# Housing Bubbles and Expected Returns to Homeownership

## Lessons and Policy Implications[*]

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## Abstract

House prices in many industrial countries increased dramatically in the years prior to 2007. Countries with the largest increases in household debt relative to income experienced the fastest run-ups in house prices over the same period. During the run-up, many economists and policymakers maintained that U.S. housing market trends could be explained by fundamentals. But in retrospect, studies now mostly attribute events to a classic bubble driven by over-optimistic projections about future house prices which, in turn, led to a collapse in lending standards. A common feature of all bubbles which complicates the job of policymakers is the emergence of seemingly-plausible fundamental arguments that seek to justify the dramatic rise in asset prices. A comparison of the U.S. housing market experience with ongoing housing market trends in Norway once again poses the question of whether a bubble can be distinguished from a rational response to fundamentals. Survey evidence on people's expectations about future house prices can be a useful tool for diagnosing a bubble. In light of the severe economic fallout from the recent financial crisis, central bank views on the use of monetary policy to lean against bubbles appear to be shifting.

Keywords: *House Prices, Speculative Bubbles, Credit Growth, Expected Returns, Risk Premiums, Monetary Policy, Financial Stability*.

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## 1. Introduction

House prices in many industrial countries increased dramatically in the years prior to 2007. Countries with the largest increases in household debt relative to income experienced the fastest run-ups in house prices over the same period (Glick and Lansing 2010, International Monetary Fund 2012a). Within the United States, house prices rose faster in areas where subprime and exotic mortgages were more prevalent (Tal 2006, Mian and Sufi 2009, Pavlov and Wachter 2011). In a comprehensive report, the U.S. Financial Crisis Inquiry Commission (2011) emphasized the effects of a self-reinforcing feedback loop in which an influx of new homebuyers with access to easy mortgage credit helped fuel an excessive run-up in house prices. The run-up, in turn, encouraged lenders to ease credit further on the assumption that house price appreciation would continue indefinitely. When the optimistic house price projections eventually failed to materialize, the bubble burst, setting off a chain of events that led to a financial and economic crisis. The "Great Recession," which started in December 2007 and ended in June 2009, was the most severe U.S. economic contraction since 1947, as measured by the peak-to-trough decline in real GDP (Lansing 2011).

This article compares the U.S. housing market experience to ongoing housing market trends in Norway with the aim of considering whether a bubble can be distinguished from a rational response to fundamentals. Case and Shiller (2004) make the point that "the mere fact of rapid price increases is not in itself conclusive evidence of a bubble…The notion of a bubble is really defined in terms of people's thinking about future price increases." Survey evidence on people's expectations about future house price appreciation can therefore be a useful tool for diagnosing a bubble. As was true in the United States, housing investors in Norway appear to expect high future returns on real estate even after a sustained run-up in the price-rent ratio. Such views are directly at odds with the idea that a decline in the risk premiums of rational investors is the explanation for the run-up in house prices.

## 2. Fundamentals versus Bubble

The term "bubble" is used to describe an asset price that has experienced a sustained run-up beyond the level that can be justified by economic fundamentals (see Lansing 2007). According to Stiglitz (1990), a bubble exists when the price of an asset is high today "only because investors believe that the selling price will be high tomorrow." The fundamental value of an asset is typically measured by the present-value of expected future cash or service flows that will accrue to the owner. Service flows from housing are called "imputed rents." The discount rate used in the present-value calculation is comprised of a risk-free yield and a compensation for perceived risk, i.e., a risk premium. Their sum defines the rate of return that an investor expects to receive to justify purchase of the asset. All else equal, a lower risk premium implies a lower expected return and a lower discount rate in the present-value calculation. Future service flows will be discounted less and the fundamental value will rise. The fundamental value could also rise if service flows from the asset are expected to grow faster over time due to some underlying structural change, such as faster long-run income growth.

In the years following the 2001 recession, house prices in the United States and many other countries rose rapidly. Media attention soon focused on the possibility of a housing bubble. But

Fed Chairmen Alan Greenspan (2004a) voiced skepticism: "Housing price bubbles presuppose an ability of market participants to trade properties as they speculate about the future. But upon sale of a house, homeowners must move and live elsewhere. This necessity, as well as large transaction costs, are significant impediments to speculative trading and an important restraint on the development of price bubbles." However, even at the time, it was widely-accepted that Japan had experienced an enormous real estate bubble in the late 1980s. As noted by Shiller (2007), the presence of large transaction costs can actually make bubbles more likely because pricing inefficiencies become difficult to exploit via arbitrage. Moreover, according to data compiled by the National Association of Realtors, as much as 40 percent of U.S. residential sales during the mid-2000s were coming from buyers of vacation or investment homes—thus avoiding the need for them to "move and live elsewhere." Indeed, the possibility of housing speculation was brought up at the December 14, 2004 meeting of the Federal Open Market Committee, where some participants noted "signs of potentially excessive risk-taking…[including] anecdotal reports that speculative demands were becoming apparent in the markets for single-family homes and condominiums."

Still, many economists and policymakers maintained that U.S. housing market trends could be explained by fundamentals. A paper by New York Fed economists McCarthy and Peach (2004) concluded that "a home price bubble does not exist," instead arguing that observed price trends could be explained by fundamentals such as increases in personal income, demographic forces, and declines in nominal mortgage interest rates.[1] In a February 2004 speech, Fed Chairman Alan Greenspan (2004b) stated that "American consumers might benefit if lenders provided greater mortgage product alternatives to the traditional fixed-rate mortgage." As house prices continued to rise, the lending industry marketed a range of exotic mortgage products, e.g., loans requiring no down payment or documentation of income, monthly payments for interest-only or less, and adjustable rate mortgages with low introductory "teaser" rates that reset higher over time. While sold as a way to keep monthly payments affordable for the large influx of new and often credit-impaired home buyers, the exotic lending products paradoxically harmed affordability by fueling the price run-up.

Commenting on the rapid growth in subprime mortgage lending, Fed Chairman Alan Greenspan (2005) offered the view that the lending industry had been dramatically transformed by advances in information technology: "Where once more-marginal applicants would simply have been denied credit, lenders are now able to quite efficiently judge the risk posed by individual applicants and to price that risk appropriately."[2] In a July 1, 2005 media interview, Ben Bernanke, then Chairman of the President's Council of Economic Advisers, argued that fundamental factors such as strong growth in jobs and incomes, low mortgage rates, demographics, and restricted supply were supporting U.S. house prices. In the same interview, Bernanke stated his view that a substantial nationwide decline in house prices was "a pretty unlikely possibility." At the December 12, 2006 FOMC meeting, committee members voiced their opinion that any weakness in housing was unlikely to significantly impact other sectors of the U.S. economy.

It is now clear that much of the strength of the U.S. economy during the mid-2000s was linked to the housing boom itself. In the aftermath of a burst technology stock bubble, the Federal Reserve reduced the federal funds rate to just 1% and held it there for over 12 months during 2003

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[1]Similar arguments were put forth in a September 2005 New York Fed Staff Report by Himmelberg, et al. (2005).

[2]According to the report of the U.S. Financial Crisis Inquiry Commission (2011, p. 70), new subprime mortgage originations went from $100 billion in the year 2000 to around $650 billion at the peak in 2006. In that year, subprime mortgages represented 23.5% of all new mortgages originated.

and 2004—a policy path substantially below that implied by the well-known Taylor rule. Some studies find evidence that Fed's interest rate policy during this period contributed to the run-up in house prices (Taylor 2007, McDonald and Stokes 2011). Low mortgage interest rates set off a refinancing boom, allowing consumers to tap the equity in their homes to pay for all kinds of goods and services. The consumption binge was accompanied by a rapid increase in household debt relative to income and a decline in the personal saving rate (Lansing 2005). Hundreds of thousands of jobs were created in construction, mortgage banking, and real estate. In various ways, stimulus from the expansion of the housing bubble helped to mitigate, or perhaps simply postpone, the economic fallout from the burst stock market bubble. Recently, in a review of the Fed's forecasting record leading up to the crisis, Potter (2011) acknowledges a "misunderstanding of the housing boom…[which] downplayed the risk of a substantial fall in house prices" and a "lack of analysis of the rapid growth of new forms of mortgage finance."

