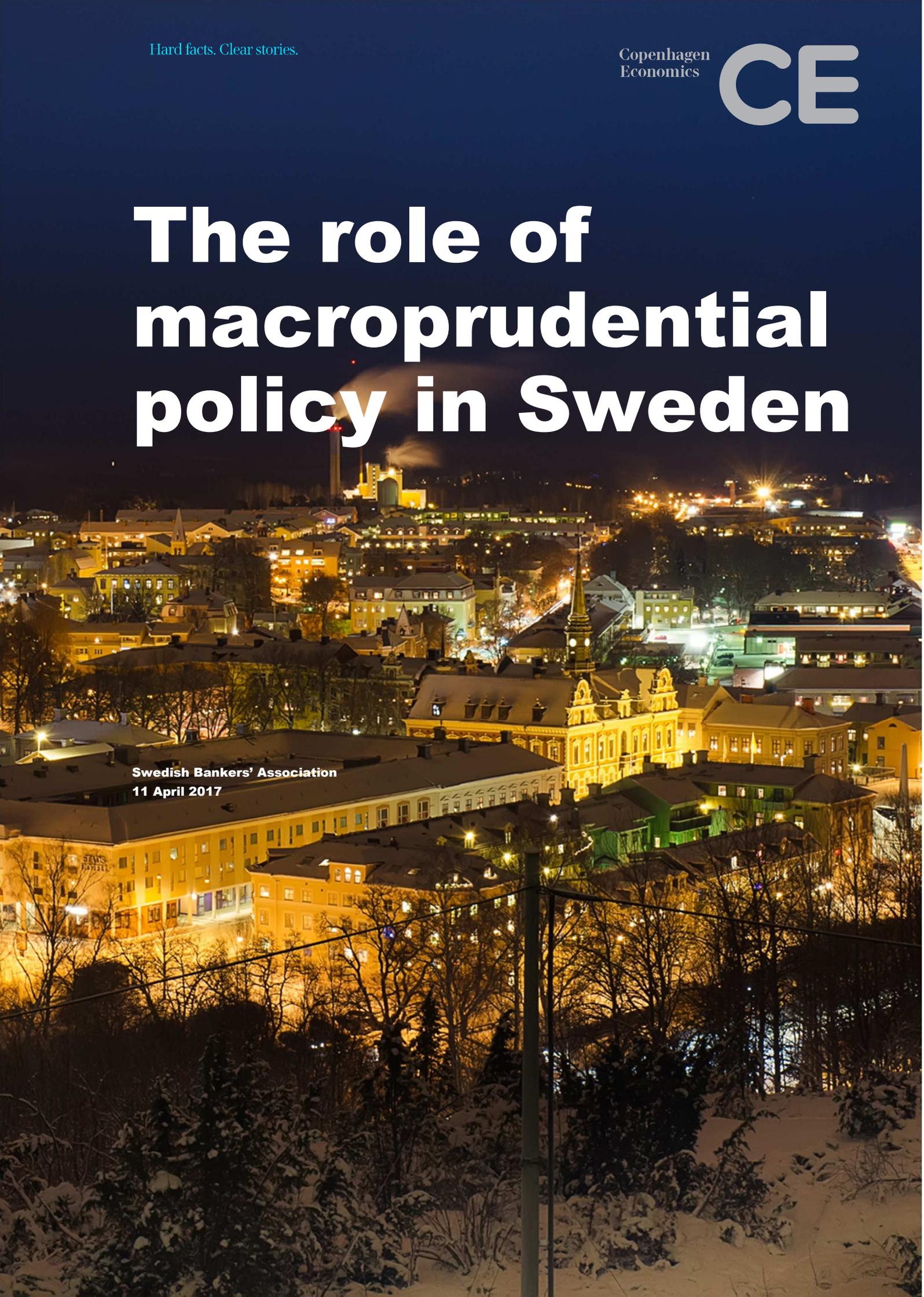


The role of macroprudential policy in Sweden

Swedish Bankers' Association
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Preface

Swedish banks and authorities have since the financial crisis been at the international forefront in taking measures to make the banking sector more robust. Capital ratios are in top among European peers, while the share of non-performing loans are among the lowest.

However, a possible burst of a perceived housing price bubble has lead public authorities in Sweden to consider new so-called macroprudential measures to dampen demand for owner-occupied accommodation and hence keep a lid on housing prices and household debt. An amortisation requirement and a loan-to-value (LTV) requirement have already been implemented and a debt-to-income (DTI) limit of 600 per cent has recently been put forward by the Swedish FSA (Finansinspektionen) as a possible new measure.

The perceived risks on the Swedish housing markets have further sparked a debate on the responsibility of the macroprudential policy in Sweden. As a response, the government have proposed to widen the mandate of the FSA, which would enable them to implement a wide range of different restrictions on lending (such as the DTI limit) without the need to have the measures adopted in the Swedish parliament (but merely approved by the government).

Against this background, the Swedish Bankers' Association has asked us to 1) analyse how to best curb the booming Swedish housing prices, 2) analyse the effects of these macroprudential measures and 3) give recommendations on the mandate of the Swedish FSA.

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Executive summary

The main drivers of housing prices in Sweden

The Swedish housing market is booming. Prices rose by 43 per cent from 2009 to 2016, with by far the biggest surge in the larger urban areas.

Our analysis suggests this is triggered by three main drivers: (1) highly expansionary monetary policies in the form of exceptionally low policy rates and purchases of securities (quantitative easing), (2) changes in tax policies have encouraged ownership of houses and (3) increased migration towards highly urban areas; the annual net inflow to the larger Stockholm area rose from 1 per cent in the two decades up to 2006 to nearly 2 per cent since 2006 while the stock of housing in the region has grown much less.

This is a cocktail of factors that drives up housing prices and total mortgage credits.

Get housing and credit markets back on track

The trend of migration towards urban areas is global and linked to better job opportunities, often in industries with high productivity. The key to ease pressures on prices and reduce risks to financial stability is to focus on the fundamental factors that drive the housing market boom. By far the quickest and most effective approach would be to align monetary policies better with underlying inflation pressures in the Swedish economy. We also suggest that a relatively modest adjustment of tax policies could ease pressures on the housing markets. Finally, we recommend a housing policy that allows for more housing to be constructed in the areas where the population wants to live and where more and often better paid jobs are available.

Adding it all up, we estimate that had this set of policies been in place over the last years, housing prices in Sweden would have increased 20-25 per cent since 2009 instead of 43 per cent.

The challenges with macroprudential measures

The use of macroprudential measures is still in its infancy, and there is limited international experience to draw from. Existing research suggests that macroprudential measures may reduce credit growth but have limited effect on the housing markets. Consequently, we expect little effect on the Swedish housing prices if the proposed debt-to-income (DTI) limit is implemented – especially since the proposed measure will only affect around 12 per cent of the housing market.

On the contrary, the proposed DTI limit has several counter-productive features:

- Banks already include DTI as a primary indicator when granting a loan. However, there could be good reasons why some households might surpass the (DTI) limit, for example a household with two persons recently graduated from college or a person with a large stock of financial assets. In other words, there is a difference between a guiding principle and a rigid legal constraint.

- A DTI limit can basically be seen as the implementation of a market error on the credit market – this brings about a welfare loss. If it takes the form of the proposed measure, it could correspond to a decline in GDP of around ½ per cent.
- Finally, we estimate that the implementation of a DTI limit would reduce GDP by some 0.4 per cent in the short run. Thus, the implementation of such a proposal would need to be carefully timed with the cycle of the economy in order to avoid, e.g., strengthening a downturn in the economy.

More generally, macroprudential policy *can* play an important role in preventing the build-up of financial imbalances that would eventually materialise as macroeconomic instability. However, the macroprudential measures are inefficient and ineffective in conducting macroeconomic stabilization policy and we see an attempt to stabilise the housing market through macroprudential measures as a poor substitute for more targeted macro and structural policies as discussed below.

Transparency and efficiency in ensuring economic and financial stability

In general, we recommend that the pros and cons of different approaches to reduce housing price growth are compared in a transparent manner, in particular regarding the effects on consumers. Regulatory measures targeting the financial sector – being taxes on wages or the DTI limit – impose significant costs on consumers, but these costs tend to somewhat forgotten in the policy debate and typically not calculated for different consumer segments. In contrast, focused policies targeting the root causes of the housing price boom imply more visible, direct costs for consumers. We see a risk that policy makers choose instruments that imply more hidden costs for consumers, e.g. a DTI limit, rather than the more effective and transparent direct measures

More generally, it is important that the task of stabilising the economy and ensuring financial stability is not “split” between different agencies. Indeed, a wide array of policies affects the stability of the economy, but the government is the only institution that has the legislative power to implement the most effective measures (together with the parliament), taking into account the effects on consumers in a transparent manner.

Consequently, we recommend that the Swedish FSA focus on financial stability, i.e. to make sure that “*the financial system is robust to disturbances in the economy*”.¹ In doing so, we recognise that macroprudential policy can be a useful tool. However, the FSA should only focus on risks to the macroeconomic stability to the extent that the risks originate from the financial sector.

Currently, we deem the risk of solvency issues in the financial sector being a source of macroeconomic instability to be small. According to the EBA stress tests, the Swedish financial sector can, with a large margin, withstand a macroeconomic setback more severe than the Swedish crisis in the first half of the nineties. Similarly, there is no indication that the economic setback after 2008 caused Swedish banks to hold back credits to healthy firms.

¹ The definition is from: Norwegian Central Bank (2003), Financial Stability Review, February.

As a result, we see no need to widen the mandate of the Swedish FSA, as proposed by the government. The current mandate already includes financial stability as an objective, and the FSA already has a sufficient set of tools to ensure this objective. If the responsibility of the overall macroeconomic stability was outsourced to the Swedish FSA, there is a risk that several “second-best policies” would be implemented, as the whole palette of economic policy tools is not – and can never be – available to the Swedish FSA.

A way forward: Increase transparency and comparability of internal models

In Sweden as in other countries, it has been discussed whether the internal models of IRB-approved banks have too low risk-weights for certain low-default portfolios, such as mortgages. This may be a valid point and the European Banking Authority (EBA) is currently working to increase the transparency and comparability of internal models. If the risk-weights of some portfolios are perceived as too low, we suggest to meet this challenge in connection with the development of internal models by increasing the transparency and, perhaps as well the content of stress testing. However, we strongly advise against using these technical issues as a pretext for adding new layers of financial regulation with potential substantial costs for bank customers. Policies should focus on the stability of institutions, not on the merits of individual loans to households and firms.

Chapter 1

The Swedish housing market

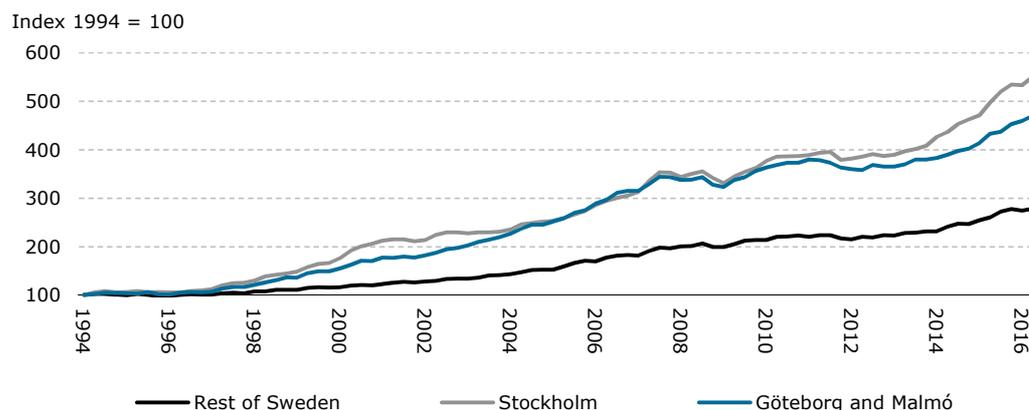
The key driver for the demand for (more) macroprudential policies is the sustained surge in Swedish house prices since 2009. In several policy reviews, this surge is pointed out as a potentially destabilising factor for the Swedish economy and the financial system. We will analyse the effects of macroprudential policies in *chapter 2*, but would like from the start to understand what has been driving the strong housing price growth; otherwise, it will be difficult to treat the problem.

Hence, in this chapter we do an extensive regional statistical analysis of the Swedish housing market, in particular in order to answer the question: Is this a bubble or are prices simply driven by fundamentals, i.e. increased demand and limited supply? In *section 1.1*, we start out by documenting the strong housing price growth in Sweden in recent years, particularly in the urban areas. In *section 1.2*, we explain the three main drivers behind the housing price growth and in *section 1.3*, we review the overall effects.

1.1 Urban area price boom as in other EU countries

From 2009 to 2016, housing prices in Sweden increased by 43 per cent, corresponding to about 5 per cent per year, *cf. Figure 1.1*. In Stockholm, housing prices have risen by 59 per cent, or 7 per cent per year. The housing markets in other urban areas have also been booming, while the price dynamics in the rest of the country were more subdued with annual housing price growth in the order of 4.5 per cent from 2009 to 2016.

Figure 1.1 Strong housing price growth in Swedish cities



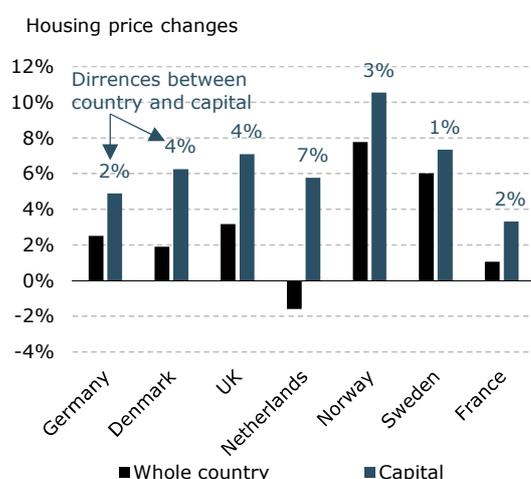
Source: SCB

This stronger housing price trend in urban areas compared to provincial areas is not only a Swedish phenomenon. Looking at price dynamics since the crisis in other comparable countries, prices have increased by 1-7 per cent more in the capital regions compared to the

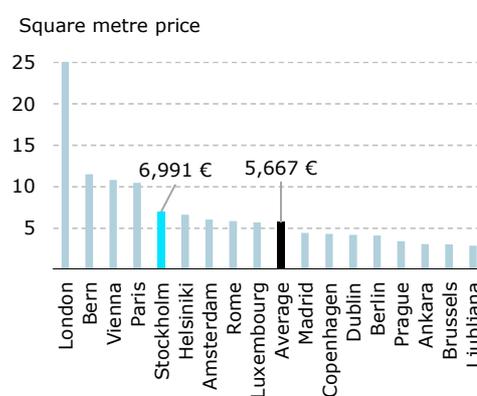
rest of the country, cf. Figure 1.2a. In fact, the development of Swedish housing prices are actually more homogeneous than most other countries. When looking at the *level* of housing prices, Stockholm is at the high end, although not far from comparable cities such as Amsterdam and Helsinki, cf. Figure 1.2b.

