Working Paper

No. 138. March 2015

Macroeconomic Effects of a Decline in Housing Prices in Sweden

By Peter Gustafsson, Pär Stockhammar and Pär Österholm

National Institute of Economic Research

Macroeconomic Effects of a Decline in Housing Prices in Sweden [*]

Peter Gustafsson[∀], Pär Stockhammar[#] and Pär Österholm[♣]

March 2015

[*] We are grateful to seminar participants at the National Institute of Economic Research for valuable comments on this paper.

[∀] Sveriges Riksbank, 103 37 Stockholm, Sweden
Email: peter.gustafsson@riksbank.se Phone: +46 8 787 0638

[#] National Institute of Economic Research, Box 3116, 103 62 Stockholm, Sweden
e-mail: par.stockhammar@konj.se Phone: +46 8 453 5910

[♣] National Institute of Economic Research, Box 3116, 103 62 Stockholm, Sweden
e-mail: par.osterholm@konj.se Phone: +46 8 453 5948

WORKING PAPER NO 138, MARCH 2015
PUBLISHED BY THE NATIONAL INSTITUTE OF ECONOMIC RESEARCH (NIER)

NIER prepares analyses and forecasts of the Swedish and international economy and conducts related research. **NIER** is a government agency accountable to the Ministry of Finance and is financed largely by Swedish government funds. Like other government agencies, **NIER** has an independent status and is responsible for the assessments that it publishes.

The **Working Paper** series consists of publications of research reports and other detailed analyses. The reports may concern macroeconomic issues related to the forecasts of the institute, research in environmental economics, or problems of economic and statistical methods. Some of these reports are published in their final form in this series, whereas others are previews of articles that are subsequently published in international scholarly journals under the heading of **Reprints**.

Reports in both of these series can be ordered free of charge. Most publications can also be downloaded directly from the NIER website.

KONJUNKTURINSTITUTET, KUNGSGATAN 12-14, BOX 3116, SE-103 62 STOCKHOLM
TEL: +46 8 453 59 00 FAX: +46 8 453 59 80
E-MAIL: KI@KONJ.SE HOMEPAGE: WWW.KONJ.SE
ISSN 1650-996X

Abstract

Real housing prices in Sweden have roughly doubled the last 15 years. The rise in housing prices has coincided with a rise in household debt, sparking debate about both the presence of financial imbalances in the Swedish economy and the macroeconomic effects that a correction of these imbalances would have. In this paper, we conduct a quantitative assessment of the macroeconomic effects of a considerable decline in housing prices using a Bayesian VAR model. Results show that a 20 per cent drop in housing prices would lead to a recession-like impact on household consumption and unemployment. The impact would be even greater if falling housing prices coincided with a global economic downturn.

JEL classification code: C32, F43

Keywords: Bayesian VAR, Housing prices, Household consumption, Unemployment, Small open economy

Sammanfattning

De reala bostadspriserna i Sverige har ungefär fördubblats de senaste 15 åren och denna prisuppgång har sammanfallit med en ökad skuldsättning bland hushållen. Detta har föranlett en debatt om både förekomsten av finansiella obalanser i den svenska ekonomin samt vilka makroekonomiska effekter en eventuell korrigering av dessa obalanser skulle innebära. I denna studie görs, med hjälp av en Bayesiansk VAR-modell, en kvantitativ bedömning av vilka makroekonomiska effekter ett betydande bostadsprisfall skulle kunna få. Resultaten visar att ett bostadsprisfall på 20 procent skulle ha en recessionsliknande effekt på hushållens konsumtion och arbetslöshet. Effekterna blir större om prisfallet sammanfaller med en internationell konjunkturnedgång.

Contents

1. Introduction

The financial crisis of 2008-2009 left long-lasting scars on the real economy in many countries. In some countries, most notably Ireland, Spain and the United States, this was in part caused by significant downturns in inflated housing markets and the unwinding of financial imbalances. In Sweden, however, the dip in housing prices during the financial crisis was small and short-lived – see Figure A1 in the Appendix – and real housing prices are today at a historically high level, having grown rapidly since the mid-1990s. It can be argued that the increase in Swedish housing prices to a large extent can be explained by structural factors such as slow growth in the supply of housing, falling real interest rates, lower housing-related taxes and favourable growth in household income; see, for example, Sveriges Riksbank (2011). The surge in housing prices has, nevertheless, caused real aggregate household debt to grow rapidly to very high levels by historical standards.[1] This has initiated a debate about both the presence of financial imbalances in the Swedish economy and the macroeconomic consequences of a correction of these imbalances; it has also affected actual monetary and macroprudential policies.[2] Against this background, it is of interest to quantify the extent to which the Swedish real economy would be affected by a drop in housing prices.

In this study we empirically quantify the macroeconomic effects of a decline in Swedish housing prices. More specifically, we assess the effects

---

[1] The rising housing prices have also contributed to an increase in housing wealth, which now accounts for around 45 per cent of households' gross wealth.

[2] For example, when motivating its repo rate decision in February 2014, Sveriges Riksbank (2014, p. 18) stated that *"An even more expansionary monetary policy could lead to inflation attaining the target somewhat sooner. But a lower repo rate could also lead to resource utilisation being higher than normal in the long run and to the risks linked to household debt increasing further. The current repo-rate path is expected to stimulate economic developments and contribute to inflation rising towards 2 per cent, at the same time as taking into account the risks linked to household indebtedness."* Concerning macroprudential policies, Sweden's Financial Supervisory Authority introduced a risk-weight floor for mortgages of 15 per cent in 2013, which was raised to 25 perc ent in 2014. A maximum loan-to-value ratio of 85 per cent was introduced in 2010.

on household consumption and unemployment.[3] To do this, we employ a Bayesian VAR (BVAR) model including both domestic and foreign variables. Conditional forecasts from the model are then used to measure the macroeconomic impact of a decline in housing prices. Our results indicate that a drop in housing prices would reduce household consumption growth and increase unemployment. The effects are not negligible, and are further amplified if the downturn in the housing market coincides with other shocks. The results are consistent with previous studies in which VAR models are used to estimate macroeconomic effects of a change in housing prices.[4]

The rest of this paper is organised as follows: In Section 2, we conduct our empirical analysis, present the results from three different scenarios and discuss the uncertainty of the results. Section 3 concludes.

