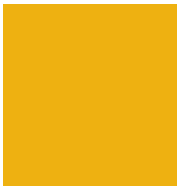
Sveriges Riksbank Economic Review

2015:2

SVERIGES RIKSBANK



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Dear readers,

Three articles discussing current economic policy challenges are published in this edition.

- Magnus Jonsson and André Reslow analyse the risks of a central bank's policy rate remaining low over a long period of time. The analysis is based on Irving Fisher's theory, which posits that the nominal interest rate should be equal to the sum of the expected inflation rate and the real interest rate. The authors also assume that monetary policy is neutral in the long run – i.e. it does not influence the long run development of real economic variables. Using an economic model and empirical estimates with data from several countries, the idea that a low policy rate over a long period of time can lead to low inflation is supported.
- Gabriela Guibourg, Magnus Jonsson, Björn Lagerwall and Christian Nilsson analyse the possible consequences of various macroprudential policy measures. Based on economic theory, capital requirements, leverage ratio requirements, loan-to-value limits, debt-to-income limits and debt-service-to-income ratio limits are discussed. The authors provide an overview of the rapidly growing scientific literature and highlight the economic effects of macroprudential policy measures. They also analyse how monetary policy can be affected. New macroprudential policy instruments can deal with financial imbalances more efficiently, which would ease the situation for monetary policy, but they can also affect inflation and resource utilisation in a way that monetary policy may need to consider.
- Robert Emanuelson analyses the supply of housing in Sweden. He investigates the factors that have contributed to the low level of housing construction over recent decades. The public sector's share of housing construction has, for example, decreased and government subsidies of new builds have been substantially reduced. New construction is also affected by a distorted incentives structure for both private and municipal builders. There are also laws and regulations that hamper competition on the market and that contribute to a lower-than desirable amount of land ready for development. One conclusion is that the structural problems on the housing market need to be addressed. With more homes, geographical mobility would increase and the labour market would also function better. Furthermore, the risks associated with high household debt would decrease.

Read and enjoy!

Claes Berg, Martin W Johansson, Jesper Lindé and Dilan Ölcer

Contents

Interest and inflation rates through the lens of the theory of Irving Fisher

Magnus Jonsson and André Reslow*

Magnus Jonsson has a PhD in Economics and André Reslow has a Master's Degree in Economics. Both work in the Monetary Policy Department at the Riksbank.

The nominal interest rate and inflation are positively correlated with each other in the short run and in the long run, in Sweden as well as in other countries. In this article, we show that the positive correlation can be understood through Irving Fisher's theory of the relationship between the nominal interest rate, the inflation rate and the real interest rate. In our analysis, the short run correlation can be explained by supply and demand shocks in a standard macroeconomic model, where Fisher's theory is a key factor. If we assume long run monetary neutrality, Fisher's theory implies that the correlation between the nominal interest rate and inflation is positive also in the long run. Finally, we show that if the real interest rate is equated to the GDP growth rate per capita, the long run implications of Fisher's theory fit the data in Sweden and several other countries. This provides empirical support to the idea that a low policy rate over the long run could lead to low inflation, as has been proposed by Narayana Kocherlakota, among others.

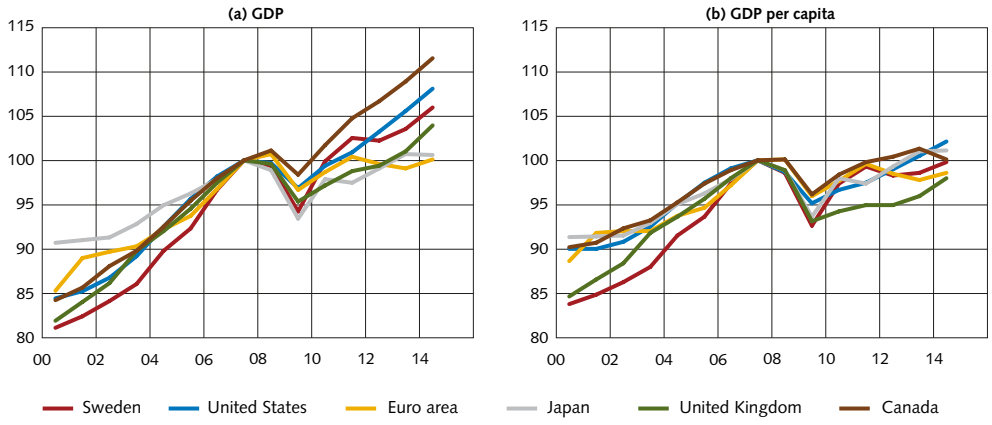
Almost seven years have passed since the investment bank Lehman Brothers declared bankruptcy in the autumn of 2008 and the global financial crisis broke out with full force. The crisis brought with it the largest fall in GDP since the Great Depression of the 1930s. Moreover, the recovery after the crisis has been unusually slow in many countries, see Figure 1(a). In the euro area and Japan, GDP is at about the same level as when the crisis broke out, while in Sweden, the US, the UK and Canada the level is five to ten per cent higher. Additionally, GDP per capita is at the pre-crisis level in all these countries, see Figure 1(b). Sweden only just reaches the pre-crisis level and both the euro area and the UK are below that level.

The central banks reacted promptly and cut the policy rates to near zero per cent at the outset of the financial crisis in order to avoid a further deepening of the crisis, see Figure 2(a). However, the policy rates have remained at these low levels. In Sweden, the policy rate is currently slightly negative and in several other countries it is close to zero per cent.

Inflation fell rapidly at the beginning of the financial crisis, even though it recovered relatively quickly, see Figure 2(b). For example, in Sweden inflation was above two per cent around 2011, but since then it has been falling again and remained at low levels. The low inflation rates in the recent years are, however, not just a Swedish phenomenon, but are being experienced by several other countries.

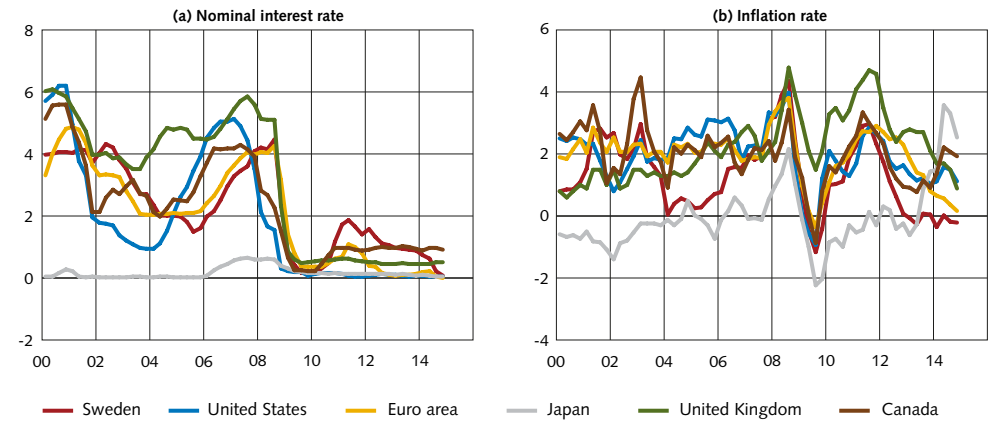
* We would like to thank Claes Berg, Paolo Bonomolo, David Kjellberg, Hanna Köhler, Eric M. Leeper, Jesper Lindé, Marianne Sterner, David Vestin and Anders Vredin for valuable discussions and suggestions. The opinions expressed in this article represent the authors' personal opinions and cannot be regarded as an expression of the Riksbank's view.

Figure 1. GDP and GDP per capita in Sweden, the US, the euro area, Japan, the UK and Canada
Index, 2007 = 100



Sources: Eurostat, Japanese Cabinet Office, Official Statistics of Japan, Statistics Sweden, Statistics Canada, UK Office for National Statistics, US Bureau of Economic Analysis and US Census Bureau

Figure 2. Nominal interest and inflation rates in Sweden, the US, the euro area, Japan, the UK and Canada
Per cent



Note. The nominal interest rates are measured by three-month treasury bills, except in the euro area where the nominal interest rate is measured by EONIA. Inflation is measured by CPI inflation in all countries, except in the US where it is measured by PCE inflation, and the euro area where it is measured by HICP inflation. Note that the high rates of inflation in Japan in 2014 were mostly, 2 percentage points, due to temporary effects from increased taxation on consumption (the calculations in the article is adjusted for this).

Sources: ECB, Eurostat, Macrobond, OECD, Statistics Sweden and the US Bureau of Economic Analysis

WHY IS INFLATION NOT RISING?

Monetary policy has thus been characterised by policy rates near zero per cent since the beginning of the crisis. In addition, several central banks have purchased government bonds and adopted other so-called unconventional measures to make monetary policy even more expansionary. At the same time, inflation has been low and below the inflation target in

many countries. What is causing these low inflation rates? Why has monetary policy, which has been exceptionally expansionary in a historical perspective, not led to higher rates of inflation?

A common explanation is that monetary policy has been constrained by the zero lower bound, i.e. the policy rate cannot be substantially below zero per cent. Proponents of this view argue that demand is still below normal and is therefore not creating any upward pressure on inflation. In other words, monetary policy has not been expansionary enough.[1]

Another explanation that has been put forward is that increasing competition, entailed by globalisation and digitalisation, has made it more difficult for firms to raise prices without losing customers.[2]

CAN LOW POLICY RATES OVER THE LONG RUN LEAD TO LOW INFLATION?

Perhaps a more challenging explanation is that low policy rates over the long run could lead to low inflation. This may sound contradictory, as policy rate cuts according to standard theory should lead to rising inflation. Nevertheless, Narayana Kocherlakota, president of the Federal Reserve Bank of Minneapolis, explored this idea in a speech 2010, see Kocherlakota (2010):

> *Long run monetary neutrality is an uncontroversial, simple, but nonetheless profound proposition. In particular, it implies that if the FOMC maintains the fed funds rate at its current level of 0-25 basis points for too long, both anticipated and actual inflation have to become negative. Why? It's simple arithmetic. Let's say that the real rate of return on safe investments is 1 percent and we need to add an amount of anticipated inflation that will result in a fed funds rate of 0.25 percent. The only way to get that is to add a negative number, in this case, –0.75 percent. To sum up, over the long run, a low fed funds rate must lead to consistent, but low, levels of deflation.*

Kocherlakota's claim is based on two well-known economic theories. The first is the theory of long run monetary neutrality, which says that a change in the policy rate does not affect long run values of real interest rates and other real variables. The second is Irving Fisher's theory of the long run relationship between the nominal interest rate, the inflation rate and the real interest rate.[3] Fisher's theory is simple and intuitive: in the long run, inflation has to correspond to the difference between the long run levels of the nominal and the real interest rates. Taken together, these two theories imply that a long-lived change in the nominal interest rate corresponds to an equal change in inflation.

1 See Hall (2014).
2 See Apel et al. (2014). See also Jonsson (2007) who quantifies the effects of increased competition on inflation in the Riksbank's macroeconomic model Ramses.
3 See Fisher (1977).

Central banks use changes in a short-term nominal interest rate (i.e. the policy rate) to influence inflation.[4] But how these changes affect inflation depend on several different factors.[5] Kocherlakota emphasised that the length of the change may be an important factor. We therefore dedicate a large part of the article to explain why short-lived changes may affect inflation differently than long-lived changes.

OUTLINE AND SUMMARY

The outline of the article is as follows: The next section describes Irving Fisher's theory of the relationship between the nominal interest rate, the inflation rate and the real interest rate. This section also describes the assumptions under which the real interest rate can be equated to the GDP growth rate per capita.

The following section sheds light on the short run relationship between the nominal interest rate and inflation. We first show that the correlation between these two variables is positive in Sweden and other countries. This may appear contradictory, as short-lived cuts in the policy rate normally lead to rising inflation and increases to falling inflation, which should imply a negative correlation. However, this fact need not necessarily imply that the correlation in the data is also negative. Changes in the policy rate are generally not an important factor behind the business cycle fluctuations. These are instead mainly driven by supply and demand shocks. We therefore conclude this section by explaining why these shocks give rise to a positive correlation between the nominal interest rate and inflation.

We then, in the next section, look at the long run relationship. Also the long run correlation between the nominal interest rate and inflation is positive in the data. We demonstrate that in a standard macroeconomic model, where Fisher's theory and long run monetary neutrality are key assumptions, a long-lived change in the policy rate leads to an equal change in inflation, which explains the positive correlation and also confirms Kocherlakota's claim.

In the subsequent section, we make use of the fact that under certain assumptions the real interest rate can be equated to the GDP growth rate per capita. We show that the average inflation in Sweden and other countries can be explained by the difference between the average nominal interest rate and the GDP growth rate per capita. This suggests that the long run implications of Fisher's theory fit the data in several countries. Furthermore, it provides empirical support to Kocherlakota's claim.

Japan was badly hit by a financial crisis in the beginning of the 1990s. The Japanese experience in the post-crisis period is of particular interest, since Japan's economy has been characterised by low nominal interest rates and inflation. We show that the average

4 The terms nominal interest rate and policy rate are used interchangeably in the article. In the empirical analysis, the nominal interest rate is measured by the yield on a three-month treasury bill. The difference between this interest rate and the policy rate is normally marginal.

5 Milton Friedman said that monetary policy works with long and variable lags, by which he meant that the effects on inflation of changes in monetary policy takes time and varies over time, see Friedman and Schwartz (1963).

inflation in Japan, both in the pre-crisis and post-crisis periods, can be explained by the difference between the average nominal interest rate and the GDP growth rate per capita.

Following this, there is a section that takes a much-debated article, Bullard (2010), as a starting point for a discussion of the effects of low nominal interest rates over a longer period.[6] Bullard's article explains why Fisher's theory together with the zero lower bound may imply a steady state characterised by near-zero nominal interest rates and low or negative inflation.[7] The data suggest that it is still too early to determine whether Sweden and other countries have moved into such a steady state following the financial crisis. Seven years of data is not enough to determine this. On the other hand, it appears as if Japan, following the financial crisis at the beginning of the 1990s, has moved into a steady state of low inflation. Finally, we make some concluding remarks.

The relationship between the nominal interest rate, the inflation rate and the real interest rate according to Irving Fisher

Irving Fisher's theory of the relationship between the nominal interest rate, the inflation rate and the real interest rate, the so-called Fisher relation, is fundamental in monetary theory. This relation is also a key feature in the micro-founded macroeconomic models that central banks use in their forecasting and policy work. The Riksbank's model Ramses is an example of such a model.[8]

The Fisher relation is formally an arbitrage condition between a real and a nominal asset and can be written in the following way,

$$1+R_t=(1+E_t\pi_{t+1})(1+r_t), \tag{1}$$

where R denotes the nominal interest rate, π inflation, E expectations ($E_t\pi_{t+1}$ thus denotes expected inflation in time $t+1$ that an agent has at time t), and r the real interest rate.

