than discrete.

in the response of output to a shock but explain very badly the persistence of the impact.

- although the effect of monetary policy is significant and follows a well-identified pattern, it is not very strong. This results is not so surprising given that the period under study was a period of high growth with a very low unemployment rate (contrary to the 1980s which are often included in studies of monetary policy with VAR). For both production and unemployment (Figures 2 and 3), the maximum of the impact (1,3% and 4%) are almost equal to the standard deviation of these series over the period. A simple variance decomposition analysis show that around 10% of the variance of production and 20% of the variance of unemployment is explained by the shock on the monetary dummy (the remaining is thus explained by the lags of other variables). Figure 4 presents such variance decompositions for a 4 variables VAR (dummy, unemployment, production, inflation). The share of the variance explained by monetary policy is an important number since the VAR include 36 lags of output... Since there were not big supply shocks during the period, these results suggest that credit controls were one of the most important source of fluctuations, even though the fluctuations remained low.

Figure 5 shows that these results still hold when the dummy variable is included in a 4 variables VAR with inflation, production and unemployment. In such a VAR, inflation is ordered before the dummy variable in the Cholesky decomposition in order to account for the causation of inflation on monetary policy. Because of the endogeneity between inflation and the dummy variable, the response of inflation is delayed and the standard errors are very large. This response is thus not likely not be interpretable.
Figure 6 presents the IRF of a different index of industrial production. This other official index, also provided by the French National Institute of Economics and Statistics, included the sector of construction but since there was no good data about production in this sector, the number of employed workers was used as a proxy. Thus this index was a composite of the number of workers in construction and of the production in other sectors. The response of this index to monetary restrictions reflects this composite aspect : the delay of the response of the unemployment rate causes this composite index to respond less rapidly to a shock.

2.2 Comparisons with other measures

In order to assess the relevance and the contribution of the estimations, I compare these results with usual estimation methods of the impact of monetary policy. Without specific knowledge of French monetary policy over the period, one would presumably run a 4 variables VAR with inflation, variation of the log of production, variation of the unemployment rate and the following measures of monetary policy : either the French discount rate, or the variation of the money base (M2) or the Fed discount rate. The rationale for the Fed fund rate would be to find an exogenous measure of monetary policy[25] . The results of a 4 variables VAR, presented in *Figures, 5, 7, 8, 9,* clearly shows that these 3 other measures suffer from an endogeneity problem compared to the dummy variable : industrial production responds positively to a rise of the French bank rate and negatively to an increase of the money supply. Rightly, the VAR with the Fed discount rate does not experience such a problem and industrial production responds in the normal way. Nevertheless, the overall effect is less important, the impact on unemployment is not significant and there is a strange pattern of industrial production after 10 months. Undoubtedly, the 'narrative' measure of monetary policy is leading to better estimations and is the only one to produce findings that are coherent with the VAR literature that have tried to address efficiently the identification problem.

In the previous sections I have assumed that taking into account the duration of the monetary restrictions in the dummy variable was necessary. But one might argue that only the change from a normal regime to a regime of credit control is important in terms of monetary policy. Thus I construct a new dummy variable that takes the value 1 only in the first month of the monetary restriction. Then this measure turns out to be the same than the one used by Romer and Romer (1989, 1994). Figure 10 and 11 shows that industrial production and unemployment responded to monetary shocks with a more subsequent lag than in previous estimations (respectively 10 months rather than 2, and 17 rather than 14 months). This new lag is comparable to the one in Romer and Romer (1989, 1994). Interestingly, the other features of the IRF (value, maximum at 25 months) are unchanged. These comparisons lead to an important conclusion : accounting for the duration of the restrictive monetary policy reduces considerably the lag of the response of output to a monetary shock. We interpret this result in two ways. First, taking only

[25]For this reason, Mojon (1998) used the German rate in his study on French monetary policy during the 80's.

the change from an accommodating policy to a restrictive policy does not rightly take into account the behavior of firms and households. For instance the behavior of Firms and households at time t is not only influenced by a change in monetary policy that happened several months before but is also explained by the ongoing restrictions and credit and by the fact that, if the change of monetary policy had been credible, they expect the restriction to last for some months (years). They have no incentive to delay their response to production and they react immediately. Second, taking into account the duration of the monetary restriction causes that the shock in a VAR does not arise in isolation : if the shock arises on the 12th month of a monetary restriction, its effect is immediate since the preceding months are likely to have been months of credit control.
Thus, it is not obvious to say whether the differences between accounting or not for the duration express real economic effects or only econometrical issues. Nevertheless, since the maximum of the impact (25 months) remains the same with both measures, the econometrical argument surely does not explain all the differences. In particular, these findings, and the argumentation about the duration of the shock, may explain the 'timing problem' highlighted by Ramey (2009), that is why she finds such a difference of lags between her narrative measure of fiscal shock (dummy variable) and other measures.
Other robustness checks, including modifications of the sample size and the dummy variable, and a discussion of cointegration, are reported in Appendix A. None of them changes the main results and interpretations.

3 Is the impact the same over the whole period ? Explaining the delay of production response

For historical as well as theoretical reasons, it is important to estimate whether previous results hold over the whole period or we observe differences that can be interpreted in economic terms.
Non surprisingly, tests of structural breaks over the sample are non significant since there is no important exogenous shock that would modify the relationship between monetary policy and output. Nevertheless important changes occured in the French economy at the end of the 1950s and it is worth splitting the sample in two periods. The changes that occured at the end of the 1950s were gradual and endogenous ; they result from a slow

movement from a catch-up and reconstructing economy with a very interventionist State to a rebuilt economy where the reconstruction is almost over and free market forces are becoming more powerful (Sicsic and Wyplosz, 1995, Quenouelle-Corre 2005). During the first period, France restarts its economy in a context of shortages and rationing under the strong supervision of the Planning Office. The reconstruction of industry is the first priority. The political environment is still unstable : governments only last few months, alliances change rapidly and wars (Indochina and then Algeria) seize the public debate. In 1958, France joins the European Economic Community and manages its return to external convertibility. The creation of the Vth Republic opens the way to a more stable political life and the Rueff Plan, implemented in December 1958, introduce a new path of fiscal discipline and development of free market. December 1958 is thus a turning point in French economic history. Did this change have consequences on the transmission and the effects of monetary policy ?

Estimations with monthly data reported in *Figures 12 and 13* show a strong difference between the two periods. After 1958, the impact is weaker, less significant and, most of all, is not immediate anymore. Industrial production starts to fall after 10 months. Interestingly, before and after 1958, the maximum is still 25 months.

These changes in the response of production to monetary policy are not likely to be explained by the new political regime or the creation of the EEC. Two more plausible explanations are competing : either the implementation of credit control and monetary policy has become less effective (i.e its direct effect on credit growth is delayed), or the mechanisms of transmission of monetary policy have changed (i.e the fall of credit leads to a decrease of output through a different channel). To distinguish between these explanations, we need a wider range of data - credit , consumption , and investment - that are only available in a quarterly format[26].

Dividing the sample in two subperiods, we observe that, as for production, the delay

[26]Statistics on credit are from the National Council of Credit. They are computed from the forms that banks had to send monthly to the Banque of France. Due to many errors in reports, quarterly stats are more reliable than monthly statistics because they were readjusted. Banks only had to declare credit superior to a certain amount. According to the estimations of the Banque (comparisons with total banks balance sheets) these credits represented 80% of the total along the period. Thus these series does not take into account small credit to small business or credits to households. Investment and households consumption statistics are from the INSEE. All the series were deflated substracting the inflation rate to growth rate of the variable.

of the response of households consumption and investment to a monetary shock is longer after 1958 than before (*Figures 16, 17, 18, 19*). For practical matters, I only report results with 3 variables for all these figures since results are similar between a VAR with 2 or 3 variables. The response of mid-term credit follows a similar pattern while the response of short term credit falls immediately in both subperiods.

