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Asset valuations and financial stability

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Sweden and many other countries are in a period of low inflation. Therefore, interest rates in Sweden and globally have been trending down in recent years. This highly expansionary monetary policy could have the side effect of fostering imbalances in financial markets by inflating asset prices. This Economic Commentary examines the prices of equities, bonds, and housing in Sweden, and concludes that the current valuations in both equities and housing seem high by historical standards. After narrowing for several years, the credit spreads in both corporate bonds and covered bonds have widened somewhat in recent months. While high valuations do not necessarily lead to large falls in asset prices, they do pose risks to financial stability by increasing the probability of such an occurrence.

Introduction

Long-term interest rates in Sweden have been trending down in recent years, at a pace that is broadly similar to other advanced economies around the world. Monetary policy has been expansionary due to inflation being below the two per cent target. Since early 2015, the repo rate has been negative, and it currently stands at -0.35 per cent. In February 2015, the Riksbank also launched a program of quantitative easing by buying government bonds. Going forward, the repo rate is expected to stay at this low level until the first half of 2017.

The interest rate tool used by the Riksbank to stimulate economic activity and to bring inflation closer to target could possibly have the side effect of fostering imbalances in asset markets by inflating asset prices, if not counterbalanced by other measures. In this Economic Commentary, we examine the valuations of three asset classes: equities, bonds, and housing, to shed light on whether current asset valuations may be high by historical standards, therefore raising the likelihood of a disorderly correction in asset prices in the future.

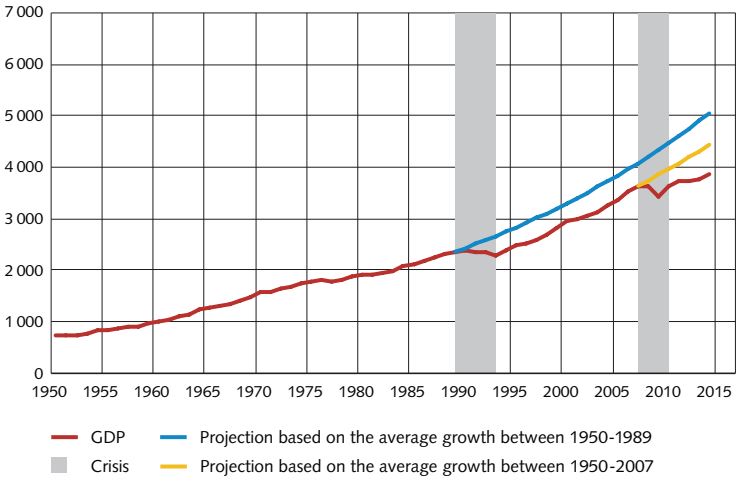
Of course, even if stretched valuations are found, predicting if, when, and how asset prices could behave in a disorderly fashion in the near future is very challenging. Therefore, rather than forecasting asset price behaviour, our objective is to identify vulnerabilities in asset markets so that policy makers can consider macroprudential measures to counteract imbalances, and/or to enhance the resilience of the financial system by safeguarding against a potential downfall.

Historical experiences and international evidence show that large and persistent falls in asset prices could have sizable and long term negative effects on the real economy. If such asset price falls take place during a financial crisis, fire-sale externalities and seizing up in financial markets could produce large negative shocks that are both severe in magnitude and long-lasting in duration. As documented in Reinhart and Rogoff (2009), using data from a large number of economies around the world over a fairly long period of time, financial-crisis-induced recessions on average were found both to be more severe, and to take much longer to heal than non-financial-crisis recessions. Moreover, in recent decades, a number of financial crises, particularly the banking crisis in the 1990s and the 2008 global financial crisis, were shown to exhibit apparently permanent effects on the economy, as shown by Swedish GDP in Figure 1.

Before delving into the valuations in the three asset markets, it would be useful to briefly discuss the valuation methods, the co-movements between Swedish valuations and international valuations, and the effecs of interest rate normalisation on asset prices.

1. We thank Jesper Lindé and Karl Walentin, both from the Monetary Policy Department of the Riksbank, for their contributions to the housing analysis. Helpful comments and suggestions on earlier drafts by Riksbank staff are gratefully acknowledged.

Figure 1. Development of Swedish GDP before and after a financial crisis
Billion SEK



Note. The gray areas represent the crisis in the 1990's and the 2008-2009 financial crisis.
Sources: National Institute of Economic Research and the Riksbank

Valuation methods

In this analysis, we employ a variety of commonly used valuation metrics, as well as econometric models to examine asset valuations. A large literature suggests that valuation ratios such as the price-to-earnings ratio and the price-to-rent ratio help predict asset returns at medium to long horizons (Campbell and Shiller (1988), Shiller (2005)). The precise strength of this predictive power is quite uncertain, but few would dispute the finding that, across asset classes, high valuation ratios increase the chance of a large fall in prices in the medium-term. The academic literature has mainly discussed the interpretation of this predictability.

The general finding can be summarised as follows: high valuations tend to predict below-average future asset returns rather than above-average future increases in fundamentals. This is true for stocks, bonds, and housing prices (see Ilmanen (2011) for an extensive survey across asset classes).

Although valuation ratios have forecasting power in the medium term, the ability to say something about near-term asset price developments remains very difficult. In general, a valuation ratio above its long-term mean tends to predict below-average return at medium- to long-term horizons, but it rarely suggests a higher probability of negative returns than positive returns.

Strong co-movements between valuations

When analysing Swedish asset prices, it is crucial to take a look at international valuations in both equities and bonds. This is due to the fact that Swedish and international valuations have exhibited strong co-movements over the last three decades. For stock prices, this relationship is particularly tight. Long-term bond yields in Sweden also co-move fairly strongly with bond yields in other advanced economies. With globalisation and more integrated financial markets, it seems reasonable to expect the strong co-movement in asset prices between Sweden and other advanced economies to continue. Thus, we expect any development in Swedish asset prices to be in the same direction as in Europe and the United States.

What will happen when interest rates normalise?

According to standard valuation models (such as the Gordon model (Gordon 1959) and its extensions), the price-to-earnings and the price-to-rent ratios should be negatively related to the real interest rate. However, the effect would not be large, unless real interest rate changes are both large and expected to be persistent. As such, if monetary policy in Sweden normalises because the inflation rate is moving closer to the target, the theory of rational expectations implies that the small net change in the real interest rate would only have a small impact on asset returns.

However, in practice, an empirical puzzle confounding financial economists is that since the 1950s, asset returns are found to co-move much more strongly with nominal interest rates than with real interest rates (Campbell and Vuolteenaho 2004, Ilmanen 2011). As such, alternative models have been proposed to explain stock returns. Among them, one of the most prominent is Modigliani and Cohn (1979), who assume money illusion among equity investors. Brunnermeier and Julliard (2008) argue that money illusion is especially strong in the housing market, where the highly visible monthly mortgage payments are directly proportional to the nominal interest rate. If households compare the monthly mortgage payments with the monthly rental price on a house, they might exhibit money illusion. If the empirical relation between asset valuations and nominal interest rate continues to hold, an increase in nominal rates could precipitate a fall in asset prices, including housing prices, even when the increase in the nominal rate is in lock-step with the higher inflation rate.

In what follows, we analyse whether there are signs of inflated asset prices by examining the valuations of equities, bonds and housing in Sweden.