Figure 1.2 Square metre prices at the high end in Stockholm

a) Housing price increase in capital cities compared to province, 2009-16



b) Average square metre price in European capitals



Note: Figure 1.2b displays selected European cities with the latest data available. The average is calculated for all European OECD countries where data were available.

Source: Global property guide, SCB

1.2 Main drivers of the housing price surge

In this section, we conduct a statistical analysis of the housing prices in Sweden, based on a regional housing price model of Sweden. Based on the model, we identify three main drivers behind the surge in housing prices:

1. **The monetary policy** has been quite expansionary since the financial crisis, despite the fact that Swedish economy has been much less affected compared to the Euro area.
2. **Property taxes** have been gradually reduced in recent decades, most recently in 2008 where taxes were fixed in nominal terms at around a third of the rate of the mid-1990s.
3. **The urbanisation process** has been strong in Sweden in recent years (as in many other countries), together with a sizeable population growth in general due to immigration. However, urban housing supply is quite restricted and has not been able to react sufficiently to the increasing population.

We examine the importance of these three drivers by running a counter-factual analysis, with three alternative scenarios (*cf. also appendix*):

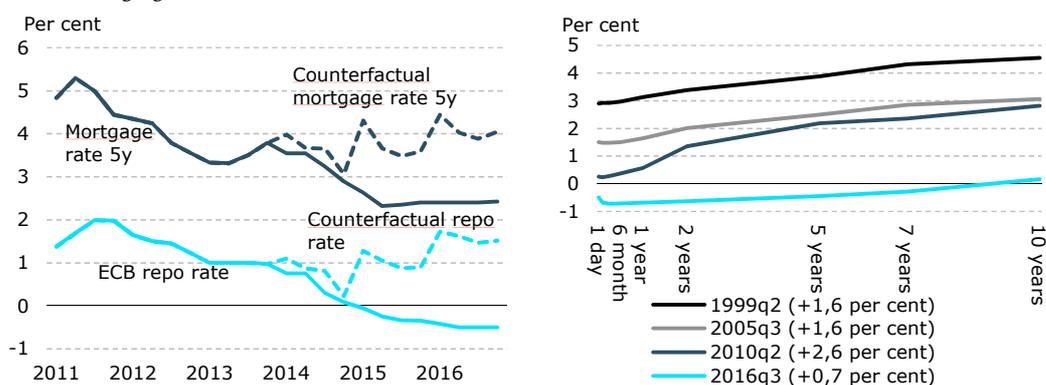
1. **Monetary policy:** We look at how the monetary policy rate would have been if the Riksbank had responded more “normally” to the levels of inflation and GDP growth in the years from 2013 until today. In other words, we analyse the effects of the Riksbank pursuing a more aggressive monetary policy than warranted by objective factors based on international practices.
2. **Property taxes:** We look at how the user costs (or effective costs) of housing would have been if the government had not decreased property taxes from 2008 and onwards.
3. **Urbanisation and supply restrictions:** We consider a scenario where the housing supply is less restricted and is able to increase at the same rate as the population from 2008 and onwards.

The monetary policy’s effect on housing prices

The monetary policy is a main driver of the mortgage rates – especially the short-term rates, which are typically used for financing housing in Sweden (3-month to 5-year rates). When the mortgage rate declines, the effective cost of buying a house declines and prices increase (at least in the short to medium term). This effect is especially important for homebuyers, which are short-sighted or credit-constrained.

Figure 1.3 Monetary policy and interest rates

a) Actual and rule-based monetary policy and mortgage rates b) Current and historical yield curves



Note: Figure a shows ECB's monetary policy rate (repo) and a standard rule-based policy rate (counterfactual) and the implications this would have for the mortgage rate (see *appendix* for details). Figure b shows the yield curve in different historical low interest rate environments (where 3 per cent was a relatively low interest rate in 1999). The numbers in parentheses indicate the difference between the repo rate and a 10-year government bond rate.

Source: The Riksbank and own calculations

Analysing the monetary policy in Sweden in recent years, we find that the Riksbank has run a quite expansionary monetary policy from 2013 and onwards, see estimates in *appendix*.

For example in 2014, the policy rate became negative in a situation where economic forecasts suggested that the Riksbank should start to increase its policy rate, *cf. Figure 1.3a*.²

In recent years, the low monetary policy rate has had an almost one-to-one effect on both the short- and long-term mortgage rates. This is due to a historical flat yield curve: The interest rate difference between the short-term policy rate and a 10-year government bond rate is typically above 1.6 per cent in low interest rate environments – this difference is currently around 0.7 per cent, *cf. Figure 1.3b*. The flat yield curve should be seen in the light of the quantitative easing programmes of central banks at a global level.

We find that this expansionary monetary policy has had a strong effect on housing prices, especially in Stockholm, *cf. Figure 1.4*. This indicates that prices are more interest rate sensitive in urban areas, partly since urban families use a larger portion of their income for housing and take on a higher leverage. Our estimate also indicates that urban families are more short-sighted or credit-constrained and finance their house using short-term mortgages. The estimates are quite in line with earlier results in the literature, *cf. Box 1.1*.

Box 1.1 Results are in line with other results in the literature

The results found here are more or less in line with earlier results, both similar national statistical models and models using alternative methods. For example, using a theoretical NPV model (the so-called user-cost approach), Svensson (2012) analyses the permanent effect of monetary and mortgage tax policy:

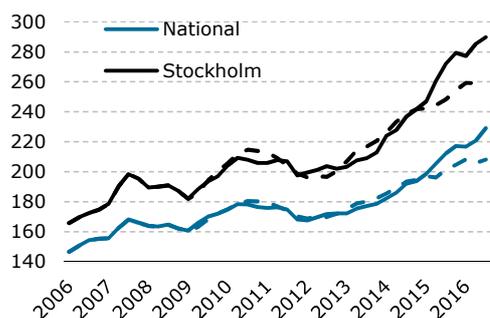
- 1) For the monetary policy, he finds a semi housing price elasticity with respect to permanent interest rate changes of -7. In our case, when the monetary policy rate is increased by 1.85 percentage points, housing prices should decrease by 13 per cent. This is closely in line with our national result.
 - 2) For the mortgage tax, Svensson (2012) finds semi elasticity of -10.9. In our case, when mortgage taxes are lowered by 0.4 percentage points, housing prices should increase by 4.5 per cent. This is somewhat lower than what we find.
-

When looking at the time dimension, the monetary policy was especially important for the housing price boom from 2013 and onwards, where the actual monetary policy started to deviate from the rule-based policy, *cf. Figure 1.3a and Figure 1.4a*. From 2013 to 2016, we find that the price growth would have been about 13 percentage points lower if the monetary policy had followed a rule-based policy.

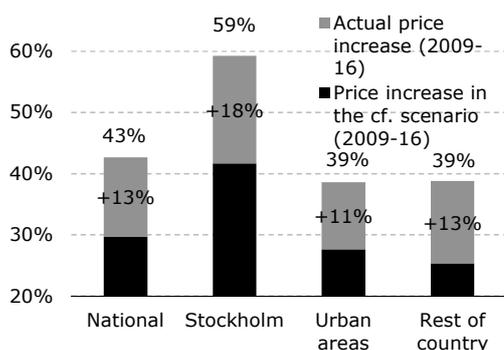
² See Hannoun (2015): “Ultra-low or negative interest rates: what they mean for financial stability and growth” for a discussion of the effects of negative interest rates.

Figure 1.4 The price effect of monetary policy

a) Dynamic price effect of monetary policy



b) Effects on price changes from 2009 to 2016



Note: The dashed lines are the counterfactual scenarios.

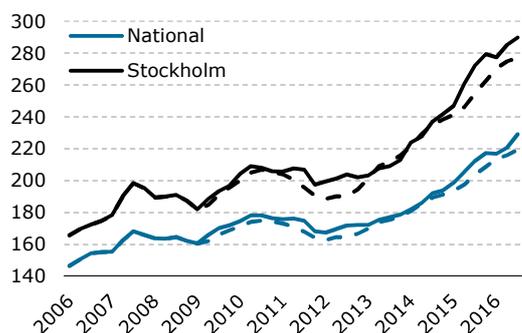
Source: SCB and own model estimates

The property tax effect on housing prices

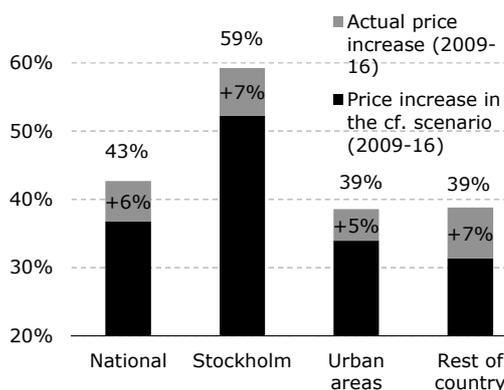
Through consecutive tax reforms, Swedish property taxes have gradually eroded since the late 1990s, from an average tax rate of 1.2 per cent to around 0.6 per cent to 0.2 per cent today. In addition, Swedish property taxes were decoupled from the housing value, with a nominal cap of SEK 7,000 in annual property tax – independent of the housing value. As a result, the ceiling has by definition had the largest effect in urban, high price areas such as Stockholm.

Figure 1.5 The price effect of mortgage taxes

a) Dynamic price effect of the mortgage tax decrease from 2007 and onwards



b) Effects on price changes from 2009 to 2016



Note: The dashed lines are the counterfactual scenarios.

Source: SCB and own model estimates using a regional house price model, see appendix

The lower property taxes have significantly reduced the effective costs of housing, which have further stimulated the surge in housing prices, although not to the same magnitude

as the expansionary monetary policy, cf. *Figure 1.5*.³ From 2009 to 2016, we find that the price growth would have been about 6 percentage points lower if the property taxes were kept at 0.6 per cent from 2007 and onwards.

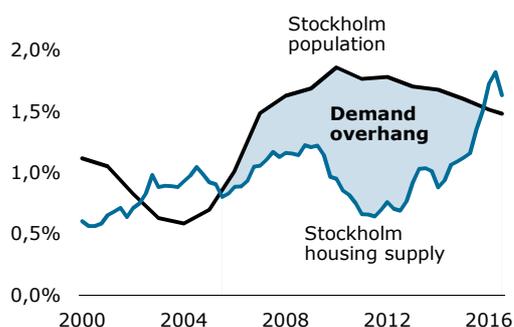
Note that due to data limitation, our estimates are based on average national mortgage tax rates. As a result, our estimates might underestimate the effect of the tax reforms in the urban areas – especially Stockholm – and overestimate the effects in the rest of the country (see also *appendix*).

The effects of increased urbanisation

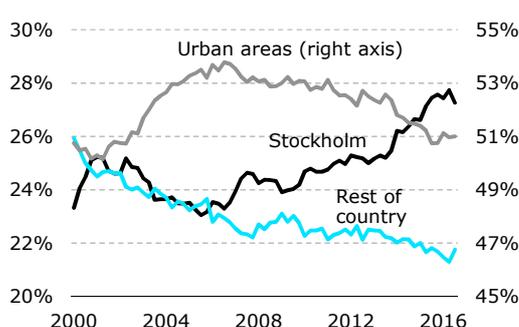
Since 2006, there has been a strong urbanisation process in Sweden.⁴ From 1985 to 2005, the annual average population growth in Stockholm was around 1 per cent. From 2006 and onwards, the annual population growth has jumped to an average of some 1.8 per cent, cf. *Figure 1.6a*. The housing supply in Stockholm could not keep up with the population growth, giving rise to a large population-demand overhang (see the blue area in *Figure 1.6a*). Not until 2015 did the housing supply start to pick up. Other urban areas did not face the same tendencies, primarily since the regions include more space for new construction. Consequently, the Stockholm region's share of total value of the housing stock has risen from 22 to 28 per cent since 2006, cf. *Figure 1.6b*.

Figure 1.6 Strong population growth in Stockholm combined with a low increase in housing supply

a) Yearly growth in population and housing supply



b) Housing values in different parts of Sweden as a share of total



Note: The housing values are simply the multiple of the housing stock and housing price index.

Source: SCB and own model estimates

A significant effect of supply restrictions on the price boom in Stockholm

When housing demand increases – for example because of urbanisation – the increase can be absorbed by a higher supply, thereby preventing an increase in housing prices. However,

³ Note that the model does not account for regional differences in mortgage taxes (data are not available). It may be the case that the nominal tax freeze has a larger effect on the mortgage tax percentages in urban areas where prices are relatively higher. This would result in higher price effects in urban areas.

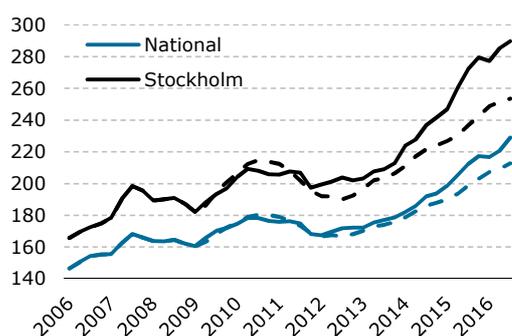
⁴ The national population growth has also increased to some extent – only the Upper Norrland has seen a depopulation since 2006.

in areas with high supply rigidity, higher demand will to a large extent result in higher prices. This is especially the case for urban areas and especially in cities with both geographical and regulatory restrictions on the availability of land and areas zoned for housing construction.⁵

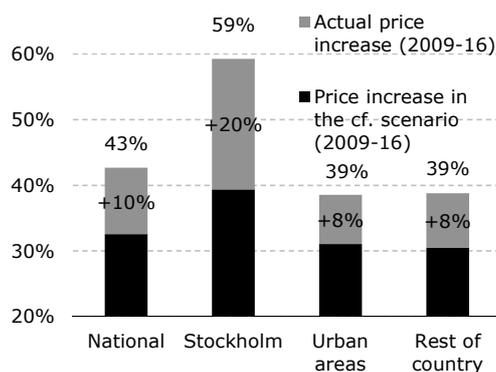
If the supply in Stockholm had been more flexible and able to absorb just half of the population-demand overhang from 2007 and onwards, we find that prices would have been significantly lower in Stockholm, see *Figure 1.7*. In addition, regional price dynamics are highly interconnected through spill-over effects, and a more flexible supply in Stockholm would likewise mitigate housing price growth nation-wide.⁶

Figure 1.7 The price effects of supply restrictions

a) Dynamic price effect of urbanisation and supply restrictions in Stockholm



b) Effects on price changes from 2009 to 2016



Note: We have analysed the price effect of a counterfactual urban planning policy in Stockholm, where the supply is able to absorb half of the actual population-demand overhang seen as the grey area in *Figure 1.6* (see *appendix* for details).