Thus the lag of the response of production after 1958 is not due to a complete change in credit control effects since short term credit does not experience such a delay. Nevertheless, the delayed response of mid-term credit provides an explanation to the delayed response of investment. The delayed response of mid-term credit after 1958 is easily explained by the selectivity of credit controls in the restrictive period 1968-1970. Indeed , because of the balance of trade deficit and of the new priorities given to housing by the Planning Office, all mid term credit and then mid-term credit to construction and to exportation were excluded of the control. Thus, selective measures on mid-term credit provides an explanation to the delay of the response of investment. Furthermore investment only explains a small part of the change in the response of production after 1958 because values of the investment response are very close in both periods while values of the production response are divided by two between the two periods. On the contrary, the response of consumption after 1958 has two common characteristics with the production response : a lag of at least 4 quarters and a smaller value compared with the previous period. So what can explain the change in the response of consumption after 1958 ? To my mind the mechanism is working through savings. During the 1950s, the French economy is in a phase of reconstruction ; saving is low and illiquid because of the few possibilities offered by banks to buy liquid assets[27]. In the 1960s, the economy is booming, there is a general wealth effect, saving is increasing and most of all, liquid savings have taken off, as shown in the graph below (*Figure 1*). These important changes in French economy, households wealth and financial development allow households to smooth their consumption so that the response of overall households consumption is delayed and less sensitive to a monetary restriction. Since households are smoothing their consumptions, it means that during recessions they are saving a lower proportion of their revenues in order to counteract a loss of wealth. Indeed, the saving rate responds negatively to a monetary shock after 1958 while there is no significant effect before 1958 *(Figures 20 and*

[27]Higher inflation and greater economic and political uncertainty may also explain the low rate of liquid savings during the 1950s compared to the 1960s

21).

After 1958, credit controls started to have a more delayed and a weaker effect on the economy. Weaker constraints on the controls (especially for mid-term credit) can explain a part of the lag of the response of investment and a part of the weaker effect on production. On the other hand, the better ability of households to use their savings during restrictive periods explains partly the greater lag and the weaker level of the response of consumption to shocks, and then another part of the pattern of production.

These findings show that a lag in the response of production to a monetary shock is not a universal phenomenon, or a statistical effect due to the VAR methodology. When identification is properly made, the lag of the response offers real interpretation in terms of the transmission mechanism of a monetary shock.

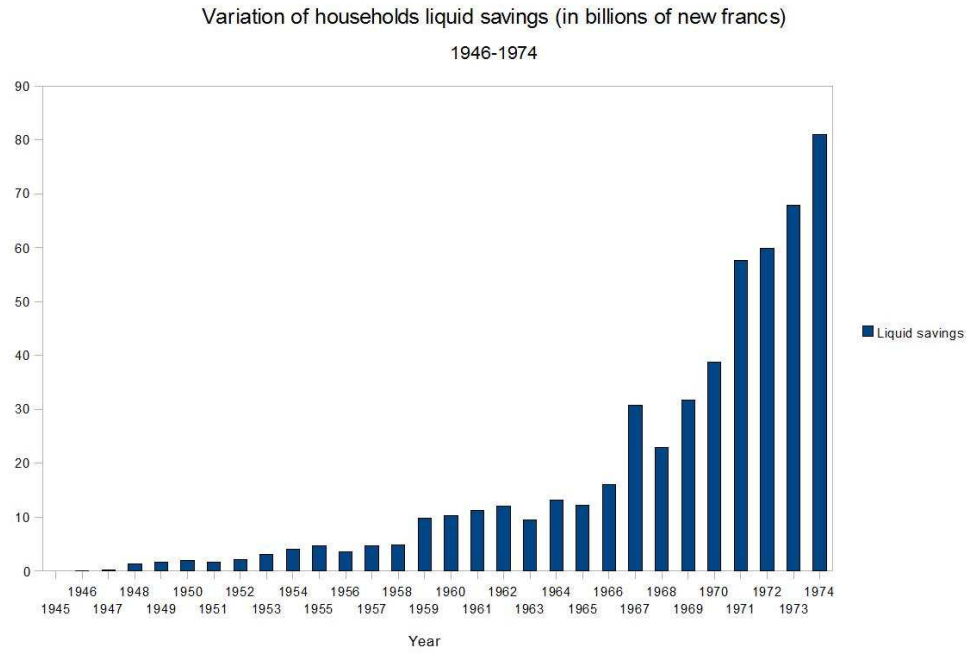


Figure 1: Evolution of liquid savings (total of households liquid savings/PIB), sources : CNC reports

4 A measure of monetary restrictions free of endogeneity

So far, I had not been able to provide an accurate estimation of the impact of credit controls on inflation since narrative evidence have shown that controls are endogeneous to inflation. Since credit control arises in response to high inflation, the simple VAR framework probably underestimates the negative impact of monetary restrictions. In order to address this fundamental problem of the narrative analysis, Romer and Romer (2004) have derived a new measure of monetary shocks 'relatively free of both endogenous and anticipatory actions'. They first derive an expected funds rate from the FOMC (Federal Open Market Committee) records and then they regress it on forecasts of economic variables from the 'Greenbook' prepared for each meeting of the FOMC. The residuals from this regression show changes in the intended fund rate not taken in response to information about future economic developments. Then, the authors are able to estimate the impact of a monetary shock over prices, without endogeneity problems.

The Romers' method clearly depends on the kind of information available at the Fed. In the case of French monetary policy between 1945 and 1973 we do not have information about forecasts guiding decisions of policy makers. In the following section I will use Romer's intuition and try to apply it to France given the information (mostly quantitative) that I have from the deliberations of the General Council and the National Credit Council.

The measure of credit control does not suffer exactly from the same kind of endogeneity as the Fed fund rate. While the Federal fund rate can move day to day for reasons unrelated to monetary policy (movements in output or inflation), credit controls are not endogenous to output but are endogenous to prices because the decision is taken in response to the level of inflation. Thus, a measure of credit control relatively free of endogeneity would be a measure of credit control not taken in response to information about future developments. Expectations were formulated in function of the past values of the variables. Consequently, the residuals of the monetary policy reaction function estimated at the end of Section I can be interpreted as the information that affect the monetary policy decision but which is not included in the explicative variables.

Then I interpret the residuals of this regression as a measure of credit control relatively free of endogeneity. This new series is interesting in itself. It shows sharp peaks between credit control episodes when monetary policy did not respond to significant problems like the big trade deficit at the end of 1955. It shows that during credit control episodes the variable can be less than 1 when expectations explain the restriction and more than 1 when they do not.

This new series now enters the VAR specification used previously. Given the estimation of the monetary policy reaction function, I am only able to use quarterly data. *Figure 22* presents the IRF of a two variables VAR with inflation and the simple measure of monetary restrictions (dummy variable) and *Figure 23* the IRF of the VAR with the new measure. With the new measure, the response of inflation does not experience such a long delay as with the simple binary measure[28]. Inflation starts to fall 2 quarters after the shock rather than 6. This result provides evidence of the relevancy of the new series : the very long lag of the response of inflation to monetary restrictions (usually called

[28]In France , there had been several cases of direct price control, especially in agriculture and regarding wages. But since we use the consumer price index, these controls are not very important at an aggregate level. Furthermore, price controls in the agricultural sector had been used over the whole period and are not correlated with restrictive monetary measures. Wage control was only used in 1957.

'price puzzle') was mainly due to endogeneity problems. Furthermore, estimations of the responses of unemployment, production and credit to this new measure[29] are very close to the previous ones studied in Section 3. It is now possible to conclude that credit control episodes had a negative effect on inflation : after one year the inflation rate is 0.25 percentage point lower than it would have been without the shock, after 10 quarters it is 1 percentage point lower (it reduces the price level by 1 %). But, this estimation is only indicative because, first the standard errors are very large, and second, and foremost, it is difficult to interpret in economic terms a shock on this new measure. Indeed, while a shock on the dummy variable is striclty speaking a change in monetary policy (restrictive to non restrictive), the meaning of a shock on the new series is less clear and much more abstract. Nevertheless it provides a better assessment of the effectiveness of monetary policy on the price level.

5 Conclusion

During the Golden Age of its economy, French monetary policy had a significant and important impact on the business cycles through direct credit controls. A 'narrative approach' to the identification of monetary policy shocks had proved to be the best suited method to estimate its effects. Taking into account the duration of monetary restrictions avoids biased responses and thus allows this approach to obtain IRFs that are comparable with other studies. Some results, in particular the long lasting effects of monetary restrictions, are very similar to previous studies on different countries and periods and thus would deserve to be incorporated in formal models. Some other results are more context specific and show the need to investigate the effects of monetary on different subsamples. I especially have highlighted that the reconstruction of households ability to smooth their consumption in the 1960s has considerably affected the transmission mechanism of monetary policy and thus changed the lag of the response of production. Finally the analysis also show that the effectiveness of monetary restrictions on credit, and then on the economy, decreased along the period. This result may partly explain the evolution of French monetary policy toward a different regime after 1974 and further work must be devoted to this change. We still know very little about the dismiss of direct

[29] Not reported here. Available on demand.

credit controls in countries where it had been the main instrument of monetary policy for decades.

