Monetary Policy and Business Cycle

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Lecture V

The Ultimate Goal and the Final Target of Monetary Policy

"Motto"

"How large is the welfare cost of inflation?"

Outline

- Introduction
  - The loss function of a central bank
  - Preference for price stability in actual monetary policy
- The long-term view: only price stability matters
  - Costs of inflation
- Inflation and output growth in the short run
  - An analysis for demand and supply shocks
  - Policy implications
- Operational issues
  - Choice of a price index
  - Defining concrete target values

Introduction

- the ultimate goal of monetary policy is always the welfare of the population

- therefore, the literature describes the decision problem of a central bank as a 'social welfare function', which has to be minimized:

$$L_t = \frac{1}{2}\Big[(\pi_t - \pi^*)^2 + \lambda\Big(\frac{Y_t - Y^*}{Y^*}\Big)^2\Big] \qquad (1)$$

- its arguments are deviations of the inflation rate from the 'desired' level (level consistent with price stability) and the deviation of the actual output from potential output, i.e. the output gap

- the squaring implies that positive and negative deviations are similarly negative for the society

- the factor λ determines the weight of output and inflation in the loss function

- as long as the λ is non zero the variant is similar to a *nominal income target*, which can be formulated as follows:

$$L_t = \frac{1}{2}[(\pi_t + y_t - y_{t-1}) - (\pi + \Delta y)^*]^2 \qquad (2)$$

- under the nominal income target, a central bank tries to minimize the difference between the actual growth rate of nominal GDP and the targeted growth

- the main difference between the two approaches concerns the impact of the *real output growth rate*

- given the wide spectrum for λ, monetary policy can opt for quite different approaches

- monetary history has seen central banks that were trying mainly to stabilise output (especially in the 1970s and 1980s) and others that were concerned mainly with price stability

- today, it is above all central bankers who regard price stability as the final target of monetary policy

- however, in contrast to this view, many academics argue in favour of defining the final target of monetary policy in terms of both inflation and real GDP: *It is widely agreed that the goals of monetary policy are low rate of inflation ('price stability') and a small gap between actual and potential GDP* (Feldstein and Stock, 1994) or *... it seems fair to say that the consensus today favors nominal income as the most suitable objective of monetary policy* (Hall and Mankiw, 1994)

- despite the latter, during the 1990s, a lot of central banks explicitly adopted price stability as their final target (be aware that it is somewhat misleading to use the term *'inflation targeting'* for any price stability oriented monetary policy)

- in most countries price stability as the final target is now prescribed in the central bank constitution

- the final target of the Czech National Bank is defined in Article 98 of the Constitution of the Czech Republic and in Article 2 of Act No. 6/1993 Coll., on the Czech National Bank: *The primary objective of the CNB is to maitain price stability. Whithout prejudice to its primary objective, the CNB shall support the general economic policies of the Government leading to sustainable economic growth.*

- similarly the final target of the ECB is defined in Article 105(1) of the EC Treaty: *The primary objective of the ESCB shall be to maintain price stability. Whithout prejudice to the objective of price stability, the ESCB should support the general economic policies ...*

- to make the picture complex, it is worth to mention that the most notable exception is the United States; Section 2A of the Federal Reserve Acts

states: *The Board of Governors of the Federal Reserve System and the Federal Open Market Committee shall maintain long run growth of the monetary and credit aggregates commensurate with the economy's long run growth potential to increase production, so as to promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates.*

- an exact definition of 'price stability' is usually part of the bank's *'monetary policy strategy document'* and we are going to discuss this issues at the end of this Lecture

The long-term view: only price stability matters

- a starting point for a definition of the policy targets in the long run are the results of our discussion about the *empirical evidence* and *transmission process*

- from this point of view, it is clear that in the long run, monetary policy is not able to affect real economy

- thus, its contribution in the long run is a neutral policy stance that enables an efficient use of money in its main functions

- it follows that the nominal income is not an appropriate long run target for monetary policy, as the nominal income is very much determined by real factors, and it would make little sense to compensate a decline in real growth with a higher inflation

- thus, the price stability is the only suitable long term target

Costs of inflation

- the result that the monetary effects are neutral in the long run lefts open the question, why price stability should be viewed as a target *per se*

- indeed, the neutrality hypothesis suggests that an economy could live with 1000% annual inflation as well as with price stability

- remember that neither inflation nor money were part of the households optimisation problem in previous 'business cycle' lectures