### 3. Can Lower Risk Premiums Explain the Run-up?

Cochrane (2009) argues that one cannot easily tell the difference between a bubble and a situation where rational investors have low risk premia, implying lower expected returns on the risky asset. Specifically, he remarks "Crying bubble is empty unless you have an operational procedure for distinguishing them from rationally low risk premiums." Along similar lines, Favilukis, et al. (2011) argue that the run-up in U.S. house prices relative to rents was largely due to a financial market liberalization that reduced buyers' perceptions of the riskiness of housing assets. The authors develop a theoretical model where easier lending standards and lower mortgage transaction costs contribute to a substantial rise in house prices relative to rents, but this is not a bubble. Rather, the financial market liberalization allows fully-rational households in the model to better smooth their consumption in the face of unexpected income declines, thus reducing their perceptions of economic risk. Lower risk perceptions induce households to accept a lower rate of return on the purchase of risky assets like houses. A lower expected return leads to an increase in the model's fundamental price-rent ratio, similar to that observed in the data. In the words of the authors, "A financial market liberalization drives price-rent ratios up because it drives risk premia down… Procyclical increases in price-rent ratios reflect rational expectations of lower future returns."

In our view, the relaxation of lending standards in the mid-2000s was an endogenous consequence of the house price run-up, not an exogenous fundamental driver of the run-up. Standards were relaxed because lenders (and willing borrowers) expected house price appreciation to continue. Empirical evidence supports this view. Within the United States, past house price appreciation in a given area had a significant positive influence on subsequent loan approval rates in the same area (Dell'Ariccia, et al. 2011, Goetzmann, et al. 2012).

### 4. Bubble Evidence: High Expected Returns Near Market Peak

One way in which a bubble might be distinguished from a situation with rationally low risk premiums is to examine investors' expectations about future returns on the asset. Rational investors with low risk premiums would expect low future returns after a sustained price run-up, whereas irrationally exuberant investors in the midst of a bubble would expect high future returns because they simply extrapolate recent price action into the future. As discussed below, survey data from both stock and real estate markets confirm that investor expectations tend to be

extrapolative.[3] Overall, the evidence appears to directly contradict the view that declining risk premiums (resulting in low expected returns) were the explanation for the run-up in U.S. house prices relative to rents.

Shiller (2000) developed a questionnaire to study investor expectations about future stock market returns in Japan and the U.S. during the 1990s. From the data, he constructed an index of "bubble expectations" which reflected the belief that stock prices would continue to rise despite being high relative to fundamentals. He found that the index moved roughly in line with movements in the stock market itself, suggesting that investors tend to extrapolate recent market trends when making predictions about future returns.

Two additional studies by Fischer and Statman (2002) and Vissing-Jorgenson (2004) also find evidence of extrapolative expectations among U.S. stock market investors during the late 1990s and early 2000s. Using survey data, they found that investors who experienced high portfolio returns in the past tended to expect higher returns in the future. Moreover, expected returns reached a maximum just when the stock market itself reached a peak in early 2000.

In a comprehensive study of the expectations of U.S. stock market investors using survey data from a variety of sources, Greenwood and Shleifer (2013) find that measures of investor expectations about future stock returns are: (1) positively correlated with the price-dividend ratio and past stock returns, and (2) positively correlated with investor inflows into mutual funds. They conclude (p. 30) that "[O]ur evidence rules out rational expectations models in which changes in market valuations are driven by the required returns of a representative investor…Future models of stock market fluctuations should embrace the large fraction of investors whose expectations are extrapolative."[4]

Using survey data on homebuyers in four metropolitan areas in 2002 and 2003, Case and Shiller (2004) found that about 90 percent of respondents expected house prices to increase over the next several years. More strikingly, when asked about the next ten years, respondents expected future annual price appreciation in the range of 12 to 16 percent per year—implying a tripling or quadrupling of home values over the next decade. Needless to say, these forecasts proved wildly optimistic. In a study of data from the Michigan Survey of Consumers, Piazzesi and Schneider (2009) report that "starting in 2004, more and more households became optimistic *after* having watched house prices increase for several years."

Anecdotal evidence further supports the view that U.S. housing investors had high expected returns near the market peak. The June 6, 2005 cover of *Fortune* magazine was titled "Real Estate Gold Rush—Inside the hot-money world of housing speculators, condo-flippers and get-rich-quick schemers." One week later, the June 13, 2005 cover of *Time* magazine was titled "Home $weet Home—Why we're going gaga over real estate." Both covers depicted happy and celebrating housing investors—all suggesting a rosy outlook for U.S. real estate.

In surveys during 2006 and 2007, Shiller (2007) found that places with high recent house price growth exhibited high expectations of future price appreciation and that places with slowing house price growth exhibited downward shifts in expected appreciation. Indeed by 2008, in the midst of the housing market bust, Case, Shiller, and Thompson (2012) show that survey respondents in prior boom areas now mostly expected a decline in house prices over the next year. In a review of the time series evidence on housing investor expectations, the authors conclude (p.

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[3] See also Lansing (2006) and Jurgilas and Lansing (2012).
[4] Gelain and Lansing (2013) apply this advice to a model of housing market fluctuations.

17) that "12-month expectations [of future house prices changes] are fairly well described as attenuated versions of lagged actual 12-month price changes."[5]

The takeaway for researchers is that models in which investors employ extrapolative or moving-average type forecast rules appear to be a promising way to capture the behavior of real-world asset prices.

## 5. Applying U.S. Lessons to Norway

[Figure 1 about here]

Lessons learned from the U.S. experience may help in assessing whether housing bubbles exist elsewhere. Norway is an instructive case. Figure 1 plots real house prices in the U.S. and Norway from 1890 to 2011. U.S. data are updated from Shiller (2005) while data for Norway are updated from Eitrheim and Erlandsen (2004, 2005). Both series show that real house prices were relatively stagnant for most of the 20th century. Norway and other Nordic countries experienced a major house price boom in the late 1980s followed by a crash in the early 1990s. The crash was accompanied by a financial crisis in Norway, Finland, and Sweden, resulting in numerous bank failures (Moe, et al. 2004 and Knutsen 2012). Interestingly, the earlier boom-bust pattern in Norway is similar in magnitude to the recent boom-bust pattern in U.S. house prices. After peaking in 2006, U.S. real house prices have since dropped by nearly 40 percent. Starting in the late 1990s, Norwegian house prices experienced another major boom but so far no bust. On the contrary, real house prices in Norway have continued to rise by nearly 30 percent since 2006.

[Figure 2 about here]

[Figure 3 about here]

Figure 2 plots price-rent ratios in the U.S. and Norway from 1960 onwards. The U.S. ratio peaked in early 2006 and has since fallen to its pre-boom level. The price-rent ratio for Norway has continued to trend upwards and currently stands about 50 percent above the last major peak achieved two decades ago. Figure 3 plots price-income ratios in the U.S. and Norway from 1980 onwards. Again, the recent ratio in Norway is substantially above the last major peak. Figure 4 compares household leverage ratios in the two countries. The U.S. ratio of household debt to disposable personal income peaked at about 130 percent in 2007. The household leverage ratio in Norway has risen rapidly over the last decade and currently stands at around 210 percent.