Source: SCB and own model estimates

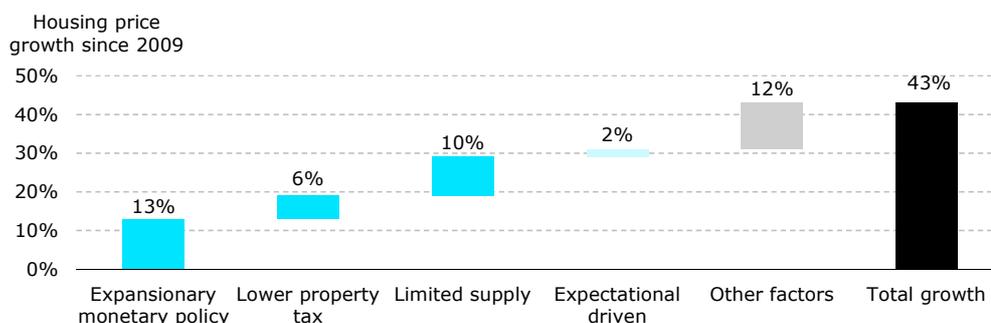
1.3 Joint effect of the three factors and the bubble hypothesis

In total, we estimate that the three main drivers account for some 24-29 percentage points of the total national housing price increase of 43 per cent since 2009, see *Figure 1.8*. In addition, we estimate that 2 percentage points are driven by expectations, while 12 percentage point of the increase is unexplained by a statistical model and can be attributed to other factors such as increasing wealth or financial innovation. Thus, the majority of the housing price boom can be explained by fundamental factors.

⁵ See, e.g., Anundsen and Heebøll (2016) Supply restrictions, subprime lending and regional US house prices, *Journal of Housing Economics* (March 2016).

⁶ The reason for this is the so-called price-ripple effects, where prices in urban areas often drive the prices in the rest of the country. See, e.g., Meen (1999, 2001) and Holmes et al. (2011).

Figure 1.8 Housing price growth in Sweden can primarily be explained by three main drivers



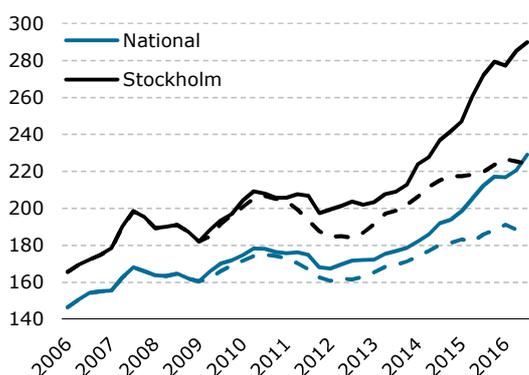
Note: Given the dynamic structure of the model (and the structure of the actual housing market), the estimated factors are not entirely additive. Concretely, we estimate that the three main factors account for some 29 percentage points of the total housing price growth from 2009 to 2016, when estimated individually. When estimating the three factors collectively, we find that they account for 24 percentage points of the total growth in housing prices.

Source: Own calculation based on the regional housing model

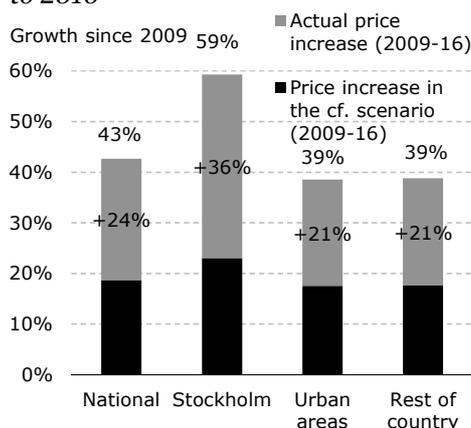
Without these three main drivers, we find that housing prices in the different regions would have increased by around 20-25 per cent since 2009. This is about 2-3 per cent per year, which is somewhat below the previous historical average of around 3.5 per cent (1986-2008), see *Figure 1.9*. In addition, without the three main drivers, the housing price development would have been more homogeneous across the different regions.

Figure 1.9 The three fundamental factors explain the price boom

a) Dynamic price effect of all three fundamental factors



b) Effects on price changes from 2009 to 2016



Note: The dashed lines are the counterfactual scenarios. On national level, the cumulative effect of the three main drivers is 24-29 percentage points – see note to *Figure 1.8*.

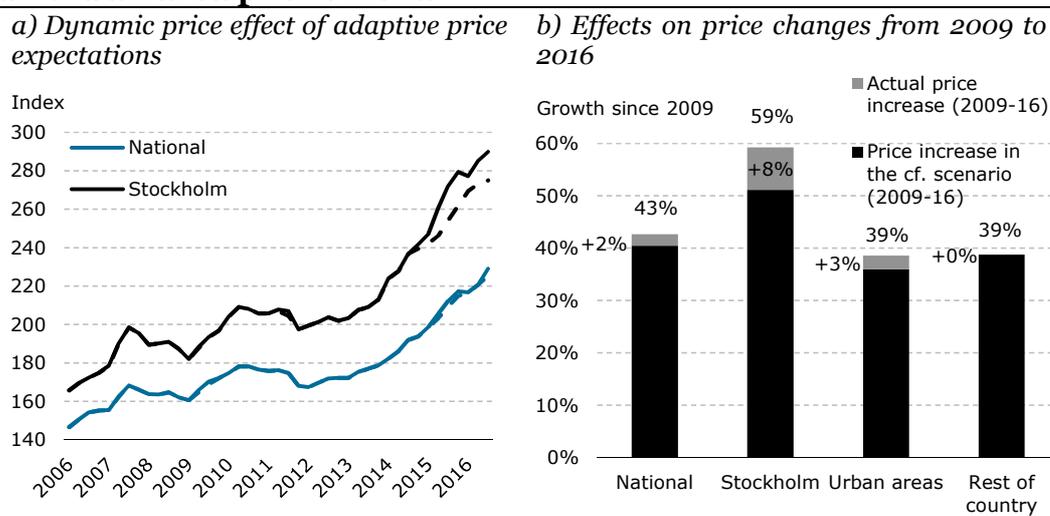
Source: SCB and own model estimates, see also *appendix*.

Housing bubble in Sweden?

This brings us back to the bubble question. Are Swedish housing prices out of sync with long-term levels risking a collapse or just driven by fundamental factors? Indeed, both the Riksbank and IMF have warned that a housing price bubble might be underway. For example, the IMF writes in their article IV consultation report on Sweden 2015: “The housing market shows imbalances, with double-digit price gains as the urban population outpaces construction, pushing up household debt from already high levels”.

Our model does suggest that some of the increase in housing prices is a consequence of expectations of further price growth, i.e. leading to a potential risk of housing price evaluations and purchases driven by a desire to post capital gains on housing investments. According to our estimates, prices in Stockholm are slightly positively affected by expectations of further price increases, as around 8 per cent of the increases is driven by expectations, see *Figure 1.10*. On national level, the expectational effect is almost negligible. Thus, in general, our analysis is not supporting the bubble hypothesis.

Figure 1.10 Some effects of adaptive price expectations – mostly an urban area phenomena



Note: Here we have used a regional statistical housing price model to analyse the price effect of adaptive price expectations (see the *appendix* for details).

Source: SCB and own model estimates

The bubble effect in Stockholm can actually be a result of the price increases themselves, as they feed the expectations of further price increases, *cf. Box 1.2*. Hence, without the fundamentally driven housing price boom, these expectational effects would most likely not have been present. That has key implications for policy-making as explained in *section 3.1*.

Box 1.2 Bubble in Stockholm?

A high housing price growth tends to create expectations of further housing price growth, which further increases the demand on the housing market. In areas where the housing supply is not able to absorb the increasing housing demand, prices will increase even further. This means that the expectations to some extent become self-fulfilling in the short and medium run.

That said, the part of the housing price growth driven by expectations can be seen as an indirect cause of the three main factors. By definition, price bubbles arise when prices to a large extent are driven by expectations for future price increases, i.e. capital gains. At this point, housing buyers are typically found to have some degree of adaptive price expectations – i.e. they use previous price changes to make predictions of future price changes (although this is not always rational).

1.4 Conclusions: Main drivers behind the housing price surge

- Based on a regional housing price model of Sweden, we identify three main drivers behind the surge in housing prices in Sweden:
 1. The highly expansionary monetary policy. Especially in the urban areas where the households are more inclined to use short-term financing.
 2. The gradual reductions in property taxes have significantly lowered the effective housing costs. The decoupling from actual housing values has further boosted the housing price growth.
 3. The strong urbanisation process since the mid-2000s with limited reaction in the housing supply.
 - Thus, the surge in housing prices since 2009 have primarily been driven by fundamental factors.
 - On the contrary, on national level, we find almost no so-called bubble effect – that is increased housing demand as a result of expectations of future capital gains. In Stockholm, we find a small bubble effect, most likely driven by the above-listed fundamentals.
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Chapter 2

Costs and benefits of macroprudential measures

The soaring Swedish housing prices have sparked a debate on whether the housing market is on an unsustainable path. In response, the Swedish authorities have proposed and implemented a number of restrictions on lending arrangements between the financial sector and individual customers going beyond regulating and supervising the overall risk of financial institutions. Most recently, a Debt-To-Income (DTI) limit of 600 per cent has been suggested as a method to curb the increasing housing prices. In this chapter, we analyse the effects of these lending restrictions in general, and the proposed DTI limit in particular.

In *Section 2.1*, we start out by defining the term “macroprudential policy”. In *section 2.2*, drawing on empirical research, we analyse the extent to which macroprudential measures can curb housing price growth. In *section 2.3*, we demonstrate that lending restrictions could lead to a very rigid credit assessment for retail customers and in *section 2.4*, we analyse the negative welfare effects of a DTI limit. Finally, in *section 2.5*, we demonstrate that the implementation of a DTI limit could have destabilising effects, if implemented during a down-turn.

2.1 Macroprudential policies seek to limit systemic risks

Macroprudential policies can broadly be defined as policy measures aimed at improving financial stability.⁷ After the financial crisis, the term has moved to the centre of the political agenda describing a long list of rather different measures seeking to limit systemic risks in the financial sector.⁸ Measures encapsulated in the term vary from capital and liquidity requirements to restrictions on lending, risk measure methodologies etc.

In the academic literature, there is also no clear-cut definition of the term and in contrast to, for example, a monetary policy, there is no main instrument that macroprudential policy operates through.⁹ The term is hereby primarily defined by the financial stability objective, which it seeks to achieve.

Macroprudential policy is sometimes defined in contrast to *microprudential* policy, which aims at improving the resilience of the individual institutions focusing on stand-alone (or idiosyncratic) risks.¹⁰ The distinction is, however, far from clear cut, as higher capital requirements for each individual institution would naturally improve the overall resilience of

⁷ BIS (2011): Macroprudential policy – a literature review, p. 6.

⁸ Dirk Schoenmaker (2011): Macroprudentialism, p. 3.

⁹ Kashyap et al. (2016): A programme for improving macroprudential regulation, Macroprudentialism, p. 21.

¹⁰ Brunnermeier et al. (2009): The Fundamental Principles of Financial Regulation.

the banking sector. In this way, a macroprudential policy can be categorised as measures in the sphere between microprudential policy and classic macroeconomic policies (such as monetary policy and structural economic policies).¹¹

As a simplification, we can divide macroprudential policies into two main categories¹²:

1. Regulation of the overall risk in each financial institution: This could be capital- and liquidity-based instruments, including Pillar II capital requirements, which seek to improve the resilience of the banking sector.
2. Lending restrictions: These are asset-based macroprudential measures, often putting restrictions on individual transactions, for example a DTI limit, amortisation requirements etc.

As these two categories seek to limit systemic risks in different ways, it is somewhat difficult to assess them collectively:

The *first* category was particularly in focus in the aftermath of the financial crisis with the implementation of Basel III. The measures have overall improved the resilience of the financial sector significantly.¹³ This category is analysed in a previous report by Copenhagen Economics: “*Cumulative impact of financial regulation in Sweden*”. In the report, we find that the optimal level of capitalisation corresponds to the standard implementation of Basel III. However, we argue that more layers of regulation will do very little to reduce the risk of a crisis but have significant real-economy costs.

In this chapter, our analysis focuses on the asset-based measures in the *second* category, also called lending restrictions, which all share the characteristics that they in some way restrict households in their financial decisions towards a more prudent behaviour. However, as we will demonstrate in the remaining of this chapter, the measures are ineffective in curbing housing price growth and will lead to a rigid credit assessment.

Lending restrictions in Sweden

In Sweden, so far two lending restrictions have been implemented after the financial crisis, with a DTI limit currently being discussed, cf. also *Figure 2.1*¹⁴:

1. In October 2010, a Loan-To-Value (LTV) limit of 85 per cent was implemented, which cap the mortgage at 85 per cent of the value of the house, thereby imposing a minimum down payment.
2. In June 2016, an amortisation requirement was implemented, which means that households must amortise 2 per cent of the total size of their mortgage if the LTV is above 70 per cent and 1 per cent if between 70 per cent and 50 per cent.

¹¹ Bank of England (2009): The role of macroprudential policy, p. 3.

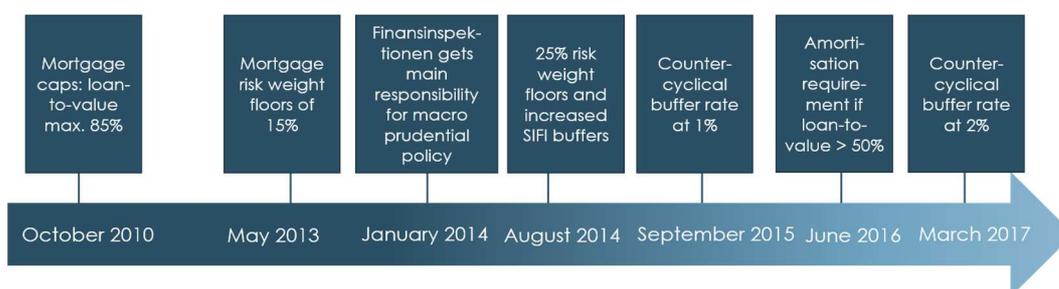
¹² ECB (2016) further splits category 1 into asset-based and liquidity-based instruments.

¹³ Although there is still work to be done, most recently exemplified by the controversy on the bailout of Monte dei Paschi.

¹⁴ Furthermore, the capital requirement has been strengthened several times, including an increased systematic risk buffer for the four large Swedish banks and increased risk weight floors of 25 per cent on mortgages.

3. The Swedish FSA has suggested the introduction of a DTI limit of 600 per cent.¹⁵ This implies that new mortgages cannot result in a debt for a household, which is more than six times higher than the disposable income. An alternative milder version suggests that 15 per cent of new mortgages for each institute can have a DTI above 600 per cent.

Figure 2.1 Timeline of macroprudential policy in Sweden



Source: Finansinspektionen: Financial stability report 2010:2, 2016:1 and Finansinspektionen: Macroeconomic effects of debt-to-income ratios

Purpose of lending restrictions

As documented in empirical literature, soaring housing prices and subsequent strong credit growth can fuel a self-reinforcing credit bubble, putting the overall economic stability at risk, *cf. Box 2.1*.¹⁶ The idea behind lending restrictions is to prevent this credit/house price bubble to build up in the first place.¹⁷

In particular, LTV and DTI limits both put an upper limit on the price of the house an individual household can buy, which in turn should curb housing price growth.¹⁸ The amortisation requirement is aimed at decreasing debt for new homeowners once the house is bought. Although it could have an effect on housing prices to the extent that the total instalments are important to new homebuyers.¹⁹

However, the success of these lending restrictions in terms of actually affecting housing prices depends on the extent to which they affect marginal house buyers, as discussed in the next section.

