Flexible inflation targeting

Speech by Deputy Governor Jarle Bergo, Gausdal, 23 January 2004

The address is based on the assessments presented at Norges Bank's press conference following the Executive Board's monetary policy meeting on 17 December 2003 and on previous speeches and publications.

Price stability, or low and stable inflation, is the primary objective of monetary policy in most countries. Historical experience from Norway and other countries has shown that the absence of price stability has resulted in low and unstable output and employment. High inflation or deflation is both a cause and a symptom of systematic imbalances in resource allocation.

In the 1920s, John Maynard Keynes suggested that monetary policy should be aimed at stabilising the price level.[1,2] This did not become common until the 1990s, however, even though Sweden had an explicit target for price stability in the period 1931-1937.

We have had four periods of high inflation over the past 100 years: during the two World Wars, the Korean War and a 15-year period from the first half of the 1970s to the second half of the 1980s. In Norway, high inflation is a wartime phenomenon and a 1970s and 1980s phenomenon.

In 1973, western economies experienced a recession which would prove to be the start of a long period of sluggish growth. Annual GDP growth in Western Europe was nearly halved compared with the previous ten-year period. This was largely due to a negative shift in productivity growth. In addition, we experienced a cost shock as a result of the oil crisis in 1973.

In Norway, the recession in the 1970s was dealt with by means of a strong counter-cyclical policy. Despite price regulation and rising unemployment, inflation rose sharply. This was an indication that structural shifts had taken place in the economy in the 1970s, shifts that were not apparent to politicians and economists at the time. The objective of full employment was given priority at the expense of price stability[3].

But we did not achieve higher growth in exchange for higher inflation. An economic policy that fuels inflation does not generate higher economic growth. On the contrary, it paves the way for subsequent recession and unemployment. It would take time, however, before this view took hold in Norway. One of the first to express this idea clearly during the debate in Norway was Per Schreiner, Director General in the Ministry of Finance at the time. He wrote the following in 1982:[4]

"It has been a common belief in the Nordic countries for a long time that it was possible to make a political choice between price stability and full employment. There are strong indications that this option does not exist [..].Personally, I am no longer in doubt that controlling inflation is essential to achieving other social objectives."

Norway adopted a nominal anchor when the devaluation policy was abandoned in 1986. We adopted an inflation target in the spring of 2001.

Section 1, first paragraph, reads: *"Monetary policy shall be aimed at stability in the Norwegian krone's national and international value, contributing to stable expectations concerning exchange rate developments. At the same time, monetary policy shall underpin fiscal policy by contributing to stable developments in output and employment.*

Norges Bank is responsible for the implementation of monetary policy.

Norges Bank's implementation of monetary policy shall, in accordance with the first paragraph, be oriented towards low and stable inflation. The operational target of monetary policy shall be annual consumer price inflation of approximately 2.5 per cent over time. [. .]."

Section 1 of the regulation states that in addition to sustaining the rate of inflation at approximately 2½ per cent over time, monetary policy shall also contribute to stable developments in output and employment.

The mandate therefore establishes a flexible inflation target for monetary policy where variations in both output and employment are given emphasis. Since inflation is a monetary phenomenon over time, the level of the inflation target may be chosen by the authorities. A target for output, however, cannot be chosen in the same way.

The economy grows over time. This is a result of positive productivity growth and population growth. The level of output that is consistent with stable inflation over time is discussed in economic theory as potential output. The level of potential output cannot be influenced by monetary policy. When the economy grows more rapidly than this level, inflationary pressures will build up in the economy. When the inflation rate becomes high and unstable, self-regulating mechanisms will tend to curb growth. Experience shows that periods of high inflation are followed by periods of contraction. Over time, it will be impossible to maintain output at a level that is higher than the potential output level.

Monetary policy's contribution to stabilising output will therefore be to curb fluctuations around the potential output level. The potential output level cannot, however, be observed. It is also difficult to capture changes in productivity and technology.

One approach to measuring the level of potential output may be to calculate trend output, which entails a smoothing of historical GDP figures.