2. Empirical analysis

2.1 The model

We employ a BVAR model which in its general form is given by

$$\mathbf{G}(L)(\mathbf{x}_t - \boldsymbol{\mu}) = \boldsymbol{\eta}_t, \tag{1}$$

where $\mathbf{G}(L) = \mathbf{I} - \mathbf{G}_1 L - \ldots - \mathbf{G}_m L^m$ is a lag polynomial of order *m*, $\mathbf{x}_t$ is an *n*x1 vector of stationary variables, $\boldsymbol{\mu}$ is an *n*x1 vector describing the steady-state values of the variables in the system and $\boldsymbol{\eta}_t$ is an *n*x1 vector of *iid* error terms fulfilling $E(\boldsymbol{\eta}_t) = \mathbf{0}$ and $E(\boldsymbol{\eta}_t \boldsymbol{\eta}_t') = \boldsymbol{\Sigma}$. As can be seen

[3] There is ample evidence that housing prices affect household consumption, even if there of course is some dispute in the field; see, for example, Case *et al*. (2005), Campbell and Cocco (2007), Attanasio *et al*. (2009) and Disney *et al*. (2010). Effects of housing prices on household consumption are often explained along the lines of Modigliani and Brumberg's (1954) life cycle hypothesis or Friedman's (1957) permanent income hypothesis. In addition, a more recent literature has focused on household debt to understand the consumption effects relating to a decline in housing prices; see, for example, De Bonis and Silvestrini (2012), Dynan (2012), Mian *et al*. (2013) and Cristini and Sevilla (2014). Since a decline in housing prices causes household indebtedness – measured, for example, as the debt divided by the value of the asset – to increase, it can be argued that households wishing to decrease indebtedness will do so mainly by spending less so that they can save more and amortise their loans (commonly referred to as "balance sheet effects").

[4] See, for example, Musso *et al*. (2011) and André *et al*. (2012)

from equation (1), the specification of the model is slightly unconventional as it is expressed in deviation from the steady state. This specification of the BVAR – which was developed by Villani (2009) – has the benefit that an informative prior distribution for $\boldsymbol{\mu}$ often can often be specified. This has, not surprisingly, been shown to be beneficial for forecasting performance; see, for example, Beechey and Österholm (2010).

The priors on the parameters of the model used in this paper follow those in Villani (2009). The prior on $\boldsymbol{\Sigma}$ is given by $p(\boldsymbol{\Sigma}) \propto |\boldsymbol{\Sigma}|^{-(n+1)/2}$ and the prior on $vec(\mathbf{G})$, where $\mathbf{G} = (\mathbf{G}_1 \quad \dots \quad \mathbf{G}_m)'$, is given by $vec(\mathbf{G}) \sim N_{mn^2}(\boldsymbol{\theta}_{\mathbf{G}}, \boldsymbol{\Omega}_{\mathbf{G}})$.[5] Finally, the prior on $\boldsymbol{\mu}$ is given by $\boldsymbol{\mu} \sim N_n(\boldsymbol{\theta}_{\boldsymbol{\mu}}, \boldsymbol{\Omega}_{\boldsymbol{\mu}})$ and is specified in detail in Table A1 in the Appendix. The hyperparameters of the model are uncontroversial and follow the literature.[6] Finally, the lag length in the model is set to $m = 4$.

We define the vector

$$\mathbf{x}_t = \left(Y_t^{World} \quad HY_t^{US} \quad U_t \quad HC_t \quad HP_t \quad I_t \quad FI_t\right)', \qquad (2)$$

where Y_t^{World} is the world GDP (trade weighted, seasonally adjusted), HY_t^{US} the high-yield corporate bond spread in the United States,[7] U_t the unemployment rate in the age group 15-74 years (seasonally adjusted), HC_t household consumption (seasonally adjusted), HP_t real housing price (deflated by seasonally adjusted CPIF inflation), I_t the three-month mortgage interest rate (list price) and FI_t the financial conditions index

---

[5] It can be noted that the priors on the dynamics are modified slightly relative to the traditional Minnesota prior. Rather than a prior mean on the first own lag equal to 1 and zero on all other lags (which is the traditional specification), the prior mean on the first own lag is here set equal to 0.9; all subsequent lags have a prior mean of zero. The reason for this is that the traditional specification is theoretically inconsistent with the mean-adjusted model, as it takes its starting point in a univariate random walk and such a process does not have a well-defined unconditional mean.

[6] See, for example, Doan (1992) and Villani (2009) where the overall tightness is set to 0.2, the cross-variable tightness to 0.5 and the lag decay parameter to 1.

