Monetary Policy and Business Cycle

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Lecture II

Monetary Policy Transmission

”Motto”

”When the monetary authorities are pursuing a restrictive monetary policy, there is an average lag of 12 months (until the output is affected), with a fluctuation range of 6 to 29 months; when they are pursuing an expansionary policy, there is an average lag of 18 months, with fluctuation range of 4 to 22 months.”

(Milton Friedman and Anna Schwartz in their Monetary History of United States, 1963)

Outline

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Some General Comments

- an objective of this Lecture is the analysis and description of the long, indirect, and complex relationship between monetary policy action (e.g. an increase in the repo rate) and their effect on the final targets (e.g. the price level)

- one should be, however, aware that the different opinions about the monetary policy transmission are in fact the centrepiece of different monetary theories

- and that they have been debated at lenght and quite controversially by all famous academics

- consequently, for the puprose of this course we can do no more than highlight the most important channels of transmission

- it will become evident from what follows that among the vast number of theoretical studies there are comparatively few that really get to grips with detailed structure of the transmission process

- this lead Mishkin (1995) to use the expression 'black box' describing the *reduced form evidence* approach towards the transmission process relying simply on

the direct relationship between the money supply and the ultimate targets

- it is worth to mention that the this approach was above all propagated by monetarist

Limited knowledge and transmission lags

- the limited knowledge about the transmission is, basically, due to two factors
- first of all, there is the *model uncertainty*; i.e. there is no consensus among economists about the 'right model' or the 'right econometric techniques'
- second, the transmission is associated with *long and variable lags*
  - remember the "Motto" of this Lecture ...
  - in addition to it for example ECB (2000b) states: *'rise in the short term interest rate ... tends to be followed by a temporary fall in output after two quarters ... prices ... only start to fall significantly below zero after six quarters*
- this evidence (long and variable lags) lead Friedman (1969) to formulate his *rule of constant money growth*
- as there is a permanent danger that monetary policy that was designed to be countercyclical end up being pro-cyclical
- a dicretionary policy can therefore be viewed as a cause of macroeconomic instability and the ability

of monetary policy to fine-tune economic processes as a very limited one

The Quantity Theory Channel

- is based on simple but strictly defined conception of the transmission process

- this is implied by the fact that the quantity theory was developed in the period of metallic currency (*Schumpeter (1954) assigns its discovery to the year 1568, when the relationship was first formulated by Jean Bodin*)

- characteristic feature of such system is that money is available only in the form of gold or silver coins

- if rich new sources of gold an silver are found, this has a direct effect on the money supply as it has always been possible to mint gold and silver coins for a small fee (seignorage)

- holders of *new* coins can now directly increase demand

- the essential macroeconomic relationship for a transmission process according to the quantity theory is of type

$$PY^D = f(M) \tag{1}$$

- under such conditions, nominal macroeconomic demand is determined exclusively by the money supply

- on the basis of quantity equation ($M\bar{V} = PY$), equation (1) can be formulated as

$$Y^D = \frac{M}{P}\bar{V} \tag{2}$$

  and for given money supply, i.e. $M^S = M_0 = M^D$, we can then present equation (2) as the macroeconomic demand curve

$$Y^D = \frac{M_0}{P}\bar{V} \tag{3}$$

- we end up with the famous proportional relationship that, according to quantity theory, exists between changes in the money supply and the price level (combination of demand hyperbola and a classic macroeconomic supply curve

