Norges Bank Watch 2009

Monetary Policy and the Financial Turmoil

Michael Bergman
University of Copenhagen
michael.bergman@econ.ku.dk

Steinar Juel
Nordea
steinar.juel@nordea.com

Erling Steigum
BI Norwegian School of Management
erling.steigum@bi.no

Centre for Monetary Economics
BI Norwegian School of Management
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Foreword

Each year the Centre for Monetary Economics (CMI) at The Department of Economics, BI Norwegian School of Management appoints an independent group of experts to evaluate monetary policy in Norway. This report is the tenth, an anniversary we are proud of.

The committee consists of Michael Bergman, Associate Professor of Economics at The University of Copenhagen, Steinar Juel, Chief Economist for Norway at Nordea, and Erling Steigum, Professor of Economics at BI. The committee is solely responsible for the report and the views therein. The report does not necessarily represent the views of the CME or of its members.

The Ministry of Finance partly funds the Norges Bank Watch reports which contain useful information and analysis for the Ministry's evaluation of monetary policy that is presented each year in a White Paper to the Parliament.

Oslo, 24 February 2009

Centre for Monetary Economics

Arne Jon Isachsen

Executive summary

This report evaluates the conduct of monetary policy in Norway in 2008. We will not discuss the institutional framework for monetary policy. The report offers, however, an evaluation of the new price index, CPIXE, which Norges Bank adopted in 2008 for measuring underlying inflation.

The international financial turmoil

In the last quarter of 2008, all the large industrial countries in the OECD area were hit by a severe and synchronized business cycle slump, involving a steep decline in industrial production and exports, rapidly increasing unemployment and unprecedented policy rate cuts by central banks. In December, both Riksbanken and Norges Bank surprised markets by cutting policy rates by astonishing 175 basis points (bp) on top of previous cuts in October and November.

The main driving force behind the international slump appears to be a sudden increase in counterparty risk and financial turmoil involving dysfunctional money and credit markets. Many commentators have considered the failure of Lehman Brothers on September 15, 2008 to be the single most important event that triggered the panic in international money markets and the ensuing credit crunch. In the weeks and months following the Lehman Brothers bankruptcy, dramatic increases in money market spreads were observed all around the world. The initial steps taken by the U.S. Government and the Fed to repair money and credit markets probably did have unintended negative effects on trust and perceptions of counterparty risks among banks, making the financial crisis more severe rather than less.

In Norway, both the mortgage rate and Nibor increased significantly more than the key policy rate in 2008. For example, the mortgage rate increased by nearly 150 bp from December 2007 to October 2008. The key policy rate only increased by 50 bp in this period. We have no indications that the sharp rise in the mortgage rate from September to October 2008 was intended by Norges Bank. The present monetary policy strategy of Norges Bank involves a strong focus on the key policy rate, which is normally only changed at 6 weeks interval and after thorough economic analysis of its effects and on the outlook for the Norwegian economy.

More flexibility and speed in setting the overnight deposit rate of Norges Bank is possible, however. The Swiss National Bank (SNB) has adopted a different strategy of monetary operations from most other inflation-targeting central banks. The SNB implements its monetary policy by fixing a target range for the three-month Swiss franc Libor. From late September through October, the Swiss repo rate was cut aggressively to counteract the tendency of the Swiss franc Libor to increase due to the money market shocks after the Lehman bankruptcy. In this way, SNB was able to gain better control of the 3 months Sweiss Libor rate than what was the case in Norway and Sweden. In our view, Norges Bank should take a closer look at the SNB's strategy of monetary operations to see what can be learned from a sharper focus on the 3-month Nibor to enhance the effectiveness of monetary policy in Norway.

Monetary policy in 2008

Monetary policy before September 2008

Since 2004, the Norwegian economy has boomed. Late 2007, Norges Bank expected the Norwegian economy to cool down gradually over the next three years. The envisaged "soft landing" was

forecasted to require the key policy rate to be hiked by 25 bp to 5.25 percent in December, and to 5.50 in Q2 2008. Norges Bank left its key policy rate unchanged at 5.25 percent at the Executive Board-meetings on 23 January and 13 March, but it was raised at the meeting 23 April. That was in line with the interest path and strategy outlined in Monetary Policy Report 1-2008. The press release after the meeting on 23 April indicated that the Bank's concern over inflation had increased.

At the time of the Executive Board meeting on 28 May, Norges Bank concluded that underlying inflation now had become somewhat higher than the inflation target, but the key policy rate was kept unchanged. In the new Moneatry Policy Report 2-2008 presented on 25 June, the interest path was lifted significantly and the rate was hiked by 25 bp to 5.75 percent. The new interest path indicated a 50 percent probability for another hike in October 2008. Due to the extremely high capacity utilisation in the Norwegian economy, it was understandable that Norges Bank was very concerned about inflation taking off. Rise in food and energy prices could further fuel inflation. Inflation was now envisaged to overshoot for some time and then decline toward the target late in the Bank's forecast horizon.

In June there were signs that economic growth in Norway was slowing down more pronounced than previously expected and the outlook for growth internationally had weakened further. The growth forecasts for 2009 in Moneatry Policy Report 2-2008 both for Norway and in particular for the major industrial countries were on the optimistic side compared with other forecasters. Consensus, as surveyed by Reuters, expected an unchanged rate at 5.5 percent. We think, however, the the increase in the key policy rate in June can be defended, given the inflation and output gap projections that were reasonable at that time.

At the Executive Board-meeting on 13 August, Norges Bank acknowledged that growth internationally, particularly in Europe, was slowing rapidly. The impact on the Norwegian economy was considered to be out-weighted by higher core inflation than expected in June. That slower growth would have a negative effect on inflation going forward was not a theme. With the information available in August, it could be argued that the Bank was too focused on the most recent inflation numbers – which was the result of past economic development – and not sufficiently forward looking. However, the Bank did probably not have sufficient information that would warrant a rate cut. Still, in August the Bank could have signalled that the probability of another hike later in the autumn had diminished.

In our opinion, Norges Bank's monetary policy in the period January-August 2008 was consistent with the signals given after each Board meeting and in the two Moneatry Policy reports. In the first half of the year, Norges Bank had good reasons to be focused on avoiding excessive inflation. Monetary policy was tightened gradually as current inflation continued to surprise on the upside.

Monetary policy in the period September – December 2008

Up till August, Norges Bank assessed the economy to be well on track for a "soft landing" between 2008 and late 2010. The shock waves after the failure of Lehman Brothers in September changed the situation dramatically, however. Growth outlook weakened quickly as did the outlook for inflation.

The press release and press conference after the Executive Board meeting on 24 September conveyed the impression of a central bank in bewilderment. Norges Bank was still concerned about inflation, but on the other hand, the crisis in the financial markets worldwide had deepened. Norges Bank had reacted to the turmoil in the money market by supplying more NOK liquidity to the banks, and by lending USD. At the time of the Board's meeting, the Bank's main focus was to give

”first aid” to the money market. The Executive Board concluded that it was difficult to determine the effects on Norway’s inflation and activity of the unusually high degree of uncertainty linked to the turbulence in financial markets. The key policy rate was therefore not reduced. “No new signals” was the main message. It was considered too early to signal a revision of the interest path presented in Monetary Policy Report from June.

It is understandable that Norges Bank on 24 September had not digested the consequences of acute financial turmoil after Lehman Brothers’ failure. No one expected Norges Bank to cut rates on 24 September. But there were expectations that the Bank now would indicate reduced probability for another hike later in the autumn. In our view, Norges Bank had sufficient information to signal increased probability of a constant rate, or a rate cut, later in the fall.

On 8 October, a coordinated rate cut took place internationally. Federal Reserve, European central bank, Bank of England, Swedish Riksbank, Bank of Canada and Swiss National bank cut rates by 50 bp. Norges Bank decided to convene an extraordinary meeting on 15 October, which decided to cut the key policy rate by 50 bp. Our view is that this decision was very appropriate. The coordinated cut by other central banks was probably an eye opener and the main reason for Norges Bank’s cut on 15 October.
During the fall, ***liquidity management*** became an important part of monetary policy. As the NIBOR market is based on banks borrowing in USD and swapping to NOK, spreads also increased in the NIBOR-market, due to higher counterparty risk perceived by international lenders of USD. Banks’ funding costs therefore increased. Norges Bank reacted by supplying more and longer NOK-funding to banks through the F-loan facility, by easing the collateral requirements for acquiring F-loans and by lending USD to the banks.

As the banks’ difficult funding situation continued, the Government together with Norges Bank set up a facility where banks could exchange Norwegian covered bonds (OMFs) with government securities for a period of 3-5 years. The facility was adopted by the Storting on 24 October and had a limit of NOK 350 bill. However, most of the government securities’ banks have received have ended up as collateral for F-loans in Norges Bank. These interventions did not eliminate the extraordinarily high spreads.

The Executive Board met again on 29 October and lowered the key policy rate by 50 bp to 4.75 percent. The new interest rate path published in Monetary Policy Report 3-2008 indicated further 0.25 percentage point cuts at the next Board meetings in December 2008, March 2009 and August 2009. Ahead of the 29 October meeting, however, the market priced in a larger cut and a lower interest path than Norges Bank presented.

The unusually high uncertainty was not reflected in the Moneatry policy Report in other ways than verbally. At this juncture, the Swedish Riksbank’s communication with the markets was superior to Norges Bank’s. Riksbanken published a new Monetary Policy Report in October, six days before Norges Bank. It also usually publishes alternative scenarios and this time the alterative scenario illustrated what the Bank would do if there were strong negative effects of the credit crisis. Riksbanken indicated that in such a situation, an unusually large rate cut would be warranted. As the negative effects of the credit crisis materialized in November and December, Riksbanken cut its policy rate about as illustrated in the previous scenario from October, by 175 basis points on 4 December.

Between the Executive Board-meetings on 29 October and 17 December, the market’s expectations for a larger cut from Norges Bank was fed with more weak indicators, stronger than expected decline in inflation rates and large rate cuts in other countries. In Sweden, the Riksbank forwarded its Monetary Policy Committee-meeting from 16 to 4 December, signalling an extraordinarily large

cut. On the same day, The Bank of England cut its policy rate by 100 bp and the European central bank (ECB) by 50 bp.

The uncertainty before Norges Bank's Executive Board-meeting on 17 December was extraordinarily large. The 175 bp cut on 17 December more or less surprised everybody.

Assessment of monetary policy in September-December 2008

Norges Bank was during the fall criticised for reacting too slowly to the changed situation. Generally, Norges Bank became follower to other central banks in cutting rates. However this has to been seen in the context that the impact on the Norwegian economy of weaker growth internationally came late and that capacity utilisation and that domestically inflationary pressure was higher than in other industrialised economies. The slowdown in economic growth we saw up to August originated mainly from domestic demand, and was the result of tighter monetary policy. Growth in manufacturing production, which to a large degree is driven by exports and investments in the petroleum sector, kept up well during the first three quarters of the year. This contrasts with for instance Sweden and Germany where growth in manufacturing production was negative most of 2008. However, at the time of the MPC-meeting in August and even more when the September meeting took place, there were clear signs that growth in the Norwegian economy was decelerating more than expected.

Our view concerning monetary policy in the period September-December 2008 can be summarized as follows:

With the information available at the time, Norges Bank could at the MPC-meeting in August and certainly at the MPC-meeting in September, have indicated less probability of another rate hike later in the autumn.

We think it would be helpful if Norges Bank start publishing its network reports when they are ready, independent of MPC-meetings. In situations with extraordinarily high degree of uncertainty about the economic outlook, the Bank should let that be reflected in the alternative scenarios it publishes in the MPR. When the Bank's assessment changed so dramatically just a few weeks after the publication of a new MPR and before a new MPC-meeting, Norges Bank should in appropriate ways have communicated that publicly as early as possible.

It was appropriate that Norges Bank published an update on 17 December. However, its lack of completeness made the update less useful as a basis for assessing whether current indicators developed in line with, or deviated significantly from Norges Bank's forecasts. We recommend that future updates, which hopefully will be few, are published with more complete forecasts.

Norges Bank seems to have reacted promptly to the turmoil in the money market by extending F-loans and offering loans to banks in other currencies. The bank's alertness was high and its contact with the treasury departments in the banks seems to have been good. Norges Bank could at an earlier stage have offered longer term F-loans. The exchange facility for OMFs and governments securities has improved the banks' longer term funding situation. However, the same could have been obtained by long term F-loans and use banks using OMFs as collateral. The government securities obtained by the banks have mostly been used directly as collateral for loans in Norges Bank and not to obtain liquidity from other sources.

Financial stability, asset prices and monetary policy

In the US and the UK, both the Fed and the Bank of England have been criticized – fairly or not – for neither preventing the financial crisis nor for seeing what was coming much before it happened. Central banks have also been criticized for setting key policy rates too low, generating a housing bubble and financial instability at a later stage.

Modern central banks like Norges Bank play an important role in fostering financial stability. This responsibility is shared with the FSA of Norway (Kredittilsynet) and the Ministry of Finance. A separate Financial Stability Wing in Norges Bank has for many years been fully operational, in line with the Monetary Policy Wing and Norges Bank Investment Management Wing. In regard to the monetary policy and financial stability wings, the challenge is to facilitate closer interaction, cooperation and communication between them.

In general, price stability makes financial stability more likely. On the other hand, financial stability is crucial for price stability. An important lesson from economic history is that systemic banking crises could push an economy into deflation and depression. Thus, central banks should have a financial stability goal in addition to a price stability goal.

Unfortunately, successful price stability guarantees financial stability, however. In the boom before the 1929 stock market crash, for example, there was no consumer price inflation. In real time, it is hard to distinguish a long-lived, but unsustainable economic boom from an increase in the economy's trend growth rate. Sometimes advances in technology can increase the sustainable rate of growth, and in such episodes, the fundamental values of stocks, housing and other real estate usually also increase. The possibility that unsustainable asset price "bubbles" may be built up during non-inflationary economic booms, and that the bursting of such bubbles could trigger both financial and price instability, is therefore an extremely important issue for central banks as well as for economic science.

In many countries, a boom and bust of house prices have threatened macroeconomic stability. In the policy framework of flexible inflation targeting, however, neither house prices, the exchange rate nor other asset prices should be considered as separate goal for monetary policy in addition to inflation and output gap stability. Still, information on house prices could be important for central banks because they affect aggregate demand and the output gap. An inflation-targeting central bank should therefore take into consideration that rapidly rising house prices could affect future output gaps and inflationary pressure. Since monetary policy should be forward-looking, this should be taken into consideration when the key policy rate is set. This line of reasoning is similar to how an inflation-targeting central bank in a small open economy should think about the exchange rate.

There are two types of errors that a central bank can make with respect to asset price movements. The first error is to fail to adjust monetary policy when it should have. The second type of error is to change monetary policy when it should *not* have. Ex post, after a bubble in a major asset market has busted, it may look obvious that the central bank should have seen what was coming and reacted in time. But this is not fair. It is easy to demonstrate that monetary policy normally could have been improved with the benefit of hindsight. The problem confronting central banks and governments is to make good decisions using real time data. In real time it is usually almost impossible to know, several years before a bubble bursts, that a dangerous asset bubble was in fact inflating.

The second type of error is also important. There are many examples of central banks that did react to an asset price movement, and later regretted. An example is the monetary restraints in Chile and New Zealand due to the East Asian and Russian crises in 1997 and 1998. These crises led to currency depreciation in both countries. It would have been more appropriate, however, to ease monetary policy instead of a tightening, just like the Australian central bank did in response to the East-Asian crisis in 1997-1998.

One important conclusion was that in principle, the monetary policy strategy that Norges Bank has adopted – flexible inflation targeting – requires that Norges Bank should take account of asset prices to the extent that asset prices bear incremental information about the macroeconomic goals of monetary policy, i.e. about their effects on future inflation and output gap stability. A difficult problem for Norges Bank and other central banks, however, is that the relation between asset price movements and the macroeconomy is uncertain and often obscure.

In our view, Norges Bank should continue to focus on low and stable inflation and contribute to stable developments in output and employment in the framework of flexible inflation targeting, as well as maintaining an efficient and stable payment and credit system. However, Norges Bank should take into account asset prices in monetary policy decisions to the extent that they affect future inflation and the output gap.

The new price index CPIXE

In the last chapter we focus on the new price index of underlying inflation that Norges Bank adopted in Monetary Policy Report 2-2008. The main reasons for putting less emphasis on CPI-ATE that has been used as the main indicator of core inflation are that the latter excludes temporary as well as permanent changes in energy prices and that CPI-ATE tends to underestimate future inflationary pressure in the Norwegian economy. We agree with Norges Bank that it is important to construct different alternative measures of underlying inflation as well as using different methods to forecast future inflation. We argue, however, that CPIXE is not an optimal indicator of future inflationary pressure. The main problems with CPIXE are first that, by construction, it is extremely sensitive to small changes in the underlying data and sample, and second, that historical index values are revised as new observations of energy prices become available.

For example, the forecasts of permanent inflation in energy prices in January 2009 as measured every second month since June 2008 vary between 4 and 10 percent, corresponding to an effect on annual CPIXE-inflation of between 0.4 and 1 percentage points.

Our view is that Norges Bank still should use CPI-ATE as the focus measure of underlying inflation. The properties of the latter index have been thouroghly evaluated and testet against available alternatives. The history of CPI-ATE is not revised in response to new observations.

One such alternative merits mentioning here. Norges Bank has initiated a project aiming at improving short-term inflation forecasts the so-called System of Averaging Models (SAM). In our view, this work is encouraging and we recommend that Norges Bank continues to develop, test and evaluate these forecasting tools. We also recommend that Norges Bank publish the NowCasting reports regularly and use these forecasts as alternative approaches when estimating future inflationary pressure.

1. Introduction

This report, Norges Bank Watch 2009, is an evaluation of the conduct of monetary policy in Norway in 2008. As previous Norges Bank Watch reports, we adopt the ex-ante rather than the ex-post perspective, i.e. our assessment of the conduct of monetary policy is solely based on the information available when decisions were made, not data and information that became known afterwards.

This report will not evaluate the institutional framework for monetary policy. It offers, however, an evaluation of the new price index, CPIXE, which Norges Bank adopted in 2008 for measuring underlying inflation.

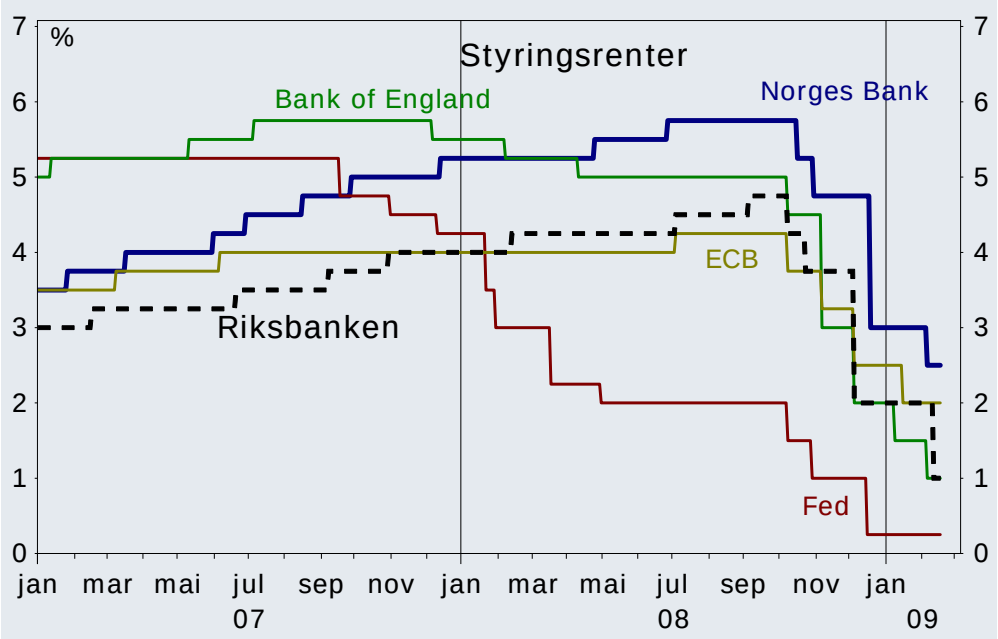
The committee for Norges Bank Watch 2009 met in Oslo on five occasions during the period November 2008 – February 2009. On December 11, 2008 we had a meeting with The Financial Supervisory Authority of Norway (Kredittilsynet), represented by Bjørn Skogstad Aamo, Director General, and Emil Steffensen. The committee had meetings with the management and staff of Norges Bank on January 27, 2009, including Svein Gjedrem, Central Bank Governor, Jan F. Qvigstad, Deputy Governor, Jon Nicolaisen, Kjetil Olsen, Ingvild Svendsen and Anders Svor. We wish to thank Norges Bank and Kredittilsynet for supplying us with useful data. On February 12, 2009, we met officials of the Ministry of Finance, including Knut Moum and Arent Skjæveland. The committee would also like to thank Nina Bjerkedal, Hilde Bjørnland and Arne Jon Isachsen for useful comments and discussions. The responsibility for errors and omissions rests solely with the committee, however.

The report is organized as follows. In chapter 2 we review the recent financial turmoil. Chapter 3 evaluates Norges Bank's monetary policy in 2008, and chapter 4 discusses financial instability, asset prices and monetary policy. Chapter 5 evaluates the new price index CPIXE.

2. International Financial Turmoil: From Boom to Bust

The year 2008 was dramatic for the global economy as well as for governments and central banks around the world. Due to escalating financial turmoil, all the large industrial countries in the OECD area were hit by a severe and synchronized business cycle slump in the last quarter of 2008, involving a steep decline in industrial production and exports, rapidly increasing unemployment and unprecedented policy rate cuts by central banks. As shown in figure 2.1, Fed reduced its policy rate from 2 to 0,25 percent during the last three months of 2008, while ECB and The Bank of England lowered their rates from 4,25 to 2 and from 5 to 2 percent, respectively. In December, both Riksbanken and Norges Bank surprised markets by cutting policy rates by astonishing 175 basis points on top of previous cuts in October and November.

Figure 2.1 Monetary policy rates of the Fed, ECB, Bank of England, the Swedish Riksbank and Norges Bank, January 2008 – January 2009.



In the last quarter of 2008, the international financial turmoil forced many central banks to resort to untraditional monetary policy actions. The very sharp reductions in key policy rates – in some cases to virtually zero – have raised concerns that monetary policy may not be sufficient to prevent falling aggregate demand and output. Even deflation and liquidity traps can no longer be excluded as a possibility in some countries.

2.1 What happened?

A sudden increase in counterparty risk and financial turmoil involving dysfunctional money and credit markets appear to be the main driving forces behind the sudden and synchronized slumps in aggregate demand, production and international trade in the last quarter of 2008. Many commentators have considered the failure of Lehman Brothers on September 15, 2008 to be the single most important event that triggered the panic in international money markets and the ensuing credit crunch.