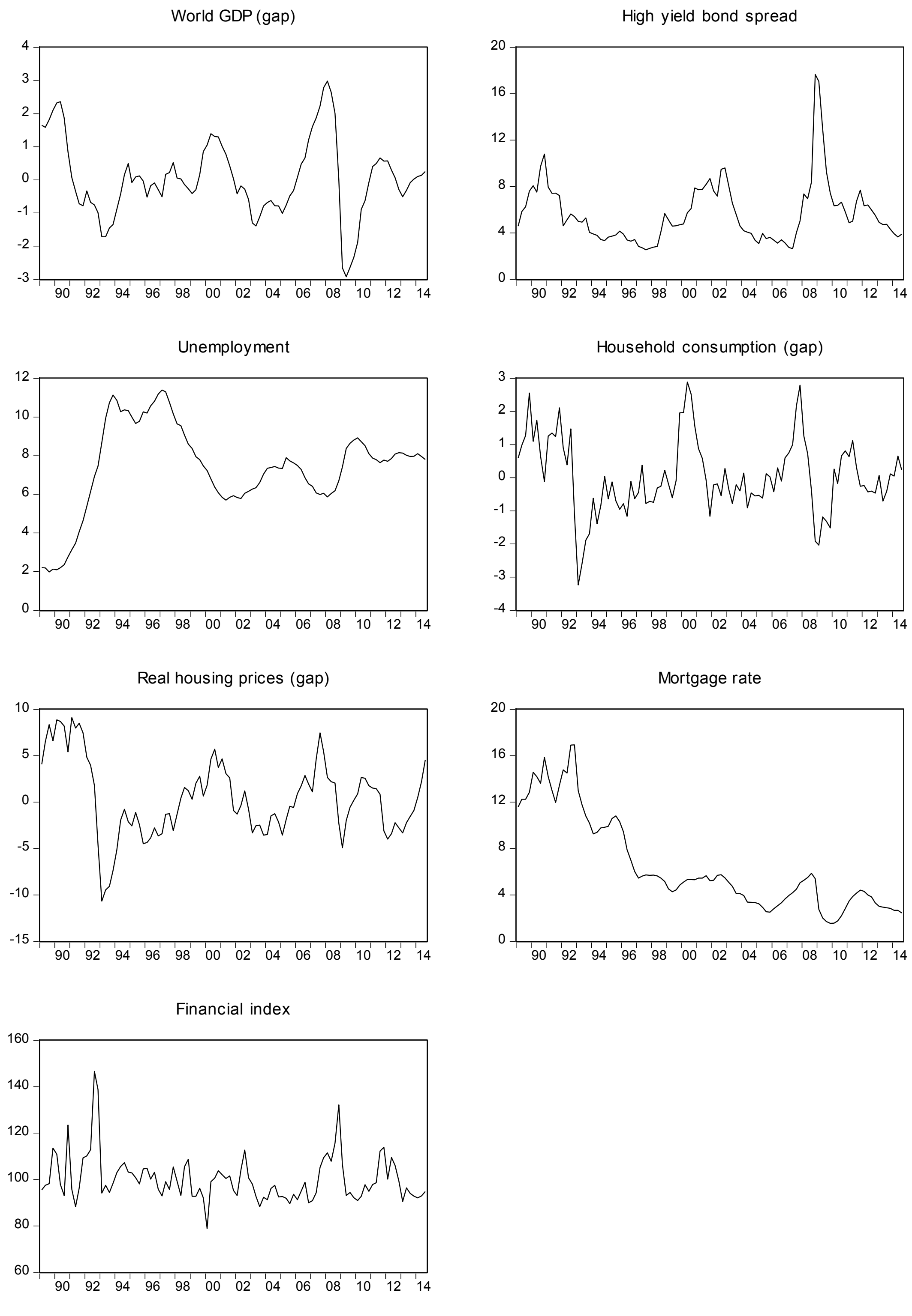
[7] The high-yield bond spread is sometimes interpreted as reflecting risk appetite; see, for example, González-Rozada and Levy Yeyati (2008) and Österholm and Zettelmeyer (2008). It has also been shown to have predictive power for the US real economy; see, for example, Mody and Taylor (2003).

of Österholm (2010).[8,9] Throughout the BVAR analysis, the foreign variables – that is, world GDP and the US high yield bond spread – are treated as block exogenous with respect to the Swedish variables. This block exogeneity is achieved with an additional hyperparameter which shrinks the parameters on the Swedish variables in the US equations to zero; see Villani and Warne (2003) for details. Quarterly data from 1989Q1 to 2014Q3 are used for the analysis. For the three variables that exhibit a trend, Y_t^{World}, HC_t and HP_t, a Hodrick-Prescott (HP) filter is used to calculate a deviation from a trend for the logarithm of each variable. It is these deviations that are modeled. Data are shown in Figure 1.

[8] CPIF is the main measure of underlying inflation defined as the CPI with a fixed interest rate.

[9] The domestic financial conditions index has three components: a short real interest rate, a short interbank spread and movements on the Stockholm stock exchange (sign reversed). These three components are given equal weights and the index is standardized so that the mean equals 100 and the standard deviation equals 10.

Figure 1. Data.



Note: GDP (world), household consumption and real housing prices are given as percentage differences from a HP trend. The high yield bond spread is given in percentage points. Unemployment and the mortgage rate and are measured in percent. The financial index is an index.

2.2 Impulse response functions

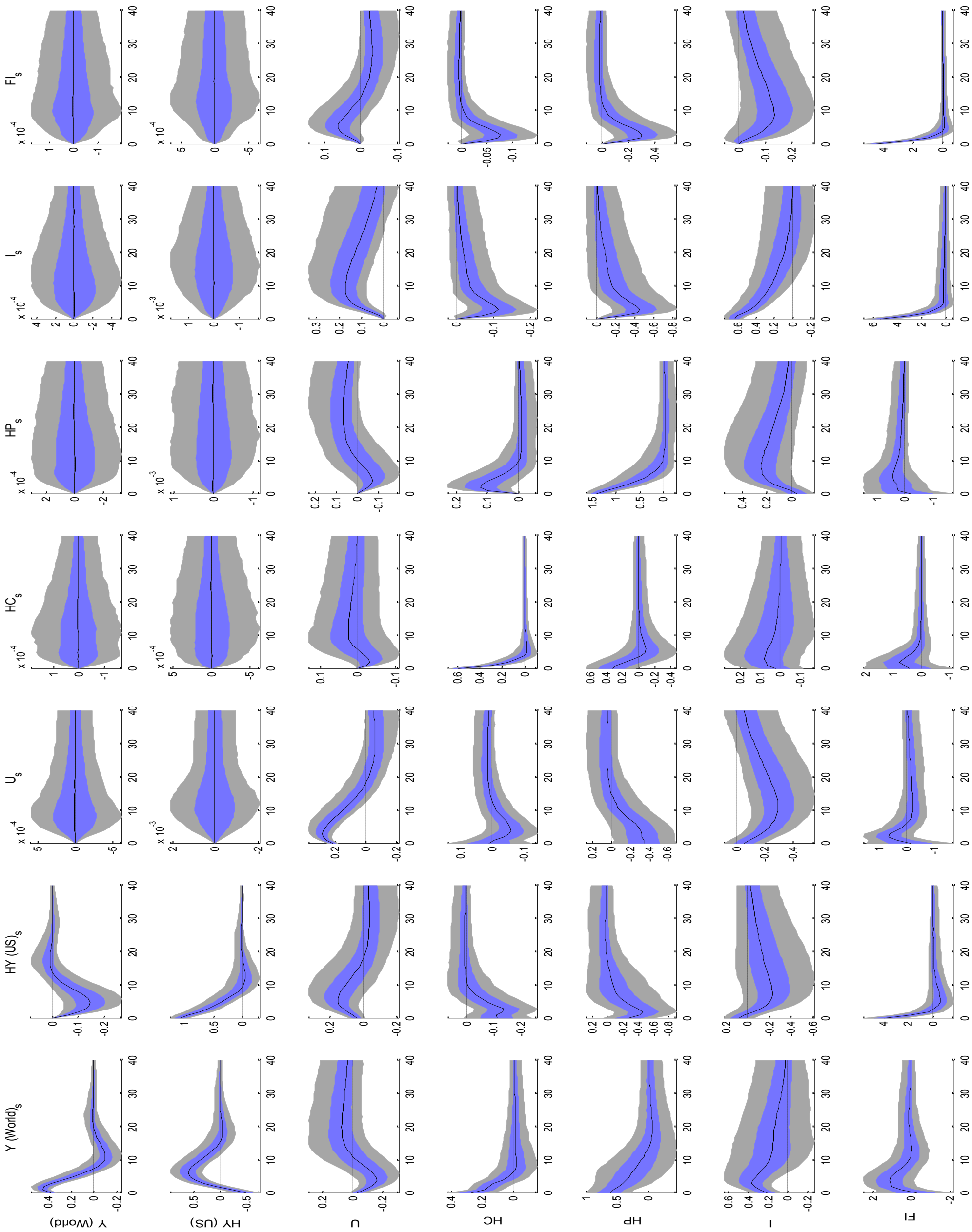
The impulse response functions of the model specified in equations (1) and (2) are given in Figure 2. Shocks are ordered in columns and all have a magnitude of one standard deviation. The impulse response functions are calculated using the Cholesky decomposition of the covariance matrix; this means that orthogonal shocks, $\boldsymbol{\varepsilon}_t$, are calculated according to the relationships $\boldsymbol{\Sigma} = \mathbf{PP}'$ and $\boldsymbol{\varepsilon}_t = \mathbf{P}^{-1}\boldsymbol{\eta}_t$. The order of the variables is the same as that given in equation (2). Trade-weighted GDP is hence assumed to be contemporaneously independent of all shocks except its own; the US high-yield bond spread is assumed to contemporaneously depend only on trade-weighted GDP shocks and so on.