Equity Markets

Research shows that stock market crises (sharp and prolonged falls in equity prices) do affect the real economy, but not to the same extent as debt and housing crises (Reinhart and Rogoff 2008). Although a stock market crash by itself might not be as destabilising as a debt crisis, falling stock prices nonetheless could trigger or aggravate an ongoing debt crisis. The crash of 1929 in the United States and the crash of the Japanese stock market in 1990 are prominent examples of how the debt crisis and the stock market crisis reinforced each other with severe consequences for the real economy.[2] Brunnermeier and Schnabel (2015) emphasise that, historically, equity crashes that had strongly negative effects on the real economy were almost always accompanied by lending booms. Hence, since both equity valuations and household debts in Sweden are currently quite high, it seems prudent to give some thoughts to stock market valuations.

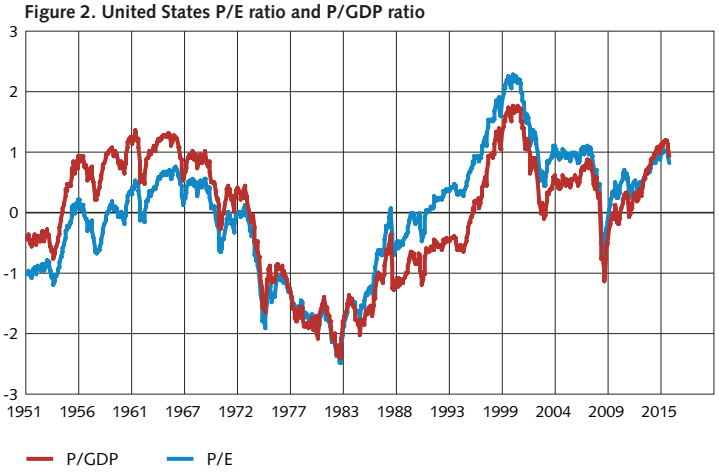
Valuation measures for stock indexes

The dividend yield (D/P) is perhaps one of the most theoretically appealing valuation measures for equities, and was widely used to gauge equity valuations before the 1990s. Since then, it has become apparent that firms were reducing dividends and using the cashflows instead to repurchase shares in order to lessen the tax burden on shareholders. The academic literature has explored several adjustments to take stock repurchases into account, and the price-earnings ratio (P/E) and its inverse, the earnings yield (E/P), have become widely used valuation measures. Corporate earnings are quite volatile, so the price-earnings ratio is usually smoothed by averaging earnings over a five or ten year period, as in Shiller's Cyclically-Adjusted-Price-Earnings ratio (CAPE). While smoothing earnings is empirically necessary, it also has drawbacks. For example, business cycle frequency, amplitude, and duration are highly irregular, so that averaging earnings over a fixed horizon could make interpretation challenging and time-series comparison difficult.

Alternative measures have been proposed to mitigate some of the shortcomings of the P/E ratio while providing qualitatively similar signals. One such alternative is market capitalisation over GDP, or the P/GDP ratio (where P is a stock index) because the empirical data support the theoretical argument that this ratio should be mean-reverting over long periods (see Figure 2).

2. The 1929 crash is generally known as a stock market crisis, but Mian and Sufi (2014) have recently documented a very large increase in private debt in the run-up to the crash.

Figure 2. United States P/E ratio and P/GDP ratio



Note. Standardized, sample 1950-2015.
Source: Shiller's web page

The central finding of Campbell and Shiller (1988) is that high valuations predict low future returns rather than high growth rates in real dividends (or real earnings). Predicting earnings growth is a task that has humbled both econometric models and financial analysts; for asset valuations over a long horizon, research suggests that the historical mean seems fairly robust. So, under the premises that future earnings are not accurately forecastable, the insights from Campbell and Shiller suggest that high valuation ratios imply low growth rates in stock prices.

What causes overvaluation?

We define overvaluation as a high P/E (or similar) ratio, which, under the framework of Campbell and Shiller, is associated with below-average future returns. A great deal of behavioural finance literature has linked overvaluation to systematic biases in human behaviour in the following ways:

- Excessive extrapolation of recent returns.
- Overconfidence in "this time is different" stories that justify high valuations.
- House money effect, that is, the tendency to exhibit lower risk aversion after a good streak of returns.

The insight of the house money effect is shared by recent models with rational agents, namely, the idea that risk aversion is lower (higher) when people feel richer (poorer) than in their recent past. In fact, the class of asset pricing model with habit formation has time-varying risk aversion at its core.

As noted by Brunnermeier and others at least since Keynes, overvaluations are very difficult for contrarian investors to deflate, so they can persist for long periods.

Interest rates and stock market valuation

In rational expectations models of asset valuations (such as the Gordon model in Gordon (1959) and its extensions), the P/E or P/D ratio is affected by forecasts of the future real interest rate. Since the long-run real interest rate forecast is fairly stable, the predicted effects of real interest rates on stock market valuations in these models are fairly modest. In contrast, if real interest rates are in fact expectedto be low in the future, this would imply a higher valuation.

On the other hand, the empirical experience of the last sixty years and the dominant view among practitioners suggest a different view. One popular model of stock market valuation among practitioners is the so called Fed Model, which relates the yields on stocks (E/P or D/P) to the yields on government bonds. Practitioners argue that the yield on bonds plus a constant or slow-moving risk premium represents an equilibrium yield stocks are expected to earn over sufficiently long horizons. An implication of the model is that low nominal bond yields will also tend to drive earning yields down, so that equity overvaluation is more likely in periods of low nominal bond yields.

The Fed Model has been quite successful as an empirical description of asset prices (see for example Asness (2003). This has puzzled economists for a long time because the model relates a real quantity (E/P) to a nominal one (the nominal interest rate), which seems hard to reconcile theoretically. Intriguingly, the data shows a much stronger relation between stock prices and nominal interest rates, rather than real interest rates.

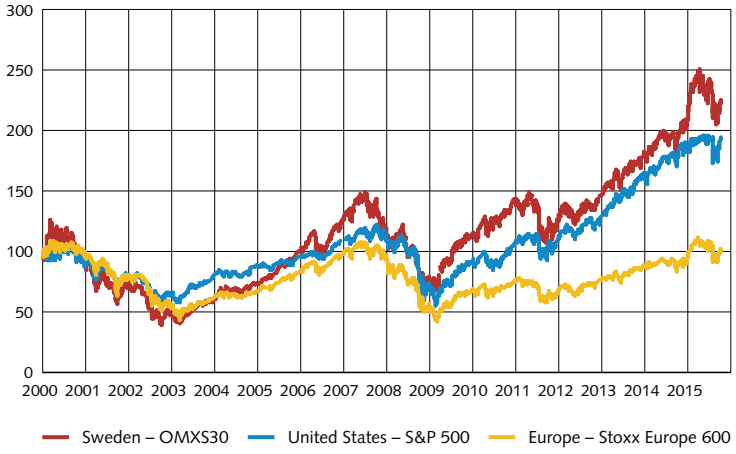
Among the most prominent theories in explaining the nominal interest rate effects is Modigliani and Cohn (1979), who assumed that stock investors suffer from money illusion and approximate the real interest rate with the more readily available nominal rate. Using more recent data and methods, Ritter and Ward (2002) and Campbell and Vuolteenaho (2004) provide further support for this interpretation of the data. Thus, according to this theory, an increase in nominal interest rates from their current record low levels could have a negative effect on stock market prices.[3, 4]

Are Swedish and international stock markets currently overvalued?

Swedish stock market valuations have been moving in lock-step with those in the United States and Europe, as shown in Figure 3. Hence, shocks to the US or European stock markets are likely to have repercussions on Swedish equities.