¹⁵ See, for example, speech by Erik Thedéen, Director of the Swedish FSA (2015): <http://fi.se/contentassets/991ddb6382684db59eba3e7e18b0f483/erik-thedeem-sns-20151119.pdf>

¹⁶ Reinhart and Rogoff (2009): This time is different

¹⁷ Kannan et al. (2012): Monetary and Macroprudential Policy Rules in a Model with House Price Booms

¹⁸ See ECB (2016): Macroprudential and Monetary Policy Interactions in a DSGE Model for Sweden, chapter 6, for a thorough theoretical description of the mechanisms of lending restrictions.

¹⁹ According to simplistic microeconomic theory, an amortisation requirement should not affect housing prices, as it is simply a requirement on increased savings. This could be countervailed by a reduction in other forms of saving, for example pension. The real cost of buying a home is thus unchanged with the amortisation requirement. However, empirical studies have shown that the total instalments do affect the housing demand and might thereby affect housing prices. In the housing model presented in chapter 1, we also assume that total payment affects housing prices, see *appendix*.

Box 2.1 Underlying dynamics of a self-reinforcing credit bubble

In a credit bubble, there are several factors that interplay, but overall the mechanisms are as follows: Higher housing prices increases the collateral of homeowners, which allows them to borrow more, and in turn buy more expensive houses. This puts an upward pressure on housing prices as the housing supply is relatively inelastic in the short run. This further increases the collateral of the homeowners, allowing them to borrow even more etc. This process gradually moves housing prices away from their fundamental value.

Eventually, the bubble bursts with a resulting sharp decline in housing prices as they return to the fundamental value. The net wealth of the households declines correspondingly, which in turn brings on an economic setback, with subdued demand, while the households consolidate.

Limited effects of lending restrictions on house prices

In general, the use of lending restrictions to curtail the build-up of systemic risks is still in its infancy, and there is a limited amount of international experience to draw from.²⁰ Nevertheless, empirical research suggests that lending restrictions are somewhat able to curb credit growth but have less impact on housing prices, as evidenced by two studies on Sweden:

- In a study from 2016, IMF examines the effects of the already implemented macroprudential measures (not the suggested DTI limit) and concludes that they reduce the households' DTI ratios and reduce consumption volatility, although the reduction in housing prices is more limited.²¹ For example, in the model, a reduction in the LTV limit from 85 per cent to 80 per cent decreases the long-term debt of the households by 10 per cent, whereas house prices only decrease by 1.5 per cent.
- In a study by the Riksbank from 2015, the effect of a DTI limit of 600 per cent in Sweden is evaluated. They find that housing prices in the short run will decline 4 per cent after the introduction of the DTI limit but only 0.3 per cent in the long run, and highlight that an *“uncertainty factor in the analysis is the extent to which house prices are affected”*.²² Further, they find that the DTI ratio declines little in the short run, as only new mortgages are affected by the limit. Once the limit is fully implemented, they estimate that the DTI ratio will have declined by 11 percentage points.

The limited effect of such measures on housing prices was also the conclusion of a large international study by BIS from 2013. Based on three different econometrical methods on data from 57 countries spanning more than three decades, they analyse three different measures²³: Two asset-based macroprudential measures 1) an LTV limit 2) a debt-service-to-income (DSTI) limit (which resemble a DTI limit)²⁴ and 3) higher property taxes. They find that all three measures successfully curb credit growth, with the DSTI limit generally

²⁰ Goodhart (2014): The use of macroprudential instruments, *Macroprudentialism*, p. 15.

²¹ IMF (2016): *Macroprudential and Monetary Policy Interactions in a DSGE Model for Sweden*.

²² The Riksbank (2015): *An analysis of the DTI limit as policy measure*, p. 14.

²³ BIS (2013): *Can non-interest rate policies stabilise housing markets? Evidence from a panel of 57 economies*.

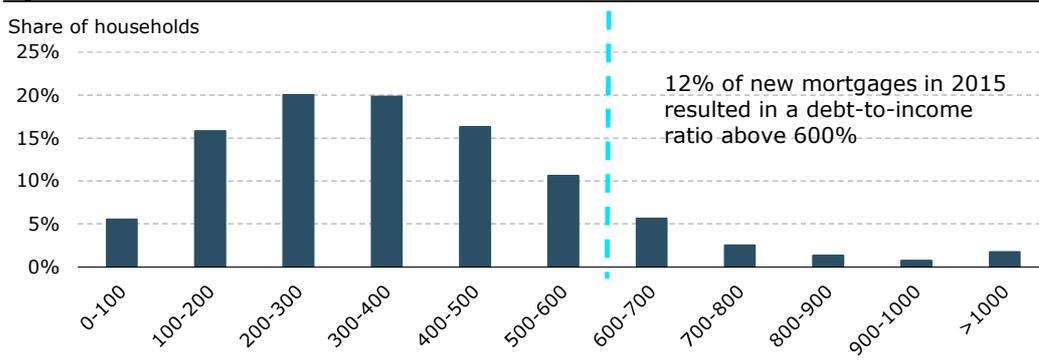
²⁴ A DSTI limit puts a cap on the allowed interest expenditure compared to income. Thus, the difference between a DSTI and DTI limit is that DSTI fluctuates with the interest rate. For a fixed interest rate, the two measures are identical.

being the most effective. However, out of the three measures: “An increase in housing related taxes is the only policy with a measurable impact on house prices”. Whereas instruments that affect the supply of credit (such as the DTI limit) “have little or no detectable effect on the housing market.”²⁵

BIS suggests that their result is due to the fact that the lending restrictions only work on the credit-constrained subset of the housing market. These credit-constrained consumers might not be the marginal purchasers of housing and therefore have little or no effect on housing prices.

Overall, the empirical evidence suggests that lending restrictions have limited effect when it comes to curbing housing prices. Consequently, we expect a DTI limit of 600 per cent to have little impact on Swedish housing prices. Especially since it will only affect some 12 per cent of potential new buyers, cf. Figure 2.2.²⁶

Figure 2.2 The majority of potential buyers would be unaffected by a DTI limit



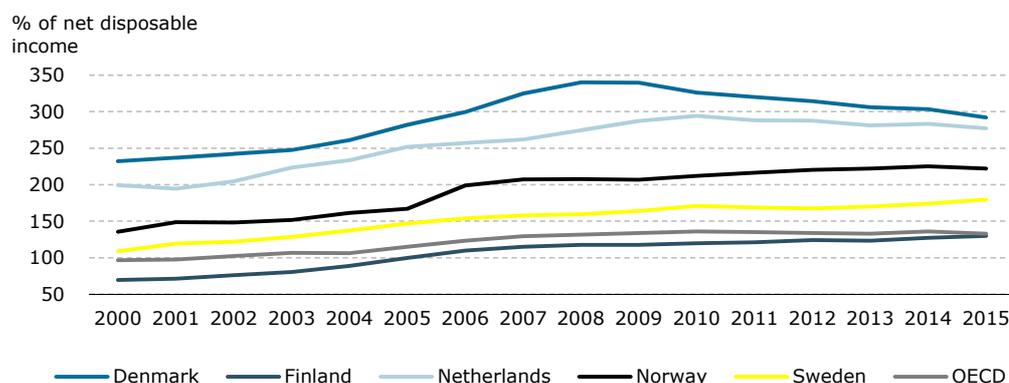
Source: The Riksbank (2015): Financial stability report 2015:1

Indebtedness of Swedish households is not alarming

Although lending restrictions are inefficient in terms of stabilising the housing market, they can to some extent limit credit growth. However, the average indebtedness of Swedish households is not alarming in comparison with other Nordic countries, cf. Figure 2.3. Currently, credit to households does grow faster than incomes, but not as fast as before previous crises: Since 2008, the average DTI of Swedish households has grown with some 3 percentage points annually. In comparison, the Danish DTI grew on average around 18 percentage points annually in the build-up to the financial crisis (2003-2008).

²⁵ BIS (2013): Can non-interest rate policies stabilise housing markets? Evidence from a panel of 57 economies, p. 26.

²⁶ The Riksbank (2015): An analysis of the debt-to-income limit as policy measure, p. 6.

Figure 2.3 Household debt in line with other Nordic countries

Note: OECD average is based on the countries where data were available

Source: OECD

As such, we do not see the current DTI of Swedish households as a strong argument for implementing any restrictions on lending. This is backed up by the Swedish FSA, who assess “that Swedish households in general have a good financial position. They have sufficient assets such that there is a limited risk that many households will suffer negative net wealth as a result of a fall in asset prices”²⁷.

2.2 A debt-to-income limit would lead to a rigid credit assessment procedure

When assessing a DTI limit, it is important to recognise that banks already consider DTI in their credit assessment procedure – in fact, it is one of the primary indicators of customers’ creditworthiness.

In making this report, Copenhagen Economics has been in contact with Nordea and SEB. In their credit assessment, they perform a coherent evaluation of the customer, including a long list of factors which eventually leads to a final credit decision. If justified reasons exist, both banks may allow a DTI above 600 per cent, although they would in general be careful in these situations.²⁸ If, for example, a loan is granted in Nordea that results in a DTI above 600 per cent²⁹, the loan granting is double-checked by a designated independent team.

In general, a DTI limit would to some extent prevent banks from doing their core business; grant loans based on sound credit assessment. It would make credit granting to households rather rigid instead of being based on a holistic credit assessment procedure on the basis of repayment capacity.

²⁷ Swedish FSA’s financial stability report 2016:2, p. 37.

²⁸ SEB currently allows a DTI of maximum 500 per cent based on *gross income* (before tax), whereas the proposed DTI limit of 600 per cent is based on disposable income.

²⁹ Concretely, Nordea’s exact limit is based on a stress test of the customer, which typically corresponds to a DTI limit of around 600 per cent.

As Swedish banks include many factors in their credit assessment procedure, there could be many reasons why a loan would be granted with a DTI above 600 per cent. Consequently, who will be affected by a DTI limit would be somewhat arbitrary and there will be no clear tendency in terms of age and income (see Alfelt et al. (2015), for a thorough statistical review of those affected³⁰).

If a DTI limit was to be implemented, we see the recorded income of last year to be the most likely measure of income to be used; the monthly or quarterly income is too volatile a measure to be used in calculating the DTI ratio, and a forward-looking measure will be dependent on assumptions of the individual bank and customer, which would make it practically difficult to administrate.

However, there could be reasons why the recorded income is an inaccurate measure of a bank customer's creditworthiness, and where a more coherent credit assessment procedure, would be more accurate (see also *Box 2.2*). This could, for example, be:

- A household with two persons recently graduated from college, in fairly secure jobs, for example two teachers. In this case, a backward-looking income measure would hardly be a fair representation of their payment capacity.
- A widow, with sizeable insurance beneficiaries.
- Entrepreneurs or self-employed, which often have a more volatile income.

Another example could be a household with a large holding of financial assets. If the household approaches a default, they could liquidate their assets and use them to service the mortgage. In this case, a strict DTI limit would merely entail, that the household would be forced to liquidate their assets in order to meet the requirement. Hence, a DTI limit restrains households' financial options by preventing them from choosing their preferred asset/liability allocation.

³⁰ Alfelt et al. (2015): "An analysis of the debt-to-income limit as policy measure"

Box 2.2 Two examples of households that will be affected by a DTI limit

A strict DTI limit of 600 per cent would create a wedge between the actual payment capacity and the amount households are allowed to borrow. This could affect different households somewhat arbitrarily as illustrated by the following two stylised examples:

Example 1: A household with two recently graduated teachers. The couple currently has a disposable income of SEK 480,000 per year³¹; however, their disposable income last year was SEK 75,000 in stipends and SEK 100,000 from student jobs. Furthermore, the household currently has a student debt of SEK 250,000.³² The couple would like to buy a house in a large city region for SEK 2.6 million, which would result in a DTI ratio just below 600 per cent given their current income. However, a strict DTI limit with a backward-looking measure of disposable income would imply that the family can only borrow SEK 800,000 – a difference of SEK 1.8 million. This would essentially exclude the family from the housing market in any larger city in Sweden.

Example 2: An entrepreneur with volatile income. The entrepreneur has recently had a capital injection into a successful start-up company. The capital injection allows the entrepreneur to have disposable income of SEK 500,000 going forward. However, the year before the entrepreneur was busy building capital in the company and only paid wages equivalent to SEK 100,000 in disposable income. The entrepreneur is not able to realise any of the capital vested in the company, as the capital is tied up in, e.g., production equipment, to finance the purchase of a house and therefore relies solely on a mortgage bank for a loan. If a strict DTI limit is introduced, the entrepreneur can only borrow SEK 600,000 (which implies a DTI of 120 per cent compared to the future income). In addition, this could imply that entrepreneur is not able to move the business to the region where it is most profitable and the probability of success is highest.

Source: Copenhagen Economics and SCB

2.3 A debt-to-income limit will entail a welfare loss

As discussed above, a DTI limit would entail that some loans will not be granted to customers – even though the bank is willing to lend. As such, this can be seen as an implementation of a “market error” on the credit market. The mirror image to this is that certain households cannot spend as much on housing consumption as they desire.

According to our estimation, a DTI limit will cause an 8 per cent decline in the household debt.³³ This means that the average Swedish household cannot buy as expensive a house as they prefer. On the contrary, the lower debt and thereby lower interest expenses free up funds, which the households can spend on other type of goods. However, the composition between housing-related costs and other types of consumption is not as the households prefer. This “in-optimal” composition of consumption implies a welfare loss. Using an economic model of Swedish households, we calculate the loss and for illustrative purposes

³¹ A disposable income of SEK 480,000 per year corresponds approximately to the average income of a household according to the Riksbank (2015): An analysis of the debt-to-income limit as policy measure, p. 13.

³² The average student debt at the end of college was roughly SEK 124,000 in 2013 according to the Centrala Studiestödsnämnden.

³³ The calculation is based on 2015 data from the distribution of DTI of Swedish households from: The Riksbank (2015): Financial stability report 2015:1.

measure it in terms of a GDP decline (as “which decline in GDP will produce the same welfare loss as the DTI limit does”), *cf.* see *appendix*. Using the above described method, we find that the welfare loss corresponds to a decline in GDP of around ½ per cent.

The negative welfare effect will be very unevenly distributed among the population, as only 12 per cent of the housing market will be affected by a DTI limit. In other words, the ½ per cent of GDP loss would be borne by 12 per cent of the population. Thus, the vast majority of the population will not experience any welfare loss. Those who will be restricted by the limit, will be affected quite considerably.