A shock to world GDP decreases the Swedish unemployment rate and increases Swedish household consumption, house prices and mortgage rates. A shock to the high-yield bond spread increases the Swedish unemployment rate and decreases household consumption and house prices. The increase in the Swedish financial conditions index – which indicates a deterioration of the conditions – is not suprising given the degree of globalization in financial markets today.

Turning to the shocks to Swedish variables, it can initially be noted that they – due to the block exogeneity assumption described above – have no effect on world GDP or the US high-yield bond spread. Shocks to the unemployment rate lower house prices and mortgage rates. A shock to housing prices[10] significantly increases household consumption with a fairly short delay. The maximum effect can be found after two quarters where household consumption is 0.13 percentage points higher. It also significantly decreases unemployment and the mortgage rate. Shocks to the mortgage rate and the financial conditions index have qualitatively similar effects on the rest of the variables in the model; the unemployment rate increases whereas the household consumption and housing prices decrease. Summing up, we believe that the model appears to exhibit desirable properties as the impulse response functions are almost exclusively in line with what we would expect based on economic theory.

[10] The standard deviation is 1.43 percentage points.

Figure 2. Impulse response functions

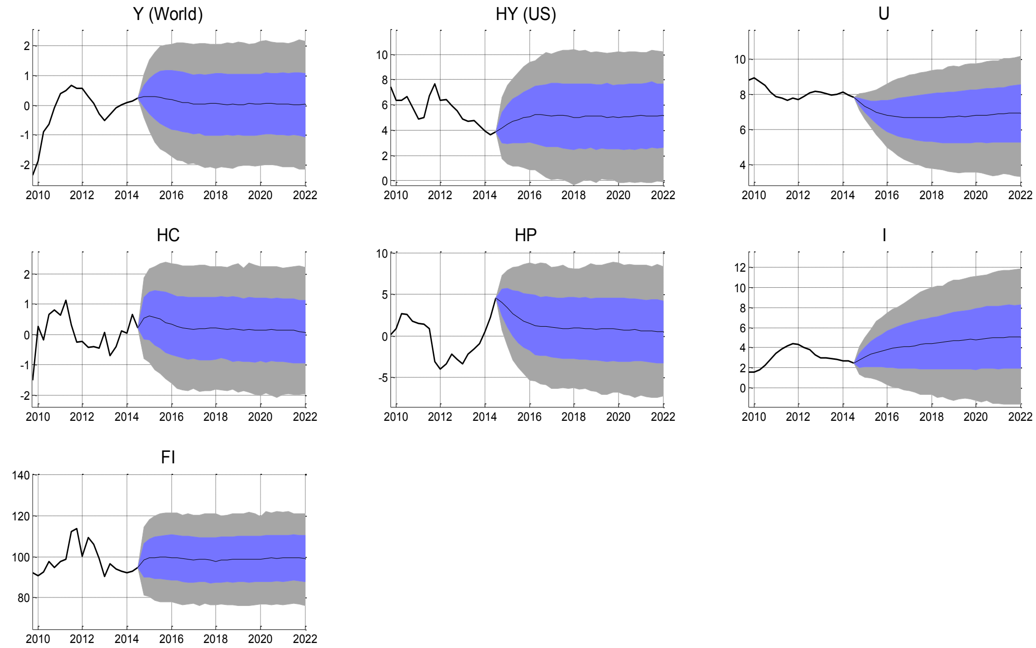


Note: Shocks in columns, responses in rows. Black line is the median. Coloured bands are 50% and 90% confidence bands. Maximum horizon is 40 quarters.

2.3 Scenario analysis

In order to study the effects of a decline in housing prices we need to relate the unconditional (endogenous) forecast to a conditional forecast from the BVAR model. The endogenous forecast indicates that household consumption will stay above its trend for more many years to come, an increase in the interest rate and a falling unemployment rate; see Figure 3. This endogenous forecast is compared to three different conditional forecasts (scenarios) where the impact of housing prices on consumption and unemployment are analysed.

Figure 3. Endogenous forecast



Note: Black line is the median. Coloured bands are 50% and 90% confidence bands.