[Figure 4 about here]

Using data extending through 2008, Anundsen and Jansen (2011) find strong evidence of a self-reinforcing feedback loop between Norwegian house prices and household debt. In the words of the authors: "Higher housing prices result in higher credit growth due to collateral effects, which again spurs housing price growth and so on." Akram (2012) also finds that Norwegian house prices and household debt respond positively to each other in both the short-run and long-run. Consistent with such a link, the Norges Bank (2012a) recently stated (p. 41): "Policy measures which are directly aimed at restraining credit growth will thus also have a fairly immediate effect on the rise in house prices, and vice versa."

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[5] Similarly, Lansing (2009a) shows that survey forecasts of U.S. GDP price inflation are well-approximated by a moving-average of past observed inflation rates.

Some studies have found that at least part of the run-up in Norwegian house prices can be explained by changes in fundamentals. Variables involving lagged house prices are often included in such studies as part of an error correction specification. Jacobsen and Naug (2005), for example, report that favorable after-tax lending rates, low unemployment, and strong growth in wage income have all contributed to higher house prices using data extending through the first quarter of 2004. However, their study also finds that lagged house prices help to explain movements in current house prices, which suggests the presence of non-fundamental factors such as extrapolative expectations. Indeed, a long-term multi-country study by the International Monetary Fund (2004) found that lagged house price growth was an important explanatory variable for observed house price growth even after taking into account a wide range of other variables such as per capita real income growth, the level of interest rates, population growth, stock price growth, and the growth rate of real credit. The last two variables might also be viewed as reflecting non-fundamental factors. Recall that Japan experienced twin bubbles in stocks and real estate in the late 1980s while mortgage credit and house prices rose together in a self-reinforcing feedback loop during the U.S. housing bubble of the mid-2000s.[6]

**Table 1: Explaining House Price Growth in Norway**
$$\Delta_4 hp_t = \alpha + \beta_1(\Delta_4 hp_{t-1}) + \beta_2(\Delta_4 gdp_t) + \beta_3(r_t) + \varepsilon_t$$

| $\Delta_4 hp_t$ | I | II | III |
|---|---|---|---|
| $\alpha$ | 0.11*** | 0.01 | 0.01** |
| | (4.89) | (1.14) | (2.48) |
| $\beta_1$ | | 0.80*** | 0.85*** |
| | | (12.02) | (17.6) |
| $\beta_2$ | 1.63*** | 0.22 | |
| | (4.65) | (0.94) | |
| $\beta_3$ | -0.01*** | -0.001 | |
| | (-5.24) | (-0.67) | |
| $R^2$ | 0.45 | 0.79 | 0.79 |
| *Obs.* | 85 | 84 | 84 |

Notes: Sample period is 1991.Q1 to 2012.Q1. $\Delta_4$ denotes the 4-quarter change, $hp_t$ = log of real house price, $gdp_t$ = log of real GDP, $r_t$ = real interest rate defined as 4-quarter average nominal mortgage rate less 4-quarter average inflation rate. *t*-statistics are shown in parenthesis. *** indicates the variable is significant at the 1% level and ** indicates the variable is significant at the 5% level.

To illustrate the crucial role of lagged house price growth in helping to explain current house price growth in Norway, we estimate the following simple regression equation using quarterly data over the period 1991.Q3 to 2012.Q1:

$$\Delta_4 hp_t = \alpha + \beta_1(\Delta_4 hp_{t-1}) + \beta_2(\Delta_4 gdp_t) + \beta_3(r_t) + \varepsilon_{t,,}$$

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[6] A more recent IMF empirical study by Igan and Loungani (2012, Table 4) omits lagged house price growth as an explanatory variable but continues to include the lagged ratio of house prices to income, stock price growth, and credit growth. All three variables are often significant in helping to explain quarterly changes in real house prices in a variety of countries over the period 1970 to 2010.

where $\Delta_4 hp_t$ is the four-quarter change in the logarithm of the real house price index, $\Delta_4 rgdp_t$ is the four-quarter growth rate of real GDP, $r_t$ is the real mortgage interest rate (four-quarter average nominal mortgage rate minus four-quarter average inflation), and $\varepsilon_t$ is an error term. The empirical model is estimated with and without lagged house price growth as an explanatory variable and the results are reported in Table 1. The table shows that when lagged house price growth is omitted from the regression, the fundamental explanatory variables ($\Delta_4 rgdp_t$ and $r_t$) are both significant and the associated coefficients have the expected sign (Column I in Table 1). By themselves, however, these variables can only account for 45% of the variance in real house price growth over the sample period In contrast, the inclusion of lagged house price growth allows this simple empirical model to account for nearly 80% of the variance in real house price growth over the past 20 years (Column II in Table 1). Indeed, a simple first-order autoregressive time series model of real house price growth that completely ignores any fundamental variables performs just as well (Column III in Table 1).

Population growth in Norway, and more specifically the country's recent high immigration rate, is often cited as a possible fundamental driver of house prices. Figure 5 shows that real house prices and net migration have both increased relative to their long-run averages over the past decade. Similarly, employment in the Norwegian construction sector has trended up over the same time period. However, a careful examination of the data shows that house price movements tend to consistently lead movements in the other two series.[7] In other words, it appears that the rapid rise in Norwegian house prices is contributing to high immigration rates, possibly by stimulating demand for workers in construction and other sectors tied to the housing market.

[Figure 5 about here]

Restricted supply is another fundamental argument that is frequently put forth to justify the rise in Norwegian house prices. It is often argued that the limited buildable acreage in and around major cities such as Oslo prevents housing supply from keeping up with housing demand, thus driving up prices. Similar arguments were used to forecast never-ending house price run-ups in coastal areas during the U.S. housing boom (Leamer 2002). However, to the extent that rental housing is viewed as a substitute for purchasing a home, restrictions on supply would be expected to similarly drive up rents—something which is not observed in the data as evidenced by the rising price-rent ratio (Figure 2). A recent empirical study by Anundsen and Heebøl (2012) shows that U.S. regions with the lowest housing supply elasticities experienced the most pronounced boom-bust episodes in house prices from 2000 to 2010. The authors attribute their findings to a financial feedback mechanism whereby rapidly rising house prices in supply-restricted areas contributes to a loosening of lending standards which causes prices to overshoot on the upside. The same mechanism operates in reverse when house prices start falling, causing supply-restricted areas to also experience the most severe price declines.

In a report issued last year, the International Monetary Fund (2012b) concluded "[F]undamentals appear to explain part, but not all, of the house price boom in Norway. In particular, fundamentals such as higher income, population growth, and tax changes have all boosted demand. Additional pressures on prices have come from the slow adjustment of supply. However, non-fundamental factors such as optimistic price expectations—which are unlikely to be sustainable and could change quickly—have also played a role. Low interest rates and favorable financing conditions may also not be sustainable indefinitely. On balance, model-based

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[7] Evidence is based on Granger causality tests applied to an estimated vector error-correction model that includes real house prices, cumulative net migration, and construction employment over the sample period 1970 to 2011.

estimates…suggest that Norwegian residential property prices may be misaligned by 15 to 20 percent."