A mathematical derivation of the Fisher relation can be found in several textbooks, see for example Walsh (2003). Here we explain the intuition behind the relation through a verbal reasoning. Suppose that we have a real asset that costs one apple in period t and that gives the return of $(1+r_t)$ apples one period later. In nominal terms, the real asset costs P_t in period t and P_{t+1} in the next period. The nominal price of the real asset in period $t+1$ is thus $(1+r_t)P_{t+1}$ and the nominal return will be $((1+r_t)P_{t+1}-P_t)/P_t$. In order to avoid arbitrage opportunities, the return on the real asset must be as high as on a nominal asset, R_t, i.e. $R_t=((1+r_t)P_{t+1}-P_t)/P_t$. This expression can be re-written in terms of inflation rates, $1+R_t=(1+\pi_{t+1})(1+r_t)$. If we also take into account that the future price level is unknown, we get equation (1).

6 See Bullard (2010).
7 Bullard's article builds on insights from Benhabib et al. (2001).
8 See Christiano et al. (2011).

For small values of the inflation and real interest rates, equation (1) can be approximated with the following expression,

$$R_t = E_t\pi_{t+1} + r_t. \tag{2}$$

Equation (2) is the "short run" Fisher relation, since it is valid at each point in time t. In macroeconomic models, a time period is usually a quarter. The Fisher relation is also valid in the long run, i.e. in steady state, where it is written as,

$$\bar{R} = \bar{\pi} + \bar{r}\,, \tag{3}$$

where a bar indicates that it is a long run (steady state) value of a variable. Long run values are usually calculated as the average over a longer period, usually ten years or more.

THE REAL INTEREST RATE CAN BE EQUATED TO THE GDP GROWTH RATE PER CAPITA UNDER CERTAIN ASSUMPTIONS

The following factors can be shown to determine the long run real interest rate under certain assumptions on the households' preferences and the firms' production technologies,[9]

$$1 + \bar{r} = \frac{1}{\beta}(1+\gamma)^{\sigma}, \tag{4}$$

where β denotes the households' discount factor, γ the (real) GDP growth rate per capita (working age population) and $1/\sigma$ the households' intertemporal elasticity of substitution. Equation (4) shows that the long run real interest rate depends on two fundamental factors. The first is how households value consumption today versus consumption tomorrow, β, and the second is the GDP growth rate per capita, γ.[10]

Explaining why the real interest rate depends on β is best done through an example. Assume that households are impatient, i.e., they prefer consuming today as opposed to consuming tomorrow. If households are to value consumption tomorrow as highly as consumption today, they must be compensated for deferring their consumption.[11] That is to say, if they save and postpone some of today's consumption until tomorrow, there must be a positive real interest rate on this saving.

In addition, the real interest rate depends on the growth rate. The marginal utility of consumption is normally diminishing, i.e. a small increase of consumption increases households' utility but at a diminishing rate. Or, to put it differently, the utility of eleven apples is greater than that of ten, but the marginal utility of the eleventh apple is less than that of the tenth. In a growing economy, the consumption level today is lower than

9 See Jonsson (2002).
10 "The GDP growth rate per capita" will hereafter be called "the growth rate".
11 Utility maximisation implies that households are indifferent about consuming today or tomorrow.

future levels, which implies that the marginal utility of consuming today is greater than the marginal utility of consuming in the future. The real interest rate must therefore be positive if households are to be indifferent between consuming today and in the future. How high the interest rate has to be depends on the intertemporal elasticity of substitution of the households. If the willingness of substituting consumption between periods is relatively low, i.e. if σ is relatively high, the real interest rate needs to be relatively high.

Note that according to equation (4), if $\beta = \sigma = 1$ the real interest rate equals the growth rate. If $\beta = 1$ then today's generation will value its own consumption as highly as future generations' consumption, which could be a reasonable assumption from the perspective of justice. It may be more difficult to justify a certain value for σ. It has also proved to be difficult to estimate this parameter with any certainty. However, a common value for this parameter in many macroeconomic models is 1, which, for example, is the case in the Riksbank's macroeconomic model Ramses. If we assume that $\beta = \sigma = 1$ the long run Fisher relation can be defined as follows,

$$\bar{R} = \bar{\pi} + \gamma. \tag{5}$$

The nominal interest rate and inflation are positively correlated in the short run

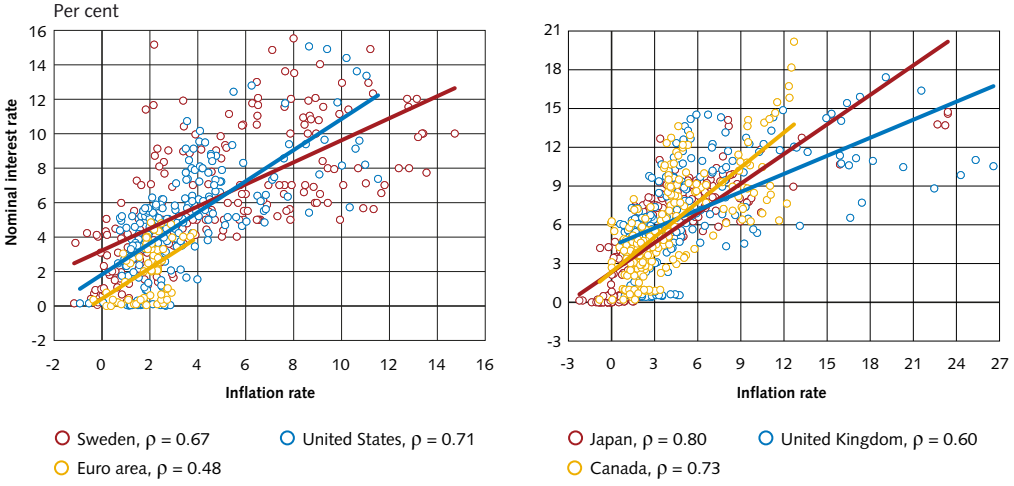
The nominal interest rate in the Fisher relation should according to theory be measured by a short-term risk-free nominal interest rate. Given that, we use the yield on a three-month treasury bill as a measure of the nominal interest rate in Sweden, the US, Japan, the UK and Canada. For the euro area, where there are no treasury bills issued jointly by the member states, we use EONIA (Euro OverNight Index Average), which is a reference rate for loans between banks with a maturity of one banking day. Regarding inflation, there are several different measures to choose from. Although there is no indisputable measure, which is reflected in that central banks usually report several measures in their reports. We follow this practice and report two measures. The first is inflation according to the consumer price index, i.e. CPI inflation.[12] The second is a measure of so-called core inflation.[13]

Figure 3 shows the correlation between the nominal interest rate and inflation in six countries: Sweden, the US, the euro area, Japan, the UK and Canada. The time period is 1961-2014 for all countries, except the euro area, where it is 1999-2014. As can be seen, the correlation is positive throughout. It is strongest in Japan, with a correlation coefficient of 0.80, and weakest in the euro area, where the correlation coefficient is 0.48.

12 However, for the US, we use PCE inflation (the consumption deflator), which is the preferred measure by the Federal Reserve.

13 Core inflation is measured by CPI excluding food and energy, except in Sweden, where it is measured by CPIF excluding food and energy, the US, where it is measured by PCE inflation excluding food and energy, and the euro area, where it is measured by HICP excluding food, energy, alcohol and tobacco. Note that measures of core inflation are not available for the 1960s and 1970s.

Figure 3. Correlation between the nominal interest rate and inflation in Sweden, the US, the euro area, Japan, the UK and Canada
Per cent



Note. ρ denotes the correlation coefficient. Quarterly data 1961-2014 for all countries, except the euro area, which is based on quarterly data 1999-2014. The nominal interest rates are measured by three-month treasury bills, except in the euro area where the nominal interest rate is measured by EONIA. Inflation is measured by CPI inflation in all countries, except in the US where it is measured by PCE inflation, and the euro area, where it is measured by HICP inflation.

Sources: ECB, Eurostat, Federal Reserve, Macrobond, OECD, Statistics Sweden and US Bureau of Economic Analysis

MONETARY POLICY SHOCKS RESULT IN A NEGATIVE CORRELATION BETWEEN THE NOMINAL INTEREST RATE AND INFLATION

The positive correlation between the nominal interest rate and inflation may appear contradictory at first glance. Policy rate cuts normally lead to rising inflation, while increases lead to falling inflation, which should imply a negative correlation. However, this does not necessarily imply that the correlation in data also has to be negative. We can explain why this is the case with the help of a simple macroeconomic model, in which the Fisher relation is a key feature.[14]

The central bank follows a simple, linear rule à la Taylor (1993) with the following parameterisation,[15]

$$R_t = 0.8\,R_{t-1} + (1-0.8)\,[\bar{R} + 1.5\,(\pi_t - \bar{\pi}) + 0.1\,(y_t - \bar{y})] + \varepsilon_t, \tag{6}$$

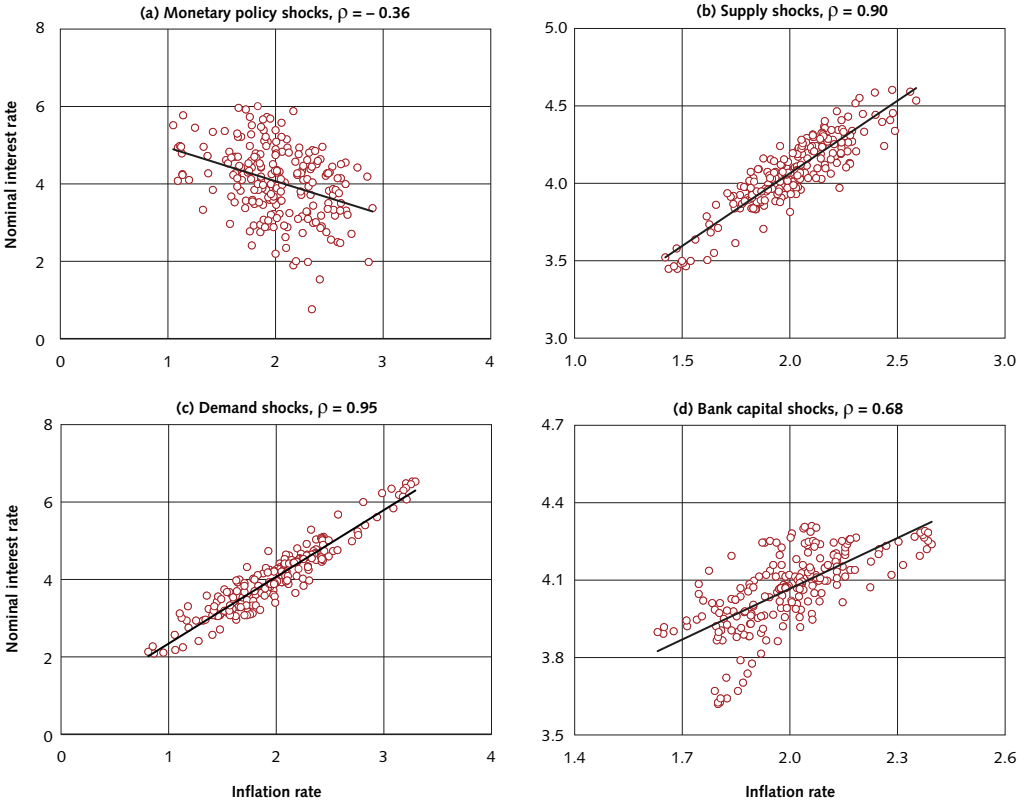
where R denotes the policy rate, $\bar{R}$ the policy rate's long run level, π inflation, $\bar{\pi}$ inflation's long run level (i.e. the inflation target), y output, $\bar{y}$ the long run output level, and ε a monetary policy shock. The differences, $\pi_t - \bar{\pi}$ and $y_t - \bar{y}$, are thus inflation's deviation from the inflation target and the output gap, respectively.

14 See Meh and Moran (2010) and Jonsson and Moran (2014) for a description of the model.
15 The Taylor rule is a simple recommendation for how monetary policy should be conducted under normal circumstances. The rule has also been shown to work well in many different types of macroeconomic models, see Plosser (2008).

Business cycle fluctuations are due to different types of shocks hitting the economy, to which prices and quantities adjust. This implies that the correlation between different variables will depend on these shocks. Hence, in order to explain, for example, the correlation between the nominal interest rate and inflation it is necessary to know which shocks that have created the fluctuations.

The monetary policy shock in the Taylor rule may be interpreted as a change in the policy rate that is due to neither deviations of inflation from the target nor deviations of output from its normal level. We can thus illustrate how short-lived changes in the policy rate affect inflation by allowing monetary policy shocks to drive the business cycle. Figure 4(a) shows the correlation between the nominal interest rate and inflation in this case. As expected, the correlation is negative and the correlation coefficient is –0.36.

Figure 4. Correlation between the nominal interest rate and inflation after monetary policy shocks, supply shocks, demand shocks and bank capital shocks
Per cent



Note. ρ denotes the correlation coefficient.

Source: Own calculations

An important assumption in the model is that prices are sticky in the short run, i.e. some firms are not changing their selling prices along with changes in demand. Assume a short-lived cut in the policy rate and that the prices are so sticky that they initially remain unchanged. This means that the cut, $R_t \downarrow$, must be matched by an equally large fall in the real interest rate, $r_t \downarrow$, i.e.,

$$R_t \downarrow = \bar{\pi} + r_t \downarrow , \tag{7}$$

where $\bar{\pi}$ indicates that inflation initially remains on the long run level. However, as time passes, the falling real interest rate tends to increase households' consumption and firms' investment. This boosts demand, which pushes up inflation when firms eventually start to change their prices. Short-lived policy rate cuts are thus associated with rising inflation and, conversely, increases are associated with falling inflation. This explains the negative correlation after monetary policy shocks in Figure 4(a).

But how can it then be that the nominal interest rate and inflation are positively correlated in the data when monetary policy shocks give rise to a negative correlation? This is simply because monetary policy shocks are in general not an important cause of business cycle fluctuations. These are usually due to other shocks.

BUT SUPPLY AND DEMAND SHOCKS RESULT IN A POSITIVE CORRELATION

Supply and demand shocks are often the main drivers of the business cycle and, hence, the correlations in the data. The supply shock is modelled as a shock to the firms' production technology. This shock affects the production possibilities of the firms and therefore has a direct effect on the supply of goods and services. An improvement of the production technology means that the firms' production possibilities increase, but it also means that the cost of production decreases and that the firms can lower their prices. A positive supply shock thus leads to falling prices. The central bank reacts to this by cutting the policy rate to bring inflation back to the target. Hence, the correlation between the nominal interest rate and inflation becomes positive. The correlation coefficient is 0.90, see Figure 4(b).