Concerning the scenarios, the causes of the decline in housing prices assumed are not specified in detail; it could either be explained as a correction of expectations or as an adjustment to changes in the fundamental determinants of housing prices. Needless to say, the cause of a price fall could matter for the effects on the macroeconomy. The employed reduced form BVAR model is, however, unable to distinguish between different causes. We accordingly analyse a decline in housing prices of unknown causes and the effects are determined by the average historical correlations between the variables.[11] Finally, it should also be noted that

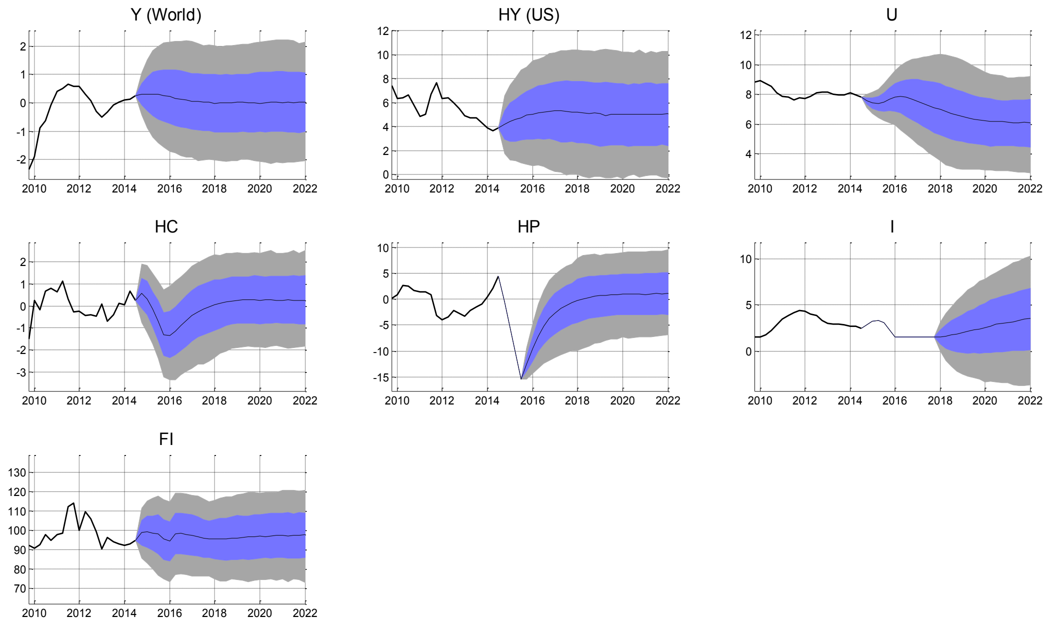
[11] We generate conditional forecasts in the follwing manner (see Österholm (2009) for details). For each draw from the posterior distribution of parameters, we employ a sequence of shocks $(\boldsymbol{\varepsilon}_{T+1},\ldots,\boldsymbol{\varepsilon}_{T+H})$, where *H* is the forecast horizon, together with the definition $\mathbf{P}\boldsymbol{\varepsilon}_t = \boldsymbol{\eta}_t$ to generate the reduced-form shocks and, given the historical data and drawn parameters, the future data. The only difference between the unconditional and conditional forecasts is that in the unconditional case, the entire vector $\boldsymbol{\varepsilon}_t$ is generated randomly at each horizon. In the conditional case, on the other hand, only the orthogonal shocks belonging to a subset of the endogenous variables are created randomly; the shocks of the conditioning variables are implied by the assumed conditioning path.

because of the zero lower bound, it is assumed that mortgage rates do not fall below 1.5 per cent.[12]

2.3.1 SCENARIO 1: AN ISOLATED DECLINE IN HOUSING PRICES

In the first scenario it is assumed that housing prices fall by 5 percentage points for four consecutive quarters. The housing prices are then treated endogenously and no other conditioning paths – other than that needed to address the zero lower bound restriction mentioned above – are used. The conditional forecast from this scenario is given in Figure 4.

Figure 4. A decline in housing prices.



Note: Housing price fall is 4*5 percentage points. Zero lower bound restriction applies. Black line is the median. Coloured bands are 50% and 90% confidence bands.

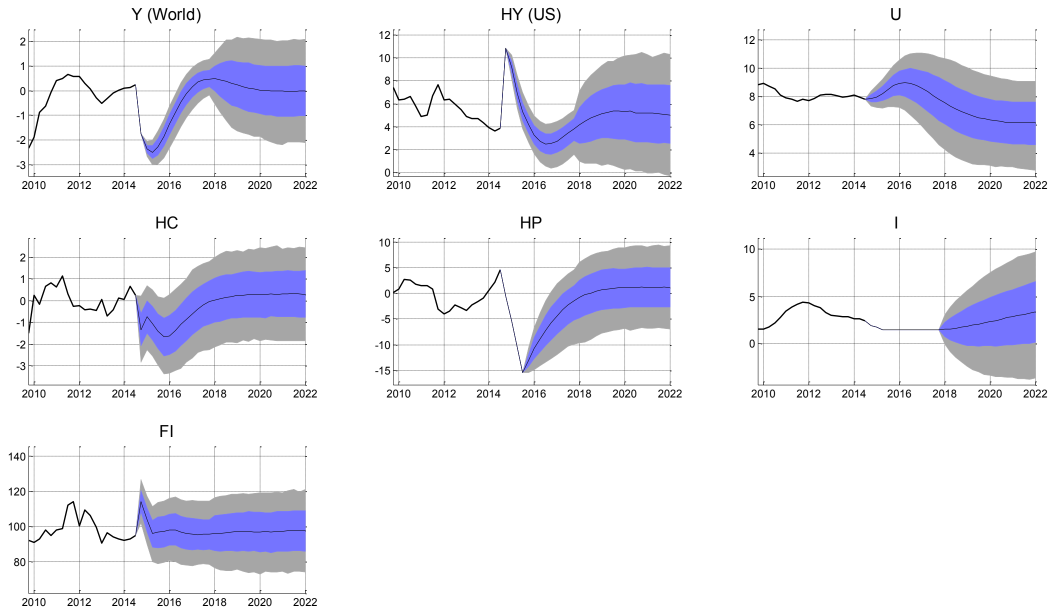
The impact on household consumption is greatest after five quarters, when it is 1.7 percentage points lower than in the base scenario, and it takes 16 quarters for consumption to return to the trend level; see Figure A2 in the Appendix. Unemployment peaks after seven quarters at a level which is 1.1 percentage points higher than in the base scenario. After three years, it is still 0.6 percentage points higher; see Figure A3 in the Appendix.