More research and investigations are necessary before we know why the financial turmoil became so severe in the last quarter of 2008. In a recent newspaper article, John B. Taylor argues that the Lehman Brothers failure is only part of the story.[1] Taylor thinks that the initial steps taken by the U.S. Government and the Fed to repair money and credit markets may have had unintended negative effects on trust and perceptions of counterparty risks among banks, making the financial crisis more severe rather than less:

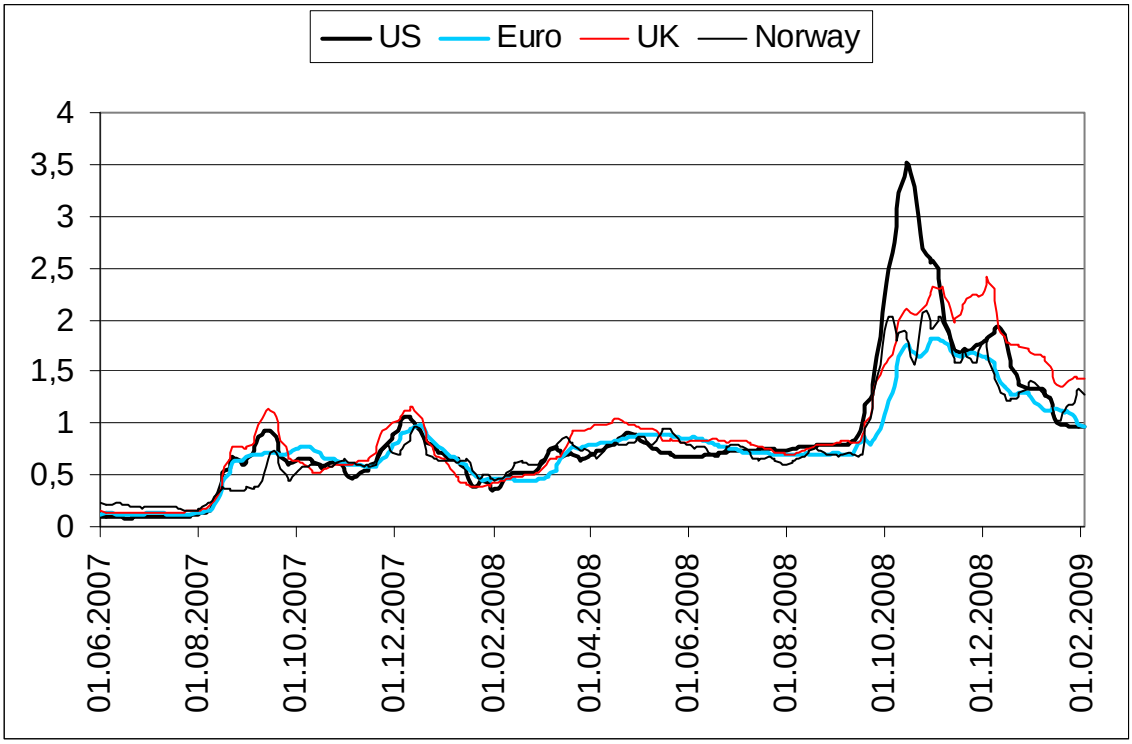
"While interest rate spreads increased slightly on Monday, Sept. 15, they stayed in the range observed during the previous year, and remained in that range through the rest of the week. On Friday, Sept. 19, the Treasury announced a rescue package, though not its size or the details. Over the weekend the package was put together, and on Tuesday, Sept. 23, Fed Chairman Ben Bernanke and Treasury Secretary Henry Paulson testified before the Senate Banking Committee. They introduced the Troubled Asset Relief Program (TARP), saying that it would be $700 billion in size. A short draft of legislation was provided, with no mention of oversight and few restrictions on the use of the funds.

The two men were questioned intensely and the reaction was quite negative, judging by the large volume of critical mail received by many members of Congress. It was following this testimony that one really begins to see the crisis deepening and interest rate spreads widening.

The realization by the public that the government's intervention plan had not been fully thought through, and the official story that the economy was tanking, likely led to the panic seen in the next few weeks. And this was likely amplified by the ad hoc decisions to support some financial institutions and not others and unclear, seemingly fear-based explanations of programs to address the crisis. What was the rationale for intervening with Bear Stearns, then not with Lehman, and then again with AIG? What would guide the operations of the TARP?" (John B. Taylor, "How Government Created the Financial Crisis", Wall Street Journal, 9 February, 2009).

[1] This article builds on his working paper, Taylor, John B.(2009), "The Financial Crisis and the policy responses: An empirical analysis of what went wrong", Working Paper 14631, National Bureau of Economic Reseach, Cambridge, MA, January 2009.

Figure 2.2. Difference between 3-month money market rate and key policy rate expectations in the market.1). Percentage points. 5-day moving average. June 1, 2007 – February 2, 2009



Source: Bloomberg, Thomson Reuters and Norges Bank.

1) The expected key rate is derived from Overnight Indexed Swap (OIS) interest rates. For Norway, the estimates are based on Norges Bank's projected money market- and key policy rate.

Figure 2.2 illustrates the dramatic increase in money market spreads in the weeks and months following the Lehman Brothers bankruptcy. The spread increased much more in the US than in the other countries, going from 1.1 percent on September 17 to a maximum of 3.51 percent on October 15. The Norwegian interest rate spread increased from 0.68 on September 17 to a maximum of 2,09 percent on October 27 (corresponding to a US spread of 2.62 percent on the same day).

It is interesting to note that the spread in the UK money market was higher than in the Euro area and in Norway, except for some days in late September and early October where the UK spread was marginally lower than the Norwegian one. The time profile of the UK spread is also different. The maximum UK spread materialized on December 4 (2.41 percent against a US spread of 1.81 percent on the same day).

A general loss of trust among banks appears to be the main factor behind the increased money market spreads in the last four months of 2008. When banks trade with each other in the inter-bank Libor market, loans are not secured. Lending is therefore based on trust, i.e. a very small or non-existent perceived counterparty risk. The international system of money markets among advanced nations have functioned well since the 1970s. Episodes involving increased spreads have been few and short-lived. Since the term money market rates, such as 3-months Libor, directly affect interest

rates on securities, loans and credit to households, firms and financial institutions, high and variable spreads could seriously reduce the effectiveness of the monetary transmission mechanism.

Lack of trust and high counterparty risk in money markets are reflections of lack of transparency on how exposed the banks were to losses on "toxic assets" such as mortgage-related securities originated in the U.S. During October and November it became increasingly clear that it was not only the US banking system that were suffering from huge losses, weak balance sheets and insufficient equity capital, but that many European banks also would need huge capital injections by governments to survive. The large money market spreads in the US and the UK in figure 2.2 attest to the fact that the banking problems were particularly severe in those two countries. This again is probably a reflection of the fact that the scale of the housing sector boom and busts were greatest in the US and the UK.

We shall return to the important question of why the Norwegian money market spread increased so much in the last quarter of 2008.

First we wish to emphasize another noticeable fact that figure 2.2 reveals: Money market spreads first increased substantially from mid-August to December 2007. John B. Taylor and John C. Williams (2008) regard the August 2007 money market shock as a highly unusual "black swan" event, impinging on the availability and cost of credit to firms and households and weakening the transmission mechanism of monetary policy.[2] The underlying data shows that the US money market spread used to be only 9 basis points before this event, slightly less than the Euro area spread (12 basis points) and the UK spread (14 basis points). Before August 2007, we see from figure 2.2 that Norway's money market spread used to be about 20 basis points.

After August 9, 2007, these spreads increased to surprisingly high levels without so far having returned to "normal" levels. The US spread increased from 19 bp to slightly above 1 percent in mid-December 2007. Likewise, the Euro and UK spreads increased from about 20 bp to 96 and 113 bp on 13 December, 2007, respectively. On this day, the Norwegian spread reached 0.97 percent, a local maximum that was not passed before September 22, 2008.

What happened on Thursday, August 9, 2007? Here is how Taylor and Williamson (2008) describe the "black swan" event:

"*On Thursday, August 9, 2007 traders in New York, London and other financial centers around the world suddenly faced a dramatic change in the conditions in the money markets where they buy and sell short-term securities. The interest rate on overnight loans between banks – the effective federal funds rate – jumped to unusually high levels compared with the Fed's target for the federal funds rate. Rates on inter-bank term loans with maturities of a week or more surged as well, even though no near-term change in the Fed's target interest rate was expected. Many traders, bankers and central bankers found these developments surprising and puzzling after many years of comparative calm.*"

Taylor and Williams (2008) consider two alternative hypotheses that could explain what happened. The first hypothesis is that a sudden increase in the demand for liquidity by banks took place, and the second is a sudden increase in counterparty risks, making banks more reluctant to lend to each

[2] Taylor, John B. and John C. Williams (2008), "A Black Swan in the Money Market", Working Paper 2008-4, Federal Reserve Bank of San Francisco Working Paper Series. In light of what happened after Lehman 13 months later, the "black swan" label on this event is not entirely convincing.

other because of the fear of the location of newly disclosed losses on subprime mortgages. They conclude that the existing empirical evidence suggest that counterparty risk is the key factor in explaining the money market spreads from August 2007 and onwards. Their econometric analysis also indicates that Term Action Facility (TAF), which was introduced by the Fed in December 2007, though which banks could borrow from the Fed without using the discount window, did not have an effect on the money market spread in the US as long as increased counterparty risk was the main driving force behind them.

2.2 The Norwegian boom and bust

The boom in the Norwegian economy that ended late 2008, started in 2004, when Mainland GDP grew by 4.4 percent from the previous year, see Table 2.1.

Table 2.1 Real growth and unemployment during the boom years 2004 – 2008.

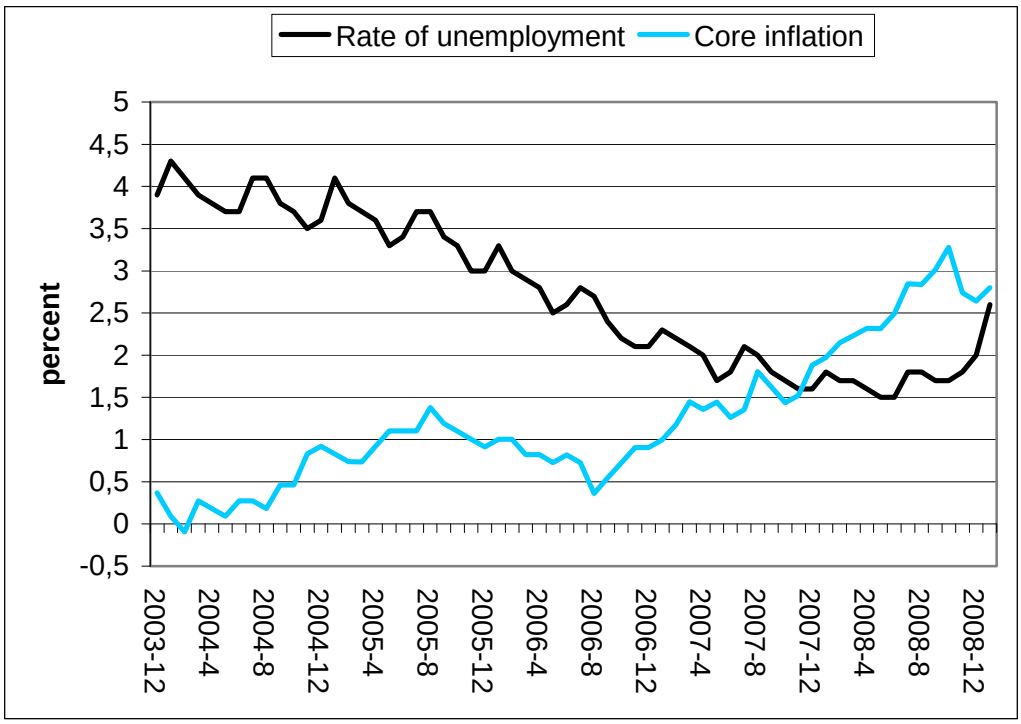
Year	Mainland GDP growth rate (percent)	Average rate of registered unemployment (percent)	Housing price deflated by CPI. Change between 4th quarters (percent)
2004	4.4	3.9	9.1
2005	4.6	3.5	6.0
2006	4.8	2.6	13.8
2007	6.2	1.9	5.8
2008	2.4*)	1.7	-10.7

Source: Statistics Norway.
*) Statistics Norway, 19 February 2009. Norges Bank's forecast in MPR 3/08 was 2.5 percent.

The growth rate of 6.1 percent from 2006 to 2007 came as a big surprise to both Norges Bank and other forecasters. Such a high rate of growth would not have been possible without a considerable inflow of immigration workers. The boom reduced the average rate of (registered) unemployment from 3.9 percent in 2004 to 1.9 percent in 2007. Monthly data shows that the rate of unemployment bottomed out in May and June 2008 (1.5 percent). Such low rates of registered unemployment have not been observed since the "credit boom" in 1986-87, triggered then by the financial deregulation. Back in those years, the boom ended with an outburst of inflation, banking crisis and further macroeconomic instability.

Real housing prices (nominal prices deflated by the CPI) also increased fast during the boom, but the growth rate turned negative in the second half of 2008, particularly in the last quarter.

Figure 2.3 Rate of registered unemployment and the rate of change in CPI-ATE (from previous year), December 2003 – January 2009.

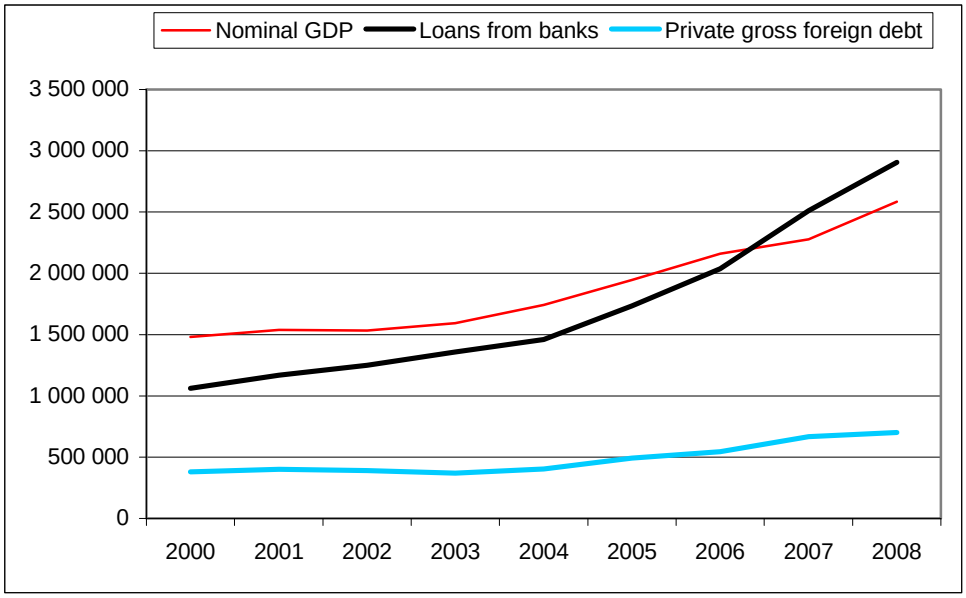


Source: Statistics Norway.

Figure 2.3 illustrates the time paths of the rates of unemployment and core inflation during the boom and bust. During the three months from October 2008 to January 2009, unemployment increased from 1.7 to 2.6 percent. Even though such a sudden increase in very unusual, the January 2009 unemployment rate is still extremely low compared to present unemployment rates in other OECD countries.

Inflation has been much lower than the 2.5 percent inflation target for many years, due among other things to a strong and favorable "China effect" on Norway's terms of trade. As emphasized by Norges Bank, the rate of growth of CPI-ATE has underestimated core inflation somewhat – due to increasing energy prices. Nevertheless, inflation has been significantly lower than intended by Norges Bank. The motivation behind the monetary stimulus strategy in 2004-2006 has been to close the gap between the inflation target and the realized rate of inflation. Although inflation did overshoot the target in part of 2008, lower energy prices and a rapid cooling of labor market in the last months of 2008 suggest that CPI inflation again will undershoot the inflation target in 2009.

Figure 2.4 Loan from banks*), private foreign debt**) and nominal GDP, 2000 – 2008 (million NOK)



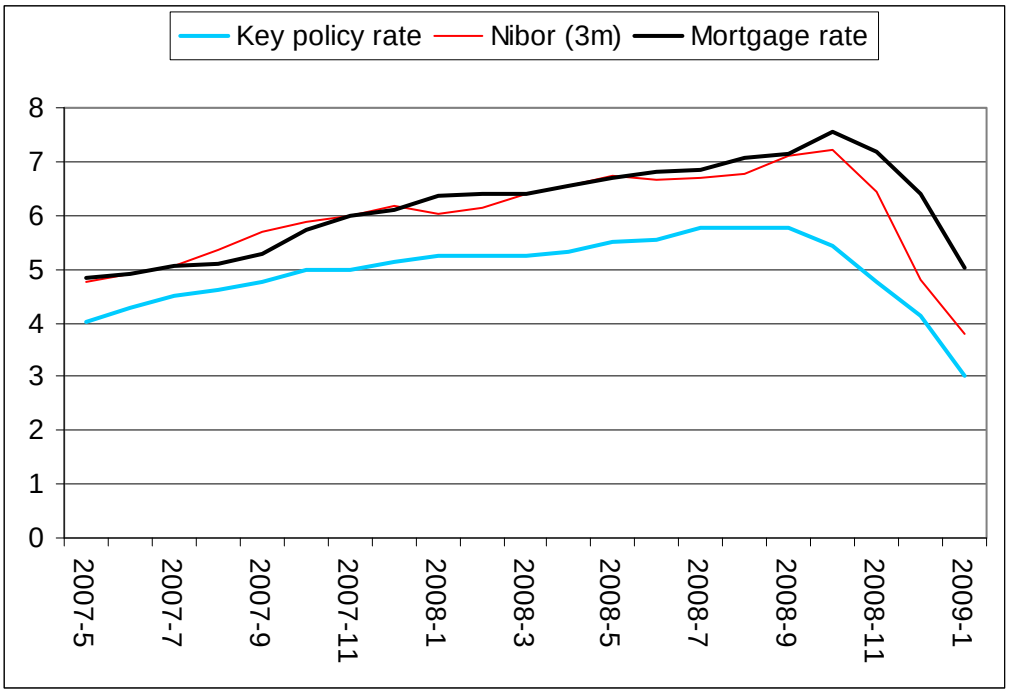
Source: Statistics Norway.

*) Including loans from "Housing credit firms" (Boligkredittforetak) owned by large banks.
**) The difference between the credit indicators K3 and K2.

Figure 2.4 suggests that strong growth of bank lending fuelled the boom, including a rapid increase in housing prices. From 2004 to 2008, nominal GDP increased by 10.4 percent per year on average, due to real growth as well as a rapid increase in the oil price. Still, bank loans to the public increased by 19 percent per year on average in this period. The share of bank loans in nominal GDP therefore increased from 83.7 percent at the start of the boom (2004) to 112.5 percent at the end (2008).

Figure 2.5 compares the key policy rate with 3-month Nibor and an interest rate on mortgage loans from banks from May 2007 to January 2009.

Figure 2.5 Norges Bank's key policy rate, 3 months Nibor (effective), and a lending rate on new mortgage loans from the 20 largest banks in Norway*), May 2007 – January 2009 (monthly averages of daily observations).



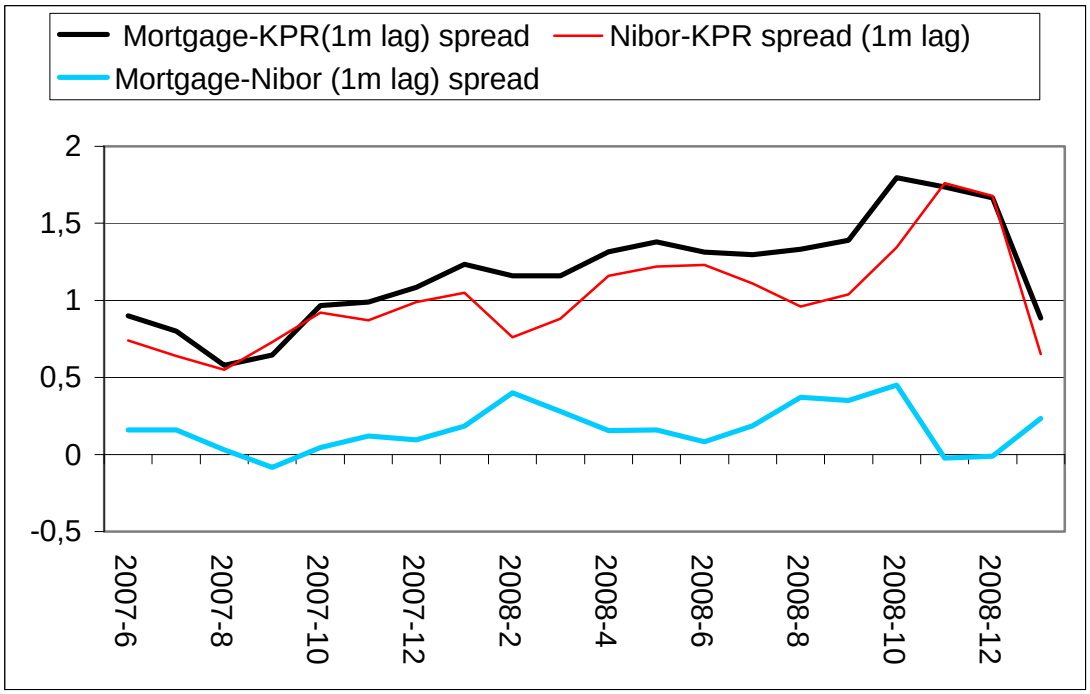
Source: Norsk familieøkonomi AS and Norges Bank.

*) Nominal interest rates on new mortgage loans for NOK 1m within 60 percent of purchase price with floating interest rate. 20 largest banks, weighted average according to market shares.

Both the mortgage rate and Nibor increased significantly more than the key policy rate in 2008. For example, the mortgage rate increased by nearly 150 basis points from 6.08 to 7.55 percent from December 2007 to October 2008 (to 7.1 percent in September). The key policy rate only increased by 50 basis points from 5.25 to 5.75 percent. We have no indications that the sharp rise in the mortgage rate from September to October 2008 was intended by Norges Bank. To avoid the mortgage rate shock in September and October, cuts in the key policy rate would have been required in August and September. As discussed more in detail in section 3, however, Norges Bank had insufficient and conflicting information and did not switch to monetary easing.

In figure 2.6 we take a closer look on the spreads between the interest rates in figure 2.5.

Figure 2.6. A decomposition of the mortgage – lagged key policy rate spread1) in Norway, June 2007 – January 2009 (monthly averages of daily observations).



Source: Norsk familieøkonomi AS and Norges Bank.
1) The underlying data in figure 2.5.

This figure makes a decomposition of the difference between the mortgage loan rate and the key policy rate, the latter rate lagged one month to capture decision lags in banks. This spread increased gradually from the fall of 2007 to the end of 2008, and then fell significantly from December 2008 to January 2009. Most of this spread can be accounted for by the (3-months Nibor – key policy rate) spread (lagged one month). The mortgage rate fluctuates less than the Nibor rate, generating a weak negative correlation between the (mortgage rate – Lagged Nibor) spread and the (Nibor – key policy rate) spread (lagged). Figure 2.6 suggests that the role of the (mortgage rate – Lagged Nibor) spread in accounting for the (mortgage rate – lagged key policy rate) spread has been small. The former spread increased somewhat up to October 2008, which could indicate reduced willingness by banks to supply loans. In September and October, therefore, both spreads were higher than normal, contributing to the exceptionally high mortgage – lagged key policy rate in October 2008.

From the fall of 2007 to the present clearly shows that the international financial turmoil has reduced the efficiency of the transmission mechanism of monetary policy in most countries. Until August 2007, Norges Bank could rely on a strong and reliable casual link running from its key policy rate and the interest rates in money markets and market for mortgage loans, and to a considerable degree also to interest rates in markets for securities and credit to business. The Bank did not even have to cut rates at once, its signals and communication to the markets that the key policy rate would be cut in the near future, did have immediate effects on the Nibor term rates on many occasions.