History tells us that episodes of sustained rapid credit expansion together with booming stock or house prices are almost always followed by periods of stress in the financial system (Borio and Lowe 2002, Riiser 2005, Grytten 2011). The recent Norwegian housing market trends have thus raised concerns among regulators about risks to financial stability. The Norges Bank (2012a) identifies the household sector as having a high level of risk or vulnerability to shocks. A report by the Financial Supervisory Authority (FSA) of Norway (2012a) emphasized the risks posed by growing debt burdens relative to income, high loan-to-value ratios, greater recourse to interest-only borrowing, and a widespread belief among residents that house price appreciation will continue. The report also noted that indebtedness had risen the most among young and low-income borrowers—a trend reminiscent of the U.S. housing boom. A report by the Norwegian Ministry of Finance (2012) noted that the proportion of home purchase loans with loan-to-value ratios exceeding 90% has increased markedly to 38% in 2011 and that one-in-four new residential mortgage loans was made on interest-only terms—the highest level since 1994. Most recently, the FSA (2012b) raised concern about the explosive growth in the issuance of covered bonds as a cheap funding source for Norwegian banks operating in the residential mortgage market.[8] According to the report, "Banks' access to relatively favorable funding of home loans on the covered bond market may thus have spurred growth in mortgage lending and intensified price pressures in the housing market."

[Figure 6 about here]

[Figure 7 about here]

[Figure 8 about here]

Figure 6 plots the results of a recent survey which shows that the percentage of Norwegian households who believe that property prices will keep rising has gone up from a low of 10 percent in 2008 to nearly 70 percent in 2012. Comparing Figure 6 to the price-rent ratio in Figure 2 suggests that Norwegian households expect high future returns on housing even after a sustained run-up in the price-rent ratio. This pattern is directly at odds with the idea of rationally low risk premiums. Figure 7 shows that the balance of Norwegian households expecting a house price increase over the next 12 months is strongly correlated with nominal house price growth over the preceding 12 months. Figure 8 shows that a similar pattern holds for Sweden. Both figures suggest that housing investors employ extrapolative or moving-average type forecast rules.

Another trend suggestive of housing speculation in Norway is the explosive growth in home remodeling. According to a recent news article, Norwegians were on track to purchase 1.5 million new kitchen cabinets in 2012—a huge number given the country's population of only about 5 million people (Berglund 2012). A spokesperson for the home furnishings firm IKEA is quoted in the article as stating "Norway is in a class of its own when it comes to remodeling." Since remodeling projects are typically financed with home equity loans, the home improvement boom is contributing to the buildup of household leverage. Choi, et al. (2011) note that spending on U.S. home remodeling surged during the boom years of the mid-2000s but then dropped precipitously

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[8] A covered bond is a structured finance product similar to a mortgage-backed security, but without risk transfer. Investors in covered bonds have an explicit claim to a pool of mortgages that are subject to quality criteria (e.g., less than 75% LTV). If, during the lifetime of the covered bond, assets in the collateral pool deteriorate, the issuer of the bond (the bank) must replace ineligible assets in the pool with assets that meet the quality criteria. Cao and Jurgilas (2013) develop a theoretical model to examine the financial stability implications of bank funding via covered bonds.

after 2007 when house prices were falling. They argue that such behavior is consistent with a model of housing speculation whereby existing homeowners seek to participate in the market for appreciating housing structures while holding their land ownership fixed.

[Figure 9 about here]

Figure 9 shows that there is a positive correlation between real house price changes and real consumption growth in Norway. A property price decline of 15 to 20 percent would be expected to exert a significant drag on overall economic growth. In an effort to address such risks, the FSA (2012a) has urged banks to: (1) reduce the maximum loan-to-value ratio on mortgages, (2) impose a maximum loan-to-income ratio on borrowers, (3) limit the issuance of interest-only mortgages, and (4) allow for a future interest rate increase of 5 percentage points when assessing a borrower's debt-servicing ability. If fully implemented, such measures would help lean against the expansion of a credit-fueled housing bubble.

[Figure 10 about here]

Figure 10 plots mortgage foreclosure filings in Norway as a percentage of the population. The source data are from the Norwegian court administration, as described by Grindaker (2013). The data show that foreclosure filings increased by 55% from 2006 to 2011, suggesting that financial stress among Norwegian households is on the rise, despite what appears to be an otherwise healthy economy. It's worth noting that U.S. mortgage delinquencies started trending up well before the onset of the Great Recession (U.S. Financial Crisis Inquiry Commission 2011, Chapter 11).


## 6. Policy Implications

"Nowhere does history indulge in repetitions so often or so uniformly as in Wall Street…The game does not change and neither does human nature," observed legendary speculator Jesse Livermore way back in the year 1923.[9] History has proven him right. The dramatic run-up and crash of the U.S. stock market in the late 1920s was followed decades later by twin bubbles and crashes in Japanese real estate and stocks during the late 1980s and early 1990s. Nordic countries experienced a boom-bust episode in real estate prices that led to a banking crisis in the early 1990s. These events were followed by the U.S. technology stock mania of the late 1990s, which reversed course in March 2000. Most recently, a global housing bubble during the mid-2000s nearly brought down the world's financial system when, like all preceding bubbles, it ultimately burst. Despite these many historical examples, the appropriate response of monetary policy to booming asset prices and rapid credit growth remains an unsettled issue.

A common feature of all bubbles which complicates the job of policymakers is the emergence of seemingly-plausible fundamental arguments that seek to justify the dramatic rise in asset prices. One fundamental argument for asset price run-ups involves a decline in the risk premium of rational investors. However, as we have argued, this explanation seems clearly refuted by a variety of evidence which shows that real-world investors typically expect high future returns near market peaks.

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[9] From Livermore's thinly-disguised biography by E. Lefevére (1923, p. 180).

Shiller (2005) documents that major speculative bubbles have generally coincided with the emergence of some "new era" theory that involves the introduction of new technology.[10] The enthusiasm expressed by Greenspan (2005) for the use of new information technology to efficiently price risk in the subprime mortgage market fits perfectly with this pattern. Excessive run-ups in asset prices can have important consequences for the economy as firms and investors respond to the price signals, potentially resulting in capital misallocation.[11]

Another lesson from history is that bubbles can be extraordinarily costly when accompanied by significant increases in borrowing. On this point, Irving Fisher (1930, p. 341) famously remarked, "[O]ver-investment and over-speculation are often important; but they would have far less serious results were they not conducted with borrowed money." The use of leverage magnifies the contractionary impact of a decline in asset prices. The typical residential housing transaction is financed almost entirely with borrowed money. It is therefore not surprising that: (1) housing-bust recessions tend to be longer and more severe than stock-bust recessions (International Monetary Fund 2009), and (2) the severity of housing-bust recessions is positively correlated with prior increases in household leverage (Glick and Lansing 2010, International Monetary Fund 2012a). A study by King (1994) identified a positive correlation between prior increases in household leverage and the severity of the early 1990s recession using data for ten major industrial countries from 1984 to 1992. He also notes that U.S. consumer debt more than doubled during the 1920s— a factor that no doubt contributed to the severity of the Great Depression in the early 1930s. The unwinding of excess household leverage typically involves lengthy periods of sluggish growth in GDP and employment (Reinhart and Reinhart 2010, Roxburgh, et al. 2012). As noted originally by Persons (1930, p. 119), "When the process of expanding credit ceases and we return to a normal basis of spending each year...there must ensue a painful period of readjustment." Such outcomes were certainly true for the U.S. housing market of the mid-2000s. Time will tell whether things will turn out differently for the Norwegian housing market.

The extensive harm caused by the global financial crisis raises the question of whether policymakers could have done more to prevent the buildup of dangerous financial imbalances, particularly in the household sector. An important unsettled question in economics is whether policymakers should take deliberate steps to prevent or deflate suspected asset price bubbles.[12] The mainstream view prior to the crisis was that central banks should not attempt to prick a suspected bubble. Instead, according to former Fed Chairman Alan Greenspan (2004c), they should follow a "strategy of addressing the bubble's consequences rather than the bubble itself." This view is predicated on the idea that it is difficult for policymakers to identify a bubble in real time.

