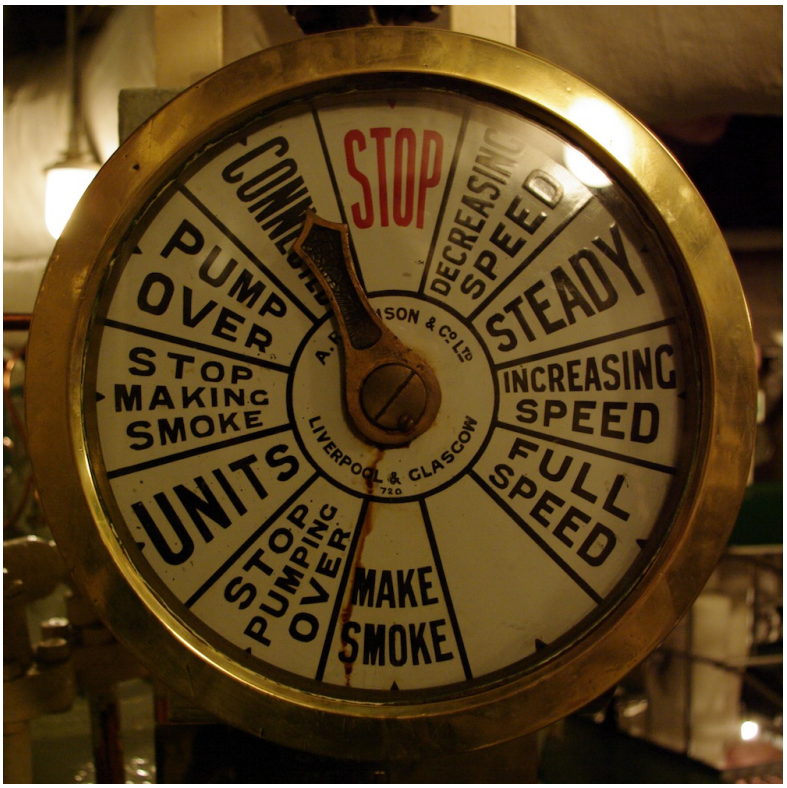
How did the inflation targeting policy of Norges Bank impact the 2008 financial crisis?

Thomas Revå



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Cover picture: Engine room telegraph, HMS Belfast. Photo by the author.

Abstract

The present thesis analyzes the impact of the Norwegian inflation targeting regime on the 2008 financial crisis. A series of macroeconomic indicators are used to evaluate the usefulness of inflation as a proxy for economic activity.

I find that a combination of rapidly increasing prices in housing and stock markets, combined with increasing export prices and declining import prices have led to an exceptionally large gap between pressure in the economy and the inflation rate. Consequently, the central bank ought to have pursued a tighter monetary policy, to limit vulnerability to new shocks.

Preface

The image on the cover shows the engine room telegraph onboard the Royal Navy cruiser HMS Belfast. The captain could transmit precise orders to the engine room, confident that these would be followed immediately. My first years of studying economics felt much the same, it was primarily a subject of precise logic. Models were better when more bells and whistles were included.

Courses on economic history and financial crises changed my view of economics radically. Classical economics, Keynesianism, Austrian economics, monetarism and more recently neo-Keynesianism have all failed to explain key developments. Increasing complexity and apparent precision does not necessarily improve results – the models may be asking the wrong questions.

As much as economists like to aim for precise measures and definitive conclusions, monetary policy has consistently failed to be a predictable science. This thesis reflects both what I have learnt through five years at NHH and what I believe to be the limits of empirical analysis. Rather than construct a complicated econometric model answering a narrow question precisely, a wide range of data is analyzed.

I owe a large debt to my advisor Ola Honningdal Grytten for encouragement, inspiration, patience and feedback in the writing process. I could not be more grateful for his support.

Bergen, June 4th 2010

Thomas Revå

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Chapter 1

Introduction

The link between monetary policy and financial crises constitutes a central part of our understanding of the occurence and management of financial crises. The deflationary monetary policy of Norges Bank during the 1920s is considered one of the central causes of the Norwegian financial crisis in that decade (Klovland 1999), and the expansionary policy of the 1930s is argued to be the key factor in explaining the modest impact of the Great Depression (Grytten 2006). Similar stories can be told for other periods and countries (Reinhart and Rogoff 2009). This thesis deals with the impact of the current monetary policy regime on the 2008 financial crisis.

Financial crises have significant impact on the development of the real economy and economic institutions. The financial turmoil in the interwar period has received large attention, a review of the Norwegian literature on the field is available in Hodne and Grytten (2002). The debate concerns both how the economy functions, and the choice of policies to manage that economy. Caprio and Klingebiel (1996) compile a list of bank insolvencies and an estimate of the associated costs, finding that transfers payments made during the recovery are often in the region of 10-20 per cent of GDP, with the extreme cases of Chile and Argentina estimated at 40-55 per cent.

The purpose of this thesis is to analyze the link between inflation targeting and economic output from 2000 to 2009. Because inflation is central to monetary policy, understanding this link can yield potentially valuable information about the

effects of inflation targeting in general and its contribution to the 2008 financial crisis in particular.

No open economy has been left unharmed in the current turmoil, so the point of the exercise is not to seek the single Holy Grail that gives a complete overview of the crisis. Given the universal impact of the crisis, all guilt can obviously not be assigned to domestic factors. However, discrepancy between developments in different countries suggests that differences in the domestic sector have affected the size of the domestic bubble. Monetary policy is one such factor. Since many countries follow a inflation targeting policy similar to that in Norway, I also expect my analysis to be of value in explaining the development in other countries.

This thesis is organized as follows: chapter 2 looks at the basics of inflation targeting – the macroeconomic arguments supporting it, its implementation in Norway and some potential pitfalls. Chapter 3 summarizes some of the literature on financial crises, to give an impression of how monetary policy could lead us into or let us escape from bubbles in financial markets. Chapter 4 provides an overview of recent economic developments. Chapter 5 analyzes how inflation targeting may have contributed to a bubble. Finally, conclusions are offered in chapter 6.

Chapter 2

Inflation Targeting – theoretical grounds and implementation

Managing monetary policy through the explicit statement of an inflationary goal is a relatively new phenomenon, New Zealand was the first country to introduce such a policy in 1989 (Bernanke and Mishkin 1997, p. 99). Since then, a large number of countries have introduced inflation targeting. In this chapter, I present the logic behind and arguments for inflation targeting, outline the implementation in Norway and introduce some potentials pitfalls.

2.1 Balancing goals – expectations and stability

The systemic debate – the role of central banks

The role of central banks has been a key question in economics over the past century. Is the role of monetary policy merely to protect the value of a currency at a predictable level, or does monetary policy have to do with the real economy?

Klovland (1989, p. 32) summarizes the view on the long run role of monetary policy, writing "there is overwhelming theoretical and empirical evidence showing that monetary policy in the long run mainly affects *nominal* figures in the economy." Finding theoretical arguments or empirical support against the *neutrality*

of money in the long run is hard – as long as inflation is kept within reasonably predictable limits. Monetary policy cannot lead to economic growth in the long run – such growth is led by the real sector.

Whilst the role of monetary policy in the long run is very limited, much research has suggested that economic output in the short run is dependent on monetary policy. Clarida, Galí and Gertler (1999, p. 1) write that "a stream of empirical work beginning in the late 1980s has made the case that monetary policy significantly influences the short-term course of the real economy."

As a consequence of this duality between short run impact and long run neutrality, monetary policy must be designed to strike a balance between controlling output in the short term and keeping nominal figures predictable in the long term.[1]

Constraints and flexibility – keeping options open or being bound to the mast?

The value of flexibility is a basic fact of life in economics. If a decision can be postponed without cost, it should always be considered. Having the *option* to change our minds at a later stage is usually valuable. In the realm of central banking, this is not necessarily the case.

In Homer's Odyssey, the witch-goddess Circe warns Odyssey about the Sirens, whose seducting voices would leave sailors compelled to shipwreck.

> ... have them tie you hand and foot on the fast ship, standing
> upright against the mast with the ropes' ends lashed around it,
> so that you can have joy in hearing the song of the Sirens;
> but if you supplicate your men and implore them to set you
> free, then they must tie you fast with even more lashings.
> (Homer 1991, p. 186)

[1] In the term "strike a balance", some kind of tradeoff is implied – this need not be more complicated than the eternal wish for as high output as possible in the short run, whilst keeping nominal figures reasonably predictable in the long run.

Only through being bound to the mast could one live through hearing the song of the Sirens. Inflation targeting is one case of being bound to the mast.

Keeping options open leaves greater room for speculation, fear and uncertainty in financial markets – all undesirable characteristics. Thus we are left with one of the puzzles of monetary policy, the balance between keeping the flexibility to sort out problems and the need to communicate clearly and convincingly with markets, in order to establish a nominal anchor.

When evaluating inflation targeting and its consequences, assuming that all would be well if full discretion were to be given to the monetary authorities would be an unfair comparison. We need to take into account the possibility of other policies seducing sailors and central bankers to shipwreck. Inflation has not been a problem in major western economies in recent years, but there is no guarantee that things stay that way; past gains should not be taken for granted.

Escaping inflationary bias – the case for inflation targeting

Inflation targeting is one possible way of balancing long and short term goals. When the monetary policy of a central bank is dictated by inflation targeting, the central bank aims for a specified inflation target – this may be a single value or a range. The target is usually stated with some designation of the time frame within which the target should be reached.

As explained by Kydland and Prescott (1977), governments have incentives to first communicate that it will pursue a monetary policy leading to low inflation, then expand the economy once expectations of low inflation have been established. Escaping this *inflationary bias* is a key goal of inflation targeting.

A publicly stated inflation target yields clear information to actors in the market. For example, during wage negotiations, employees know approximately what level of inflation to expect. This creates a reasonably secure link between expected and actual real wages, once agreement on a nominal level has been reached.

Promising low inflation rates does not in itself guarantee escape from the inflationary bias. The inflation target has to be *credible* if markets are to act on it. How is a target made credible? Plagued with high inflation before the introduc-

tion of inflation targeting, New Zealand followed an extreme route, and explicitly stated that the governor of the central bank would be fired if inflation exceeded a set level (Gärtner 2006, pp. 351-2). This gives the governor a strong incentive to ignore short-term pleas from interest groups and focus on reaching the inflation target.

As effective as such an extreme policy might be in meeting the inflation target, having a central bank governor focusing solely on keeping inflation low might be a costly exercise; we usually want monetary policy to stabilize macroeconomic fluctuations as well. Introducing a formal target as part of the central bank's mandate, even without any clear consequences set if the target is not reached, might also have a positive effect on escaping a high-inflation environment. The argument for this can take several forms, one of them is that the inflation target is a way of communicating with markets and politicians.

Bernanke (2003) has argued that introducing a formal target increases the central bank's *independence from external pressure*. For example, it is hard for politicians to argue against a central banker when a tight economic policy is needed to lower inflation towards the targets set by the same politicians.

The transmission mechanism of monetary policy

Monetary policy influences the real economy through the *transmission mechanism*. Bank of England Monetary Policy Committee (2001) provides an overview of this mechanism. Figure 2.1 summarizes the channels through which monetary policy works.

The *interest rate channel* is the primary mechanism in many macroeconomic models. The basic idea is simple – given some degree of sticky prices, increased nominal interest rates increase the real interest rates and hence the user cost of capital. This change leads to postponement of consumption or reduced investments, and consequently reduced economic activity. In figure 2.1, this channel is represented by the official and market rates.

Bernanke and Gertler (1995) describe how the macroeconomic response to interest rate changes is larger than that suggested by estimated interest elasticities

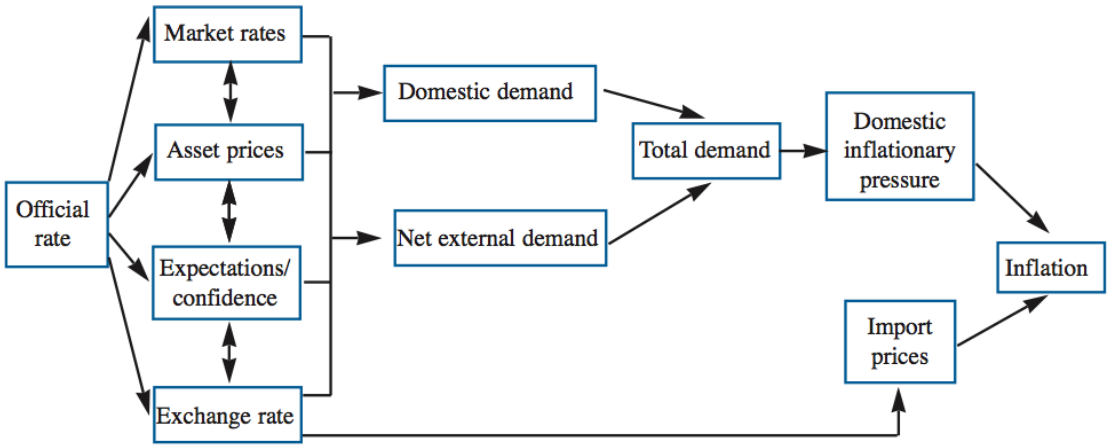

Figure 2.1: A summary of the transmission mechanism of monetary policy. Source: Bank of England Monetary Policy Committee (2001).

of consumption and investment. This suggests that other channels also have an impact on the effectiveness of monetary policy.

The *wealth channel* can bridge part of the gap. This channel originates in the thinking of Ando and Modigliani (1963). They describe a life-cycle model where the wealth of a household is a key component in their spending decisions because the household wishes to maintain an even consumption path over time. Monetary policy affects wealth through asset prices – increasing interest rates reduces the net present value of long-lived assets.

Asset prices further determine the value of collateral presented when obtaining loans. In an idealized credit market without friction, this change in collateral value should not change investment or consumption decisions. However, when agency costs and imperfect information play a significant role, declining collateral values will increase the risk premium for borrowers. Kuttner and Mosser (2002, p. 17) label this as the "financial accelerator effect".

One simple way of illustrating this effect is the model used by Hall (2001) to describe the *external finance premium*. This model postulates that investors prefer internal financing because external financing involves informational asymmetries and agency problems, and consequently comes at a higher cost. Reduced collateral

values increase this premium.

The model is illustrated in figure 2.2. Initially, the interest rate is at level r_1, and an investor has F amount of internal funds available. Demand for funding is given by the demand curve D, supply is initially s_1. The agency costs lead investors to investment level I_1' because they will have to pay a premium of $r_1' - r_1$ to compensate lenders for the asymmetries, lowering investment from I_1 which would have been the equilibrium if no agency costs were present.

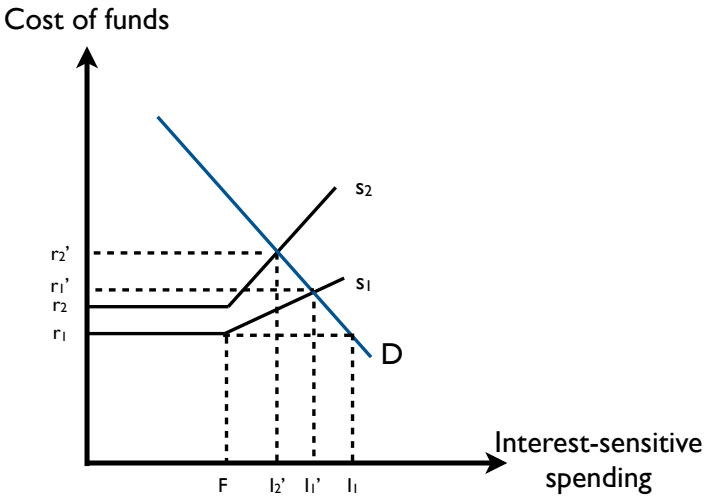

Figure 2.2: Interest rate changes and the marginal cost of finance.

Imagine that the interest rate in a market without asymmetries[2] increases from r_1 to r_2. The increased funding cost for internally funded investments is simply the change in interest $r_2 - r_1$. If collateral is provided to reduce the agency costs for the external financing, the value of this collateral is likely to have been reduced as a consequence of the interest rate change. This can make the premium on external financing higher – thus increasing the gradient of s_2, the supply curve for external financing. This is the essence of the financial accelerator effect.

[2]The interest rates r_1 and r_2 are not meant to be risk free interest rates – after all, the internal funds may be lost if the firm goes bankrupt, so there is a very real element of risk in these rates. The rates r_1 and r_2 take into account the operational risk, not the risks associated with agency costs.

Monetary policy influences expectations and confidence. For example, an increase in interest rate by the central bank may be interpreted as a sign that the central bank has revised its growth estimates upwards, giving cause for optimism in the economy. Alternatively, the same interest rate change might be seen as taking action to limit inflation. Consequently, we cannot determine any fixed relationship between monetary policy and expectations, but we know that this channel may have a role. Bank of England Monetary Policy Committee (2001) emphasize how this makes the effect of monetary policy decisions very uncertain, and increases the need for clear communication from the central bank.

Exchange rates are closely related to monetary policy. The links are many and complex – expectations play an important role – but in general an unexpected rise in interest rates would cause an appreciation of domestic currency, because domestic assets become more attractive to foreign investors. Bank of England Monetary Policy Committee (2001, pp. 4-6) write that "the exchange rate should move to a level where investors expect a future depreciation just large enough to make them indifferent between holding sterling and foreign-currency assets."