Norges Bank bases its calculations of trend growth on an HP filter (Hodrick Prescott filter), but also takes into account other factors such as structural changes or changes in the number of vacation days. Our assessment of the volatility of trend growth is also a matter of discretionary judgement.[5]

The output gap measures the deviation in output from the level of potential output. There are various methods for estimating the output gap. Statistics Norway, like Norges Bank, uses the HP filter, but bases its calculations on quarterly figures for GDP. Statistics Norway's calculations of the output gap are very similar to the calculations made by Norges Bank, with

the exception perhaps of the last period, where Statistics Norway did not make adjustments for the increase in vacation days in 2001 and 2002. The OECD calculates the output gap by using the production function method, where trend levels for labour, capital and available technology are inserted into a specified production function. Potential output is then determined by trend growth in factor inputs. The IMF uses a number of methods, but has chosen to calculate the output gap for Norway in approximately the same way as Norges Bank. As you can see from the chart, the different methods of calculation give roughly the same outcome.

To cross-check the projections for potential output and thus the output gap, we also look at alternative indicators of pressures in the economy.

The wage gap measures the difference between actual wage growth and the growth that over time is consistent with the inflation target, and is an indicator of labour market tightness. With an estimate of 2 per cent productivity growth, wage growth of 4.5 per cent over time will be consistent with an inflation target of 2.5 per cent. In the chart, the wage gap up to 2000, i.e. before the introduction of the inflation target, is defined as the difference between wage growth in Norway and in other countries. As we see from the chart, there appears to be a close relationship between this wage gap and the output gap as it is measured by Norges Bank. If we look at developments in employment in relation to trend growth (measured as a percent of the population in employable age groups), we get a similar path.

We also consider credit growth to be an indicator of public demand. Growth in credit which over time deviates from growth in nominal GDP may indicate that the level of activity in the economy is higher or lower than normal. In addition, we monitor various cyclical indicators and acquire information from our regional network.[6]

There is uncertainty associated with the estimation of both trend growth and the output gap, but the correspondence that seems to exist between the different methods of indicating pressures in the economy makes us confidant that the output gap, as we calculate it, provides useful information. The output gap provides an overview of the overall pressures in the real economy.

If there are no substantial economic disturbances - or shocks - there will be no conflict between stabilising inflation and stabilising output and employment. A positive output gap will over time result in inflation that is above target, while a negative output gap will result in inflation that is too low.

Nor will demand shocks in a closed economy result in a conflict in the short term between price stability and stability in the real economy. A positive demand shock will result in higher inflation, and an appropriate monetary policy response would be to increase the interest rate as much as is necessary for output to return rapidly to its potential level.

In an open economy, however, a conflict of objectives could arise in the short term following a demand shock. Although a higher interest rate would contribute to stabilising both output and inflation, there might be a conflict with regard to the "dosage". If the interest rate is increased to the extent that output is reduced to a level that is consistent with stable

inflation over time, inflation may be too low as a result of an appreciation of the exchange rate in the short term. A trade-off must be made in the short term between the inflation target and stability in the real economy.

A cost shock, which fuels inflation and at the same time reduces output and employment, leads to a more marked conflict in the short term between the inflation target and stability in the real economy.

Different types of disturbances will often occur at the same time, and the central bank must continuously make trade-offs between variations in output and employment on the one hand and variations in inflation around the target on the other. Given that inflation over time shall be close to the target, these trade-offs are at the core of flexible inflation targeting.

In the theoretical literature, making trade-offs between price stability and stability in the real economy is often described as minimising a loss function, where variations in output and variations in inflation are included.[7] The central bank shall then choose the path for interest rates ahead that minimises the discounted "losses" in all future periods. The loss in one individual period will be:

$$L_t = (\pi_t - \pi^*)^2 + \lambda(y_t\text{-}y_t^*)^2$$

In the equation, π denotes inflation, π^* the inflation target and $(y\text{-}y^*)$ the output gap. The loss function thus includes the deviation between output and the output potential and between inflation and the inflation target. The deviations enter the loss function quadratically. Large deviations from the targets are thereby deemed to be a considerably more serious disadvantage than small deviations. In the event of large deviations between inflation and the inflation target, or substantial imbalances in the real economy, the use of relatively strong measures may be appropriate. The trade-off between inflation stability around the inflation target and stable growth in output is expressed by parameter λ. The higher λ is, the greater the emphasis on real economic stability in relation to stability in inflation. With a strict inflation target, i.e. emphasis is only placed on inflation, λ is equal to zero. $\lambda > 0$ is the definition of flexible inflation targeting. Although the loss function has two add factors, both of which are given emphasis, a fundamental difference is that the monetary policy authorities can choose the inflation target but not the level of potential output.