For the US, both the P/E ratio of the S&P 500 and the market cap/GDP ratio are well above their historical mean, and are currently about as high as just prior to the 2008 financial crisis (Figure 4). The valuations for Swedish equities are broadly similar, with market capitalisation to GDP (shown in Figure 4) and P/GDP (with P the OMX index) approximately at the same levels reached just before the stock market crashes of 2000 and 2008. Hence, the above analysis of the various measures of equity valuation suggests that equity prices are high in a historical comparison.[5]

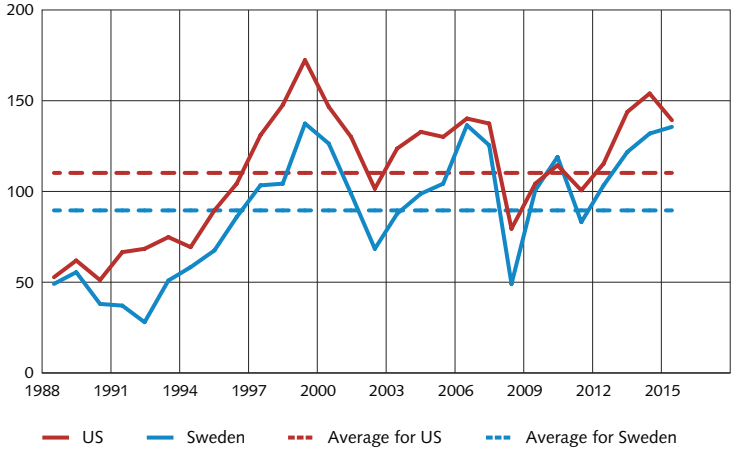
Figure 3. Stock indices
Index, 1 Jan 2000=100



Sources: Bloomberg and the Riksbank

3. It is important to remember that movements in E/P and nominal interest rates are very persistent, making precise inference difficult. Hence, the correlation between nominal interest rates and earning yields could break down in the future.
4. The low interest rate environment might encourage otherwise conservative investors to search for yields outside of the government bond market, leading to downward pressure on the yields of riskier assets.
5. In this analysis, the ratio of market capitalization to GDP is preferred to the more commonly used price to earnings ratio in this analysis because the time series data on Swedish firms' earnings available to us does not go back very far, and smoothing the earnings using a ten-year moving average as in CAPE provides a long-run mean that is rather short to be meaningful. Moreover, the ratio of capitalization to GDP is found to be a better predictor of future returns based on U.S. data (Ilmanen 2011).

Figure 4. Market capitalisation to GDP
Per cent of GDP



Sources: World Bank, the Riksbank and own calculations (estimates for the period after 2012) based on the GDP and the value of OMX and S&P500 indices

Bond Markets

In this section, we examine bond market valuation through the same lens that was used in equity market valuation. We would like to know whether bond prices look stretched so that future bond returns are expected to be low or even negative. To answer this question, we primarily focus on bond risk premium: credit risk premium for corporate bonds and covered bonds and term premium for government bonds. A compressed bond risk premium means that the required return for bearing risk – default risk in corporate bonds and covered bonds and interest rate risk in government bonds – is low relative to historical averages.[6]

An unusually low credit risk premium in corporate bonds implies that the default risk is low or that the price for bearing default risk is low, or both. Historically, low credit spreads have predicted low corporate bonds returns better than low default rates (Ilmanen 2011), suggesting a low risk premium. A renormalisation of the credit risk premium would unambiguously tighten financial conditions that would have negative effects on real activities, ceteris paribus. More importantly, a disorderly renormalisation of the credit spread could, at the limit, lead to failure in the bond market that is akin to a credit freeze. While the risk of such occurrence may be very small, we nevertheless witnessed the freezing up in certain credit markets in the United States during the recent financial crisis.

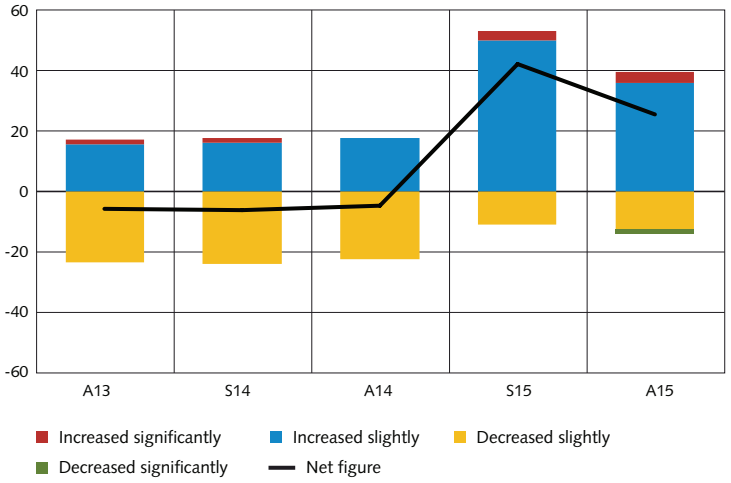
In the next section, we first take a look at some survey evidence on risk-taking by bond market participants in Sweden. This is followed by our analysis of the bond risk premium in the corporate bond market and the government bond market.

The Riksbank Risk Survey

Let us first take a look at the risk survey conducted among institutional investors, who can be considered informed investors[7], by the Riksbank in autumn 2015.[8] About one half of the survey respondents reported that the total risk level in the Swedish financial system over the past six months on balance has not changed much. Interestingly, among those respondents that reported a change in risk (53 per cent), a majority of them perceived a higher risk in the Swedish financial system, as shown in Figure 5.

6. Dattatreya and Fabozzi (2001) discuss risks associated with investments in fixed-income securities.
7. Analyzing the data for Taiwanese auctions in 1995-2000, Chiang et al. (2009) show that institutional investors, as opposed to individual investors, are informed and adjust the bids adequately. On the other hand, individual investors misprice the securities, which could indicate that their financial sophistication level is different from that of institutional investors.
8. The Riksbank's risk survey has been conducted twice a year since spring 2008 among institutional participants in the Swedish fixed-income and foreign exchange market and it comprises both closed- and open-ended questions. See: "Market participants' views on risks and the functioning of the Swedish fixed-income and foreign exchange markets", Autumn 2015, Sveriges Riksbank.

Figure 5. What is your perception of the way the total risk level in the Swedish financial system has developed in the past six months?
Per cent

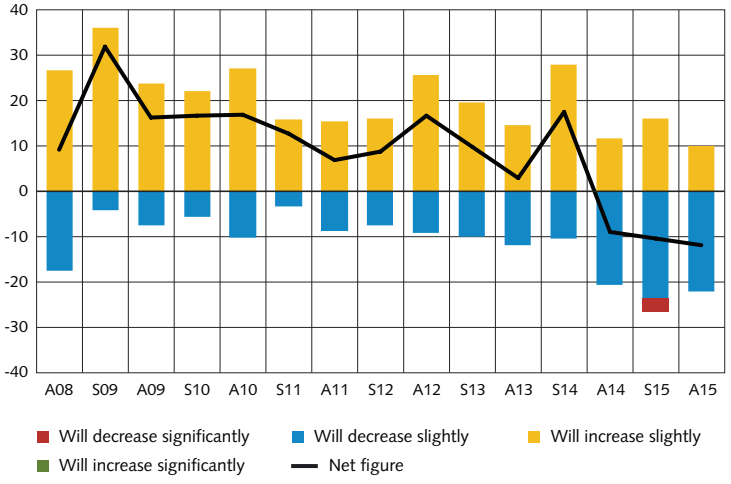


Note. The category "Neither increased nor decreased" is not shown in this chart. Net figure shows the difference between the columns above and below zero. A stands for the Autumn Survey and S stands for the Spring Survey.
Source: The Riksbank

Upon closer inspection Upon closer inspection, survey respondents cited the following reasons for the perceived higher risk: search-for-yield by investors, and decreased liquidity in the bond market (specifically the corporate bonds and covered bonds market, but also for government bonds).