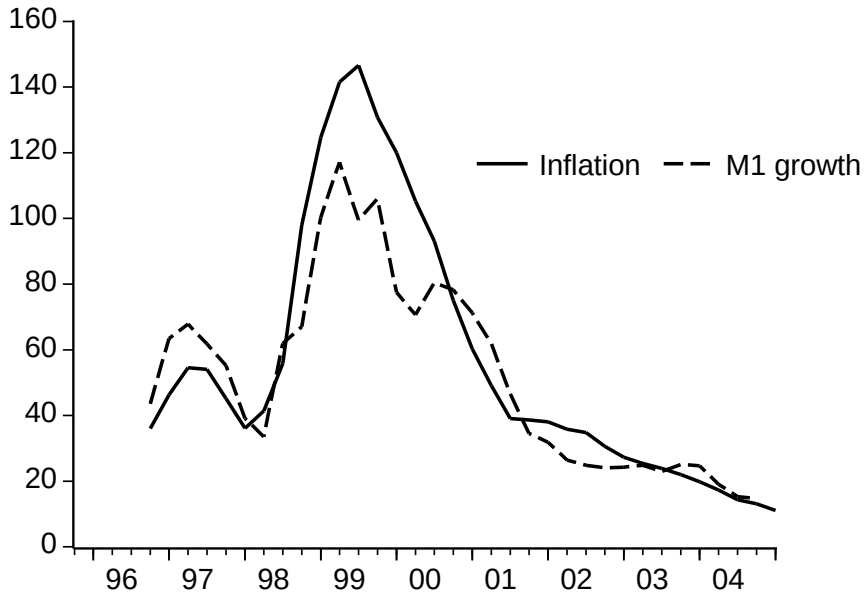
- it becomes clear that quantity theory as a description of transmission mechanism offers an adequate picture of reality only where demand is so determined by changes in the money supply that the other determinants, such as real income or the interest rate level can be ignored

- during periods of gold discoveries, this was no doubt a very accurate description of reality

Central bank financed state expenditure

- over the history it has been proven that such a direct channel of transmission on the demand side can also exist under a formal paper currency system
- this is to be found whenever the State is able to finance its expenditure by borrowing from the central bank; indeed, all periods of major inflation can be attributed to central bank financed state expenditures
- following Figure brings an instructive example from recent history (Republic of Belarus), where the central bank started to finance the government during the year 1998

Inflation and Money Growth



Helicopter Money

- *"Lets suppose now that one day a helicopter flies over this community and drops an additional 1000 USD in bills from the sky, which is of course hastily collected by the members of this community"* Friedman (1969)

- the quantity theory transmission channel becomes problematic under the institutional conditions that prevail in most industrial countries (formal paper currency with prohibition to finance the state deficit)

- then economists seeking to defend quantity theory typically have to resort by invoking so called 'helicopter money'

- however, this idea (that in fact goes back to Hume) that "*we all wake up one morning with twice as many shillings or sovereigns in our pockets, while all else remains uchanged' (Wicksell, 1922)* is not very helpfull to an uderstanding of transmission process

- a major problem is the fact that the *money supply process (e.g. money multiplier)* as a whole is obscured, which uder the system of paper currency combined with deposit money, is hardly justifiable

- we conclude that the quantity theory under present conditions no longer corresponds to the actual circumstances on the money and financial markets

- which means that the nominal macroeconomic demand is *not* determined *exclusively* by the money supply

- nevertheless, the quantity theory has some important policy implications that can be very useful either for countries with high inflation or for a medium term oriented monetary policy strategy

- in fact, the quantity theory is a keystone of the 'money targeting' monetary policy strategy (Lecture 7 will discusse this in more detail)

Interest Rate Channel

- all recent advanced textbooks on monetary theory (Walsh, 2003 or Woodford, 2003) incorporates those theories that explain monetary transmission with changes in interest rates (or their structure)

- this approach is consistent with the conclusion of the influential Radclife Report (1959), which recommended *'the structure of interest rates rather then some notion of the "supply of money" as the centre-piece of monetary action'*

- more than thirty-five years later Smets (1995), surveying the central bank models, concluded:
  'In most central banks' macroeconometric models the transmission process of monetary policy is modelled as an interest rate transmission process. The central bank sets the short term interest rate, which influences interest rates over the whole maturity spectrum, other asset prices, and the exchange rate. These changes in financial variables then affect output and prices through the different spending components. The role of money is in most cases a passive one, in the sense that money is demand determined.