References

[1] Andrieu Claire (1984), 'A la recherche de la politique du crédit, 19461973', *Revue historique*, n°271.

[2] Bagliano, Fabio C. and Carlo Favero, (1998) 'Measuring monetary policy with VAR models: An evaluation', *European Economic Review*, , vol. 42(6), p. 1069-1112.

[3] Barrère Alain (1951), 'La Politique du Crédit en France depuis 1945', *Revue économique*, Volume 2, Numéro 5 p. 513 - 542.

[4] Batini Nicoletta and Edward Nelson (2005), 'The U.K.s Rocky Road to Stability', Working paper, Federal Reserve Bank of St Louis.

[5] Bernanke Ben S. ans Ilian Mihov (1998), 'Measuring Monetary Policy', *The Quarterly Journal of Economics*, vol. 113(3), p. 869-902.

[6] Carré Jean-Jacques, Pierre Dubois and Edmond Malinvaud (1972), *La Croissance Française*, Paris, Seuil.

[7] Casella Alessandra and Eichengreen Barry (1994), 'Halting inflation in France and Italy after the Second World War', in *Monetary Regimes in Transition*, M.Bordo and F.Cappie eds., Cambridge, Cambridge University Press, p.312-345.

[8] Christiano Lawrence J., Eichenbaum, Martin et Evans Charles L. (1999), 'Monetary policy shocks : What have we learned and to what end ? ', in J. B. Taylor and M. Woodford eds., *Handbook of Macroeconomics*, , Elsevier, vol. 1, chp. 2, p. 65-148.

[9] Clarida Richard, Jordi Galí, and Mark Gertler (1998), 'Monetary Policy Rules in Practice : Some International Evidence', *European Economic Review*, 42(6),

10331067. Clarida Richard, Jordi Galí, and Mark Gertler (2000), 'Monetary Policy Rules and Macroeconomic Stability: Evidence and Some Theory', *Quarterly Journal of Economics*, 115 (1), 147-180.

[10] Cochrane John H. (1998), 'What do the VARs mean? Measuring the output effects of monetary policy', *Journal of Monetary Economics*, vol. 41(2), p. 277-300.

[11] Cochrane John H. (2004), 'Comments on A new measure of monetary shocks: Derivation and implications' by Christina Romer and David Romer, presented at NBER EFG meeting, July 17 2004.

[12] Feiertag Olivier (2006), *Wilfrid Baumgartner. Un grand commis des finances*, Paris, CHEFF.

[13] Friedman Milton, and Anna J. Schwartz (1963), *A Monetary History of the United States 1867-1960*, Princeton, Princeton University Press.

[14] Friedman Milton (2007)[1969], *The Optimum Quantity of Money*, Aldine Transaction, New Brunswick.

[15] Friedman, Milton (1980), 'Memorandum: Response to Questionnaire on Monetary Policy, June 11, 1980', In Treasury and Civil Service Committee, Memoranda on Monetary Policy. London: HMSO. p.55-61.

[16] Guillaumont-Jeanneney Sylviane (1969), *Politique monétaire et croissance économique en France*, Paris, Fondation Nationale des Sciences Politiques.

[17] Hansen Lars Peter (1982), 'Large Sample Properties of Generalized Method of Moments Estimators', *Econometrica*, 50, 1029-1054.

[18] Hodgman Donald.R (1972), 'Selective Credit Controls', *Journal of Money, Credit and Banking*, Vol. 4, No. 2,, p. 342-359.

[19] Hodgman Donald.R (1973), 'Credit controls in Western Europe, an evaluative review', *Conference Series 11*, Federal Reserve Bank of Boston, p.137-177.

[20] Hoover, Kevin and Stephen Perez (1994),'Post hoc ergo propter hoc once more: an evaluation of Does monetary policy matter? in the spirit of James Tobin', *Journal of Monetary Economics*, 34(1), 47-73.

[21] Jonung Lars (1994), 'The rise and falls of credit control, the case of Sweden', in *Monetary Regimes in Transition*, M.Bordo and F.Cappie eds., Cambridge University Press, p.346-372.

[22] Juselius Katarina (2006), *The Cointegrated VAR Model : Econometric Methodology and Macroeconomic Applications*, Oxford University Press.

[23] Kriz M.A (1951), 'Credit Control in France', *The American Economic Review*, Vol. 41, No. 1,, pp. 85-106

[24] Leeper Eric M (1997), 'Narrative and VAR approaches to monetary policy : Common identification problems', *Journal of Monetary Economics*, vol. 40(3), p. 641-657.

[25] Mojon Benoît (2008), 'Monetary Policy under a Fixed Exchange Rate Regime, the Case of France 1987-1996,' Working Papers, CEPII.

[26] Mojon Benoît (2008), 'When did unsystematic monetary policy have an effect on inflation?', *European Economic Review*, vol. 52(3), p. 487-497.

[27] OCDE (1975), *Le rôle de la politique monétaire dans la régulation de la demande. L'expérience de six grand pays*, OCDE, Série Etudes Monétaires, Paris.

[28] Quenouelle-Corre Laure (2005), 'The state, banks and financing of investments in France from World War II to the 1970s',*Financial History Review*, 12.1, pp. 6386.

[29] Ramey Valerie and Matthew D. Shapiro (2009), 'Costly Capital Reallocation and the Effects of Government Spending', *Carnegie-Rochester Conference Series on Public Policy*, 48 , p. 145-194.

[30] Ramey Valerie (2009), 'Identifying Government Spending Shocks: Its All in the Timing', Working Paper, UCSD.

[31] Romer, Christina and David Romer (1989),'Does monetary policy matters ? A new test in spirit of Friedman and Schwartz', *NBER Macroeconomics Annual 1989*, edited by Olivier Jean Blanchard and Stanley Fischer, p. 121-170. Cambridge, MIT Press.

[32] Romer, Christina and David Romer (1994),'Monetary policy matters', *Journal of Monetary Economics*, 34(1), p.75-88.

[33] Romer Christina D. and David H. Romer (2004), 'A New Measure of Monetary Shocks : Derivation and Implications', *American Economic Review* 94 (4), 1055-1084.

[34] Romer Christina D. and David H. Romer (2009), 'The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks', *American Economic Review*, forthcoming.

[35] Schreft, Stacey L. (1992).'Welfare-improving credit controls', *Journal of Monetary Economics*, vol. 30(1), pages 57-72,

[36] Sicsic Pierre and Charles Wyplosz (1996), 'French Postwar Growth', in Crafts N. and Toniolo G. eds., *Economic Growth in Europe since 1945*, Cambridge University Press, p.210-236.

[37] Sims Christopher A. , James H. Stock and Mark W. Watson (1990, 'Inference in Linear Time Series Models with some Unit Roots' *Econometrica*, Vol. 58, No. 1, p. 113-144.

[38] Stock James and Watson Mark (2001), 'Vector autoregressions', *Journal of Economic Perspectives*, 15, 4, p. 101-115.

A Robustness

As shown in the text, the results are the same with a 2 or a 4 variables VAR, such that comparisons can be drawn with the VAR literature. Changes in the sample size (cf Table 1), notably the inclusion of the post November 1972 period and the change of the start date of the 3rd restriction from April 1957 to February 1958 period, or the 5th restriction (November to June) do not change the main results.

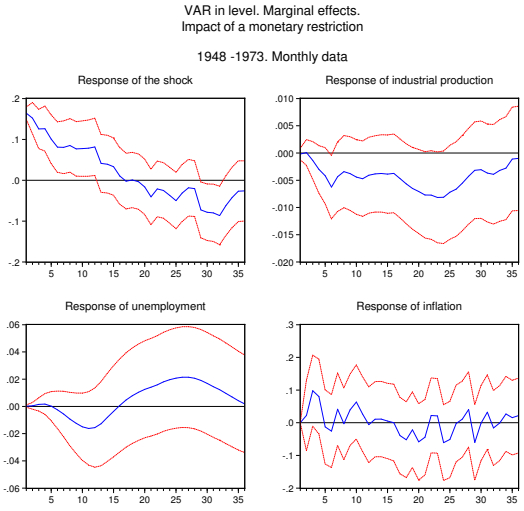
One important problem though is the inclusion of the dummy variable in level while the other variables are in difference (percentage change). As shown by Sims, Stock and Watson (1990), differencing can eliminate of lot of information, such as the possibility of cointegration relationships . Can we obtain similar results with a VAR in level ? IRFs checked that the VAR with variables in level leads to the same result than in differences except that the response of the inflation rate is even less significative. Marginal response functions of the VAR in level correspond to the accumulated response functions of the VAR in difference. But, then, an econometrical problem remains : the introduction of endogenous dummy variables in the VAR in level tends to create cointegration (Juselius, 2006). This effect can potentially lead to important bias ; nevertheless it has not been addressed so far in the papers which introduce shocks as dummy variables in the auto regressive process (Christiano et alii,1998, Ramey, 2009). Indeed, the Johansen test indicates at least one cointegrated relationship in the VAR. Not taking into account these cointegrating relationships would cause several bias : the BJ test indicates that the residuals do not follow a Normal law and the LM and Portemanteau tests show autocorrelation in the residuals. Thus, the standard errors are biased and should not be interpreted[30].