2.2 Implementation in Norway

Legal mandate

The Norwegian inflation targeting is formalized in the "Regulation on Monetary Policy" established by Royal Decree 29 March 2001. This decree states that "The operational target of monetary policy shall be annual consumer price inflation of approximately 2.5 per cent over time", thus laying the foundation for the Norwegian inflation targeting policy.

It is interesting to note that whilst the Decree specifies inflation as the *operational target* of the bank, other macroeconomic variables should also be taken into account when making decisions on the monetary policy;

> Monetary policy shall be aimed at stability in the Norwegian krone's national and international value, contributing to stable expectations

> concerning exchange rate developments. At the same time, monetary policy shall underpin fiscal policy by *contributing to stable developments in output and employment.*

A key point here is that Norges Bank is very explicit in stating that both inflation and real variables are part of its target. These targets are not intended as competing goals that need to be balance, rather "the first indicates the situation that should eventually be reached (...), while the second describes the type of transition path by which it should be reached" (Woodford 2007, p. 11).

As a consequence, the legal mandate implies a theory of the connection between inflation and ouput; through steering inflation towards the 2.5% goal in the medium term, it is believed that major output gaps can also be avoided.

Time horizons and loss functions – is inflation targeting a fixed rule?

The Royal Decree states that inflation should reach 2.5% over time – what exactly is meant by "over time"? To be more precise: how long time does the central bank have to reach its target? The answer to this question contains important information about the interpretation of the mandate – what is the optimal balance of deviations from target of output and inflation?

In the introduction to the Monetary Policy Reports (and the Inflation Report, its predecessor), Norges Bank provides an interpretation of its mandate. The time horizon for reaching the inflation target is specified, which is of particular interest here.

Table 2.1 shows how the central bank has changed its interpretation of the time horizon. Over time, the time horizon has grown and the bank seems less preoccupied with reaching the exact target. There are two natural interpretations of this – either the central bank has become less concerned with reaching the inflation target, or a wider range of policies can be introduced without jeopardizing the expectations of low inflation once the central bank's commitment to the target has become credible. The truth is likely some combination of the two.

The central bank's view of the time horizon may be seen as part of the estima-

Table 2.1: Time horizon in Norges Bank's communication. Sources: Norges Bank (2001, 2002, 2004, 2007) and Gjedrem (2009).

Time	Description of time horizon
2001	... at the target in two years ...
2002	... *normally* at the target in two years [my emph.]
2004	... at the target within a reasonable time horizon, normally 1-3 years.
2007	... near the goal in the medium term ...
2009	... we should probably have a fairly long time horizon, so that any output shocks may be accommodated ...

tion of a loss function the central bank minimizes, commonly stated as[3]

$$L_t = \frac{1}{2}[(\pi_t - \pi^*)^2 + \lambda(y_t - y_t^*)^2] \tag{2.1}$$

where $(\pi_t - \pi^*)^2$ is the squared deviation between the current inflation and the inflation target, $(y_t - y_t^*)^2$ is the squared difference between current and potential output, λ is a parameter weighing the relative "cost of deviations" for the central bank.

In more intuitive terms, the loss function is a mathematical approximation of the mandate of central banks, specifying that the banks should avoid deviations both from potential output and the inflation target.

The λ parameter specifies the optimal tradeoff between inflation and output deviation. The extreme case of $\lambda = 0$ would imply that only deviations from the inflation target should be given weight – ignoring all output deviation. When $\lambda > 0$, some weight is given to the output gap, usually called *flexible inflation targeting*. A higher λ can then be interpreted as a sign that the time horizon for reaching the inflation target is longer – and vice versa.

Thus, with the language of the central bank indicating a longer time horizon and reduced "precision", it seems that λ has grown over time; the bank focuses more on stabilizing output and less on reaching the inflation target quickly.

[3]See e.g. Røisland and Sveen (2006, p. 20)

Reduced focus on inflation is interesting as a way of understanding monetary policy. Perhaps at least as important, it is also an indication of the degrees of freedom the central bank has even when an inflation targeting "rule" has been established. Inflation targeting does not involve replacing economic judgment with an automated process.

Measuring inflation

The legal mandate of Norges Bank specifies that the relevant price index for inflation targeting is the consumer price inflation. This section describes the main indices used in measuring inflation, and outlines how these are calculated. All three measures are used by Norges Bank, see e.g. Monetary Policy Report (Norges Bank 2010*b*). This section also contains a description of how the cost of housing is included in the inflation indices.

The Consumer Price Index from Statistics Norway – the CPI

The basic measure of inflation in Norway is the the Consumer Price Index (CPI), an index prepared by Statistics Norway.

The index is calculated through collecting prices of a wide range of goods and services in Norway. These prices are then weighed according to their share of consumption as measured by an annual household survey. The aim of the index is to measure the cost of living, as modeled by the cost of consuming a fixed basket of goods.

The index is used in a large number of public and private bodies for a wide variety of purposes, so it is prepared not only to facilitate monetary policy management (Johannessen and Sandberg 2004). This limits the extent to which the inflation measurement can be fine-tuned to match the specific needs of the central bank.

Inflation without energy and tax changes – CPI-ATE

The mandate of the central bank specifies that changes in the inflation caused by "changes in interest rates, taxes, duties and idiosyncratic, temporary shocks" should not be taken into account. To adjust for this, Statistics Norway prepares an index that excludes energy products and is adjusted for tax changes, the CPI-ATE.

Excluding energy prices reduces the sensitivity of the index to price shocks, so that the measured inflation is insensitive to "idiosyncratic and temporary shocks". It can be argued that an increase in energy prices such as the 1973 OPEC shock should not require a tight monetary policy to limit inflation if a large part of that inflation is caused by the sudden spike in oil prices.

Including energy price trends, not shocks – CPIXE

Nordbø (2008) describes how energy prices over a period from the late 1990s to 2008 had grown faster than other prices, thus causing the CPI-ATE to undervalue the underlying inflation. The salient point is that the CPI-ATE excludes all energy prices, not only the temporary shocks the central bank is mandated to exclude from its target.

Because of this omission, Norges Bank has developed a third measure of inflation, CPIXE (Nordbø 2008). This measure is a combination of the CPI-ATE and an estimated trend growth in energy prices. The measured rate of inflation should then be closer to the true increase in cost of living than what has been the case when energy prices have been excluded.

Housing prices

The prices of most goods can be monitored either through electronic collection of data or through physically checking prices periodically. Inflation measures should ideally show the increase in nominal income required to keep utility constant. When monitoring prices periodically, it is thus assumed that the utility from a good is obtained at the time of purchase.

It is not the act of buying a house that yields utility. Home ownership is

modeled as an investment in housing capital that yields a stream of services over time (Johannessen and Sandberg 2004). It is this stream of *housing services* that yields utility. However, the market value of this stream is not observable.

There are two main approaches to solving this problem: estimate user prices or use rental costs. Statistics Norway uses the latter approach when preparing the inflation indices, consistent with the consensus among statisticians (Johannessen and Sandberg 2004).

If rental costs do not have the same price determinants as rents, this could cause a deviation between estimated and actual cost of housing services. In 2001, 23% of norwegian households rented their accommodation. 58.8% of households with the oldest member younger than 24 was renting their home, 13.8% of households where the oldest member is between 45 and 49 rent their accommodation (Statistics Norway 2002). These figures illustrate both the prevalence of owner-occupied dwellings and how the rental market is skewed towards the low end of the market.

The main alternative approach is to estimate user prices. This involves deducting interest rate and upkeep costs from capital gains made on sale. This technique requires that equilibrium is reached in all markets, and that the savings rate is constant (Johannessen and Sandberg 2004). If user prices are used, this will lead to large changes in estimated housing costs when interest rates or home prices change.

"Reaching equilibrium in all markets" might sound like a standard economics assumption without any major implications. However, in the housing market, there are likely to be major deviations from this idealized market. The assumption really implies that all households should adjust their investment in the housing market with changing prices or interest rate. Both the financial and non-financial costs associated with moving are large, and a major limitation to flexibility in the housing market.

Both approaches have their strengths and weaknesses, no theoretically correct option exists, so the choice must rely on empirical investigations. Inflation measures are used for a wide variety of purposes, and Statistics Norway are very clear in communicating that rental costs are used because they provide the best approx-

imation of housing costs – not that their choice necessarily is the optimal for use in inflation targeting (Johannessen and Sandberg 2004).

2.3 Pitfalls – inflation and output

This section introduces three studies relevant to inflation targeting, and discusses how their conclusions might affect the execution of monetary policy under an inflation targeting regime. First, the historical link between inflation and output is analyzed. I then summarize a study describing a method for constructing a "stability price index" – a measure of inflation intended to minimize macroeconomic fluctuations. Finally, a summary of Borio and Lowe (2002) illustrates how an inflation targeting policy might contribute to the creation of bubbles.

Empirical estimates of output and inflation

Grytten and Hunnes (2009) analyze the link between short term output changes and price fluctuations for Norway over the period 1830-2006. A key assumption in Keynesian economics is that there is a positive correlation between output and prices in the short term. In the Norwegian inflation targeting regime, this assumption is the basis for the link between keeping inflation low and output deviations small. In other words, Keynesian economics implies that inflation targeting will generally be counter-cyclical, in that high inflation is correlated with a positive output gap.

Most economists agree that the economy is led by the supply-side in the long run, where output depends on production possibilities. With this approach, output can be described by a production function stating that output is a result of capital C, labour L and natural resources N. A residual factor ε normally denoted total factor productivity.[4]

$$Y = F(C, L, N) + \varepsilon \tag{2.2}$$

[4]This model presented here is described in Grytten and Hunnes (2009).

In the short run, Keynesian economics assumes that output moves within the limits of production barriers in the economy. Consequently, output fluctuations in the short term reflect how the production possibilities are utilized. Keynesian theory postulates that the degree of utilization depends on the demand side of the economy, implying that output is a function of demand,

$$Y = F(D) \tag{2.3}$$

Production possibilities are fixed in the short run, so it is assumed that positive shifts in the demand curve lead to increases in price. This makes the price level P a function of demand,

$$P = F(D) \tag{2.4}$$

In Keynesian theory, demand is made up of consumption C, investment I, government expenditures G and net exports $X - M$.

$$D = C + I + G + X - M \tag{2.5}$$

Thus, price movements $\mathrm{d}P$ can be estimated as a function of GDP movements $\mathrm{d}Y$. This is the main relationship estimated by Grytten and Hunnes (2009).

$$\mathrm{d}P = F(\,\mathrm{d}Y) \tag{2.6}$$

Grytten and Hunnes (2009) find that there is no clear positive correlation between inflation and output. Contrary to the assumptions behind Keynesianism, they find evidence of a negative relationship in the short run, suggesting that most business cycles are caused by supply-side factors rather than demand-side shocks. They do however find that negative demand shocks often cause a lagged negative price response, suggesting that demand-side factors are critical in some business cycles.

In other words, the Keynesian assumption about the relationship between output and inflation is found to be wrong in most periods, while it exists in others – notably where there is clear evidence of a negative demand-side shock. Negative demand shocks are key to Keynesian economics, and one interpretation of the result is that the conclusions from Keynesian models should not be uncritically applied in all periods, though they can provide valuable insight in some periods.

Significance for inflation targeting

In inflation targeting, the link between short-term output fluctuations and inflation is critical. Monetary policy targets an inflation rate, and the real economic impact of this targeting depends on the link between inflation and output.

In periods with demand-side shocks, the results from Grytten and Hunnes (2009) suggest that the correlation between inflation and output is positive, hence moving the economy towards the inflation target would presumably also move the economy towards its production possibility frontier. Inflation targeting then has a counter-cyclical effect – positive output gaps are correlated with high inflation, which calls for a tight monetary policy, and vice versa.

The case is different in periods where development in the economy is led by the supply-side. The counter-cyclical nature of inflation targeting applies only when there is a positive link between inflation and output. When and where the link between inflation and output is negative, the consequences of strict inflation targeting might be a pro-cyclical monetary policy. To avoid such policies and limit macroeconomic instability, alternative approaches to inflation targeting might be worthwhile, either through using alternative approaches for measuring the output gap or through using a different measure of inflation. We now turn to one such measure of inflation.

Are all sectors created equal? Constructing an economically optimal measure of inflation

Mankiw and Reis (2003) ask what inflation measure central banks should choose to maximize economic stability. Their departure point is that measures of the overall price level have been studied extensively from a statistical standpoint, but little formal work has been done to establish a measure optimal from a macroeconomic standpoint.

A fairly large amount of attention has been devoted to some questions concerning the optimal inflation measure. Mankiw and Reis (2003) mention two examples. Some economists choose to focus on "core inflation" excluding some volatile prices

such as oil prices, whilst others argue that these volatile prices "are particularly good indicators because they are highly responsive to changing economic conditions" (Mankiw and Reis 2003, p. 1). Asset prices have also been central to the discussion, with some economists arguing that they prices should be included because of the information these prices contain.

With these discussions as their basis, Mankiw and Reis (2003) create an optimization model where the goal of the central bank is to maximize macroeconomic stability through changing the weight applied to different sectors in the price index. Their empirical starting point is that

1. sectors differ in their budget share
2. some sectors have more cyclical prices than others
3. some sectors have large idiosyncratic shocks
4. the degree of price flexibility differs between sectors

Mankiw and Reis (2003) formalize these observations as

$$p_k^* = p + \alpha_k x - \varepsilon_k \tag{2.7}$$

Where p_k^* is the equilibrium price in sector k, p the conventional measurement of the price level (e.g. as measured in the standard inflation measures), α_k the sensitivity of sector k's equilibrium price to the business cycle, x the output gap and ε_k an idiosyncratic shock with standard deviation σ_k^2. In other words, it is postulated that the equilibrium price in a sector depends on "the state of the business cycle and some other shock" (Mankiw and Reis 2003, p. 3.)

The inflation is measured as

$$p = \sum_{k=1}^{K} \theta_k p_k \tag{2.8}$$

with K sectors and θ_k as the weight assigned to each sector.

The degree of price stickiness in a sector is modeled in Mankiw and Reis (2003) by assuming that a fraction λ_k of prices in a sector are based on updated information, and a fraction $1 - \lambda_k$ is based on expectations $E(p_k^*)$. This implies that the

price p in sector k can be shown as

$$p_k = \lambda_k p_k^* + (1 - \lambda_k) E(p_k^*) \tag{2.9}$$

The smaller λ_k is, the less the sector responses to news about equilibrium prices. Conversely, as λ_k approaches 1, the price in a sector is assumed to be perfectly flexible.

Inflation targeting implies a wish to keep the weighed average of sector prices at a given level, Mankiw and Reis (2003) sets this to 0 – non-zero values would not change the conclusion. We can then write the central bank goal as

$$\sum_{k=1}^{K} w_k p_k = 0 \tag{2.10}$$

For a set of weights w_k that satisfy

$$\sum_{k=1}^{K} w_k = 1 \tag{2.11}$$

We now have target weighs w_k and consumption weights θ_k. The target weights w_k is modeled as a decision variable of the central bank in a simple optimization problem.

The goal of the central bank is assumed to be maximization of macroeconomic stability – in other words, to minimize the variation in output x. The central choice is then to choose a set of weights w_k that achieve this goal, given the sectoral characteristics described.

Putting this together, we have:

$$\min Var(x) \tag{2.12}$$

by changing

$$w_k$$

subject to

$$\sum_{k=1}^{K} w_k p_k = 0$$

$$\sum_{k=1}^{K} w_k = 1$$

$$p_k = \lambda_k p_k^* + (1 - \lambda_k) E(p_k^*)$$

$$p_k^* = p + \alpha_k x - \varepsilon_k$$

$$p = \sum_{k=1}^{K} \theta_k p_k$$

Thus, the central bank chooses weights w_k in its stability price index so that volatility in the output gap is minimized, given the constraints in the economy.

Mankiw and Reis (2003) specify this model for the U.S. economy with a simple model with four sectors. The weights θ_k and optimized weights w_k for these sectors is shown in table 2.2.

Table 2.2: U.S. weights in consumption and optimized indices. Source: Mankiw and Reis (2003).

Sector	θ_k	w_k
Energy	0.07	0.10
Food	0.15	0.37
Other goods	0.78	-0.73
Nominal wages	0	1.26

It is particularly interesting to note that nominal wages seems to provide significant value to the model. Wages are of course not included in the regular price index. It is also worth noting that "other goods" are given a large negative weight in the optimal index. This result is dependent upon the pattern of correlations between shocks in different sectors (Mankiw and Reis 2003, p. 18).

Mankiw and Reis (2003) are very clear that their results are preliminary, and that the index they create is nowhere near ready for implementation. What seems

to be clear from the results, however, is that a central bank wanting to minimize variations in the output gap might need to focus on a different price index than the general consumer price index. Inflation targeting does not automatically lead to a counter-cyclical monetary policy, and the relationship between inflation and output depends on the sectors in the economy. Thus, increased prices in one sector might be a sign that the central bank should enact a tight monetary policy, whilst the same change in prices for another sector is likely to represent an idiosyncratic shock.

Will excess demand cause inflation with a credible inflation targeting policy?