The demand shock equals public consumption in the model, since changes in public consumption have direct effects on aggregate demand. An increase in public consumption pushes demand up and therefore also increases inflationary pressures. To keep inflation on target the central bank raises the policy rate. This gives rise to a positive correlation between the nominal interest rate and inflation, see Figure 4(c), and a correlation coefficient of 0.95.

We have claimed that supply and demand shocks are the most common shocks, but other shocks do also occur. The credit crunch associated with the financial crisis of 2008 is an example of a financial shock (a so-called bank capital shock) where the effects spread rapidly to other parts of the economy. This type of shock is unusual and, like the monetary policy shock, does not provide an important explanation of the correlations in data over

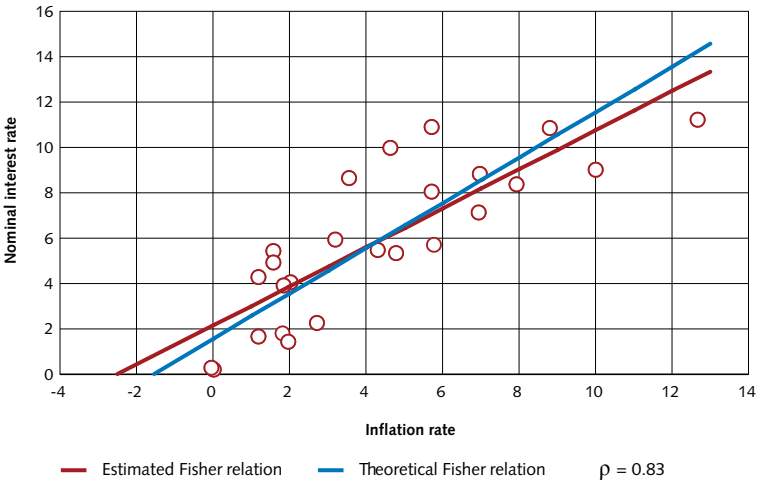
longer periods. Nevertheless, the macroeconomic model shows that the correlation between the nominal interest rate and inflation is positive, as in the data, and measures 0.68 when the banks' lending is exposed to bank capital shocks, see Figure 4(d).

The nominal interest rate and inflation are positively correlated also in the long run

Figure 5 shows the long run correlation between the nominal interest rate and inflation in five countries: Sweden, the US, Japan, the UK and Canada. The long run values have been calculated as ten-year averages. The time period covers 1965 to 2014, meaning five observations for each country and a total of 25 observations. As we can see, the correlation is positive throughout and the correlation coefficient is 0.83.

The blue line in the figure shows the theoretical Fisher relation, in which we have calculated the long run real interest rate as the average difference between the nominal interest rate and inflation for all countries over the entire period. This gives a value of 1.56 per cent. The red line shows an estimate of the Fisher relation. The estimated slope coefficient is 0.86, which is relatively close to the theoretical value of 1. Also, a statistical test does not reject the null hypothesis that the slope is 1.[16]

Figure 5. Long run correlation between the nominal interest rate and inflation in Sweden, the US, Japan, the UK and Canada, ten-year averages, 1965-2014
Per cent



Note. ρ denotes the correlation coefficient. The nominal interest rates are measured by three-month treasury bills. Inflation is measured by CPI inflation in all countries, except in the US where it is measured by PCE inflation. The blue line shows $\bar{R}_t = 1.56 + \bar{\pi}_t$. while the red line shows $\bar{R}_t = 2.16 + 0.86\bar{\pi}_t$.

Sources: Federal Reserve, Macrobond, OECD, Statistics Sweden, US Bureau of Economic Analysis and the Riksbank

16 An F-test with the null hypothesis that the slope is one in the estimated Fisher relation gives a p-value equal to 0.06 (F-value = 3.79, covariance = 0.01 and degrees of freedom (1, 23)).

We can see in the figure that the estimated Fisher relation lies relatively close to the theoretical relation, but several isolated points nevertheless lie some distance away. This can be due to several things. The long run real interest rate may not have been the same in all countries over the entire period. It is also likely that the long run real interest rate has varied between the ten-year periods within the different countries.

A LONG-LIVED POLICY RATE CUT IMPLIES THAT INFLATION WILL BE LOWER OVER THE LONG RUN

We can understand the long run correlation between the nominal interest rate and inflation through the implications of the long run Fisher relation. Assume, like Kocherlakota, that the real interest rate is independent of monetary policy in the long run (monetary neutrality) and that the central bank determines the policy rate. This second assumption means that the causality between the policy rate and inflation runs from the policy rate to inflation.

Let us assume that the central bank carries out a long-lived (in this scenario permanent) cut to the policy rate, $\bar{R}\downarrow$, see equation (8). Monetary neutrality implies that the real interest rate remains unchanged at the long run level, $\bar{r}$. Hence, the policy rate cut only affects long run inflation (i.e. the inflation target), which is adjusted downwards, $\bar{\pi}\downarrow$. It is adjusted downwards as much as the policy rate in order to avoid arbitrage opportunities between nominal and real assets. A long-lived policy rate cut thus leads to lower long run inflation in accordance with Kocherlakota's claim. This also explains the long run positive correlation,

$$\bar{R}\downarrow = \bar{\pi}\downarrow + \bar{r}. \tag{8}$$

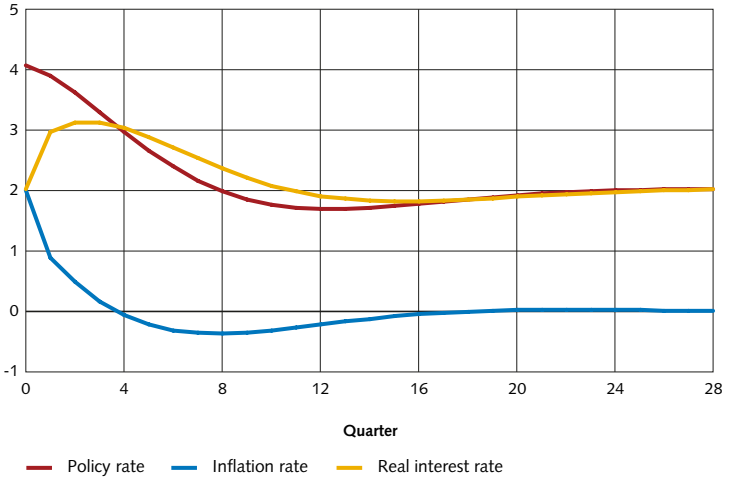
Note the difference to a short-lived change in the policy rate. As we have seen, in this case there is a change in the real interest rate, since prices in the model are sticky. This means that the nominal interest rate and inflation, in the short run, need not necessarily move in the same direction.

The macroeconomic model can be used to illustrate how the real interest rate and inflation may adjust after a long-lived policy rate cut. Assume that the long run levels of the policy and real interest rates are initially four and two per cent, respectively. Inflation is thus two per cent. The central bank cuts the policy rate successively to two per cent, where it remains, see Figure (6). The real interest rate initially rises slightly, but then falls back to the long run level of two per cent. Inflation falls successively over the whole period to its new long run value, which according to the Fisher relation must be zero per cent.

A notable feature of this scenario is that inflation successively adjusts downwards to its new long run level. The main reason for this is that agents in the economy have what is known as rational expectations. This means that the households and the firms do not make any systematic errors when they form expectations of future monetary policy. They understand that the policy rate cut will be long-lived. They also understand that a long-

lived cut is associated with a lower inflation rate over the long run. The firms therefore start adjusting their prices downwards at the moment of the policy rate cut.

Figure 6. The policy rate, the inflation rate and the real interest rate after a long-lived (in this scenario permanent) cut in the policy rate with two percentage points
Per cent



Source: Own calculations

According to the long run Fisher relation there is only one level of the policy rate that is consistent with a specific inflation target, given the long run real interest rate. If the policy rate deviates from this level during a longer period, there is a risk that agents in the economy may interpret this as a change in the inflation target. The agents may therefore have interpreted the long-lived cut in the policy rate as an intention to lower the inflation target from two to zero per cent in this scenario. In other words, if the central bank has an inflation target of two per cent and the long run real interest rate is two per cent, the policy rate must on average be four per cent if the inflation target is to be attained. If the policy rate instead averages two per cent, the inflation rate, as we have seen in Figure (6), will on average be two percentage points lower, i.e. zero per cent.

This scenario also illustrates why the level of long run real interest rate is important to the central bank. It must be aware of this level in order to set a policy rate level that is consistent with the inflation target. In the wake of the financial crisis, Larry Summers and other economists have advanced a thesis of secular stagnation.[17] Among other things, they argue that the long run level of the real interest rate may have fallen. If this is correct, the long run level of the policy rate must be adjusted downwards in proportion to the fall in the real interest rate, otherwise inflation will be too high.

17 See Summers (2014).

The long run Fisher relation fits the data in Sweden and other countries

Kocherlakota's claim that low policy rates over the long run can lead to low inflation relies on the long run Fisher relation. In this section, we carry out an empirical test of this relation. To do so, we calculate the inflation implied by the long run Fisher relation and compare it to the observed average inflation. In these calculations we make use of the fact that the real interest rate under certain assumptions can be equated to the growth rate, see equation (4). Hence, we calculate inflation from the Fisher relation as the difference between the average levels of the nominal interest rate and the growth rate.[18] This inflation rate is called the Fisher inflation, and is thus defined as,

$$\bar{\pi}^F = \bar{R} - \gamma. \tag{9}$$

To determine whether the long run Fisher relation fits the data, we show the difference between the Fisher inflation and the observed inflation from different countries in bar charts as well as results from a statistical test. Note that the real interest rate in this test, which is equated to the growth rate, may vary from country to country, unlike the calculations in Figure 5.

To test long run relationships the time period examined should be as long as possible, at the same time as the data should not display any clear trends. It may also be an advantage if the monetary policy regime is the same over the entire period. To take this into account, we present results from two different periods. The first longer period is limited by access to data and stretches from 1961 to 2014. For this period, we have data for Sweden, the US, Japan, the UK and Canada.

The second shorter period is, to the extent possible, characterised by a stable monetary policy regime and no clear trends in the data. Alan Greenspan was appointed Chairman of the Federal Reserve in 1987. The period prior to Greenspan was characterised by both high nominal interest rates and high inflation. We therefore start the second period for the US in 1987. For the UK, Canada and Sweden, the second period starts one year after the inflation targets were announced in each country, i.e. 1992 for Canada, 1993 for the UK and 1994 for Sweden. Starting the year after the announcement of inflation targeting allows us to avoid including the effects of the economic and financial crisis that hit these countries at the start of the 1990s. During the 1960s and 1970s, Japan underwent a transition from relatively low GDP levels to levels in parity with those of the developed industrial countries. The shorter period for Japan therefore starts in 1981. This period also includes the euro area. The euro was officially introduced on 1 January 1999, which is why the period starts in 1999 for the euro area.

18 Hence, the empirical test does not just include the Fisher relation but also how well the long run real interest rate can be approximated by the growth rate. The reason we make this approximation is because the long run level of the real interest rate is not observable.

The nominal interest rate in Sweden averaged just over six per cent between 1961 and 2014, while the growth rate was just over two per cent, see Table 1. This means that the Fisher inflation was around four per cent, which was only slightly lower than the CPI inflation, see Figure 7(a). For the shorter period we can see that the Fisher inflation was in line with the observed inflation, i.e. both the CPI and core inflation, see Figure 7(b).

In the US, the nominal interest rate averaged five per cent and the growth rate averaged almost two percent over the period 1961-2014, see Table 1. The Fisher inflation was therefore about 3.2 per cent. This was just a few tenths of a percentage point lower than the PCE inflation, see Figure 7(a). The Fisher inflation also corresponded well with both the PCE and core inflation for the shorter period, see Figure 7(b).

In the UK, the Fisher inflation underestimated the observed inflation slightly for the longer period, while it overestimated the CPI and core inflation slightly for the shorter period, see Figures 7(a) and 7(b). In Canada, the Fisher inflation was in line with the observed inflation in both the shorter and the longer periods, see Figures 7(a) and 7(b).

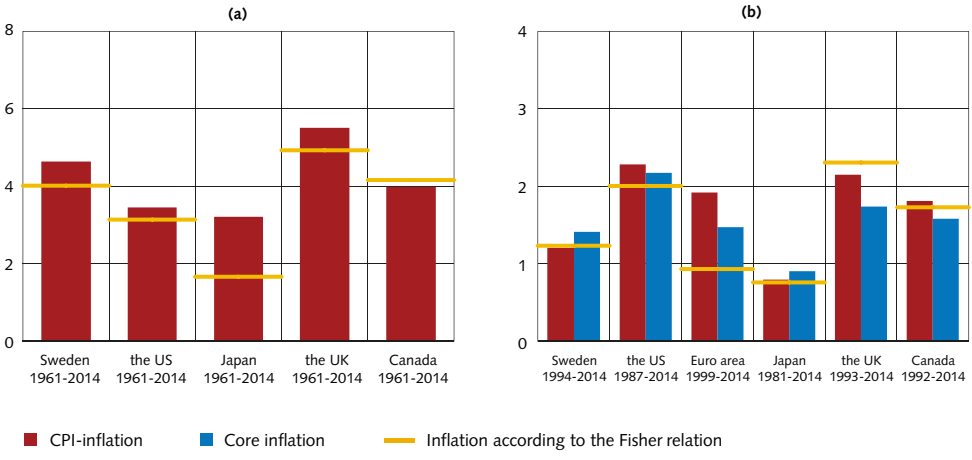
The Fisher inflation in the euro area was lower than both the CPI and the core inflation, although it was not that far from the core inflation, see Figure 7(b). Nevertheless, the result indicates that the Fisher relation seems to fit somewhat less well in the euro area than in the other countries. This could be due to a number of factors. The time period is relatively short, 15 years, and almost half of these years have been characterised by the financial crisis. Another problem could be that it does not exist treasury bonds issued jointly by the member states, i.e. the EONIA rate may have been a poor approximation of a short-term risk-free rate in several of the countries in the euro area.