In practice, no central bank uses a loss function of this kind directly. What inflation-targeting central banks do in practice does, however, contain elements of the thinking behind this theory.

The choice of horizon for monetary policy implicitly provides some information about the central bank's loss function.[8] A central bank that places considerable emphasis on inflation and little emphasis on the real economy will choose a short horizon. A central bank that places considerable emphasis on the real economy will choose a long horizon. Behind the choice of a horizon of normally two years lies a perception of how the interest rate affects developments in inflation and output, and the central bank's trade-off between variations in these two variables.

According to theories on optimal monetary policy, the horizon should vary and partly depend on the size and duration of disturbances to the economy. For some types of disturbances, such as demand shocks, the optimal choice may be to achieve the inflation target relatively rapidly. For other types of disturbances, such as cost shocks, a longer horizon may be optimal, provided that confidence in monetary policy is not in jeopardy.

Even though, according to the theory, the horizon should be variable, there are some advantages to maintaining a fairly firm horizon that have not been as prominent in the literature. It is crucial that the public and market participants understand how the central bank sets the interest rate in order to contribute to confidence and credibility in monetary policy. According to the principle normally followed by Norges Bank, the interest rate is set with a view to achieving inflation of 2½ per cent at the two-year horizon. If it appears that inflation will be higher than 2.5 per cent, the interest rate will be increased. If it appears that inflation will be lower than 2.5 per cent, the interest rate will be lowered. This is a clear and simple interest rate setting principle to which the public and market participants can easily relate. This kind of simple principle also contributes to reducing uncertainty about the central bank's trade-offs between price stability and stability in output and employment. We have no reason to believe that a variable horizon would generally result in substantially higher stability in inflation and output than a two-year horizon.

In some cases, however, it may be appropriate to change the horizon. In situations where the central bank's forecasts indicate that substantial imbalances in the real economy would arise if the interest rate was set so that the inflation forecast two years ahead was the same as the target, it might be appropriate to apply a somewhat longer time horizon. The same may be the case if financial stability is at risk.

The entire path for inflation and the real economy, both before and after the two years, will be taken into account when setting interest rates. There are two reasons for this. First, there may be several paths that result in inflation of 2.5 per cent at the two-year horizon, and developments after the two- year period may be important to the choice of path. Second, the entire path will be considered when assessing whether there are grounds for changing the horizon. We have also begun providing projections for a three-year period in the *Inflation Report*.

If extraordinary conditions prompt Norges Bank to apply a different time horizon than two years, the Bank will provide a clarification of this.

However, confidence and credibility in the conduct of monetary policy are necessary before taking such additional considerations into account. The greater the confidence in the inflation target, the larger the scope for stabilising the real economy. A rapid and pronounced change in the interest rate may be appropriate in cases where there is a risk that inflation might deviate considerably from the target over a longer period, so that inflation expectations might be affected or where heightened turbulence in financial markets or a cost-push shock resulting from wage negotiations indicates that confidence in monetary policy is in jeopardy.

In Norges Bank's *Inflation Report*, we present our forecasts for both inflation and the output gap in the same chart. The reason for this is that we want to be as transparent as possible

concerning the trade-offs made in our conduct of monetary policy. Transparency enhances confidence in and the understanding of monetary policy. This has been well received internationally, cf. the following quote from a presentation by Professor Lars Svensson at a conference hosted by the Federal Reserve Bank of St. Louis:[9]

"A recent innovation of the Bank of Norway [..].is to plot the inflation forecast and the output-gap forecast in the same graph. This clearly serves to emphasize that the bank is concerned with the stability of the real economy as well as with inflation, emphasizing the flexibility in its inflation targeting."

Transparency and communication

Confidence in monetary policy makes it easier to achieve the inflation target and increases the possibility of stabilising output and employment. Transparency can contribute to strengthening confidence.

Transparency makes monetary policy more predictable. In an environment where market participants understand the central bank's response pattern, the reaction of market rates to new information about economic developments has a stabilising effect.

Norges Bank wants to be open about its monetary policy work. An account of the methods we use for our inflation projections, analyses of the functioning of the economy and our professional judgment is provided in our *Annual Report, Inflation Report,* strategy documents, speeches and other publications.