When it comes to the individual risk assessment by institutional investors over the next six months, again, the majority of them (68 per cent) do not plan to change their risk attitude. But the ones that foresee a change in their risk-taking indicate that they will likely decrease risk-taking. Figure 6 shows the changing attitude towards risk experienced by informed investors and indicates that many of them were increasing their risk-taking over the past few years, perhaps in response to the low interest rate environment. The cumulative survey evidence in Figure 5 indicates a gradual build-up of risk-taking in the bond market over time. It is not until the second half of 2014 that we observe some reduction in risk-taking by bond market investors.

Figure 6. How do you foresee your propensity to take risk over the coming six months?
Per cent

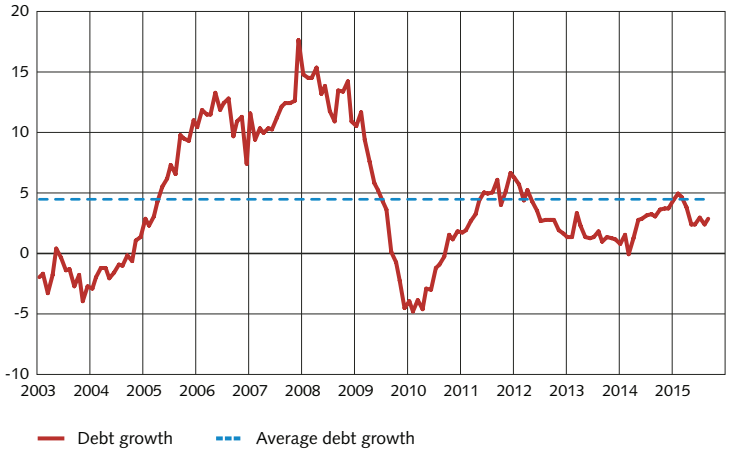


Note. The category "Neither increased nor decrease" is not shown in this chart. Net figure shows the difference between the columns above and below zero. A stands for the Autumn Survey and S stands for the Spring Survey.
Source: The Riksbank

Corporate bonds[9]

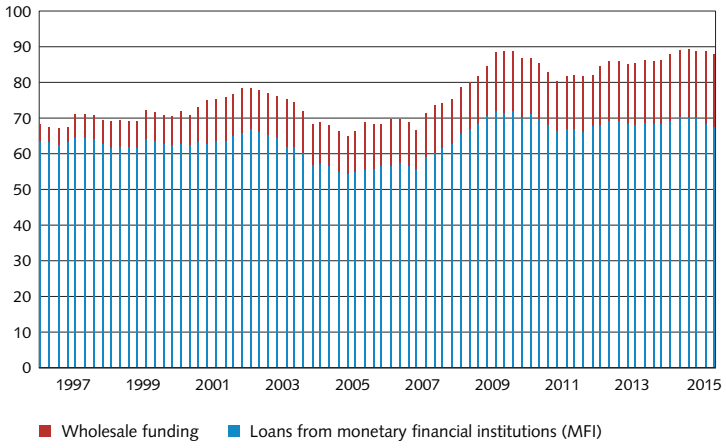
The total indebtedness of Swedish companies has grown recently but at relatively low rates (see Figure 7). In relation to GDP, corporate debt has thus increased marginally (see Figure 8) and at a much slower pace than household debt.[10] The main source of financing for Swedish companies has been bank loans. However, non-bank financing – corporate bonds and commercial papers – has increased somewhat as a source of financing for companies since 2011.[11]

Figure 7. Corporate debt growth (annual)
Per cent



Sources: Statistics Sweden and the Riksbank

Figure 8. Total debt as a percentage of GDP
Per cent



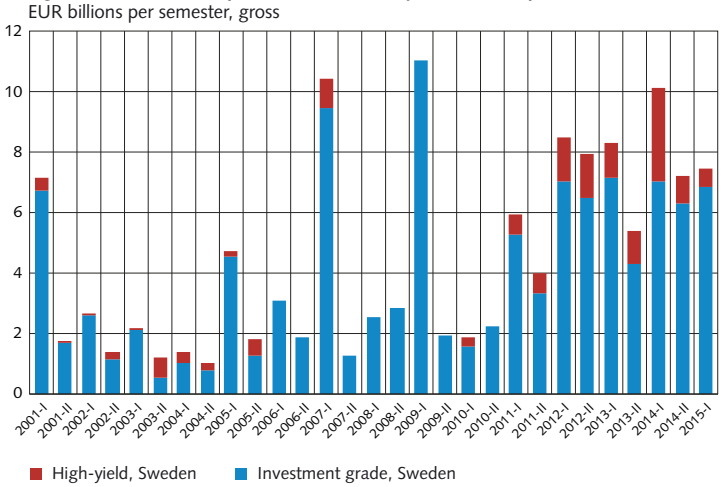
Sources: Statistics Sweden and the Riksbank

The increase in non-bank funding could be due to a growing appetite for risky investment by investors searching for yields in the low interest rate environment. At the same time, there has been a number of changes in the Swedish bond market. Better statistics, new marketplaces and trustees have facilitated Swedish corporations to fund themselves on international financial markets. These changes have also contributed to the increased issue volumes of corporate bonds.[12] In particular, issuance of high yield bonds by Swedish non-financial corporations has grown fast (see Figure 9), reaching an average annual growth rate of 40 per cent during the last four

9. For more information on the recent development of the Swedish market for corporate bonds see Bonthron (2014).
10. See FSR 2015:1.
11. While non-bank financing represented 18 per cent of the total funding in the first quarter of 2011, by the first quarter of 2015 its contribution increased to 24 per cent.
12. For a discussion on the increase in market funding of Swedish corporations, see, Bonthron (2014).

years as compared to an average annual growth rate of 20 per cent for investment grade bonds.[13]

Figure 9. Volumes of corporate bonds issued by Swedish companies
EUR billions per semester, gross



Note: The volumes correspond to the issuances made in domestic and international markets. The respective amounts in foreign currencies are expressed in EUR.
Source: Deologic

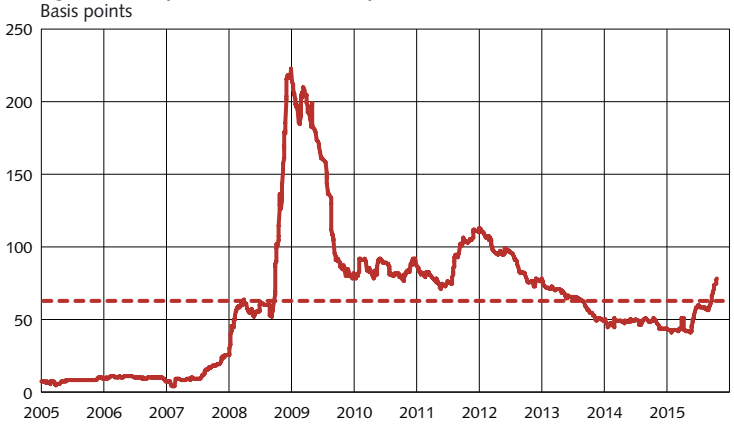
The risk premium for Swedish corporate bonds, defined as the yield spread on corporate bonds over similar maturity default-free government bonds[14], fell below historical averages between mid-2013 and mid-2015 (see Figure 10). A similar pattern was observed for the risk premium of bonds issued by US and UK corporations (see Figure A2 in Appendix 1). The relatively low risk premiums observed during this period, and the increased issuance of high-yield bonds by below-investment-grade firms, were consistent with growing tolerance for risk-taking by bond market investors. Consistently, Gertler and Karadi (2015) argue that accommodative monetary policy and searching-for-yield by investors could result in lower credit risk premium. Moreover, using data from the United States, López-Salido, Stein and Zakrajsek (2015) find that narrow corporate bond credit spreads and a high share of high-yield bond issuance tend to be followed by slower economic growth over the subsequent years.