Borio and Lowe (2002) analyze the potential for occurence of bubbles in a low-inflation environment. When an inflation targeting regime has anchored expectations, the degree of price stickiness in wages and prices may be increased. This stickiness can increase the time it takes for increased aggregate demand to show up in the form of inflation.

If aggregate demand can increase significantly without causing inflation in the short term, this reduces the "visible" need for central banks to respond with tighter monetary policy, since the inflation target is not under pressure.

Inflation targeting can reduce the pro-cyclical tendency found in exchange rate regimes and consequently stabilize the economy.[5] However, when cases with excess demand do not lead to inflation because of price stickiness, and the stable prices signal to the central bank that all is well, inflation targeting might actually lead to increased financial instability.

Borio and Lowe (2002) suggest that rapid credit expansion and above-average capital accumulation are areas where excess aggregate demand is likely to show up when price stickiness leads to low inflation. To explain these tendencies and understand how bubbles can be spotted, we turn to the next topic of this thesis –

[5]The simplest way of illustrating this pro-cyclical nature of fixed-rate regimes is to consider the gold standard – a current account deficit causes an outflow of gold, this outflow leads the central bank to reduce the money supply.

the theories of financial bubbles and crises.

Chapter 3

Financial bubbles and crises – theories and frameworks

The link between financial bubbles and crises is neither obvious nor simple. This chapter presents a few of the models postulating how these situations are linked. The aim is to create a mental framework for making sense of the many details involved in both bubbles and crises, hopefully useful in creating a coherent image of the situation when delving into details.

3.1 A theory of bubbles

Bubbles in financial markets are often described as *speculative*, implying that some agents stipulate that developments in the market place will give them a return on their investments, even if the fundamental economics of an instrument do not support such high prices.

The bubble can then be expressed in a simple equation[1], defining the value of a bubble b_t as a function of the expectations E of the future value of the bubble b_{t+1}, discounted by a cost of capital r. This is expressed in equation 3.1 – current deviation from fundamental value is the discounted future deviation.

$$b_t = (\frac{1}{1+r})E_t(b_{t+1}) \tag{3.1}$$

[1]The model described here is found in Grytten (2009).

Equilibrium in a financial market can be expressed as a state where the current price p is the discounted sum of expected dividends and the future price:

$$p_t = (\frac{1}{1+r})E_t(d_{t+1} + p_{t+1}) \tag{3.2}$$

Over time, the price of an financial asset will be the net present value of all future dividends over the holding period plus the discounted value of the expected future price at the time of sale.

$$p_t = \sum_{j=1}^{n}(\frac{1}{1+r})^j E_t(d_{t+j}) + (\frac{1}{1+r})^n E_t(p_{t+n}) \tag{3.3}$$

This gives a net present value of the financial object as

$$p_t = \sum_{j=1}^{\infty}(\frac{1}{1+r})^j E_t(d_{t+j}) + b_t \tag{3.4}$$

Where b_t is a stochastic process satisfying equation 3.1. Finding the value of the bubble is then simply a case of rearranging the expression:

$$b_t = p_t - \sum_{j=1}^{\infty}(\frac{1}{1+r})^j E_t(d_{t+j}) \tag{3.5}$$

That is, the bubble value is equal to the market price minus the fundamental value – the latter being defined as the discounted value of all future dividends from the asset.

The intuitive interpretation of this is that market prices can deviate from their long-term fundamental values. In a speculative market, investors buy an asset today expecting to sell with a profit at time $t + 1$ – even if fundamentals do not support such pricing. Investment decisions are not as simple as described in some introductory finance textbooks – estimates are merely indicative, and measurement errors are unknown, but often large.

This formal definition is worth keeping in mind when looking at the frameworks aiming to explain how financial crises develop. The essence of their aim is to explain how such bubbles can occur and the problems associated with unwinding them.

3.2 Kindleberger and Minsky – frameworks and models

Hyman Minsky's model of monetary crises

Hyman Minsky (1919-1996) developed a model of financial crises in five stages (Kindleberger and Aliber 2005, p. 21–30). This model is largely a theoretical one, with little reference to empirical data. It aims to explain how a financial bubble can occur, and then the path to a market crash and subsequent financial crisis. The model is deterministic; once the economy is on the path towards a bubble, averting the coming crisis is impossible (Grytten 2008*b*).

The stages of Minsky's model are summarized in figure 3.1. I will now explain each of these stages in more detail, using AD–AS (Aggregated Demand-Aggregated Supply) and IS–LM (Investments and Savings–Liquidity preference Money supply) models.

Displacement

The initial stage of the model is a *displacement*. This displacement is an exogenous macroeconomic shock changing expectations about the future development of the economy(Grytten 2008*b*). Displacements can come in many shapes and could for example be opened trade routes, a new technology or a financial innovation. New financial instruments such as collateralized debt obligations (CDO) and credit default swaps (CDS) are potential culprits with the current crisis in mind. Credit default swaps were supposed to remove the risk involved with potential lenders not paying back their loans. Through separating out this risk, markets were perceived to be more efficient at measuring and managing risk, thus supporting diversification through the creation of CDOs. This increased diversification and perceived improvement in risk management supported higher asset prices.

A positive macroeconomic shock shifts the IS curve outwards. This increases the interest rate and economic activity. The higher interest rate increases demand for domestic currency. Governments often want to avoid appreciation of the cur-

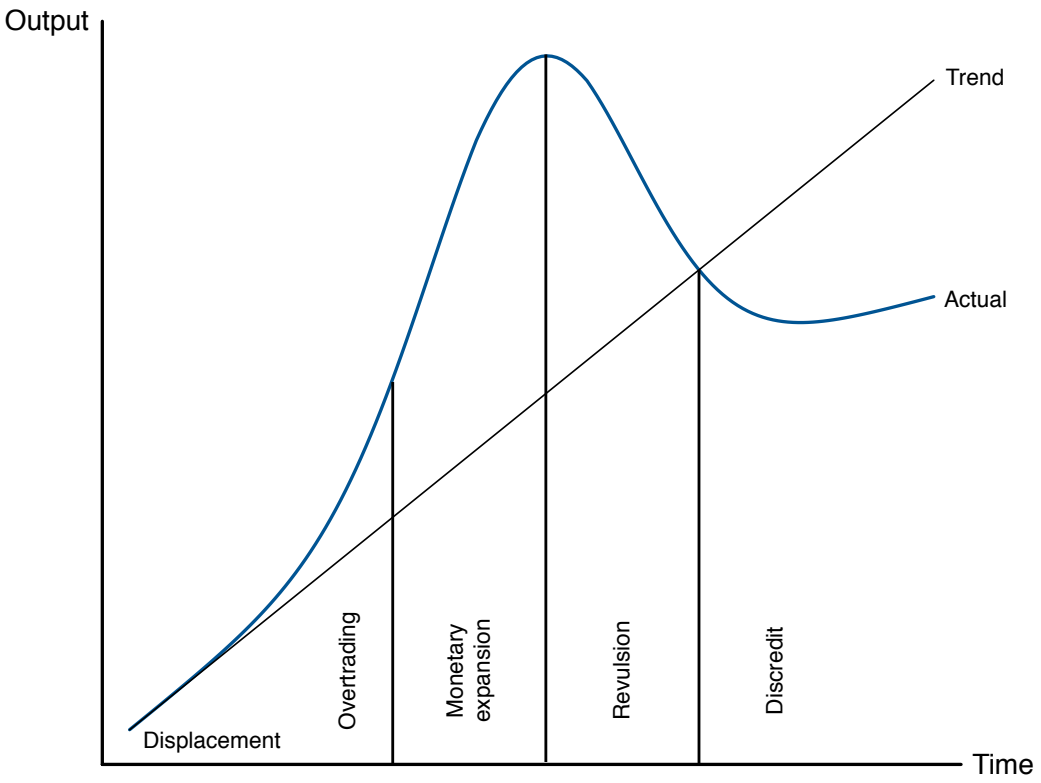

Figure 3.1: A summary of Minsky's model

rency, and would therefore increase the money supply to counter the increased demand.[2] This increased money supply represents an outward shift in the LM curve. The total effect is then lowered interest rate and increased output. Lower interest rates encourage investment. The AD curve shifts outwards.

Overtrading

After expectations have been altered in the displacement phase, the economy moves to the next phase, *overtrading*(Kindleberger and Aliber 2005, p. 25). It is argued that the impact of the positive shock is overestimated, resulting in incorrect profit estimates. With the CDS example above, this could simply imply that the benefit of separating the credit default risk was overestimated, thus putting too high a value on the securities and too low a cost on insuring the debt. Estimated profits higher than actual will result in values that are higher than those supported by underlying economic realities – and a bubble is created.

In figure 3.2, overtrading is explained in an AS–AD model. Speculation increases demand for goods and financial assets. After some time, demand exceeds supply, and prices rise. This increases the potential profit, and attracts new investors. Those usually outside the markets see the opportunity for a quick profit, and are tempted to enter. Market prices start to deviate from fundamental values, creating the positive bubble.

The element of speculation implies that investments are made with a plan to sell them, rather than to consume goods or get income from an investment. Speculators have a role in all markets by trying to find an equilibrium, but when longer-term growth in a market is driven by pure speculation, there is more cause for concern.

[2]Even if inflation targeting has abandoned the automatic accelerators of fixed exchange rate regimes, the exchange rate remains significant for monetary policy, both as a factor in inflation through imported goods and the output gap.

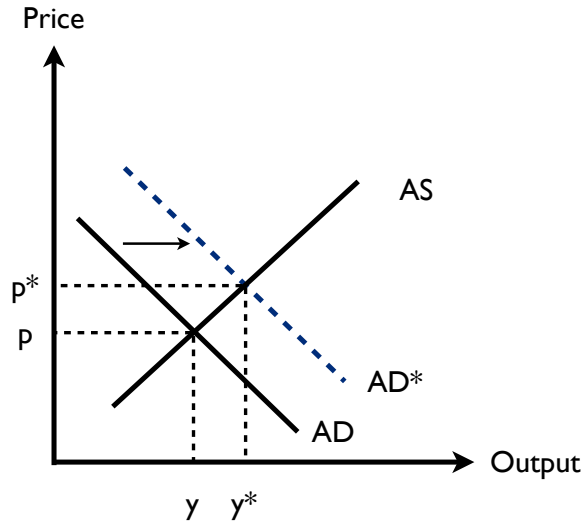

Figure 3.2: Overtrading (AS–AD)

Monetary expansion

The next stage in the model is *monetary expansion*. There is an element of path dependency in this phase, when asset prices increase in the overtrading phase, an expectation of continued increase in prices occur. This expectation makes lending money to invest an attractive proposition – even if the underlying profit expectations do not support the current price level. In addition, as Kindleberger and Aliber (2005, p. 22) outlines, "both the lenders' assessments of the risk of individual investments and their risk averseness decline." In other words, there is a pro-cyclical element in the assessment of risk. This increases the money supply.

The increased money supply represents an outward shift of the LM curve, shown in figure 3.3. This increases access to liquidity, pushing interest rates down and further increasing output. The AD curve shifts outwards yet again, leading to higher output and inflation.

Revulsion

The next phase is *revulsion* where the seemingly endless increase in prices stop. Investors start to realize that buying an asset today with a plan of selling it at

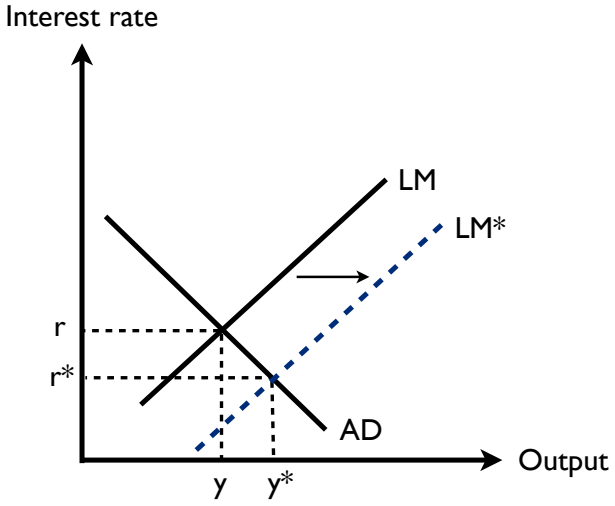

Figure 3.3: Monetary expansion (IS–LM)

a higher price at time $t + 1$ is not a fool-proof plan of action (Grytten 2008*b*). Consequently, the queue of investors eager to buy today expecting a higher price tomorrow disappears – leading to falling market prices.

The reduced willingness to finance investments through borrowing reduces the money supply, shifting the LM curve to the left, as shown in figure 3.4.

The new investment paradigm of falling asset prices reduces willingness to invest and consequently demand, shifting the AD curve inwards, as shown in figure 3.5. This leads to falling output and inflation.

Discredit

The fifth and final stage of Minsky's model is *discredit*, in which prices fall below their "natural level". Falling prices leads investors to expect continued decline, thus leading investors to sell assets expecting the prices to fall further (Kindleberger and Aliber 2005, p. 28). Another case of path dependency occurs when a large number of investors want to exit the market because of the expected fall. Investors sell because they expect prices to fall, and prices fall because of the large number of investors eager to sell. In this stage, the price will move below the "rational" level, there is a "negative bubble".

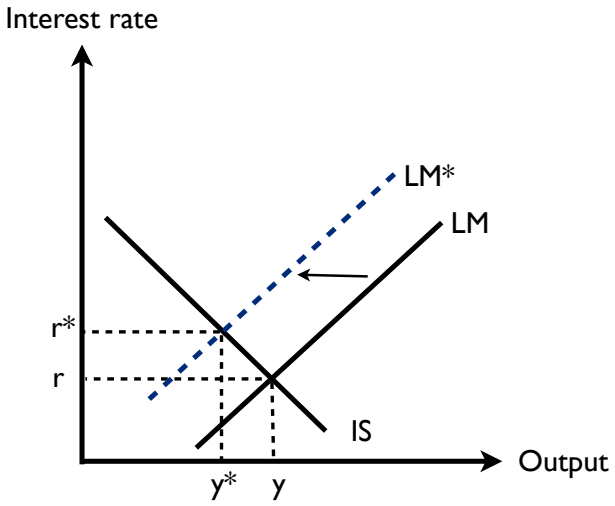

Figure 3.4: Revulsion (IS–LM)

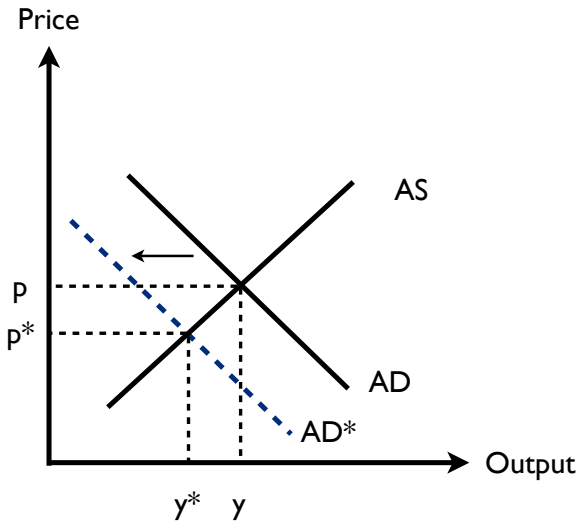

Figure 3.5: Revulsion (AS–AD)

Discredit is when the financial crisis occurs – investments that "should have been made" in normal markets are being postponed or cancelled, since even firms that have attractive investment propositions are unable to secure financing.How falling asset prices affects the real economy is of course not constant over time nor between sectors or countries.

Charles Kindleberger and the lender of last resort

Charles Kindleberger (1911-2003) developed a theory based on Minsky's model of crises. This theory is less deterministic than Minsky's model, and does not have the same rather dogmatic phases (Grytten 2008*a*). Where Minsky sees the occurence of a financial crisis as unavoidable once the initial displacement has taken place, Kindleberger focuses on how a hegemonial power can act as a market leader and lender of last resort to avoid the crisis. One of his key conclusions is that the financial sector must be monitored and regulated, and cannot be left untouched by regulatory authorities (Kindleberger and Aliber 2005, p. 253–5). As opposed to Minsky's theoretical foundations, Kindleberger has a much more empirical focus – not unexpected given that he was a prominent economic historian. Kindleberger categorizes the development in different periods rather than dividing the development into separate stages.

The first period, *monetary expansion*, includes the displacement from Minsky's model. An expansion of money supply takes effect through the expected continued rise of prices. This does not require any change in monetary policy, given how credit can expand through increased willingness to invest and lend combined with decreased risk aversion (Grytten 2008*a*).

Kindleberger calls his second period *swindles*. As the name implies, questionable or directly illegal tactics are being used to prop up expectations and profits; legendary examples of this include Enron and Tyco. One curious example in the recent U.S. subprime-boom is the provision of mortgages to "ninjas – [people with] no income, no job, no assets" (Hill and Lucas 2009) – where the bank lending money does not verify whether the lender actually has an income or any assets. This is of course little more than an invitation from the banks to let their cus-

tomers lie. Given that the firm providing the mortgage would rarely end up with the default risk, the issuing bank could thus increase volumes and secure additional short-term profit.