- a simple model description for this variant of the transmission process has been presented for instance

by Svensson (1997):

$$y_{t+1} = \beta_1 y_t - \beta_2(i_t - \pi_t) + \beta_3 x_t + \eta_{t+1} \qquad (4)$$

where real (log) output y_t (relative to potential output) can be targeted with a (real) interest i_t rate with a one period lag; x_t is an exogenous variable (fiscal policy); η_t is a shock in year t that is unknown in year $t-1$

- Rudenbusch's (2000) paper (among others) arrives at the following results:

$$y_t = 1.15 y_{t-1} - 0.27(i_{t-1} - \pi^e_{t-1}) + \eta_t \qquad (5)$$

using the expected inflation π^e_{t-1} instead of actual inflation rate

- it is worth to mention that the discussion of the interest rate channel divides in two parts, so called *direct* and *indirect* impacts

- the direct impact is based on the consumers' *consumption* and firms' *investment* decisions based on the interest rate level, assuming that financial markets are functioning with no constraints (this will be precisely discussed in Lecture 4 where the *'New Keynesian model'* will be derived)

- in a nutshell, the direct impact represents 'Keynesian' aggregate demand channel ... *lower interest rates stimulate consumption and investment ... which forces output above its potential level ... however, this is possible only with higher prices ... as the firms' marginal cost rises*

- the indirect impact is going to be discussed in more detail here ...

Indirect effects

- the indirect impact concerns the endogenous interaction between banks and the non bank sector as a special part of transmission processes

- in fact, it tries to identify imperfections arising from the credit (banking system) side of the economy

- usually it is called as the *credit channel* or *bank-lending channel* and it was for the first time mentioned in the late 1980s

- the credit channel is viewed to be especially important in Europe where the banking sector plays a decisive role in enterprises and consumers financing

- the general term *credit channel* divides in to basically two different parts:
  - 'adverse selection' problem (goes back to Stiglitz and Weis, 1981)
  - 'bank - lending' problem (goes back to Bernanke and Gertler)

- *adverse selection* explains the *non linear* reaction of banks lending to an interest rate increase
  - as a rational banks' reaction to a higher density of 'Ponzi game' borrowers in a sample of

all borrowers (who are still ready to pay higher interest payments)

- *bank - lending* explains the same (i.e. the non linear reaction of banks lending) by the lower amount of funds available (following the interest rate increase)
  - when the central bank incerases the short rates on the money market, it withdraws part of the liquidity from the money market
  - this action then constraints the 'funds' for issuing the deposits (assuming the same level of required reserves), which at the same time contracts the lending
  - Gertler and Gilchrist(1993) describe this transmission process as follows: *...legal reserve requirements on deposits provide the Federal reserve with considerable direct leverage over the quantity of funds that banks may obtain. Assuming that prices are temporalily sticky, an open market sale reduces the real quantity of deposits banks can issue. This in turn induces banks to contract lending ...*

- 'In a nutshell, the credit view asserts that i addition to affecting short-term interest rates, monetary policy affects aggregate demand by affecting the availability of terms of new bank loans.' (Bernanke, 1993)

- however, the empirical tests have found rather poor evidence supporting the existence of *credit channel* and consequently that was dismissed by many authors during the second half of 1990s (Oliner and Rudenbsch 1996a, 1996b, among others)

Expectations Channel

- despite the Friedman's pesimistic views on discretionary policy, many central banks have achieved a very successful monetary policy

- considering that all the major independent central banks that are seriously *committed* to a policy of price stability generally manage to achieve this objective, it seems likely, that there is a further way in which monetery impulses are transmitted

- this leads to the expectations channel, which basically rests on inflation expectations and is often present under the label of the *'Phillips curve'*

- a specification of the Phillips curve which is widely used today goes back to the model of Taylor (1980):

$$\pi_t = E_t\pi_{t+1} + \alpha_1 y_t + \epsilon_t \tag{6}$$

  in this Phillips curve specification inflation is determined by expected inflation $E_t\pi_{t+1}$ and by the output gap y_t, i.e. by the real output relative to potential output

- the starting point of Taylor's model is a *two-period* staggered wage-setting process, which can be easily

applied also to the price-setting process (Lecture IV reveals more details)

- for practical use the Phillips curve must be, however, extended for laged inflation to capture for observed inflation persistence:

$$\pi_t = \beta_1 E_t \pi_{t+1} + (1 - \beta_1)\pi_{t-1} + \alpha_1 y_t + \epsilon_t \qquad (7)$$

  which can be easily done if the Taylor model is reformulated in terms of changes (Lecture IV and seminars will deal with this in more detail)