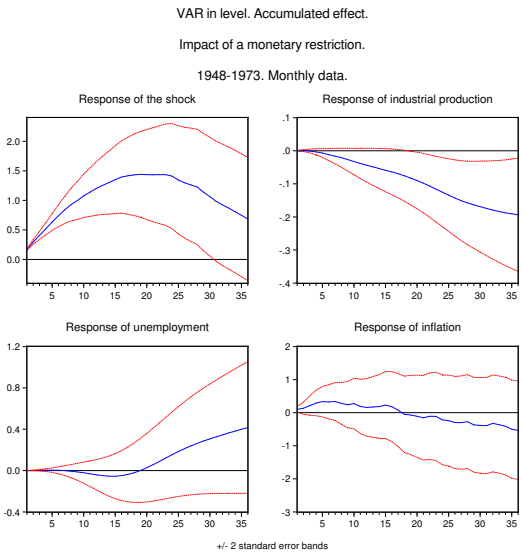
To get rid of this problem, we run a VECM (vector error correction model) that takes into account the cointegrating relationship between the variables. The results, reported below are very close (the lags of the response of unemployment and production and the value of the maximum after 25 months), except for the response of inflation which is definitely not interpretable.

But the VECM might not be a better econometric specification. Indeed, according to the tests residuals are still not normal and autocorrelated. Furthermore, the cointegrated relationship is not interpretable in economic terms : what would be the long term

[30]These probems remain with the dummy variable taking the value 1 only at the beginning of the monetary restriction.

relationship between monetary restrictions and production ? Thus, with the VECM we finally win nothing on the econometrical part but we lose much on the economic part. Consequentlty, I choose to keep the basic specification with a VAR in differences which is more interesting for the economic interpretations. These robustness checks have nevertheless shown that the results of our simple VAR in difference with production and unemployment are robust to many changes in the structure of the estimated relationships.

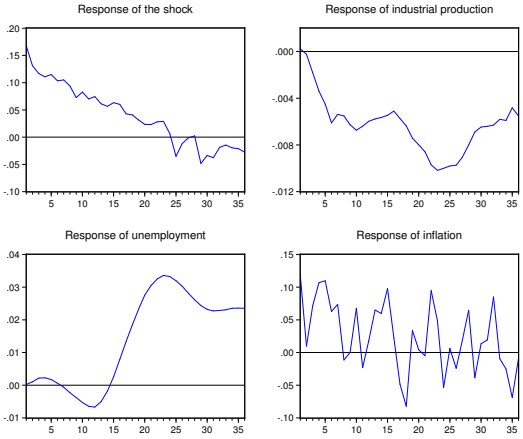




VECM. Marginal effect.

Impact of a monetary restriction.

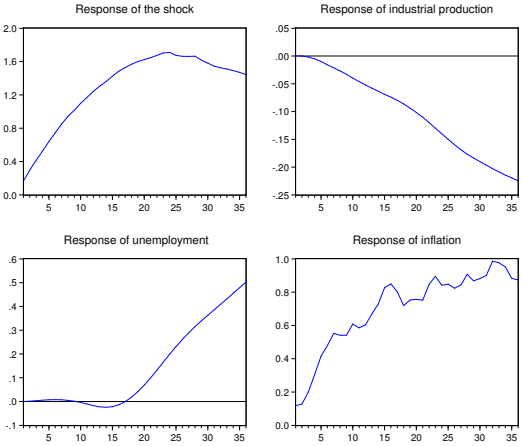
1948-1973. Monthly data.



VECM. Accumulated effect.

Impact of a monetary restriction.

1948-1973. Monthly data.