Table 1. The nominal interest rate and the GDP growth rate per capita in different countries and time periods
Per cent and annual percentage change respectively, averages

COUNTRY	PERIOD	THE NOMINAL INTEREST RATE	THE GDP GROWTH RATE PER CAPITA
Sweden	1961-2014	6.3	2.2
	1994-2014	3.3	2.0
United States	1961-2014	5.0	1.8
	1987-2014	3.6	1.5
Euro area	1999-2014	2.2	1.2
Japan	1961-1980	8.5	5.4
	1981-1990	6.1	3.7
	1981-2014	2.5	1.7
	1991-2014	1.0	0.9
United Kingdom	1961-2014	7.0	2.0
	1993-2014	4.1	1.7
Canada	1961-2014	6.0	1.8
	1992-2014	3.4	1.5
Russia	1999-2013	9.4	4.9
India	1994-2013	7.4	4.8
China	1998-2013	3.4	8.3

Sources: ECB, Eurostat, Federal Reserve, Japanese Cabinet Office, Macrobond, OECD, Reserve Bank of India, Statistics Canada, Statistics Sweden, the World Bank, UK Office for National Statistics and US Bureau of Economic Analysis

Figure 7. Inflation according to the Fisher relation and observed inflation in Sweden, the US, the euro area, Japan, the UK and Canada
Per cent



Note. Core inflation is measured by CPI excluding food and energy, except in Sweden, where it is measured by CPIF excluding food and energy, the United States where it is measured by PCE inflation excluding food and energy, and the euro area where it is measured by HICP excluding food, energy, alcohol and tobacco.

Sources: ECB, Eurostat, Federal Reserve, Japanese Cabinet Office, Macrobond, OECD, Statistics Sweden, Statistics Canada, the World Bank, UK Office for National Statistics, US Bureau of Economic Analysis and the Riksbank

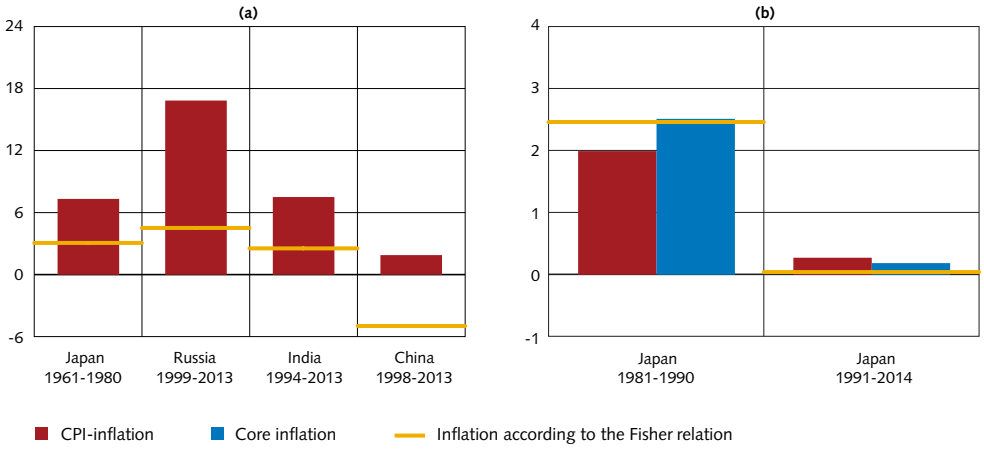
THE LONG RUN FISHER RELATION DOES NOT FIT THE DATA IN JAPAN IN THE 1960s AND 1970s – AND FOR GOOD REASONS

In Japan, the Fisher inflation was almost 1.5 percentage points lower than the observed inflation for the period 1961-2014, see Figure 7(a). On the other hand, for the shorter period, 1981-2014, the Fisher inflation was entirely in line with the observed inflation, measured by both the CPI and core inflation, see Figure 7(b).

In order for the long run Fisher relation to fit the data the economy needs to be in a steady state with no clear trends in the data. The Japanese economy grew rapidly following the end of the Second World War, with growth rates of about 10 per cent per year. These high growth rates lasted until the beginning of the 1970s, when the economy suffered from the effects of rising oil prices. Hence, the Japanese economy in the 1960s and 1970s was in a transitional phase, as it moved from relatively low GDP levels to levels in parity with those of the developed industrial countries. Consequently, we should not expect the long run Fisher relation to fit the data during this period.

Japanese growth rates in the 1960s and 1970s averaged 5.5 per cent and the nominal interest rate was just over 8.5 per cent, see Table 1. This means that the Fisher inflation was around 3 per cent. The CPI inflation was around 7.5 per cent during this period, see Figure 8(a). Hence, the Fisher inflation underestimated the CPI inflation by more than four per cent.

Figure 8. Inflation according to the Fisher relation and observed inflation in Japan, Russia, India and China
Per cent



Note. Core inflation is measured by CPI excluding food and energy.

Sources: Japanese Cabinet Office, Macrobond, OECD, Reserve Bank of India and the World Bank

We can observe a similar pattern, as in Japan's transition phase, in countries such as Russia, India and China, where the growth rates have been high in the last 15-20 years. In Russia and India, the growth rates have been just below five per cent and, in China, just over eight per cent, see Table 1. In other words, growth rates in parity with those during Japan's transition phase. However, it is not likely that these growth rates will be sustainable over the long run – those of Japan were not.

Figure 8(a) shows that the Fisher inflation in Russia, India and China was clearly below the observed inflation, just as the Fisher inflation was in Japan's transition phase. In line with the theory, this confirms that long run relations do not apply to transitional phases. In addition, and also in line with the theory, it is likely that the growth rate is a poor measure of the real interest rate in transitional phases with high growth rates.

A STATISTICAL TEST CONFIRMS THAT THE LONG RUN FISHER RELATION FITS THE DATA

By using simple "eyeball econometrics", we have shown that the Fisher inflation is in line with the observed inflation in Sweden and several other countries. This conclusion can be confirmed by a t-test with the null hypothesis that the Fisher inflation corresponds to the observed inflation in each country. The average difference between the Fisher inflation and the core inflation is –0.06, with a p-value of 0.73, while the difference between the Fisher inflation and the CPI inflation is –0.20, with a p-value of 0.28, see Table 2. For the longer period, 1961-2014, we have only 4 observations. In this case, the difference between the Fisher inflation and the CPI inflation is –0.34, with a p-value of 0.17, see Table 2.

Table 2. Matched t-test with the null hypothesis that the Fisher inflation equals the observed inflation

	MEAN VALUE	T-VALUE	STANDARD DEVIATION	DEGREES OF FREEDOM	P-VALUE
Δ^{KPI}	−0.34	−1.81	0.37	3	0.17
Δ^{KPI}	−0.20	−1.21	0.41	5	0.28
Δ^{Und}	−0.06	−0.36	0.37	5	0.73

Note. In the empirical test, $\Delta^{KPI} = \bar{\pi}^{F} - \bar{\pi}^{KPI}$ and $\Delta^{Und} = \bar{\pi}^{F} - \bar{\pi}^{Und}$ are calculated. A t-test is made of the Δ-series, which tests the null hypothesis that the three Δ-series comes from a normal distribution with mean zero. Row 1 refers to Figure 7(a), excluding Japan. Rows 2 and 3 refer to Figure 7(b).

DOES THE LOW POLICY RATE IN JAPAN EXPLAIN THE LOW INFLATION?

The financial markets in Japan witnessed widespread deregulation in the 1980s, which among other things led to a steep rise in stock and property prices. This came to an abrupt end at the beginning of the 1990s when both the stock and property prices fell in the wake of a financial crisis. Since then, Japan's central bank has held the policy rate at low levels, and at the same time the inflation has been close to zero or negative. This period, which began at the beginning of the 1990s and which, in all essentials, is continuing today, is known as Japan's "lost decades".

It may be of particular interest to apply the Fisher relation to Japan's lost decades, since they were characterised by both low policy rates and low inflation. In fact, we can show that the Fisher inflation is entirely in line with the observed inflation not only during the lost decades, but also in the preceding period.

In the pre-crisis period, 1981-1990, the average nominal interest rate was about six per cent and the growth rate almost four per cent, see Table 1. This implies that the Fisher inflation was just over two per cent, which was in line with the observed inflation, see Figure 8(b). During the lost decades, both the nominal interest rate and the growth rate fell to about one per cent. This implies a Fisher inflation around zero per cent, which was also the level of the observed inflation, see Figure 8(b).

Does this mean that the low inflation in Japan's lost decades was due to the low policy rate? Our results are consistent with such a conclusion, but we cannot rule out other explanations.[19] Nevertheless, it is worth noting that the average growth rate in Japan's lost decades was just below one per cent, which can be compared to 1.4 per cent in the US and 1.3 per cent in Canada. In other words, Japanese growth rates were about the same as those of the US and Canada – unlike its monetary policy. The nominal interest rate in Japan was about one per cent, while in the US it was 2.9 per cent and in Canada it was 3.5 per cent. Hence, the Fisher inflation was 1.5 per cent in the US and 2.2 per cent in Canada, which corresponds relatively well with the actual outcome of about two per cent in both countries. In Japan, as we have seen, the inflation was about zero per cent on average in the data and according to the Fisher relation.

19 Shirai (2012) discusses, for example, the role of demography in economic developments and shows, among other things, estimates of the output gap which indicate that it has been negative over almost the entire period since the mid-1990s. However, he also notes that there is, as of yet, no consensus over the factors that could explain such a development.

James Bullard on the effects of low nominal interest rates over a longer period

In a much-debated article from 2010, James Bullard, president of the Federal Reserve Bank of St. Louis, discussed the effects of low nominal interest rates over a longer period of time, see Bullard (2010). The purpose was to shed light on the risk that the US could be moving to a new steady state with deflationary tendencies like those in Japan. His analysis was based on insights from earlier work by Benhabib et al. (2001), in which the Fisher relation and the zero lower bound were key ingredients.[20]

Monetary policy is often described by a linear Taylor rule in standard macroeconomic models.[21] As a consequence, there exists no zero lower bound for the policy rate. Furthermore, there is only one steady state inflation rate, which coincides with the central bank's inflation target. However, if there exists a zero lower bound, there may be a second steady state, in which the policy rate is close to zero per cent and inflation is low or negative.

In Figure 9 we illustrate the two steady states. The solid line shows the Fisher relation, given a long run real interest rate of 0.5 per cent. The dashed line shows a non-linear Taylor rule, where the non-linearity is due to the zero lower bound. Hence, there are two points where the Fisher relation and the non-linear Taylor rule intersect, marking the two steady states. The blue area marks the steady state where the nominal interest rate is well above the zero lower bound and inflation is on target. This steady state is known as the "targeted" steady state. The other steady state, marked red, may appear when there is a lower zero bound. As mentioned, in this steady state, inflation may be low or even negative, which means that it will be below the central banks inflation target. This steady state is therefore known as the "unintended" steady state.

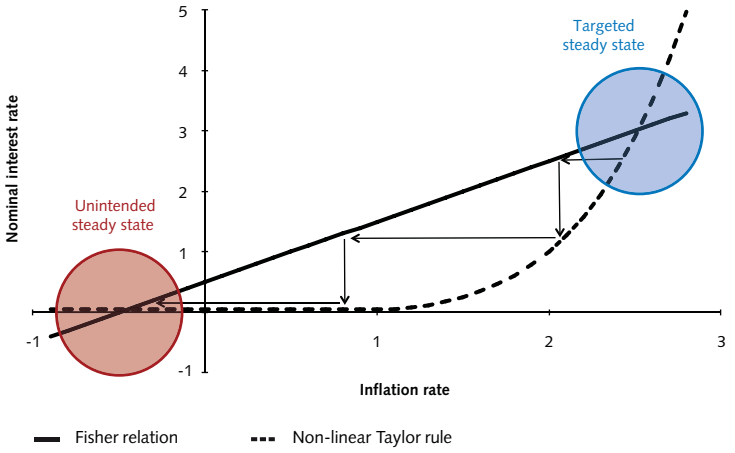
The arrows in the figure illustrate a possible transitional path from the targeted steady state to the unintended steady state. Note that monetary policy becomes passive once the economy gets stuck in the unintended steady state, since the policy rate will not react to changes in inflation. If inflation were to fall, the central bank would be unable to cut the policy rate due to the zero lower bound. If, on the other hand, inflation were to rise, the policy rate cannot be raised either, since inflation is far below the inflation target. Inflation expectations therefore remain at a level consistent with a nominal interest rate of zero per cent and a real interest rate of 0.5 per cent, i.e. a negative inflation rate of –0.5 per cent.

When the economy gets stuck in the unintended steady state, it can be difficult to escape from it, since standard monetary policy actions are ineffective. The central bank may in such a situation resort to unconventional measures. Bullard argues that quantitative easing (purchasing government bonds) is the measure that has the best chance of taking the economy back to the targeted steady state.

20 The level of the lower bound is not important to the analysis in this section. The important point is that there *de facto* exists a lower bound. For the sake of simplicity, this lower limit is assumed to be zero per cent.

21 The monetary policy rule in equation (6) is an example of this.

Figure 9. The two steady states for the nominal interest rate and inflation when monetary policy is constrained by the zero lower bound
Per cent



Source: Own illustration

JAPAN APPEARS TO HAVE GOT STUCK IN THE UNINTENDED STEADY STATE

Japan has been characterised by low nominal interest rates and inflation since the outbreak of the financial crisis in the beginning of the 1990s. Does this suggest that Japan has got stuck in the unintended steady state? To investigate this, we look at the movements of the nominal interest rate and inflation before and after the crisis.