[12] The Riksbank cut its repo rate to -0.10 per cent in February 2015. A repo rate of -0.10 per cent should, based on historical relationships, correspond approximately to a three-month mortgage interest rate of 1.5 per cent.

2.3.2 SCENARIO 2: A DECLINE IN HOUSING PRICES COMBINED WITH INTERNATIONAL SHOCKS

In the second scenario, the decline in housing prices is assumed to coincide with a major global economic downturn and turmoil in global financial markets. As well as a short-term fall in housing prices similar to that used in Scenario 1, it is assumed that there is a decline in global GDP and increased financial uncertainty (that is, an increase in the US high-yield bond spread), to approximately the same degree as during the financial crisis; see Figure 4.[13]

Figure 5. A decline in housing prices combined with international shocks



Note: Housing price fall is 4*5 percentage points. Zero lower bound restriction applies. Black line is the median. Coloured bands are 50% and 90% confidence bands.

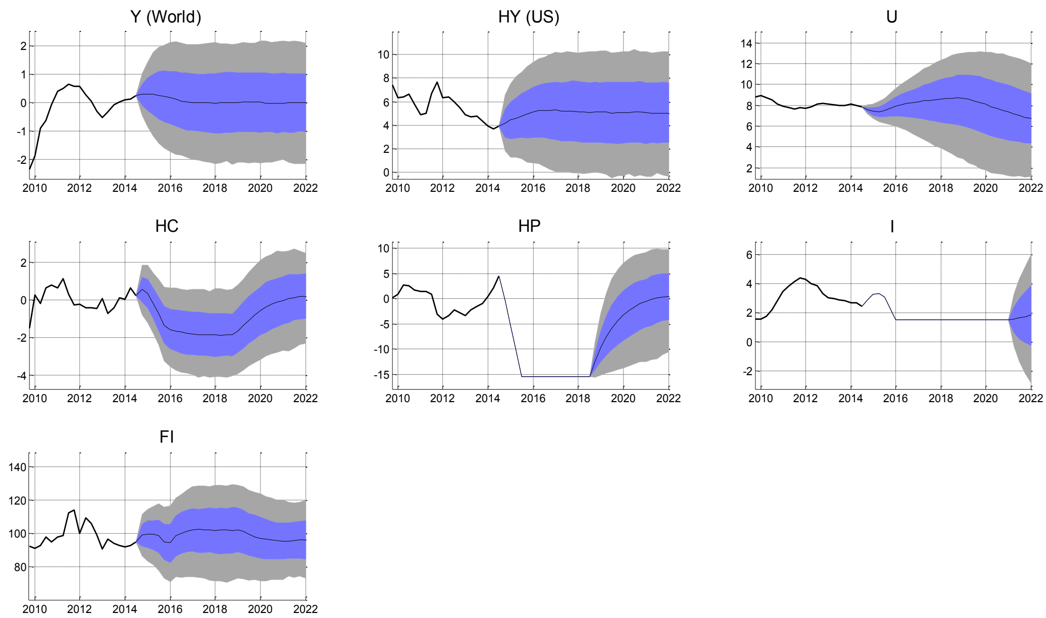
In this case, household consumption falls as far as 2.1 percentage points below the base scenario after five quarters. Even in the first quarter the impact on consumption is considerable at 1.9 percentage points, and consumption only returns to the trend level after 18 quarters; see Figure A2 in the Appendix. Unemployment is 2.2 percentage points higher after seven quarters and is still 1.4 percentage points higher than in the base scenario after three years.

[13] This is approximated by a drop in global GDP of 2 percentage points and an increase in the US high yield bond spread of 7 percentage points in the first quarter.

2.3.3 SCENARIO 3: A PROLONGED PERIOD OF LOWER HOUSING PRICES

Scenarios 1 and 2 – that is, an isolated shock to domestic housing prices and a housing price shock combined with considerable international shocks – are considered to be two economically significant, yet realistic, scenarios. Another conceivable scenario is to assume a prolonged period of lower housing prices as was the case in the 1990s Swedish economic crisis; see Figure 1. This scenario is constructed by assuming that housing prices fall by 4*5 percentage points in the first year and then remain unchanged for three years; see Figure 6.

Figure 6. A prolonged period of lower housing prices.



Note: Housing price fall is 4*5 percentage points; prices then remain unchanged for three years. Zero lower bound restriction applies. Black line is the median. Coloured bands are 50% and 90% confidence bands.

Unsurprisingly, this assumption concerning housing prices has bigger and longer-lasting effects on both household consumption and unemployment. Household consumption hits a low of 2 percentage points below the endogenous forecast after 15 quarters (see Figure A2), whereas the maximum effect on unemployment is 2,1 percentage points after 17 quarters (see Figure A3).

The three scenarios discussed above all indicate that household consumption and unemployment would be substantially affected by a highly plausible drop in housing prices. Given the magnitude of the shocks studied here, the effects are similar to a normal economic downturn but smaller than the downturn during the financial crisis 2008−2009.

2.4 Caveats

Although seemingly robust and plausible, there is reason to be cautious when interpreting the results of the analysis.[14] First, a key assumption is that the impact of lower housing prices on the macroeconomy is approximately linear. This is a strong assumption but could still be considered reasonable for the magnitude of the decline in housing prices analysed here. One should nevertheless bear in mind that in the case of a fall in housing prices sharp enough to disrupt the functioning of financial markets, the model's predictions will probably underestimate the actual impact. Second, it is important to be aware of the fact that the model is estimated over a period when the functioning of the Swedish economy is likely to have changed in some ways. The model is based on data for a period of time which includes the Swedish crisis of the 90's. This period was characterised by a weak housing market coinciding with a depreciation of the Swedish krona and an increase in net exports, which in turn fuelled the recovery from the crisis, indirectly benefitting the households. A future scenario involving a decline in housing prices need not necessarily be associated with a similar development of the krona and net exports, and the negative effects may therefore be greater than what the model would suggest. On the other hand, the negative effects could also be smaller, as household saving in Sweden is currently historically high and public finances are stronger than during most of the period on which the model is based.