Management compensation has been linked to short-term profits rather than the long-term viability of a strategy, giving incentives to propping up short-term profits regardless of the real risk associated with the loans made by banks. Systemic risks have largely been guaranteed by governments, further contributing to a situation where short-term gains are privatized and long-term losses socialized. These are all examples of the wider meaning of swindles.

The *critical phase* comes next in Kindleberger's theory. The name of this period carries a significant meaning. It points to Kindleberger's less deterministic view which opens for the possibility of limiting the negative effects of a crisis. A revulsion in which the markets turn may be part of this period (Kindleberger and Aliber 2005, p. 77). Whether a bursting bubble ends up in a full-fledged financial crisis will depend on the policy responses of governments and international organizations. If a temporary liquidity problem is about to lead markets into a revulsion, a swift response from governments could hinder this development.

In the critical phase, Kindleberger focuses on the role of the market leader which has the power to hinder the dissemination of the crisis or limit its effects. This leader should according to Kindleberger act as a lender of last resort by supplying both short and long term credit at reasonable rates, maintain an open market for distressed goods, ensure exchange rate stability and coordinate macroeconomic policy between governments.

Depending on the cause of the crisis and how it has developed, many different institutions might be called upon to act as lender of last resort. It could often be the central bank of a single country or international institutions such as the IMF. In other cases, market regulators such as the Financial Supervisory Authority could play a role in averting a crisis – some have for example argued that the ban on shorting financial stocks during the autumn of 2008 limited further collapses of financial institutions.

These examples are included to illustrate the lack of generality in Kindle-

berger's theory – few conclusions are set in stone, and careful judgments have to be made when analyzing the development of crises. It could be argued that this reflects the difference in approaches between economists and historians. Economists often view the laws of economics to be constant, historians search for the characteristics that make an event unique.

Failing to hinder a crisis, the next period is described as a *domestic propagation* of the crisis. "Domestic" here can have the natural meaning of within a country's borders, or it could mean that the crisis spreads within a specific market or sector.

The final period, *international propagation*, occurs if problems in some regional or sectoral markets spread to the rest of the economy.

3.3 Barry Eichengreen and elusive stability

In his book *Elusive Stability: Essays in the History of International Finance, 1919-1939*, Barry Eichengreen presents an alternative theory of financial crises. Rather than trying to summarize one common path for all crises, he views financial crises as a result of distorted equilibria leading to unstable markets.[3] Eichengreen's main focus has been empirical investigation of the interwar period.

One example of an *elusive stability* is the fragile international financial system in the 1920s. Germany paid large war reparations to the allied states, France and Great Britain paid back loans made by the US during the World War I. Germany's war reparations were to a large extent financed through short-term private lending from US banks – a connection that was not stable and would eventually lead to chaos when it broke down.

Eichengreen presents a theory explaining how the financial sector might lead an economy to a temporary equilibrium outside of the fundamental, long-term equilibrium (Grytten 2008*c*). These temporary equilibria obscure the underlying imbalances, leading to a mismatch in financial markets.

Eichengreen postulates that such imbalances can occur because of deficiencies

[3]The synthesized presentation here borrows heavily from Ola Grytten's lecture notes for the course FIE431 – Panics and crashes, Autumn 2008 (Grytten 2008*c*).

in macroeconomic coordination – this could for example be between fiscal and monetary policies or coordination between central banks. Regimes in monetary policy are in his view central to the development of financial crises, explaining the breakdown, correction processes and establishment of new regimes.

False equilibria lead to situations where actors in the financial markets base their decisions on incorrect assumptions. If future profits have been over-estimated this can initiate situations such as credit-financed bubbles. As time passes, investors realize that the optimistic profit estimates were unrealistic and markets adjust from the false equilibrium to the newly discovered long-term equilibrium. This adjustment process is analogous to the dismantling of the bubble in the earlier models, and prone to be costly.

Eichengreen's thesis is that economic growth and financial crises are not merely the result of supply-side changes, but also depend on a balanced, stable and coordinated monetary policy. International financial crises are, according to his view, frequently initiated by fixed-rate currency regimes. Coordination and consistency between central agents is necessary to avoid and limit the impact of crises.

3.4 Identifying bubbles through deviations from trend

Having reviewed some theories behind financial crises, it is clear that identifying bubbles as they build up can be of significant value. However, it is equally clear that this discovery is no simple matter – had the existence of a bubble been obvious to all it would not have occurred in the first place. This section presents a strategy for discovering bubbles as they develop.

It is frequently believed that there exists some kind of trend in economic data. GDP has for example grown over time and the tendency to grow constitutes a trend. Stock prices also grow over time, but with a much larger volatility.

Establishing deviations from trend might then be one way of finding and bursting bubbles. We might for example estimate that stock prices grow at 10% per year over time and look for explanations for the deviation if the growth differs

much from this estimated trend. The large volatility of stock prices implies that deviations would have to be very large to constitute a significant departure from the trend. Even if the deviation is large, there might be fundamental reasons for the break from the trend.

The HP filter

One approach to finding a trend is to filter the value of a time series through the Hodrick-Prescott (HP) filter. This filter creates a smoothened non-linear representation of a time series, making it more sensitive to long-term than short-term fluctuations.

The time series y_t is made up of a trend component τ and a cyclical component c satisfying $y_t = c_t + \tau_t$. Given a positive λ, there is a trend component τ that will minimize the function

$$min \sum_{t=1}^{T}(y_t - \tau_t)^2 + \lambda \sum_{t=2}^{T-1}[(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2 \tag{3.6}$$

Equation 3.6 is less complicated than it looks – it merely says that a trend can be found through minimizing the squared distances between actual output and the trend component, with λ specifying how sensitive the filter should be. With $\lambda = 0$, there will be no filtering; with a very high value for λ, the trend will change very little over time.

Deciding a value for λ involves a degree of judgment – there is no simple way of deciding which values are right. The choice of λ decides the degree of smoothing which should depend on the true trend in the underlying data. Consequently, the smoothing parameter ought to be chosen with care and the data set in mind. Standard values for λ are 100 for annual data, 1600 for quarterly data and 14400 for monthly data (Ravn and Uhlig 2002).

Weak theoretical grounding. The HP filter has a limited theoretical grounding. We are simply assuming that the filtered series constitutes a trend and that this trend represents fundamental values. The results we get are highly dependent

on the λ chosen, and there is little theoretical basis for choosing a λ value, beyond finding one that is "suitable".[4]

The end-point problem. Bernhardsen, Eitrheim, Jore and Røisland (2004) discuss the end-point problem in the HP filter. The weights change as we move from the middle of a time series to its ends – we only have data for one side of the point of time in question. This can be accommodated to some extent by extending the time series further back at the start of the period.

The only possible workaround at the end of a time series with recent data is to extend the series through creating some kind of forecast. If our goal is to discover whether a bubble exists, there is of course little use in making such forecasts. This would involve either assuming that the current trend continues or assuming that there is a bubble and that it will burst. Regardless of which alternative is chosen, our conclusion is the result of a simple assumption rather than rigorous analysis.

Real-time data. Bernhardsen et al. (2004, pp. 21–27) discuss problems associated with revisions to data when performing real-time analysis. The salient point is that recent observations are uncertain and often revised significantly at later points in time. This problem is accentuated when using the HP filter in real time by giving the most recent observations additional weight through the end-point problem. Prognosticating future values is a possible way out here too, though the perils of prognosis remain.

Long business cycles and trends. If a deviation from trend persists over a long time, the HP filter's "aversion to change in trends" – the second term in equation 3.6 – will be given relatively little weight. For normal values of λ the deviation from trend will be modeled as a change in trend. When attempting to discover bubbles, this implies that a bubble that has built up over a long time period will not be shown. The HP filter will give us yet another reason to believe

[4]There are, however, extensive mathematical descriptions of how λ values can be chosen to fit a time series – se e.g. Schlicht (2004).

that "this time is different" (Reinhart and Rogoff 2009) rather than revealing the bubble.

Asymmetry in booms and busts. In the first term of the HP filter, $\sum_{t=1}^{T}(y_t - \tau_t)^2$, positive and negative deviations from trend are given the same weight. It is therefore implicitly assumed that periods above the trend are as long as those below the trend. This need not be the case – for example, Romer (1999) explains how booms are generally longer than recessions.

Conclusion. In sum, the HP filter has a series of problems, and using it to discover bubbles is extremely difficult. Any analysis will be based on a large set of assumptions, and making these assumptions will often involve tilting the conclusion.

Chapter 4

Growth and crisis – an introduction

This chapter is divided in two parts. First, economic developments in Norway over the last decade are presented. I then give a short introduction to the international aspects of the 2008 financial crisis, providing a context for analyzing domestic issues.

4.1 A decade of growth and low inflation

Economic growth in Norway was high in the period leading up to the crash in 2008, as shown in figure 4.1. This growth partially reflected a period of high growth in the world economy and was strengthened by high oil prices and subsequent high export revenues, shown in figure 4.2.

Norwegian inflation was remarkably low and stable during this period of high economic growth. The CPIXE, as shown in figure 4.3, does not indicate any major inflationary pressure which Keynesian economics postulates for boom periods. Until the end of 2007, the inflation was well below the target, hovering for a long period between 0.5 percent and 1.5 percent.

Interest rates, shown in figure 4.4, were relatively low most of the period. However, an upward adjustment beginning in July 2005 peaked at 5.75 percent

in June 2008 and tightened economic policy slightly as the bubble developed. In other words, the central bank did use monetary policy to alleviate some of the pressures in the economy, the remaining question is whether this was sufficient and whether the timing was right.

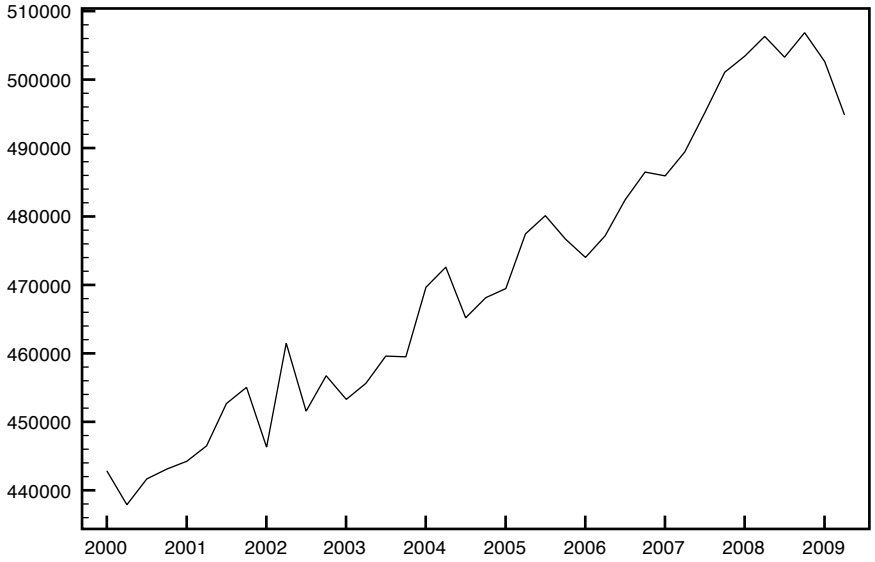

Figure 4.1: Norwegian GDP, 2000-2009. NOK per capita. Source: Statistics Norway.

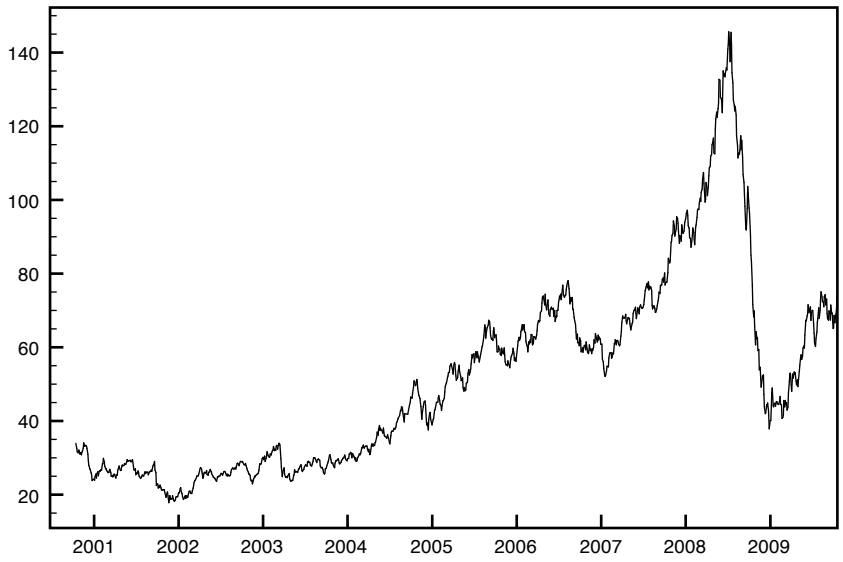

Figure 4.2: Brent dated oil price, 2000-2009. USD per barrel. Source: ICE.

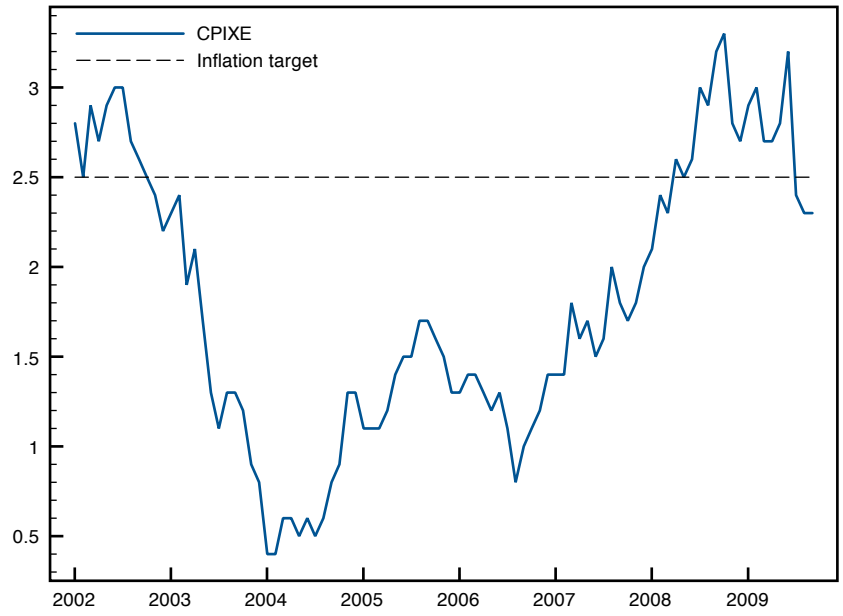

Figure 4.3: CPIXE and inflation target. Source: Statistics Norway.

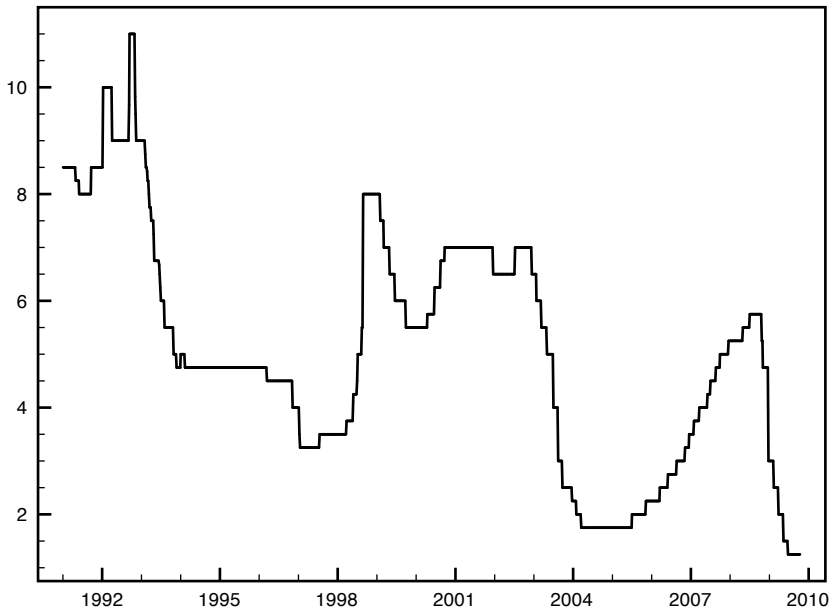

Figure 4.4: Norwegian deposit rate, 1991-2009. Source: Norges Bank.

These simple graphs portray a success story, a decade with high growth and low inflation. The decline in GDP in the current recession has been mild and inflation has been low throughout the period. It is important to both acknowledge the successes of the period and investigate complexities hidden by these simple figures when studying monetary policy in this period. I will attempt to address two questions in particular. Firstly, has the pressure in the economy been higher than that suggested by the CPI? Secondly, has this deviation contributed to a bubble?

4.2 An introduction to the 2008 financial crisis

A series of problems showed up in the U.S. housing market in August 2007. American Home Mortgage, a large provider of home loans, filed for bankruptcy on August 6. It had made significant losses in the subprime market – a part of the U.S. housing market where borrowers generally have few assets and low incomes. On August 9, the French bank BNP Paribas suspended three of its investment funds – again citing problems with the U.S. housing sector. This froze up the short-term credit markets (Soros 2008, pp. xiii–xvii). These early problems in the American housing markets were followed by similar collapses in other firms and injections of liquidity to the financial markets by central banks.