We also try to have a systematic procedure for interest rate decisions where we operate with a pre-announced calendar for the monetary policy meetings. The interest rate decisions, together with a thorough explanation of the background for the decision, are published after each meeting. A press conference is held after each monetary policy meeting, whether the interest rate is changed or not, where either the central bank governor or deputy governor presents the background for the decision and answers questions.

The strategy documents, which are published at a later time, should serve to further clarify the trade-offs and the rationale behind the decision.

The *Inflation Report* contains our analyses of the economic situation and projections concerning developments in inflation and output in the next few years. These reports provide guidance for market participants and the general public concerning monetary policy in the period ahead.

Thus far, Norges Bank has generally used two alternative technical assumptions concerning the interest rate in the *Inflation Report*: that the interest rate follows market expectations, represented by implied forward rates, or that the interest rate remains unchanged. We have often used both assumptions, but in the last *Inflation Report*, we only used forward rates. Based on the assumption that the interest rate and the krone exchange rate move in line with the forward interest rate and forward exchange rate respectively, our projection implied that inflation would return to target after two years. We interpreted this as an

indication that the market's interest rate expectations were consistent with achieving the inflation target at the two-year horizon. This type of assumption also provides an internal consistency between interest rate and exchange rate assumptions.

There are also other possible interest rate assumptions, however. We could, for example present an "optimal" interest rate scenario, based on model- based calculations and an explicit loss function, or on more judgmental assessments. Another alternative is to base future interest rate developments on a simple rule, for example, a variation of the Taylor rule. In the inflation reports of The Reserve Bank of New Zealand, the interest rate varies over the projection period based on a simple forecast-based interest rate rule.

Even though these endogenous interest rate paths are a theoretically more satisfactory way of presenting these forecasts, they are not unproblematical. For example, an "optimal" interest rate path could lead to a misconception that the central bank is committed to setting future interest rates in line with this path, regardless of the shocks that occur. An interest rate path based on a simple rule may give the impression that the interest rate is actually set on the basis of this rule.

In terms of communication, there is no definitive answer as to what are the best interest rate assumptions. Sometimes, projections based on specific interest rate assumptions may indicate that the monetary policy objective will not be achieved within a reasonable horizon. This will be a signal that the interest rate will probably deviate from these assumptions in the period ahead.

Monetary policy under uncertainty

There is always uncertainty associated with economic projections, but there is also uncertainty concerning the actual state of the economy at the time of the decision. Moreover, the effects of our own interest rate setting are uncertain.[10]

Because most aspects of the future are uncertain, our projections are seldom 100 per cent correct. Viewed in retrospect, it might appear that monetary policy could have been conducted better. However, interest rate decisions have to be assessed *ex ante*, in the light of the information that was available at the time that the decisions were made.

One of the main problems associated with the conduct of monetary policy under uncertainty is access to real time data that provide good information about inflationary pressures in the economy. Petter Jacob Bjerve pointed this out in an unusually perspicacious article in 1981 on cyclical policies in Norway in the 1970s:

"It will otherwise always be a problem for economic policy that the statistics are prepared more or less after the events, and that it takes time after the statistics are published before we are aware of whether new trends have begun to emerge. [...] Moreover, the analyses were based on projections of productivity growth that proved to be too high."

As I pointed out in my introduction, there was strong growth until 1973, and it took time before it became apparent that there had been a negative shift in potential output. The red dotted line in the chart shows what GDP would have been if the growth rate had been the

same after 1973 as in the previous 10 years. Because the negative shift in the level of potential output was not discovered in time, a counter-cyclical policy was employed in an attempt to sustain the output level. Whereas the output gap was believed to be negative, it subsequently proved to be positive, as illustrated by the chart.

Similarly, in a study of previous US monetary policy, Orphanides[11] finds that central banks overestimated the level of output that was consistent with stable inflation in the 1970s because they were not aware of falling productivity growth in time. As a result, the output gap was underestimated and policy was too expansionary. Also in the 1990s, we saw an increase in productivity growth, and even though the mistake from the 1970s was not repeated, there was a vigorous debate concerning different measures of trend growth and the output gap.

In addition to the difficulty of capturing changes in potential output fast enough, there is also considerable uncertainty about the level of actual GDP. As an example, Norway's GDP figures were extensively revised in June 2002. Growth in mainland GDP was revised upwards by an average of 1 percentage point per year for the period 1995-1999. The largest revision was for 1999. As late as in May 2002, we believed that growth in 1999 had been 1.1 per cent. The revised figures now show that growth was in fact 2.7 per cent. It is obvious that such revisions can have a considerable impact on the actual output gap.