B Figures

B.1 First estimations with Monthly data

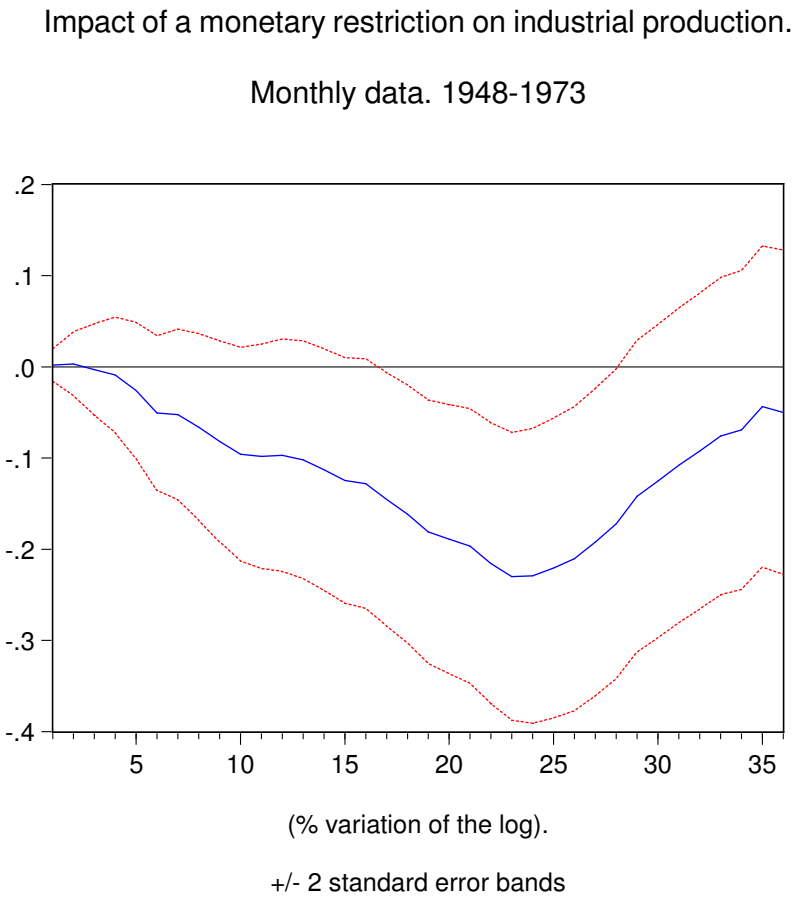


Figure 2: Production

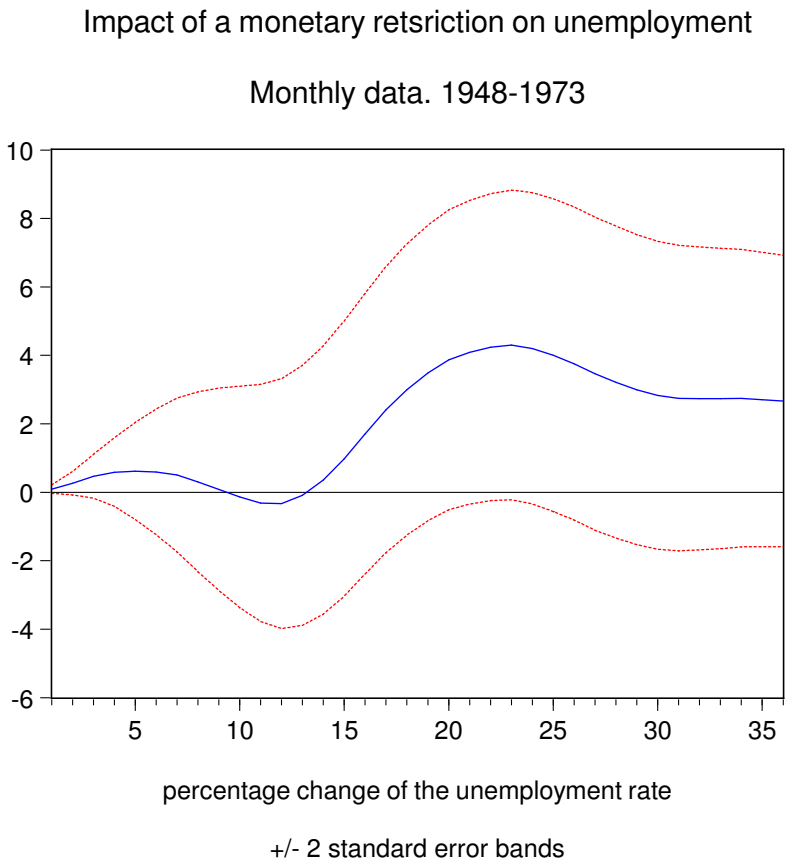


Figure 3: Unemployment

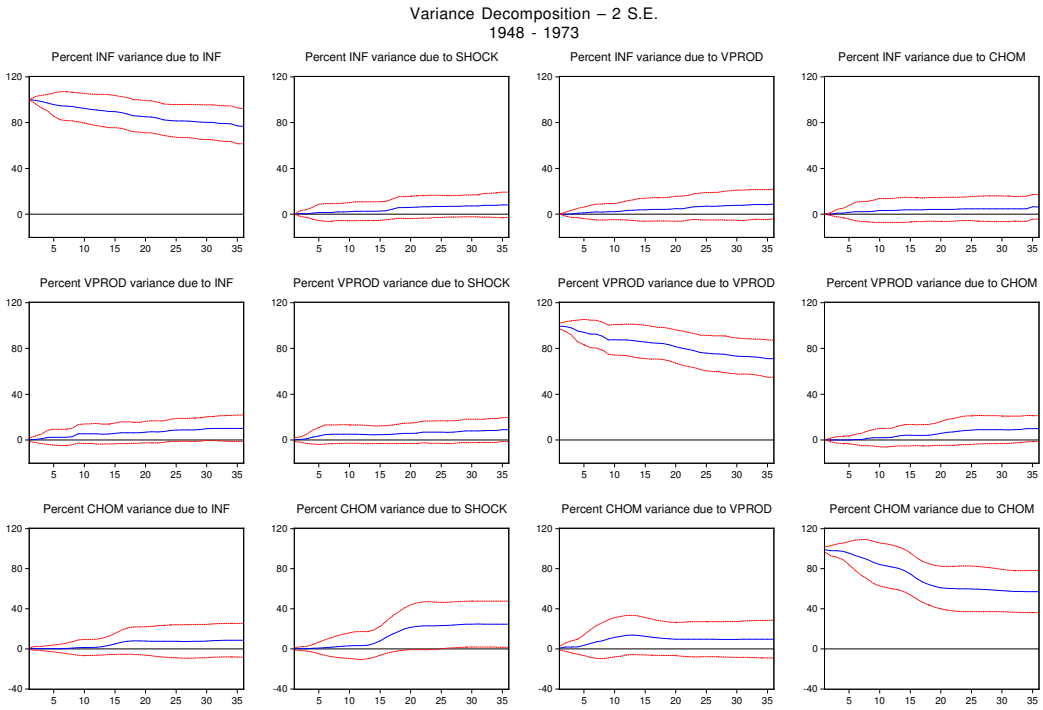


Figure 4: Variance decomposition 1948 -1973. VAR with 4 variables

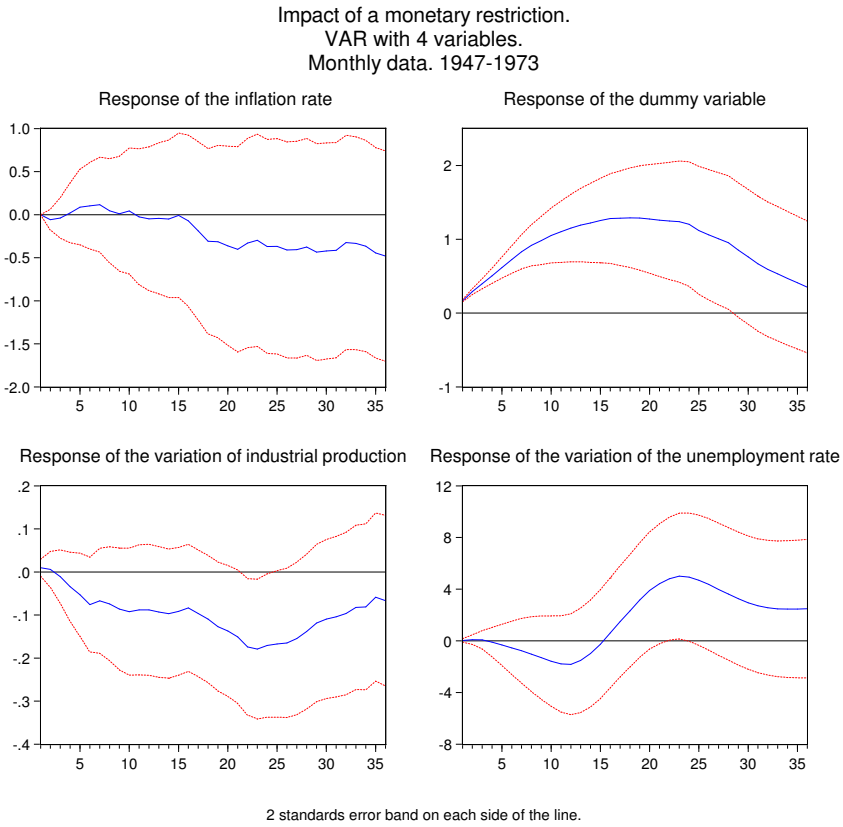


Figure 5: VAR with 4 variables.

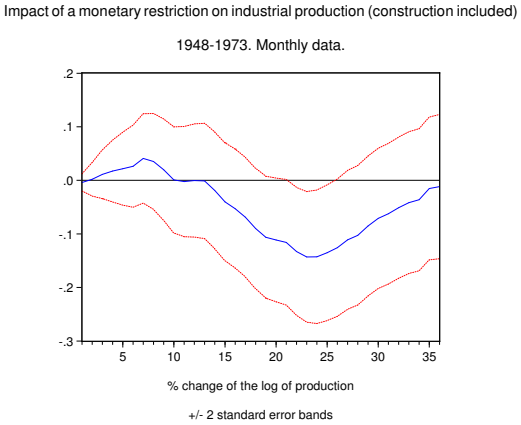


Figure 6: Production (included construction)