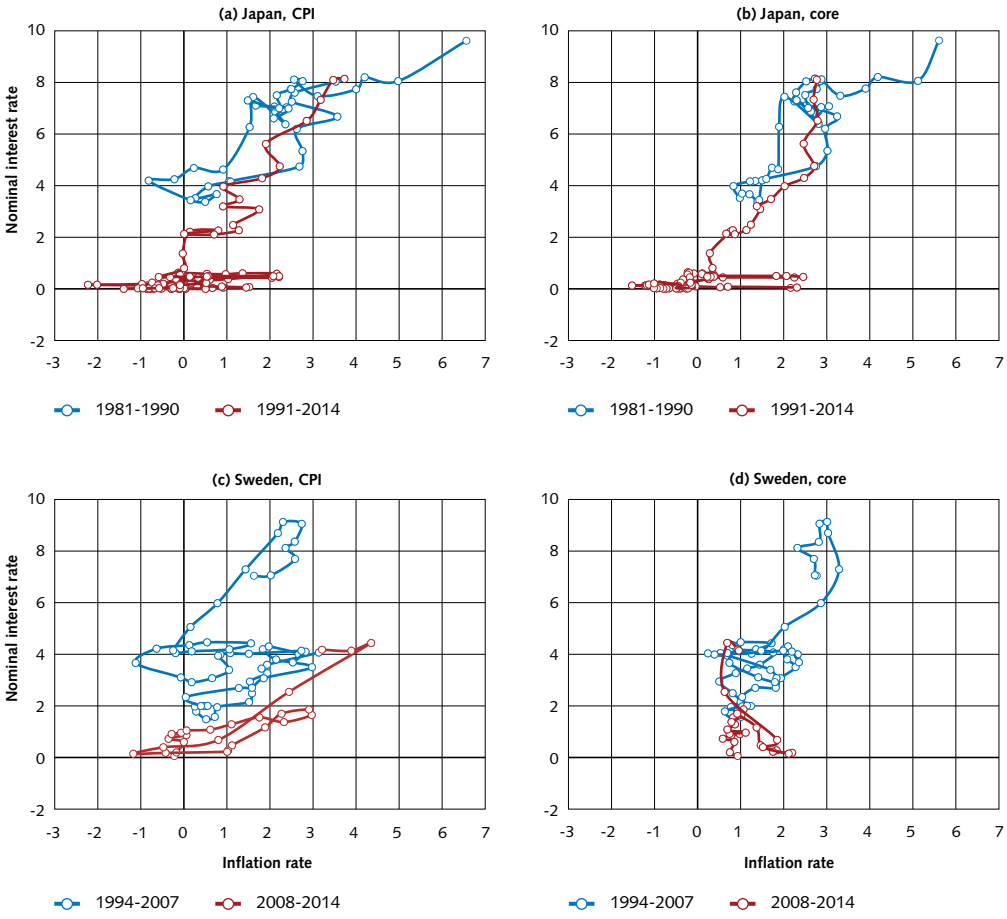
The nominal interest rate in the pre-crisis period appears to have varied around a long run level of 6-8 per cent and inflation around a level of 2-3 per cent, see the blue outcomes in Figures 10(a) and 10(b). Outcomes in the post-crisis period are marked red. The nominal interest rate appears to fluctuate around zero per cent. The inflation rate has varied, but most of the observations are still around zero per cent. This indicates that Japan may have moved from the targeted steady state to the unintended steady state.[22]

SEVEN YEARS OF DATA IS NOT ENOUGH TO DETERMINE WHETHER SWEDEN AND OTHER COUNTRIES HAVE MOVED TO THE UNINTENDED STEADY STATE

Sweden and several other countries have since the outbreak of the financial crisis in 2008 had nominal interest rates close to zero and low inflation. Does this suggest that these countries are about to move to the unintended steady state? Seven years of data is not enough to determine this, but it may be enough to distinguish certain tendencies.

22 This is also confirmed by Aruoba et al. (2014).

Figure 10. Nominal interest rates and inflation in Japan and Sweden
Per cent



Note. The nominal interest rates are measured by three-month treasury bills. Core inflation is measured by CPI excluding food and energy in Japan and by CPIF excluding food and energy in Sweden.

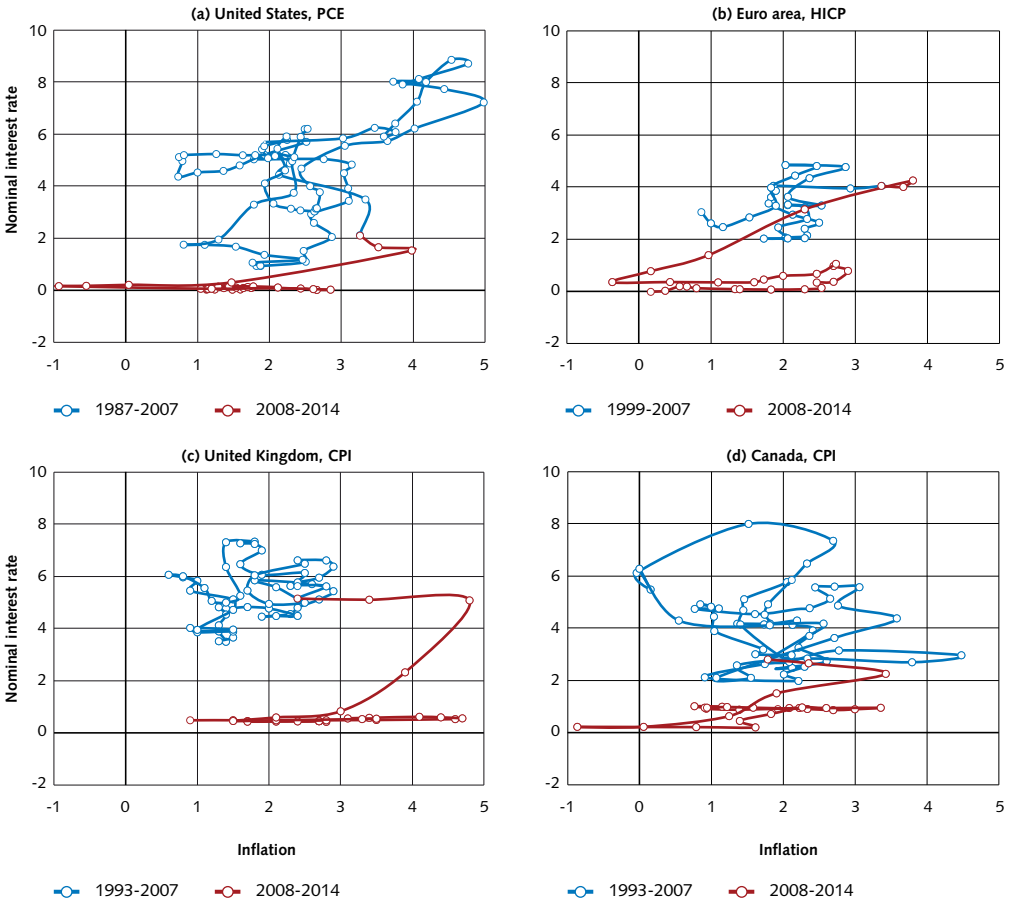
Sources: Macrobond, OECD, Statistics Sweden and the Riksbank

Figures 10(c) and 10(d) show the nominal interest rate and inflation in Sweden between the years 1994 and 2014. In the pre-crisis period the nominal interest rate varied around 3-4 per cent and inflation around 1-2 per cent. After the outbreak of the crisis, the nominal interest rate has been falling to around zero per cent, although it is not possible to distinguish a new steady state. This is the case regardless of whether we look at CPI inflation or core inflation.

In the US, the steady state prior to the financial crisis appears to have been about 4 per cent for the nominal interest rate and about 2 per cent for inflation, see Figure 11(a). In the post-crisis period, the nominal interest rate has been about zero per cent, but inflation has varied a good deal and most of the observations fluctuate around 1-2 per cent.

In the euro area inflation has been fluctuating extensively in the post-crisis period. At lowest, it was –0.3 per cent and, at highest, 3 per cent, see Figure 11(b). We note that the most recent observations indicate that inflation is approaching deflation territory. But it is hard to distinguish a new steady state on the basis of this, even if the euro area appears to have left the steady state it was in prior to the crisis. Neither do the developments in the UK and Canada in the post-crisis period indicate that these countries have been falling into the unintended steady state, see Figures 11(c) and 11(d). However, like the euro area, the UK appears to have left the steady state it was in before the financial crisis.

Figure 11. Nominal interest rates and inflation in the US, the euro area, the UK and Canada
Per cent



Note. The nominal interest rates are measured by three-month treasury bills, except in the euro area where the nominal interest rate is measured by EONIA.

Sources: ECB, Eurostat, Macrobond, OECD and the US Bureau of Economic Analysis

Concluding remarks

One of the objectives of this article has been to explore Narayana Kocherlakota's claim that a low policy rate over the long run can lead to low inflation. The idea relies on long run monetary policy neutrality and the long run Fisher relation. Under these assumptions, it follows that a long-lived cut in the policy rate leads to a proportional fall in inflation.

However, even if economic theory predicts low inflation if the policy rate is held at a low level over a longer period, this does not necessarily imply that this also will be the case in reality. Economic theories are based on various simplified assumptions and are therefore, by definition, inaccurate in one way or another. It is therefore important to empirically test to which extent the economic theory is consistent with data. We have shown that, if the real interest rate is equated to the GDP growth rate per capita, the average inflation in Sweden and other countries can be explained by the difference between the average nominal interest rate and the growth rate. We find this interesting, since it indicates that, in several countries, the long run Fisher relation is consistent with the data. In addition, it provides empirical support to Kocherlakota's claim.

Several scientific articles have recently been published where the Fisher relation is one of the key factors behind the results. Schmitt-Grohé and Uribe (2013) is one example. They present a scenario which is intended to resemble the experiences of the US following the outbreak of the financial crisis in 2008, i.e. a long period of nominal interest rates close to zero, inflation expectations below the inflation target and slow employment growth. The Fisher relation plays a key role in how households and firms interpret changes in the policy rate in their model. A policy rate increase is a signal of higher future inflation. One of their conclusions is that an increase in the policy rate pushes up inflation expectations and promotes employment.

Another example is Leeper and Leith (2015). They present a model in which the fiscal theory of the price level and the Fisher relation are two key features in determining inflation.[23] The fiscal theory of the price level is relevant when expansions in nominal debt are not expected to be funded by higher taxes or lower expenditure, i.e. when households and firms do not expect fiscal policy expansions to be funded by a future surplus. When this is the case, raising the policy rate raises the nominal interest rate receipts of the bond holders (i.e. the households). Since they do not expect higher future taxes to finance the increased expenditures their nominal wealth also increase. The increase of wealth pushes up consumption and demand, which eventually also pushes up inflation.

23 See also Leeper and Yun (2006) for a description of the fiscal theory of the price level.

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Macroprudential policy – effects on the economy and the interaction with monetary policy

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Macroprudential policy is a new policy area used to counteract the emergence of financial imbalances, and contribute to the stability of the financial system. In this paper we discuss the extent to which monetary policy should take explicit account of financial imbalances once macroprudential policy is actually in place. However, macroprudential policy can also affect both resource utilisation and inflation – a factor that monetary policy may need to take into consideration. We also provide an overview of the rapidly growing scientific literature on the effects produced by various macroprudential tools. One conclusion we draw is that heightened capital requirements primarily bolster the resilience of the banks. In order to reduce household indebtedness, tools that directly target households are more effective, such as the mortgage cap and tax relief on mortgage interest. A conclusion from several studies is also that macroprudential tools, in particular tools directly targeting specific sectors, are more efficient than monetary policy in counteracting financial imbalances.

Macroprudential policy is a new policy area that has emerged in the wake of the financial crisis. It is the policy area with primary responsibility for counteracting the emergence of financial imbalances, and contributing to the stability of the financial system. Put simply, macroprudential policy has two primary tasks. First, it must strengthen the resilience of the financial system, such as through measures that ensure that banks have sufficient capital to absorb credit losses. Second, it must counteract financial imbalances, which in practice is about preventing credit and debt from rising too rapidly.

Risks in the financial system are usually divided into cyclical and structural risks. This is also a common way of dividing up the various tools of macroprudential policy.[1] The cyclical tools are intended to change over time, and according to the financial imbalances that may arise. The countercyclical buffer is an example of such a tool. When household and corporate lending of the banks rises rapidly, the buffer requirement is increased. When the banks then exercise more restraint in their lending, it can be reduced. The structural tools, on the other hand, are intended to be implemented "once and for all" to create sound,

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1 See, for example, Nordh Berntsson and Molin (2012).

long-term conditions for a stable financial situation. In practice, however, it is not easy to make a clear distinction between these tools. A certain tool may, under some conditions, be used to counteract both cyclical and structural risks.[2] In this paper we focus primarily on the cyclical tools, because it is primarily those which interact with monetary policy.

From the point of view of a central bank, an important matter is the extent to which monetary policy should take explicit account of financial imbalances once macroprudential policy is actually in place. However, the various macroprudential tools also have effects on other parts of the economy. For example, resource utilisation and inflation can be affected by the various tools, which monetary policy may need to take into consideration.

The paper consists of three sections. The first section contains a discussion of principle and the definition of different types of macroprudential tools. The tools are divided into those that affect credit supply (i.e. tools directed towards banks), and those that affect credit demand (i.e. tools directed towards households and corporations). In the second section, we discuss a selection of empirical studies that shed light on the effects of various macroprudential tools on debt and house prices. In the third and final section, we address the interaction between monetary and macroprudential policies. We discuss, for example, the cost in terms of lower GDP in the short term that arises when various tools are used to reduce financial imbalances. These findings are mainly theoretical and based on simulations in different macro models. At the end of the paper a glossary of the terms used is provided.

Macroprudential tools can target credit supply or demand

Macroprudential tools can be used to influence either the supply of or demand for credit. Tools targeting supply have the primary purpose of bolstering the banks' resilience against credit losses, and thus strengthening financial stability. If they also curb excessive credit growth, this can be seen as a positive side effect. Tools targeting demand have the primary purpose of bolstering the resilience of households by reducing credit growth.

MACROPRUDENTIAL TOOLS THAT AFFECT CREDIT SUPPLY

Capital requirements form a common macroprudential tool used to influence the banks' equity and supply of credit. The purpose of capital requirements is to enhance the resilience of the financial system. The banks' capital forms a buffer against unexpected losses and can thus reduce the risk of a banking crisis. In addition, the risks that the banks need to use state guarantees and capital injections are reduced if they have a large share of equity.

Following the financial crisis, a new set of international regulations for banks was prepared, Basel III, which sets out how much capital the banks must hold.[3] To start with,

2 Tools that do not change over time can also help curb lending cycles. Blanchard (2015) finds that a suitable distinction between financial regulation and macroprudential policy is that the macroprudential tools are intended to vary over time, while financial rules are intended to be permanent. With this approach, macroprudential policy is limited to consisting of tools that are to counteract cyclical risks in the financial system, while tools to counteract structural risks come under financial regulation.

3 See BIS (2011).

there is a minimum requirement, but in addition there are also several different "buffer requirements".[4] Then, on top of those requirements there is a "specific own funds requirement" which is the overall assessment of the supervisory authority of an appropriate capital requirement level for each individual bank. In other words, the regulations are relatively complex, yet we can still in a comprehensive way describe how the capital requirements are intended to function. A simplified balance sheet of a bank could be as follows:

$$B^H + B^F = D + A \tag{1}$$

where B^H denotes household lending and B^F corporate lending. The sum of B^H and B^F is the bank's total assets. The bank's total liabilities consist partly of deposits received by the bank from the general public, D, and partly of equity, A. Using this balance sheet, we can then define the bank's capital ratio K^{ω}, i.e. the bank's equity in relation to its risk-weighted lending,as

$$\mathrm{K}^{\omega} = \frac{A}{\omega_H B^H + \omega_F B^F}, \tag{2}$$

where ω_H is the risk weight on loans to households and ω_F the risk weight on loans to corporations. By dividing the bank's equity (A) by risk-weighted loans to households ($\omega_H B^H$) and risk-weighted loans to corporations ($\omega_F B^F$) we obtain a value for the bank's capital ratio.

The capital requirement functions such that a minimum level for the capital ratio is set. The purpose of the risk weights is for the capital requirement to be affected by the extent of risk assumed by the bank. If the bank takes greater risks, it must hold more equity. This renders capital allocation in the economy more efficient.