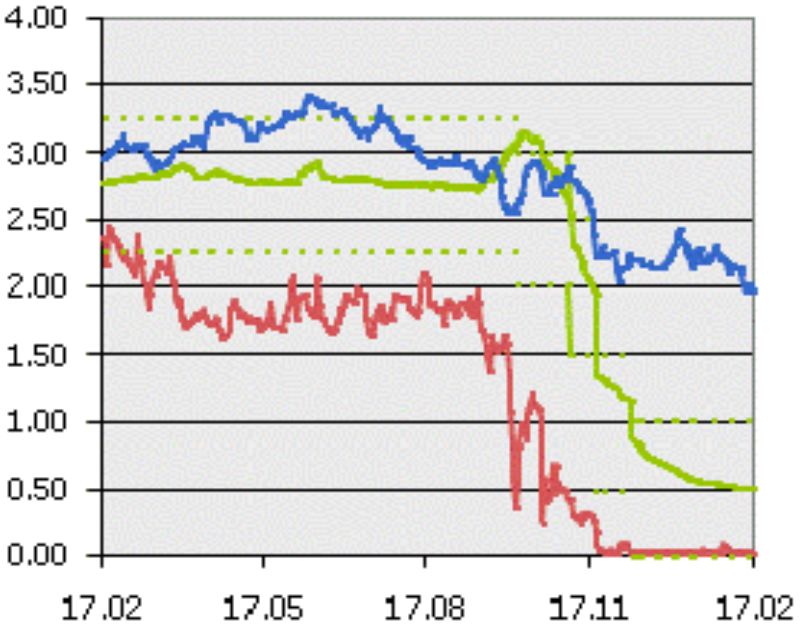
2.3 Swiss monetary policy

Was there nothing that central banks could do to protect the transmission mechanism of monetary policy? Before addressing this important question, let us take a closer look at the monetary policy of The Swiss National Bank (SNB), which has adopted a different strategy of monetary operations from most other central banks. SNB has a flexible inflation target of less than 2 percent per year. The SNB implements its monetary policy by fixing a target range for the three-month Swiss franc Libor. As a rule, this target range extends over one percentage point, and the SNB generally aims to keep the Libor in the middle of the range. The SNB then adjusts the amount of liquidity continuously in the overnight market to target the 3-months Libor rate.[3]

Figure 2.7 shows the repo overnight index, which corresponds to the key policy rates in Norway and Sweden, the 3-months Libor, and a yield on 10-year Swiss Confederation bonds. The Swiss way of conducting monetary policy clearly involves a much more flexible overnight rate of interest (repo rate) than in Norway. From late September through October, the repo rate was cut aggressively to counteract the tendency of the Swiss franc Libor to increase due to the money market shocks after the Lehman bankruptcy. By the end of November, the Libor target range had been reduced to 0 – 1 percent and the repo rate had been reduced to almost zero in the second half of November.

[3] See McGough, B., G.B. Rudebusch and J.C. Williams: "Using a Long-Term Interest Rate as the Monetary Policy Instrument," *Journal of Monetary Economics* 52, 5, 855-879, for a theoretical analysis of the choice of a policy rate of interest.

Figure 2.7. Interest rates in Switzerland, February 17, 2008 – February 17, 2009.



Repo Overnight Index (SNB)

(SNB special rate of the following day: + 0.5 percentage points)

3-month LIBOR CHF
0.50 SNB target range: 0.00 - 1.00

Yield on Swiss Confederation bonds
Spot interest

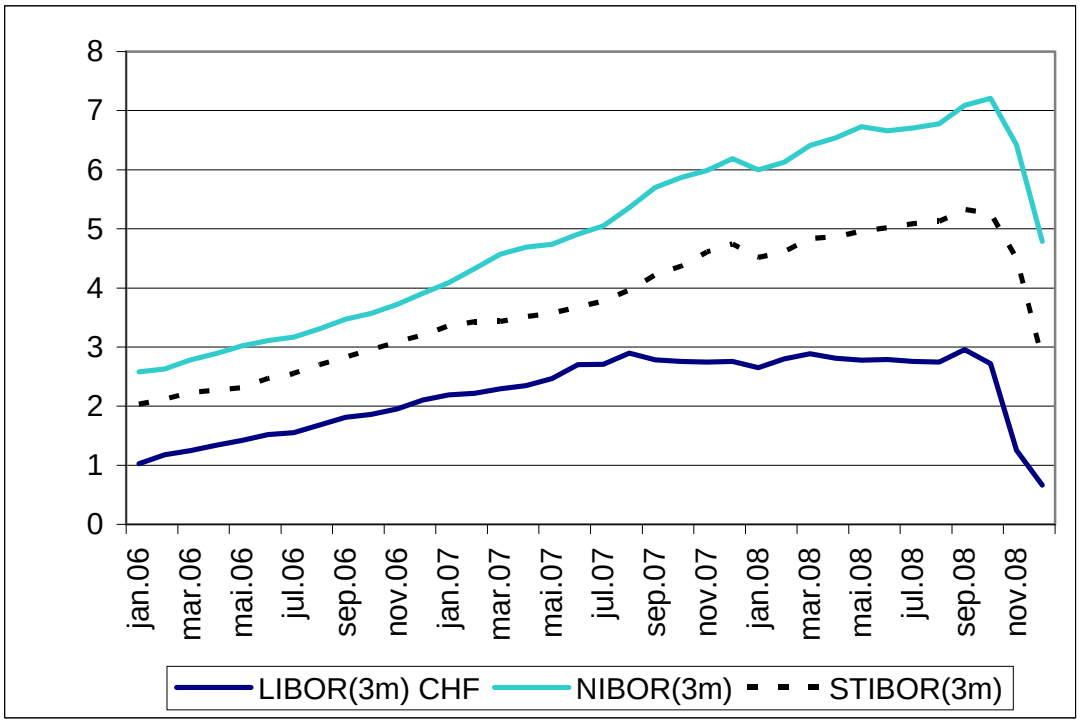
Source: The Swiss National Bank.

Figure 2.8 compares Norway's 3-month Nibor rate with the corresponding term rates of Switzerland and Sweden. When the international money market spreads suddenly increased due to financial turmoil, i.e. in the fall of 2007 and 2008, the Norwegian and Swedish term rates increased much more than the Swiss Libor. This evidence strongly suggests that the Swiss way of targeting the Libor rate makes a difference from the monetary policies of Norges Bank and Riksbanken.

NBW's view:

Norges Bank should take a closer look at the SNB's strategy of monetary operations to see what can be learned from a sharper focus on the 3-month Libor to enhance the effectiveness of monetary policy in Norway.

Figure 2.8. The Swiss 3-month Libor compared to Norway's Nibor and Sweden's Stibor. Monthly averages of daily observations. January 2006 – December 2008.



Source: Norges Bank, Riksbanken and SNB.

3. Monetary Policy in 2008

When entering 2008, we could look back on four years with real growth in mainland GDP exceeding 4 percent. Economic growth was strongest in 2007, 6.1 percent. The economy's capacity to generate so high growth rates surprised most analysts during the years 2006-2008. Unemployment declined to 2.5 percent, levels not seen in more than 25 years. Employment grew strongly facilitated by increased participation rate and a large inflow of labour from new EU-member states and from Sweden. Higher prices on petroleum and other raw materials resulted in large terms of trade gains for Norway.

It was in particular domestic demand that grew strongly. The increase in households' real disposable income was high and contributed to rapid growth in private consumption. Households also reduced their savings rate to about zero. Investments in residential houses, and in most business sectors, including the petroleum sector, increased strongly. Residential house prices increased by 27 percent between 2005 and 2007.

Norges Bank lowered its policy rate to 1.75 percent during the spring of 2004. Inflation was low, growth weak and NOK relatively strong. The policy rate was kept at this level until the summer 2005. In the first period the policy rate was increased in small and infrequent steps. The hiking speed increased in the second part of 2006 and through 2007. Inflation remained surprisingly low for a long period as prices on imported consumer goods continued to decline and the capacity of the economy expanded strongly. However, in 2007, inflation started to surprise on the upside.

The situation in the Norwegian economy changed dramatically during the decond half of 2008. In the first half of the year, Norges Bank was focused on avoiding rising inflation to become entrenched. Monetary policy was tightened gradually as current inflation now continued to surprise on the upside. Norges Bank aimed at closing the large positive output gap gradually. Up to August, Norges Bank assessed the economy to be well on track for a soft landing. The shock waves triggered by the failure of Lehman Brothers 15 September changed the situation dramatically. Growth outlook weakened quickly as did the outlook for inflation. As the situation was different between the two periods January-August and September-December, the discussion of the conduct of monetary policy in these two periods in two sections is done separately.

3.1 January-August; soft landing in sight, but inflation surprised

Late in 2007, Norges Bank expected the Norwegian economy to cool down gradually over the next three years. The output gap, as defined by the Bank, was expected to decline from about 3 percent to just above 0 in late 2010. Core inflation, defined as annual change in CPI-ATE[4], was expected to reach the 2½ percent target, also late in 2010. When Norges Bank late in October 2007 gradually published new forecasts in Monetary Policy Report 3-2007 (MPR3-07), the last report that year, core inflation was about 1½ percent. The envisaged soft landing was forecasted to require rates hiked by 25 bp to 5.25 percent in December, and may be to 5.50 in Q2 2008. Norges Bank's key policy rate was hiked to 5.25 at the December Monetary Policy Committee meeting (MPC-meeting). However, the Bank considered at that point (12 December 2007) to leave the rate unchanged because of the heightened turbulence in the money and credit markets. Stronger growth than expected in Norway in late 2007 was considered to outweigh the negative effects of stronger market turbulence and higher money market rates.

[4] Consumer price index adjusted for taxes and energy prices

The first MPC-meeting in 2008 was ***23 January***. Norges Bank left its key policy rate unchanged at 5.25. Inflation had picked up more strongly than expected and growth in the Norwegian economy continued to be considered stronger than forecasted in MPR3-07. If the international growth outlook, in particular in the United States, had not been weakened, the bank indicated a hike would have been considered.

At both the MPC-meeting December 2007 and January 2008, Norges Bank commented on the development in total CPI more than usual previously. The Bank had in many years used an index for core inflation which excludes effects of changes in taxes and energy prices (CPI-ATE) as the main indicator for current inflation. In recent years, Norges Bank has also applied other indicators for core inflation. In the press releases after the abovementioned two MPC-meetings, higher increase in CPI, partly because of a strong increase in electricity prices, was mentioned as a concern. This was a small indication of the forthcoming change in the Bank's use of indicators for core inflation.

As the Norwegian economy entered 2008 at a higher speed than forecasted, the output gap was adjusted up in the first MPR for 2008, published ***13 March***. The new forecasted growth-path showed a steeper deceleration than the one in MPR3-07. Growth in mainland GDP for 2008 was adjusted up while it was adjusted down for 2009 and 2010. The forecast for core inflation in 2008, defined as change in CPI-ATE, was also adjusted up, while the inflation forecasts for the two next years remained unchanged. The indicated strategy response was a somewhat higher interest rate the next 12 months and lower from mid 2009, than assumed in MPR3-07. Norges Bank was more concerned with higher inflation in the short term than with weaker outlook for economic growth late in 2008 and onward. This was stated at page 9 and 10 in MPR1-08:

"On balance, the outlook and balance of risks suggest that in the near term the interest rate should be set somewhat higher than projected in Monetary Policy Report 3/07 (see Charts 1.7a-d and 1.8). The prospect of higher price and cost inflation will in the short term outweigh the effects of weaker growth in the world economy. Should external interest rates fall to the low level now implied by forward interest rates, this may also lead to a somewhat lower interest rate level in Norway slightly further ahead."

Norges Bank left its key policy rate unchanged at the MPC-meeting 13 March, but it was raised at the meeting ***23 April***. That was in line with the interest path and strategy outlined in MPR1-08. The press release after the MPC-meeting 23 April indicated that the Bank's concern for the inflationary development had increased. Again the inflation had surprised on the upside. The Executive Board noted in its assessment that the rise in prices for domestically produced goods and services had been particularly strong. The underlying inflation was close to the 2.5 percent target, the Bank said. The most recent CPI-ATE inflation was 2.1 percent y/y, while core inflation indicators as the trimmed mean of the twelve month rise in sub-indices and a weighted mean showed 3.3 and 3.0 percent, respectively. However, the wage settlement between the Confederation of Norwegian Enterprises (NHO) and The Confederation of Trade Unions (LO)/Confederation of Vocational Unions (YS) came out slightly below what the Bank had expected. Norges Bank also assessed the international outlook to have worsened further. The turmoil in the financial markets persisted as spreads between key money market rates and Norges Bank's policy rate slightly exceeded 100 bp. The two central banks that started reducing rates already in the second part of 2007, Federal Reserve (Fed) in United States and Bank of England (BoE), continued to cut rates in March/April. Fed cut its rate by 75 bp to 2 percent on 17 March and BoE with 25 bp on 10 April.

At the time of the MPC-meeting ***28 May***, Norges Bank concluded that underlying inflation now had become somewhat higher than the 2.5 percent target. All core inflation indicators CPI-ATE, trimmed mean of the twelve-month rise in the sub-indices in the CPI and the weighted median showed higher inflation. In the published background for the decision and in its general assessment, the Bank also mentioned a new fourth indicator for underlying inflation. It was changes in the consumer price index (CPI) adjusted for tax changes and temporary changes in energy prices. According to this indicator, which later was named CPIXE, inflation was now 2 ¾ percent.

Despite the fact that core inflation now was considered to be above target, the key policy rate was left unchanged. In the assessment, the Bank explicitly mentioned high premium on money market rates as an argument for not responding to the higher inflation with a new hike. It was now signs of weaker growth in the Norwegian economy. Unchanged rate at the May meeting was in line with the strategy and interest rate path outlined in the latest MPR.

In the new MPR presented ***25 June***, (MPR2-08) the interest path was lifted significantly. In line with that, the interest rate was hiked by 25 bp to 5.75 percent and the path indicated a 50 percent probability for another hike in October. In the press release after the meeting, the Bank's assessment of the situation was summed up in the following:

"Inflation has been slightly higher than expected and there are prospects that inflation will move up further. We give weight to preventing the higher rate of inflation from becoming entrenched. It is therefore appropriate to raise the interest rate now", says Deputy Governor Jan F. Qvigstad. "The upturn in Norway is entering a new phase. Inflation has been low and growth high for a long period. It now appears that inflation will be somewhat higher and that growth will be lower", says Qvigstad.

In MPR2-08, the inflation forecast for 2008-2009 was lifted, but lowered for 2010-2011. Higher food prices after the price and income negotiations between the farmers' organisations and the government contributed to the outlook for higher food price inflation the next year or so. The forecasted output gap for 2008 and 2009 was hardly changed, but it was lowered somewhat for the years after, i.e. for 2010-2011.

The new indicator for underlying inflation, called CPIXE, was introduced in MPR2-08. CPIXE is a weighed average of CPI-ATE and an estimated trend in energy prices. CPIXE is discussed in chapter 5.

Norges Bank's assessment had not changed very much when the executive board met again to make a decision on the interest rate ***13 August***. Inflation had again surprised on the upside (July-inflation) and growth in world growth was slowing markedly. The Board concluded that:

"The analysis in the Monetary Policy Report *published in June indicated that the key policy rate will remain at the current level, or perhaps somewhat higher, in the coming year. - New information does not provide a basis for departing from the strategy set out in June…".*

The rate was kept unchanged at 5.75 percent.

Figure 3.1: Actual and forecasted CPI-ATE inflation

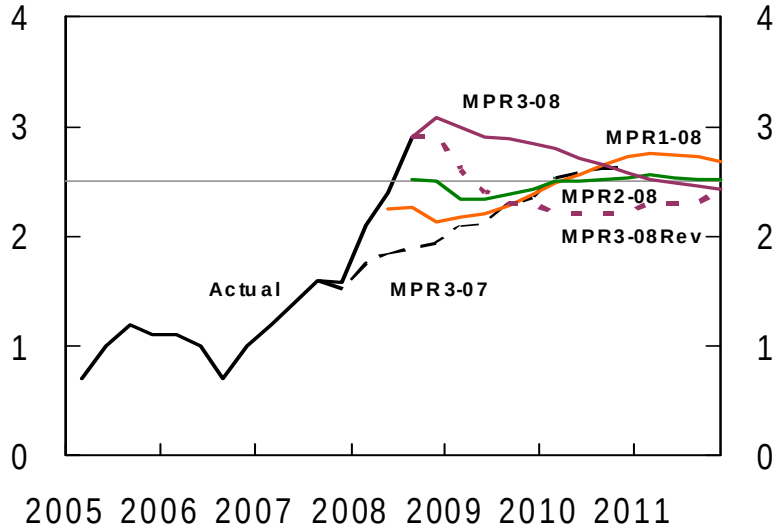


Figure 3.2: Paths for Norges Bank's policy rate

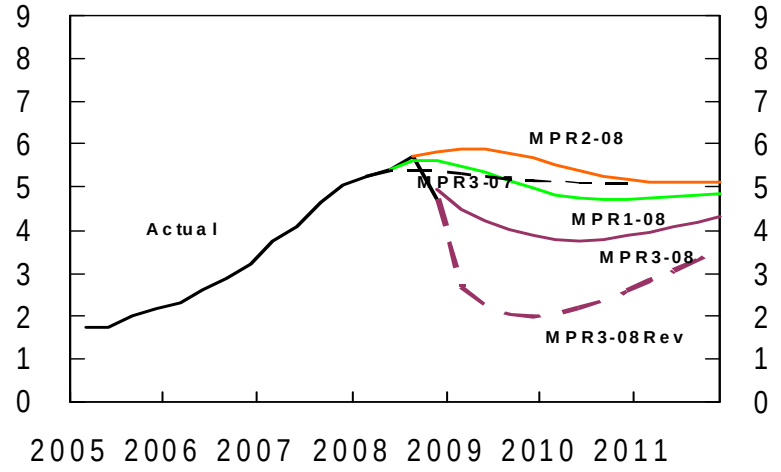
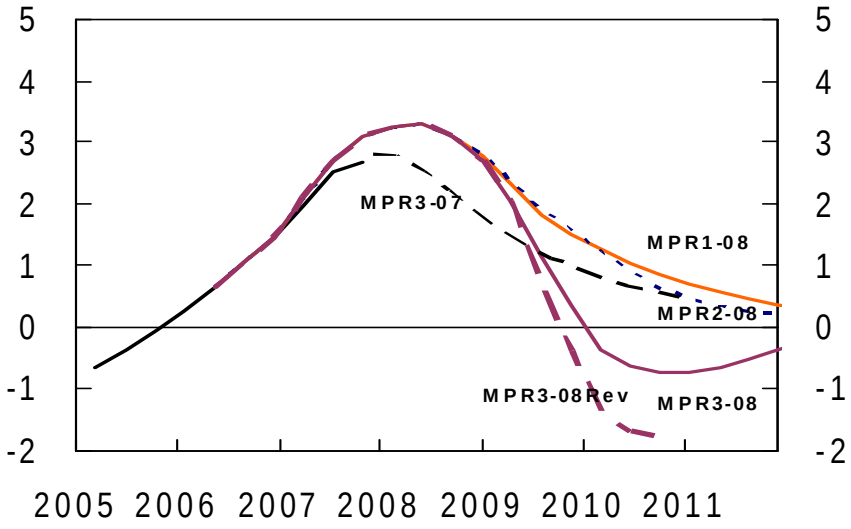


Figure 3.3: Forecasted and assumed output gap



Source: Norges Bank

Assessment
Norges Bank's policy reaction in the period January-August 2008 was consistent with the signals given after each MPC-meeting and in the MPRs. Inflation threat was a main theme, which also was the case in other countries except for United States and partly United Kingdom. Rates were hiked in both Sweden and the Euro zone during the same period. Food prices had gone up significantly. Part of the reason was poor harvests in some regions of the world. With more normal harvests prices would probably come down again. But increased demand for grain and soya beans to the production of biofuel seemed to represent a permanent shift factor. The oil price and other energy prices continued to increase during the first half of 2008 despite gradually weaker growth outlook internationally.

With an extremely high capacity utilisation in the Norwegian economy, it its understandable that Norges Bank was concerned when inflation took off more strongly than expected. Rapid rise in food and energy prices could further fuel inflation. The rate hikes during the first half of 2008 would, however, not influence inflation until 1-3 years ahead. Inflation therefore was envisaged to overshoot for some time and then decline toward the target late in the Bank's forecast horizon.

At the time when MPR2-2008 was released (June), there were signs that economic growth in Norway was slowing more pronounced than expected and the outlook for growth internationally had weakened further. The growth forecasts for 2009 in MPR2-2008 for Norway and in particular for the major industrial countries were on the optimistic side compared with other forecasters[5]. Before the MPC-meeting on 25 June, analysts were divided on the outcome. Consensus, as surveyed by Reuters, expected unchanged rate at 5.5 percent. This was the only time during the first half of 2008 consensus' expectations deviated from the outcome.

At the MPC-meeting 13 August, Norges Bank acknowledged that growth internationally, particularly in Europe was slowing rapidly. The slowdown seen in the Norwegian economy was said to be as expected. The impact slower international growth would have on the Norwegian economy was considered to be out-weighted by higher core inflation than expected as recently as in June. That slower growth would have a negative effect on inflation going forward was not a theme. The Bank observed that oil and commodity prices had come down, but concluded that levels remained high. That weaker growth internationally might pull these prices further down was neither a consideration mentioned in the press release.

NBW's view:

With the information available at the MPC-meeting in August, it could be argued that Norges Bank was too focused on the most recent inflation numbers, which was the result of past economic development, and not sufficiently forward looking. However, the Bank did probably not at this stage have information that would warrant a rate cut. But the bank could in August have signalled that the probability of another hike later in the autumn had diminished.

[5] Comparison is done with Statistics Norway's forecast from May and August, and IMF's April and July forecasts

3.2 Post Lehman

The first MPC-meeting after the acute crisis following Lehman Brothers' bankruptcy (15 September) was ***24 September***. The press release and press conference after the meeting conveyed the impression of a central bank in bewilderment. Norges Bank was still concerned about inflation. Its new favourite measure of core inflation, CPIXE had increased to 3.4 percent in August (in December revised down to 3.0 percent). On the other hand, growth prospects internationally had weakened further and the crisis in the financial markets worldwide had deepened. The bank's Executive Board concluded as follows:

"The Executive Board's strategy is that the key policy rate should be in the interval 5¼ - 6¼ per cent in the period to the publication of the next Report *on 29 October, unless the Norwegian economy is exposed to major shocks. There is now an unusually high degree of uncertainty linked to the turbulence in financial markets. There are wide daily swings in money market rates, equity prices, the krone exchange rate and oil and commodity prices. It is difficult to determine how long this pressure will last and the effects on inflation and activity in the Norwegian economy.*

An overall assessment indicates that it is appropriate to maintain the interest rate unchanged at this meeting."

It is understandable that Norges Bank 24 September had not had time to digest the consequences of acute financial turmoil after Lehman Brothers' failure. Norges Bank had reacted to the turmoil in the money market by supplying more NOK liquidity to the banks, and by lending USD. At the time of the MPC-meeting the Bank's main focus seems to have been giving first aid to the money market and avoid a situation where higher money market rates pushed up the banks' lending rates to customers.

"No new signals" was the main message from the executive board. At the press conference after the MPC-meeting, one question referred directly if the probability of another hike later in the autumn now was reduced. Norges Bank replied that it was too early to signal a revision of the interest path presented in MPR2-2008. The Bank still expected mainland-GDP to grow by 2 percent (annual rate) in the second half of the year. But the alertness for a more severe international downturn had increased.