B.2 Comparisons with other measures

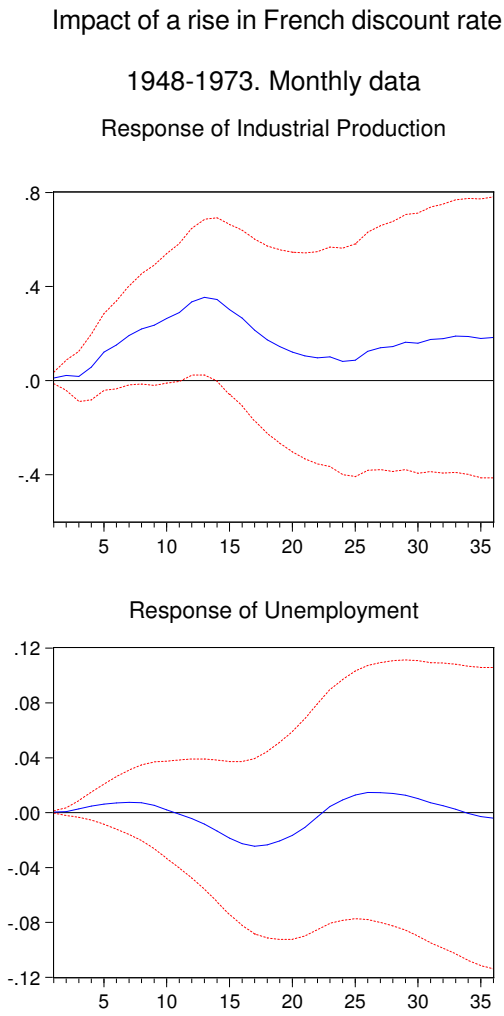


Figure 7: VAR with the French discount rate

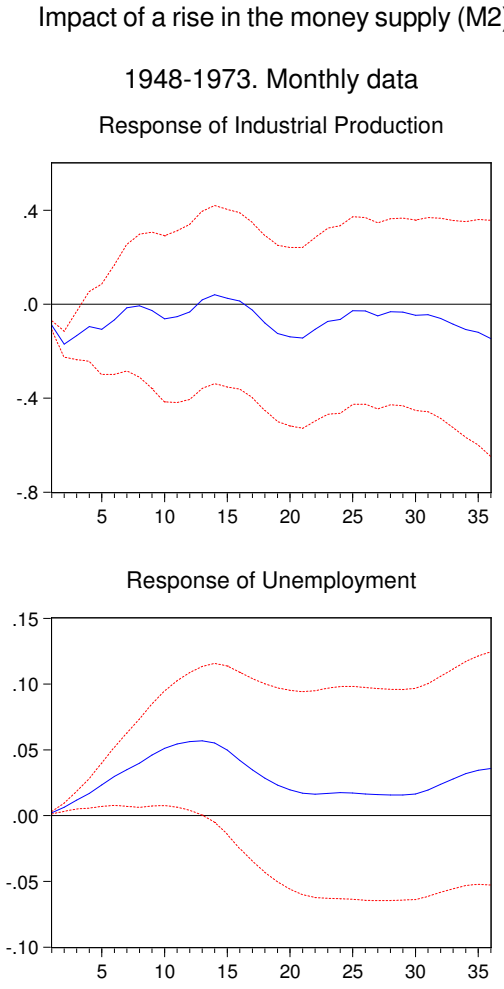


Figure 8: VAR with the money supply

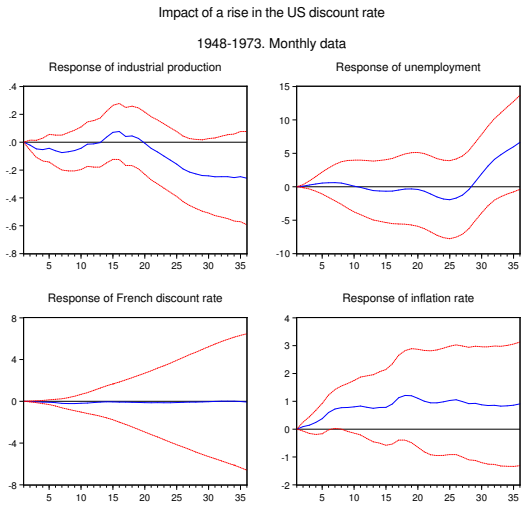


Figure 9: VAR with the Fed discount rate

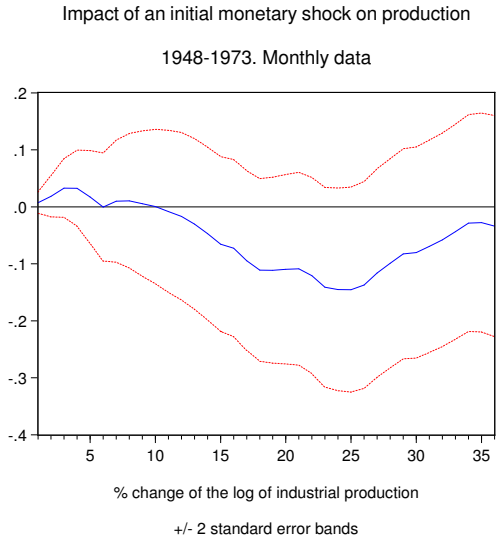


Figure 10: Production (shock with no duration)

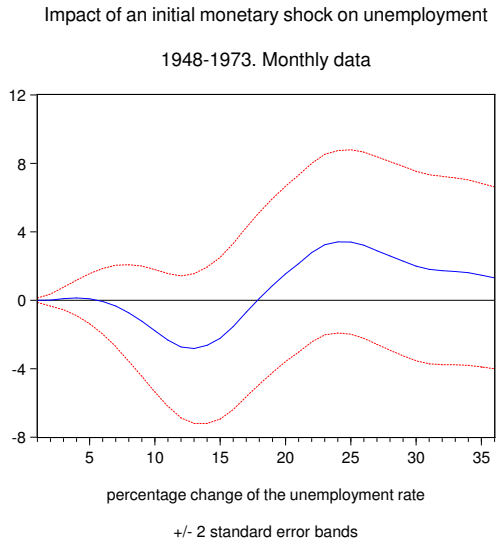


Figure 11: Unemployment (shock with no duration)