The risk weights can be determined in different ways. Since the Basel II Accord came into effect in 2007, Swedish banks have been permitted to use internal models for calculating the weights that reflect the risk in their lending. In that process, the banks sharply reduced their risk weights for mortgages. In order to prevent the banks from setting risk weights that are far too low, Finansinspektionen thus introduced a risk weight floor for mortgages in May 2013.[5]

When the Basel III regulations are fully implemented, another macroprudential tool will be introduced to complement the risk-weighted capital requirement – the *leverage ratio requirement.* The leverage ratio is a bank's equity in relation to its total lending. It is defined as

4 The capital conservation buffer, the countercyclical capital buffer, the systemic risk buffer, the capital buffer for global systemically important institutions and the capital buffer for other systemically important institutions, see SOU 2013:65 (chapters 3 and 4) for a more detailed description of the terms.

5 The capital requirement for the Swedish banks is currently 12 per cent. However, various buffer requirements, the risk weight floor for mortgages and specific capital requirements for individual banks render the requirement higher in practice, see Sveriges Riksbank (2014a).

$$\mathrm{K} = \frac{A}{B^H + B^F}, \tag{3}$$

where K denotes the leverage ratio. A leverage ratio requirement sets a minimum level for the bank's equity in relation to its total lending. Unlike the risk-based capital requirement, the leverage ratio requirement is thus not affected by the extent of risk presented by the various assets.

High capital requirements thus increase the resilience of the financial system to shocks, which reduces the risk of a financial crisis. However, equity funding is usually more expensive for the banks than debt funding. If the banks must raise funding with more equity, their funding costs therefore increase. This might entail higher lending rates for customers, resulting in lower lending and lower GDP. However, if the households and the firms have excessive debt, borrowing less might be a positive side effect.

MACROPRUDENTIAL TOOLS TARGETING CREDIT DEMAND

When house prices rise quickly in combination with rapidly escalating household indebtedness, this usually requires the introduction of some sort of limit on borrowing. The most common types of limitation on borrowing are the *mortgage cap*, which limits the size of the loan in relation to the value of the home, the *loan-to-income cap*, which limits the size of the loan in relation to the household's disposable income, and the *debt-service-to-income cap* which limits the size of interest payments and loan amortisation in relation to the household's disposable income.[6, 7] The loan-to-income cap and the debt-service-to-income cap are, in other words, based on the household's income, while the mortgage cap is based on how much the home is worth. A common feature of this type of macroprudential tool is that they make it more difficult or more expensive for households to take on debt. Hence, they help curb household indebtedness, thus bolstering their resilience.

The essential differences between these tools can be illustrated based on a simplified budget restriction for a household.[8] Assume that the household lives in two periods. In the first period the household consumes c_1 goods and in the second period it consumes c_2 goods. The household also consumes housing services, which correspond to the house h in this context. In the second period, the household releases its equity in the home to finance its consumption.[9] The budget restriction of the household can thus be described as

6 The mortgage cap is also called the LTV cap (loan-to-value-cap), and the loan-to-income cap is abbreviated as the LTI cap and the debt-service-to-income cap as the DSTI cap. Amortisation requirements are another possible measure to reduce household indebtedness, see e.g. Sveriges Riksbank (2014b).

7 The risk of credit losses among the banks can also decrease if household resilience is strengthened. The mortgage cap can reduce the banks' loss in the event of the borrower defaulting, while the loan-to-income and the debt-service-to-income caps can reduce the probability that households fail to honour their commitments.

8 This description is based on Kuttner and Shim (2013).

9 The first period equals the first part of the life cycle, and the second period the latter part of life.

$$c_1 + p_1 h + \frac{1}{1+r} c_2 = \frac{p_2 h}{1+r} + y_1 + \frac{y_2}{1+r}, \tag{4}$$

where p_1 is the house price in the first period, p_2 the house price in the second period, r the interest rate, y_1 the income in the first period and y_2 the income in the second period.[10] The household's borrowings in the first period, B^H, are the difference between the consumption of goods and housing services and income in the first period, i.e.

$$B^H = c_1 + p_1 h - y_1. \tag{5}$$

Because of the mortgage cap, it is more difficult for the household to borrow using the home as collateral. In Sweden Finansinspektionen introduced a mortgage cap in October 2010 in the form of general guidelines setting out that a mortgage may not exceed 85 per cent of the market value of the home. The following expression defines the household's mortgage cap, θ,

$$\frac{B^H}{p_1 h} \leq \theta. \tag{6}$$

If the restriction is binding, a tightening – i.e. a reduction – of the mortgage cap means that the household will have less money to spend on housing and consumption in the first period. In general, the household reduces its consumption of both goods and housing services, but the extent thereof depends on its inclination to substitute these utilities with each other.

A feature of the mortgage cap is that it becomes less binding when house prices, p_1, rise, because the ratio between household borrowing and house value, $B^H/p_1 h$, then falls. Rising house prices can therefore fuel a credit boom. Rising house prices can also neutralise the effects of reducing the mortgage cap if the supervisory authority wishes to curb a credit boom.

A loan-to-income cap puts a limit on how much a household can borrow in relation to its income. Banks require, when they perform a credit assessment of a household, that the household has sufficient income to honour its obligations. However, there is no formal cap in Sweden that limits borrowings in relation to income, as there is in other countries. The household's loan-to-income cap, ϑ, can be written as follows

$$\frac{B^H}{y_1} \leq \vartheta. \tag{7}$$

Just as in the case of a reduced mortgage cap, the household must cut back on its consumption of goods and housing services if ϑ is reduced and the restriction is binding. How and to what extent depend, as in the previous case, on the household's preferences.

10 The consumption good is the numeraire, i.e. income and house prices are expressed in terms of the consumption good.

In practice, the loan-to-income cap prevents low-income households from taking on excessive loans. The difference compared with a mortgage cap is thus that, with a loan-to-income cap, income is the binding restriction, and not the capital investment.

The debt-service-to-income cap is a way of limiting how much households may borrow based on their repayment ability. In other words, it is the ability of the household to pay interest and amortisation that limits the extent of the loan it may take out. A debt-service-to-income cap, φ, for the household may be defined as follows

$$\frac{rB^H}{y_1} \leq \varphi. \tag{8}$$

In this instance too the household must cut back on consumption of goods and housing services if the debt-service-to-income cap is reduced and the restriction is binding. A binding debt-service-to-income cap illustrates an important link between interest and credit growth, since an interest rate cut brings about reduced interest expenditure and the restriction thus becomes less binding. An interest rate cut can thus have a greater effect on credit when the restriction is binding than when it is not.

The effects of macroprudential tools in empirical studies

In recent years, a great number of papers have been published that study the effects of various macroprudential tools on financial imbalances. In this section, we highlight some papers which in our view reflect the current picture of this new area of research.

Because the studies differ in terms of analytical method, choice of countries, credit measures and tools that are studied, the comparisons are of a fairly general nature.

Kuttner and Shim (2013) is a much-quoted study of the effects on mortgages and house prices of a great number of economic policy measures in 57 countries during the years 1980-2011. The most common tools according to this study are reserve requirements (whereby the bank must hold part of deposits as reserves in an account at the central bank), mortgage caps and housing-related taxes and tax relief. The most common combination of tools in these countries is the mortgage cap and the debt-service-to-income cap. Around 55 per cent of the tools studied have been of a tightening nature. It is also indicated that tools such as risk weights, provisioning requirements, mortgage caps and debt-service-to-income caps did not start to be used to any great extent until 2005.

We start by describing some studies in which the macroprudential tools are directed at the supply side of the credit market.

HIGHER CAPITAL REQUIREMENTS WOULD NOT HAVE SUFFICED TO CURB LENDING TO A SUFFICIENT EXTENT AHEAD OF THE FINANCIAL CRISIS IN THE UK AND SPAIN

Several empirical studies of microdata, primarily from the UK, have studied how individual banks are affected by changes to capital requirements. These studies calculate first of all

how the banks' capital ratio changes, and then how that, in turn, affects lending volumes and lending rates.

Francis and Osborne (2009, 2012) use microdata from UK banks to calculate how changes in the capital requirements affected these banks during the period 1996-2007. They study how the banks' targeted capital ratio is affected by changes to capital requirements, and how the banks adapt their balance sheet to achieve a new capital ratio. Changes to capital requirements have a major impact on the banks' capital ratio, but also on their lending. Nevertheless, the authors conclude that if the capital requirements had been increased during the years preceding the financial crisis, this would not have had a sufficiently large effect on lending to prevent the rapid credit expansion.[11]

Aiyar et al. (2012) also find that the lending of UK banks is affected to a relatively great extent by changed capital requirements. However, they also observe that lending increases among banks not covered by the capital regulations, and hence that there is an element of "leakage". Their findings suggest that around a third of the effects on the banks' lending covered by the regulations are offset by the banks not covered by the regulations lending more.

Drehmann and Gambacorta (2012) study how the lending of Spanish banks would have been affected during the period 1986-2007 if a countercyclical capital buffer had been introduced at the time.[12] They find that credit supply during that period would have been around 18 per cent lower. The conclusion is that the effects on lending of the capital buffer might be relatively large, but that they are nevertheless small compared with the sharp credit growth that occurred in the Spanish economy ahead of the financial crisis. So, it is very likely that the countercyclical capital buffer would not have been able to significantly curb credit growth in Spain. In summary, these studies show that banks adapt their capital ratio to a relatively great extent when the capital requirements are changed. The banks reduce lending a great deal, but not sufficiently to be able to slow down a financial cycle in the upturn phase.

CAPITAL REQUIREMENTS AFFECT TOTAL LENDING, BUT DO NOT HAVE ANY CLEAR EFFECTS ON MORTGAGES

IMF (2012) is an empirical study that calculates which effects time-varying capital requirements and other macroprudential tools may have on various financial and real variables. The paper estimates the effects on credit, house prices and GDP of various tools in 36 countries during the period 2000-2011. The study also attempts to take account of the fact that the tools might have asymmetrical effects, i.e. that their strength may vary depending on whether it is a matter of easing or tightening. Capital requirements prove to have significant effects on both credit and house prices, but no substantial effects on GDP growth. According to this study, a capital requirement have greater effects on credit during

11 For further empirical studies of how UK banks reacted to changed capital requirements, see e.g. Bridges et al. (2014) and Noss and Toffano (2014).

12 See e.g. Juks and Melander (2012) for a description of the countercyclical capital buffer.

financial crises (when the credit volumes are declining), but the effects seem to be equally strong whether the requirement is tightened or relaxed (symmetric effects).

Unlike the IMF study, Kuttner and Shim (2013) do not focus on total credit, but on household mortgages. Tools studied include limitations on exposures to the housing sector, risk weights for mortgages and provisioning requirements that are intended to affect the banks' equity and supply of housing loans.[13] They also study the effects of quantitative limitations on credit growth (such as a limit on how much the banks may increase their lending by month or quarter), reserve requirements and liquidity requirements (whereby the bank must hold part of deposits in liquid funds, such as treasury bills). They find that, out of these different tools, only limitations on the extent to which banks may be exposed to the housing sector have significant effects on mortgages.[14] None of these tools have an effect on house prices.

Akinci and Olmstead-Rumsey (2015) update the databases used by IMF (2012) and Kuttner and Shim (2013), but limit themselves to developments since 2000. Hence, their database comprises macroprudential tools in 57 countries for the period 2000-2013. They study, for example, which effects countercyclical capital requirements, provisioning requirements, restrictions on growth in bank credits and stricter requirements for consumer loans have on total bank credits, mortgages and house prices. They find that provisioning requirements and countercyclical capital requirements have significant effects on total bank credits, but not on mortgages. They also find that capital requirements have significant effects on house prices, but provisioning requirements, however, do not. Although some of these macroprudential tools may have effects on total credit growth, these studies suggest that other tools are required to substantially affect household mortgages. In the next section, we describe some studies in which macroprudential tools target household demand for credit.

MORTGAGE CAPS HAVE EFFECTS ON MORTGAGES, AND MOST LIKELY ALSO ON HOUSE PRICES

IMF (2012) also studies the effects of various macroprudential tools geared to households' credit demand. According to the study, the mortgage cap and the loan-to-income cap have little effect on credit growth when they are estimated for all countries.[15] The mortgage cap has significant effects on both house prices and GDP growth, which is not the case for the loan-to-income cap.

Kuttner and Shim (2013) is another study that analyse the effects of macroprudential tools targeting credit demand. They also look at the effects of housing-related taxes and tax relief on mortgage interest. According to one empirical method, the mortgage

13 Provisioning can take place in the form of the banks setting aside parts of their profit in boom times to have better resilience to credit losses in times of crisis.

14 Examples of exposure limitations are how high a share of the banks' lending may be to a certain sector, such as the housing sector. Kuttner and Shim (2013) point out however that the number of registered events in terms of exposure limitations are few in the data material.

15 However, in developing countries these effects are significant.

cap, debt-service-to-income cap and housing-related taxes have significant effects on mortgages, but according to other methods it is only the debt-service-to-income cap that has significant effects on mortgages. Housing-related taxes are the only measures that have any effect on house prices.

McDonald (2015) employs methods and data similar to those of Kuttner and Shim (2013) to study effects from macroprudential tools on growth in mortgages and house prices. However, he limits the analysis to effects of mortgage caps and loan-to-income caps in the 17 countries that were the most active users of these tools between 1990 and 2013. During this period the mortgage cap was cut 54 times and increased 21 times in those countries, while the loan-to-income cap was reduced 20 times and increased 5 times.

McDonald finds that both the loan-to-income cap and the mortgage cap have significant tightening effects on how quickly mortgages rise, and that the tightening effect is greater in countries where house prices are high compared with household income.[16] Also, mortgage caps have had a relatively greater effect on credit growth than loan-to-income caps. When mortgage caps are reduced, this also slows down the rate of increase of house prices.

Akinci and Olmstead-Rumsey (2015) also find that stricter mortgage caps and loan-to-income caps can keep a lid on growth in total bank credit, mortgages and house prices. The authors also draw the conclusion that the use of macroprudential tools gives economically significant results. A counterfactual analysis shows that house prices would have increased at twice the rate in 2011-2013 in the countries that used a macroprudential tool during those years, while growth in mortgages would have been one and a half times higher.

Krznar and Morsink (2014) study the effectiveness of macroprudential tools in Canada. Besides the mortgage cap and amortisation requirements, the terms of mortgage insurance contracts have varied over time, thus affecting credit growth in different ways. Until 2008, the mortgage insurance rules were made more generous, which spurred credit growth. From 2008, credit terms have been tightened instead. Mortgage caps have been lowered, amortisation requirements have been tightened and the mortgage insurance rules have become stricter. Krznar and Morsink find that the combined tools during 2010–2012 had significantly tightening effects on credit growth (and house prices according to a separate analysis). They also describe estimates of which effects the specific mortgage cap and amortisation requirement tools have had. Their findings suggest that mortgage caps for new loans and for refinanced loans have had significantly dampening effects on mortgage growth, while amortisation requirements have not had significant effects when mortgage caps are also included in the estimation. A reduction in the mortgage cap by one percentage point reduces mortgage growth by 0.25-0.5 percentage points. They also do a counterfactual analysis, finding that without the macroprudential tools used since 2008, the loan-to-income ratio at the end of 2013 would have been 170 instead of 165 per cent.