The report from Norges Bank's regional network that was published together with the interest rate decision 24 September, indicated that growth had decelerated significantly in recent months. The report was based on interviews conducted during August, i.e. before the Lehman bankruptcy. Growth was weakening more than the respondents expected when interviewed last time, which was in April/May, before MPR2-2008. Economic growth was characterised to be "slightly moderate", which was the lowest growth measured by the network since autumn 2003. The report indicated that the respondents expected growth to decline further the next six months.

It was still mainly companies dependent on domestic demand that reported weaker growth. In August the respondents continued to expect growth in exports and oil-related activities. So the message conveyed in the report from the regional network was that domestic demand weakened somewhat more than expected in the spring, while weaker international growth still had limited effects on the activity in the Norwegian economy. The weaker domestic demand was to a large extent an intended effect of tighter monetary policy.

The perception among businesses and analysts of how the Norwegian economy would be affected by weaker growth internationally changed dramatically between August and October. At the time of the MPC-meeting 24 September it was clear that the risk for a severe international downturn had increased, but it was unclear how serious the situation was. On the

other hand, Norges Bank continued to observe that inflation was increasing more than expected. If the international situation had not worsened so dramatically after the Lehman Brothers bankruptcy, it could have been a case for a rate hike on 24 September, given the bank's previous signals.

No one expected Norges Bank to cut rates on 24 September. No other central banks had at that time, reacted to the recent financial turmoil by cutting rates. But there were expectations that the Bank now would indicate reduced probability for another hike later in the autumn. As mentioned above, the Bank chose to give no new signals.

During the autumn ***liquidity management*** became an important part of monetary policy. As the NIBOR market is based on banks borrowing in USD and swapping to NOK, spreads increased in the NBOR-market also due to higher counterparty risk perceived by lenders of USD. The implication was that the banks' funding costs increase although Norges Bank kept its policy rate unchanged. The spreads started to increase already during autumn 2007, but as discussed in chapter 2, the situation escalated in late September and October. Spreads on longer term funding increased more than on shorter term, see figure 3.4 and 3.5. Norges Bank reacted by supplying more and longer NOK-funding to banks through the F-loan facility, by easing the collateral requirements for acquiring F-loans and by lending USD to the banks (first time 13 October). Until 2008, F-loans with maturity past the next MPC-meeting, i.e. above six weeks, were usually not offered. After the Lehman failure, Norges Bank both offered three and six months F-loans, and in late November last year, also a two years F-loan.

As the banks' funding situation continued to be difficult, the Government together with Norges Bank set up a facility where banks could exchange Norwegian covered bonds (OMFs) with government securities for a period of 3-5 years. The facility was adopted by the Storting on 24 October and had a limit of NOK 350 bill. The purpose with the facility was to supply banks with negotiable government securities that they could use to obtain liquidity, either as collateral when borrowing from Norges Bank, or as collateral when borrowing from each other. The government and Norges Bank hoped the supply of government securities again would give life to the market for somewhat longer term funding between banks. However, most of the government securities' that banks have received have ended up as collateral for F-loans in Norges Bank.

The exchange facility was criticised for being complicated and not accessible for smaller banks. Therefore the target group for Norges Bank's F-loans with 2 years maturity (in 2009 also with 3 years maturity) was smaller banks.

Norges Bank's and the government's intervention in the money market and in the market for longer term funding of banks did not eliminate the extraordinarily high spreads. High spreads remained the order of the day in other countries also. However, spreads came gradually down, but are at the time of writing still considerably higher than normal.

Spreads last year increased more in Norway than in neighbouring Sweden. (See figure 3.6) Neither Norway nor Sweden experienced a banking crisis, but the markets were impacted by the international financial crisis. However, the Swedish money market is a clean SEK market and is not like the Norwegian based on USD and the swap market. That is probably a reason why the Swedish spreads were less affected by higher spreads in the USD money market. There is also much less volatility in the Swedish banks' liquidity situation as the government's accounts are with private banks and not with the central banks as is the case in Norway.

Figure 3.4: Norwegian banks' funding cost

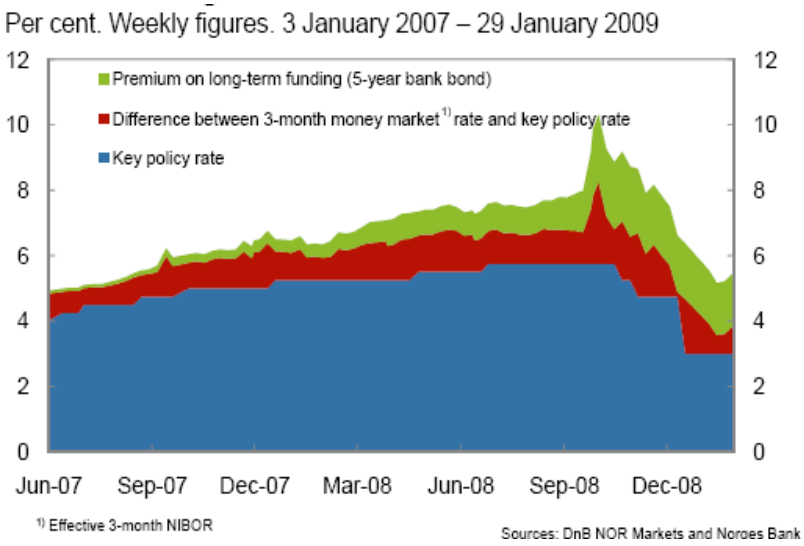
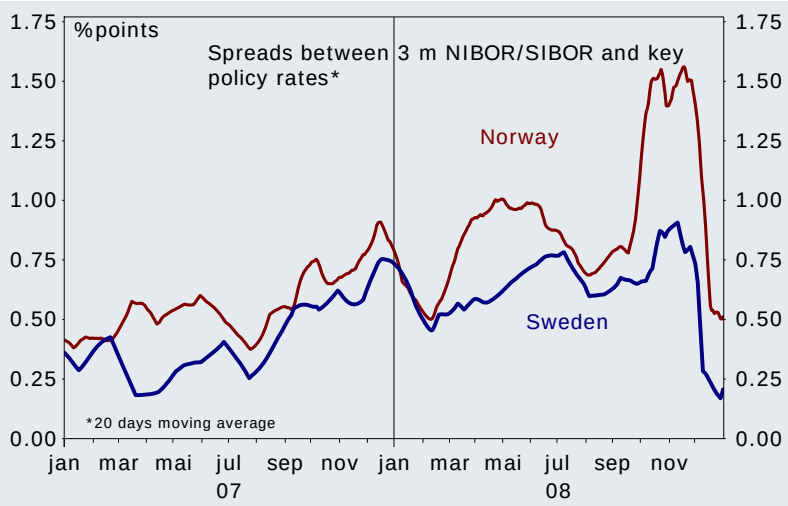


Figure 3.5: Key policy rate, 3 month NIBOR money market rate1) and banks' weighted lending rate on new mortgages2)

Diagram 3.6: Spreads in the Norwegian and Swedish money markets



On ***8 October***, a coordinated rate cut took place internationally. Federal Reserve, European central bank, Bank of England, Swedish Riksbank, Bank of Canada and Swiss National bank cut rates by 50 bp. The turmoil in the financial markets had continued, growth outlook deteriorated day by day, and prices on energy and raw material was falling sharply. The coordinated cut came as a surprise to Norges Bank. It decided to convene an extraordinary MPC-meeting on ***15 October***. An ordinary non-MPC meeting in the Executive Board was already convened that date. Norges Bank then cut its key policy rate by 50 bp. Unusually high uncertainty about the economic developments ahead was the main reason for the cut. In the press release it was further stated:

"The most robust approach may therefore now be to implement measures to reduce the uncertainty and stave off particularly adverse outcomes for the economy. This implies a more active monetary policy than normal, both in interest rate-setting and through liquidity policy measures."

In the Executive Board's assessment it was also stated:

"The slowdown in the Norwegian economy appears to be occurring faster and to be more pronounced than previously projected. Inflation remains high, but the forces that have fuelled inflation have now diminished."

The outlook had definitely worsened between the MPC-meeting 24 September and 15 October, but this had not yet shown up in official Norwegian data. Except for registered unemployment, the main indicators for demand and production published between the two meetings were not weaker than expected, while inflation also for September surprised on the upside. It is therefore hard to see that it was these new data that made Norges Bank now conclude that the economy appeared to slowdown faster and more pronounced than previously projected. The main source for that conclusion must have been the report from Norges Bank's regional network which already was available at the MPC-meeting 24 September, and a new assessment of the situation. The coordinated cut by other central banks was probably an eye opener and the main reason for Norges Bank's cut 15 October.

Two weeks later, ***29 October***, an ordinary MPC-meeting took place and MPR3-2008 was published. The deposit rate was again lowered by 50 bp to 4.75 percent. The justifications given in the press release after the meeting were as follow:

"The effects of the financial crisis will most likely be more pronounced than envisaged only recently. The slowdown in the Norwegian economy appears to be occurring rapidly and is likely to be pronounced, says Governor Svein Gjedrem.

Prices have increased markedly since autumn 2007, but the outlook suggests that inflation may edge down ahead. The key policy rate forecast has been lowered. The Executive Board's strategy is that the key policy rate should lie in the interval 4% – 5% in the period to the publication of the next Monetary Policy Report *on 25 March 2009, unless the economy is exposed to new major shocks.*

The krone exchange rate has depreciated substantially. Should the krone remain weak for a long period, inflation may remain high. Norges Bank is closely monitoring developments in the krone exchange rate."

The Executive Board had considered as an alternative to limit the rate cut to 25 bp. But the unusual high degree of uncertainty concerning the economic development warranted a 50 bp cut. The new strategy interval and interest rate path indicated a 25 bp cut at the MPC-meetings in December 2008, March 2009 and August 2009. Ahead of the MPC-meeting 29 October, the market priced in a larger cut and a lower interest path than Norges Bank presented. The market rates moved somewhat up after the result of the meeting was known, but not fully up to Norges Bank's new interest path. The market continued to expect a significantly steeper decline in rates than forecasted by Norges Bank, see figure 3.7.

Figure 3.7: Norges Bank's MPR3-2008 interest path and the market's expectations just after the path had been published

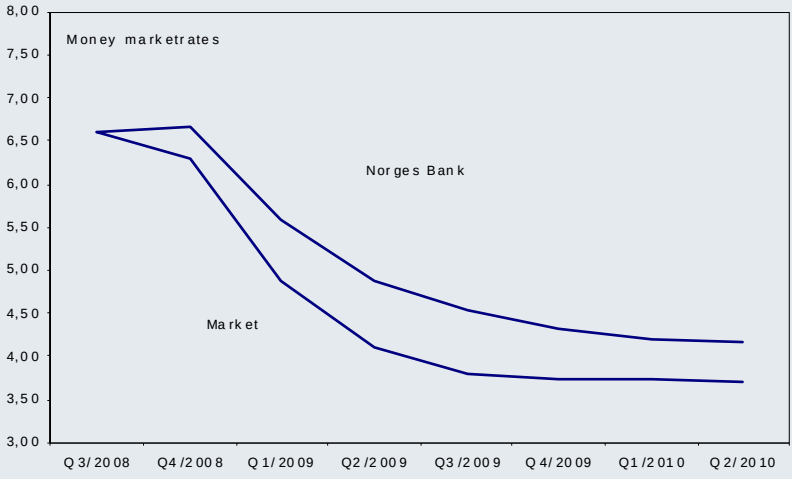
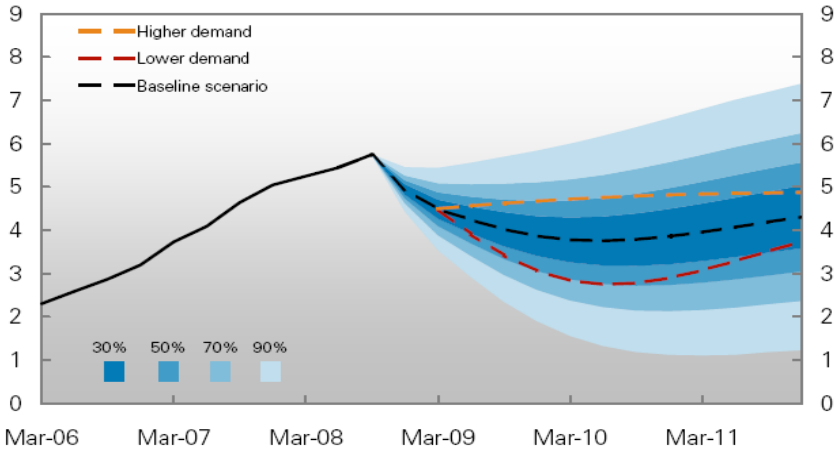


Figure 3.8: Alternative interest rate paths, Norges Bank's MPR3-2008

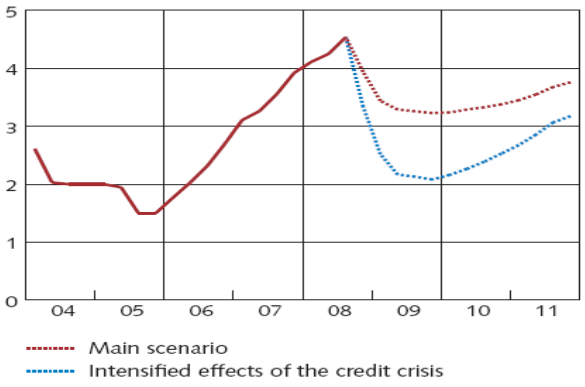
Chart 1.23a Key policy rate in the baseline scenario and the alternative scenarios with higher and lower demand. Per cent. 2006 Q1 – 2011 Q4



Source: Norges Bank

Diagram 3.9: The Riksbank's MPR3-2008; Alternative interest rate paths

Figure 34. Repo rate
Per cent, quarterly averages



Note. Broken lines represent the Riksbank's forecast.
Source: The Riksbank

With Norges Bank's assessment of the economic situation in late October and based on previous communication, the rate cuts going forward should have been made in an slower speed than indicated in the new interest path. Because of the high uncertainty, Norges Bank moved rate cuts forward compared to previous reaction function.

The unusually high uncertainty was not reflected in the MPR3-2008 in other ways than verbally and that cuts indicated in the new interest rate path to a certain degree had been moved forward. The uncertainty fans and the character of alternative scenarios for the economic development did not deviate from previous reports. Figure 3.8 is taken from MPR3-2008 and shows Norges Banks baseline interest rate path together with two alternative paths. The highest illustrate a situation where demand surprises on the upside and the lower one where demand surprised on the downside. In the latter, the key policy rate is indicated to be cut more than in the base line scenario and approach 3 percent in March 2010. However, the rate was cut to that level already six weeks later.

The Swedish Riksbank published a new Monetary Policy Report on 23 October 2008, i.e. six days before Norges Bank. The Riksbank also usually produces alternative scenarios in its reports. In report number 3 published 23 October, an alternative scenario with intensified effects of the credit crisis was produced. The Riksbank indicated that in such a situation, an unusually large rate cut would be warranted, see figure 3.9. The effects of the credit crisis worsened, and the Riksbank cut rate about as illustrated in the alternative scenario, by 175 bp on 4 December. However, despite the information contained in the Riksbank's MPR3-2008, the market was taken by surprise 4 December.

Between the MPC-meetings 29 October and 17 December, the market's expectations for at a larger cut from Norges Bank was fed with more weak indicators, stronger than expected decline in inflation rates and large rate cuts in other countries. In Sweden, the Riksbank forwarded the MPC-meeting convene 16 December to 4 December. It signalled by that an extraordinarily large cut, and the repo rate was reduced by 175 bp. Bank of England the same day cut its policy rate by 100 bp and the European central bank (ECB) by 50 bp.

The uncertainty before Norges Bank's MPC-meeting ***17 December*** was extraordinarily large. The market's expectation increased to a cut of 125-150 bp. Analysts expectations varied between 75 bp and 150 bp. Norges Bank had not given any prior guidance as it did before the extraordinarily large 100 bp cut in June 2003. The 175 bp cut 17 December therefore surprised everybody.

When assessing the economic situation prior to the MPC meeting 17 December, Norges Bank seems to have relied heavily on the fifth and last report in 2008 from its regional network. The report, based on interviews in November, painted a gloomy picture of the situation. Production was falling and the inflationary pressure abated. On 17 December Norges Bank published for the first time an update to a MPR, including a new interest rate path. Growth was now forecasted to decline in Q4-2008 and Q1-2009, and core inflation (CPIXE) was expected to come down to the 2.5 percent target already summer 2009. In MPR3-2008, published six weeks before, this was forecasted to take place the summer 2011.

The update published 17 December did not contain a full set of new forecasts. That made it difficult for the market to assess whether the economy going forward as expected by Norges Bank or not.

Assessment

The situation in the world economy and in the international financial markets changed dramatically last fall. The crisis moved from a liquidity crisis to a crisis in the capital markets

with the availability of credit drying up to an economic crisis. When governments had implemented remedies to solve one problem another emerged. Forecasts for economic growth and inflation the next 12-24 months were revised down weekly. Central banks worldwide were operating monetary policy under an extreme degree of uncertainty.

Norges Bank was during the autumn criticised for reacting too slowly to the changed situation. Generally, Norges Bank became follower to other central banks in cutting rates. (See figure 3.10.) However this has to been seen in the context that the impact on the Norwegian economy of weaker growth internationally came late and that capacity utilisation and that domestically inflationary pressure was higher than in other industrialised economies. The slowdown in economic growth we saw up to August originated mainly from domestic demand, and was the result of tighter monetary policy. Growth in manufacturing production, which to a large degree is driven by exports and investments in the petroleum sector, kept up well during the first three quarters of the year. This contrasts with for instance Sweden and Germany where growth in manufacturing production (also y/y) was negative most of 2008. However, at the time of the MPC-meeting in August and even more when the September meeting took place, there were clear signs that growth in the Norwegian economy was decelerating more that expected.

As discussed above, Norges Bank could have indicated a reduced probability for another rate hike in the autumn already at the August meeting. But it was more surprising that the Bank at the MPC-meeting 24 September continued to keep the option open for another rate hike. With just nine days after the Lehman failure and a high degree of uncertainty about the consequences of the on going market turmoil, it could hardly be expected that Norges Bank would cut rates already at this meeting. All the time up till now, the predominant concern had been inflation higher than expected. On 24 September, however, it seemed very unlikely that the Bank would increase the key policy rate later in the autumn. We think Norges Bank at this stage had sufficient information communicating that.

Norges Bank can not be blamed for not being invited or informed about the coordinated international rate cut 8 October. The bank reacted promptly afterwards by announcing an extraordinary MPC-meeting on 15 October. By convening this MPC-meeting, the Bank also signalled that a rate cut now would come. The expectations in the market were a 50 bp cut, and Norges Bank delivered as expected. The Bank's assessment of the situation was now very different from the on at the MPC-meeting three weeks earlier. The other central banks' coordinated cut was the main reason for the extraordinary MPC-meeting and Norges Bank's cut on 15 October although other justifications were used as main arguments in the press release after the meeting.

The situation continued to be fragile and the outlook extraordinarily uncertain. This was also verbally expressed in the new MPR published at the ordinary 29 October Board meeting. To underline this and to better guide the market about its possible reaction to a faster weakening in demand, the Bank could like the Swedish Riksbank, have outlined in the new MPR an alternative scenario with an un-normally strong weakening in demand. Instead, the alternative scenarios in MPR3-08 were generic and did not express the higher risk expressed verbally in the report.

The uncertainty before the MPC-meeting 17 December was large. The economic situation and outlook had deteriorated. Other central banks continued with large rate cuts, especially Riksbanken in neighbouring Sweden. On the other hand, the market had a few weeks old

MPR with a rate path indicating 25 bp cut in December. Norges Bank also had informed that a cut of 25 bp was considered as an alternative to the 50 done 29 October. The six week old MPR proved to be of little help in estimating what Norges Bank would do. Other central banks actions proved to be a better predictor for Norges Bank's decision.

Figure 3.10: Monetary policy rates

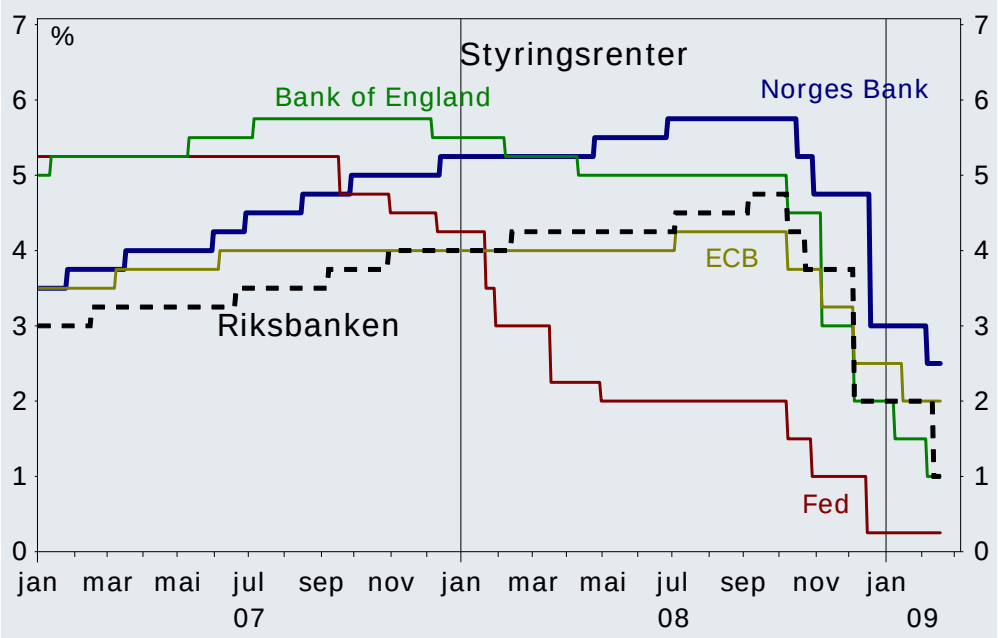
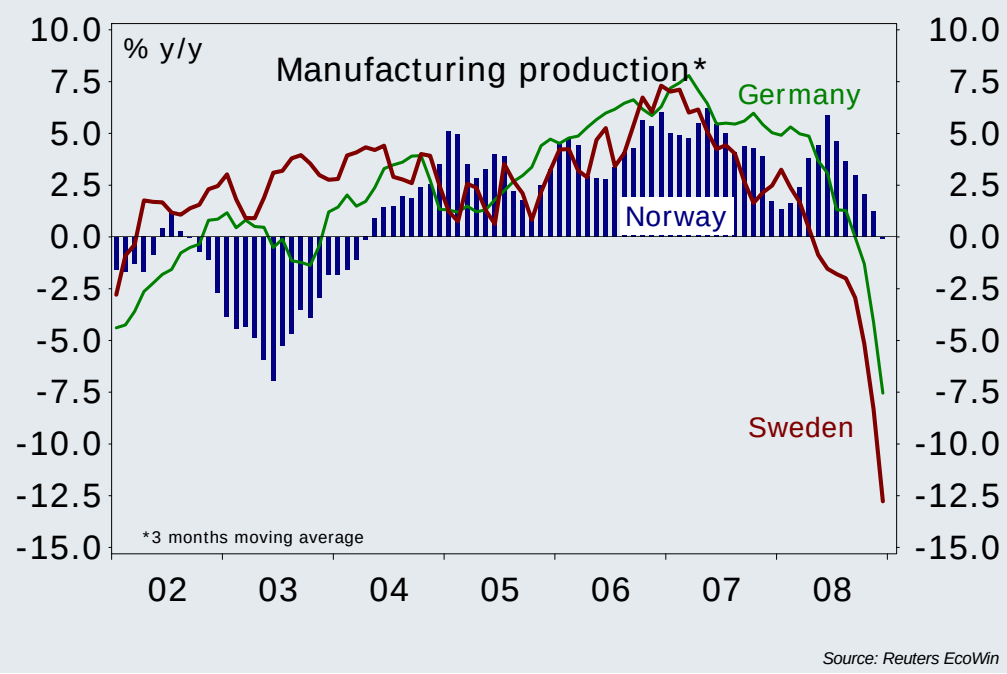


Figure 3.11: Growth in manufacturing production



An obsolete MPR (or the inflation report) just weeks after it was published was something Norges Bank also experienced six years ago, late autumn 2002. At that time, the Bank neither published interest rate forecasts nor its strategy. However, the inflation reports contained verbal indications about rate changes going foreward. The Bank's forecasts also indicated what it planned to do. Before the December MPC-meeting in 2002, the Governor indicated in a speech that Executive Board probably would act differently than indicated in the report. No such indications were given before the MPC-meeting last autumn.