A DTI limit with an exception of 15 per cent will give a smaller welfare loss

A possible version of the DTI limit would be to implement it on institutional level, with an exception for 15 per cent of each institution. Hereby, banks can grant loans with a DTI above 600 per cent for 15 per cent of their loan portfolio. As only 12 per cent had a DTI above 600 per cent in 2015, such a limit will only imply limited negative welfare effects (some banks might have more than 15 per cent of their customers above the DTI-ceiling, so the restriction may still have some effect). On the other hand, the mitigating effects would be correspondingly negligible, primarily leaving such a measure to increase compliance and regulatory complexity.

In a similar fashion, if the DTI limit was implemented based on a forward-looking income, the negative welfare consequences would be smaller. For example, the two recently graduated teachers would be more likely to be granted a loan. Again, the mitigating effects would be correspondingly smaller.

2.4 The implementation of a DTI limit could have destabilising effects

An implementation of a DTI limit could potentially destabilise the economy as a DTI limit will have a negative impact on GDP in the short run.

When a DTI limit is introduced, credit-constrained households can no longer borrow the amount they desire when buying a home. The lower housing demand causes a decline in housing prices, implying an equivalent decline in the wealth of the households. As a result, households decrease their consumption for non-durable goods to rebuild their wealth. The lower demand for goods depresses GDP and employment, until the consolidation process of households is completed.

Concretely, we estimate that GDP would decline approximately 0.4 per cent after one year, corresponding to SEK 17 bn.³⁴ In addition, Swedish employment would decrease by an estimated 0.5 per cent, corresponding to approximately 22.000 full-time employees. Our result is in line with the Riksbank, which finds the maximum decline in the short-term GDP to be 0.3-0.7 per cent³⁵.

³⁴ The calculation is based on the Gerali et al. (2010) DSGE model, see *appendix*.

³⁵ The Riksbank (2015): An analysis of the debt-to-income limit as policy measure, p. 15.

The DTI limit will have to be implemented with some lag to allow financial institutions to adopt the measure, and there will be a further lag before the measures impact economic activity. These lags make the implementation of a DTI limit an unfit tool for stabilising the economy, since it is difficult to assess whether the suppressing effects on GDP will be beneficial: If the measure is implemented during an economic upswing, with excess demand, the implementation will have beneficial mitigating effects. However, if the implementation coincides with an economic downturn or a decline in housing prices, it could further worsen the business cycle situation.

A DTI limit could lead to other unintended consequences

A DTI limit changes incentives within the financial sector, which could lead to some other unintended side effects besides those already mentioned.³⁶ For example:

- Smaller companies sometimes use a private home as collateral when applying for a business loan. Thus, a DTI limit could somewhat restrain investments in the private sector as well.
- One factor that could speak in favour of granting a loan that results in a DTI above 600 per cent would be if the loan was used to purchase a newly build house, as these typically involve lower costs for electricity and maintenance. A DTI limit could thereby obstruct the construction of new housing.
- A DTI limit could lead to increased shadow banking. If a household is affected by the DTI limit, they could circumvent the restriction by applying for credit through a less regulated part of the financial sector, for example through the rapidly growing FinTech industry.

³⁶ Borio (2016): Macroprudential frameworks: (Too) great expectations, Macroprudentialism, p. 33.

2.5 Main findings on the costs and benefits of macroprudential measures

Limited benefits:

- The use of macroprudential measures in the form of lending restrictions – such as the proposed DTI limit – is still in its infancy, and there is limited international experience to draw from.
- Empirical research suggests that the measures can to some extent restrict credit growth, but have little or no effect on the housing market.
- Consequently, we expect little effect on Swedish housing prices if the proposed DTI limit is implemented – especially since it will only affect 12 per cent of the housing market.

Significant costs:

- Banks already consider DTI when assessing customers' creditworthiness, but there could be good reasons why some customers have a debt-to-income ratio above the suggested limit.
 - For example, a household of two persons recently graduated from college might have a high DTI but still be credit-worthy. In this way, a DTI limit will lead to a rigid credit assessment procedure and might affect households somewhat arbitrarily.
 - To illustrate the negative effects, we calculate the welfare loss, which the average Swedish household will experience. According to our estimation, the welfare loss will be equivalent to a decline in GDP of around ½ per cent.
 - Finally, a DTI limit will cause a decline in the Swedish GDP of around 0.4 per cent in the short run. If the measure is implemented during an economic downturn, this could have destabilising effects.
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Chapter 3

A focused mandate for the Swedish FSA

The booming housing market has sparked a general discussion on the overall responsibility for macroprudential policies in Sweden. With the current legislation, the FSA cannot implement measures like the DTI limit; first, it has to be proposed by the government and later passed by the parliament. Consequently, the FSA argues that they do not have the sufficient set of tools to carry out their mandate. In this chapter, we analyse the current economic policy framework in Sweden, including the responsibility of macroprudential policy, and discuss how to best stabilise the soaring housing prices.

In *section 3.1*, we describe our recommended economic policy framework and describe which instruments can best be used to counter the current risks in Sweden. In *section 3.2*, we discuss the responsibility for the economic policy in Sweden, including the mandate of the FSA. In *section 3.3*, we discuss our recommended division of responsibility for the economic policy in the light of the financial crisis.

3.1 Adapt a coherent approach to economic stabilisation policy

Economic recessions can have immense economic and social costs, regardless of whether the crisis originates from imbalances in the financial sector, from an overheated real economy or from an entirely different source.³⁷ As a result, it is not sufficient solely to focus on risks emerging from imbalances in the financial sector in the economic stabilisation policy – the next crisis affecting the Swedish economy, national or international, might very well emerge from a different source.

Below, we shortly describe a policy framework outlining how to approach emerging risks to economic stability emphasising a coherent approach. We then apply this framework to the current Swedish economy and give recommendations on how best to stabilise the boom on the housing market.

1) Identify the nature of the risk

Economic crises often emerge as a combination of several interlinked factors. However, a positive two-way feedback mechanism between the real economy and the financial sector in the build-up to the crisis often plays an important role. For example, a booming housing market – which could be classified as an overheating of the real economy – will normally lead to strong credit growth increasing the risk of financial imbalances being build up. Likewise, financial deregulation, which eases the access to credit, can lower the effective cost of housing purchases, which can cause a surge in the housing market.

³⁷ Minir et al. (2012): Required reserves as a credit policy tool.

In order to prevent the build-up of such a credit demand boom, it is important to identify the source of the instability as soon as possible so that targeted measures can be implemented.

2) Implement targeted measures

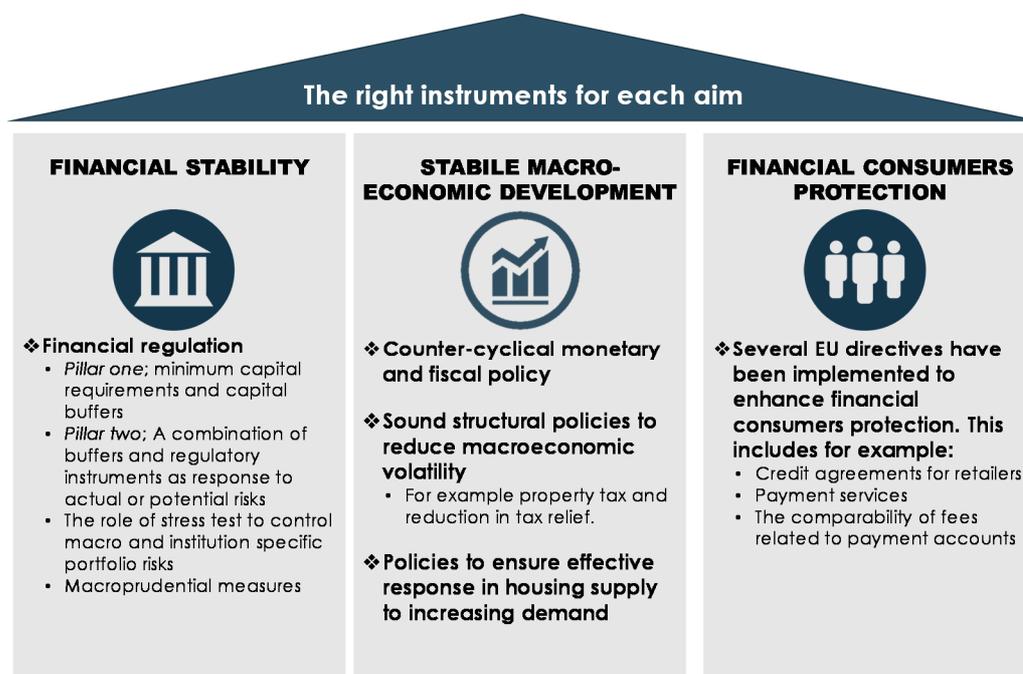
A correct and early identification of the risk allows for a targeted measure to be implemented before the risk spreads to other parts of the economy.³⁸ The chosen measure to counter the risk should be targeted, i.e. one that ensures a sufficient impact and has the lowest possible costs:

- If the identified risks stem from *the financial sector*, the risks can best be targeted by financial regulation. An example could be to implement sufficient liquidity and capital requirements to ensure that the sector can withstand a severe financial shock with a resulting stark decline in asset prices. In this regard, macroprudential measures can play a role in terms of minimising systemic risks in the financial sector.
- If the identified risks stem from *the real economy*, the risks can best be countered by more classic economic policy. If the issues are a simple overheating of the economy, the risks can best be countered by a counter-cyclical fiscal and monetary policy. If the risks have a structural component, it may be necessary to implement new structural economic policies, such as changing the tax system, introducing a better competition policy etc.
- Finally, if the identified risks affect *individual consumers*, but do not pose a risk to the overall economy, the problem should be solved through sound consumer protection.

As such, when addressing economic risks, it is important to clearly determine which policy aim the chosen measure is addressing, *Figure 3.1*. It is in particular important to distinguish between macroeconomic stabilisation and financial stability. Financial stability can be defined as a situation where: “*the financial system is robust to disturbances in the economy, so that it is able to mediate financing, carry out payments, and redistribute risk in a satisfactory manner.*”³⁹ If authorities assess that the financial stability is at risk, meaning that the financial system is *not* robust to disturbances in the economy, then the risk should be countered by financial regulation – including macroprudential measures. In this sense, macroprudential policy can play an important role in preventing the build-up of financial imbalances that eventually materialise during macroeconomic instability. However, this does not mean that financial regulation, including macroprudential measures, should be used to conduct macroeconomic stabilisation policy. Nevertheless, if, for example, the proposed DTI limit is implemented in Sweden, this is exactly what would be the case, as discussed in the next section.

³⁸ See IMF, FSB, BIS (2016): Elements of Effective Macroprudential Policies, p. 12, on how to calibrate policy responses to the risk.

³⁹ See Norwegian Central Bank (2003), Financial Stability Review, February. For a discussion on the definition of financial stability, see IMF (2004): Defining Financial Stability.

Figure 3.1 Different tools for each policy aim

Source: Copenhagen Economics

Applying the policy framework to the Swedish situation

Below, we apply the above-described policy framework on the current Swedish economy.

1) Identifying underlying source of the risk: Overheated housing market

As described in *section 1.3*, there is in Sweden a general consensus that the currently surging housing prices pose a risk to the stability of Swedish economy.⁴⁰ Below, we apply our described policy framework and our results from chapter 1 to recommend how best to counter this risk. As described, we clearly classify the surge in housing prices as a *real-economy risk* as it can be explained by identifiable fundamental factors very much linked to potential policy failures in macro and structural policies. The current high DTI is a result of the strong housing price growth, which in turn, to a large extent, can be seen as an adjustment to the low after-tax mortgage rate.

This does not change the fact that the current growing DTI ratio of Swedish households, and in particular the surging housing prices, pose a risk to economic stability. If the Swedish economy should collapse, with resulting plummeting housing prices, it could result in a prolonged period with subdued private consumption as the households would need to consolidate.⁴¹ However, the causality has implications for the optimal measure to counter the risk.

⁴⁰ See, for example, the Swedish FSA's Financial stability 2016:1 or the Riksbank's Financial Stability 2016:1.

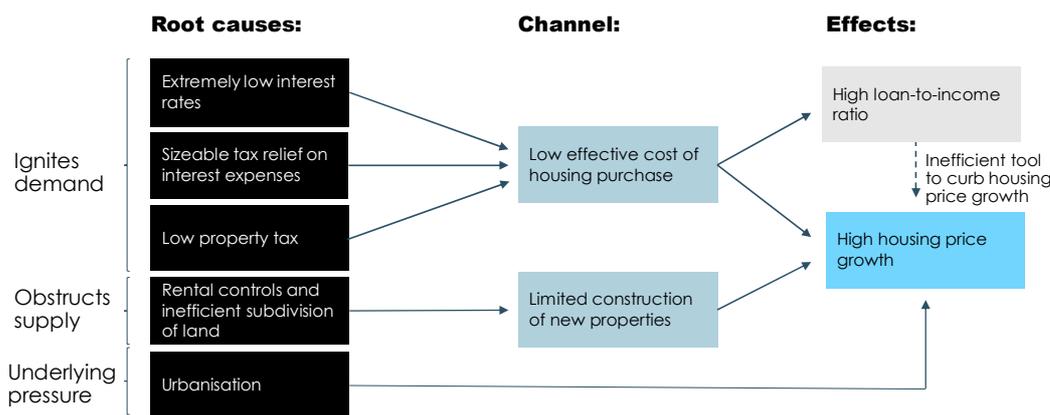
⁴¹ Swedish FSA's Financial stability 2016:2, p. 36.

2) *Implement targeted measures: Focus on the root causes*

As the surging housing prices can be explained by real-economy factors, we see the attempt to curtail the housing market imbalances by primarily financial regulatory initiatives as somewhat derailed – they should instead be countered by economic policy tools targeting the root causes of the strong housing price growth such as (see also *Figure 3.2*):

1. **Increase the property tax:** This will increase the costs of housing for all participants on the housing market, including existing homeowners, who will then be more inclined to sell, thereby increasing supply.
2. **Reduce the tax relief on interest expenditures:** This would increase the costs of increasing indebtedness, thereby reducing both credit growth and housing prices (see also section below).
3. **Normalise the expansive monetary policy:** Increasing the monetary policy rate will increase mortgages rates and thus the effective costs of housing, especially in urban areas.
4. **Remove barriers to the construction of new housing, for example by improving the subdivision of land and reforming rental controls:** This could boost the supply of housing, thereby countervailing the strong urbanisation process.

Figure 3.2 Stabilise the Swedish housing market by focusing on the root causes



Source: Copenhagen Economics

Targeting the root causes is more in line with economic theory

The economic rationale for implementing lending restrictions is that high credit growth implies an elevated risk (and potentially cost) of a financial crisis. In economic terms, this

translates into: debt acquisition of individual households imposes a negative externality on the rest of the economy.⁴²

The standard approach to cope with such an externality would be to internalise the externality – in this case, that would entail a *tax* on debt acquisition. Instead, in Sweden (as in many other European countries), the contrary applies as debt acquisition is effectively *subsidised*, with a 30 per cent tax relief on interest expenditures (21 per cent above SEK 100,000). Thus, a natural first step to counter the booming housing prices would be to reduce the tax relief on interest expenses. This would structurally increase the cost of debt acquisition for all participants on the housing market, thereby getting the economic incentives for house purchases and debt acquisition more aligned with what is economically preferable.