B.3 Two periods : 1948-1958 and 1958-1973

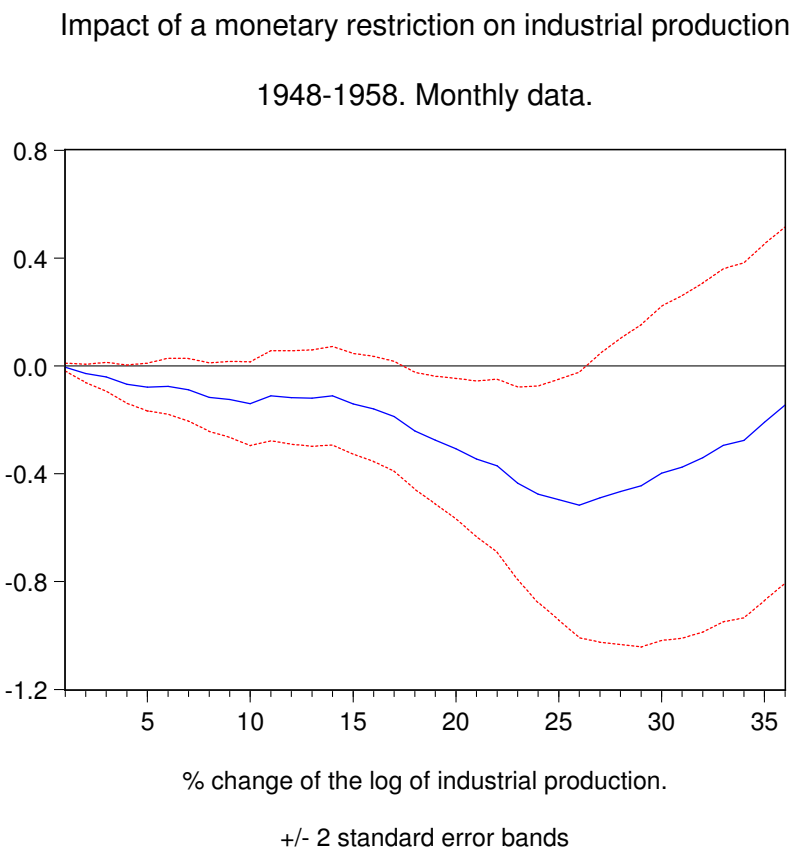


Figure 12: Monthly production 1948-1958

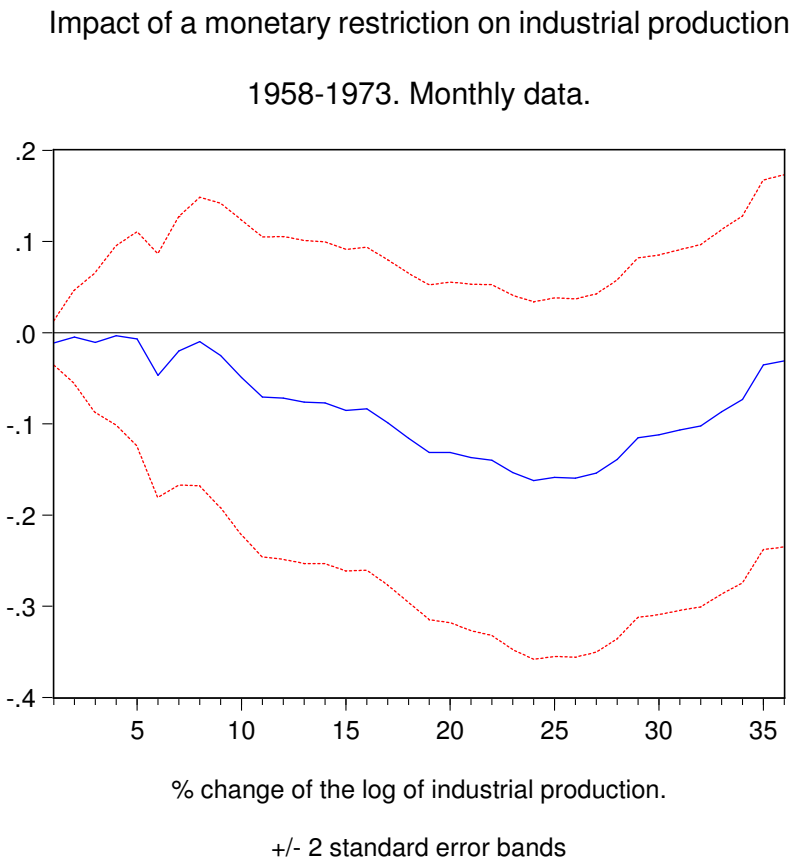


Figure 13: Monthly production 1958-1973

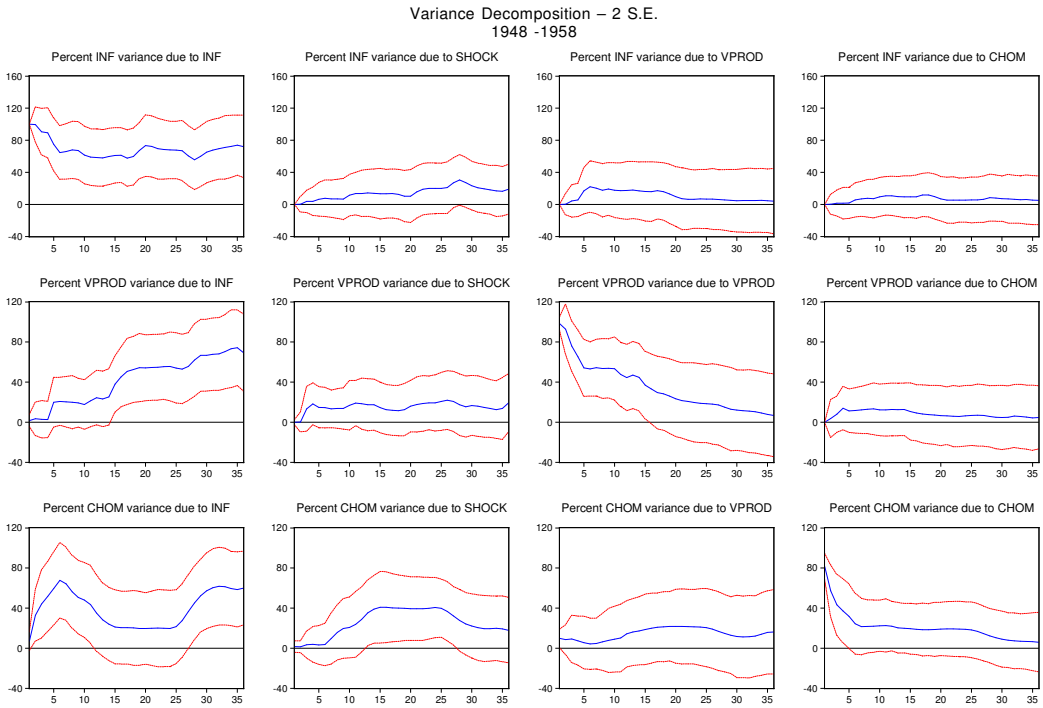


Figure 14: Variance decomposition 1948-1958. VAR with 4 variables

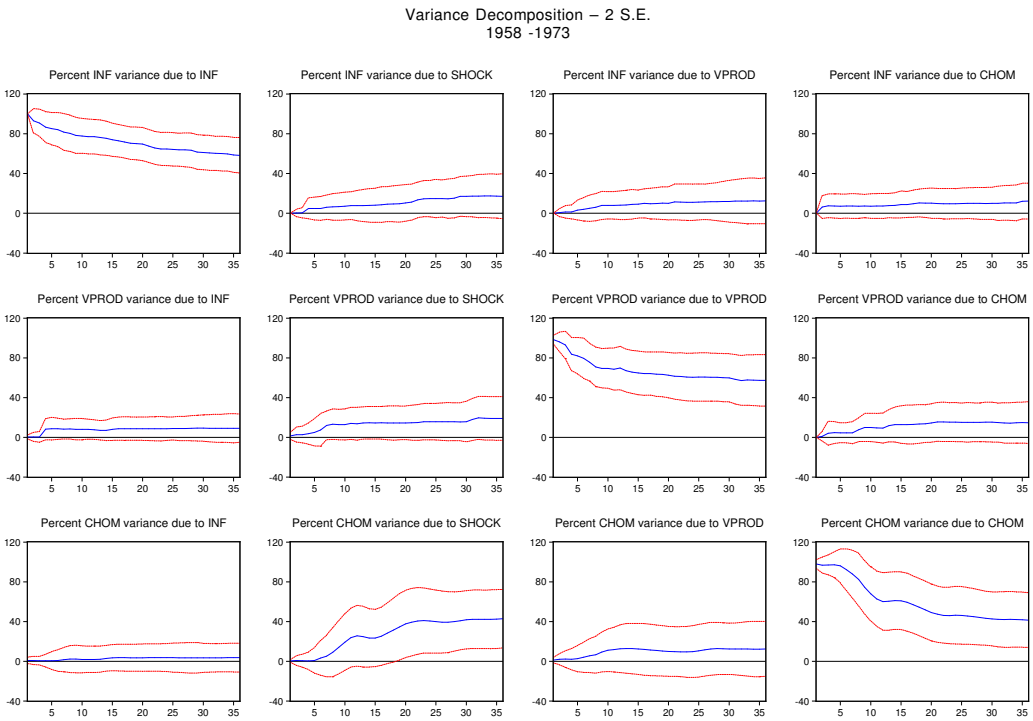


Figure 15: Variance decomposition 1958-1973

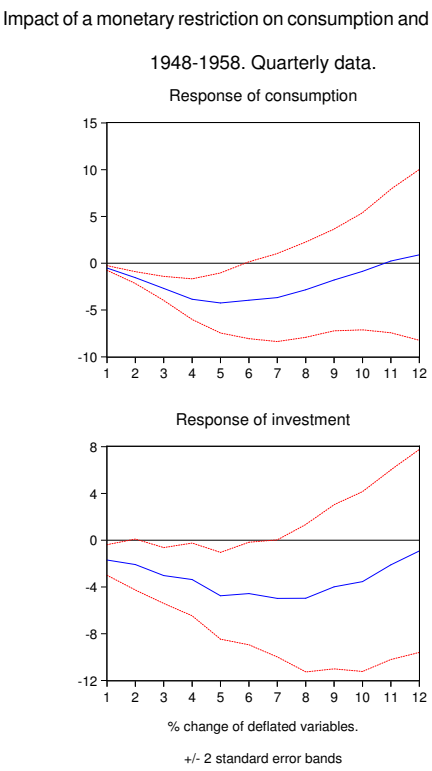


Figure 16: Investment and consumption 48-58