16 According to McDonald, this might explain differences between countries in terms of effects of macroprudential tools. As an example, it is mentioned that mortgage caps may have had a greater effect in countries such as Hong Kong, China and Singapore compared to countries like Norway, which has much lower house prices in relation to household income.

Krznar and Morsink also discuss international experience from using macroprudential tools to attempt to limit growth in house prices and mortgages. They observe that the mortgage cap is the most used tool. It is also noteworthy that the majority of countries that have introduced mortgage caps have varied them over time and lowered (i.e. tightened) the requirements when the growth rate of house prices is high, and increased (i.e. eased) the requirements when house prices decline. They also observe that the mortgage cap have often been used in combination with the loan-to-income cap.[17]

Based on the Riksbank's previously published analyses, Guibourg and Lagerwall (2015) estimate the macroeconomic effects of a number of tools aimed at limiting household indebtedness. Gains appear to arise through lower indebtedness – and hence reduced risks in the longer term – while costs arise in the short term with lower consumption and GDP growth. They determine that tools that only affect new borrowers in most cases have limited effects on both indebtedness and the macroeconomy in general. Adjusting tax relief on mortgage interest is however a potentially more powerful tool because it affects all borrowers and the effects on both indebtedness and the macroeconomy would thus be greater. The effects of the various tools on the macroeconomy also depend on how much house prices are affected.

MORTGAGE CAPS AND INCOME-BASED LOAN CAPS ARE EFFECTIVE IN REDUCING MORTGAGES

One conclusion from the review of the literature is that capital requirements should typically be used when there is a desire to bolster bank balance sheets, while mortgage caps, loan-to-income caps and debt-service-to-income caps should primarily be used when there is a desire to curb rising house prices and the progression of household debt. We also note that there is great uncertainty in terms of which effects the various macroprudential tools produce. There are several reasons for this. The tools have not been in use for very long, so the evaluation period is short. Also, several tools have been used simultaneously, making it difficult to separate the effects of the different tools. Yet, we can nevertheless draw certain conclusions. It seems that capital requirements can affect the banks' capital ratio and limit total lending, but not sufficiently to be able to curb overly rapid credit growth. Several studies show that both mortgage caps and income-based loan caps can be effective in preventing mortgages from rising too quickly. It is therefore not surprising that it is the mortgage cap and the income-based loan cap that seem to be those most used that seem to be those most used, and often in combination with each other. Housing-related taxes such as property tax or tax relief on mortgage interest also have effects on mortgages. Housing-related taxes and mortgage caps also appear to have significant effects on house prices. However, the effects of the other tools on house prices are not clear-cut.

17 As mentioned previously, one reason for this is that mortgage caps can create procyclical dynamics in which sharp upturns and downturns in house prices can create considerable variations in how much households may borrow.

These conclusions are in line with the literature review in Claessens (2014).[18] Claessens emphasises, however, that most empirical studies only study the effect of using one tool at a time, and seldom with varying intensity or length of time. Often, only the effects on lending or house prices are evaluated, and not whether systemic risks decline. On the whole, he nevertheless finds that mortgage caps and loan-to-income caps can probably limit the risk of rising house prices leading to surging borrowing, which in turn fuels house prices in a "feedback loop". They can hence help reduce systemic risks in the economy.

Interaction between macroprudential and monetary policies

Monetary policy works by means of, for instance, influencing the volume of credit in the economy. There may thus be a reason for the central bank to attempt to counteract the emergence of financial imbalances, because they can ultimately affect inflation and resource utilisation. However, a well-functioning macroprudential policy should reduce the need to employ monetary policy in such situations, because the various macroprudential tools are normally more effective in managing financial imbalances than monetary policy. Various macroprudential tools also affect lending in the economy, and can therefore affect resource utilisation. High resource utilization leading to overheating of the economy may threaten financial stability. The supervisory authority may therefore wish to work towards resource utilisation not being too high. In terms of both objectives and means the two policy areas are thus interlinked.

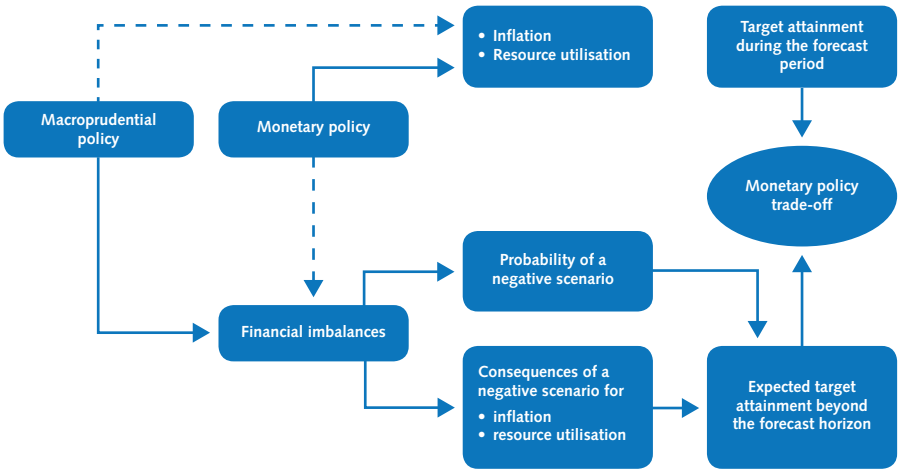
A CONCEPTUAL FRAMEWORK FOR THE INTERACTION BETWEEN MACROPRUDENTIAL AND MONETARY POLICIES

Sveriges Riksbank (2014c) presents a conceptual framework showing how monetary policy may take account of financial imbalances. In Chart 1 we extend that framework by including also macroprudential policy.

Macroprudential policy is aimed at counteracting the emergence of financial imbalances and limiting the risk of financial crises, as illustrated in the lower area of the diagram. The trade-off for monetary policy is illustrated in the upper area. Price stability is the fundamental objective of monetary policy. In practice, however, most central banks conduct "flexible inflation targeting", meaning that they set the policy rate such that they can achieve a good target attainment for inflation and resource utilisation in two to three years. Consideration for financial imbalances in monetary policy decisions is illustrated in the lower area of the diagram. The policy rate can affect financial imbalances. Hence, monetary policy can affect the probability of a negative scenario, in which increasing financial imbalances lead up to a financial crisis, but also the consequences if the negative scenario do occur.

18 See also Galati and Moessner (2014) for a review of literature regarding the effects of various macroprudential tools.

Chart 1. Schematic outline of the interaction between macroprudential and monetary policies



A discussion is under way regarding whether macroprudential policy could counteract financial imbalances without the support of monetary policy.[19] This is an important issue, but thus far there is too little practical experience to be able to draw any sure conclusions. However, whether this is the case or not, it is likely that macroprudential tools affect resource utilisation and inflation – a factor that monetary policy may need to take into account.

MACROPRUDENTIAL POLICY IS MORE EFFICIENT THAN MONETARY POLICY IN COUNTERACTING SECTOR-SPECIFIC FINANCIAL IMBALANCES

Alpanda et al. (2014) study the interaction between macroprudential and monetary policies in a "dynamic general equilibrium model" with a relatively comprehensive financial sector. They can thus study the effects of several different macroprudential tools, such as capital requirements, mortgage caps and risk weights for both households and corporations. The model also contains a foreign sector, so exchange rate effects can be taken into account.

Using the model, the authors study the extent to which capital requirements and mortgage caps are more efficient than monetary policy in reducing household debt. In order to decrease household debt by around 8 per cent, GDP declines by around 0.7 per cent if the mortgage cap is used, and by around 2 per cent if the capital requirement is used. If instead monetary policy is used, the drop in GDP is around 7 per cent. The cost of using monetary policy compared to the mortgage cap is thus, according to that analysis, ten times greater. This is because the mortgage cap directly targets the household sector, and therefore takes the greatest effect there. The capital requirement works on a slightly broader front than the mortgage cap and is therefore a little less effective, while monetary policy works on the broadest front.

19 See e.g. Smets (2013). In the Swedish debate, it is also expressed that macroprudential policy needs the support of fiscal policy (tax relief on mortgage interest, property tax, etc.).

Alpanda and Zubairy (2014) complement Alpanda et al. (2014) in that they also include fiscal policy tools such as property tax and tax relief on mortgage interest in the analysis. A difference from Alpanda et al. (2014) is also that the model is simpler. For example, it does not have an explicit banking sector or foreign sector. On the other hand, it has a relatively detailed model of the mortgage market. The restriction on borrowing is more realistic and pertains only to new loans, unlike many other models, in which the restriction applies to the entire stock, meaning that amortisation and housing equity withdrawal can also be studied.

Tightening monetary policy by one percentage point reduces household borrowing from the banks by around 0.2 per cent in the model of Alpanda and Zubairy. However, the effect on GDP is greater, meaning that the households will get a greater debt in relation to GDP, i.e. the debt ratio increases. Alpanda and Zubairy then compare how efficiently monetary policy can be used to reduce household indebtedness with three other tools: mortgage cap, property tax and tax relief on mortgage interest. All of these tools reduce indebtedness more efficiently than monetary policy. It is most efficient to reduce tax relief on mortgage interest, followed by the mortgage cap and property tax. While reduced tax relief on mortgage interest is indeed a somewhat broader tool than the mortgage cap, and therefore potentially more costly in terms of reduced production, it is ultimately nevertheless more effective to reduce the tax relief on mortgage interest because that also reduces the incentive of households to mortgage their homes.

Boivin et al. (2010) is another paper that studies whether monetary policy should be used to counteract financial imbalances. In the first part of the paper, they study the effects of a time-varying mortgage cap in a model that resembles that in Walentin (2014). The basis is a shock that pushes up both house prices and the credit gap, measured as the deviation from trend of the mortgages. If monetary policy attempts to curb the upswing in the credit gap by increasing the policy rate, this leads to considerable volatility both in the deviation from target of inflation, and in the GDP gap. A better alternative is to allow monetary policy to focus on the inflation target and GDP gap and instead introduce a time-varying mortgage cap that can prevent the credit gap from increasing. This illustrates how a targeted macroprudential tool is, usually, more efficient than monetary policy in counteracting financial imbalances in a certain sector of the economy.

In the second part of the paper, focus is on the countercyclical capital buffer and the aggregate credit volume in the economy. They show that if monetary policy, besides reacting to the deviation from target of inflation and the GDP gap, also reacts to the credit gap, measured as the deviation from trend of bank lending, the fluctuations in inflation, the GDP gap and the credit gap decrease. The introduction of a countercyclical capital buffer does not alter the conclusion that monetary policy should, in that case, react to the credit gap.

A conclusion that we can draw from these studies is that, if financial imbalances are specific to a certain sector, it is often more efficient to use a specific macroprudential tool for that sector. If, for example, the financial imbalances are specific to the

housing market, a mortgage cap or (reduced) tax relief on mortgage interest is more efficient than monetary policy. If, on the other hand, there is a general increase in lending in all sectors, a macroprudential tool that works broadly should be used, such as the countercyclical capital buffer. In that case, monetary policy can also support macroprudential policy.

THERE MAY BE ECONOMIC GAINS FROM COORDINATING MONETARY POLICY WITH MACROPRUDENTIAL POLICY

Angelini et al. (2014) study the interaction between monetary policy and the countercyclical capital buffer. The central bank and supervisory authority can choose between coordinating their decisions, and not coordinating them. They show that a lack of coordination can lead to heightened fluctuations in both the policy rate and in the countercyclical capital buffer when supply shocks (productivity shocks) generate cyclical fluctuations. However, coordination is less important in terms of volatility in inflation, the GDP gap and the credit gap. When financial shocks are the reason for cyclical fluctuations (i.e. in financial crises), the introduction of a countercyclical capital buffer considerably reduces volatility in the credit gap and GDP gap, irrespective of whether or not the authorities coordinate decisions.

Jonsson and Moran (2014) study the interaction between monetary policy and the countercyclical capital buffer in a model that resembles that of Angelini et al. (2014). One difference, however, is how they model the banking sector. In the model of Jonsson and Moran, the banks do not have full information about the projects and intentions of borrowers. The banks' task as loan mediators is to mitigate or ideally counter the effects of this information problem. In Angelini et al. (2014) the banks instead have full information about borrowers' projects, but they operate on a market that is not fully competitive. They also assume that it is costly for the banks to deviate from the capital requirements of the supervisory authority in their model.

Jonsson and Moran describe the outcome of two types of shock – a supply shock that affects productivity, and a demand shock that affects public consumption. They show that the GDP gap and the credit gap move in the same direction in the case of supply shocks. If productivity improves, corporations can increase production, leading to an increasing GDP gap. It will also be more profitable to invest, and because the investments are financed by borrowed funds, the credit gap widens too. No trade-off thus arises between stabilising the credit gap and the GDP gap in this case. Coordination between the authorities gives rise to smaller fluctuations in both the credit gap and the GDP gap, compared to when they do not coordinate.

For supply shocks, the GDP gap and the credit gap move in different directions. If public consumption increases, this pushes up total demand and hence the GDP gap. However, that increase in public consumption also crowds out investment, leading to a decline in demand for credit and a drop in the credit gap. In this case, a trade-off emerges between stabilising the GDP gap and the credit gap. Coordination then does not generate any

substantial gains in terms of smaller fluctuations in these variables. But the authorities do not need to act as much to achieve this when they coordinate their decisions, which reduces uncertainty and increases social benefit.

A common feature of these and many other model analyses of the interaction between monetary and macroprudential policy is that a short-run cost arises in terms of a lower GDP when the authorities attempt, using various means, to prevent a rapidly escalating indebtedness. The models can capture this cost, but usually not the long-term gains from a reduction in the risk of financial crises. It is hence not possible to analyse the trade-off between short-term costs and longer-term gains in a formal model. That trade-off must in most cases be done in some other way.

Summary and concluding comments

Macroprudential policy is a new policy area that has taken shape based on experience from the financial crisis. It is the policy area devised primarily to reduce the risk of the emergence of financial crises. In this paper, we have attempted to provide an overview of the rapidly growing scientific literature on the effects of various macroprudential tools.

A general conclusion from these studies is that, when capital requirements are increased, the banks cut back on their lending, but not to the extent that might be needed to curb overly rapid credit growth. Several studies show that the mortgage cap and tax relief on mortgage interest are two tools that could be effective in preventing household debt from rising too quickly.