Figure 4.5 shows the S&P/Case-Shiller Composite 20 Home Price Index (SPCS20R) for the period January 2000–January 2010. This index shows a repeat-sales index for 20 metropolitan areas in the U.S.[1] The figure shows how a large bubble had developed in the housing market, with prices peaking in august 2006. Soros (2008, p. xv) outlines how these increasing prices led to both speculation and increased consumption through "extraction" of home equity – in other words, part of the rise in housing prices was consumed through refinancing. One of the aspects of the current crisis is the unwinding of these bubbles.

[1] A repeat sales index involves measuring the change in value a single house is sold at different points in time. This reduces some measurement problems – for example, a simple calculation of average price in an area at a given point in time would be sensitive to the kind of homes that have been sold recently.

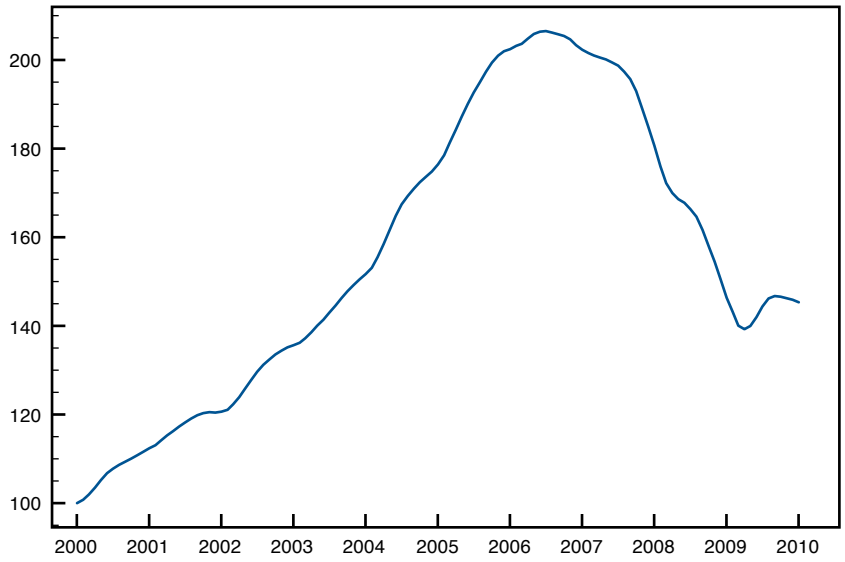

Figure 4.5: S&P/Case-Shiller Composite 20 Home Price Index. Source: S&P (2010).

The initial problems in the U.S. housing markets were followed by many other related setbacks. Securitization of mortgages through collateralized debt obligations was supposed to reduce risk through increased diversification. Soros (2008, p. xvii) contends that "they increased the risks by transferring ownership of mortgages from bankers who knew their customers to investors who did not."

The market for credit default swaps (CDS) had provided the rationale for this diversification. When one could be insured against failing CDOs, knowing the borrower was no longer necessary and risk could be taken by those best able to bear them. This failed miserably, with huge amounts of risks concentrated in some actors, requiring the insurance giant AIG to be bailed out to avoid a complete financial meltdown (Guerrera, van Duyn and Guha 2008).

GDP development from 2000-2009 for a few developed countries is shown in figure 4.6. There is a significant fall in output for all countries, though some have experienced significantly steeper falls than others.[2]

[2]Germany and Japan have large sectors producing long-lived assets. Since these sectors are

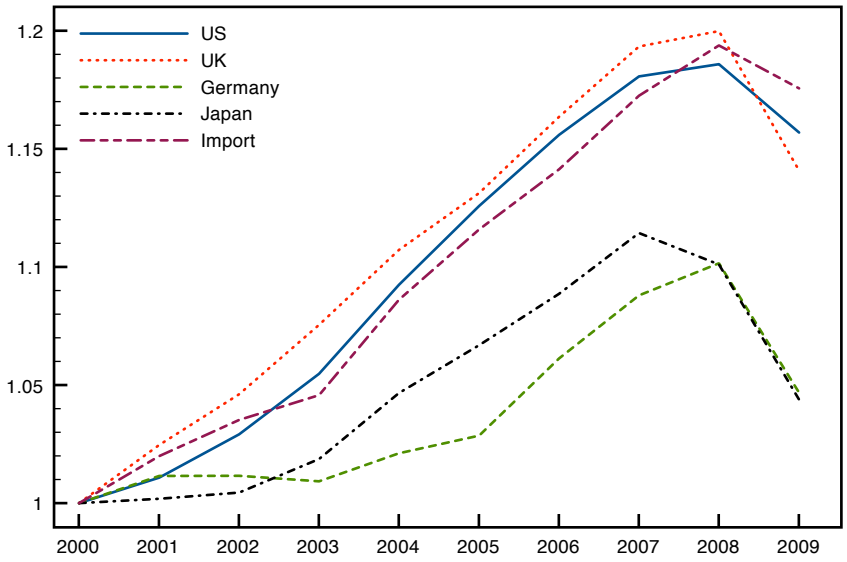

Figure 4.6: GDP in fixed prices 2000–2009, 2000 = 1. Source: IMF (2010).

Figure 4.7 shows the unemployment rate in the same set of countries for the period 2000–2009. The variation between countries is much larger here – partially because they started at very different levels, partially because the impact has differed between countries. All countries have had some increase. The increase was highest in the UK and US – this is likely to be a consequence of flexible labour markets as much as how hard the economies have been hit.

Figure 4.8 shows world merchandize export volumes for the period 1981–2009. The fall in global trade volumes resulting from the financial crisis of 2008 was dramatic with nothing like it occurring in the past decades. This decline was still much lower than in the 1929–1933 depression when approximately 2/3 of world trade vanished (Kindleberger 1986, p. 171).

The difference between three-month money market rates and expected official interest rate for the U.S. and Norway is shown in figure 4.9. The freeze in credit

highly sensitive to the business cycle, the rapid GDP decline in these countries might be a result of such sensitivty rather than offering any information on the bounce-back effect. See e.g. Wynne and Balke (1993) for an analysis of this effect.

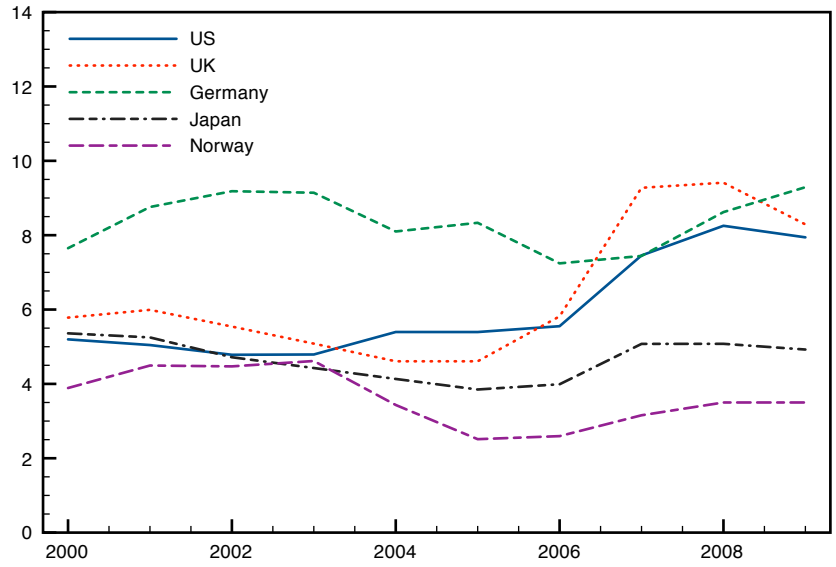

Figure 4.7: International unemployment rates. Source: IMF (2010).

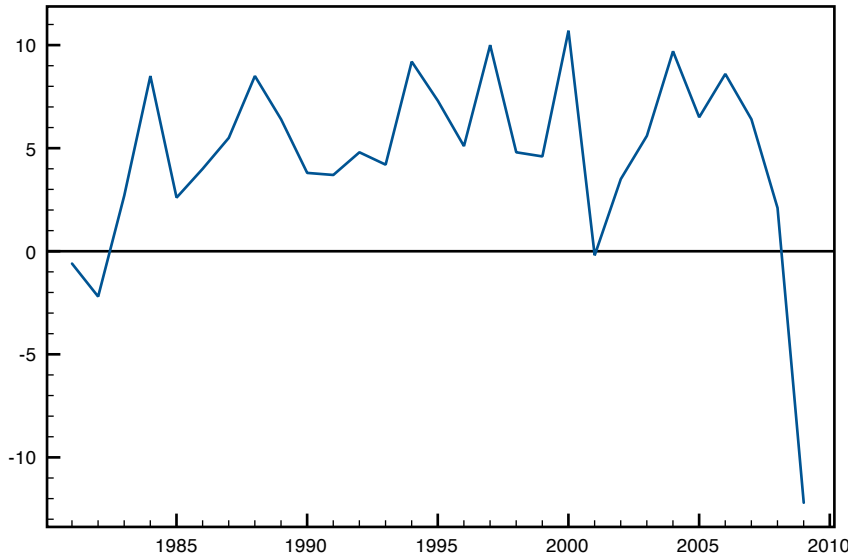

Figure 4.8: World merchandise export volume, change from previous year. Source: WTO (2010).

markets following the bankruptcy of American Home Mortgage can be seen in August 2007, the huge spike in the autumn of 2008 came after the collapse of Lehman Brothers and the rescue of AIG.

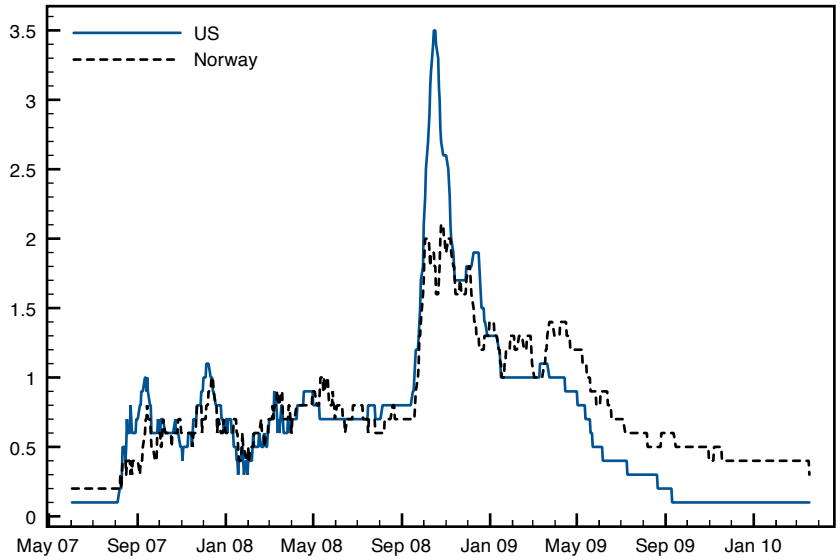

Figure 4.9: Difference between three-month money market rate and expected bank rate. Source: Norges Bank (2010).

Money markets have now returned to more normal levels, unemployment rates in some countries seem to have peaked and the U.S. housing market – the collapse of which signaled the start of the crisis – has stopped falling. The output loss has been significant, and while a new depression seems to have been avoided, it is evident that the great moderation (Bernanke 2004) was not so great.

Chapter 5

Did inflation targeting contribute to the current financial crisis?

The previous chapters introduced the theories of inflation targeting and financial crises, and introduced recent macroeconomic developments. The aim of this chapter is to use the background from the previous chapters to answer the central question of this thesis: did the Norwegian inflation targeting policy contribute to the current financial crisis?

Because no single model or theory will suffice in explaining a complex phenomenon, many approaches have been presented in the preceding chapters. This chapter reflects that view – many different macroeconomic indicators are assessed, and theories are used where they provide plausible explanations.

5.1 The housing market

Housing prices have increased dramatically in Norway since the crash in the early 1990s. Housing prices declined somewhat as part of the financial crisis, but this decline has now turned into a moderate growth in prices. Figure 5.1 shows the development from January 1990 to March 2010.

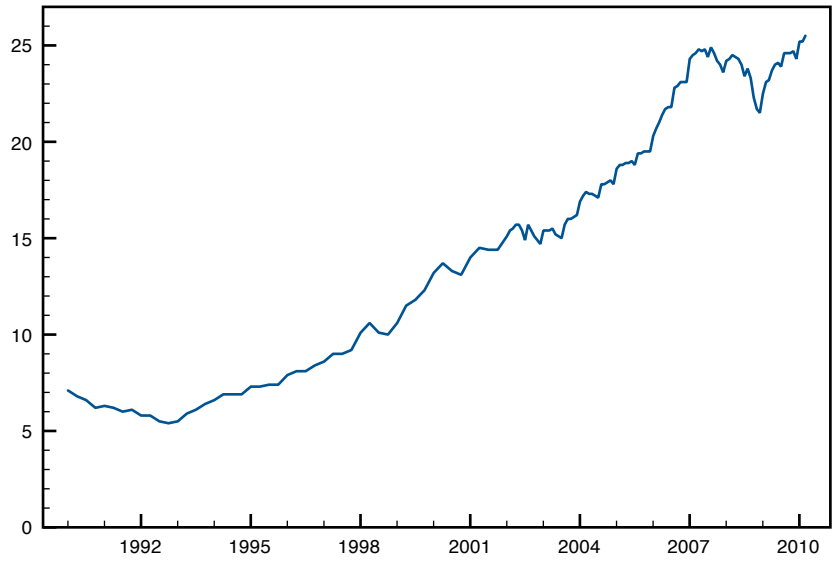

Figure 5.1: Housing prices in Norway, thousand NOK per square metre. Source: Econ.

Rental and owner-occupied homes in the price index

Because rent is used to measure housing costs in the price index, large increases in housing prices have not led to high inflation. Figure 5.2 shows the development of home and rental prices and gives an idea of the size of the deviation.

There are valid arguments for using rent as a proxy for housing costs (see section 2.2), but problems occur if significant deviations between the two persist over time. The current home price level is relevant only for those who have bought homes recently or are about to buy. However, since the prices have been diverging for an extended period of time, a large part of the cost of housing for Norwegian consumers is not reflected in the price index. Such persistent deviations give misleading signals when inflation is used as an indicator of pressure in the economy.

Constructing an alternative price index. Finding a difference between rental cost and sales prices is interesting in itself though it would be more useful if the effect was quantified. Figure 5.3 is an attempt at illustrating the size of the prob-

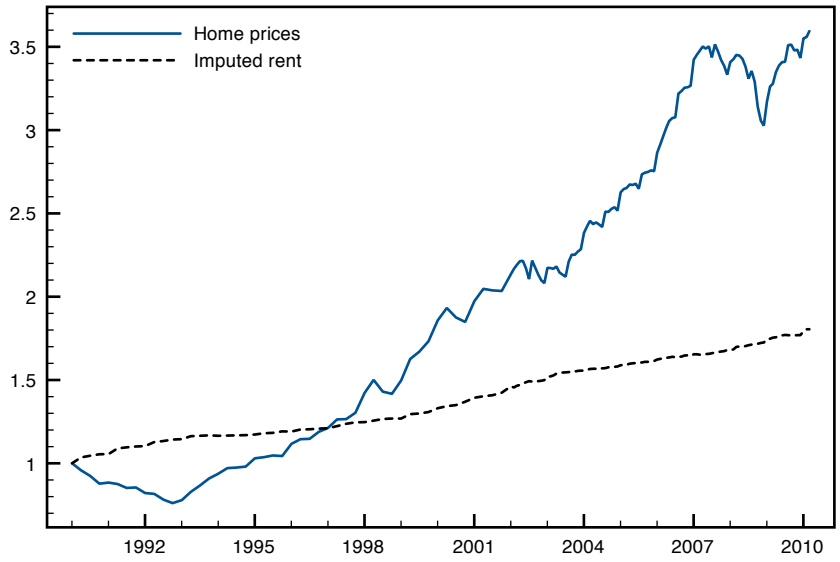

Figure 5.2: Normalized housing prices in Norway and housing component in CPI. January 1990 = 1. Source: Econ and Statistics Norway.

lem. The figure shows two price indices – the standard price index using imputed rents and a new index constructed by replacing the imputed rent index with the Econ home price index.

Figure 5.3 clearly shows that the disparity between imputed rent and home prices make a significant difference in the price index. The difference seems to be larger in the 2000s than in the 1990s. This is partially the result of the housing crash in the early 1990s, but also reflects a statistical technicality that might not be as representative of economic realities. Statistics Norway changed the classification of consumption in 1999. This changed the weights applied to goods and services in the price index significantly. For example, the weight given to imputed rent was doubled between July and August 1999. The new index is consequently likely to underestimate the effect of including home prices for the 1990s.