- nevertheless, in the following we will discuss how inflation can affect either the availibility of goods or the amount of time that households can devote to leisure

- basically, inflation erodes the value of money causing that money is not fully, or perhaps not at all, used as a means of payment, store of value, or as a unit of account

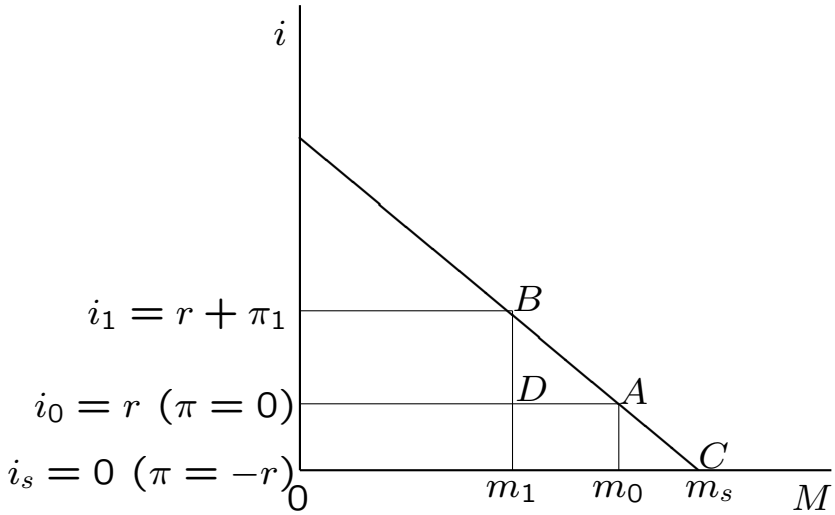
- even in case of fully anticipated inflation, distortions arise from:
  - sub-optimal money holdings
  - transaction costs for price marking ('menu costs')

– tax law 'nominalism'

- *Sub-optimal money holdings* arise out of higher opportunity cost that is identical with higher nominal interest rate (higher inflation)

- this is captured by the Fisher equation $i = r + \pi^e$ assuming that in the long run the realized inflation equals expected, i.e. $\pi = \pi^e$

- following Figure shows the point



if inflation is equal to zero, then it holds that $i_0 = r$ and households hold an amount of money m_0; any increase in inflation towards π_1 forces nominal interest rate to rise, and thus, money holdings to decline (m_1); m_s represents Friedman(1968) *'optimum quantity of money'* when $i = 0$ and the opportunity cost of money holdings does not exist

- for countries with low inflation, the costs of 'sub-optimal money holdings' are realtively low
  - if one assumes that an average household holds an amount of non-interest bearing money (M1) of 20 000 CZK, an inflation rate of 3%, and a real interest rate of 2% imply costs of money holding of 1000 CZK per annun or 83.33 CZK per month
  - if this is regarded as a fee for using the network of a universally accepted currency, it is certainly not enough to induce *barter* transactions

- this is completely different when inflation rates are very high, Bofinger(2000) shows (using the example of CIS countries in the 1990s) that inflation can revert an economy to a barter economy (or at least to 'currency substitution')

- to determine empirically the welfare costs of sub - optimal money holdings, a concrete money function is necessary
  - Lucas (1994) uses following semi-logarithmic real money demand function (constant interest rate semi-elasticity and unite income elasticity)

$$\frac{M_t}{P_t} = \beta e^{-\alpha i} Y_t \tag{3}$$

- for US economy he obtains a value of 0.27 for β and value of 7 for semi-elasticity α
- for nominal interest rate of 6%, inflation rate of 4%, and real interest rate of 2%, Lucas estimates:
  * the welfare costs of *a zero inflation rate compared with a deflation of 2%* to 0.3% of GDP in the US
  * the welfare costs of *a 2% inflation rate compared with an inflation rate 0%* to 0.2% of GDP in the US
- other studies arrive at quantitatively similar results, Cooley and Hansen (1991) find for US that an inflation rate of 10% is associated with costs amounting to 0.6% of GDP

- this evidence supports the view that with the inflation down to around 2% in most industrial countries the welfare effects of *sub - optimal money holdings* are relatively low

- *menu costs* are connected with all the costs that arise out of the need to change the prices more often in an inflationary environment
  - it captures not only the costs of reprinting the price lists

  - but also the costs of renegotiating wages and salaries, converting the vending machines ...
  - ... and when inflation rates are really high - costs of printing new banknotes