3.2 The responsibility for economic policies and the mandate of the FSA

In Sweden, there is currently a debate on whether to widen the mandate of the FSA.

The institution was given the responsibility for macroprudential policy in Sweden on 1 January 2014. However, there has been a lack of clarity on the exact content of this new mandate. The FSA already had the responsibility for financial stability (partly shared with the Riksbank as they have responsibility to promote a safe and efficient payment system), and the new mandate did not provide the Swedish FSA with any new legislative powers.

This lack of clarity on what this new mandate concretely entailed is somewhat understandable, as macroprudential policy first and foremost is defined as policy aimed at improving the financial stability (as described in *section 2.1*) – and financial stability has been included in the mandate of the Swedish FSA since 1995.⁴³

Currently, the Swedish FSA does not have the legislative power to implement lending restrictions, such as a DTI limit – they can merely suggest it to the Swedish government, and the proposal must eventually be adopted by the Swedish Parliament. The Swedish government has proposed to widen the mandate of the Swedish FSA in a way that enables the FSA to implement a wide range of different lending restrictions (such as the DTI limit), without the need for the Swedish Parliament to adopt the measures.⁴⁴ According to the proposal, the measures should still be “approved” by the Swedish government (since they could restrict individual households’ finances), but it is clear from the proposal that the initiative and responsibility in terms of suggesting measures lie with the FSA. If adopted, the proposal will take effect on 1 February 2018.

⁴² Favara and Ratnovski (2014): Externalities: An economic rationale for macroprudential policy, Macroprudentialism.

⁴³ See speech by Martin Andersson (2015): http://www.fi.se/content-assets/d674c84ddd7b47a59d6783785c28bo47/ett_ar_makrotillsyn_eng.pdf. On 23 February, the government elaborated on what this new mandate should entail, see: <http://www.government.se/press-releases/2017/02/proposal-to-expand-finansinspektionens-mandate-regarding-additional-macroprudential-tools/>

⁴⁴ First in a political agreement in October 2016: <http://www.government.se/press-releases/2016/10/broad-political-agreement-on-expanded-mandate-for-finansinspektionen/>. Which in February 2017 was turned into an actual proposal: <http://www.regeringen.se/rattsdokument/departementsserien-och-promemorior/2017/02/ytterligare-verktyg-for-makrotillsyn/>

In the rest of this section, we discuss the responsibility for the economic policy in Sweden in light of the proposal to widen the mandate of the FSA.

The overall economic stability policy is the responsibility of the government

As described in *section 3.1*, when dealing with emerging risks to economic stability, it is important to use the measures that most effectively and at the smallest possible cost adequately counter the risk. As a consequence, it is important to consider the whole palette of economic policy tools when conducting economic stabilisation policy.

It will not be practically feasible to delegate the entire spectrum of economic policy tools to independent governmental institutions, such as the Riksbank or the Swedish FSA. For example, successfully solving the current issues on the Swedish housing market requires such diverse measures as changing the tax policy and the legislation regarding the subdivision of land. If the responsibility for the economic policy was delegated to an independent governmental institution (such as the Swedish FSA) with limited available economic tools at its disposal, there would be a risk that numerous second-best policy options would be implemented.

Therefore, the responsibility for the overall economic stability cannot be “outsourced” to an independent institution with limited policy tools available – the responsibility for the Swedish economic policy lies with the government. Thus, the responsibility for countering the current overheated housing market eventually lies with the Swedish government.

The Swedish FSA should focus on financial stability

As the responsibility for the overall economic stability cannot lie anywhere else than with the government, we recommend that the mandate of the Swedish FSA should focus on the resilience of the financial sector, i.e. financial stability. This entails:

1. Ensuring a sufficient economy-wide flow of credit at all times, even during adverse economic conditions.
2. Reducing the risk of taxpayer-financed bailouts.
3. Preventing banks from taking excessive risks as a result of implicit and explicit government insurance and imperfect information on the capital markets.

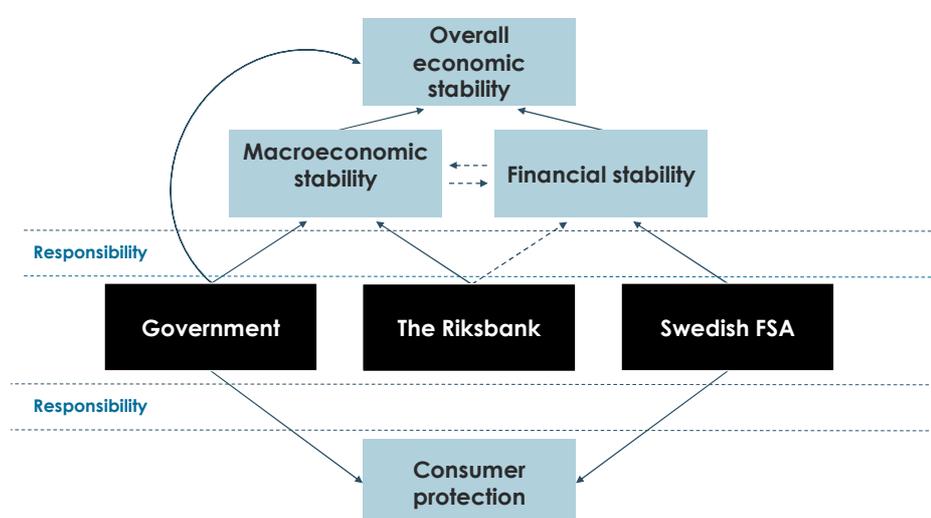
This is overall in line with the current formulation of the mandate of the Swedish FSA: “*FI’s mandate is to help ensure that the financial system is stable, and also to counteract imbalances with the purpose of stabilising the credit market. At the same time, FI shall promote comprehensive consumer protection.*”⁴⁵

We see nothing wrong with that the responsibility for the macroprudential regulation lies with the FSA. Referring to our definition in *section 2.1*, macroprudential policy is simply measures aimed at improving financial stability. However, we do currently not see the need to further widen the mandate of the FSA, as its current mandate, in combination with the regulation in Basel III (and the European adoption called CRR/CRD IV), is wide enough to

⁴⁵ Speech by Martin Andersson (2015).

successfully achieve the above-stated objectives. First and foremost, the mandate empowers the FSA to impose the capital requirements on Swedish banks which they deem necessary to ensure the resilience of the Swedish financial sector. As a result, the resilience of the major Swedish banks has increased to a point where they can withstand extreme macroeconomic setbacks, far surpassing the stress scenario of the EBA stress test (as discussed in the next section). In this perspective, the Swedish FSA is, in our view, currently successful in achieving the objectives provided in their mandate.⁴⁶

Figure 3.3 Division of responsibility in economic policy



Source: Copenhagen Economics

Consequently, we somewhat disagree with the Riksbank when they state that: “*The mandate should make it clear that Finansinspektionen can take measures to counteract financial imbalances even when there are no immediate risks to financial stability but rather risks to macroeconomic stability.*”⁴⁷ We clearly see that the responsibility for counteracting direct risks to the macroeconomic stability lies with the government and, in part, the Riksbank. The Swedish FSA should focus on risks to the macroeconomic stability only to the extent that the risks originate from the financial sector, cf. *Figure 3.3*.

The FSA has an important role in spotting emerging economic risks

Even though we do not see a need to widen the mandate of the FSA, we strongly acknowledge their role in advising and providing policy recommendations to the Swedish government and the Riksbank and participating in the public debate in general. For example, we welcome that the Swedish FSA, together with the Riksbank and IMF, have recommended the Swedish government to reduce the tax relief on interest expenses. Or, that the

⁴⁶ In fact, in our view, the Swedish FSA might have somewhat “overachieved” their goal, as we estimate the current capitalisation to be higher than what is socio-economically optimal, see Copenhagen Economics (2016): Cumulative impact of financial regulation in Sweden, p. 29.

⁴⁷ The Riksbank’s Financial Stability report 2015:1, p. 17.

FSA recommend the Riksbank to somewhat tighten their monetary policy in order to accommodate the current extremely low after-tax mortgage rate. Similarly, the FSA, together with the Riksbank, has an important role in spotting and identifying emerging risks to the Swedish economy. In this respect, we acknowledge that the FSA and the Riksbank identified the high housing price growth as a potential risk relatively early.

3.3 Macroprudential measures and the robustness of banks

The discussion on a proper division of responsibility for economic policies can be illustrated by the economic development in Sweden following the economic crisis starting in 2008. The subsequent decline in economic activity was driven by a sharp fall in exports and investments. The fall in net exports accounted for around $\frac{1}{4}$ of the total decline in GDP, whereas investments accounted for around $\frac{2}{3}$ of the decline. The decline in investments was most likely driven by the huge uncertainty created by the global financial crisis and weakened foreign demand.

By contrast, there was limited indications of a dysfunctional financial sector unable to provide credit to healthy firms seeking credit.⁴⁸ The credit markets were somewhat supported by measures from the Riksbank throughout the crisis.⁴⁹ However, the government eventually earned a net profit on the interventions, amounting to around 0.4 per cent of GDP.⁵⁰

In other words, the key objectives of the FSA were achieved: 1) no signs that weak bank balance sheets held back economic activity in a situation with weak demand and 2) tax payers did not suffer any net losses from efforts to stabilise the banking sector; the Riksbank acted as a lender of last resort to an overall healthy banking sector.

Thus, the sharp decline in economic activity in Sweden in 2008-2009 was the real economy affecting the financial sector – not the other way around. As a result, the government – having prudently established a credible fiscal position – could loosen fiscal policy to support economic activity.

But is the Swedish banking sector also robust enough to handle a potential future, severe economic crisis given, in particular, exposures to high and rising housing prices?

Based on available evidence, the answer is yes. Sweden currently has one of the most robust financial sectors in Europe.⁵¹ The four large banks had an average CET1 ratio of 19 per cent by the end of 2015. This is significantly more than most banks across Europe participating in the European Banking Authority (EBA) stress test. Rating agencies put the four large Swedish banks among the top-rated banks in Europe with an AA-rating on average. Finally, the extensive robustness of the Swedish financial sector is also reflected in lower CDS spreads than most of their European peers.

⁴⁸ The Riksbank found in a study from 2009: “no signs of any credit crunch, neither for households nor companies”. Instead they assessed that the observed stricter credit terms are primarily a result of the increased credit risk following in the wake of a severe economic downturn. See: The Riksbank (2009): “No serious credit crunch in Sweden”

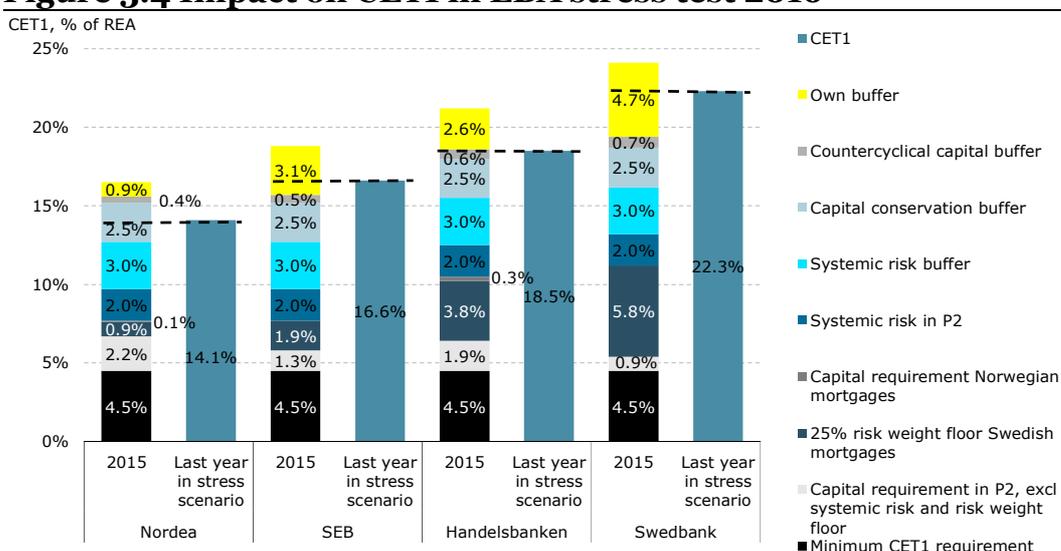
⁴⁹ See The Riksbank (2008) Financial Stability Report 2008:2 for an overview of measures.

⁵⁰ See Daniel Barr and Hannah Pierrou: Vad blev notan för statens bankstöd under finanskrisen 2008-09?

⁵¹ See Copenhagen Economics (2016): Cumulative impact of financial regulation, chapter 2, for a detailed discussion.

The resilience of the Swedish financial sector is also apparent from EBA stress tests, cf. *Figure 3.4*. Given the severe stress scenario, as discussed below, the four largest Swedish banks will on average experience a decline in their CET1 ratio of 2.3 per cent.⁵² This means that the four largest Swedish banks – even after an extreme stress scenario – would be better capitalised than the average European bank is today (even by a significant margin).

Figure 3.4 Impact on CET1 in EBA stress test 2016

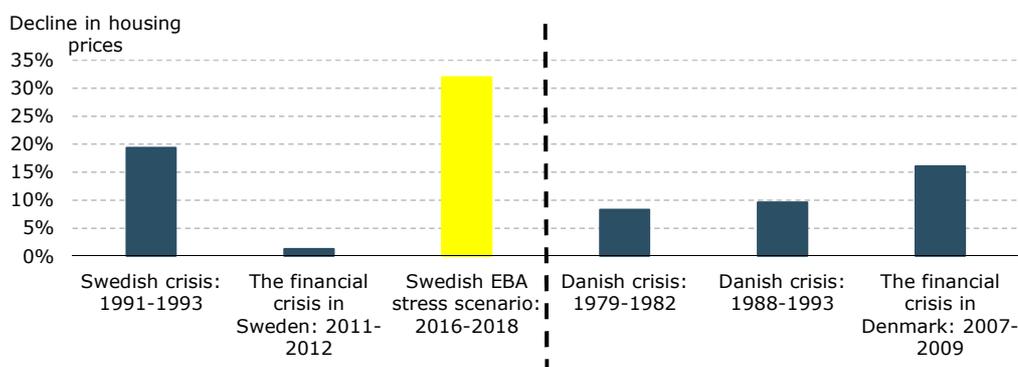


Note: Data from the end of 2015

Source: EBA stress test 2016

The stress scenario in the EBA stress test is very severe in a historical perspective, cf. *Figure 3.5*. The decline in housing prices in the Swedish stress scenario is largest in Europe, approximately 32 per cent over three years, and significantly more severe than any decline observed in Sweden in a historical context. In particular, the significant setback during the 1990s resulted in housing prices declining by 19 per cent. Also compared to historical crises in Denmark, the Swedish stress scenario appears very severe.

⁵² EBA 2016 stress test.

Figure 3.5 Historical crises and stress test scenario in Sweden

Note: All historical declines are top-to-bottom.