Table 5.1 shows historical inflation figures using both imputed rent and home prices. Arithmetic average inflation is changed from 2.65% to 3.72% over the period January 1990–March 2010. Inflation from January 2000–March 2010 is

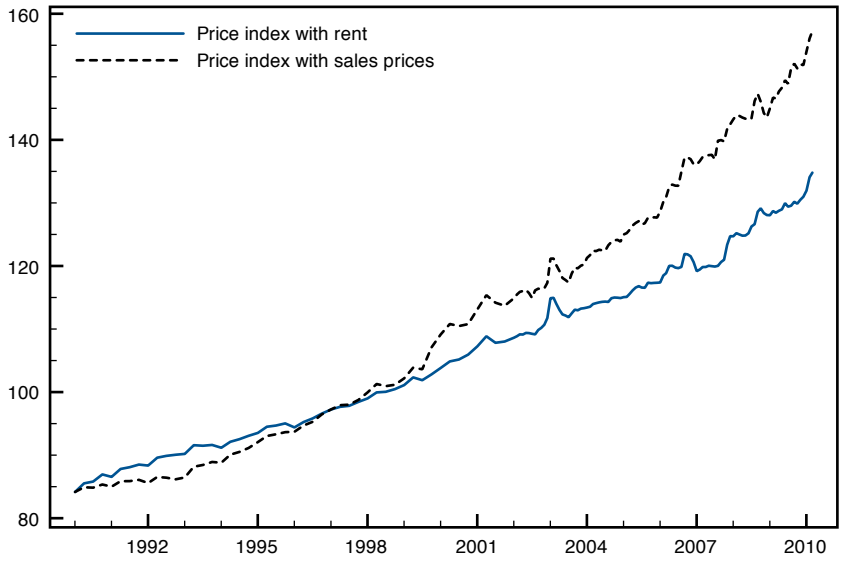

Figure 5.3: Inflation with prices and imputed rent. Sources: Statistics Norway, Econ.

increased from 2.86% to 4.24%. This suggests that the cost of living has increased at a pace significantly different from the price index.

The new index only replaces the imputed rents for owner-occupied homes, the rents paid are still included with weight corresponding to their share of consumption. The imputed rent index is based on the same rental market survey as the paid rent index. Statistics Norway does some very minor adjustments to the imputed rent index, but the correlation between the imputed and paid rents remain at above 99.8% after these adjustments. As a result, different rates of quality improvement in owner-occupied homes and rented homes are not reflected in the imputed index.

Adjusting for different rates of quality improvements. Increasing home prices is not only the result of higher prices for a given type of property, it also reflects quality improvements. Those renting their dwellings are generally young, low-income households. If quality improvements are a normal good – as seems

Table 5.1: Average inflation, using official values, Econ prices and deflated Econ prices. Sources: Statistics Norway, Econ.

	Inflation	Adjusted inflation	Adjusted inflation with discounting
1990-2010	2.65%	3.72%	3.04%
1990-1999	2.07%	2.25%	2.11%
2000-2010	2.86%	4.24%	3.36%

reasonable – the quality improvements over time are likely to be larger for owner-occupied homes.

It is necessary to construct another price index to adjust for this deviation. In this index, the Econ home price index is discounted by 2% per year.[1] This index is shown in figure 5.4.

The discounting does of course reduce the deviation between the two indices, though a difference remains. It is worth noting that applying the 2% discount to the whole period might cause an underestimation of the deviation, as homes are not upgraded at a constant rate. The weight applied to maintenance and upgrade of homes has increased over time and current levels are very high compared to the early 1990s.

Testing for significance. Table 5.1 shows the average inflation for different period using the different price indices. Using the undiscounted home price series causes a major increase in inflation for all periods, the change is less dominating with the discounted series.

I have performed a simple regression analysis to evalute the statistical signifi-

[1]This figure might seem to be chosen rather randomly. It is definitely not a highly precise measure, but should hopefully not be completely out of line with reality. Maintenance and upgrade of homes and cabins make up around 6% of Norwegian consumption. Some maintenance is needed to keep the quality constant, and there has been some increase in the quality of rental homes. If a crude assumption of equal weights to these factors is made, we are left with a discounting factor of 2%.

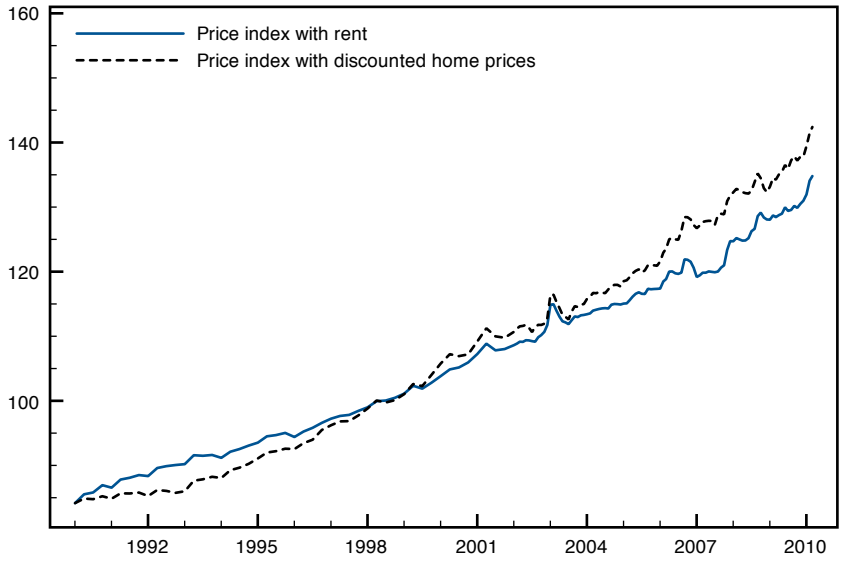

Figure 5.4: Inflation with discounted prices and imputed rent. Source: Econ, Statistics Norway.

cance of these results. The two new indices P_t^{Econ} and $P_t^{EconDisc}$ are first discounted by the consumer price index.

$$x_{k,t} = \frac{P_t^k}{CPI_t} \qquad \text{with } k = Econ \text{ and } EconDisc \tag{5.1}$$

I then regress the discounted index with time as the independent variable.

$$x_{k,t} = \beta_0 + \beta_1 t + \epsilon_t \tag{5.2}$$

A positive coefficient for time, β_1, implies that the new index has grown significantly faster than the old.

Table 5.2 shows the regression results for the adjusted inflation index. The deviation from the consumer price index is clearly positive, with a t value of 39.44 and an annual deviation being around 1%. Table 5.3 shows results for the series additionally discounted by 2% each year. The conclusion is similar though the magnitude of the difference has obviously been decreased. The t value of 30.21 is still very high, the annual deviation is around 0.5% and the deviations are clearly significant.

Table 5.2: Regression analysis, adjusted inflation discounted by regular inflation.

	Coef.	Std. Err.	t	P >| t |	[95% Conf.	Interval]
Time	.0107	.000271	39.44	0.000	.0102	.0112
Constant	.935	.00377	247.74	0.000	.927	.942

Table 5.3: Regression analysis, adjusted inflation discounted by regular inflation and 2% p.a.

	Coef.	Std. Err.	t	P >| t |	[95% Conf.	Interval]
Time	.00515	.000170	30.21	0.000	.00481	.00549
Constant	.955	.00237	403.01	0.000	.951	.960

Hidden pressures in the housing market. Section 2.3 described how a credible inflation targeting regime can lead to financial instability through hindering pressures from showing up as higher prices.

It can be argued that such pressures showed up in the Norwegian housing market. A large rise in credit-financed housing investment caused a speculative frenzy resulting in a macroeconomic bubble that echoed the classic description of Kindleberger and Minsky.

Because inflation was low, the central bank followed an expansionary monetary policy. The bubble did not show up in the form of inflation because asset prices are not included in the price index. This allowed the central bank to maintain its low interest rates, causing further monetary expansion.

Is there a housing bubble in Norway?

One interesting aspect of the development in housing prices is the occurrence of a bubble. The adjustment costs associated with a bubble in the housing markets are large. Hence, it would probably not be courageous to suggest that even though it is not a direct target for the central bank. Avoiding housing bubbles is a central component in ensuring financial stability, which is clearly part of the central bank's mandate.

No one is seriously suggesting that central banks should target a particular level of home prices. The key question is whether central banks should "lean against the wind" by tightening monetary policy when asset prices grow rapidly. The aim of this section is to evaluate whether there is a bubble in Norwegian home prices, and consequently, whether the central bank ought to have followed a tighter monetary policy.

In section 3.1, we derived a formal theory of bubbles – the difference between the market price of an asset and the net present value of its future payments to the holder. Calculating this difference is a straight forward task, making assumptions that accurately reflect economic realities is not so simple.

This lack of certainty limits the gains from using any single statistical test or model to discover bubbles. An alternative approach is to consider a multitude of factors and gain an understanding through the sum of information from these factors. The danger in this is that conclusions are likely to differ between factors and the "this time is different" problem remains – it will always be possible to find some cogent reason for excluding or including one strand of analysis.

To get a sense of the size of the Norwegian price growth in the recent years, it is worth comparing it to that in other countries. Figure 5.5 shows the Econ price index and the S&P/Case-Shiller Composite 10 Home Price Index from January 1990–January 2010. One striking conclusion from the graph is that the increase in price was similar, but Norway has not yet experienced a major correction.

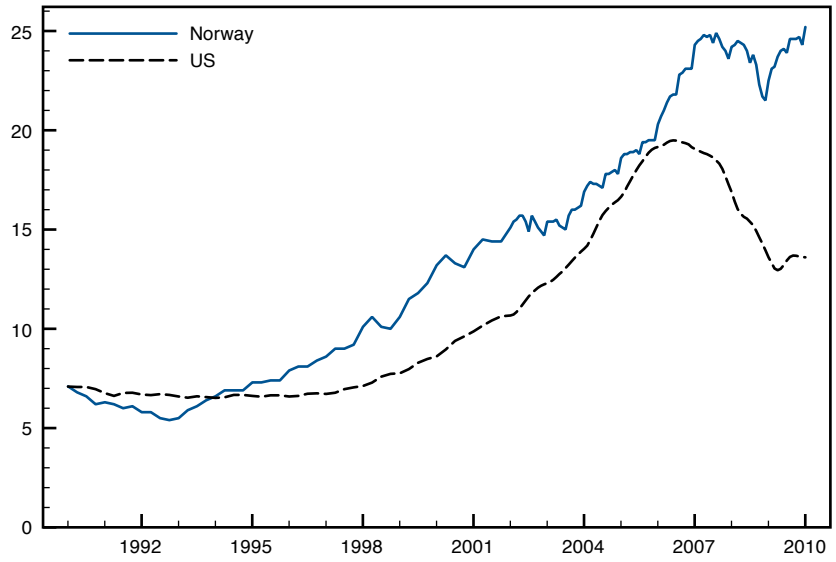

Figure 5.5: Housing prices in Norway and the U.S. (rebased to Norwegian). Source: Econ, S&P (2010).

Equilibrium in the housing market

Consumers have the choice between buying and renting their homes. One way of measuring the existence of a bubble would therefore be to analyze whether consumers are indifferent between these two substitutes. If this is not the case, one of the markets – or both – is not in equilibrium.

A simple way of measuring whether consumers are indifferent between renting and buying homes is calculating the relationship between prices P and rent R – the P/R coefficient. Figure 5.6 shows such a coefficient time series for Norway from 1970-2009. The figures are calculated from a combination of statistics. Rental prices are from Statistics Norway. The housing price series has been spliced from two data sets – figures from 1970-1989 are from Norges Bank's Historical Monetary Statistics project, while figures from 1990-2009 are from Econ.

The housing bubble in the late 1980s shows very clearly in figure 5.6, the coefficient rose significantly in that period. If increase in recent years should be

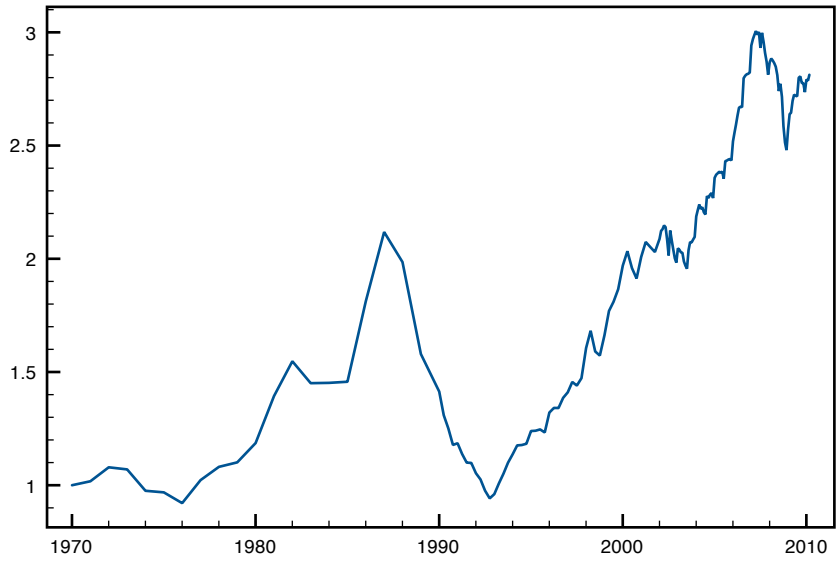

Figure 5.6: P/R coefficients for Norway, 1970-2009. Sources: Statistics Norway, Econ and Norges Bank.

interpreted in a similar way, we obviously have a large bubble in the Norwegian housing market.

Imbalances in the rental market. Finding a deviation between the market for rental and owner-occupied homes does not necessarily imply that there exists a bubble. After all, the imbalance may be in the rental market.

Rental markets have been highly regulated in Norway. Much of this regulation has been dismantled, but there are still limits defining how much a landlord can increase the rent when a contract is running. This regulation and the differences between rental and owner-occupied homes could explain some of the deviation between the two series over time.

However, with most regulation dismantled and the effects of discounting for quality differences shown to be marginal in section 5.1, there is nothing in these arguments that can explain the rapid rise of price-to-rent ratios since the early 1990s. We cannot expect the markets to move in parallel, but neither can we

explain a complete separation.

Credit-financed bubble. The expansion of credit is a critical factor in explaining financial crises. In this context, it is interesting to note that those renting homes are largely detached from the credit markets whilst those buying homes are critically dependent on access to credit. An intriguing way of looking at the two markets is to imagine housing as a uniform good where the rental market is disconnected from credit markets and the market for owning homes is closely connected to credit markets. Changes in the price-to-rent ratio should then be a pure reflection of changes in the effect of being connected to the credit market.

This "pure reflection" is obviously not an accurate description of the realities of the housing market. It does however represent a valuable framework for analyzing differences between the two markets. There will always be some deviation between the markets because of different housing types, gradual improvements made by homeowners and friction in the market. After these factors have been accounted for and there remains a large difference, the credit market is likely to be central in explaining the residual change in the P/R coefficient. This mode of thought indicates that we now have a large, credit-based housing bubble in Norway.

The trend in the Norwegian housing market

Figure 5.7 shows prices in the Norwegian housing market from 1970-2009[2] and two HP-filtered trends, using λ values of 100 and 2500. In figure 5.8, the deviation between the trend using $\lambda = 2500$ and the price series is shown. It is clear that changes have occurred over time and one could perhaps suggest that the figure shows two periods with bubbles – a recent episode in addition to the bubble in the mid 1980s.

However, most of the recent bubble seems to have vanished by a fairly marginal fall in prices according to figure 5.8. This might simply reflect the limitations of the HP filter described in section 3.4. The end-point problem is particularly

[2]Only annual values are included here, to simplify the process of HP-filtering – in previous calculations, figures were used at the maximum granularity available.

problematic here, with the trend changing to accommodate whatever movement happens in the recent periods.

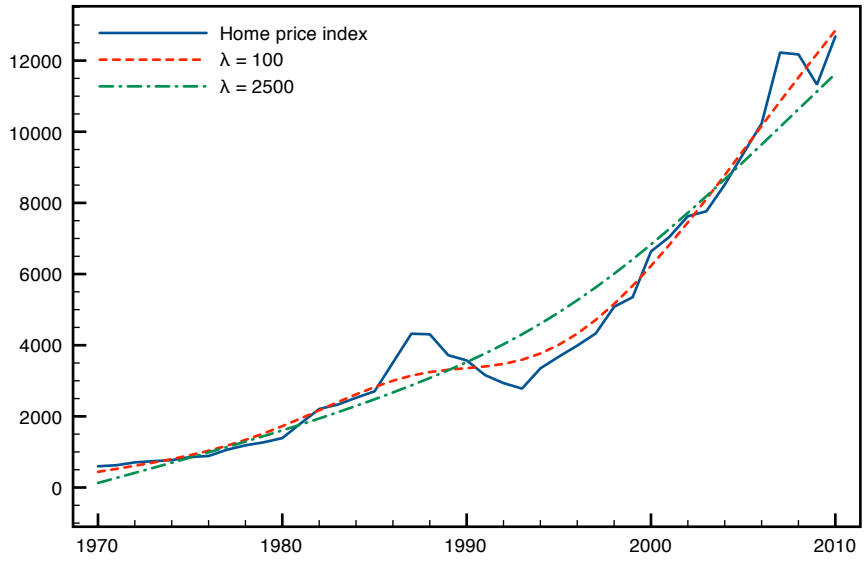

Figure 5.7: Housing prices in Norway, NOK per square metre and HP-filtered trends with $\lambda = 100$ and 2500. Source: Econ, Norges Bank.

Evaluating the choice of λ. Figure 5.9 shows the deviation between home prices and HP-filtered trends using $\lambda = 100, 2500$ and 10000. The aim of this is to illustrate the sensitivity of our conclusion to the choice of λ. All three values seem to capture the boom in the 1980s fairly well. There are larger differences in how the series portray the subsequent crash.