During recent months, the risk premium has retraced slightly, reaching levels close to the historical average. It is however not obvious how this should be interpreted as the average is decreased by the low levels just before the last financial crisis. The increase in the risk premium during the recent months may be due to the perception that uncertainty has increased but also that investors are less prone to take risk.

This is consistent with the most recent Riksbank risk survey, as discussed earlier, which indicated that a higher proportion of investors were planning to decrease their propensity to take risk in the following six months. Yet, all in all, it is still difficult to judge the risk apetite in the Swedish corporate bond market and therefore about valuation.

13. An increase in the issuances of US high-yield corporate bonds has also been observed during the same period (with an average annual growth of 35 per cent for high-yield bonds and of 30 per cent for investment grade bonds). The share of high-yield bonds of total issuances of corporate bonds has remained higher in the United States than in Sweden (see Figure A1 in Appendix 1).
14. Risk premiums in general represent the compensation demanded by investors for bearing the liquidity risk, the interest rate risk and the default risk embedded in a corporate bond. Nonetheless, it is difficult to sort out what portion of changes in the risk premium is due to changes in each of these risks. Moreover, accurate measures of these risks are not available.

Figure 10. Risk premium on Swedish corporate bonds
Basis points



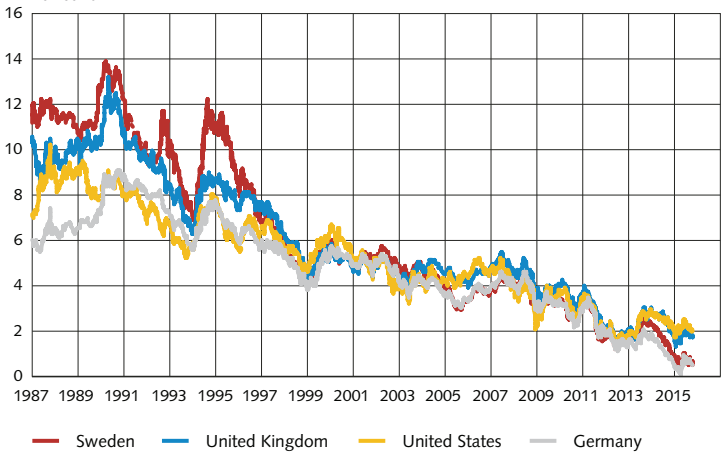
Note. The index is based on indicative prices on the secondary market and reflects the difference between the average yield on a selection of Swedish corporate bonds issued in SEK and an interest-rate swap with a corresponding maturity.
Sources: Nasdaq and Bloomberg

Government bonds

In recent years, the yields on Swedish government bonds have been declining, a pattern also observed in other countries (see Figure 11). Under risk neutrality, the expectation theory of the term structure says that the expected return from holding a long-term bond equals the expected return from holding a series of short-term bonds. However, risk-adverse investors would demand a term premium for holding a long-term bond in excess of the expected future short rate to compensate for bearing interest rate risk.

The term premium cannot be observed directly and must be estimated. Although different term structure models provide different estimates of the term premium, the general consensus from this growing body of literature[15] is that the estimated term premium has been falling, and has been negative in a number of advanced economies. Figure 12 shows one such estimate for Sweden (Figure A3 in Appendix 1 shows the term premium for the United States).

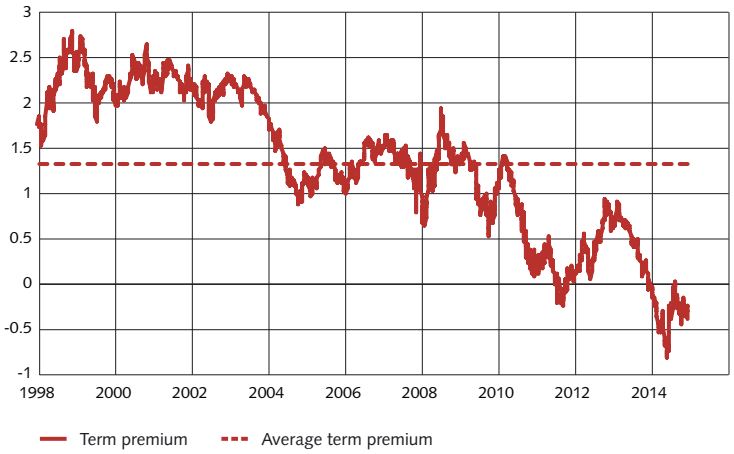
Figure 11. Ten-year government bond rates
Per cent



Source: The Riksbank

15. See, e.g., Adrian et al., (2013).

Figure 12. Term premium of 10-year government bonds in Sweden
Per cent



Source: Internal Riksbank calculations

The term premium at historically low levels indicates that bond investors require a very small (or even negative) compensation for bearing interest rate risk to hold long-term bonds. A low term premium is one of the transmission channels of quantitative easing in monetary policy, aimed at stimulating economic activities and boosting inflation.[16]

However, an extraordinary low term premium also poses risks. We have very little experience (not just in Sweden, but around the world) in how the term premium might normalise going forward. The "taper tantrum" episode in the spring of 2013 in the United States demonstrated how volatile the term premium could behave over a very short period of time (Abrahams et al. 2015). At the very least, even an orderly renormalisation of the term premium represents a tightening of financial conditions that could spill over to other interest sensitive asset classes, such as housing and commercial real estates.

Covered bonds

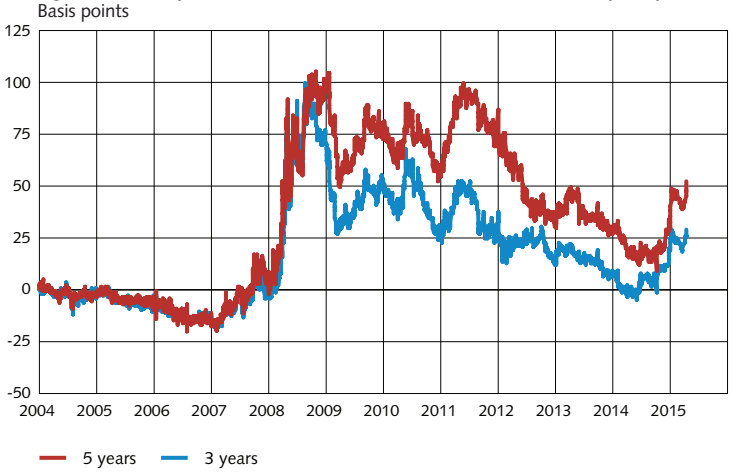
Our analysis of the Swedish bond market would not be complete without examining the covered bond market, which is bigger in size than the Swedish government securities market. More importantly, about one-quarter of the Swedish banks' funding is obtained by issuing covered bonds.

A large share of Swedish covered bonds is issued in Swedish kronor, but foreign currency-denominated covered bonds have grown rapidly in recent years. Major investors in Swedish covered bonds include Swedish insurance companies, banks, pension funds, and mutual funds; 30 to 40 per cent of covered bonds are held by foreign investors.