However, central banks regularly respond to economic variables that are difficult to measure in real time, such as the "output gap," defined as the difference between actual and potential GDP. According to Borio and Lowe (2002), bubble-popping skeptics fail to sufficiently take into account the asymmetric nature of the costs of policy errors when faced with a suspected bubble (p. 26): "If the economy is indeed robust and the boom is sustainable, actions by the authorities to restrain the boom are unlikely to derail it altogether. By contrast, failure to act could have much more damaging consequences, as the imbalances unravel."

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[10] Major stock price run-ups occurred in the early 1900s (high speed rail travel), the 1920s (mass-production of automobiles), the 1960s (television and space travel), and the late 1990s (internet-based business model). For additional discussion, see Lansing (2009b).

[11] Lansing (2012) examines the welfare consequences of technology-driven bubbles in a model where excessive asset price run-ups can affect the economy's trend growth rate.

[12] For an overview of the various arguments, see Lansing (2003, 2008).

In the midst of the U.S. housing boom, former Fed Chairman Paul Volcker (2005) called attention to several disturbing economic trends in an opinion piece titled "An Economy on Thin Ice." Specifically, he noted that "personal savings in the United States have practically disappeared," and that "home ownership has become a vehicle for borrowing." He called for federal policies to "forcibly increase" the saving rate as a way to address the growing imbalance between domestic spending and domestic production.

The official report of the U.S. Financial Crisis Inquiry Commission (2011) states (p. xvii): "We conclude this financial crisis was avoidable…Despite the expressed view of many on Wall Street and in Washington that the crisis could not have been foreseen or avoided, there were warning signs. The tragedy was that they were ignored or discounted. There was an explosion in risky subprime lending and securitization, an unsustainable rise in housing prices, widespread reports of egregious and predatory lending practices, dramatic increases in household mortgage debt…among many other red flags. Yet there was pervasive permissiveness; little meaningful action was taken to quell the threats in a timely manner. The prime example is the Federal Reserve's pivotal failure to stem the flow of toxic mortgages, which it could have done by setting prudent mortgage-lending standards."

In light of the severe economic fallout from the crisis, policymakers' views regarding the use of monetary policy to lean against bubbles appear to be shifting. [13] In an interview during the crisis (Wall Street Journal 2008), Fed Chairman Ben Bernanke was asked "What are the lessons of the last few years from the economy and from the financial markets for the conduct of monetary policy?" In response, Bernanke said, "[O]bviously the last decade has shown that bursting bubbles can be an extraordinarily dangerous and costly phenomenon for the economy and there is no doubt that as we emerge from the financial crisis, we will all be looking at that issue and what can be done about it."

In a speech years earlier, Bernanke (2002) emphasized that central banks should take deliberate steps to prevent deflation. In particular, he asserted that "Sustained deflation can be highly destructive to a modern economy and should be strongly resisted...For this reason, as I have emphasized, prevention of deflation is preferable to cure." The most well-known historical examples of deflation have occurred in the aftermath of burst asset price bubbles, specifically during the U.S. Great Depression of 1930s and Japan's lost decades of the 1990s and 2000s. If a bursting bubble can set the stage for deflation which in turn would be "highly destructive to a modern economy," then the same logic of "prevention is preferable to cure" would seem to imply that monetary policy should strive to prevent bubbles from becoming too large in the first place. In the words of San Francisco Fed President Janet Yellen (2009), "What has become patently obvious is that not dealing with certain kinds of bubbles before they get big can have grave consequences. This lends more weight to arguments in favor of attempting to mitigate bubbles, especially when a credit boom is the driving factor."

This brings us to the question of what policy instruments should be used to lean against bubbles. A broad view of monetary policy includes regulatory oversight of financial markets and institutions. Many have argued that a central bank's interest rate policy is too blunt an instrument and that macroprudential regulations are better suited to restraining bubbles. However, macroprudential policy may not be a magic bullet. Unfortunately, as history attests, regulations put in place after a crisis to prevent financial imbalances are often unwound over time, setting the stage for the next bubble and crisis (Gerding 2006). In this regard, a central bank's interest rate policy may have a distinct advantage because it stands ready to be deployed against bubbles by

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[13] Malliaris (2012) reviews the evidence of a shift in central bank policy thinking in favor of leaning against bubbles.

vigilant central bankers, regardless of the regulatory environment. As noted by Boivin, et al. (2010), even if one stipulates that macroprudential regulation should be the first line of defense against financial imbalances, it need not be the only line of defense.

An example of the dangers of relying solely on macroprudential guidelines can be found in the U.S. housing boom of the mid-2000s. Figure 11 shows that standard loan-to-value measures did not signal any significant increase in household leverage during the boom years because the value of housing assets rose together with mortgage debt in a self-reinforcing feedback loop. Only after the collapse of house prices did the loan-to-value measures provide an indication of excessive household leverage. But by then, the over-accumulation of household debt had already occurred. Indeed, in a February 2004 speech, Fed Chairman Alan Greenspan (2004b) remarked "Overall, the household sector seems to be in good shape, and much of the apparent increase in the household sector's debt ratios over the past decade reflects factors that do not suggest increasing household financial stress." Similarly, in an April 2004 speech, Fed Governor Donald Kohn (2004) stated "And, while [household] debt has been increasing, assets on household balance sheets have been rising even more rapidly. Barring a collapse in house or equity prices…household net worth should remain comfortably above the levels of a few years ago."

[Figure 11 about here]

A basic problem with loan-to-value constraints is that the denominator (i.e., value) is subject to excess volatility. A debt-to-income constraint represents a more prudent lending criterion than a loan-to-value constraint because income, unlike asset value, is less subject to distortions from bubble-like movements in asset prices. Figure 11 shows that the ratio of U.S. household mortgage debt to disposable personal income started to rise rapidly around 2001—about five years before the peak of the bubble—thus providing regulators with an early warning signal of a potentially dangerous buildup of household leverage. Unfortunately, the signal was not heeded.

A study by Gelain, et al. (2013) shows that increasing the emphasis on the borrower's wage income in the lending decision can help dampen fluctuations in household debt and other macroeconomic variables in the context of a quantitative general equilibrium model. Interestingly, the most successful stabilization policy in the model calls for lending behavior that is basically the opposite of what was observed during the U.S. housing boom. As the boom progressed, U.S. lenders placed less emphasis on the borrower's wage income and more emphasis on expected future house prices. So-called "no-doc" and "low-doc" loans became increasingly popular.[14] Loans were approved that could only perform if house prices continued to rise, thereby allowing borrowers to refinance. In retrospect, it seems likely that stricter adherence to prudent debt-to-income guidelines would have forestalled much of the housing bubble, such that the subsequent reversal and the resulting financial turmoil would have been far less severe.[15]

Recently, the Committee on International Economic and Policy Reform (2011) issued a report that called for central banks to go beyond their traditional emphasis on flexible inflation targeting and adopt an explicit goal of financial stability. The committee recommended that macroprudential tools be used in conjunction with monetary policy to achieve this goal. Some central banks are already moving in this direction. In its recent renewal of the inflation-control

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[14]According to the report of the U.S. Financial Crisis Inquiry Commission (2011, p. 165), "Overall, by 2006, no-doc or low-doc loans made up 27% of all mortgages originated."

[15] A cross-country empirical study by Lim, et al. (2011) examines the use and performance of loan-to-value constraints versus debt-to-income constraints together with other macroprudential policy tools. Their regression results (p. 53) show that the implementation of a debt-to-income cap is more effective than a loan-to-value cap in reducing the growth rates of real estate prices and credit.

target, the Bank of Canada (2011) stated (p. 26): "Where imbalances pose an economy-wide threat and/or where the imbalances themselves are being encouraged by a low interest rate environment, monetary policy might itself be the appropriate tool to support financial stability."