- moreover, estimation attempts often end up with the laged inflation only, given the evidence that inflation follows strong autoregressive process

- Rudenbusch (2000) comes to following values for the Svensson (1997) form of the Phillips curve

$$\pi_{t+1} = 0.71\pi_t + 0.13 y_t + \epsilon_{t+1} \qquad (8)$$

- anyway, a key ingredient of the expectations channel are *price rigidities*

- thus, the crucial role of expectations arises out of the need to fix prices and wages in advance as the opportunity to do it in the near future is from some reasons limited

- the theory explains the rigidities due to the fact that the price adjustments can be costly; thus the prices, unlike Walras's neoclassical model, do not adjust continuously to the market situation

- in the literature are these costs summarised under the heading *'menu cost'*, refering to the cost of changing the menu in a restaurant

- the term *'menu costs'* originates in the work of Mankiw (1991) who edited (together with David Romer) highly influential almanac *New Keynesian Economics* (Lecture IV reveals more details)

- however, the Lecture 3 will point out that not all economists share the view that the rigidities are crucial for the business cycle explanation

Expectations Formation

- for better understanding of consequent Lectures, we shall at this stage review the ways how the inflation expectation in the Phillips curve can be understand

- the economic literature recognises three basic mechanism that have been developed over the history: *extrapolative, adaptive and rational expectation* formation

- the *extrapolative expectations hypothesis* originates with Fisher (1930) and it is simply assumed that the economic agents expect the coming inflation to be equal to the inflation rate observed for the previous period

- with such expectations the expected inflation for period t is

$$\pi_t^e = \pi_{t-1} \tag{9}$$

- in a more complex variant, the expected inflation rate can be also formed as a weighted average of past inflation rates:

$$\pi_t^e = \alpha_1\pi_{t-1} + \alpha_2\pi_{t-2} + \alpha_3\pi_{t-3} + ... + \alpha_n\pi_{t-n} \tag{10}$$

where $0 < \alpha_i < 1$ and $\sum_{i=1}^{n} \alpha_i = 1$

- in the case of *adaptive expectations* (Cagan, 1956), the expected inflation rate also depends on past inflation, but here economic agents take account of both inflation expectations and expectation errors that have occured in earlier years:

$$\pi_t^e = \pi_{t-1}^e + \beta(\pi_{t-1} - \pi_{t-1}^e) \tag{11}$$

or

$$\pi_t^e = \beta\pi_{t-1} + (1-\beta)\pi_{t-1}^e \tag{12}$$

- thus, for example, if in period $t-1$ the actual inflation rate turned out to be higher than the expected rate, when expectations are formed for t, an *add* will be applied to the previous expectations

- since the same proces of expectations formation is followed for π_{t-1}^e as for π_t^e we can simply iterate backward:

$$\pi_{t-1}^e = \beta\pi_{t-2} + (1-\beta)\pi_{t-2}^e \tag{13}$$

insert this in to the (9) and get

$$\pi_t^e = \beta\pi_{t-1} + (1-\beta)[\beta\pi_{t-2} + (1-\beta)\pi_{t-2}^e] \tag{14}$$

finally, if we substitute all the past inflation expectations we end up with

$$\pi_t^e = \beta \sum_{n=0}^{\infty} (1-\beta)^n \pi_{t-n-1} \tag{15}$$

- which is, of course, also a weighted average of all past values

- adaptive expectations formation is thus in principle similar to extrapolative expectations, in so far as both procedures go back as far as possible into past

- crucial message of both these formation procedures is that *history matters*

- this is, however, changed by the adoption of *rational expectations*, which is based on research carried out by Muth (1961) and Lucas (1976)

- rational expectations operate on the assumption that economic agents no longer take as their reference point the past values of a given variable

- instead, they form their expectations with the help of an economic model using all the information available at the time of forecasting (Ω_{t-1}):

$$\pi_t^e = E[\pi_t | \Omega_{t-1}] \tag{16}$$

- crucial aspect of this procedure is that what does matter is the *future* and not the *history*