Figure 13 charts the yield spreads of covered bonds over the swap rate for two different maturities. The risk premium of 3-year and 5-year covered bonds has been trending down since mid-2011, but has retraced somewhat recently. The decline in risk premium is broadly consistent with the responses in the Riksbank risk survey discussed earlier; that is, investors' appetite for risk-taking was increasing until 2014, consistent with the declining risk spreads in other bond markets.[17] Currently, the risk spreads of covered bonds are close to historical averages. As clearly shown in Figure 13, turbulence in international financial markets (the 2008-09 global financial crisis) had led to a sharp jump in covered bond spreads that had large repercussions for Swedish banks' funding.

16. See, e.g., Gagnon et al. (2011), Rudebusch et al. (2012), Christensen, Rudebusch (2012) or Alsterlind et al. (2015).
17. Although the current spread is slightly above the average spread since 2004, abstracting from the unusually small spreads before the 2008-09 financial crisis, the current spreads have been quite low since 2009.

Figure 13. Yield spreads of Swedish covered bonds over similar maturity swap rates
Basis points



Source: Macrobond

Housing Market

Swedish housing prices have grown rapidly over the last three decades (see Figure A4 in Appendix 1). In 2014 housing prices for the country as a whole increased by about 18 per cent. Moving forward, different models estimated over different time periods paint a somewhat different picture. Model estimates using the last thirty years of data predict a soft landing in housing as a rather plausible outcome. However, from a longer historical perspective, current valuations look high, and an outright decline in housing prices cannot be ruled out.

Rising household debt in Sweden is driven largely by rising housing prices. As a result, households' consumption of housing and other goods becomes more exposed to adverse macroeconomic shocks (see e.g. Walentin (2014)). To the extent that households cannot insure themselves against these risks, a key objective for financial stability policy is to prevent further build-up of such risks.

Below, we outline several approaches to the question of house price valuations.

Price-to-rent ratio

Following the work of Case and Shiller (1989), a widely used metric for assessing housing price valuation is the price-to-rent (P/R) ratio, which is similar to the price-to-earnings ratio commonly used in equity evaluation. In a stylised and frictionless environment, increases in the P/R-ratio would make it relatively more attractive to rent, which would decrease demand for home ownership, thus reducing housing prices. High P/R-ratios during long periods of time may therefore be used as an argument for the existence of unrealistic expectations of future housing price increases.

All available measures of the P/R ratio in Sweden are currently at record high levels. However, using the P/R ratio as an indicator for housing price overvaluation in Sweden comes with several problems, the main one being rent control. Rents in Sweden are not set by the market, but through negotiations between tenant (Hyresgästföreningen – Swedish Tenants' Association) and landlord representatives (Fastighetsägarna – Swedish Property Federation). These negotiations follow a user-value principle (bruksvärdesprincipen), which means that rents are set to reflect the value of living in the apartment from the tenant's perspective.[18] Since 2011, the negotiations are allowed to disregard the user-value principle for newly built housing and rents for new housing are considerably higher than for housing stock, which can be seen in Figure A5 in Appendix 1. Since rents for new housing are also set through negotiations, these rents cannot be considered to reflect the market price either, but they are closer to it than rents paid for older apartments.

18. Factors taken into account are: size, age of the building, condition of the apartment, location of the apartment within the building etc.

Econometric models

We employ three different empirical models to ask the question whether house prices are overvalued. Below we briefly describe the analyses undertaken in each model and the results we obtain.

A limitation of all three models is that they are confined to residential house prices and do not take owner-occupied apartments, whose prices have increased relatively faster, into account. The price series for owner-occupied apartments, provided by Valueguard from 2005 and onwards, is not long enough for the methods used in the empirical analysis employed in this economic commentary. Further details of the models, their limitations and results can be found in Appendix 2.

An error correction model (EC)

This model captures the long-run relationship between housing prices and a standard set of macroeconomic variables, and can be used to study the long-run valuation of houses; it tells us if we should expect upward or downward pressure on prices in the future given today's fundamentals. According to this model, the recent rise in real housing prices can largely be accounted for by higher disposable income and financial wealth per capita, insufficient supply of housing, as well as a low interest rate.[19]

A concern regarding the results from the EC-model is that it is based on a short sample, and that for large parts of the period of study, Tobin's q for housing has been below one resulting in negligible construction. This may cause some biases in the estimates, and provide us with a too optimistic assessment of the current fundamental housing price.

A Bayesian vector autoregressive model (BVAR)

This multivariate model finds that price increases have been consistent with strong demand driven by increases in disposable income and financial wealth, and by falling interest rates. The recent increase in supply, i.e. residential investment, has not been sizable enough to have a material impact on the housing stock and exert downward pressure on housing prices. According to this model, several years of record-high construction activity are needed to have a meaningful impact on house prices. Looking ahead, the model does not support the view that housing prices will continue to rise at a rapid pace, as forecasted housing prices stabilise towards the end of the forecast horizon.

A single-equation model

Our third model is inspired by the work of Case and Shiller (1988, 2003) and of Brunnermeier and Julliard (2008). It has only three, easily interpretable coefficients, and gives similar estimates both on Swedish data (1985-2015) and on longer US data (1965-2015). The model's estimates say that: (i) at short and medium horizons housing price movements show considerable inertia: trends in returns have substantial persistence, (ii) when the price-to-rent (or price-to-income) ratio is high, future returns on housing are expected to be below average, all other things being equal, (iii) the nominal interest rate (more than the real rate) has a sizable effect on housing price growth at sufficiently long horizons.

Estimates from this model suggest that Swedish housing prices are above their trend (but not necessarily that they will fall), and that the estimated response of housing prices to nominal interest rate movements is larger than estimated from other models. However, when estimated over the same sampling period, the model forecasts do not differ greatly from the BVAR forecast, both predicting a soft landing in housing as a plausible scenario.

Housing prices from a long historical perspective

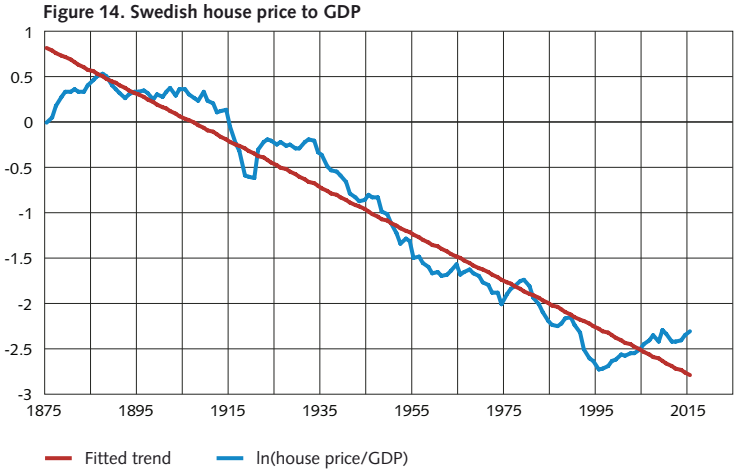
Over the last thirty years, nominal Swedish housing prices grew at an annual rate of close to 6 per cent on average. Thus, forecasts generated from a model (including our three models above) estimated using the last thirty years of data mechanically

19. Similar results are reported by Turk (2015).

incorporates this upward trend in the data so that the downside risk of housing prices falling seems limited. However, since 1875, nominal housing prices in central Stockholm and Gothenburg have grown roughly at the same pace as inflation in other goods and services.[20] This may seem surprising, but Case and Shiller reach the same conclusion studying long housing price series for Manhattan (100 years) and Amsterdam (400 years). As a result, the ratio of real housing prices over GDP per capita has a strong downward trend over sufficiently long time periods (see Figure 14). A few episodes of large housing price appreciations can be seen in Figure 14, followed by prices falling in relation to per-capita GDP.