Establishing which of the series best portrays economic realities involves a degree of judgement – when was the market really in equilibrium and how large was the negative bubble? If we crudely assume that the market was in equilibrium halfway between the peak and trough, implying that January 1990 represents the equilibrium in my sample. From January 1990 to January 1993, market prices declined by 790NOK per square metre and it had at this point declined by 751NOK

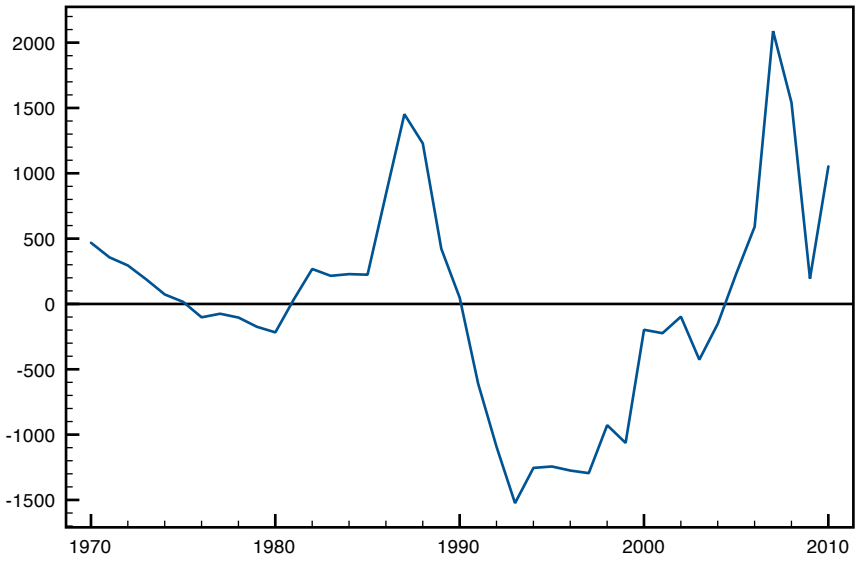

Figure 5.8: Housing prices − HP-filtered trend, $\lambda = 2500$. Source: Econ, Norges Bank.

per square metre from the peak in January 1987.[3] From this, it looks as if the "standard" λ value of 100 captures the essence of the crash fairly well.

Even if the HP filter with a λ of 100 captured the previous housing bubble well, this does not imply that it performs well in real-time. Lower λ values increases the sensitivity of the filter to the end-point problem.

There are two conclusions from this analysis. Firstly, results are prone to be spurious because of limitations from the HP filter. Secondly, if current price levels are in line with fundamentals a rapid trend growth is implied. Is such a growth plausible?

A rational growth path? Grytten (2009) investigates the rationality of the price growth based on three factors – cost of building, moderate growth in an international perspective and improved standard of living. He finds that the costs of building have increased significantly, but not enough to justify current price

[3]Using monthly data leads to a marginal change in the figures and dating of peak and trough.

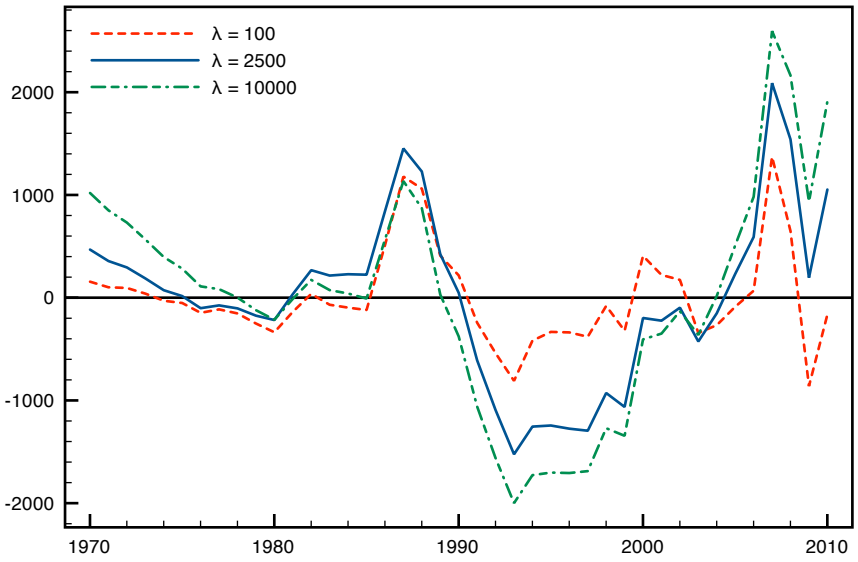

Figure 5.9: Housing prices − HP-filtered trend, $\lambda = 100$, 2500 and 10000. Source: Econ, Norges Bank.

levels. Norwegian price growth has been fairly high compared to that in other countries. Disposable income has increased around 80 percent from 1995-2007 whilst real home prices increased by 230 percent.

Housing prices increasing more rapidly than disposable income is not necessarily an argument in itself for the existence of a bubble. As real disposable income increases, the proportion of income spent on necessities such as food and clothing may decrease and the proportion available to spend on housing increases. An interpretation is that the increase in disposable income could support part of the price growth, but a very large part of the increased disposable income would have to be spent on housing if all the price increase should be explained by increased disposable income.

Norges Bank's model for home prices. Jacobsen and Naug (2004) describe a model used by Norges Bank to analyze home prices. The model is specified on the basis of macroeconomic data from 1990–2004. It uses indicators such as nominal

interest rates, unemployment and nominal wages to estimate both a short-term and long-term equilibrium. The estimated model confirms intuition – nominal interest rates have a large and swift effect on prices and rising unemployment leads to falling prices.

This model finds that current market prices are reasonably well in line with fundamentals, see e.g. OECD (2010, pp. 69–72). Conclusions from the model are necessarily based on an assumption that the period from 1990–2004 is representative of longer-term developments. This is essentially the same conundrum we ended up with when using the HP filter. If price growth over the last cycle is in line with fundamentals the model is likely to be correct. However, if fundamentals cannot explain the price growth the model's conclusions are not correct in the longer term.

The model has established a very clear link between short-term changes in nominal interest rates, wages and home prices – but it is impossible to establish whether this link is fundamentally sound in the long-term or another case of *elusive stability*.

Conclusion

It is impossible to reach any definite conclusion regarding the existence of a housing market bubble in Norway. Depending on the approach used, one might conclude that the market is either roughly in line with fundamentals or that prices are much higher than can be rationally supported in the long term.

Significantly higher unemployment rates or interest rates could cause a collapse in the housing market. With the rapid increase in prices since the 1993 trough, consumers have a large part of their financial assets in the form of housing. A significant part of this is credit financed.

The rapid, credit-financed increase in house prices makes households vulnerable to economic shocks and a winding down of debt and house prices could be extremely costly. This indicates that the central bank should have "leaned against the wind" by increasing the interest rates when prices were spiraling upwards.

5.2 Stock market bubble

The stock market experienced a significant boom in the years preceding the current financial crisis. The main index on the Oslo Stock Exchange rose to 524.37 in July 2007 from a low of 98.57 in February 2003. Conditions could hardly have been more euphoric. A fairly limited decline in the second half of 2007 was replaced by a rapid increase starting in early 2008 in prices that lasted until May 2008. The price development of the OSEBX index from 2000-2009 is shown in figure 5.10.[4]

In the middle of 2008, market values declined rapidly – following both a collapse in international stock markets and the oil price. Panic was widespread and the index fell from over 500 to less than 200 in about 7 months.

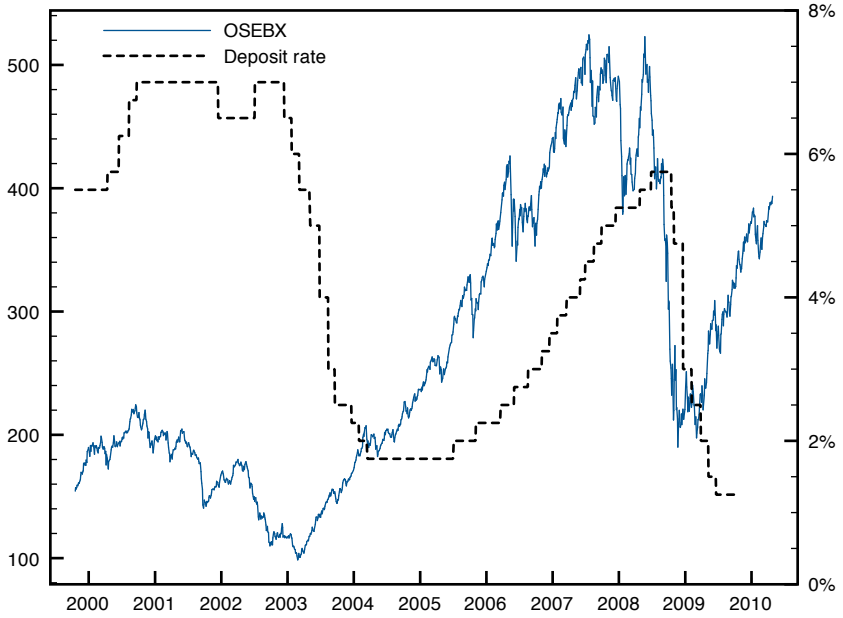

Figure 5.10: OSEBX Index and deposit rate January 2000–March 2010. Sources: NHH Exchange Project and Yahoo Finance.

This period of stock market ecstasy provided another signal of pressure and optimism in the economy. Should this have called the central bank to action,

[4]Figures from 2000–2004 are from the NHH Exchange Project (Børsprosjektet ved NHH), figures from 2005–2010 are from Yahoo Finance

tightening monetary policy?

Using asset prices as an input in monetary policy decisions is controversial. Akram, Bardsen and Eitrheim (2006) develop an econometric model of the Norwegian economy to analyze the problem. They find that including housing and equity prices can improve financial stability.

Bernanke and Gertler (2000) examine the same problem and find that asset prices should be taken into account only to the extent that they signal inflationary or deflationary pressures.

Conclusions in the literature are ambiguous and developing, what would be the most appropriate response for Norway? One potential argument for taking asset prices into account is the importance of oil and investments in the oil sector. Pressures in this sector do not show up as inflation directly, but bubbles in the oil sector can cause large problems.

A high oil price increases demand for goods and services in the oil industry and its suppliers. Government revenues are also highly dependent on oil prices, as shown in figure 5.11. The producer price index for oil and gas production in Norway has risen rapidly in recent years, as shown in figure 5.12. The Norwegian stock market is highly correlated with oil prices, see figure 5.13.

The combination of a stock market highly correlated with oil prices and a real economy heavily depending on oil prices indicates that signals from the stock market may be particularly relevant for Norwegian monetary policy.

As can clearly be seen from figure 5.10, monetary policy was counter-cyclical[5] in one sense – the deposit rate tended to be increased when stock prices increased and vice versa.

A marginal tightening of policy does not indicate that monetary policy was tight when measured on an absolute level. The average deposit rate from 2004-2006 was 2.16 per cent. This seems remarkably low compared to an average nominal deposit rate of 5 per cent from 1991–2009 (Norges Bank 2010*a*). The central bank considers 4.5–5.5 per cent a "normal level" (Bernhardsen 2010). Interest rates

[5]Peaks and troughs in the business cycle are obviously not dated purely by stock exchange movements; this is a case of correlation, not causality.

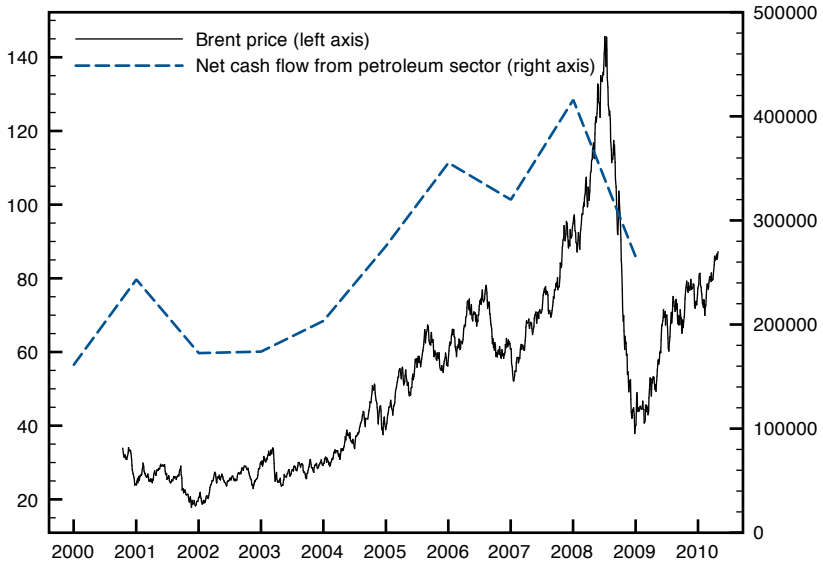

Figure 5.11: Brent price (USD) and government net cash flow from activities in the petroleum sector (billion NOK). Source: ICE and the Norwegian Petroleum Directorate (2009).

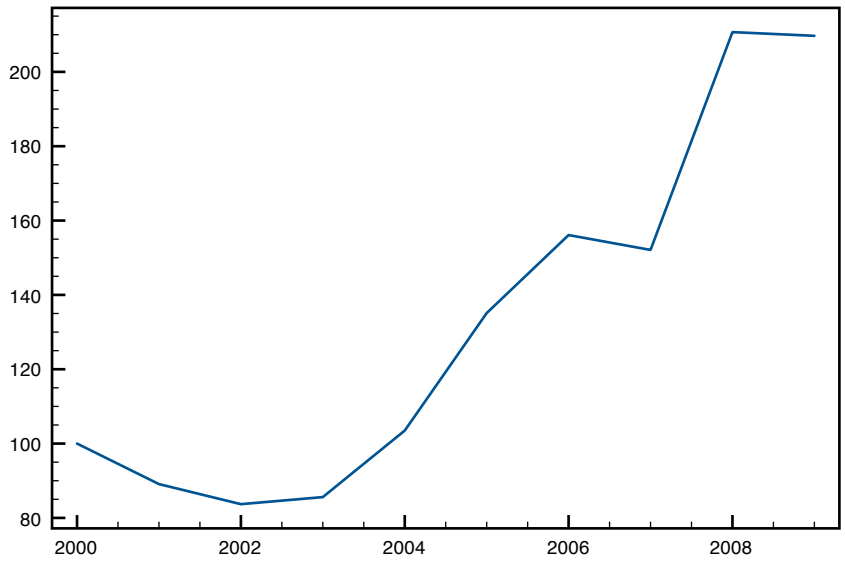

Figure 5.12: Producer price index for Norwegian oil and natural gas production. Source: Statistics Norway.

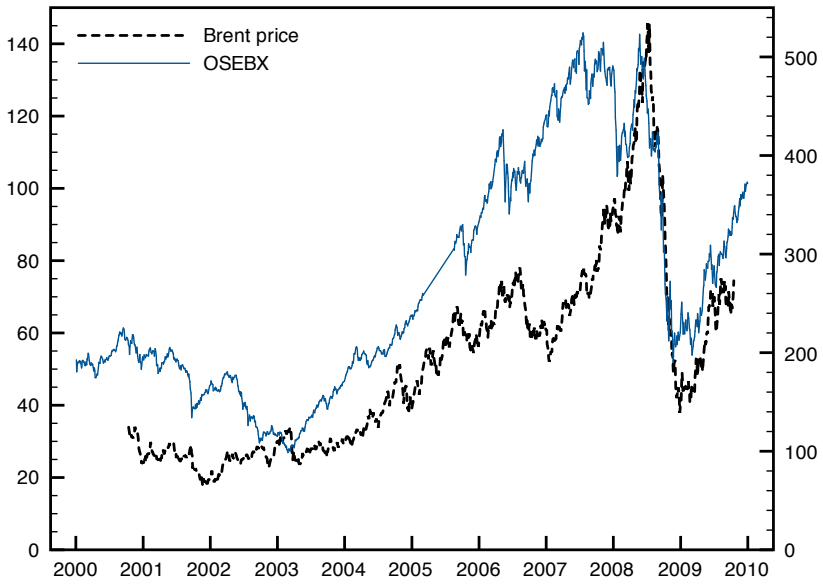

Figure 5.13: Brent price (USD) 2000-2009 and OSEBX. Source: ICE and OSE.

were increased from 2005 to limit pressure in the economy, but this was too little, too late. From a mathematical perspective, the sign of the first derivative was correct, but the absolute level too low.

5.3 Cheap imports, expensive exports

Most oil and natural gas production in Norway is exported and the prices of these commodities are included in the price index according to their weights in consumption. There is nothing dramatic in a single sector having a different weight in the economy than in the average consumer's purchases – this is to be expected in an open economy.

If sectors given little weight in the inflation measure are important to the economy and the development in this sector differs from the average sector, pressure in the economy is unlikely to show up as inflation. Similarly, prices of imported goods are important for the level of inflation, but say little about the capacity utilization of the domestic economy.

Figure 5.14 shows prices of export and imports from 2000-2009. As expected, export prices have increased significantly and this increase correlates well with the rise in oil and natural gas prices.