Source: Copenhagen Economics based on EBA stress test 2016 and Statistics Sweden

Important to regain confidence in risk models

The fact that the Swedish financial authorities keep adding new layers of regulatory measures – even though the financial sector is very robust – could indicate that there is some lack of confidence in the risk model setup of Swedish banks.

In order to prevent inefficient regulation being implemented, we find it important to build a model framework in which the authorities have complete confidence. This would imply that when stress tests clearly indicate that Swedish banks can withstand a strong macroeconomic setback, then there is no need to add new financial measures, such as the DTI limit.

In this regard, we welcome the current work of the EBA to improve comparability and general confidence in the risk parameters estimated on the basis of internal models. Especially since the EBA acknowledges the importance of preserving the risk sensitivity of capital requirements. In addition, stress testing could include a more precise modelling of the risks associated with large portfolios in individual institutions, not least the risks related to real estate, which historically has been a main source of financial instability. This includes more explicit modelling of feedback loops between the real economy, assets prices and the financial sector. Such an exercise could provide a useful platform for a better understanding of the risk positions of banks, and the banks' internal and external auditors could be helpful in engaging in this in their various roles.⁵³

This should further convince the Swedish authorities that there is no need to keep adding new layers of measures aimed at improving the robustness of Swedish banks. Instead, as already mentioned, the focus should be on implementing sound classic economic policies to stabilise the housing market, see also *section 3.4*.

⁵³ See for example ECB (2013): A macro stress testing framework for assessing systemic risks in the banking sector, chapter 2.5, for a discussion on feedback mechanisms in macro stress testing. See EY (2016): "Are we nearly there yet?" for a discussion on the future role of bank auditing.

3.4 Main recommendations

- When implementing economic policies to countervail the build-up of risks, it is important to identify the source of the risk and implement targeted measures, at the lowest possible cost.
 - In terms of the overheated Swedish housing market, this means countering the main drivers behind the surge by:
 1. Increase the property tax
 2. Reduce the tax relief on interest expenses
 3. Normalise the expansive monetary policy
 4. Remove barriers to the construction of new housing, for example by improving the subdivision of land and reforming rental controls.
 - However, we advise *against* implementing any lending restrictions, such as the DTI limit. Such measures are economically inefficient and ineffective in terms of stabilising the housing market.
 - The government should take the overall responsibility for countering the current risks on the housing market, as only *they* have the legislative power to implement the measures targeting the root causes of the booming housing market.
 - The FSA should focus on ensuring financial stability. If the responsibility for macroeconomic stability is outsourced to the FSA, there is a risk that several "second-best policies" would be suggested and eventually implemented, as the whole palette of economic policy tools is not available to the FSA.
 - We see no need to further expand the mandate of the FSA as it already has financial stability as an objective. As the Swedish financial sector is highly robust, the FSA is currently somewhat successful in achieving their objectives.
 - We welcome the work of EBA to increase transparency and comparability of the internal models of banks since this could further convince Swedish policy makers that there is no need to add new layers of financial regulation, such as the DTI limit.
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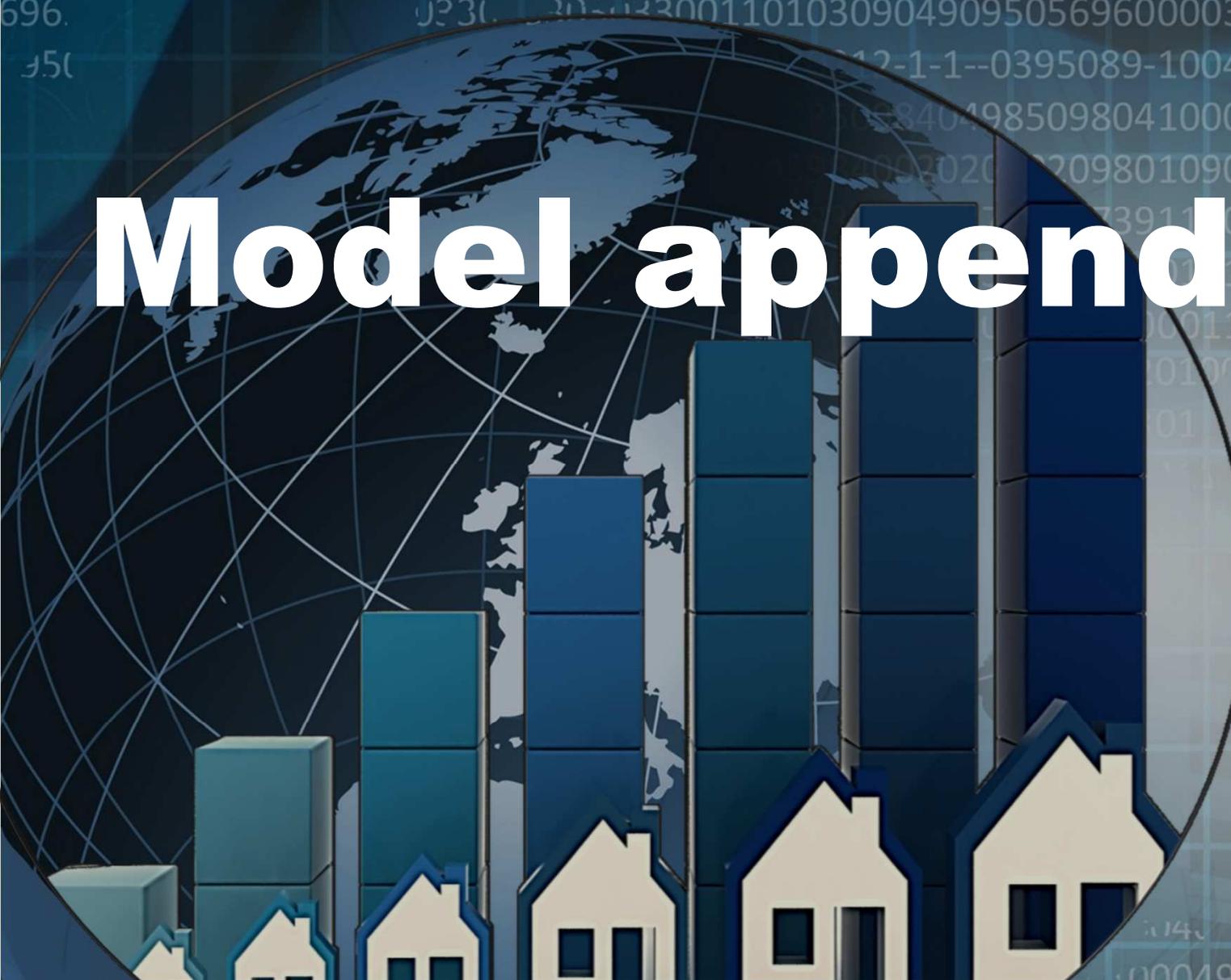
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Model appendix



DETAILS ON THE HOUSING MODEL

A regional, dynamic Swedish housing price model

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Overview of the model:

An extensive regional analysis of Swedish housing prices

In chapter 1 it is analysed how the recent housing price boom in Sweden results from various types of regional and national economic policies.

HOW DO WE ANALYSE THIS?

We use a regional statistic housing price model based on the eight Swedish statistical regions (Riksområden), see the map below. There are three types of areas:

- 1) **Stockholm**
- 2) **Urban areas:** comprising East Middle Sweden (incl. Uppsala), South Sweden (incl. Malmö) and West Sweden (incl. Gothenburg).
- 3) **Rest of the country:** comprising the four remaining areas.

Stockholm and the other urban areas comprise around 80 per cent of the total housing value. We use quarterly data since 1986.

CONTROLLING FOR VARIOUS FACTORS

We depart from a rather standard dynamic model in the related literature, where we include several extensions:

- Our model is regional and allow for regional price spill-over effects
- We allow for the effects of financial innovation and credit constraints
- We model expectational driven bubble effects

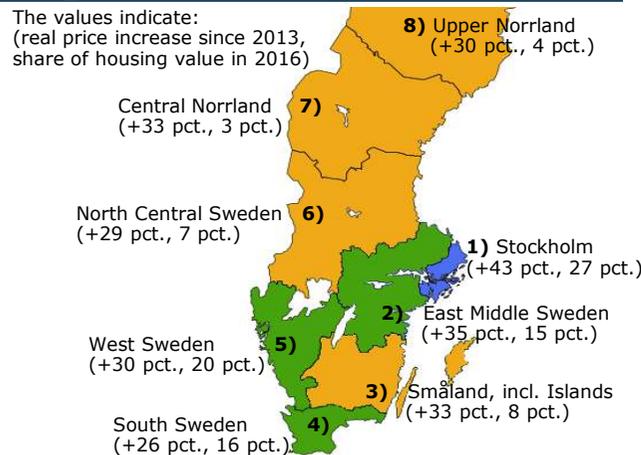
The model is at large able to explain the regional price dynamics. For example, it explains 96 per cent of the national price increase from 2009 to 2016, and 95 per cent of the price increase in Stockholm, see the two figures below.

COUNTERFACTUAL ANALYSIS AS A TOOL

We use the model to simulate and analyse the housing prices in four different counterfactual scenarios:

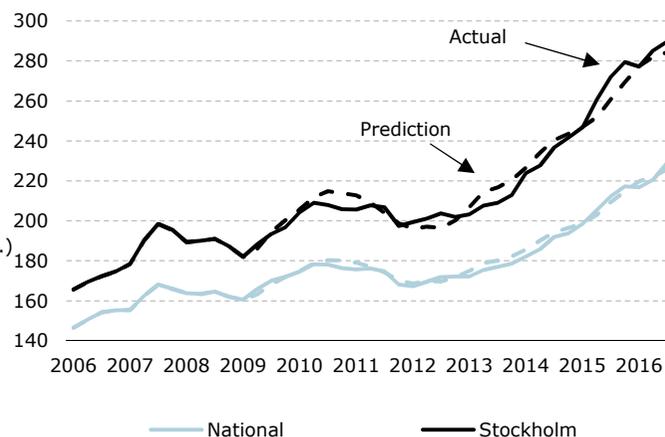
- A. **Monetary policy:** following a standard Taylor rate from 2013 until today.
- B. **Property taxes:** unchanged from 2007 and onwards.
- C. **Urbanisation and supply restrictions:** the housing supply is less restricted and able to increase at almost the same rate as the population from 2008 and onward.
- D. **Expectational driven price booms:** buyers' adaptive price expectations are "turned off" from 2009 and onwards.

Regions in the model

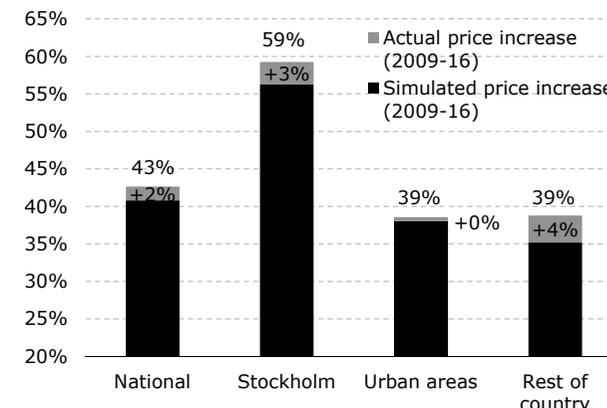


Note: These are average price increases in the regions.
Source: Statistics Sweden

Model precision



Source: Own calculation based on the regional housing model



Note: The national price index is a weighted average of the regional prices, weighted by housing stock
Source: Own calculation based on the regional housing model

The empirical model in further details

MODEL DETAILS

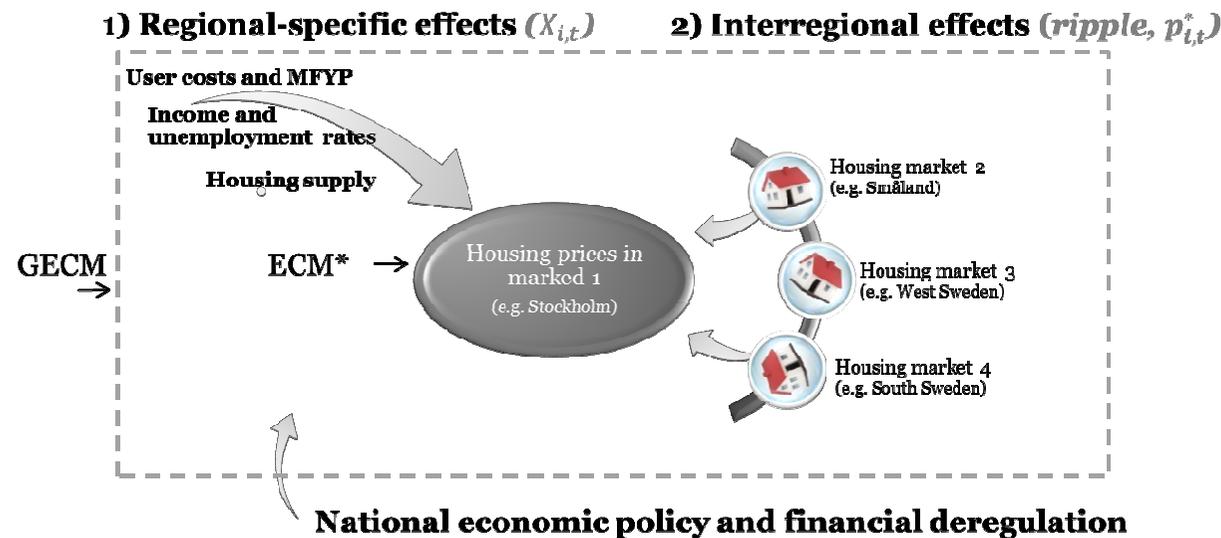
We model the regional housing prices using a Global Error Correction Model, see Pesaran et al. (2004) and Heebøll (2014). This model has the advantage that it allows housing prices in each region to be determined by several mechanisms:

- **Regional specific price determinants**, affecting prices in the short and long run, including both demand and supply factors.
- **Endogenous expectation effects** and bubbles.
- **National economic policies**, affecting prices in all regions, e.g. monetary policy.
- **Interregional effects**, where national housing price booms often start in urban areas and spread throughout the country.

THE UNDERLYING ECONOMIC THEORY

- We estimate a log inverted demand curve for housing services in each region, working in the medium to long run (a co-integration relation)
- Theoretically, this is mainly based on the so-called life cycle model, in which credit constrained agents demand housing services to maximize their total utility, see Meen (1990), Muellbauer and Murphy (1997) referred to in Heebøll (2014).
- In each region, a share of the agents are credit restricted or short-sighted, focusing on the minimum first year mortgage payments (MFYP_{*i,t*}). Hence their housing demand includes a quasi user cost including a weighted average of the standard user cost and the MFYP, see Badarinza et al. (2013) and Dam et al. (2011) referred to in Heebøll (2014).
- Regional housing prices are related through the so-called price-ripple effects, which is why we also account for a related area price variable in the demand equation in each region, see Meen (2001) and Holmes et al. (2011) referred to in Heebøll (2014).