Norges Bank is currently systematising different vintages of national accounts figures. We can then go back and evaluate monetary policy in "real time" to learn how we should respond to uncertain data.

Frank Knight (1921) differentiates between "risk" and "uncertainty".[12] With risk, we know the probability distribution for the potential outcomes, but with pure uncertainty we do not. Thus, there is risk, but not uncertainty, associated with the fall of a die, according to Knight. Thus, for a decision- maker, risk is far more manageable than pure uncertainty.

In practice, the distinction between risk and uncertainty is not absolute; rather, there is a continuous scale. We never have complete knowledge of the probability distribution of the economic variables, although historical experience provides some indication. But some variables are characterised more by risk, in the sense that the range of outcomes is well specified, than others.

Let's look at some concrete examples. Projections for wage growth are important for the conduct of monetary policy. For a given wage formation system, the outcome of wage negotiations is characterised more by risk. We do not know with certainty in advance what the outcome will be, but historical experience provides us with information about the probability distribution. However, the probability distribution depends on no change having taken place in the wage formation system. Such changes may occur, but we have little basis for judging the probability of this. If a change has actually taken place, however, we have little information about the probability distribution for the outcome of wage negotiations in the future. Whereas wage growth projections were previously characterised more by risk, they are now characterised more by Knight uncertainty.

Another factor is the rise in prices for imported goods. There have been major structural changes in world trade, with intensified competition and China's WTO membership. It is still too early to establish the effects of these factors on inflation abroad or how long the process of change in world trade will persist. Projections for imported price inflation may therefore be said to be characterised more by Knight uncertainty for a period ahead.

Monetary policy under uncertainty was one of the many topics discussed in the report Norges Bank Watch 2003, where our policy response pattern and communication were evaluated in the light of the theory of monetary policy under uncertainty. This was useful input and constructive criticism which we will keep in mind in our future work.

Norges Bank Watch 2003 points out, for example, that we should make a clearer distinction between additive uncertainty and multiplicative uncertainty. This distinction is most clearly reflected in our economic models. The uncertainty associated with the exogenous variables is called additive uncertainty. Examples of additive uncertainty are add factors in our economic models and other exogenous factors such as fiscal policy and the oil price. Uncertainty about the actual functioning of the economy may, however, lead to multiplicative uncertainty. Multiplicative uncertainty often involves uncertainty about the structural parameters in the model, such as the effect of the interest rate on demand and the exchange rate and the slope of the short-term Phillips curve.

How does the central bank relate to the fact that we do not know precisely how the world is or how it will be in the future?[13]

Alan Blinder, former Vice Chairman of the Board of Governors of the Federal Reserve and currently a professor at Princeton University, touches on this when he formulate the recipe for a successful monetary policy:[14]

- Step 1: Estimate how much you need to tighten or loosen monetary policy to "get it right." Then do less.
- Step 2: Watch developments.
- Step 3a: If things work out about as expected, increase your tightening or loosening, toward where you thought it should be in the first place.
- Step 3b: If the economy seems to be evolving differently from what you expected, adjust policy accordingly.

I have not doubt that a number of central banks will sympathise with this recipe. Norges Bank normally takes a gradual approach to interest rate setting due to uncertainty concerning economic developments, including the effects of previous changes in the interest rate.

This principle is also supported by economic theory. As early as 1967, Brainard showed that central banks should respond more cautiously to economic disturbances when there is

uncertainty as to how strongly the interest rate affects the economy, in other words when there is multiplicative uncertainty.[15]

On the other hand, according to theory, additive uncertainty, where uncertainty factors are assumed to be independent of the interest rate, shall not be taken into account when setting interest rates. Certainty equivalence implies that we make an unbiased projection for the uncertain factor and take the projection into account in the same way as if we knew with certainty that it would occur.

Theory implies that the central bank should be more aggressive when setting interest rates when faced with certain types of multiplicative uncertainty, for example, uncertainty regarding the extent to which the deviation from the inflation target for a period has an effect on market participants' expectations concerning future inflation.[16] This is in line with previous statements from Norges Bank where we state that:

The interest rate may be changed rapidly and markedly if there is a risk that inflation might deviate considerably from the target over an extended period so that inflation expectations might be influenced, or when heightened turbulence in financial markets or a rise in costs as a result of negotiated wage increases indicate that confidence in monetary policy is in jeopardy.