- to ilustrate this suppose simple example:
  - assume a massive increase in state expenditure in period t, which is financed via the banknote printing
  - the public is informed of this action at the beginning of period t
  - if the expectations are formed in a adaptive way, such a action will have no effect on inflation expectations for period t, since the expectations are based exclusively on past inflation
  - however, if the expectations are formed rationally, economic agents will process the available information using a macroeconomic model
  - thus, as an increase in money supply implies higher inflation, the inflation expectations are revised upwards

- a key assertion of rational expectations hypothesis, therefore, is that the new information directly affects the expectations' formation while the past performance of the variable is no more relevant

- this 'original' version of rational expectations is, however, viewed as too *'strong'*,

- and applying the concept of *'bounded rationality'* (Simon, 1992), *'weak'* version of rational expectations has been developed

- this assumes that economic agents face so called *'cognitive limitations'* arising from decision maker limitations of both the knowledge (information asymetry) and computational capacity

- which rationalise the use of *past observation* as the *'best'* expectation for some period of time

Open Economy

- a switch from closed to an open-economy makes the monetary transmission process more complex

- basically the theory distiguish between the *direct* and *indirect* exchange rate channel

- whereas the direct exchange rate channel is based on the purchasing power parity theory (law of one price) that deals with the nominal exchange rate, the indirect exchange rate channel is based on the consumers' and firms' decision about the domestic versus foreign goods purchases depending on their relative price

- the purchasing power parity theory states that, apart from tariffs and transaction costs, the international arbitrage will equalize the prices for tradable goods (relative prices are equal to one)

- and if the relative price of non traded to traded goods are the same (for sure they are not, and Lecture 10 will address this issue), also the prices of non traded goods will be equalized

- thus, theoretically, domestic price of the standard market basket of goods is equal to the foreign price

of the same basket times the exchange rate

$$P = SP^* \tag{17}$$

or

$$S = \frac{P^*}{P} \tag{18}$$

- focusing on changes in the price level, i.e. inflation, and changes in the exchange rate leads to the *relative version* of the PPP that plays an important role in monetary policy

$$\Delta s = \pi - \pi^* \tag{19}$$

- on the one hand proponents of a flexible exchange rate system believe that country can choose its national inflation rate according to its preferences, and that the exchange rate will compensate for the inflation differential

- on the other hand many countries have adopted a fixed exchange rate target *vis-a-vis* the currency of country with low inflation in order to import price stability

- the experience, however, shows that applications of both can be problematic:

  - countries with flexible exchange rates have experienced large deviation from relative PPP in the short term
  - countries with flexible exchange rates have experienced lower or higher inflation than was expected

- both cause the *real exchnage rate* to deviate from one, i.e. $Q = S\frac{P^*}{P} \neq 1$, invoking the existence of *indirect* exchange rate channel

- which presence is, in fact, a disprovement of the purchasing power parity theory as this predicts the relative price of domestic and foreign goods to be always equal to one

- however, the fact that the purchasing power parity theory does not hold perfectly (especially in the short run) is widely accepted and it is understand as an evidence of price rigidities (Obstfeld and Rogoff, 1996)

- following Figure depicts both nominal and real exchange rate (CZK/EUR)