3. Conclusions

In this paper, we have conducted a quantitative assessment of the macroeconomic consequences of a decline in Swedish housing prices. Our

[14] The impact of a decline in housing prices on investment and GDP has also been analysed. The effects on investment are significant, but arrive later than those on household consumption. The effects on GDP growth are also negative, but not statistically significant. Results are not reported in detail but are available from the authors upon request.

results indicate that household consumption and unemployment would be substantially affected by a drop in housing prices. The effect is larger if the downturn in the housing market coincides with other shocks originating, for example, in financial markets. Given the magnitude of the macroeconomic effects in the model exercises above, and the current discussion on how to form an appropriate macroprudential policy, there may be reason for decision makers to carefully analyse how different policy changes could affect the determinants of housing prices. Policy makers do not, of course, want to induce a substantial fall in housing prices.

The fact that a decline in housing prices has considerable macroeconomic effects on the Swedish economy should prove useful to those who analyse the Swedish economy and perhaps also other similar small open economies. In its current state, the Swedish economy appears to have a good possibility to cope with the downturn in demand associated with declining housing prices; in a historical and international perspective, household saving is high and public finances are strong. The latter appear especially important considering there is limited scope for further monetary policy stimulus.

References

André, C., Gupta, R. and Kanda, P. T. (2012), "Do House Prices Impact Consumption and Interest Rate? Evidence from OECD Using An Agnostic Identification Procedure", OECD Economics Department Working Paper No. 947.

Attanasio, O. P., Blow, L., Hamilton, R. and Leicester, A. (2009), "Booms and Busts: Consumption, House Prices and Expectations", *Economica* 76, 20-50.

Beechey, M. and Österholm, P. (2010), "Forecasting Inflation in an Inflation Targeting Regime: A Role for Informative Steady-State Priors", *International Journal of Forecasting* 26, 248-264.

Campbell, J. Y., and Cocco, J. F. (2007), "How Do House Prices Affect Consumption? Evidence from Micro Data", *Journal of Monetary Economics* 54, 591-621.

Case, K., Quigley, J. and Shiller, R. (2005), "Comparing Wealth Effects: The Stock Market versus the Housing Market", *Advances in Macroeconomics* 5, 1-32.

Cristini, A. and Sevilla, A. (2014), "Do House Prices Affect Consumption? A Re-Assessment of the wealth Hypothesis", *Economica* 81, 601-625.

De Bonis, R., and Silvestrini, A. (2012), "The Effects of Financial and Real Wealth on Consumption: New Evidence from OECD Countries", *Applied Financial Economics* 22, 409-425.

Disney, R., Gathergood, J. and Henley, A. (2010), "House Price Shocks, Negative Equity, and Household Consumption in the United Kingdom", *Journal of the European Economic Association* 8, 1179-1207.

Doan, T. A. (1992), *RATS Users Manual*, version 4.

Dynan, K. (2012), "Is a Household Debt Overhang Holding Back Consumption", *Brookings Papers on Economic Activity* 44, 299-362.

Friedman, M. (1957). *A Theory of the Consumption Function*, Princeton University Press, Princeton.

González-Rozada, M. and Levy Yeyati, E. (2008), "Global Factors and Emerging Market Spreads", *Economic Journal* 118, 1917-1936.

Mian, A., Rao, K. och Sufi, A. (2013), "House Prices, Home-Equity-Based Borrowing, and the US Household Leverage Crisis", *Quarterly Journal of Economics* 128, 1687-1726.

Modigliani, F. and Brumberg, R. H. (1954), "Utility Analysis and the Consumption Function: An Iterpretation of Cross-Section Data", in Kurihara, K. K. (ed.), *Post-Keynesian Economics*, Rutgers University Press, New Brunswick.

Mody, A. and Taylor, M. P. (2003), "The High-Yield Spread as a Predictor of Real Economic Activity: Evidence of a Financial Accelerator for the United States", *IMF Staff Papers* 50, 373-402.

Musso, A., Neri, S. and Stracca, L. (2011), "Housing, Consumption and Monetary Policy: How Different Are the US and the Euro Area?", *Journal of Banking and Finance* 35, 3019-3041.

Österholm, P. (2009), "Incorporating Judgement in Fan Charts", *Scandinavian Journal of Economics* 111 (2), 387-415.

Österholm, P. (2010), "The Effect on the Swedish Real Economy of the Financial Crisis", *Applied Financial Economics* 20, 265-274.

Österholm, P. and Zettelmeyer, J. (2008), "The Effect of External Conditions on Growth in Latin America", *IMF Staff Papers* 55, 595-623.

Sveriges Riksbank (2011), *The Riksbank's Commission of Inquiry into Risks on the Swedish Housing Market*.

Sveriges Riksbank (2014), *Monetary Policy Report*, February 2014.

Villani, M. (2009), "Steady-State Priors for Vector Autoregressions", *Journal of Applied Econometrics* 24, 630-650.

Villani, M. and Warne, A. (2003), "Monetary Policy Analysis in a Small Open Economy Using Bayesian Cointegrated Structural VARs", Working Paper No. 296, European Central Bank.

Appendix

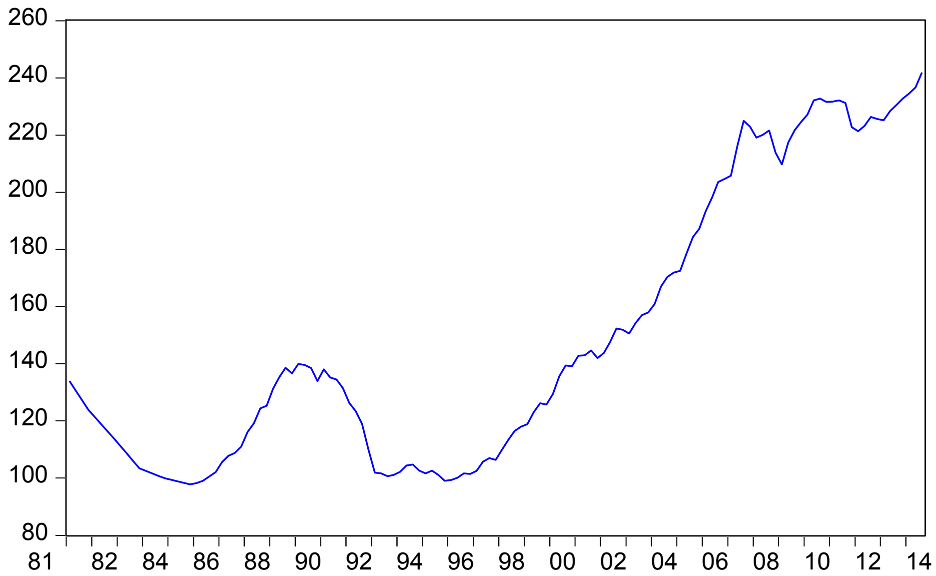
Table A1. Steady-state priors.