The fact that academic research is devoting more attention to monetary policy under uncertainty is useful for us practitioners. But it is important to be aware that the results in this literature depend, of course, on the assumptions, which are often relatively simple and stylised. Therefore, the relevance of the theoretical results to the practical conduct of monetary policy is also uncertain! We look at theory with considerable interest, albeit with a certain degree of Brainardian caution.

Summary

The government has defined a mandate for monetary policy that involves flexible inflation targeting. In addition to ensuring that inflation is close to 2.5 per cent over time, monetary policy shall also contribute to stabilising developments in output and employment. Monetary policy cannot influence the potential output level, but can dampen fluctuations around this level. In this way, monetary policy can contribute to stabilising developments in output and employment.

Inflation cannot be controlled exactly, but it is relatively simple to measure how far it is from the target. It is more demanding to measure the gap between actual output and potential output.

In our operational conduct of monetary policy, we normally set the interest rate with a view to maintaining inflation at 2.5 per cent two years ahead. Due to uncertainty, we usually proceed gradually. In our opinion, this response pattern will normally result in a reasonable trade-off between stabilising inflation around the target and stabilising output and employment.

Footnotes

[1] Keynes, J. M., (1923) "Notes for Lecture to the National Liberal Club", reprinted in "Collected Writings of John Maynard Keynes", Vol. XIX, Macmillian, London, 1981

[2] A price level target means that inflation that is too high for a period must be counteracted by negative inflation in the subseqent period. An inflation target, on the other hand, permits "base drift", which means that prices do not have to return to a specific level.

[3] See discussion in Bjerve, P. J. (1981) "Kva hende I Norge i 1970-åra- konjunkturpolitisk?", Sosialøkonomen no. 5 1981, pp 10-21

[4] Schreiner, P. (1982) "Er Ola Nordmann smart nok? Den fulle sysselsetningen i fare!", Universitetsforlaget.

[5] Norges Bank has chosen, in keeping with ordinary practice, to use a smoothing parameter, ? = 100 in the annual data.

[6] See the box "Flexible inflation targeting and indicators of pressure in the real economy" in Inflation Report 3/03, p. 46, for a more detailed description of the different indicators.

[7] See for example Svensson, Lars E. O. (2002): "Monetary Policy and Real Stabilization", in *Rethinking Stabilization Policy, A Symposium Sponsored by the Federal Reserve Bank of Kansas City*, Jackson Hole, Wyoming, August 29-31, 2002, pages 261-312.

[8] See for example Smets, F. (2000): "What horizon for price stability", ECB Working Paper nr. 24, July 2000 and Svensson, L. (1997), "Inflation forecast targeting: implementing and monitoring inflation targets", European Economic Review, 41, 6, side 1111-1146.

[9] Svensson, L. E. (2003): "Comments on Laurence H. Meyer, "Practical Problems and Obstacles to Inflation Targeting", at the conference "Inflation Targeting: Prospects and Problems, the Twenty-Eighth Annual Economic Policy Conference, Federal Reserve Bank of St. Louis, October 16-17 2003.

[10] In the opening address at last year's Jackson Hole conference, Alan Greenspan expressed the following:
"Uncertainty is not just an important feature of monetary policy landscape; it is the defining characteristic of that landscape. As a consequence, the conduct of monetary policy in the US at its core involves crucial elements of risk management."

[11] Orphanides, A. "The Quest for Prosperity without Inflation", Journal of Monetary Economics, 50(3), April 2003, 633-663.

[12] Knight, Frank H. (1921) "Risk, Uncertainty and Profit"

[13] See Frøyland, E. and Lønning, I. (2000): "The significance of uncertainty in monetary policy", *Economic Bulletin* no. 4/2000 for a more detailed description of different types of uncertainty.

[14] Blinder, A. (1998) "Central Banking in Theory and Practice", MIT Press

[15] Brainard, W. (1967) "Uncertainty and the Effectiveness of Policy," American Economic Review, 57 (2), May 1967, pp 411-425.

[16] See Söderström, U. (2000): "Monetary Policy with Uncertain Parameters", ECB Working Paper No. 13, February 2000.