- it follows that when inflation rates are very high, menu costs can be considerable and a tendency to choose another accounting unit can occur

- *costs caused by the tax system* arise out of the *principle of nominalism*, the tax systems are based on
  - this principle assumes that nominal values are always identical with real values
  - it implies that nominal interest payments are fully treated as costs or income although they also contain a compensation for inflation
  - whereas borrowing firms can set their nominal interest payments against their taxable income, which decreases the paid effective real interest rate
  - savers pay too much taxes, since they are fully taxed on that proportion of the nominal interest that only serves to compensate for the inflation rate

- the net real interest rate (r_N) can be calculated as

$$r_N = (r + \pi)(1 - t) - \pi \tag{4}$$

- and r_N is greater than 0 as long as $r > \frac{\pi}{1-t}$
- for the previously high-inflation countries as Spain and Italy it is well documented that after an initial period of r_N being negative, the real interest rate incerased (rise in risk premium) to move the r_N well above zero

- so far we have discussed the effects of *well anticipated inflation* ...

- the effects of *incorrectly anticipated inflation* are, however, even more serious

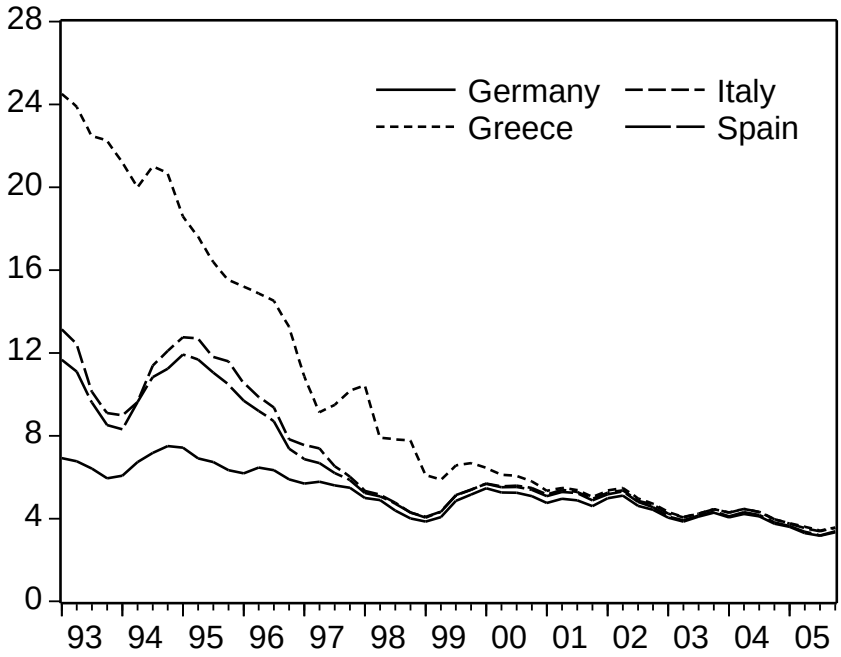
- it is well documented that the higher is the inflation the more volatile it becomes

- thus, higher inflation is associated with greater forecast errors (Barro, 1997)

- moreover, the costs of an unanticipated inflation become more serious in the case of long term contracts as are the collective pay agreements and the loans

- well known effect of an unanticipated inflation is the so-called *creditor/debtor hypothesis*:
  - there is a redistribution of wealth from creditors to debtors when the inflation rate is higher than expected
  - and in opposite way when the inflation rate is lower
- as a result, in an environment with very unpredictable inflation rate, creditors are willing to lend only if they are compensated with a 'risk premium'
- the reduction in nominal and real interest rates that was observed in several EMU member countries prior to their EMU entry showed that such risk premium could be quite high

Interest Rate, 10Y Government Bonds



Empirical evidence on costs of inflation

- even though many studies look at the relationship between the real GDP growth and inflation, empirical evidence on costs of inflation is not always very clear-cut

- this applies above all to the group of developed countries (OECD) where even for the high inflation period from 1972 to 1982, no negative correlation between inflation and real GDP growth can be detected

- this result is compatible with calculations by Barro (1995, 1997), who comes to the conclusions that significant growth losses are likely only with annual inflation rates of more than 15%

- Barro(1997) finds, for a sample of 117 countries, that a 10-percentage-point rise in the inflation rate causes a decline in the growth rate of 0.29 p.p.