Along similar lines, the Norges Bank recently announced a new loss function for monetary policy analysis that is explicitly designed to take into account the risk that a period of abnormally-low interest rates may contribute to a build-up of financial imbalances (Evjen and Kloster 2012). As explained in the Norges Bank Monetary Policy Report (2012b, p. 16): "Low interest rates for extended periods can increase the risk that debt and asset prices will move up and remain higher than what is sustainable over the economic cycle….High debt levels make borrowers more vulnerable and increase the risk of long-term instability in the real economy. A sudden, unexpected drop in incomes, higher unemployment or other macroeconomic shocks may result in a fall in property prices, creating imbalances between borrowers' debts and the value of leveraged assets. By incorporating the interest rate level in the loss function, the Bank is seeking to counter the buildup of such imbalances."

Bank of England Governor Mervyn King (2012) recently stated "It would be sensible to recognize that there may be circumstances in which it is justified to aim off the inflation target for a while in order to moderate the risk of financial crises. Monetary policy cannot just mop up after a crisis. Risks must be dealt with beforehand."

Going forward, it seems likely that more central banks will reach the conclusion that a balanced approach involving both macroprudential regulation (first line of defense) and interest rate policy (second line of defense) is the best way to prevent credit-fueled financial imbalances.


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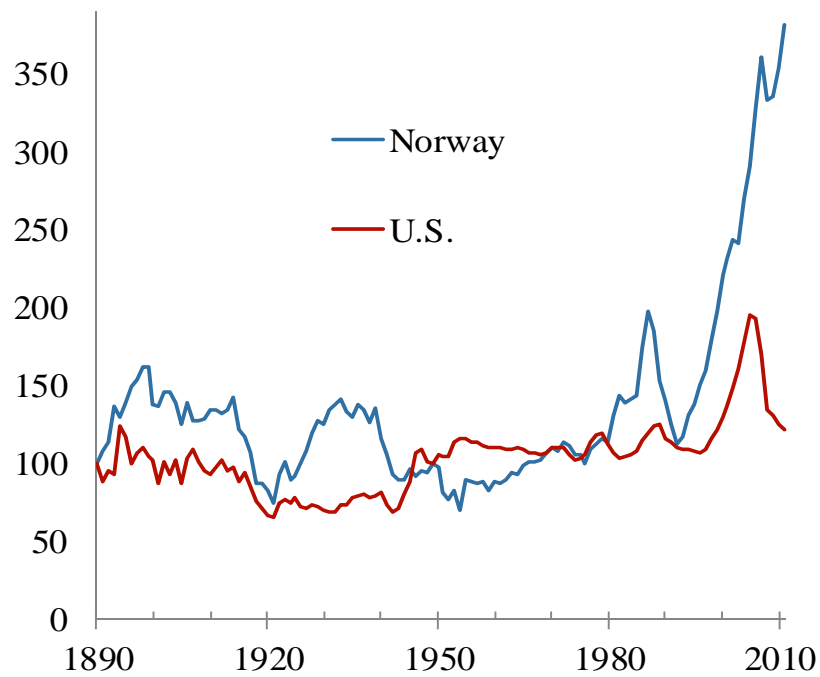
Figure 1: Real house price indexed to 100 in 1890.
Source: Updated from Shiller (2005) and Eitrheim and
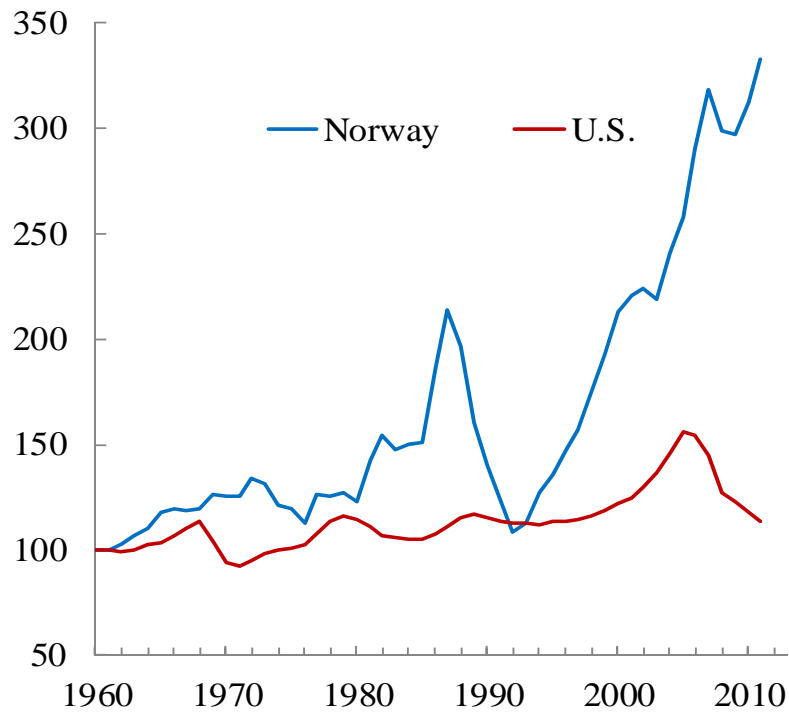Erlandsen (2004, 2005).



Figure 2: Ratio of house price to rent, 1960 - 2011.
Ratio indexed to 100 in 1960. Source: Lincoln
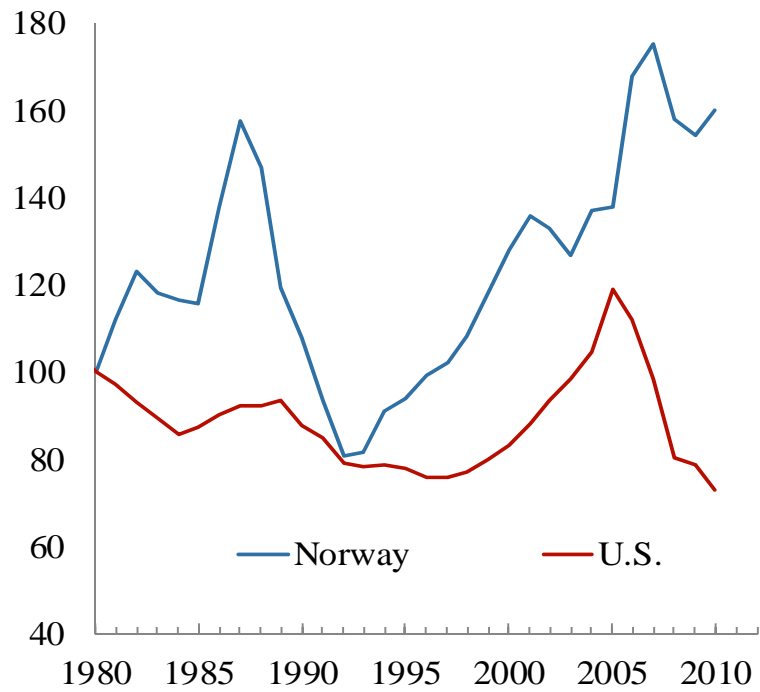Institute of Land Policy, Statistics Norway.