Variable	Prior interval
Y_t^{World}	(-1,0; 1,0)
HY_t^{US}	(3,0; 6,0)
U_t	(5,0; 8,0)
HC_t	(-1,0; 1,0)
HP_t	(-1,0; 1,0)
I_t	(4,0; 7,0)
FI_t	(95,0; 105,0)

Note: Ninety-five per cent prior probability intervals for parameters determining the unconditional means. Prior distributions are all assumed to be normal. Variables are defined in equation (2).

Figure A1. Real housing prices.

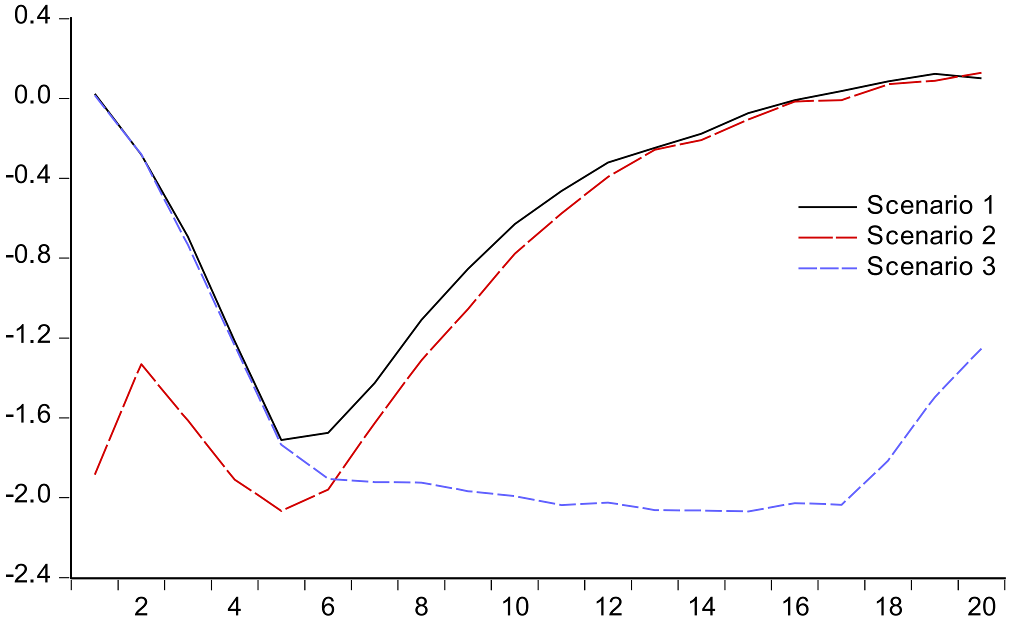
Index, 1986=100



Note: Real housing prices are calculated as the real estate price index for one- and two-dwelling buildings for permanent living deflated by seasonally adjusted CPIF. Before 1987 CPIF is linked using CPI excluding mortgage interest costs.

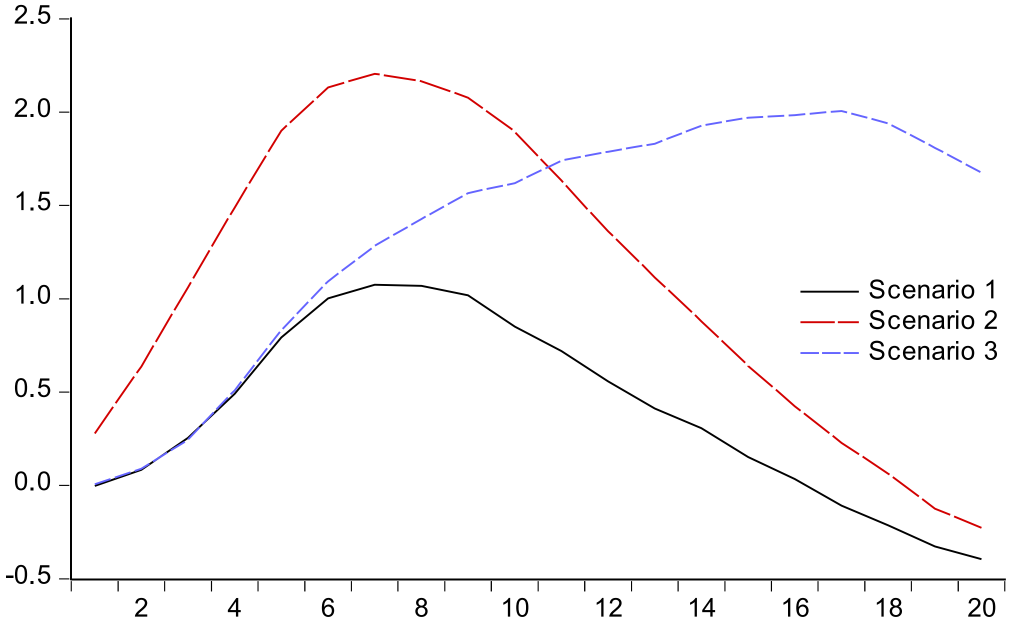
Source: Statistics Sweden.

Figure A2. Difference between unconditional and conditional forecasts for consumption.



Note: Difference given in percentage points.

Figure A3. Difference between unconditional and conditional forecasts for unemployment.



Note: Difference given in percentage points.

National Institute of Economic Research, Kungsgatan 12-14, Box 3116, SE-103 62 Stockholm, Sweden
+46 8 453 59 00, info@konj.se, www.konj.se/en

ISSN 1100-7818