From a long historical perspective, the growth rates of housing prices over the last 20-30 years seemed unusual. Current housing prices are well above the trend line (see Figure 14 again), suggesting that they are high in relation to per capita GDP. Past corrections in the housing price-to-GDP ratio show that following a boom, prices fell substantially in some cases, and grew sluggishly over many years in others.

Figure 14. Swedish house price to GDP



Note. The ratio is normalised to zero in 1875. House price is a nominal house price index, and GDP is per capita nominal GDP.
Sources: Edvinsson et al. (2014), and Riksbank calculations

Conclusions

This Economic Commentary examines the prices of equities, bonds, and housing in Sweden. Our evidence suggests that the current valuations in both equities and housing seem high by historical standards. After narrowing for several years, the credit spreads in both corporate bonds and covered bonds have widened somewhat in recent months. While high valuations do not necessarily lead to large falls in asset prices, they do pose risks to financial stability by increasing the probability of such an occurrence. Research suggests that the combination of high asset prices, excessive leverage, and expansionary monetary policy raise the odds of having a financial crisis in the economy, and the potential impact on economic output and inflation could be substantial. The current economic environment in Sweden appears to bear some resemblance to the above description. At the same time, the fact that there may be a lower bound for the policy rate limits the ability of monetary policy to respond to negative economic shocks. It is therefore arguably more important than ever to dampen the build-up of debt by households, and to discourage excessive risk-taking. History suggests that without the build-up of debt and leverage, large falls in asset prices are less likely to take place; and even when they do occur, the effects on the real economy tend to be less damaging.

20. Edvinsson et al. (2014).

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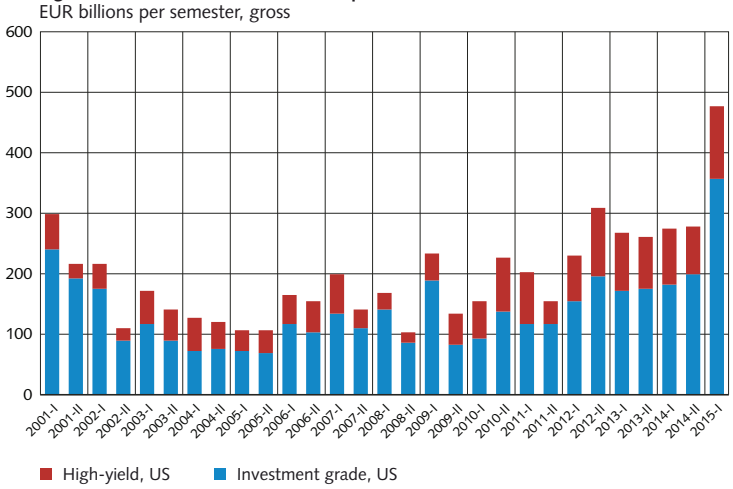
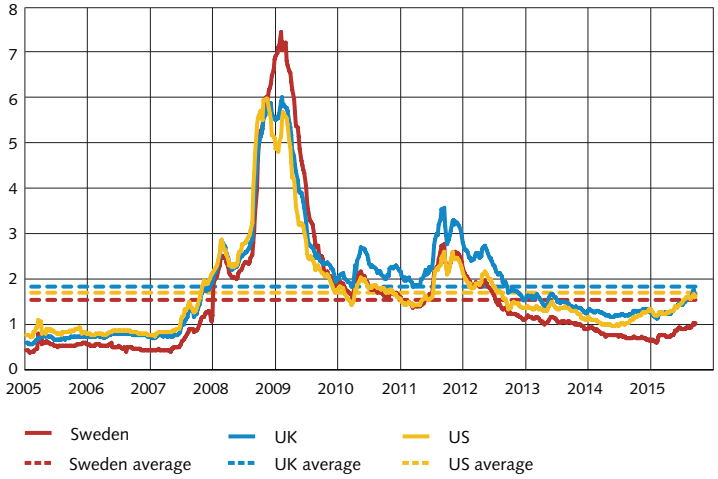
Appendix 1. Additional figures

Figure A1. Issuance volumes of US corporate bonds
EUR billions per semester, gross



Source: Deologic

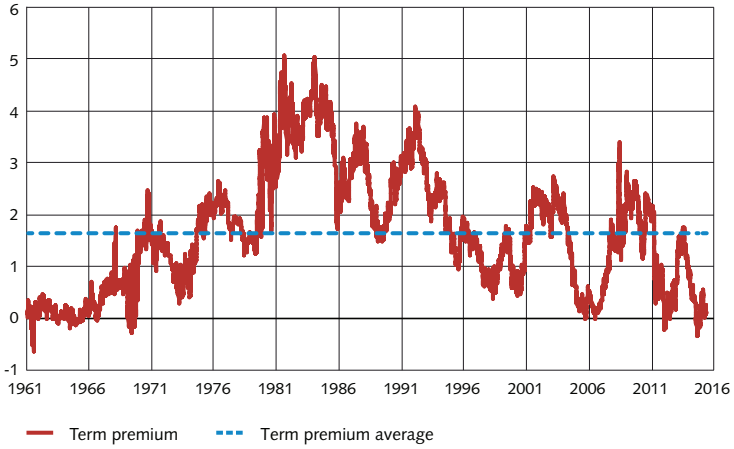
Figure A2. Risk premium of corporate bonds[20]
Per cent



Note. The index reflects the difference between the average yield on a selection of corporate bonds issued in different currencies and a similar maturity swap rate.
Source: Barclays

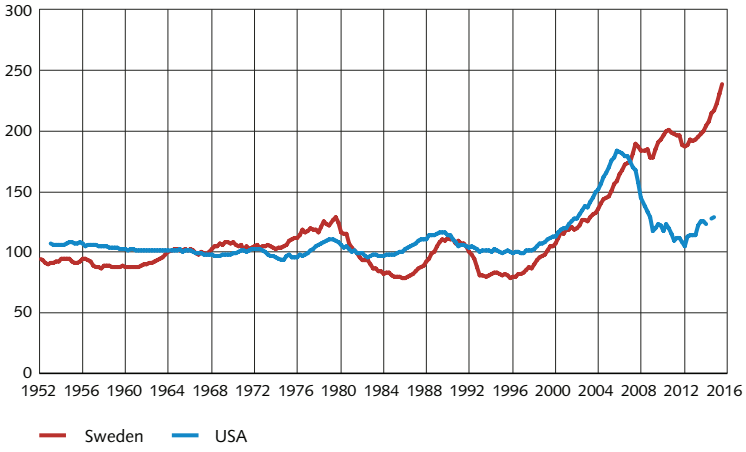
21. It refers to the Option-adjusted spread (OAS). The OAS represents the yield differential between a corporate bond and a treasury security issued in the same currency that has a comparable maturity. The OAS is adjusted for the effects of an embedded option, a call feature in which the issuer retains the right to retire the debt, fully or partially, before the scheduled maturity date. OAS can be viewed as the compensation an investor receives for assuming a variety of risks (e.g. liquidity premium, default risk, model risk), net of the cost of any embedded options.