Figure 3: House prices deflated by per capita disposable income, indexed to 100 in 1980. Source: FRB St. Louis, Norges Bank.
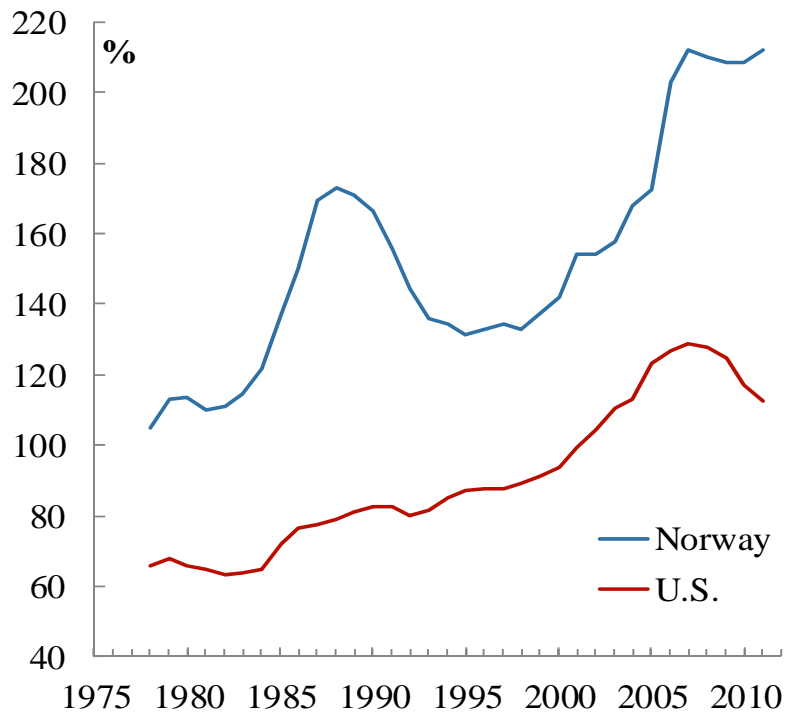


Figure 4: Ratio of household debt to disposable income, 1978 - 2011. Source: FRB St. Louis, Norges Bank.
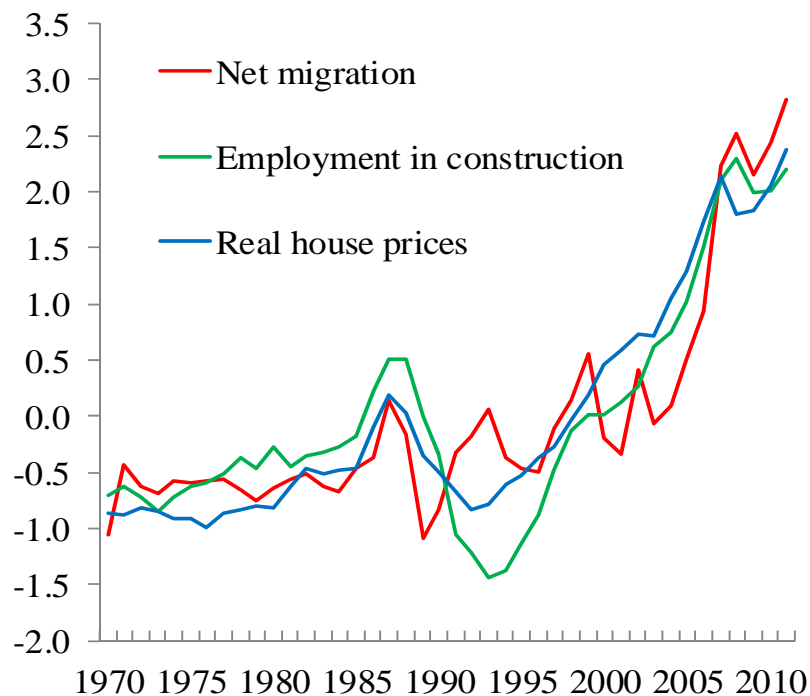
Figure 5: Net migration, employment in construction sector, and real house prices in Norway. Note: All series shown as deviations from sample mean scaled by sample standard deviation. Source: Statistics Norway.
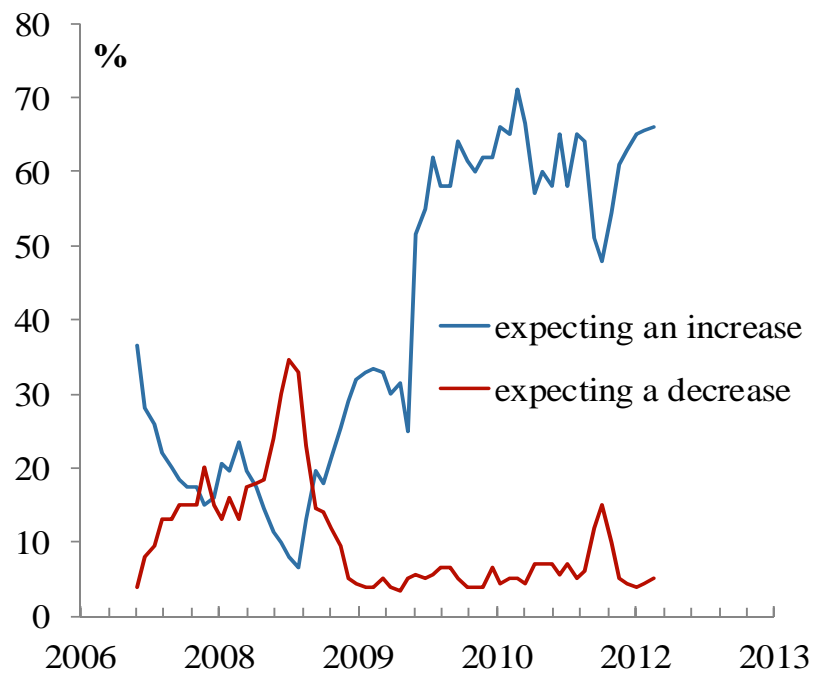


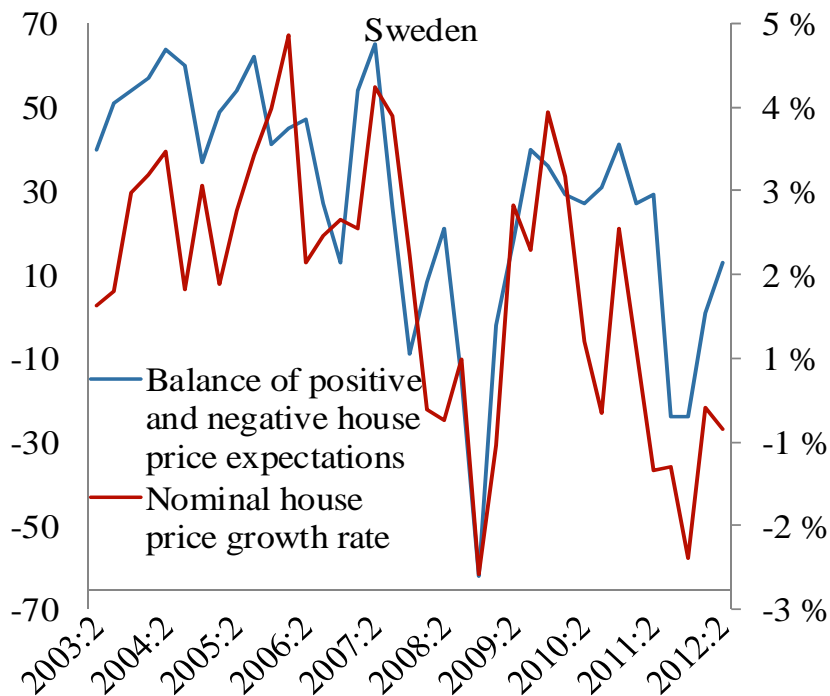Figure 6: Expectations of Norwegian households for house prices over the next 12 months. Source: Financial Supervisory Authority of Norway.
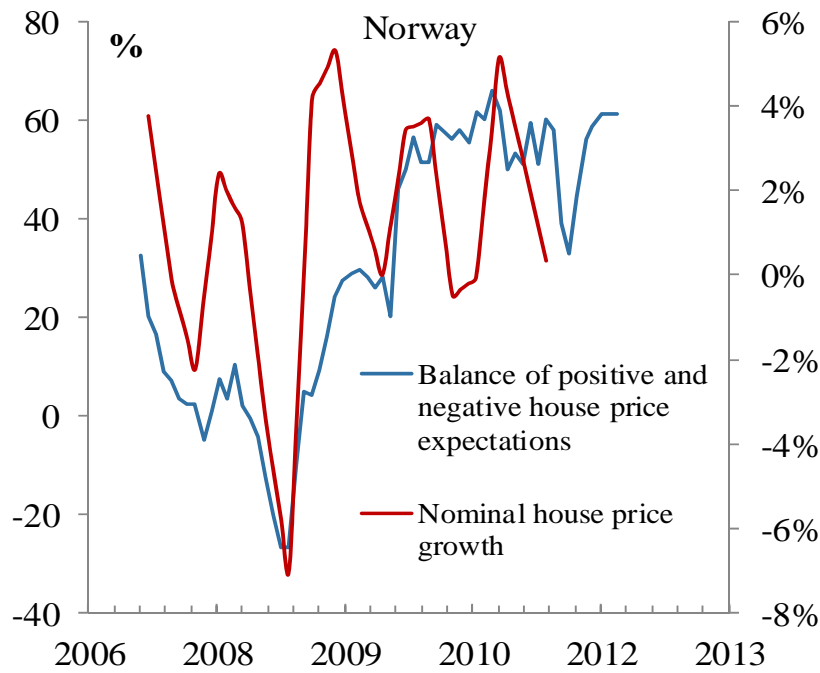
Figure 7: House price expectations (balance between those expecting an increase and a decrease, left axis) and nominal house price growth (right axis) in Norway.