The Bank has expressed that it was surprised when its analysis turned out with the result that rates should be cut by 175 bp. It has also indicated that this conclusion came very late in the process and that the new report from its regional network was an important contribution to its new understanding of the situation. Norges Bank is now considering publishing reports from its network when they are completed and not, as up to now, wait to the next MPC-meeting.

NBW's views:

With the information available at the time, Norges Bank could at the MPC-meeting in August and certainly at the MPC-meeting in September, have indicated less probability of another rate hike later in the autumn.

We think it would be helpful if Norges Bank start publishing its network reports when they are ready, independent of MPC-meetings. In situations with extraordinarily high degree of uncertainty about the economic outlook, the Bank should let that be reflected in the alternative scenarios it publishes in the MPR. When the Bank's assessment changed so dramatically just a few weeks after the publication of a new MPR and before a new MPC-meeting, the Bank should in appropriate ways have communicated that publicly as early as possible.

It was appropriate that Norges Bank published an update on 17 December. However, its lack of completeness made the update less useful as a basis for assessing whether current indicators would develop in line with or deviate significantly from Norges Bank's forecasts. We recommend that future updates, which hopefully will be few, are published with more complete forecasts.

Norges Bank seems to have reacted promptly to the turmoil in the money market by extending F-loans and offering loans to banks in other currencies. The Bank's alertness was high and its contact with the treasury departments in the banks seems to have been good. Norges Bank could at an earlier stage have offered longer term F-loans. The exchange facility for OMFs and governments securities has improved the Banks' longer term funding situation. However, the same could have been obtained by long term F-loans and use banks using OMFs as collateral. The government securities obtained by the banks have mostly been used directly as collateral for loans in Norges Bank and not to obtain liquidity from other sources.

4. Financial instability, asset prices and monetary policy

4.1. International financial turmoil

As discussed in section 2 of this report, the international financial turmoil is the main cause of the sharp contraction in real GDP in most OECD countries in the last quarter of 2008. According to Reinhart and Rogoff (2009)[6], in December 2008, there were ongoing, major, systemic banking crises in the following seven countries in the OECD: Austria (2008), Hungary (2008), Iceland (2007), Ireland (2997), Spain (2008), U.K. (2007) and the U.S.A. (2007). The years in parentheses are the beginning years of the crisis. Several other countries are suffering from minor banking crises that may evolve into more serious financial instability in 2009.

In this chapter, we discuss the relationship between financial instability, asset prices and monetary policy. In the US and the UK, both the Fed and the Bank of England have been criticized – fairly or not – for neither preventing the financial crisis nor for seeing what was coming much before it happened. Central banks have also been criticized for setting key policy rates too low, generating a housing bubble and financial instability at a later stage.[7]

Many central bankers – not least Alan Greenspan – appear to have believed that the modern global financial system had a much greater ability to diversify and absorb risk than what turned out to be the case. Greenspan did not give high priority to prudential regulation and supervision. In fact, a huge unregulated "shadow banking system" consisting of highly leveraged investment banks, hedge funds and similar financial institutions evolved into an enormous size in the United States during the recent boom. In addition, the rapid expansion of the financial sector in London has been criticized ex post for being regulated to light-handedly, although the Financial Supervision Authority (FSA) was admired for its internationally best-practice approach to prudential regulation only a few years ago.

Norway was hit by a systemic banking crisis in 1991 after years of banking problems. In contrast to many other OECD countries, however, Norway's banking industry has been in a relatively good shape in 2008. Norwegian banks have not been significantly exposed to the US subprime mortgage crisis that has undermined the balance sheets of many banks and financial institutions both inside and outside the US. To what extent tighter lending criteria from Norwegian banks have contributed to the slump in the last months of 2008 is hard to quantify. There are strong reasons to believe, however, that export demand and aggregate investment would have declined substantially even if the lending behavior of banks had not been more restrictive after the adverse money market shocks in September and October 2008. The falling credit growth rate to firms and households in the last quarter of 2008 does not tell us what is driven by supply behavior and what is due to lower demand for loans.

Financial instability and the real economy

The borderline between financial stability and instability is harder to draw than to distinguish

[6] Reinhart, C.M. and K.R. Rogoff (2009), "The Aftermath of Financial Crisis". Paper presented at the AEA meeting in San Fransisco, January.

[7] For example, John B. Taylor has identified a big deviation of US monetary policy from the "Taylor rule" in the years 2002 – 2005. He argues that these "monetary excesses" played an important role in explaining the US housing boom, see Taylor, J.B. (2007), "Housing and Monetary Policy." in *Housing, Housing Finance, and Monetary Policy*. Federal Reserve Bank of Kansas City.

between price stability and instability. A precise definition of financial instability is however not necessary in the present context. In general, what economists mean by financial instability is severe disruptions in financial markets, which are already – or are expected – to impair their ability to finance production and real investment, causing aggregate output and employment to fall, at least if the government does not succeed in repairing the financial system quickly. Often the words "financial crisis", "banking crisis", or just "financial turmoil" are used as almost synonymous alternatives to financial instability. Systemic banking crises have traditionally been considered the greatest threat to the functioning of the financial system, as banks' operations are important to all of the main functions of the financial system. Therefore, financial stability in general is often defined as a situation with absence or little risk of a systemic banking crisis.

Economic history is full of examples of financial crises. Many historians and economists have noted that the most serious economic contractions in U.S. history have all been associated with financial instability. Moreover, research suggests that financial instability *explains* why those contractions became so deep; see for example the analysis of the Great Depression by Bernanke (1983).[8]

Bordo, Eichengreen, Klingebiel and Martinez-Peria (2001) identify 118 banking crises since 1880.[9] Out of these, 40 crises have hit developed countries and the remaining 78 crises have their origin in developing countries. Since 1973, there have been 44 banking crises in 56 countries. When testing whether the frequency of crises have changed over time, they find that the probability that a country will be hit by a banking crisis has not increased since the 19th century. In a larger sample of countries, Laeven and Valencia (2008)[10] identify 124 banking crises during the period 1970-2007, of which 9 occurred in developed countries. There seems to be a slight increase in the frequency of crises during the 1990's.

Banking crises usually coincides with recession. Using the Laeven and Valencia database, it takes on average three to four and a half years before real GDP has returned to its pre-crisis level in cases where there is both a banking crisis and a recession. This suggests that we can expect the current economic slump to be long-lasting in many countries.

The empirical evidence suggests that the probability of a banking crisis increases if there is a sharp credit expansion, sharply increasing prices on financial markets including real estate markets, if economic growth is low, if inflation is high, if there are high real interest rates, if there has been financial liberalizations, and if the legal system is less developed. What is more surprising is that explicit deposit guarantees seem to increase the likelihood of a crisis.

Policy instruments used in connection to earlier crises include liquidity and capital support and deposit guarantees, and capital controls. An important concern is about moral hazard, i.e. how government rescue of banks influences future risk taking by banks and in turn increase

[8] Bernanke, B. (1983), "Non-Monetary Effects of the Financial Crisis in the Propagation of the Great Depression," *American Economic Review* (March), pp.257-276.

[9] Bordo, M., B. Eichengreen, D. Klingebiel and M.S. Martinez-Peria (2001), "Is the Crisis Problem Growing More Severe?" *Economic Policy*, 16:53-82.

[10] Laeven, L. and F. Valencia (2008), "Systemic Banking Crises: A New Database," IMF Working Paper WP/08/224.

the probability of future banking crises.

At the same time, it is necessary to use these policy instruments in order to restore the financial system and reduce the negative effects of financial instability on the real economy. It is therefore uncontroversial that government actions to stabilize the financial system as quickly as possible are crucial to reduce the real cost of financial instability in terms of lost output and real income. Hardly anybody believes that the problem of solving a systemic financial crisis should be left to the markets.

4.2. The role of Norges Bank in promoting financial stability

The literature on monetary economics suggests some basic and uncontroversial principles that can serve as useful guidelines for central banks in their conduct of monetary policy. Mishkin (2000)[11] derives the following implications of such guidelines for the role of a central bank:

- Price stability should be the overriding, long-run goal of monetary policy;
- An explicit nominal anchor should be adopted;
- A central bank should be goal dependent;
- A central bank should be instrument independent;
- A central bank should be accountable;
- A central bank should stress transparency and communication;
- A central bank should also have goals of financial stability.

Modern central banks like Norges Bank play an important role in fostering financial stability. This responsibility is shared with the FSA of Norway (Kredittilsynet) and the Ministry of Finance. An evaluation of the institutional and political framework of financial stability in Norway by the IMF a few years back was generally quite favorable.[12] A few details were pointed out with room for improvements, and these were rectified soon afterwords. After the banking crisis in the 1990s, Norges Bank has – following the example of Riksbanken in Sweden – published financial stability reports twice a year. A separate Financial Stability Wing in Norges Bank has for many years been fully operational, in line with the Monetary Policy Wing and Norges Bank Investment Management Wing. It is fairly obvious that the latter wing should be organized quite separate from the monetary policy and financial stability wings. In regard to the monetary policy and financial stability wings, however, the challenge is rather to facilitate closer interaction, cooperation and communication between them.

In general, price stability makes financial stability more likely. On the other hand, financial stability is crucial for price stability. An important lesson from economic history is that systemic banking crises could push an economy into deflation and depression. Thus, central banks should have a financial stability goal in addition to a price stability goal.

Unfortunately, successful price stability guarantees financial stability, however. In the boom before the 1929 stock market crash, for example, there was no consumer price inflation. On the contrary, the US consumer price index slowly declined from 1925 to 1929. Neither was there consumer price inflation in Japan during the build-up of the asset price "bubbles" in the market for stocks and property in the period 1985 – 1990. In both cases, it was not obvious

[11] Mishkin, F.S. (2000), "What Should Central Banks Do?" Federal Reserve Bank of St. Louis.

[12] FSSA (2005), "Financial System Stability Assessment" IMF Country Report No. 05/200.

during the economic boom that the asset price development was a "bubble" that had to burst, triggering systemic banking crises and deflation. In real time, it is hard to distinguish a long-lived, but unsustainable economic boom from an increase in the economy's trend growth rate. Sometimes advances in technology can increase the sustainable rate of growth, and in such episodes, the fundamental values of stocks, housing and other real estate usually also increase. The possibility that unsustainable asset price "bubbles" may be built up during non-inflationary economic booms, and that the bursting of such bubbles could trigger both financial and price instability, is therefore an extremely important issue for central banks as well as for economic science.

4.3. Asset bubbles and financial instability

The sharp fall in stock and housing prices in 2008 is a reminder that asset prices are very volatile in general. This is no less true for exchange rates in currency markets. This volatility represents a real treat to the performance of the financial system and the real economy.

Extreme asset price volatility is often referred to as asset bubbles. The idea of a bubble is that asset prices may fluctuate significantly more than their fundamental values. The fundamental value of an asset is defined as the rationally expected (and risk-adjusted) present value of the future cash flow to its owner. Fundamental values depend on expectations of the future and are not directly obvervable. According to classical asset price theory, news about the future explains why the fundamental values of asset prices change. Since the fundamental value is not observable, neither is it possible to observe the size of the "bubble part" of a particular asset price directly. The solution to this problem of non-observability is not to define away asset price bubbles by conventionally interpreting all asset price movements as changes in fundamentals, however. News is observable. Sometimes, stock prices falls dramatically without any evidence that there were news about the future that triggered this particular price movement. Examples are the dramatic stock market crashes in 1929 and 1987. These and many other episodes from economic history strongly suggest that asset bubbles are important real phenomena.

By its very nature, it is extremely difficult to identify an asset bubble before it bursts. In his book published in 2000, *Irrational Exuberance*, however, Robert Shiller did offer solid evidence of a large bubble in the US stock market before the burst. It can be no doubt that Shiller's book increased the awareness of the asset bubble phenomenon both in academic and policy circles.

Robert Shiller (2003) defines a speculative asset bubble as follows[13]:

"*A period when investors are attracted to an investment irrationally because rising prices encourage them to expect, at some level of consciousness at least, more price increases. A feedback develops – as people become more and more attracted, there are more and more price increases. The bubble comes to and end when people no longer expect the price to increase, and so the demand falls and the market crashes.*"

Shiller emphasizes irrational behavior as a crucial factor behind asset bubbles. Psychological research as well as experimental research in the new fields of behavioral finance and behavioral economics document that human decision making under uncertainty deviate

[13] Shiller, R. (2003), "Diverse View on Asset Bubbles", in W.C. Hunter et al. (eds.), *Asset Price Bubbles: The Implications for Monetary, Regulatory , and International Policies*. The MIT Press, Cambridge MA.

systematically from rational expected utility maximization (involving the formation of rational expectations), see De Bondt and Thaler (1995) and De Bondt (2003).[14] It is well documented from numerous experiments that people use mental frames and major rules of thumb to simplify and make sense of difficult decision making situations. These short-cuts give rise to "psychological biases". Much research remains however, before economic science will have developed a general asset pricing theory founded on behavioral finance.

Whether irrational behavior is crucial for the existence of asset bubbles or not, is still an unsettled question. Allan and Gale (2000)[15], for example, have offered a formal theory of asset bubbles in which the crucial element is an "agency problem" due to asymmetric information and debt finance of risky investments. This type of agency problem can be illustrated by the case of real estate investments:

"*If the investment is successful, the borrower repays the loan and retains the difference between the value of the asset and the principal and interest. If the investment is unsuccessful, the borrower has limited liability and the lender bears the shortfall. When the lender is unable to fully control the risk of the investment made by the borrower this payoff structure leads to a risk-shifting problem. By taking on more risk so there is a higher probability of both large profits and large losses, the borrower can increase his payoff in the good states while the lender bears the losses in the bad states. If many investors are using borrowed funds, asset prices of risky assets can be bid up above their fundamental as a result of this risk-shifting*." (Allan and Gale (2003), pp. 324)[16]

This theory predicts that the size of the bubble will depend on both the availability of credit now and on expectations of future expansion of credit. Financial deregulation usually increases the availability of credit and could therefore start an asset price bubble. The bust of the bubble could be due to a real shock that reduces asset returns or a change in monetary policy that makes credit less available.

Figure 4.1 suggests the existence of asset bubbles in the markets for commercial real estate in Oslo and Stockholm after financial deregulation in the 1980s.[17]

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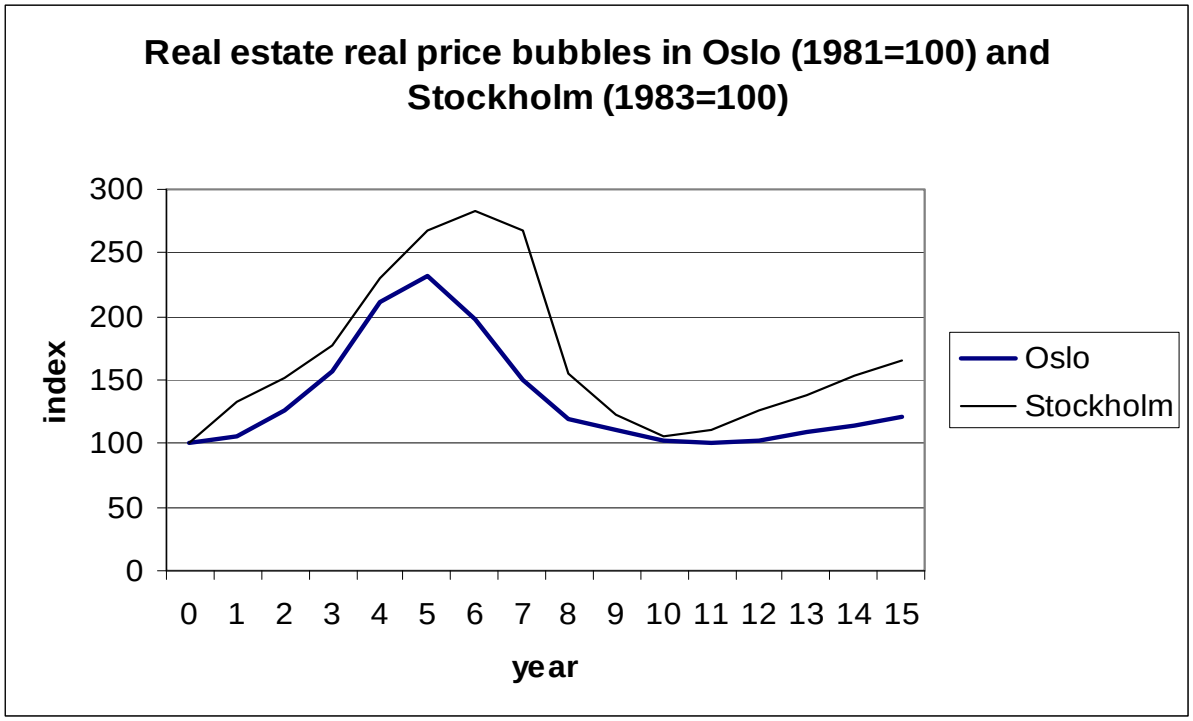
[14] De Bondt, W.F.M and R.H. Thaler (1995), "Financial Decision Making in Markets and Firms: A Behavioral Perspective," in R.A. Jarrow et al. (eds.), *Handbook in Finance*. Amsterdam: Elsevier-North Holland, and De Bondt, W. (2003), "Bubble Psychology", in W.C. Hunter et al. (eds.), *Asset Price Bubbles: The Implications for Monetary, Regulatory , and International Policies*. The MIT Press, Cambridge MA.

[15] Allan, F. and D. Gale (2000), "*Bubbles and Crises*," Economic Journal 110, pp. 236-255.

[16] Allan, F. and D. Gale (2003), "Asset Price Bubbles and Stock Market Interlinkages", in W.C. Hunter et al. (eds.), *Asset Price Bubbles: The Implications for Monetary, Regulatory , and International Policies*. The MIT Press, Cambridge MA.

[17] See Steigum, E. (2004), "Financial deregulation with a fixed exchange rate: Lessons from Norway's boom-bust cycle and banking crisis". T. Moe, J. Solheim & B. Vale (red.), "The Norwegian Banking Crisis". *Norges Bank Occasional Paper*, Oslo, 2004, 23-75.

Figure 4.1 Real price bubbles in Oslo and Stockholm after financial deregulation in the 1980s (annual observations)



Source: Steigum (2004).

Before the bubbles bursted, the relative price of commercial real estate (the nominal price deflated by the CPI) had increased by about 125 percent in Oslo (from 1981 to 1986) and by more than 175 percent in Stockholm (from 1983 to 1990). There is anecdotic evidence of speculation with borrowed money by firms with limited liability. This evidence therefore illustrates nicely the bubble theory of Allen and Gale. The bubble lasted longer in Stockholm than in Oslo, probably because the adverse oil price shock in 1986 triggered a shift to more austere monetary and fiscal policy in Norway. In the subsequent banking crises, the losses of Swedish banks were much more concentrated in the real estate sector than in the case of Norway.

4.4. Asset prices and monetary policy

The debate on the role of the exchange rate in 2001

When inflation targeting was adopted in Norway in 2001, the role of the krone exchange rate was much in focus. Many Norwegian economists were worried that the exchange rate could fluctuate a great deal if inflation targeting was adopted by Norges Bank. Exchange rates might also be contaminated by speculative bubbles, just like stock and real estate prices, for example if many foreign investors at some point were attracted to the krone as an interesting currency for speculation. It was feared that speculation could make the krone artificially strong and seriously hurt Norways non-oil export sectors. It was therefore argued by some economists that Norges Bank should include the exchange rate on the list of goals for monetary policy.

In 2001, Norges Bank interpreted its mandate as flexible inflation targeting, which has a fairly

precise meaning in monetary economics. According to Norges Bank Watch 2002 report[18], flexible inflation targeting

"*maintains that the primary goal of monetary policy is to achieve low inflation in the form of an inflation target, but it is recognized that some weight should be given to stabilizing the business cycle and, consequently, stabilizing output movements around potential output. In practice, this means taking a somewhat more gradual and more moderate approach to monetary policy, aiming to achieve the inflation target at a somewhat longer horizon (say 2-3 years) than would be technically feasible (perhaps 3-4 quarters). It also means accepting that inflation will, in the short term, deviate, sometimes quite a bit, from the inflation target. This approach also relies more on the aggregate demand channel than the direct exchange rate channel to inflation.*" (Norges Bank Watch 2002, pp. 22-23.)

The report also discussed the feasibility and desirability of exchange- rate stabilization. It argues that inflation targeting in an open economy will include an element of implied exchange-rate stabilization because of the effects on CPI of the exchange rate through prices of imported consumer goods:

"*Independent movements in the exchange rate, due to shocks and changes in international investors' sentiment, for instance, will have, through the direct and indirect exchange-rate channels* […]*, an impact on the CPI.* […] *An inflation targeting-central bank would then to some extent prevent the lower inflation by more expansionary policy, which would moderate the currency appreciation. Importantly, this implied exchange-rate stabilization is not for its own sake; it is derived from the objectives of stabilizing inflation and the output gap*." (Norges Bank Watch 2002, pp.25.)

The Norges Bank Watch 2002 report further maintains that flexible inflation targeting does not involve real exchange rate stabilization, although theoretically, this is possible:

"*In theory it is possible to add another "stabilization objective", namely the stability of the real exchange rate around its equilibrium rate. Furthermore, this equilibrium real exchange rate is ever-shifting due to shocks that change the underlying real equilibrium of the economy. Estimating the equilibrium real exchange rate is therefore a substantial challenge. Also, any stabilization of the real exchange rate would normally imply more variability of inflation and output gap. In practice, stabilization of the real exchange rate is likely to be too ambitious and fraught with difficulties. Realistically, inflation targeting central banks will have to abstain from any real exchange-rate stabilization beyond that implied by the real exchange effects on inflation and the output gap.*" (Norges Bank Watch 2002, pp. 27.)

The debate on flexible inflation targeting and the exchange rate around the introduction of flexible inflation targeting in Norway in the beginning of the century ceased after a couple of years. Norges Bank's interpretation of its mandate as flexible inflation targeting implied that it would not have exchange rate stabilization as a separate goal in addition to inflation stabilization and output gap stabilization.