Figure A3. Ten-year term premium in the United States
Per cent



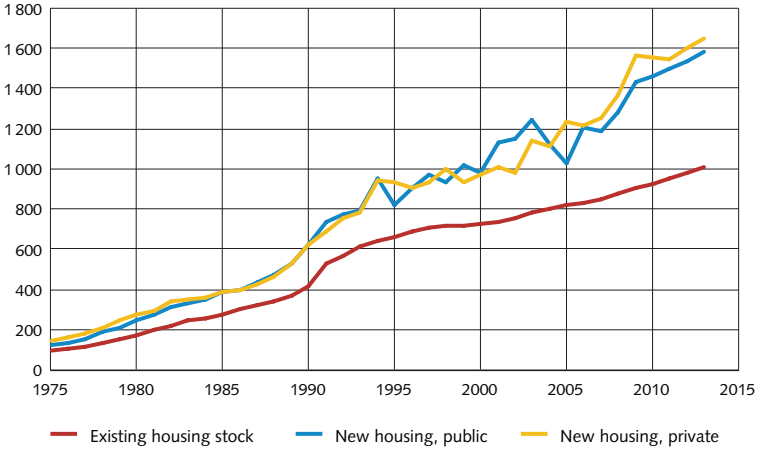
Note. Estimates based on Adrian et al. (2013).
Source: Federal Reserve Bank of New York. The graph shows the term premium from 14.06.2014 to 26.10.2015

Figure A4. Real housing prices in Sweden and the United States
Index, 1980=100



Sources: Macrobond, Statistics Sweden and the Riksbank

Figure A5. Average rent for a typical 2 room apartment
Price/m²



Note. Nominal prices.
Sources: Statistics Sweden and the Riksbank

Appendix 2. Empirical models of housing prices

An error correction model

Following Engle and Granger (1987), we consider the following long-run relationship:

$$(1) \qquad p_t^h = c + \gamma_1 x_{1t} + \gamma_2 x_{2t} + \cdots \gamma_n x_{nt} + \varepsilon_t,$$

where p_t^h is the real housing price (FPI/KPIF)[22] in period t, n is the number of regressors (5 in our model), and ε is an error term. As explanatory variables we use disposable income, real user cost, financial wealth), residential investments (as share of GDP) and a financial stress index (the CISS index). We estimate the model for the sample period 1995Q1-2008Q2.[23]

We then use the estimated coefficients to compute the predicted values of the average real housing price, $\widehat{p_t^h}$, to see what the model has to say about the evolution of the real housing price out-of-sample 2008Q3-2015Q1. This period covers the outbreak of the global financial crisis and the subsequent recovery.

Looking at the final quarter in our dataset, 2015Q1, the model suggests that prices today are well in line with fundamentals; according to this model actual prices have been higher than historical relationships can explain during 2012 and 2013, but during 2014 the gap has been closed. A record-low user cost is part of the explanation behind the closing of the gap, but favorable developments of disposable income and financial wealth have also contributed.

A Bayesian vector autoregressive model

In order to say if actual prices today are in line with historical evaluations, we use a model that summarises the historical relationships among key macroeconomic indicators. A statistical technique that can be used for this purpose, known as vector autoregression, is familiar to econometricians who seek to analyse the joint evolution of several data series over time. For our purposes, the value of such a model is that it can be used to predict the behaviour of housing prices today and in the future, assuming that historical relationships hold.

This BVAR model has the advantage of imposing few assumptions. On the other hand, the estimated coefficients have no clear interpretation. The sample period is 1987Q2-2015Q1. The included variables are: real housing prices, real user cost (mortgage rate net of taxes, minus inflation), real disposable income, real financial wealth, CPIF inflation, residential investments as a share of GDP, and a financial stress index (the CISS index).

The forecast from this model shows that the average real housing price will gradually stop increasing and stabilise at slightly higher level than that currently prevailing in a couple of years, but the probability bands indicate that this forecast is quite uncertain.

There are several limitations of the analysis using the BVAR model. One limitation of this study is that it is confined to residential housing prices (FPI). The price series for owner-occupied apartments is not long enough for the methods we use.

Another limitation, in both the EC model and the BVAR, is that for large parts of the period of study, Tobin's q for housing has been below one resulting in negligible construction. This may cause some biases in the estimates (i.e. that housing prices in our regressions become too loosely connected to residential investment and too tightly connected to disposable income and financial wealth) and may hence provide us with an over-optimistic assessment of the fundamental housing price.

Another concern, in both the EC model and the BVAR, is that we are using a relatively short sample and linear models, while housing cycles tend to be long and theory tells us that responses of housing prices to macroeconomic developments may be

22. FPI stands for the houseing price index "fastighetsprisindex".
23. We also ran regressions on data including the Swedish financial crisis in the beginning of the 1990s (starting in 1987), but our main conclusions are robust to this sample extension.

substantially stronger for large shocks.

Finally, we have not modelled household debt jointly with housing prices. Allowing for possible feedbacks between housing prices and debt might be of key importance when assessing their sustainable paths.

A single equation model

The third model that we use is inspired by the work of Case and Shiller (1988, 2003) and of Brunnermeier and Julliard (2008). It has only three, easily-interpretable coefficients, and gives similar estimates both on Swedish data (1985-2015) and on longer US data (1965-2015).

There are two ways to provide predictions of housing prices several periods ahead. One, and perhaps the most common, is to estimate a multivariate model, such as a BVAR, and iterate the predictions forward. The second, sometimes used by Shiller and others in the literature on forecasting asset prices, is to specify the model directly in the horizon of interest. Both approaches have pros and cons. Here we will adopt the second and model the growth rate of nominal housing prices as $p(t+h)-p(t) = b'x(t)+e(t)$, where h is the horizon of interest, p is the log housing price, and x is a vector of explanatory variables.

The explanatory variables included in x are a constant, the past (exponentially smoothed) growth rate of housing prices, the price-to-rent ratio (in Sweden proxied by the price-to-income ratio), and the (exponentially smoothed) short term mortgage rate. The exponentially smoothed growth rate of housing prices is motivated by Case and Shiller, who find strong persistence in housing price movements. We expect a positive coefficient. The price-to-rent ratio is also motivated by the work of Case and Shiller, and is the most obvious valuation ratio for this asset class. We expect a negative coefficient. For Sweden, we use disposable income in the denominator. Where we do have data, the rent-to-income ratio is roughly constant, justifying our approximation. There is an unspoken assumption that the price-to-rent ratio should be fixed or at least move slowly and modestly. As for stock market valuations, arguments can perhaps be raised suggesting that the equilibrium price-to-rent ratio has moved up in the last two decades or so.

The nominal interest rate is motivated by the observation that it seems to correlate with valuations in all asset classes, as well as by the work of Brunnermeier and Julliard (2008) on how money illusion affects house prices.

In our US and Swedish data, the real interest rate had little explanatory power as well as the wrong sign if added to the regression, so we excluded it. Studies based on long historical series have not found a strong impact on country-wide housing prices due to population growth, wealth, construction costs, and the share of GDP invested in housing (which tends to lag behind prices). That's not to say that such effects are not present, but they are hard to pin down based on limited and noisy time series, and we exclude them in the interest of simplicity.

Coefficients estimated on the longer US sample are rather close to those for Sweden, except for a lower average growth rate. This simple model's estimates suggest that:

1. At short horizons, housing price movements show considerable inertia, as documented by Case and Shiller (1989).
2. When the price-to-rent ratio is high, returns on housing are expected to be below average, all other things being equal.
3. The nominal interest rate has a fairly strong effect on housing price growth at sufficiently long horizons (subject to considerable sampling uncertainty). The coefficients attached to the nominal interest rates are larger than those we would obtain with the real interest rate.