- it follows that assuming steady inflation of 10% that leads to the decline in the annual GDP growth rate of 0.2 to 0.4 p.p., causes output fall by 6% to 11% in thirty years

Sum up: Long term view

- in sum, the longe term perspective shows that *price stability* is not a goal *per se*, but it is an important prerequisite for an efficient market functioning

- at the same time, it seems problematic to define a *nominal income* target as a long term goal of monetary policy

Inflation and output in the short run

- we simply define the short run as a period during which demand and supply shocks occur, while in the long run there is no role for shocks at all

- in this context the choice between *price stability* and *nominal GDP* targets is more complicated

- comparative advantages of these two targets can be best highlighted considering the difference between demand and supply shocks

- two remarks
  - it is assumed that a standard transmission works, i.e. decline in output is associated with a negative output gap (reduction of employment) and fall of prices
  - for the sake of simplicity the targets are defined as *level targets*, i.e. $P = P^*$ and $PY = (PY)^*$

- assuming first that *a negative demand shock* hits the economy, we get:
  - decline in output causing the output gap to be negative
  - fall of prices

  - and identical response of monetary policy for both *targets*

- this means that in the event of demand shocks both targets lead to the same stance of monetary policy

- however, the situation is different with *a negative supply shock* hitting the economy:
  - whereas a decline in output causes the output gap to be negative
  - shock itself forces prices to rise (negative output gap does not overweight the direct shock impact)
  - now *expanisonary* monetary policy may help to restore the output equilibrium, but it also causes a further increase in prices
  - instead, *restrictive* monetary policy is needed to ensure price level stability, however causing a further decline in output

- here it seems that *nominal output* target represents a compromise that distributes the negative effects of the shock equally between the two ultimate targets

- intuition of the advantage of nominal income rule is rather simple:

- a negative supply shock means that the nominal wages that had been agreed before the shock was realized have become too high
- if the central bank allows a temporary increase in the price level, a partial reduction of real wages is possible
- this correction is prevented if the central bank holds the price level constant

- short term analysis shows advantage of the nominal income target over a strict price level target thereby calling for the definition of the goals of monetary policy as:
  - price stability as a long term target, and
  - a stable nominal income as a short term target

- while this looks quite attractive from theoretical considerations point of view, practically such a dual target would be rather difficult to implement:
  - first, a dividing line between the short term and long term is difficult to draw (with an explicit nominal income target, monetary policy could be held responsible for mistakes in other areas of economic policy)
  - second, a short term nominal income target would require very high technicall skills of the central

bank (such a target can be met only if monetary policy is able to react even to very short term supply shocks)

  - third, with an obligation to target nominal income, the central bank would no longer be able to break inflationary expectations

- thus, in spite of the theoretical attractiveness, it seems problematic to define an explicit short-term nominal income target

- indeed, in reality, central banks have found a different and quite efficient solution coping with short term supply shocks

- as we shall later discuss in detail, this approach relies on a long term goal for price stability, which is defined flexibly enough to allow for accomodation of supply shocks in the short run

- however, it is fair to say that such a behaviour creates a potential risk of policy discretion

Operational issues

- so far we have discussed the target of price stability without a precise definition, however, such a definition is of crucial importance for practical monetary policy

- the expression 'price stability' might suggest that all prices are constant in a given economy, however, in the market economy it is inevitable that prices continually undergo adjustments in response to changes in real conditions, as the relative prices act essentially as a scarcity indicator

- an economically meaningful interpretation of 'price stability' therefore can only mean that prices do not change *on average*

- in reality an indication of whether an economy enjoys price stability or there has been a rise in the price level is given by a *price index*
  - a proper *price index* must fulfil a number of essential conditions (monotonicity, proportionality, identity, invariance)
  - and in order to be able to make meaningful long-term comparison of prices, the selection of items and their weighting must remain constant

  - the weights are often derived from the volume of goods consumed in a base period, constituting the so-called *basket* of goods

- from a theoretical viewpoint it may be objected that to include only consumers goods narrows the scope to much and that the index does not represent an appropriate measure of price stability

- on this argument it would be preferable to measure price stability using all the 'monetary transactions' (Edey, 1994)

- a broader definition of this sort would have the advantage of including (indirectly) prices of future consumer goods (through the inclusion of prices of securities and real estate)

- in practise, however, such a price index would be almost impossible to construct (Edey, 1994)