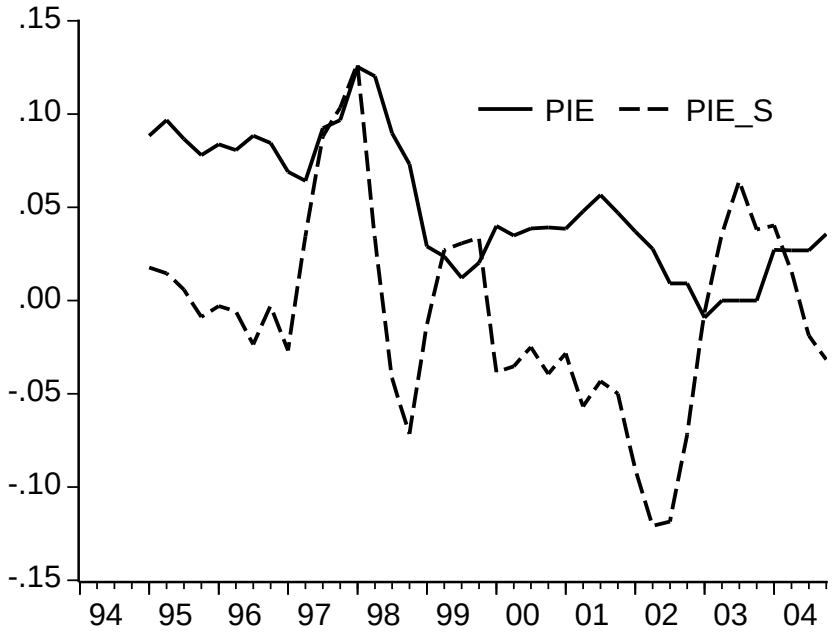
Nominal and Real Exchange Rate

- it is evident that the domestic prices have not adjusted completely the nominal exchange rate movements and that the real exchange rate deviated from its equilibrium (influencing households' an firms' decisions about the domestic versus foreign goods purchases)

- neverthelles, the domestic prices still adjust relatively quickly and the *direct* exchange rate channel is, in case of Czech economy, claimed to be quite strong

- following Figure supports this evidence

Nominal Exchange Rate and Inflation



- open economy issues will be discussed in more detail in the course of Lectures 10 and 11

Measurement Challenges

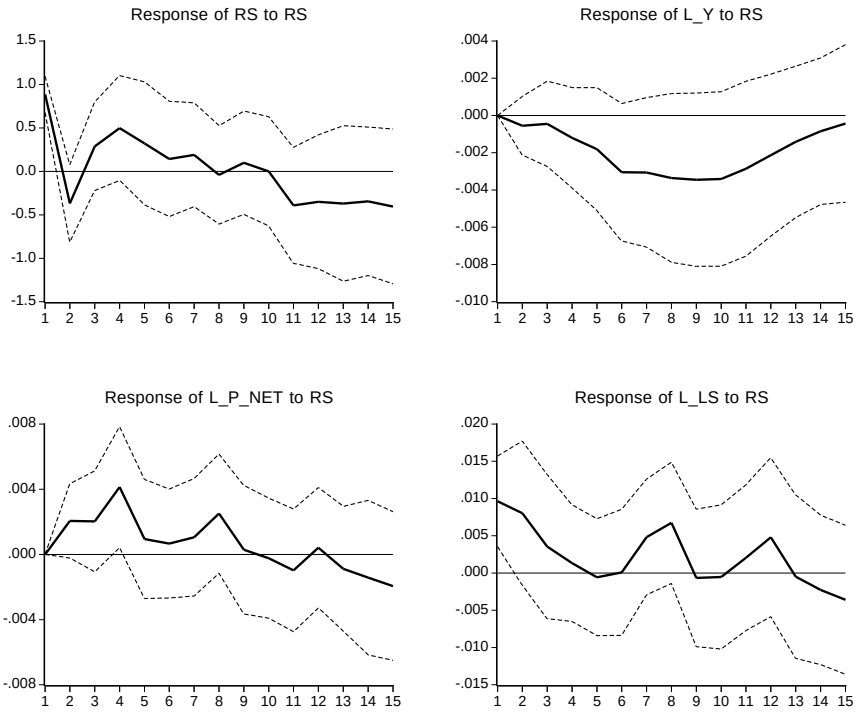
- although the theory desribes the transmission process precisely, the empirical evidence is far from being unambiguous

- consequently, Friedmans' famous statement about the *long an variable lags* is still valid

- there are several reasons for it:
  - no consensus about the 'right model', i.e. the 'flexible versus rigid prices' debate (Lecture 3 versus Lecture 4)
  - no consensus about the 'right econometric', i.e. the 'estimation versus calibration' debate