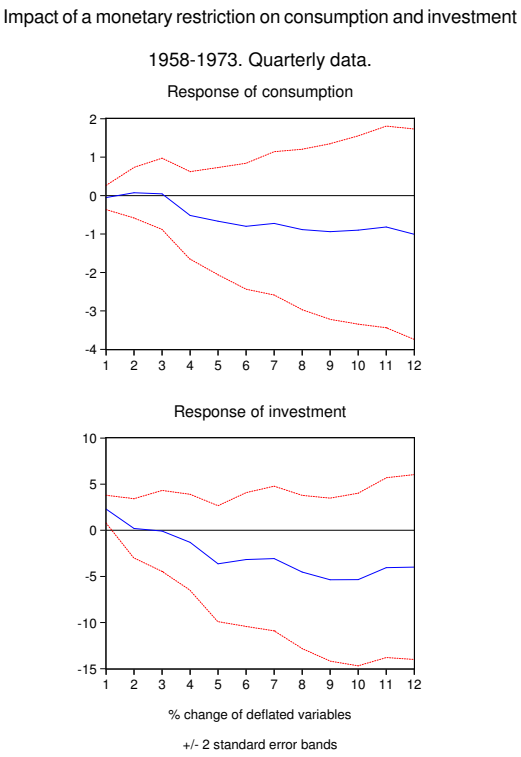


Figure 17: Investment and consumption 58-73

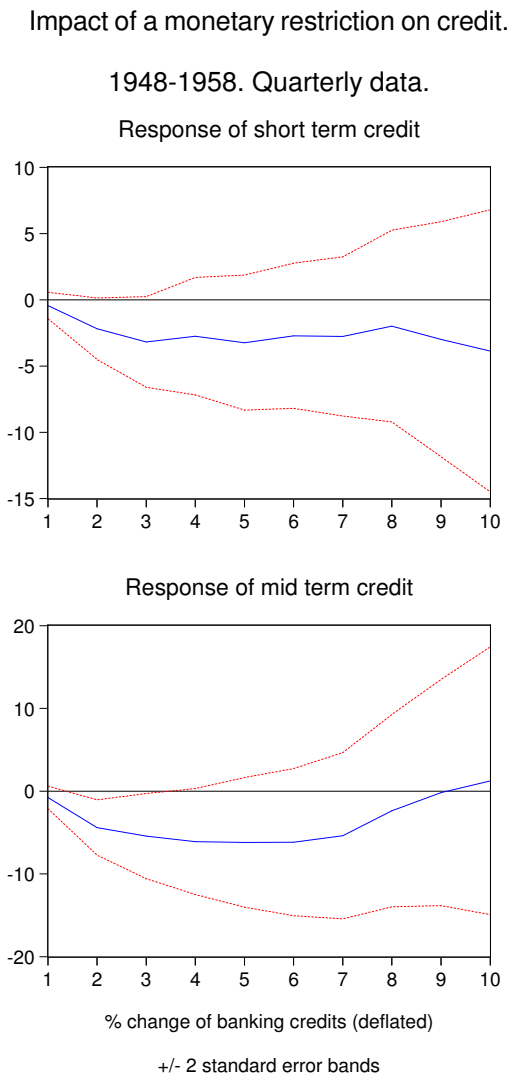


Figure 18: Credit 48-58

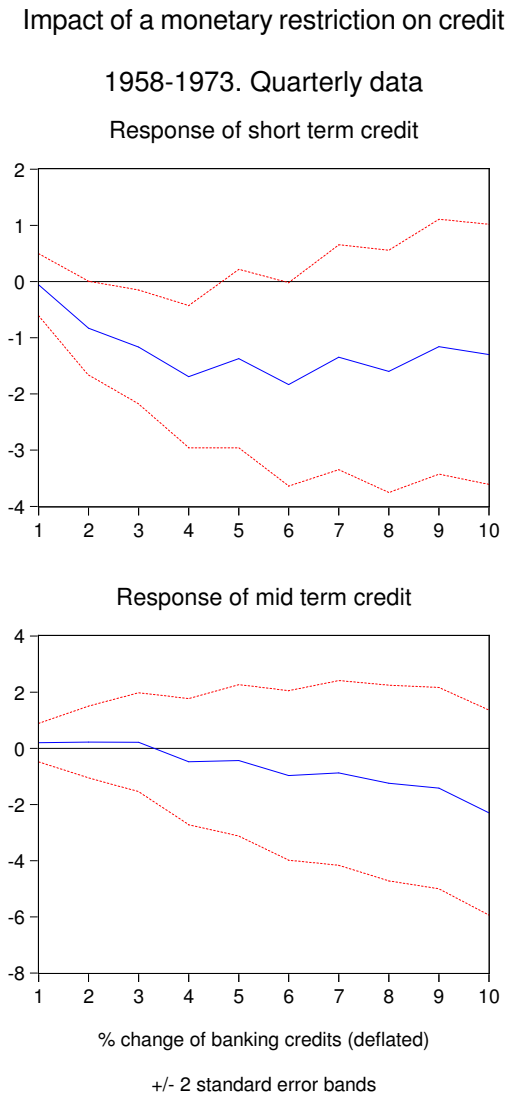


Figure 19: Credit 58-73

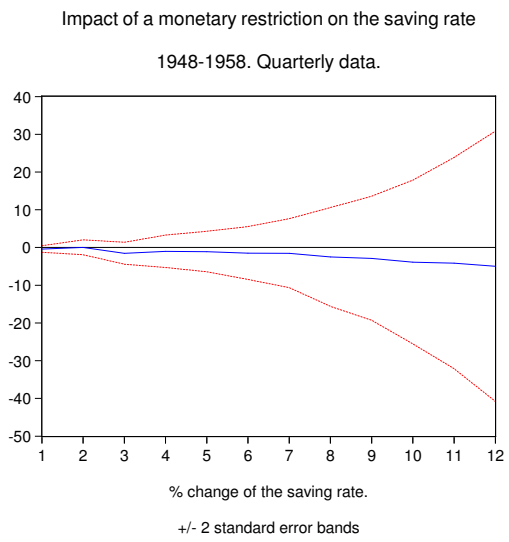


Figure 20: Saving rate 48 -58

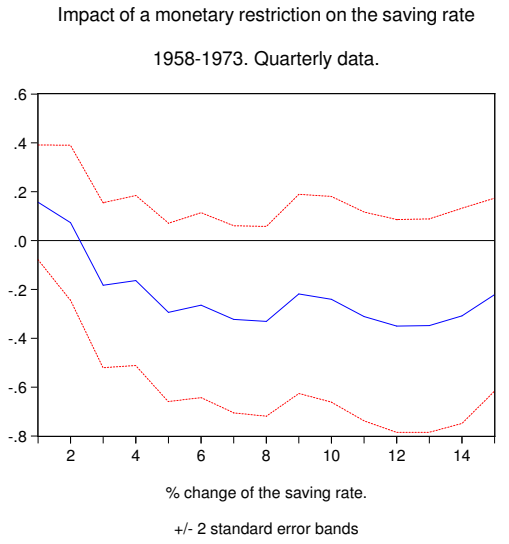


Figure 21: Saving rate 58-73

B.4 New series of monetary shocks

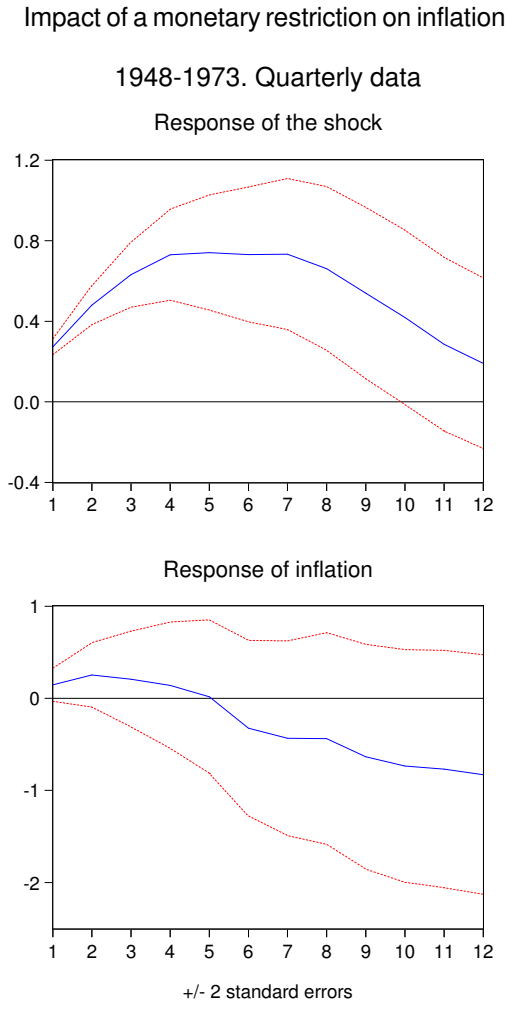


Figure 22: Dummy variable

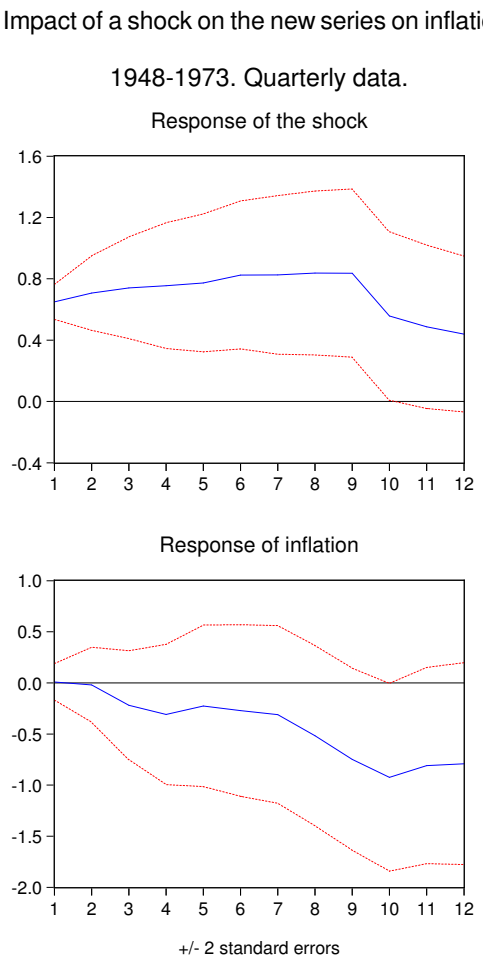


Figure 23: New series