- a more recent approach for the measurement of inflation is the concept of *core inflation* that plays an important role in the monetary policy regime of inflation targeting

  - the idea behind is that there is a well-defined concept of 'monetary inflation' that ought to be of concern to monetary policy makers and that

this type of inflation is not conceptualy different to the cost of living (Wynne, 1999)

  - as usuall the latter is rather difficult to measure in practice ...
  - nevertheless, several central banks are working with indices of core inflation, which are derived from the price index by excluding:
    * *food and energy prices*
    * *changes in interest rates (BoE, RBNZ)*
    * *changes in indirect taxes (BoE)*
    * *first-round effects of supply shocks (RBNZ)*
  - core inflation concept has, however, a serious disandvantage for the communication with the public, as it is not necessarily regarded as being relevant
  - thus, although useful for internal analysis, for 'targets' and 'communication' the headline inflation seems to be more relevant

- *price level* target versus *inflation* target is another topic of academic discussion

- Svensson (1999a) makes a conceptual distinction as follows: *I shall refer to a monetary policy regime as price-level targeting or inflation targeting, depending upon whether the goal is a stable price level*

or a low and stable inflation rate, where the latter allows base drift of the price level

- the difference can be explained with a simple example:
  - assume that the central bank defines its target either by a stable price level or by a an inflation target of 0%
  - if the inflation rate is 3% in the first period (supply shock), the price level target requires a deflation in the following period as it does not allow for the base drift
  - this is different from the inflation target where the base drift is made so that the corrective deflation is avoided
- in practice, no central bank has ever announced a price-level target
- the experience of the Deutsche Bundesbank shows that even this ambitious central bank has always been willing to accept base drifts in its monetary policy, and in periods with major supply shocks, it even went so far as to adjust its inflation target upwards
- following Table shows that all the leading central banks aim at the low and positive inflation rate

with midpoint of 1.5%-2%

Central bank	**Target**
Czech National Bank	3% (since January 2006)
Bank of Canada	1%-3%
Bank of England	2.5%(±1%)
ECB	... close but below 2%
Reserve Bank of Australia	2%-3%
Reserve Bank of New Zealand	0%-3%
Sveriges Riksbank	2% (±1%)
Swiss National Bank	less then 2%

- the experience of the last fifty years indicates that it is impractical to set an inflation target of zero, mainly, thanks to the measurement problem

- according to the OECD (1994) the measurement problems are the result, above all, of four factors:
  - *quality bias*
  - *product substitution bias*
  - *new goods bias*
  - *outlet substitution bias*

- all the above factors mean that the inflation figures tend to overstate the effective inflation

- intensive research has been done in order to estimate the magnitude of the bias

- the most prominent one is the so-called 'Boskin Report' - Boskin *et al.* (1996) estimated the effect for US and Canada at 0.2%-2%

- in addition to these statistical problems, there are also economic arguments that could speak against an inflation target of zero
  - Akerlof *et al.* (1996) argue that a slightly positive inflation rate makes it easier to achieve changes in the real wages
  - this is based on the assumption that workers are unwilling to accept a decline in nominal wages
  - thus, without inflation, a required adjustment in real wages cannot be realized, which could lead to an increase in the NAIRU
  - similarly Summers (1991) argues that inflation rate close to zero could impair the macroeconomic management as it implies a 'neutral' nominal interest rate of 2%-3%
  - and as the nominal interest rates cannot become negative, there is relatively little scope for an expansionary policy in a period of recession
  - moreover as Laidler (1992) pointed out, it is often found in practice that with negative inflation rates (or with a strong disinflation) nominal interest rates do not fully adjust in accordance

with the Fisher equation, and as a result real interest rates are too high

- so, in the view of Bernanke (1999), the main argument against aiming for an inflation rate of zero is that this *'risks tipping the economy in deflation'*

Summary

- in contrast to the 1970s, there is today a broad consensus about 'price stability' being the final target for monetary policy

- it is completely uncontroversial that inflation is detrimental in the long run

- in the short run, a trade-off between price stability and nominal (real) income growth is possible, but it is limited to supply shocks

- in the case of demand shocks, a stabilisation of output contributes to a stabilisation of the price level, but, because of the long and variable lags in the transmission process, such a approach should be limited to more persistent shocks

- this consensus is reflected in concrete inflation targets that many central banks have announced in the last ten years

- the targets are often defined in a way that leaves some scope for supply shocks