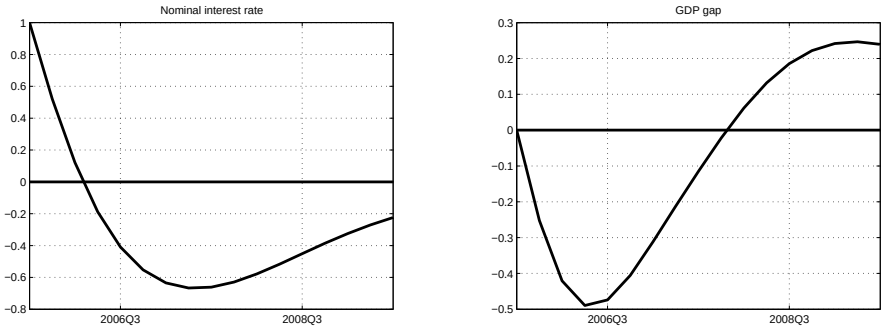
- the latter can be ilustrated using the following example:
  - first Figure decribes the basic transmission properties using the VAR model (see Lecture 1)

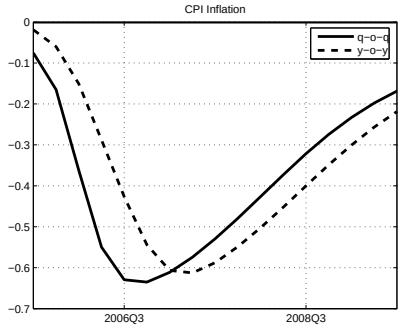
Transmission - VAR model, MP shock

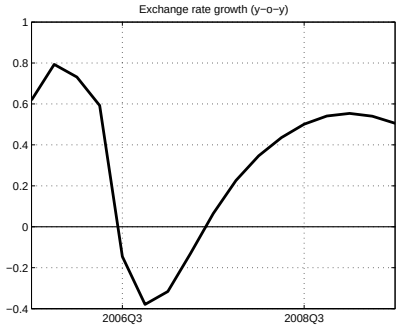


– while the second Figure desribes the transmission properties of the CNB core model

Transmission - CNB model, MP shock







- proponents of calibration use *endogeneity problem* as the main argument against any kind of estimation

- remember that the endogeneity problem is claimed to cause all the estimated coefficients to be biased (Lecture 1)
  - *to ilustrate the point assume that the central bank is able to manipulate the money supply to offset almost perfectly all the shocks*
  - *in this case the y^n would simply reflect the random errors the central bank failed to offset*
  - *and as a result m and y^n might be completely uncorrelated*
  - *moreover, if policy is able to respond to shocks u_t, m_t and u_t will be correlated and an OLS estimation of money on output will be inconsistent*
  - *then the resulting estimate will depend on the manner in which policy has induced a correlation between m_t and u_t*

- consequently, instead of estimation the model should be calibrated in accordance with the theory ...

- however, the model must of course produce an ubiased forecast

Summary

- the consensus among the majority of economists about the monetary policy transmission is
  - that the uncertainty about the short run effects of monetary policy is high
  - and that above all the transmission lags are long - remember from Lecture 1 that the output response reaches its peak after a lag of several quarters (two or three years) ...
- it follows that a countercyclical monetary policy is a very difficult task, as
  - the mechanics of the interest rate channel are complex and idirect
  - and as any attempt at active management can have repercussions on the expectations channel
- so, is the Friedman's critical stance vis-a-vis a active monetary policy correct one?
- the evidence over last 15 to 20 years seems to support the opinion that not ...
- and the central banks are able to maintain the price stability despite of an active decision making process

Seminar Readings

- Christiano, L., Eichenbaum, M., Evans, C. (1999), Monetary Policy Shocks: What Have We Learned and To What End? in Taylor, J., Woodford, M., eds., *Handbook of Macroeconomics*. North Holland, pp. 65-148. (available as NBER Working Paper No. 6400)

- Mojon, B., Peersman, G. (2001), A VAR Description of the Effects of Monetary Policy in the Individual Countries of the Euro Area. Frankfurt, European Central Bank, Working Paper No. 92.

- Arnostova, K., Hurnik, J. (2005), The monetary transmission mechanism in the Czech Republic (evidence from VAR analysis). Prague, Czech National Bank, Working Paper No. 4.