Figure 8: House price expectations (balance between those expecting an increase and a decreases, left axis) and nominal house price growth (right axis) in Sweden.
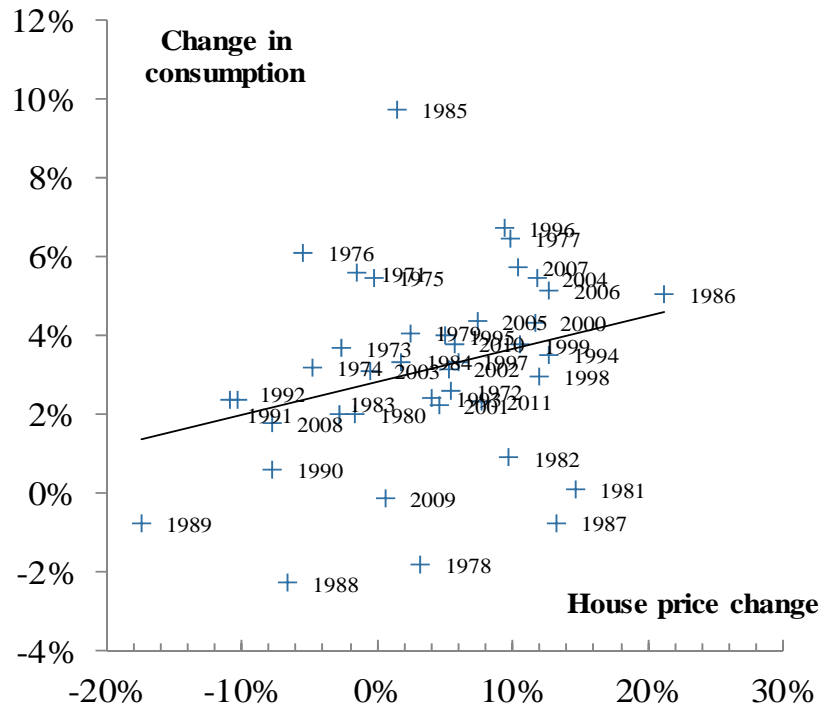
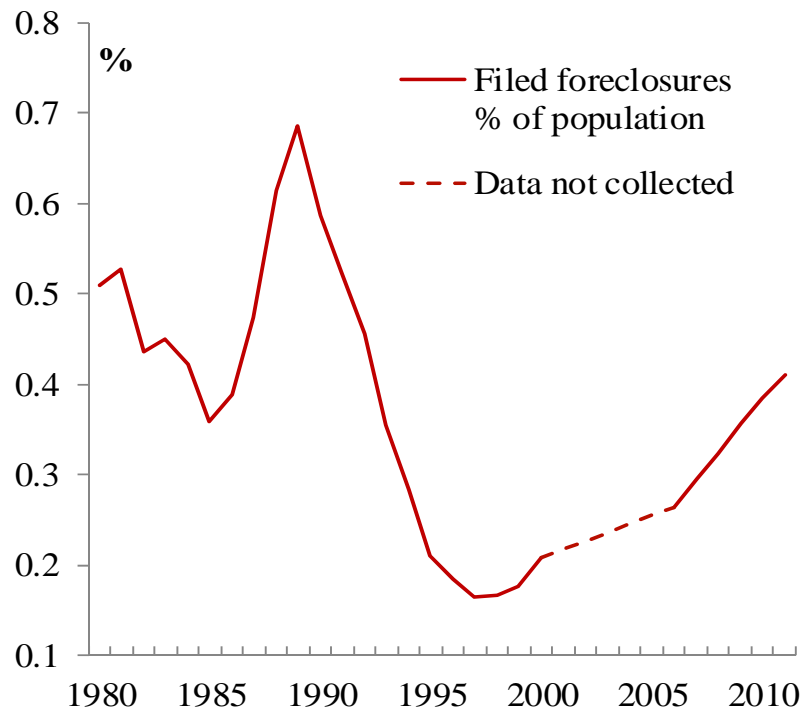Figure 9: Changes in real household consumption and real house prices, 1971 - 2011. Source: Norges Bank.



Figure 10: Filed foreclosures as a percent of population. Source: Norwegian court administration (Begjæringer om tvangssalg), Grindaker (2013).
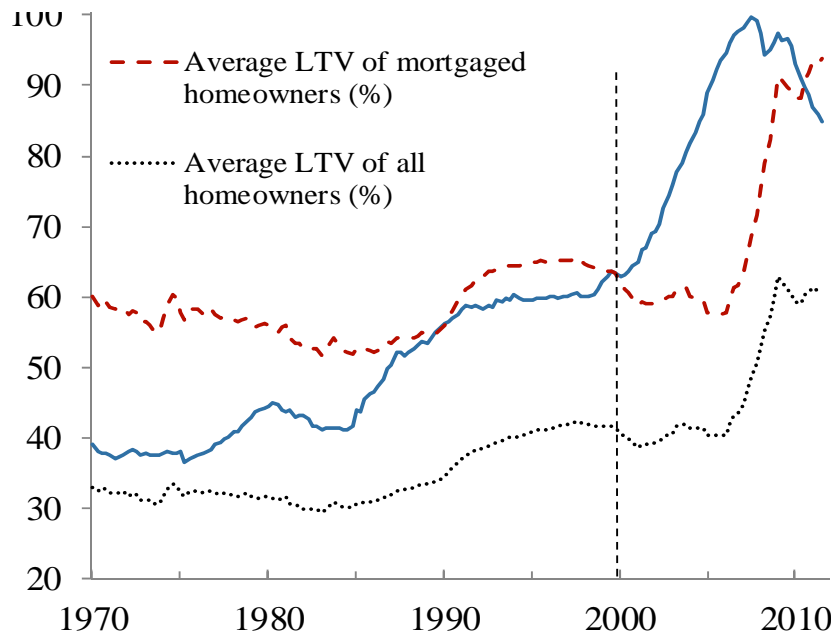
Figure 11: Leverage ratios for U.S. households: Loan-to-value (LTV) versus debt to income. Source: FRB St. Louis (William Emmons) and Federal Reserve Flow of Funds Accounts.