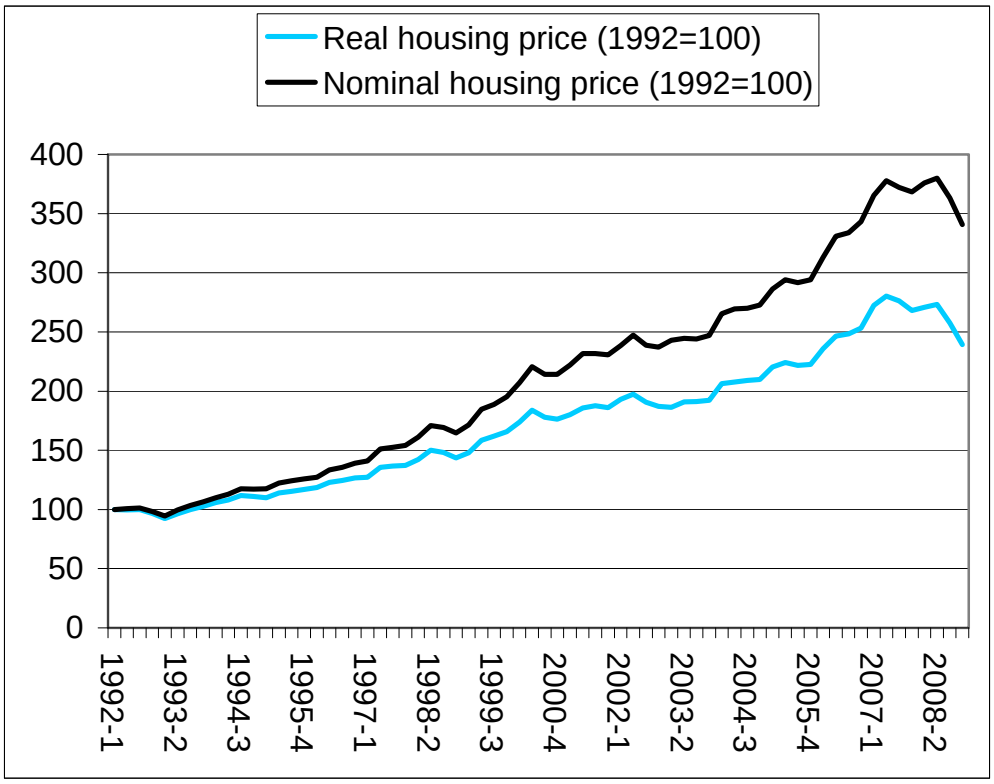
In recent years, however, another asset price has attracted a lot of attention in the Norwegian

[18] Svensson, L.E.O., K. Houg, H.O.Aa. Solheim and E. Steigum (2002), *Norges Bank Watch 2002. An Independent Review of Monetary Policy and Institutions in Norway*. Research Report 17/2002. BI Norwegian School of Management, Oslo.

as well as international debate on monetary policy, namely house prices.

House prices and monetary policy
Figure 4.2 illustrates why the focus has shifted to house prices.

Figure 4.2 Real and nominal house prices in Norway, 1992 – 2008 (quarterly observations).



Source: Statistics Norway.

From 1993 to 2002 (Q2) the real house price increased by 8.3 percent per year on average. Then it declined during the business cycle downturn in 2002-2003 and increased by 10.1 percent per year on average from 2003 to 2007 (Q2). The relative price growth was particularly strong from 2006 (Q1) to 2007 (Q1) (15.5 percent). From 2007 (Q4) to 2008 (Q4) the real price has declined by 10.7 percent. It could be argued, however, that the house prices in the beginning of the 1990s were lower than fundamental values due to the banking crisis, low aggregate demand and high cyclical unemployment.

Similar or even more dramatic booms and busts in house prices have also been observed in many other countries after the turn of the century. Critics have argued that Norges Bank should have paid more attention to the effects of monetary policy on house prices, particularly in 2004 and 2005 when the key policy rate was 1.75 percent. In those years inflation was far below target. One important reason was declining import prices, due to the “China effect”. Critics argue that Norges Bank should not worry about low inflation when favorable terms of trade changes lead to falling prices of imported consumer goods because the low interest rate could trigger asset price bubbles.

Before we discuss this issue further, let us look at an interesting episode in Swedish monetary policy in 2006, an episode which Francesco Giavazzi and Frederic Mishkin (2006) refer to (and critize) in their evaluation of Swedish monetary policy.[19]

Giavazzi and Mishkin (2006) refer to a press release on 23 February, 2006, after Riksbanken had increased the repo rate by 25 basis points. In this statement, Riksbanken first discusses the factors explaining why inflation is lower than the target and why its inflation forecast to some extent has been revised downward compared to the inflation forecast from December 2005. Then the statement points out that households' debt and house prices continue to increase fast, continuing: "On this background, the Executive Board of Riksbanken decided to increase the repo rate by 0.25 percentage points in yesterday's meeting."[20] (Giavazzi and Mishkin (2006), pp. 74.)

Giavazzi and Mishkin (2006) call this statement a "serious mistake" in the communication strategy of Riksbanken because it looks as if house prices is an additional goal for monetary policy. This led to some confusion in the markets. Riksbanken made a public statement denying that house prices were a separate goal for monetary policy in April 2006. Giavazzi and Mishkin (2006) also note that in the financial stability reports of Riksbanken, increasing house prices were not considered a threat to financial stability in Sweden at that time.

This brings us to the question of the appropriate role of house prices for monetary policy in the policy framework of flexible inflation targeting. Referring to our previous discussion of the role of the exchange rate, neither should house prices be as separate goal for monetary policy in addition to inflation and output gap stability. Giavazzi and Mishkin (2006) argue that neither house prices nor other asset prices should become targets for monetary policy. Still, information on house prices could be important for central banks because they affect aggregate demand and the output gap. An inflation-targeting central bank should therefore take into consideration that rapidly rising house prices could affect future output gaps and inflationary pressure. Since monetary policy should be forward-looking, this should be taken into consideration when the key policy rate is set. This line of reasoning is similar to how an inflation-targeting central bank should think about the exchange rate, as discussed above.

Asset prices and optimal monetary policy

The viewpoints of Giavazzi and Mishkin (2006) concerning how central banks should reacts to asset prices are consistent with an influential article by Bernanke and Gertler (1999).[21] In April 2002, The Federal Reserve Bank of Chicago and the World Bank Group in Washington, DC, cosponsored a conference on "Asset Price Bubbles: Implications for Monetary, Regulatory, and International Policies" in Chicago. At this conference, there were seemingly some disagreement on principles, but the disagreement turned out to be on empirical issues concerning the information content of asset prices, particularly stock and real estate prices. At

[19] Giavazzi, F. and F. Mishkin (2006), En utvärdering av den svenska penningpolitiken 1995 – 2005. Rapporter fråm Riksdagen 2006/07: RFR I. Sveriges Riksdag, Stockholm.

[20] In Swedish: "Mot denna bakgrunn beslutade Riksbankens direktion att höya reporäntan med 0,25 procentenheter vid gårdagens möte."

[21] Bernanke, B. and M. Gertler (1999), "Monetary Policy and Asset Price Volatility", *Federal Reserve Bank of Kansas City Economic Review* 84, pp.17 – 51. See also the short article by Bernanke, B. and M. Gertler (2001), "Should Central Banks Respond to Movements in Asset Prices?", *American Economic Review*, May.

that time, at least, the existing body of empirical research did not settle this question. Thus, economists believing that central banks could extract useful information from asset prices and perhaps even identify potentially de-stabilizing asset bubbles from real time data, were arguing that central banks should indeed use such information when setting monetary policy. Other economists did not believe that asset prices – particularly stock prices – contained useful information for central banks. Concerning principles, however, Benjamin Friedman (2002) concluded that[22]:

"A proposition with which I suspect nobody today disagrees is that the central bank should take account of asset prices to the extent that asset prices bear incremental information about the macroeconomic goals of monetary policy,[…]." (Friedman (2002), pp. 459.)

Flexible inflation targeting involves two goals of monetary policy, inflation stability around the inflation target and output stability around normal output (output gap stability). To the extent that asset price movements would affect business cycles and inflationary pressure, the central bank should take this into account when setting the key policy rate.

An obvious problem remains, however, namely that it is very difficult in practice to know when movements in particular asset prices will affect the future macroeconomy in such a way that preemptive monetary policy actions are warranted. Usually, asset price movements do not have significant macroeconomic effects. Even if a bubble can be indentified, it is not obvious that the central bank should act. For example, Michael Mussa (2003)[23] argues that even if the Fed had been able to identify the dot-com equity bubble in the US in 1999, Fed should not have tightened monetary policy just because of this bubble, because this class of assets was too narrow.

Do central banks take asset prices into account?

There has been a lot of empirical economic research devoted to what central banks in fact do. This is of course a different question from what economists think they should do. The former line of research does not answer why central banks react to asset prices, for example if they try to stop asset bubbles before they threaten macroeconomic stability. We will not attempt to review and evaluate this large research literature here. This literature suggests, however, that many central banks do in fact use asset prices as part of their information set when setting key policy rates. A recent paper by Bjørnland and Leitemo (2009) find that changes in stock prices in the US have triggered short-run reactions in the key policy rate.[24]

There are two types of errors that a central bank can make with respect to asset price movements. The first error is to fail to adjust monetary policy when it should have. The second type of error is to change monetary policy when it should *not* have. Both errors can involve substantial costs in terms of less macroeconomic stability. Ex post, after a bubble in a

[22] Friedman, B.M., "Comments on Implications of Bubbles for Monetary Policy", in W.C. Hunter et al. (eds.), *Asset Price Bubbles: The Implications for Monetary, Regulatory , and International Policies*. The MIT Press, Cambridge MA.

[23] Mussa, M. (2002), "Asset Prices and Monetary Policy", in W.C. Hunter et al. (eds.), *Asset Price Bubbles: The Implications for Monetary, Regulatory , and International Policies*. The MIT Press, Cambridge MA.

[24] Bjørnland, H.C. and K. Leitemo (2009), "Identifying the Interdependence Between US Monetary Policy and the Stock Market", forthcoming in *Journal of Monetary Economics*.

major asset market has busted, it looks obvious that the central bank should have seen what was coming and reacted in time. But this is not fair. It is easy to demonstrate that monetary policy could have been improved with the benefit of the hindsight. The problem confronting central banks and governments is to make good decisions using real time data. In real time it is usually almost impossible to know, several years before a bubble bursts, that an asset bubble was in fact inflating.

The second type of error is also important. There are many examples of central banks that did react to an asset price movement, and later regretted. An example due to Giavazzi and Mishkin (2006) is the monetary restraints in Chile and New Zealand due to the East Asian and Russian crises in 1997 and 1998. These crises led to currency depreciation in both countries. It is therefore understandable that the two central banks increased their key policy rates preemptively in response to this asset price decline. Given that the exchange rate shocks were terms-of-trade shocks that would cause an economic decline, it would have been more appropriate to ease monetary policy instead of a tightening. The Australian central bank did just that after the collapse of the currency in Thailand (the bath) in July 1997.

Lessons from the recent boom and bust

We have discussed the role of asset prices for monetary policy on the basis of research before the recent housing price busts in many countries. One important conclusion was that in principle, the monetary policy strategy that Norges Bank has adopted – flexible inflation targeting – requires that Norges Bank should take account of asset prices to the extent that asset prices bear incremental information about the macroeconomic goals of monetary policy, i.e. about their effects on future inflation and output gap stability. A difficult problem for Norges Bank and other central banks, however, is that the relation between asset price movements and the macroeconomy is uncertain and often obscure.

The recent bust and financial turmoil will no doubt generate new economic research, which may improve the understanding of asset price bubbles and help central banks to use asset price information in future monetary policy.

NBW's view:

Norges Bank should continue to focus on low and stable inflation and contribute to stable developments in output and employment in the framework of flexible inflation targeting, as well as maintaining an efficient and stable payment and credit system. However, Norges Bank should take into account asset prices in monetary policy decisions to the extent that they affect future inflation and the output gap.

5. The New Price Index CPIXE

The objective of monetary policy as it is laid out in the Royal Decree of 29 March 2001 pursuant to Section 2, third paragraph, and Section 4, second paragraph, of the Act of 24 May 1985 no. 28 on Norges Bank and the Monetary System is low and stable inflation with the operational target of approximately 2.5 percent annual consumer price inflation. In addition to this overall objective, monetary policy should contribute to stable developments in output and employment.

The target inflation rate is not explicitly defined in the regulation as has been noted previously in Norges Bank Watch 2007. The reason is that the Royal Decree also states that direct effects of taxes, excise duties and extraordinary temporary disturbances shall not be taken into account. This is unfortunate as it may create uncertainty whether the inflation target should be interpreted in terms of overall CPI inflation or in terms of an index of underlying inflation where these short-term or temporary changes have been excluded. Furthermore, in Occasional Papers nr. 34, Norges Bank states that "in the implementation of monetary policy, Norges Bank puts special weight on the development of consumer price inflation adjusted for indirect taxes and excluding energy products (CPI-ATE) as an indicator of underlying inflation" (page 91).[25] These issues were discussed at some length by Norges Bank Watch (NBW) 2007 where it was suggested that Norges Bank made a clear distinction between the inflation target formulated in terms of overall CPI inflation and the indicator of future inflation, typically a measure of underlying inflation representing the inflation pressure in the economy where short-term temporary developments are excluded.

There are many good reasons why monetary policy should not deal with temporary changes in prices, in particular prices that are not caused by or can be affected by monetary policy. A potential problem is, of course, how to define extraordinary temporary disturbances and how good measures of underlying inflation should be constructed. In the implementation of monetary policy, Norges Bank has, as was mentioned above, previously used the developments of consumer prices adjusted for indirect taxes and excluding energy products as their main indicator of underlying inflation (CPI-ATE). This measure of consumer prices is published by Statistics Norway and is based on the overall consumer price index.
In MPR2-08 it is argued that the main weakness of using CPI-ATE as a measure of underlying inflation is that it does not include permanent changes in energy prices. This view is motivated by the strong increase in energy prices in recent years implying that CPI-ATE undervalues the underlying inflation pressure in the Norwegian economy. Over the last five years CPI inflation has on average exceeded CPI-ATE by half percentage points. It could therefore be argued that CPI-ATE is a poor measure of underlying inflation. However, it could equally well be argued that monetary policy should not respond to changes in energy prices. During the period 2003 to 2004, electricity prices first increased sharply and then returned back to its trend path. As a result overall inflation increased to almost 5 percent in the beginning of 2003. During the first part of 2004, energy prices fell sharply and overall CPI inflation became negative. There are strong reasons for such temporary changes not to affect

[25] Translation of "I gjennomføringen av pengepolitikken legger Norges Bank særlig vekt på utviklingen i konsumprisveksten justert for avgifter og uten energivarer (KPI-JAE) som en indikator på underliggende inflasjon."

monetary policy. This observation led NBW 2007 to recommend that monetary policy should aim at prices that are hampered by nominal stickiness.

Nevertheless, as a response to what is viewed as permanently higher energy prices, a new indicator of underlying inflation was proposed in Economic Commentaries 3/08. This new indicator is called CPIXE and is defined as a weighted average of CPI-ATE and permanent changes in energy prices.[26] The details including comparisons to CPI-ATE are discussed in Staff Memo 7/2008 and in Economic Commentaries 3/2008. The new indicator was first used in the monetary policy decision on May 28, 2008. Since then it has been used in connection with both monetary policy decisions and discussed in two issues of the Monetary Policy Report.

In this chapter we discuss and evaluate the new indicator of underlying inflation CPIXE. Before going into the details of how this indicator is constructed, it is our view that it is important to construct and use several different measures of underlying inflation when designing monetary policy. These alternative measures should also be published by Norges Bank.

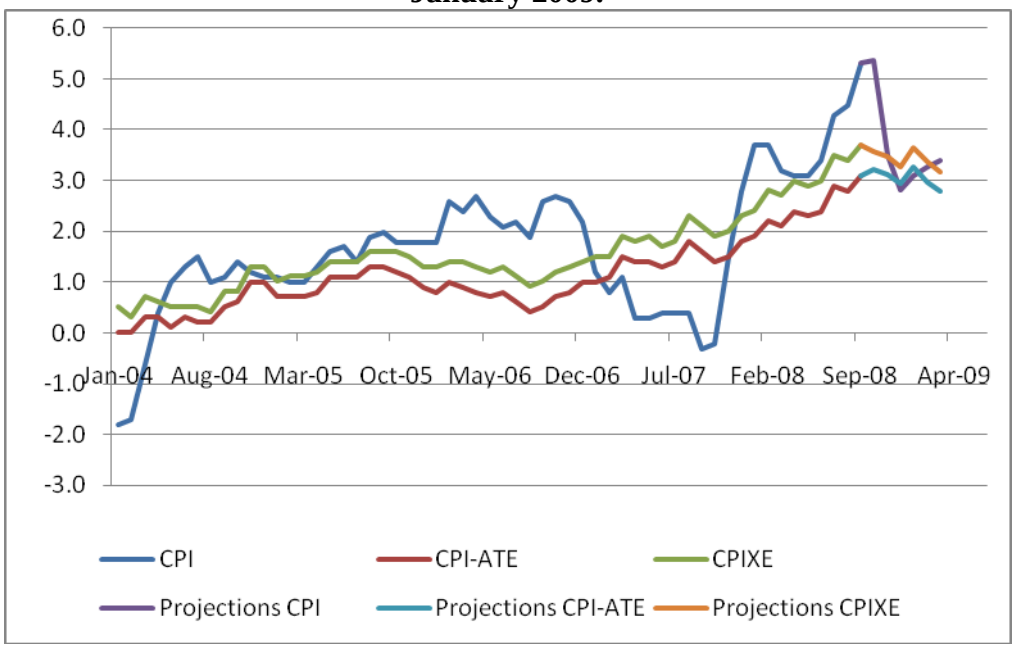
The CPIXE is constructed, as was mentioned above, as a weighted average of the 12-month change in the CPIATE and the 12-month change in an estimated trend for energy prices in the CPI (see the formula given in footnote 26). The energy price trend is based on the historical developments in energy prices in the CPI and projections of future energy prices based on forecasted future petrol prices and electricity prices. It is assumed that prices of other energy products in the CPI develop in line with the prices of petrol and electricity. The projections for electricity prices are based on electricity forward contracts on the Nord Pool Power Exchange whereas an empirical model is used to forecast petrol prices, see Staff Memo 07/8008. To forecast future petrol prices, it is assumed that the future petrol price depends on future oil prices (where forward oil prices are used as proxies for future spot prices), the future exchange rate (which is assumed to be constant) and seasonal effects. Energy prices are normally assumed to develop in line with forward prices at least 12 months ahead. Further on, prices are assumed to develop in line with other prices in the CPI. The forecasted electricity prices and petrol prices are then weighted together using weights in the CPI such that one obtains a measure of future energy prices. The final step in the computations is to apply the Hodrick-Prescott filter (HP-filter) with λ=14400 to compute the trend in 12-month changes in energy prices (ΔCPI-Energy in the equation in footnote 26). The sample used to construct the HP-filter starts in January 1979. Norges Bank publishes this indicator on the web site at 14.00 on the day Statistics Norway publishes CPI and CPI-ATE.

In Figure 5.1 we compare three different measures of inflation including projections of future inflation taken from Monetary Policy Report 03/08. First, we can confirm the argument that CPI inflation has been higher than CPI-ATE inflation during the last five years. However, there are also periods when CPI inflation has been below underlying inflation, for example during 2007. We also note that CPIXE always lies above CPI-ATE as expected. Note that CPIXE can only be below CPI-ATE if the price trend in energy prices is negative (the weight of energy prices in CPI is always positive). On average, CPIXE exceeds CPI-ATE by 0.4

[26] The CPIXE is defined as ΔCPIXE = (1-w) ΔCPI-ATE + w ΔCPI-Energy where ΔCPIXE is the 12-month change in CPIXE, ΔCPI-ATE is the 12-month change in CPI-ATE, ΔCPI-Energy is the 12-month change in the energy price trend, and w is the weight of energy prices in CPI which is computed by Statistics Norway and varies over time. The trend in energy prices is computed using a Hodrick-Prescott filter (λ=14400).

percentage points over the sample. It is clear that CPIXE provides a better indicator of underlying inflation than CPI-ATE in periods when there is a strong permanent increase in energy prices. The difference between CPIXE and CPI-ATE in figure 5.1 represents the contribution of the price trend in energy prices. This price trend depends on historical energy prices and projections of future energy prices as was mentioned above.

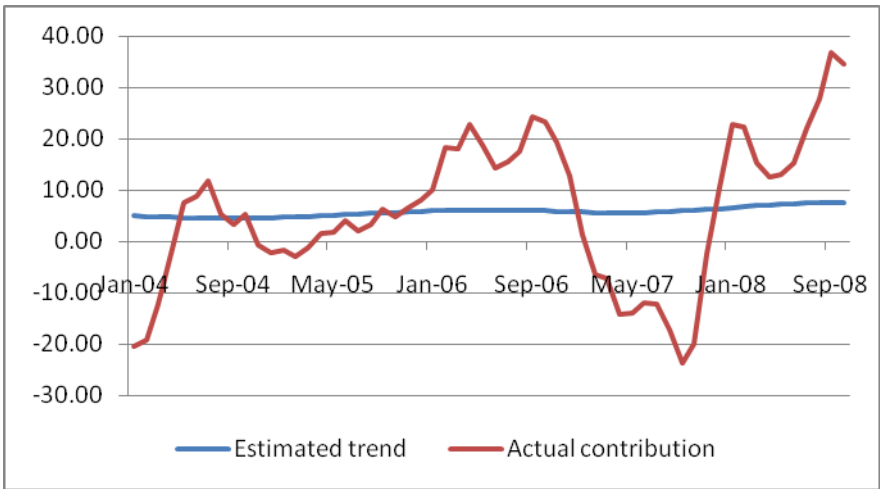
Figure 5.1 CPI, CPI-ATE and CPIXE, 12-month change in percent January 2004-January 2009.



Source: MPR3-08

Figure 5.2 shows energy price inflation (measured in percent) and the estimated trend using the Hodrick-Prescott filter taken from the MPR3-08. In this figure we note that variations in energy prices are smoothed out considerably. There are large deviations from the trend, for example in September 2007 actual energy price inflation was -23.6 percent while the permanent underlying trend in energy prices was 5.92 percent. A year later, energy prices had started to increase and reached its peak in September 2008 where energy price inflation was 37 percent and the trend had increased to 7.65 percent.

Figure 5.2 Energy price inflation and estimated Hodrick-Prescott trend.



Source: MPR3-08.

5.1 Evaluating CPIXE

In order to evaluate the CPIXE indicator we initially use the same criteria that Jonassen and Nordbø (Economic Bulletin 4/06) used in their analysis of different indicators of underlying inflation including the issue whether these different indicators are good predictors of future inflation. These criteria have been suggested in the literature and are viewed as standard requirements of optimal indicators of underlying inflation, see Jonassen and Nordbø and the references therein. A good measure of underlying inflation should satisfy the following criteria: The indicator should not systematically deviate from CPI inflation in the long-run; the indicator should be published at the same time as CPI inflation published by Statistics Norway and historical values should not be revised when new data becomes available; the indicator should be able to predict future CPI inflation; the indicator should be computed outside the central bank in order to increase credibility of the indicator; the public should be able to understand the indicator; and the indicator should be founded in economic theory. When using these criteria we conclude that CPIXE does not fulfill the basic requirements of a good indicator of underlying inflation. CPIXE does deviate from CPI inflation in the long-run. Furthermore, when comparing CPIXE and CPI-ATE we find that the only difference is that the former indicates a somewhat higher inflation than the latter. As can be seen in Figure 5.1, CPIXE is approximately half a percentage point higher than CPI-ATE over the sample 2004 to 2009.