A model illustration



A Global ECM (GECM)

For each area we estimate the ECM model:

$$\Delta p_{i,t} = \alpha_i \beta_i' \tilde{X}_{i,t-1} + \sum_{j=1}^{J_i^p-1} \Gamma_{i,j} \Delta p_{i,t-j} + \sum_{j=0}^{J_i^x-1} \Upsilon_{i,j} \Delta X_{i,t-j} + \sum_{j=0}^{J_i^*-1} \Gamma_{i,j}^* \Delta p_{i,t-j}^* + \epsilon_{i,t}$$

- $\beta_i' \tilde{X}_{i,t-1}$ represents the log inverted housing demand equation, and α_i indicates how fast prices react to ensure equilibrium.
- $\sum_{j=1}^{J_i^p-1} \Gamma_{i,j} \Delta p_{i,t-j} + \dots + \sum_{j=0}^{J_i^*-1} \Gamma_{i,j}^* \Delta p_{i,t-j}^*$ is the short-run price reactions to recent periods' price changes ($\Delta p_{i,t-j}$), changes in the demand components ($\Delta X_{i,t-j}$), and price changes in related areas ($\Delta p_{i,t-j}^*$).
- This model is estimated for each area and then combined in a full GECM for simulations.

Our data and assumptions

As the main part of the model, we estimate the following log inverted demand curve for housing services in each region, working in the medium to long run (a co-integration relation):

$$p_{i,t} = -\beta_{i,h}h_{i,t} - \beta_{i,UC}UC_{i,t} - \beta_{i,MFPY}MFYP_{i,t} + \beta_{i,y}y_{i,t} + \beta_{i,*}p_{i,t}^*$$

Here $p_{i,t}$ is the log real regional house price of area i at time t , $h_{i,t}$ is the log housing stock, $UC_{i,t}$ is the real user cost of housing, $MFYP_{i,t}$ is the minimum first year payments as housing owner, $y_{i,t}$ is the log real disposable income and $p_{i,t}^*$ represent log real housing prices in related areas.

THE MAIN VARIABLES OF THE MODEL

We use data from 1986q1 to 2016q3. The variables of the model are explained in the following:

Housing prices (p)

For our regional housing price indexes, we use the log weighted single and multi dwelling housing prices from Statistics Sweden, deflated by the CPI from Konjunkturinstitutet. See the *top figure*.

Housing supply (h)

For housing supply, we use the log total number of single and multi dwelling from Statistics Sweden. The data is interpolated from annual to quarterly frequency using quarterly data on construction activity. See the *top figure*.

User cost (UC)

The user cost is defined as the expected real interest rate payments net of tax plus property taxes. We assume that this is the same across regions.

Inflation expectations are taken from Konjunkturinstitutet, mortgage interest rates (5 years fixed) are given by Swedbank, the rate of interest deductions and property taxes are taken from Bergman and Sørensen (2014), Englund et. al (2011), Hansson et. al (2014).¹ See the *bottom figure*.

Minimum first year payments (MFYP)

As in Dam et. al (2011) and Heebøll (2014), we assume that a share of the housing buyers are credit constrained or short-sighted. Instead of the purely rational user cost, their housing demand is determined by the nominal minimum first year payments.

Disposable income (y)

The regional disposable income is taken from Statistics Sweden, interpolated from yearly to quarterly frequency using national proxies. The national proxies are also used to extent the data on regional disposable income before 1991, where regional data is not available. See the *top figure*.

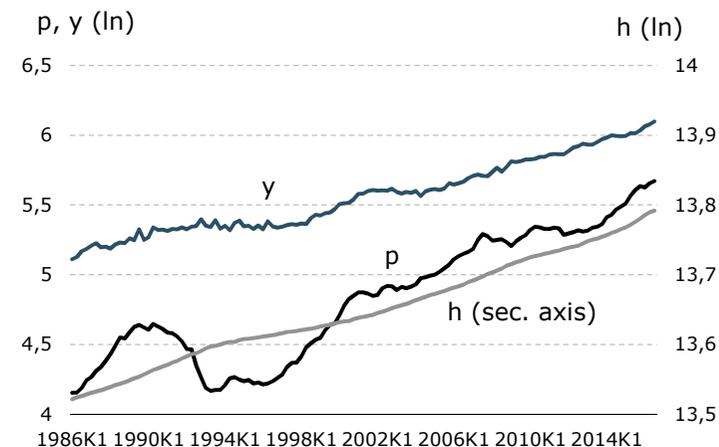
Related area prices (p*)

The related area prices are defined as a weighted index of the prices in all other regions in Sweden, weighted by 1/distance. Area prices are only allowed to depend on areas with higher population density, except the three large city areas, which are allowed to depend on each other.

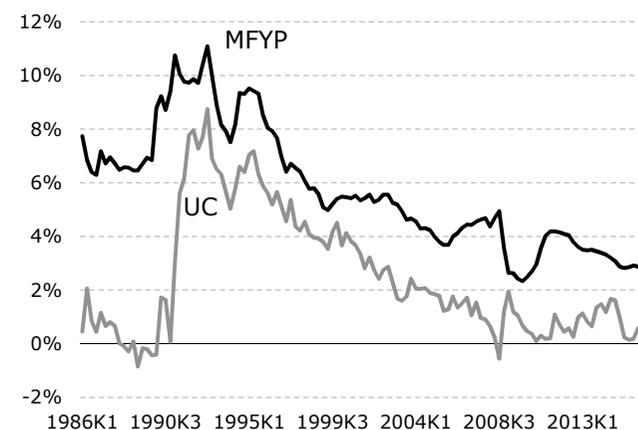
Population (pop)

In the short run, we also allow for an effect of population growth taken from Statistics Sweden.

Housing prices, housing supply and disposable income, Stockholm



User cost and MFYP, national



Details on monetary policy scenario:

Counterfactual interest rates

ESTIMATING THE ECB INTEREST RATE

The counterfactual interest rate in the monetary policy scenario is calculated using the approach in Heebøll (2014). The paper estimates a rule based policy rate (Taylor rule) that seeks to minimise the expected output gap and the deviation of expected inflation from the inflation target (2 per cent in Sweden), i.e.:

$$i_t = (1 - \rho)r^* + \tilde{\phi}_\pi(E_t\pi_{t+1} - \pi^*) + \tilde{\phi}_y(E_t y_{t+1} - \bar{y}_{t+1}) + \rho i_{t-1} + \varepsilon_t$$

where i_t is the nominal interest rate at time t , r^* is the natural interest rate, $E_t\pi_{t+1}$ is the expected inflation one year ahead in time t , π^* is the inflation target, and $E_t y_{t+1} - \bar{y}_{t+1}$ is the expected output gap. The term ρi_{t-1} is introduced to account for the tendency for central banks to smooth short term interest rates.

The parameter estimates found in Heebøll (2014) are used throughout. These are based on an estimation of ECB's monetary policy rule from 1999 to 2007; $\rho = 0.59$, $\tilde{\phi}_\pi = 0.44$, $\tilde{\phi}_y = 0.27$. We use quarterly data for the one-year ahead expected output gap and inflation estimates from Konjunktur Institutet. Furthermore, we use the (conservative) Riksbank (2014) estimate for the natural nominal interest rate of 2.5 percent.

It should be recognized that this approach may to a small degree be overestimating the counterfactual interest rate, as the actual interest rate naturally affects the expected inflation and output gap.

COUNTERFACTUAL MORTGAGE RATES

We compute counterfactual mortgage rates using error correction models for how the 5 year and 3 month interest rate is determined by the monetary policy rate. These are used to simulate the mortgage rates, see the *bottom figure*.

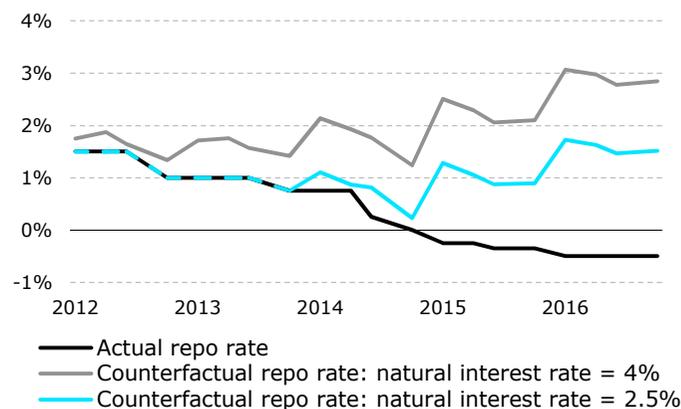
A CONSERVATIVE ESTIMATE

The Riksbank's (2014) estimate of the natural interest rate is based on market expectations of the 5 year nominal repo rate. This will generally equal the natural interest rate if market participant believe that the economy will return to its long-run equilibrium within this timeframe. However, it is quite likely that the expectations of market participants are negatively affected by the aggressive monetary policy pursued in recent years, i.e. if market participants perceive the monetary policy to be aggressive going forward the expected repo rate will underestimate the true natural interest rate.

In theory, the natural nominal interest rate is determined by technological advances and the willingness to save. According to the Riksbank (2014), the long-term natural *real* interest rate will, as a rule-of-thumb, correspond to the long-term productivity growth, which has been approximately 2 percent in Sweden since 1980. With a long-term inflation rate of 2 percent this implies that the natural *nominal* interest rate should be 4 per cent.

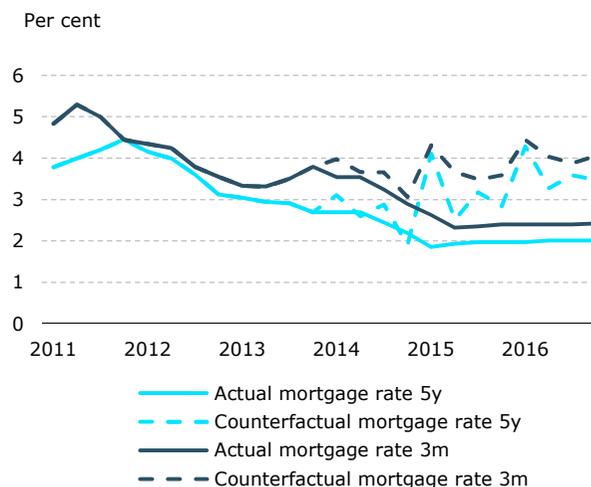
The impact of the different assumption on the natural interest rate is illustrated in the *top figure*.

Counterfactual monetary policy



Note: The figure shows the Taylor rule based monetary policy under different assumptions about the natural interest rate

Counterfactual mortgage rates



ESTIMATIONS OF WELFARE EFFECTS

Estimation of the welfare effects

The calculation of the welfare loss is based on a standard microeconomic model of the households' welfare, a so-called utility function, see for example Gerali et al. (2010). The estimation of the loss in welfare can be described in three steps:

1 SETTING UP A MODEL OF AN AVERAGE SWEDISH HOUSEHOLD

In the utility function, the households consume two kinds of goods; non-durable goods (e.g. food or entertainment) and housing. Housing consumption is measured as the user costs in the housing model, described above. The output from the model is a "level" of welfare.

We calibrate the model, so it mirrors an average Swedish household of 2015. This implies that:

- Loan-to-income (LTI) is set at 408 per cent
- Loan-to-value (LTV) is set at 65 per cent.
- The after tax user cost is calibrated to 2.1 per cent, which is the average user cost the past 20 years.
- The weight of housing in the utility function (how much households value housing consumption) follows Gerali et. Al (2010), which is calibrated to

an European economy.

In calibrating the model, we find that the LTV/LTI ratio is binding, meaning that (according to the utility function) the households would prefer to spend more on housing. The current loan-to-value can thereby be seen as a limit on the credit from Swedish financial institutions or due to prudent behaviour from households.

2 IMPLEMENTING A DTI LIMIT

Having set up the model, we can implement the DTI limit. According to our estimations on 2015 data, a DTI limit of 600 per cent will result in a decline in the debt-to-income for the average household of 20 percentage points (corresponding to a decline in the debt of 8 per cent). This implies that the Swedish households are not allowed to consume as much housing, as they previously did, since their average interest expenditures is forced down. In other words, they cannot buy as expensive houses as they prefer. This decline in housing implies a welfare loss, which can be measured in the utility function. Oppositely, we assume that the free funds, which the households now have available, will be spend on non-durables

goods. The welfare loss arise, as the composition between non-durables and housing will not be optimal.

3 TRANSFORMING THE WELFARE IN TERMS OF DECLINE IN GDP

The decline in welfare, which the model produces, have – on its own – little intuitive meaning. In order to get a measure of the decline in welfare, we transform the welfare loss into a decline in GDP. We do this by calculating: "which decline in GDP will produce the same decline in welfare as the DTI limit does". Concretely, we use the model without the DTI limit implemented and reduce both non-durables and housing until the level of welfare is the same as with the DTI limit. When the level of non-durables and housing are reduced by 1/2 per cent, the welfare has declined as much as with the DTI limit implemented. We can hereby infer that a DTI limit would reduce the welfare of Swedish households corresponding to 0.5 per cent of GDP.



Source: Finansinspektionen (2016): "The Swedish Mortgage Market"

SHORT TERM GDP EFFECT

Short term decline in GDP as a result of a 600 per cent DTI limit

OVERVIEW OF THE MODEL

To estimate the macroeconomic effect of the introduction of a 600 per cent DTI limit, we use a model developed in Gerali et al. (2010). It is a so-called Dynamic Stochastic General Equilibrium (DSGE) model, which is a micro-based macroeconomic model. The model has a detailed financial sector, which enables us to analyse the effects of introducing macroprudential measures.

WHY WE CHOOSE THIS MODEL

There are several reasons Gerali et al. (2010) is the preferred setup:

- The micro foundation of the model allows for an analysis of changing lending restrictions. This includes an intertemporal response towards the new steady state.
- The model incorporates the patient/impatient view of Iacoviello (2005), that captures the fact that liquidity constrained household will respond different to macroprudential measures.
- The paper by Gerali et al. (2010) is generally respected in the academic literature, with numerous citations.
- The model is calibrated and estimated to the European economy and the dynamics of the model will in general incorporate European economic features. In addition, we have further adapted some of the main parameters to fit Swedish economy, as discussed below.

RESULTS

According to the model, GDP will decline with an average of around 0.4% the two first years after the introduction of the DTI limit – cf. *figure*. The estimate is generally in line with the estimate of The Riksbank (2015) that finds a maximum short term GDP impact of 0.3-0.7 per cent.

CALIBRATION OF THE MODEL

As mentioned, the model has been adapted to mimic some the characteristics of the Swedish economy.

- The LTV limit is set according to current Swedish legislation (=0.85)
- Habit formation is introduced (=0.53) based on the estimation of the Riksbank's DSGE-model, Ramses II.
- Quarterly depreciation of physical capital (=1.2%)

The rest of the parameters are taken from the calibration of Gerali et al. (2010)

Using the model, we compute the intertemporal adaptation to the new steady state. The calibration is made to mimic the decline in household debt of 8 per cent. This allows us to approximate the average decline in GDP the first and second year after the introduction of the DTI limit.