Many consumer goods, such as clothing and electronics, are to a large extent imported. The inclusion of China and other developing Asian economies in the world economy has caused a outward shift in labour supply. Together with improvements in technology this has reduced the costs of producing many consumer goods. This displacement has led to a very modest growth of import prices in recent years.

The relationship between export and import prices – terms of trade – is shown in figure 5.15. This increase is yet another signal of deviation between the measure of inflation and pressure in the economy. Arguments for tightening monetary policy could be countered by measuring the level of consumer price inflation – ignoring that prices of goods produced in Norway rose rapidly. This could have concealed a large, positive output gap.

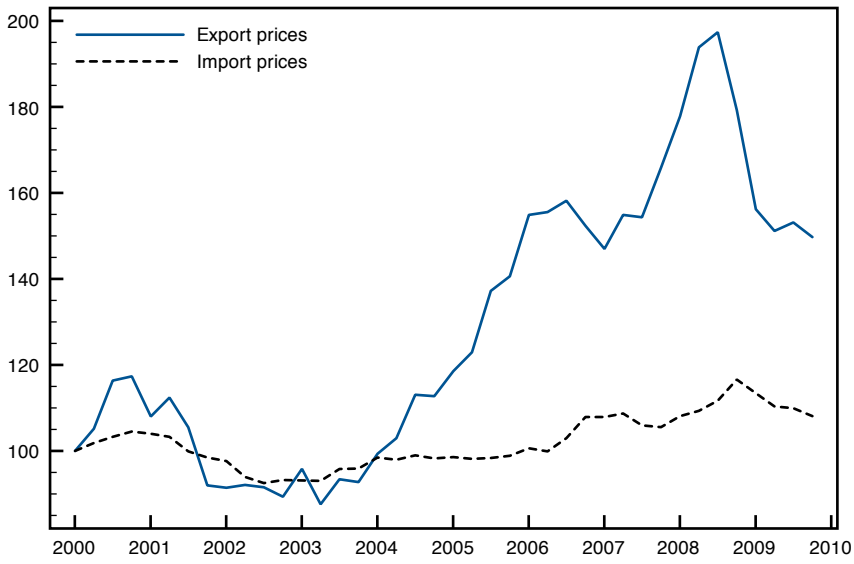

Figure 5.14: Normalized export and import prices for Norway, 2000–2009. January 2000 = 100. Source: Statistics Norway.

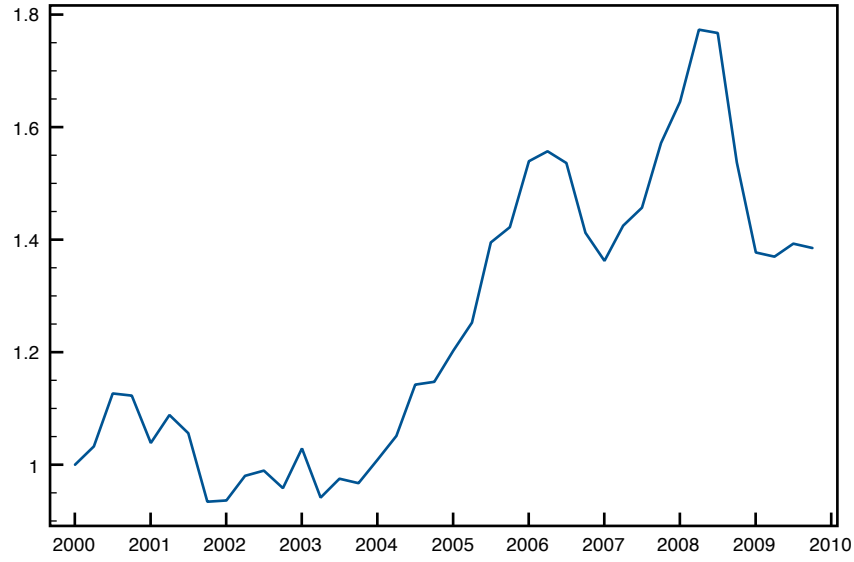

Figure 5.15: Terms of trade. January 2000 = 1. Source: Statistics Norway.

5.4 Nominal wages

Section 2.3 introduced a method used by Mankiw and Reis (2003) to produce a stability price index. One of the most interesting conclusions from this study is that including nominal wages in the price index would significantly improve macroeconomic stability.

There are two main questions relevant to this thesis that arise from Mankiw and Reis (2003). First, given the model from Mankiw and Reis (2003), has the development in nominal wages in Norway indicated that monetary policy should have been tighter? Secondly, do nominal wages provide the same information in Norway as they do in the U.S.? In other words, is the link between nominal wages and the business cycle different?

Norwegian nominal wage development

Figure 5.16 shows the annual change in nominal wages for Norway in the period 1996–2009. If a stability price index with the weights from Mankiw and Reis (2003) was introduced, then wages increasing faster than trend growth should trigger a tightening of monetary policy.

The data mean seems to be relatively stable although growth was fairly high in real terms and there are some large variations around the mean. These variations are likely to be partly caused by seasonality in the data. The conclusion from this simple analysis is that wages did not change at a pace that should have triggered a major tightening of monetary policy.

Do Norwegian wages contain the same information as U.S. wages?

Mankiw and Reis (2003) specify their model with data and assumptions based on the U.S. economy. Should we expect conclusions about the link between the U.S. labour market and business cycles to hold for Norway? Nominal wages provide value in inflation targeting because they include information about the expectations of millions of employers and employees; all these expectations are aggregated into the average change in the nominal wage level.

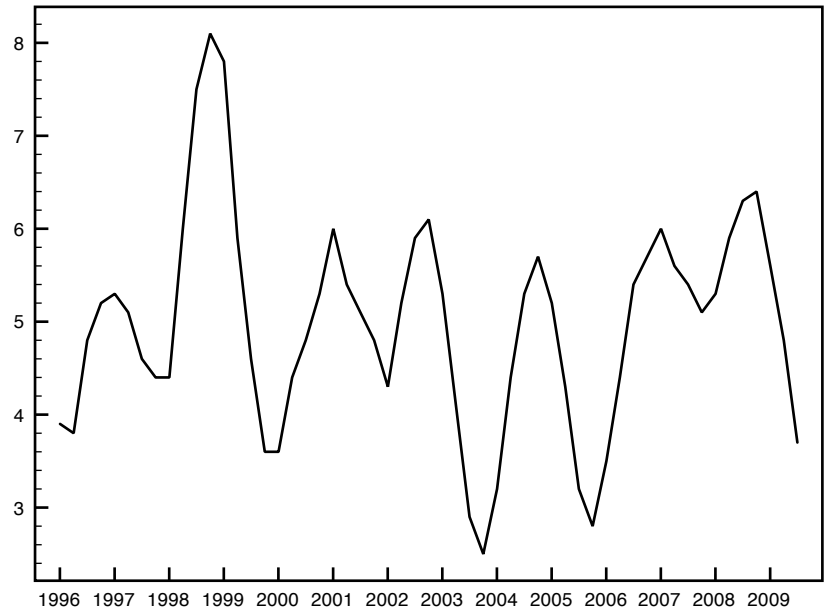

Figure 5.16: Norwegian nominal wages, per cent change from previous year. Q11996-Q3 2009 Source: Statistics Norway.

Frøland (1997) describes the history and functioning of the Norwegian wage negotiation system. The salient point is that wages are determined within a *corporative framework*. Large trade unions and employer organizations conduct centralized wage negotiations and the result from these negotiations determined the wage level for most Norwegian employees. The government takes part both through its role as a major employer and through promising policy changes in order to affect the outcome of the negotiations.

These centralized processes are likely to cause distortions different from those in a decentralized system. Centralized negotiations take into account the expectations of large organizations and their leaders, not the expectations of millions as in decentralized systems. Consequently, we cannot expect Norwegian wages to provide the same information about the business cycle as U.S. wages do.

5.5 Monetary and credit aggregates

Large and rapid increases in monetary and credit aggregates might be indicative of bubble creation, as described in section 2.3 and Borio and Lowe (2002). This section analyzes the development of these figures.

Domestic credit volume

The domestic gross credit volume from 1987-2009 is shown in figure 5.17. A slight peak is shown around 1990-1991 when the last bubble burst. The credit volume started growing again after a decline that lasted until the end of 1993. The pace of the increase increased significantly in 1997 and it seems as if credit volumes exploded in 2005.

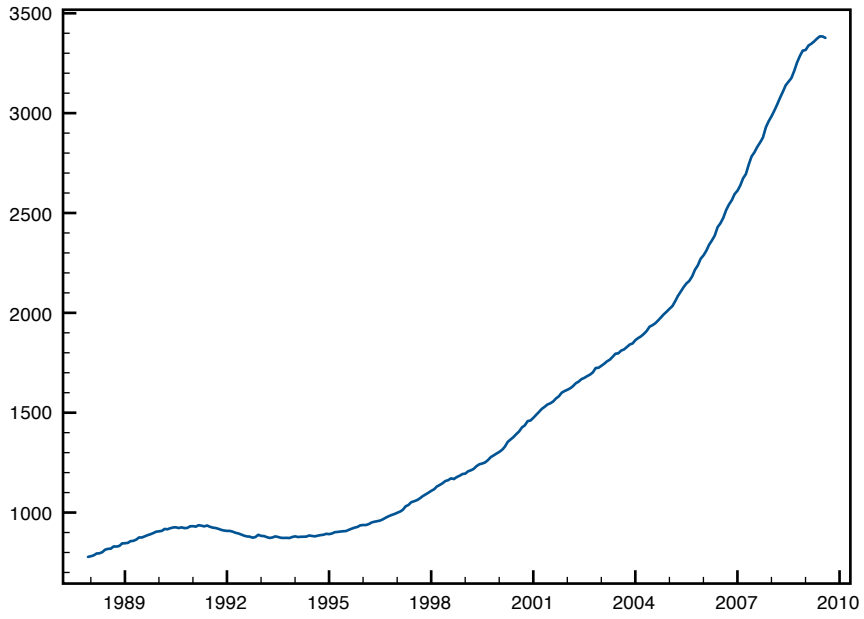

Figure 5.17: Total Norwegian domestic gross credit, 1987-2009, billion NOK. Source: Statistics Norway.

Nominal credit volumes are now 3.9 times higher than in november 1993. Nominal GDP has grown by a factor of 2.8 in the same period. The figure consequently looks more dramatic than it probably is. After adjusting for economic growth, the

increase in credit volume is not that extreme. Figure 5.18 shows the same credit volume series, discounted by nominal GDP and rebased. From this perspective, the credit growth is not as massive in the previous figure, but the increase has been fairly steep even when taking economic growth into account.

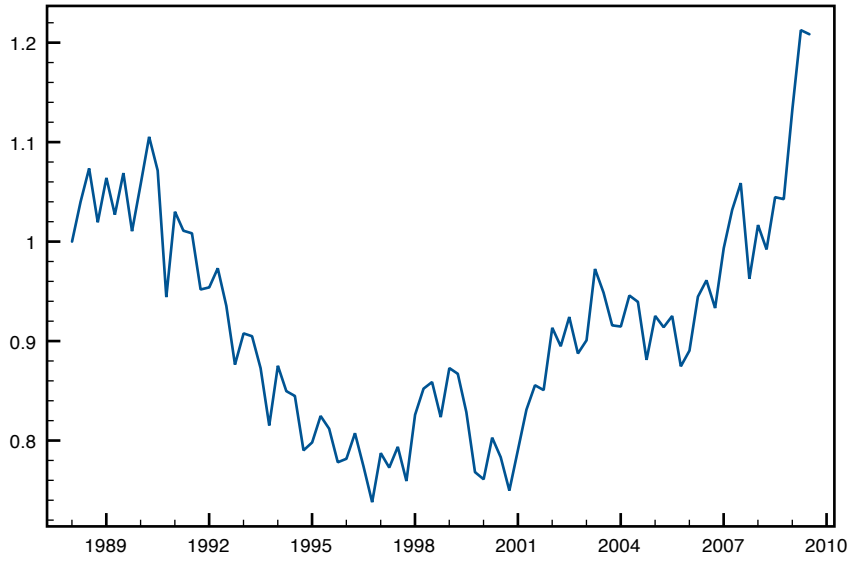

Figure 5.18: Total Norwegian credit volumes discounted by GDP. January 1987 = 1 Source: Statistics Norway.

It can be argued that the early 1990s was an exceptionally bad period in the Norwegian economy and an increase in gearing from that period is not necessarily a problem. If investments are considered more risky than they actually are in periods of crises as suggested by Kindleberger and Aliber (2005), part of the increase could simply reflect more realistic assessments.

Financial innovations probably have some role in the increased credit volumes. An example is homeowner extraction of home equity to finance consumption. This may increase the equilibrium level of indebtedness in households; where mortgages used to only be a way of financing home purchases for the fairly young, it has also become a way of increasing consumption for the elderly. Whether these financial innovations are permanent shifts in credit markets or yet another case of "this

time is different" remains to be seen.

Monetary aggregates

Figure 5.19 shows the seasonally adjusted[6] monthly growth in money supply M2 and HP-filtered trend from 1997-2009. The standard λ value of 14400 for monthly data is used.

The money stock grew from 2003 to early 2007, before it started a fairly swift decline lasting to early 2008. The growth until 2007 might reflect the generally upbeat economic conditions, and the decline fits well with the early stages of the current crisis – though the HP filter performs poorly here because of the end-point problem. The fact that the money stock did not collapse when equity markets and investor confidence did in late 2008 is likely a result of the massive rescue packages provided by governments.

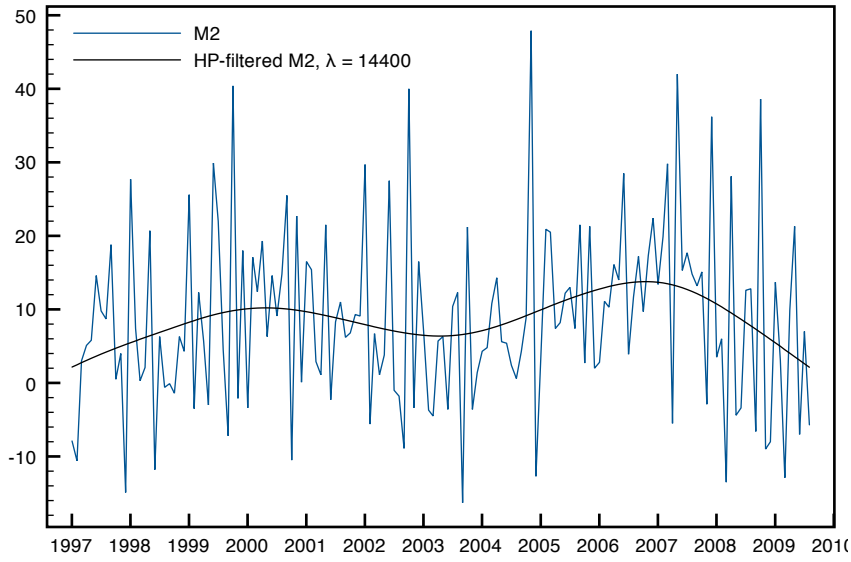

Figure 5.19: Seasonally adjusted Norwegian monthly M2 growth and HP-filtered growth with $\lambda = 14400$. Source: Statistics Norway.

[6]The figures are seasonally adjusted by Statistics Norway, using the X12-ARIMA system from the U.S. Census Bureau.

The credit volume has grown significantly, but the development does not seem all that explosive when growth in GDP is taken into account. The money stock grew during the boom period and started falling in early 2007. Both of these time series show signs of the boom and subsequent bust, but there is little indication in this that the central bank should have acted otherwise.

Chapter 6

Conclusions

Inflation targeting was formally adopted in Norway in 2001. The period since has been one of high economic growth and low inflation. High commodity prices have led to high price growth for Norway's export goods, prices of import goods have grown little.

The informational value of the consumer price inflation has been distorted by three principal factors – home prices, a stock market bubble and the difference between export and import goods. Credit market expansion provided another signal of market pressures.

Housing prices have increased rapidly and this has not been reflected in inflation figures. This has over time led to a large deviation between the costs of housing and the costs indicated by the consumer price index.

The housing prices in Norway have not declined much from their peak and are currently on the rise again, whilst other countries have experienced significant declines. Establishing with certainty whether this is because of fundamental factors or a bubble is close to impossible. The development of the relationship between costs of renting and purchasing accommodation suggests that the housing market is not in equilibrium. Prices have exploded whilst rental costs have grown modestly.

A large bubble in the stock market was a further indication of the euphoria in the economy. Few are suggesting that central banks should include asset prices as a direct target for monetary policy, though one could argue that central banks

should lean against the wind; cleaning up after major bubbles is a costly exercise.

Prices for goods that have been imported have risen very modestly over the past decade whilst prices for export goods have increased significantly. This has contributed to distorting the signals provided by the CPI, cheap consumer goods imported from Asia have kept inflation low.

In total, these three factors have led to a situation where the central bank acted as if the pressure was lower than it really was – and through this failed to take the necessary steps to limit the size of the bubble in the economy.

The policy rate was increased somewhat during the period of euphoria, but the levels were still very low in a period of high economic growth. Though we have been able to avoid a major meltdown of the Norwegian economy, high levels of debt and a housing market bubble have made households vulnerable to new shocks. This vulnerability could have been reduced if a tighter monetary policy had been pursued.

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