In their comparison of different measures of underlying inflation, Jonassen and Nordbø found that no single indicator was optimal. However, they found that CPI-ATE closely matches the moving average of CPI inflation and concluded that it was the best indicator when forecasting future inflation in the short-run, less than one year ahead. For longer time horizons, no indicator performed well. CPI-ATE was, however, among the best even when forecasting inflation 24 months ahead. Since CPIXE closely follows CPI-ATE, one could guess that the former indicator is as good as the latter. It is unfortunate that Norges Bank has not evaluated the properties of the new indicator including the ability of forecasting future inflation.

Historical values of CPIXE are revised as new observations become available and the indicator is constructed by Norges Bank using underlying data from Statistics Norway and data collected by the bank. The computations are quite complex and involve regression

models where parameters are revised when new data is used. These regression models including the forecasts used when constructing energy price inflation are not published. One could question whether the computations can be understood by the public.

Even more problematic is that it is virtually impossible to replicate the computations since the description of the method used and the underlying data including the models used are not made available. The description of the construction of CPIXE as laid out in Staff Memo 7/2008 and Economic Commentaries 3/2008 is not fully transparent. For example, there is no explicit description of the way forecasts of future electricity and oil prices are constructed. It is only argued that forward prices on electricity taken from Nord Pool and oil prices are used but there exists several different forward contracts on Nord Pool for maturities from one month to 2 years. Similarly, prices on oil futures are used as inputs when forecasting petrol prices but this is not stated. Moreover, when forecasting petrol prices they also include the future nominal exchange rate but the assumptions concerning these forecasts are not mentioned. The underlying assumption is that the nominal exchange rate is expected to remain constant. The weights used to compute energy prices are not stated but they are taken from Statistics Norway and may therefore change over time. Since this information is not published, it is impossible to replicate the computations. Our view is that all relevant information on the computations (data, model(s) used and estimates) should be available to the public and organizations in order to avoid discussions whether the central bank manipulates the indicator.

On the other hand, the indicator satisfies the criteria that it should be published at the same time as CPI inflation and CPI-ATE are published by Statistics Norway. It could be argued that the new indicator is founded in economic theory. More precisely, it is funded in statistical theory but also loosely to economic theory. Underlying inflation should measure the long-run trend in inflation where short-run temporary changes are excluded. The HP-filter used by Norges Bank is based on the idea that the estimated trend component represents these underlying permanent changes in inflation whereas the cyclical component is a measure of short-run temporary changes. Our conclusion, therefore, is that the new indicator CPIXE does not satisfy all standard criteria that a good measure of underlying inflation should fulfill. However, we believe that it would be possible to publish all underlying information allowing the public or organizations to replicate the computations.

The construction of CPIXE raises several issues that may have importance not only for the computation of the indicator but also for the design of monetary policy. Even though it is argued in the MPR2-08 that CPIXE does not reflect a new assessment of underlying inflation or future inflation it is nevertheless used as an important input when estimating future inflation pressure and will therefore potentially affect monetary policy. As stated above, it is clear that CPIXE is the main indicator of underlying inflation referred to and the only measure of underlying inflation that is published with error bands, see figure 1.14 in MPR3-08.[27] In the new projections from 17 December 2008, only forcasts for CPIXE and not for CPI-ATE were reported.

[27] Technically, the error bands should be wider also backwards (historically) to reflect uncertainty as CPIXE is revised. See for example the error bands for output in figure 1.14.

NBW's view:

The new index CPIXE is not an optimal indicator of underlying inflation using standard criteria and should therefore not be used as the main indicator when designing monetary policy. Our view is that the previously used index of underlying inflation, CPI-ATE should still be used as the focus measure since it has been tested, evaluated and has good properties at least compared to other alternative measures of underlying inflation.

Even though the new indicator of underlying inflation, in our opinion, does not satisfy all these criteria discussed above, it may still be a very good indicator. We believe that a conclusion will depend on the assumptions made when constructing the indicator, including the use of the HP-filter and assumptions made on the relationship between forward and future spot prices on electricity and oil. We will now turn to these issues and focus on (i) issues concerning the use of the Hodrick-Prescott filter including the endpoint problem, and (ii) the relationship between forward and spot prices and the question whether forward prices are good indicators of future spot prices. As will be argued, this evaluation strengthens our view that CPIXE is not an optimal indicator of future inflation pressure and should therefore not be used as the only indicator of core inflation.

5.2 The Energy price inflation trend

In order to estimate the trend in energy prices, a Hodrick-Prescott filter (with λ=14400) is used.[28] The Hodrick-Prescott filter (HP-filter) is commonly used in the literature when decomposing macroeconomic time series into a trend component and a cyclical component.[29] The filter computes a smooth trend similar to one that can be drawn by hand through the series where the smoothness of the trend is determined by the parameter λ. The cyclical component is then defined as the deviation of the actual time series from its trend.[30] Since the value of the parameter λ determines the smoothness of the trend component it will also affect the computed cyclical component. When increasing the value of λ, the trend will become linear and when λ approaches zero, the trend approximates the actual series such that the cyclical component is zero. The interpretation of the trend component is that it represents permanent changes in the series whereas the cyclical component represents short-term temporary changes. Norges Bank applies this filter in order to compute permanent changes in energy price inflation which is then multiplied with the weight of energy products in overall CPI (approximately 9 percent) and then added to the weighted CPI-ATE (the weight being equal to 100 percent minus the weight of energy products in overall CPI). The HP-filter is a so called high-pass filter since it is used to eliminate only low frequencies from the actual series leaving short-term fluctuations unaltered.

In studies of business cycles using quarterly data it is usually assumed that λ=1600 (corresponding to 14400 for monthly data) which implies that fluctuations at frequencies

[28] Hodrick, R.J. and Prescott, E.C., (1997), "Postwar U.S. Business Cycles: An Empirical Investigation," *Journal of Money, Credit, and Banking*, 29: 1-16.

[29] The underlying idea is that a series is the sum of two components, a trend and a cycle. Since these two components are not observable, it is necessary to define what is meant by a trend and a cycle before it is possible to estimate them. The Hodrick-Prescott filter is one of many different ways to compute the two components.

[30] The mean of the cyclical component is zero and represents short-term fluctuations around the smoothed trend.

equal to and greater than 32 quarters are eliminated from the series and the remaining component, the business cycle, includes all frequencies less than 32 quarters. A smaller value of λ implies a lower cutoff frequency such that the trend includes a larger part of fluctuations in the series.

The HP-filter estimates a smoothed trend by, in principle, taking a weighted moving average (symmetric and centered) of the series. The value of λ is arbitrary, Hodrick and Prescott suggest that λ=1600 should be used when estimating the business cycle in quarterly GDP which translates to λ=14400 when using monthly data. Hodrick and Prescott also show that λ can be interpreted as the ratio of the variance of shocks to the cycle divided by the variance of shocks to the trend and they held the view that a five percent cyclical component and a one-eighth of one percent change in the trend are moderately large numbers on a quarterly basis which lead them to the number 1600. Translating this into a monthly basis, one obtains the number 14400 which is used by Norges Bank.

There are several potential problems when using the HP-filter in empirical applications. It is well-known that the HP-filter is sensitive to small changes in the underlying data, there are endpoint problems, it is possible that the filter produces spurious cyclical components, there may be phase shifts in the cyclical component, and finally, there is uncertainty about the value of λ (see for example Harvey and Jaeger (1993)[31], Cogley and Nason (1995)[32], and Mise, Kim and Newbold (2003)[33]). We will first discuss the endpoint problem including sample sensitivity and then shortly discuss the uncertainty about λ.

The HP-filter can be easily computed, see Appendix A for the exact formulas. As can be seen in the appendix, the trend component is directly related to the actual time series. To compute the trend component, we take a weighted average of all observations in the sample where the weights are independent on the data. This suggests that the filter can produce very different trends depending on the sample used. Norges Bank is using a sample starting in January 1979 when they compute the trend. However, when using a shorter sample, for example by excluding the first years, one obtains a different trend and therefore different values of CPIXE. This is a problem as it would be possible to manipulate the actual values of CPIXE just by changing the sample used when estimating the trend.

As is also illustrated by a simple example in Appendix A, there is an end-point problem. The last observation has a large weight when computing the last value of the trend. Furthermore, the example shows that the second value of the trend (both at the end of the sample and at the beginning of the sample) is more affected by the last observation than its own observation. At the same time we note that there are only minor changes to the estimated trend for observations in mid-sample. These observations has led Baxter and King (1999)[34] to

[31] Harvey, A.C. and A. Jaeger, (1993), "Detrending, Stylized Facts and the Business Cycle," *Journal of Applied Econometrics*, 8:231-247.

[32] Cogley, T. and J.M. Nason (1995), "Effects of the Hodrick-Prescott Filter on Trend and Difference Stationary Time Series: Implications for Business Cycle Research," *Journal of Economic Dynamics and Control*, 19:253-278.

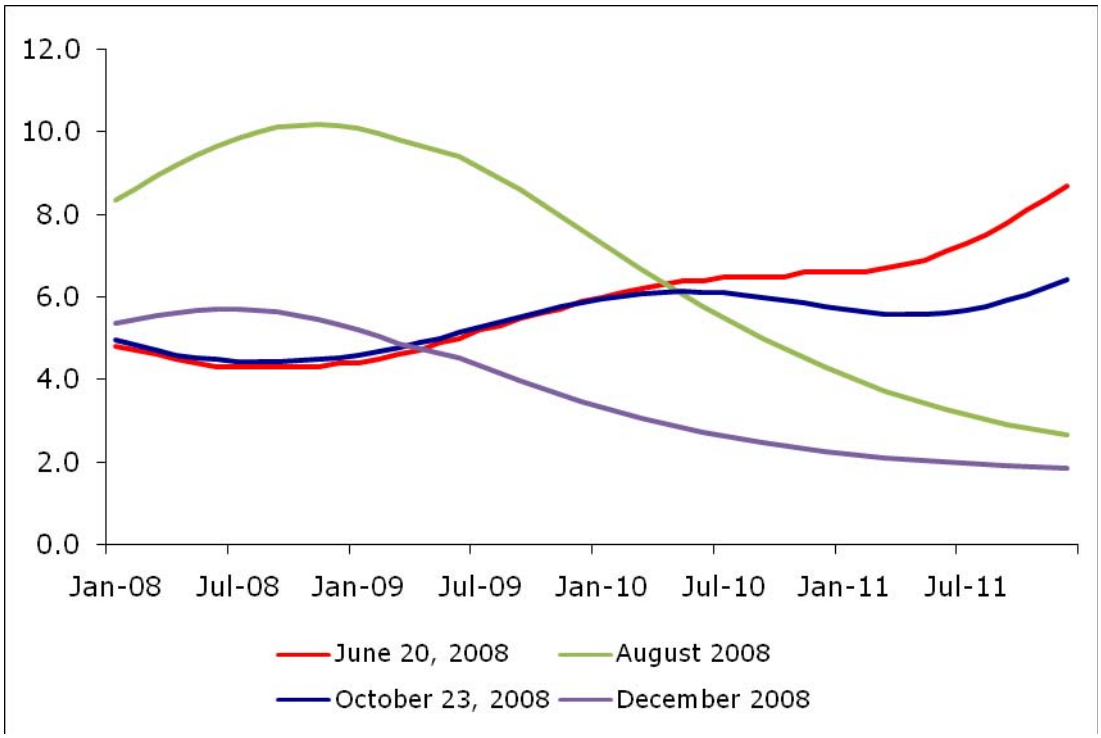
[33] Mise, E., T-H Kim and P. Newbold (2003), "The Hodrick-Prescott Filter at Time Series Endpoints," University of Nottingham, Discussion Paper No. 03/08.

[34] Baxter, M. and R. King (1999), "Measuring Business Cycles: Approximate Band-Pass Filters for Economic Time Series," *Review of Economics and Statistics*, 81: 575-593,

recommend that in order to eliminate the end-point problems, the first and last 36 observations (with using monthly data) should be eliminated. Alternatively, they suggest that the sample is extended using backcasts and forecasts to add observations at both ends using time series models for the variable. The HP-filter is applied to this extended sample and then the first and last 36 observations should be eliminated. The resulting filtered series then covers the full sample where the bias introduced by the endpoint problem is eliminated.

To illustrate the sensitivity of the HP-filter to the addition of new data to the sample we show estimates taken from MPR2-08 and from MPR3-08 (and additional estimates provided by Norges Bank) in figure 5.3. The four HP-trends in energy price inflation are estimated in June, August, October and December in 2008, every second month. Since the underlying data is monthly it implies that only two new actual observations are used when constructing the latter trend in addition to new actual observations of prices on Nord Pool forwards and futures on the oil market. Forward and futures prices are used when forecasting future spot prices on electricity and oil which are then used to compute forecasts of future energy price inflation. The graph only shows the estimated trends for the period January 2008 to December 2011. As can be seen in the graph, there are large differences between the four estimated trends.

Figure 5.3 Trend in energy price inflation computed in June, August, October and December 2008.



Source: MPR2-08, MPR3-08 and Norges Bank

A surprising finding is that there is a very large shift in the trend between June 2008 and August 2008, the values jump from around 5 percent during 2008 to almost 10 percent over the same period. This jump reflects the continuing rise in energy prices and the expectations that energy prices will remain high in the future. Then in October, the trend falls back to

approximately the position estimated in June. The only difference being forecasted values in 2011 that are somewhat lower than what was estimated in June. The last revision of the trend made in December 2008, however, suggests a much lower underlying inflation and therefore less inflation pressure in energy prices than previously estimated.

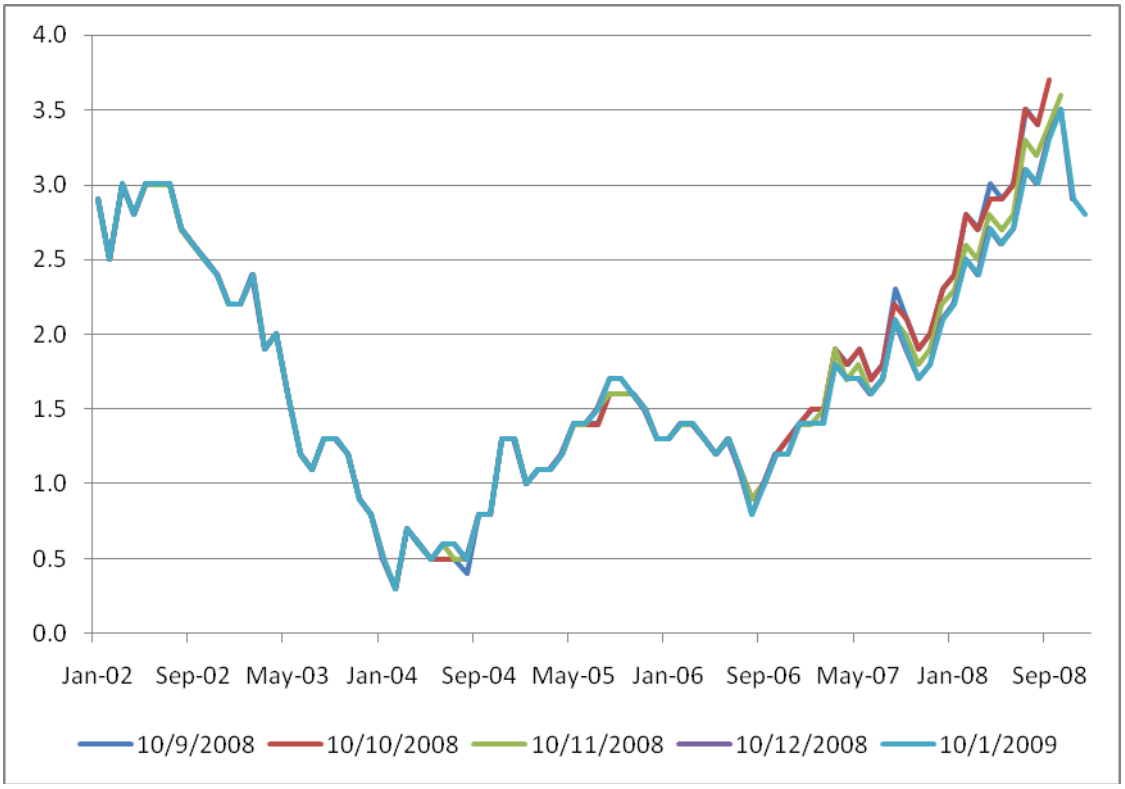
It is notable that there are very large changes in the HP-trend when only very few data points are added. One should, however, keep in mind that forecasted values of electricity and petrol also are computed and it may be the case that these forecasts have been revised during the period in between the publication of Monetary Policy Reports.

Large differences in estimated HP-trends can potentially affect monetary policy decisions. Consider for example the underlying inflation in January 2009 as measured in June and in August. The weight of energy products in overall CPI is about 9 percent implying that between June and August, CPIXE increased by 0.5 percentage points. This illustrates very clearly that few additional observations can have a substantial effect on the estimated future inflation pressure and therefore also potentially monetary policy decisions.
Our conclusion is that the HP-filter is very sensitive to changes in the underlying data. In the present case, the increasing trend in energy prices estimated in August 2008 suggests an increased inflation pressure in the economy and therefore may suggest a more restrictive monetary policy. Two months later, when estimating the new trend in October 2008, data seems to suggest a considerable shift down in the trend and therefore less inflation pressure.

It cannot, therefore, be ruled out that actual monetary policy may be affected by this sensitivity to the addition of new observations. This potential problem may be even more severe if there are large forecast errors when predicting future energy prices. In case the forecast error increases with the horizon, which is likely to be the case, then not only the last observation will be affected but also the second last observation to a high degree as the weight on the last observation is larger than the second last observation. This also holds for the third last observation. The result is that forecast errors embedded in the last observation will have a large impact on the estimated trend value and thereby the estimate of underlying inflation and eventually on the design of monetary policy.

In order to gain further insights into the effects of revisions, we compare revised estimates of CPIXE in figure 5.4. The effect of revisions of the HP-filter can clearly be seen in the graph below. As new observations become available and new projections are constructed, a new trend can be computed. But, historical values of the trend will be revised. The difference between these different trends can be substantial as is clearly seen towards the end of the sample. If the projections turn out to be far away from actual values, there will be a large impact on the estimated trend. This problem is amplified as a large weight is put on observations at the end of the sample. Therefore, there are two main problems when using the HP-filter in the present setting. First, historical values are revised and projection errors have a large impact on the estimated trend through the end-point problem.

Figure 5.4 Revised estimates of CPIXE.



Source: Norges Bank.

One could argue that the endpoint problem is less severe when using very long sample lengths. Norges Bank is using data from January 1979 to compute the HP-trend. In Appendix A we showed the explicit weights used to compute the trend and noted that they were independent on the data. Therefore, it is evident that the endpoint problem does not disappear even in cases the sample length is increased. The only way to minimize the bias introduced by the endpoint problem is to extend the sample by adding observations at the beginning and the end of the sample, and then delete these observations after the trend is computed. This method cannot easily be applied in the present case as one of the main purposes of estimates of underlying inflation is to forecast the future inflation pressure in the economy.

Another issue is that the sample used when computing the HP-filter will affect the estimated trend. For example, if we use a sample starting in 2004 instead of 1979, we obtain a substantially different trend and therefore also a different measure of CPIXE and therefore also potentially monetary policy decisions. This is unfortunate and supports our view expressed above that CPIXE is not a reliable measure of the future inflation pressure as it is dependent not only on the underlying data but also the sample used when computing the trend.

In addition to these problems when using the HP-filter, there is the uncertainty about λ. It may not be the case that the chosen value is optimal when modelling trend and cycle in energy prices. Why would the relation between volatility in the cyclical and trend components of energy prices be identical to the variance of cyclical and trend components in output. One way to mitigate this potential problem is to use the method suggested by Stock and Watson

(1998).[35] They have designed a method to obtain rough estimates of relative variance of the two components that then can be used to find an appropriate estimate of λ. Unfortunately, Norges Bank has not provided any empirical evidence suggesting that the chosen value of λ is optimal.

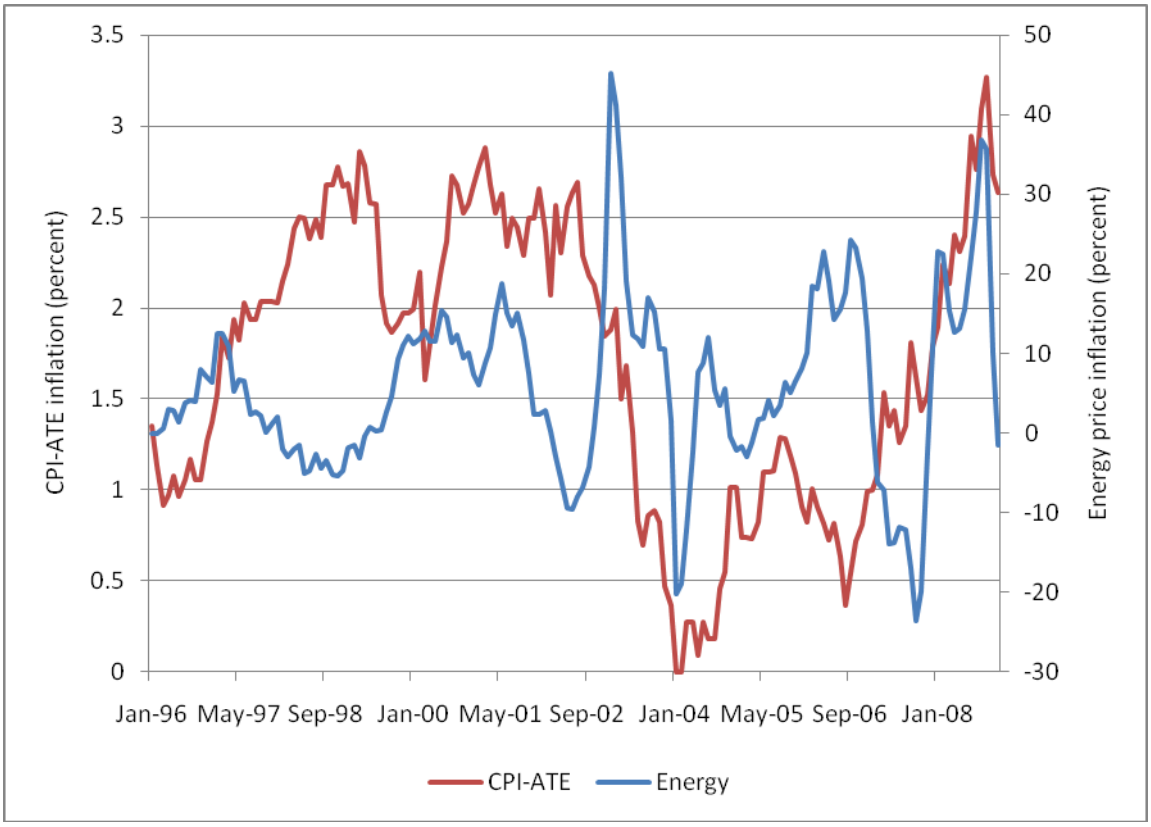
5.3 Forecasting future electricity and oil prices

In this section we discuss and evaluate the method used to forecast electricity and petrol prices, i.e., the use of prices on forward and futures contracts to forecast future electricity and oil prices. The HP-trend in energy price inflation is based on actual data on electricity and petrol prices and projections of these prices using forwards and futures contracts traded on the Nord Pool market and the oil market. Then these two series are weighted together using weights obtained from Statistics Norway to an index representing the contribution of energy price inflation in CPI.

In figure 5.5 we show CPI-ATE inflation and electricity price inflation on an annual basis. It is evident that energy price inflation is more volatile and is not very correlated with CPI-ATE inflation. The annual inflation rates also differ substantially where energy price inflation lies between -24 percent and 45 percent over the period whereas CPI-ATE inflation lies between 0 and 3.3 percent. We also observe that the two series move in the same direction during some periods and in opposite directions during other periods. Since the year 2000, the two series have become more correlated, the correlation coefficient using the full sample is 0.065 whereas the correlation is 0.197 using the sample January 2000 to December 2008. The weight of energy price inflation in overall inflation is about 10 percent implying that the total effect is considerable during periods with extreme changes in electricity and in oil prices, as has been the case during the last few years. As a result, the volatility of overall CPI has increased. The main question is if these very large swings in energy prices should affect monetary policy decisions. NBW 2007 argued that they should not be considered and we agree with that recommendation.

[35] Stock, J. and M. Watson (1998), "Median Unbiased Estimation of Coefficient Variance in a Time-Varying Parameter Model," *Journal of the American Statistical Association*, 93:349-358.

Figure 5.5 CPI-ATE and energy price inflation January 1996 to December 2008.



Source: Staff Memo 7/2008.

Let us now consider forecasts of electricity prices. Norges Bank is using forward prices on the Nord Pool market as proxies for future spot prices. In particular, to construct projections of future monthly prices on electricity it is assumed that future spot prices are equal to prices on monthly forward contracts for the first six months and then equal to prices on quarterly forward contracts where it is assumed that the spot price during the quarter is constant. For example, on Friday January 23, the forward price on electricity for delivery the third quarter of 2009 was 34.35 Euros and it is then assumed that the monthly price in July, August and September is equal to 34.35 Euros. Since forward prices may fluctuate substantially day to day Norges Bank is using an average of the forward prices over the last 10 days in the month as the projection.

One important issue is whether prices on the Nord Pool market reflect actual household prices. This is discussed in Staff Memo 7/2008 and it is shown that actual prices on electricity for households very often move in the same direction as spot prices on the Nord Pool market. Furthermore, about 40 percent of the households have electricity prices directly related to these spot prices. Therefore, it is argued that spot prices (the system price) on the Nord Pool market is a good proxy for actual energy prices. Even though we agree that the system price is a good estimate of the electricity price, it is still an open question whether forward prices are good proxies for future spot prices. A standard argument in the literature, and in Staff Memo 7/2008, is that forward contracts reflect market participants' expectations about future spot prices and therefore it is likely that prices on forward and spot contracts move in the same direction such that forward prices contain information about future spot prices. This is, in particular, the case for financial assets. Commodity markets differ, however, from financial markets since the underlying asset is different. Commodities are used as inputs in production

and are thus consumed. We should therefore not expect that commodity futures markets behave as financial futures markets.[36] In particular, the arbitrage models used to price futures or forwards are different and more complex than the models for financial assets. Additional risks such as weather conditions, political risks, storage capacities and costs may directly affect prices. The oil market can be expected to be different from the electricity market since the latter commodity cannot be stored implying that storage costs are not relevant when pricing electricity forwards as they would be when pricing oil futures. However, about 50 percent of the power production traded on the Nord Pool market is generated by hydropower reservoirs and reservoir levels determine electricity prices, both spot and forward prices, see for example, von der Fehr, Amundsen and Bergman (2005)[37]. Moreover, as reservoir levels display a seasonal pattern this implies that there may be seasonal effects in prices also. The effect on prices from shifts in demand depends on reservoir levels, if they are low prices can be expected to change substantially whereas if levels are high, production is easily adjusted leaving prices unchanged. On the other hand, if reservoirs are full, water may overflow and reduce potential gains.

The standard model for the relationship between prices on commodity futures and commodity spot prices is that the difference between futures and spot prices observed today is equal to carrying costs (storage and interest costs) minus the so called convenience yield representing the marginal benefit from holding inventories beyond those associated with expected capital gains. Carrying costs and interest costs tend to drive up the price of futures compared to spot prices. The reason is that a future is a promise to deliver the commodity in the future which requires either direct access to the production facilities or the purchase of the commodity in the spot market. In the latter case, carrying costs also includes the interest cost of borrowing to finance the purchase and storage costs. These carrying costs provide an upper limit on the difference between the current futures price and spot price. The convenience yield has an opposing effect. This yield represents the market expectation of the availability of the commodity. If the market expects that there will be shortages in the future, the convenience yield will increase. In case there are substantial inventories, there is less probability of shortages in the future and the convenience yield will be small.

Electricity cannot be stored and there cannot be any storage cost in general, but as mentioned above, since water can be stored in reservoirs and a large part of the power production is dependent on hydropower reservoirs, storage costs will not be zero. The convenience yield can be both negative and positive on the electricity market. When producers prefer to sell at a lower price instead of allowing overflows, the convenience yield is negative. If this is the case, then spot prices will be lower than forward prices (in the absence of storage costs). In the opposite case when reservoirs are low, the convenience yield will be positive and spot prices will exceed forward prices.

There are very few papers analyzing the predictability of forward prices on the Nord Pool market but the consensus is that forward prices contain some information about future spot

[36] See Hull, J.C. (1996), *Options, Futures, and Other Derivatives*, Sixth Edition, Prentice Hall for an introduction to the pricing of forward and futures contracts on both financial and commodity markets.

[37] von der Fehr, N-H M., E. Amundsen and L. Bergman, (2005) "The Nordic Market: Signs of Stress?" *The Energy Journal* (Special Issue: European Electricity Liberalisation), 71-98.

prices but there are large forecast errors. For example, Torró (2007)[38] compares in-sample and out-of-sample forecasts of future spot prices using three different models, a myopic model where it is assumed that the future spot price is equal to the current spot price, a futures model where the future spot price is equal to the price on futures contracts, and a time series model where the spot price is a function of several variables including, i.a., temperature and reservoir levels. The data used is the system price and one to four week futures contracts. The main finding is that the time series model outperforms the other two models out-of-sample in most cases. The futures model provides best forecasts at the one week horizon, but the time series models outperforms other models at longer time horizons.

To illustrate these potential problems we evaluate the use of forward prices as proxies for future spot prices. In table 5.1 we show average forecast errors when predicting future spot rates using three different methods, the forward price, the actual spot price and the assumption that the future spot rate will move in opposite direction as the difference between the forward rate and the actual price. The latter model implies that whenever the forward price exceeds the spot price, we assume that the future spot price should fall with the same amount, not increase as could be expected using standard arguments. We present results for two cases, first when we compare to the average monthly price (monthly basis) or the average quarterly price (quarterly basis). Data is obtained from Ecowin. All forward prices are monthly observations and measured in NOK as is the data used by Norges Bank. The spot price is the system price on Nord Pool. We compare the average price on forward quarterly contracts observed, for example, in January, with the average quarterly system price in the second quarter (denoted quarterly basis in the table). As an alternative we compute the average forecast error comparing the average forward price in January with the average system price in April, July, October and January. These forecast errors are denoted monthly basis in the table. It should be noted that our assumptions are different from the ones made by Norges Bank. They use only data from the last 10 trading days when computing the forward rates, we take the average over the full month. We believe that this difference is unimportant for the conclusions drawn.

As is evident from table 5.1, there are very large forecast errors. For example, the forecast error using prices on one quarter contracts and comparing to the average quarterly system price is equal to almost 87 NOK which can be compared to the average system price over the period which is 317 NOK. The forecast error is substantial. On the other hand, the forward rate seems to contain some information on future spot prices, the forecast errors are larger when using the current average system price as a predictor, that is, when we assume that the future spot price is equal to the actual spot price. Also, when assuming that the future spot rate will change opposite to the difference between the current system price and current forward price we obtain even larger forecast errors. These results suggest that forecasts using forward rates are superior to using current spot prices, but the forecast errors are very large. Therefore we can expect the estimated HP-trend to include large forecast errors that will contribute to the uncertainty of estimated CPIXE. Our interpretation is that the CPIXE index should be used with caution.

[38] Torró, H. (2007) "Forecasting Weekly Electricity Prices at Nord Pool," FEEM Working Paper No. 88.2007.

Table 5.1 Comparison of different forecast Average forecast error in NOK.

Forecasts using	Q1	Q2	Q3	Q4
Forward price (quarterly basis)	86.69	89.81	94.56	91.75
Forward price (monthly basis)	66.28	77.55	94.61	93.25
Actual spot rate (quarterly basis)	98.78	140.50	166.14	160.04
Actual spot rate (monthly basis)	84.93	127.04	157.65	171.80
Difference between forward and actual spot rate (quarterly basis)	122.23	172.16	225.70	252.73
Difference between forward and actual spot rate (monthly basis)	121.33	165.63	226.90	259.10

Source: Ecowin.

To forecast petrol prices, Norges Bank is using an empirical model for the petrol price explained in Staff Memo 7/2008. Forecasts are derived from the following regression model

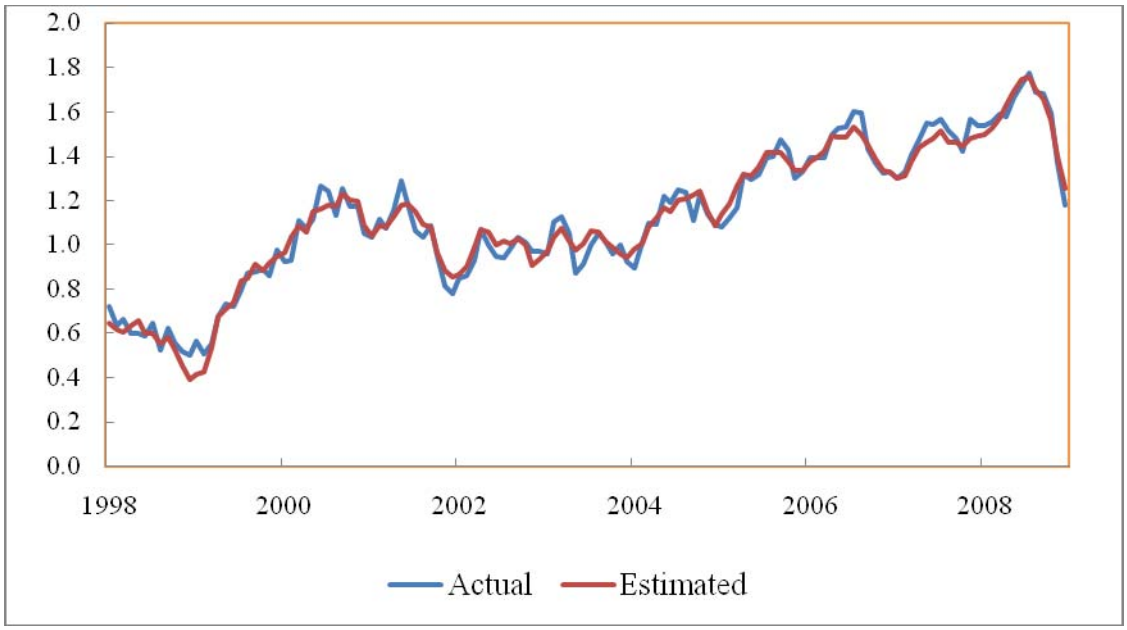
$$\Delta fp\_x_t = \beta_0 + \beta_1 \Delta oil_t + \beta_2 \Delta usd_t + \beta_3 (oil_{t-1} + usd_{t-1}) - \beta_4 fp\_x_{t-1} + \sum_{i=2}^{12} \alpha_i s_i + \varepsilon_t$$

where fp_x_t is the petrol price (95 octane unleaded), oil_t is the spot oil price (Brent Blend), usd_t is the NOK/USD exchange rate and s_i are monthly dummy variables. This model is re-estimated as new observations become available and then used to forecast future petrol prices. To construct these forecasts, future spot prices on oil are assumed to be equal to prices on monthly futures contracts on oil and the NOK/USD exchange rate is assumed to remain constant and equal to the actual exchange rate at the time.

The properties of this regression equation are discussed in Staff Memo 7/2008 where it is shown that the model performs well in-sample, see figure 5.6. The fit of the estimated model is very good. However, there is no evaluation of forecasts, i.e., out-of sample forecasts.

There are a few drawbacks when using the forecasting model above. First, the assumption that the NOK/USD exchange rate remains fixed in the future may not be optimal. Second, prices on oil futures may not be optimal predictors of future oil prices, an issue we will return to below. While it is difficult to specify a good forecasting model for exchange rates, it may be argued that it is possible to do better than just to assume that the nominal exchange rate is constant over the forecasting horizon. One possibility would be to use uncovered (or covered) interest parity or purchasing power parity in order to produce forecasts of future spot prices or make use of the forecasting model used by Norges Bank. It is well-known in the literature that exchange rate models perform very poorly when forecasting exchange rates in the short-run. However, they may give better forecasts than assuming that the change in the exchange rate remains constant. Moreover, this assumption is not consistent with Norges Bank's own forecasts of future exchange rates as shown in for example figure 1.18 in MPR3-08.

Figure 5.6 In-sample fit of forecasting model for petrol prices, January 1998 to December 2008.



Source: Norges Bank.

Let us now focus on the assumption that the future spot price on oil is equal to the current price on oil futures. As was mentioned above, the standard model states that the difference between forward and spot prices is equal to the carrying costs minus the convenience yield. The main difference between the electricity market and the oil market is that there are carrying costs and interest costs in the latter case. These costs tend to drive up the price of futures compared to spot prices. The reason is that a future is a promise to deliver oil in the future which requires either direct access to oil production facilities or the purchase of oil in the spot market. In the latter case, carrying costs also includes the interest cost of borrowing to finance the purchase and storage costs. The convenience yield represents, in this case, the marginal benefit of holding oil in reserve, that is, to let it remain in the ground. The owner of an oil field has the option of increasing the supply of oil in the future in response to unexpected increases in demand which is more convenient and less costly than buying oil on the spot market.

The existence of carrying costs and in the absence of convenience yields, futures prices must exceed current spot prices, a situation known as contango.[39] In this case, futures prices do not indicate or predict that future spot prices will increase. In case futures prices are very high, it may be profitable to buy oil on the spot market, hold the oil and deliver it in the future, in other words, sell a futures contract. In the absence of convenience yields, this would tend to drive the current spot price up and the futures price down. Another explanation could be that there is a positive relation between current spot prices and the convenience yield (now assuming that it is not zero), such that higher spot prices tend to drive down the convenience yield leading to an increase in the difference between futures and spot prices. If that is the case, future spot prices will fall (not increase as might be expected since futures prices exceed spot prices) since producers increase their production in response to the fall in the

[39] In case spot prices exceed futures prices, the convenience yield is large and exceeds the carrying cost. This case is called backwardation.

convenience yield. These two examples imply that futures prices may not contain any information about future spot prices and a simple model where it is assumed that carrying costs and convenience yields are zero will provide very poor predictions of future spot prices.

If the futures market is in contango and the convenience yield is zero, the spot price contains all available information about current and future market conditions (the cost-of-carry). New information will affect both spot prices and the price on futures implying that the future price will not contain any additional information not contained in the spot price and the futures price is a poor predictor of future spot prices. In case carrying costs are small and the convenience yield is large, spot prices will exceed the price on futures, i.e., the market is in backwardation. When the market is in backwardation, the future expected spot price will be lower than the futures price implied by the cost-of-carry model and thus contain information about future changes in oil prices. These conclusions are supported by empirical evidence. French (2005)[40], for example, finds that price on futures contain information about future spot prices only when actual spot prices substantially exceed prices on futures, the market is in backwardation. This is the standard result in the literature.

For these reasons we can expect large forecast errors when using futures prices as predictors of future spot prices. The consequence is that there will be large forecast errors when using the model above to forecast petrol prices. These forecast errors are then transferred to the index of energy price inflation underlying the estimated HP-trend that finally enters CPIXE. It is unfortunate that Norges Bank has not evaluated the forecasting properties of the model used to forecast petrol prices.

5.4 Conclusion

Our evaluation strongly suggests that the CPIXE indicator is not optimal and that there are several sources of uncertainty and biases that could severely affect the measure. It is also notable that Norges Bank has not evaluated the new indicator or compared its properties to the previous focus measure CPI-ATE. One could also question whether the new index adds new and important information that is not already included in CPI-ATE. As was shown above, the difference between CPI-ATE and CPIXE is almost constant and is in the range of 0.4 percentage points. When comparing the projections of CPI-ATE and CPIXE published in MPR3-08 we also find the same average difference. From our perspective it seems risky to use this new indicator as the main index of underlying inflation. However, it is important to explicitly state that our critique refers only to the use of CPIXE as the main or only indicator of underlying inflation. In such a case, it is our view that it is not optimal and should not be relied on. But, if CPIXE is used together with other measures of underlying inflation, such as the fourteen alternative measures analyzed in Jonassen and Nordbø, we think it could be a useful tool to analyze the importance and influence of energy prices on underlying inflation. Another problem as we see it is that not all relevant information on CPIXE is published and it is, in our view, almost impossible to replicate the computations.

[40] French, M.W. (2005), "Why and when do Spot Prices of Crude Oil Revert to Futures Price Levels?" FEDS Working Paper No. 2005-30.

NBW's view:

To repeat our view stated previously, CPIXE should not be used as the focus measure of underlying inflation. It is also our opinion that Norges Bank evaluates the new index in a similar way as they have evaluated other measures of underlying inflation. In addition, it is important to improve the methods used to forecast both electricity prices and petrol prices in order to minimize forecast errors. The method used to extract the permanent changes in energy prices must also be revised. The HP-filter is not optimal since it is very sensitive to changes in the underlying data, there are endpoint problems and historical values are revised when new data are added to the sample. There are many different available methods that can be used to split energy price inflation into permanent and temporary components and we suggest that Norges Bank initiates a new project with the aim of improving the construction of CPIXE. We also suggest that Norges Bank publishes all information on how this index is constructed and computed including the underlying data used.

Norges Bank has also initiated (in 2006) a project with the aim of improving and evaluating systems of short-term forecasts (up to a year ahead) and the publication of so called Nowcasting Reports using the new System for Averaging Models (SAM).[41] The basic idea is to produce a single forecast using a combination of forecasts from different types of models. One of the main advantages is that the method involves evaluation of the projections from each model, it is possible to improve short-term forecasts by using information contained in different models, and it is possible to obtain measures of uncertainty of these forecasts. Several other central banks including Bank of England and the Riksbank are also developing similar systems for improving short-term forecasts. These short-term forecasts can be used as additional information to projections of CPI-ATE and other measures of underlying inflation.

NBW's view:

The recent work developing the new SAM is encouraging and we suggest that Norges Bank continues to develop these forecast methods and use them as a valuable and important input in the operations and in the monetary policy decisions. We also suggest that Norges Bank considers the possibility of using this approach to forecast output and inflation up to two years instead of up to one year. Nowcasting reports should also be made available to the public.

[41] See Staff Memo 4/2008 for details on the new SAM

Appendix A: The Hodrick-Prescott filter

The Hodrick-Prescott filter is based on the idea that a time series x_t can be decomposed into a slowly evolving secular trend τ_t and a component classified as cycle c_t: $x_t = \tau_t + c_t$. The two components are not observed and must therefore be estimated given a definition of what should be counted as the trend (and what constitutes the cycle). The Hodrick-Prescott filter estimates the trend component by solving the following minimization problem

$$\min_{\{\tau_t\}} \sum_{t=1}^{T} (x_t - \tau_t)^2 + \lambda \sum_{t=2}^{T-1} \left[(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1}) \right]^2$$

where the first sum represents the goodness of fit and the second sum is the penalty for roughness. The smoothing parameter λ controls the smoothness of the trend component. When $\lambda \to 0$, the trend approximates the original series whereas if $\lambda \to \infty$ the trend becomes linear. The cyclical component is then the difference between the original series and the trend component.

Solving the minimization problem and rearranging the first order conditions we find that the relation between the original time series and the trend component can be written in the following matrix form

$$\tau_t = (I_T + \lambda K'K)^{-1} y_t$$

where I_T is a $T \times T$ identity matrix and K is given by

$$K = \begin{pmatrix} 1 & -2 & 1 & 0 & 0 & \cdots & 0 & 0 & 0 \\ 0 & 1 & -2 & 1 & 0 & \cdots & 0 & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots & \ddots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & 0 & 0 & \cdots & 1 & -2 & 1 \end{pmatrix}.$$

Consider, for example the case when $T = 5$, then we obtain the following relationship between the trend component and the actual data:

$$\begin{bmatrix} \tau_1 \\ \tau_2 \\ \tau_3 \\ \tau_4 \\ \tau_5 \end{bmatrix} = \begin{bmatrix} 1+\lambda & -2\lambda & -\lambda & 0 & 0 \\ -2\lambda & 1+5\lambda & 0 & -\lambda & 0 \\ -\lambda & 0 & 1+6\lambda & 0 & -\lambda \\ 0 & -\lambda & 0 & 1+5\lambda & 2\lambda \\ 0 & 0 & -\lambda & 2\lambda & 1+\lambda \end{bmatrix}^{-1} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \end{bmatrix}$$

From this relationship we note that the weights for any time period sum to unity and are independent on the data; weights can be negative, the filter is symmetric for one observation in this example and in general for observations that has equal number of observations before and after, endpoints will place a very large weight on their actual data implying that the filter is one-sided at endpoints, and the trend value next to the endpoints will put a larger weight on the first and last observation than on themselves. These two latter findings illustrate the endpoint problem discussed in the literature. We also find that weights will change as new data becomes available which can have substantial effects on the estimated trend, the trend will be revised when the sample is extended.

To illustrate, consider the case when the sample length is 5 and λ=14400. In this case, we have the following relationship between observed variables x and the trend τ:

$$\begin{bmatrix}\tau_1\\ \tau_2\\ \tau_3\\ \tau_4\\ \tau_5\end{bmatrix} = \begin{bmatrix}0.600 & 0.400 & 0.200 & 0.000 & 0.200\\ 0.400 & 0.300 & 0.200 & 0.100 & -0.000\\ 0.200 & 0.200 & 0.200 & 0.200 & 0.200\\ -0.000 & 0.100 & 0.200 & 0.300 & 0.400\\ -0.200 & -0.000 & 0.200 & 0.400 & 0.600\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\\ x_4\\ x_5\end{bmatrix}.$$

From this equation we find that the trend for the first observation is a weighted average of all five observations. We also find that the weights sum to unity and that the weights are independent on the data. The filter is symmetric for only one observation (observation 3). Consider now the end points of the sample, that is, observations 1 and 5. The weights are decreasing such that the first observation has a large weight and the last observation has a negative weight on the trend for the first observation. The opposite is the case for the last observation in the sample. This illustrates that adding a new observation to the sample will potentially affect the computed trend. We also note that for observation 2 (and 4), the last (first observation) have larger weight than the weight on the actual observation is the same period. This again illustrates that adding a new observation to the sample will have significant effects on the computed trend. To further illustrate these potential drawbacks of the HP-filter, we now add one observation to the data. In this case, the relationship between the HP-trend and the data is given by

$$\begin{bmatrix}\tau_1\\ \tau_2\\ \tau_3\\ \tau_4\\ \tau_5\\ \tau_6\end{bmatrix} = \begin{bmatrix}0.524 & 0.381 & 0.238 & 0.095 & -0.048 & -0.190\\ 0.381 & 0.295 & 0.210 & 0.124 & 0.038 & -0.048\\ 0.238 & 0.210 & 0.181 & 0.152 & 0.124 & 0.095\\ 0.095 & 0.124 & 0.152 & 0.181 & 0.210 & 0.238\\ -0.048 & 0.038 & 0.124 & 0.210 & 0.295 & 0.381\\ -0.190 & -0.048 & 0.095 & 0.238 & 0.381 & 0.524\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\\ x_4\\ x_5\\ x_6\end{bmatrix}$$

where we note that the weights change substantially leading to large changes in the estimated trend.