The studies also show that when rapid credit expansion occurs on the housing market, a time-varying mortgage cap is more effective than monetary policy in curbing financial imbalances. However, a broader macroprudential tool – such as the countercyclical capital buffer – should be used if the rapid credit expansion is general. It might also be effective to combine it with monetary policy to counteract the rapid credit expansion. A conclusion from several studies is also that macroprudential tools, in particular tools directly targeting specific sectors, are more efficient than monetary policy in counteracting financial imbalances.

Glossary

Basel I: The first of three "Basel Accords", reached in 1988. The Basel regulations are a set of international rules for financial institutions that primarily regulate the banks' capital adequacy, i.e. how much capital a bank must keep in relation to the risk it assumes. According to Basel I, a bank's risk-weighted assets are calculated by assets being classified into different risk categories, and weighted accordingly.

Basel II: The second Basel Accord, which enabled the banks to use internal models for calculating the size that their risk-weighted assets must be, provided that the models were approved by the supervisory authorities. Basel II was implemented in Sweden in 2007.

Basel III: The third Basel Accord. Compared with Basel II, Basel III contains stricter capital requirements and capital buffer rules. Also, Basel III regulates how the banks manage liquidity. Basel III is currently being implemented gradually through 2019.

Mortgage cap: A limit on how much a household may borrow in relation to the value of the home.

Disposable income: The sum of all income at the disposal of a person or household after taxes and fees.

Countercyclical capital buffer: A countercyclical capital buffer is a new macroprudential tool and part of Basel III. Unlike other capital requirements, a countercyclical capital buffer may vary over time and be activated in the event of strong credit growth, because that increases the risk of a future financial crisis. The purpose of a countercyclical capital buffer is to strengthen the resilience of banks in boom times, and ensure that the banking system has sufficient capital at times when disruptions in the financial system could make it more difficult for the banks to lend. In Sweden, Finansinspektionen is the authority that sets how high the countercyclical capital buffer should be through a qualitative assessment using a buffer guide. That buffer guide is calculated using the Basel Committee's standardised approach, which is based on the credit gap, i.e. how much aggregate household and corporate lending in relation to GDP deviates from its long-term trend.

Liquidity: Measure of the ability of a company or organisation to meet its payment obligations in the short term. Can also describe how quickly it is possible to convert an asset into money.

Loan-to-income cap: A limit on how much a household may borrow in relation to its income.

Debt-service-to-income cap: A limit on how high the borrowing expenses of a household, such as interest expense and loan amortisation, may be in relation to its income.

Supervisory authority: The authority charged with monitoring the financial market and counteracting risks which may bring about instability in the financial system. Finansinspektionen is the financial supervisory authority in Sweden.

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Supply of housing in Sweden[1]

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In recent decades, residential housing construction in Sweden has been low from an historical perspective, as well as in comparison with other countries and in relation to the needs arising from a rapidly-growing population and the process of urbanisation. Both quantitative and qualitative studies indicate that this has contributed to the housing shortages arising now in several parts of the country. At the same time, interest in why too little housing has been built in Sweden has intensified in recent years, with several inquiries and reports attempting to illustrate the problems on the supply side. This article reviews the relevant research in this field and gives a general description of the supply of housing in Sweden. The review shows that the low level of construction is the result of an interplay between several different factors.

Introduction

Throughout history, the development of the housing and property market has played a prominent role in economic crises. In several countries, heavy price falls on various types of property have been connected with major disruptions to both the financial sector and the economy as a whole. These crises have often been preceded by a long period of rising house prices and in many cases an increase in household debt.[2]

In Sweden, housing prices have risen sharply over a long period of time and Swedish households have become increasingly indebted in relation to their incomes (see Chart 1). However, housing prices in Sweden did not fall to the same extent as in many other countries in connection with the financial crisis in 2008-2009 and they have continued to rise in recent years. One possible reason why housing prices did not fall so much and that they are now rising rapidly is that the supply of housing has been low in relation to demand, partly due to the low level of housing construction since the early 1990s.[3]

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1 A large part of the contents of this article were reproduced in the report "The driving forces behind household indebtedness", which was used as a basis for the Financial Stability Council and published jointly by the Riksbank, the Swedish National Debt Office and Finansinspektionen, the Swedish Financial Supervisory Authority in 2015.

2 See, for instance, Reinhart and Rogoff (2010), Schularick and Taylor (2012) and also Jordà et al. (2014).

3 IMF (2009) and Swedish National Institute of Economic Research (2013) find, for instance, that large investments in housing increase the probabilitiy of a price fall on the housing market. Lind (2013) says that the low level of housing construction in Sweden is also one reason why housing priced did not fall more during the most recent financial crisis.

Chart 1. Real single-family dwelling prices and household sector debt in Sweden
Index, 2000 Q1 = 100 and total debt as a percentage of disposable income

Note. Real single-family dwelling prices are defined as Statistics Sweden's real estate price index deflated by the CPI.

Sources: Statistics Sweden and the Riksbank

The interest in why more housing has not been built in Sweden, despite the sharp rise in housing prices, has intensified in recent years with more inquiries and reports from different bodies attempting to illustrate the problems on the supply side.[4] There are many obstacles, but the factors that are often emphasised are high land prices and construction costs, demanding processes for land and planning, the municipalities' planning monopoly, a lack of competition in the civil engineering and construction industries, the regulations on the rental market and the current legislation that makes considerable demands regarding the quality of the housing built.

The Riksbank and international institutions such as the International Monetary Fund (IMF), the European Commission and the OECD have on several occasions emphasised the importance of remedying the structural problems on the housing market to increase construction.[5] This concerns both increasing geographical mobility, so that it should be easy to move to areas where there are jobs or educational courses, and to ward off a potentially unsustainable development in housing prices and thereby reduce the risks linked to high household indebtedness.[6]

The purpose of this article is to provide an overall description of the supply side of the Swedish housing market, partly by reviewing the relevant research in this field. For instance, there is a discussion of factors often highlighted in the debate on why more housing

4 See, for example, Bergendahl et al. (2015), New Construction Commission (2014), and Swedish Housing Crisis Committee (2014).

5 See Sveriges riksbank (2015), Flodén (2014), af Jochnick (2014), Jansson (2013), European Commission (2015), IMF (2014) and OECD (2013).

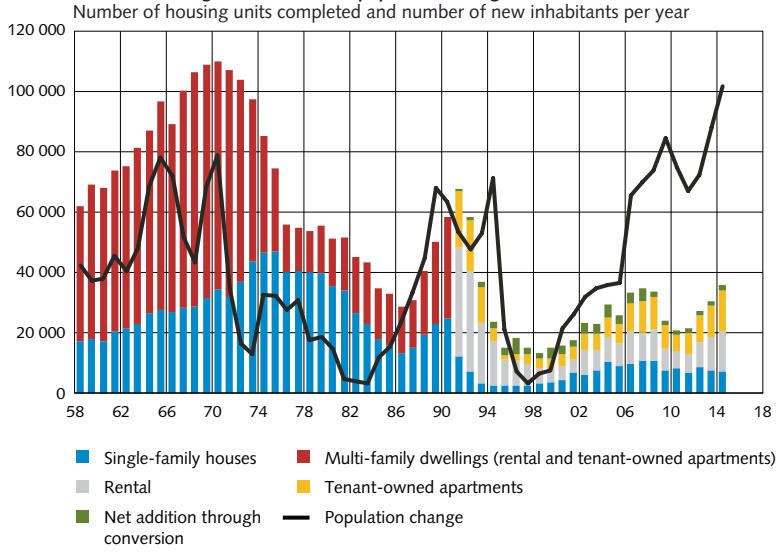
6 A low supply of housing is only one factor contributing to higher housing prices. Falling real interest rates, rising incomes and wealth in the household sector and changes in credit conditions also affect developments in prices and demand for housing. However, these factors are not analysed in this article.

has not been built in Sweden. The article also describes some of the measures taken to increase construction and make the use of the existing housing stock more efficient. The article begins with an analysis of how housing construction in Sweden has developed in recent decades in relation to the large increase in the population and the urbanisation that characterises many regions.

Housing construction has varied substantially and has been low in recent decades

Since the mid-1900s, the level of residential housing construction in Sweden has varied substantially, but after the crisis in the 1990s, it has been low from both an historical perspective and in comparisons with other countries.[7] As shown in Chart 2, housing construction has also not increased to the same extent as the Swedish population over the past decade.

Chart 2. Housing construction and population changes in Sweden
Number of housing units completed and number of new inhabitants per year



Note. Prior to 1991, it is possible to distinguish between different forms of occupancy in apartment buildings.

Sources: Statistics Sweden and the Riksbank

Housing investment in Sweden follows investment in the business sector to a large degree.[8] The variations in housing construction are thus largely due to economic activity and the economic conditions for construction companies. However, the most important explanation

7 See Chart A1 in the Appendix. See also National Institute of Economic Research (2013), which studies housing investment as a percentage of GDP for several countries and over a long period of time. During the 1970s and 1980s housing investment in Sweden was more in line with other countries' investment rates.

8 See Chart A2 in the Appendix.

for the large variation in the amount of new homes being built is nevertheless the Swedish housing policy. This entails, for instance, taxes being changed or government subsidies being introduced for housing construction.[9]

One example of how much influence the government has had over housing construction in Sweden is the Million Homes Programme. Following a political decision, a large number of new homes were built in the 1960s and 1970s to resolve a housing crisis caused by the increasingly rapid urbanisation in Sweden.[10] When the Million Homes Programme was complete, construction slowed down during a ten-year period and then began to increase again in the mid-1980s when the credit markets were deregulated and the conditions for financing housing construction changed.

One of the largest declines in housing construction took place in the beginning of the 1990s. This was partly due to the financial crisis in Sweden and the ensuing economic downturn, and also to the decline in interest subsidies and interest rate guarantees for construction projects in connection with the tax reform in 1993.[11] These changes meant, for instance, that the government-subsidised secondary mortgages disappeared and public housing companies were given similar funding conditions to private participants in the market.[12] The municipalities' costs for building housing thus increased substantially, which had a negative impact on construction of rented accommodation in particular. In recent decades, new builds have increasingly been aimed at tenant-owned housing and to some extent single-family houses, while the percentage of rented accommodation has declined.[13]

In recent years, construction has begun to increase again and several participants are assessing that it will continue to increase in the coming years.[14] If the forecasts prove correct, this means that the number of new build homes will be at the same level as in the mid-1980s (see Chart 3). However, despite more homes being built, Swedish National Board of Housing, Building and Planning (2015a) assesses that the current rate of housing construction will not be sufficient to meet the coming increase in the population in Sweden.

9 See, for instance, Lind (2003).

10 The million homes programme meant that one million homes would be built over a ten-year period between 1965 and 1975. The programme had its roots in a social inquiry into housing made in Sweden during the 1940s. This inquiry concluded that the government should steer construction and reduce housing costs so that the general public would gain a better standard of housing.

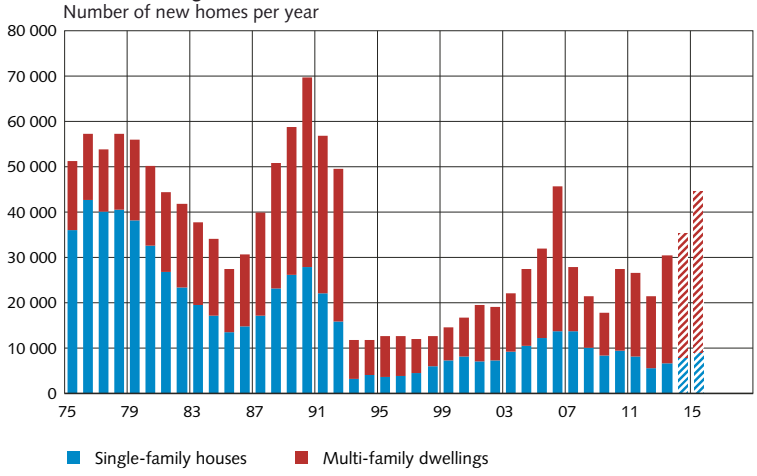
11 See, for example, Berg and Berger (2005).

12 Public housing companies are run on a non-profit basis, they are owned entirely or largely by the municipalities and they are only aimed at particular groups.

13 According to Evidens (2015) and Veidekke (2015), the main explanation as to why private construction companies are building more tenant-owned housing and single-family houses is that there is less risk in this type of new build project than when building rental properties. For example, a large share of apartment blocks with tenant-owned apartments is funded by the households themselves and not mainly through external capital.

14 See Swedish National Board of Housing, Building and Planning (2015b) and Swedish Construction Federation (2015).

Chart 3. Housing construction in Sweden
Number of new homes per year



Note. The broken lines represent the Swedish National Board of Housing, Building and Planning's forecasts. Net addition through conversion is not included in the forecast.

Sources: Statistics Sweden and Swedish National Board of Housing, Building and Planning

The population has increased faster than construction

One means of measuring how well housing construction has developed in relation to the needs prevailing over the past 40 years is to compare the number of completed homes with the development in the population. As mentioned earlier, and as shown clearly in Chart 2, the population has increased much faster than new builds over the past decade. This indicates that new builds have not been able to meet the needs of a rapidly-growing population.

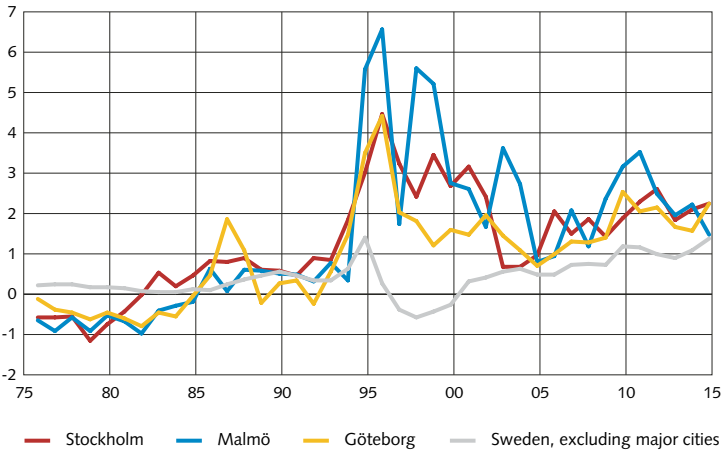
However, such a comparison can be misleading, for several reasons. Firstly, the aggregate population increase only provides a rough measure of the need for housing, as the population can increase through both immigration and an increase in births. An increase in immigration entails a greater need for housing in the near term, while a birth surplus makes greater demands in the longer run.[15] Secondly, for example, a newly-built multi-family dwelling consists of apartments of different sizes. The size of a newly-built single-family dwelling can also vary. This can mean that the need for new housing is to some extent overestimated, as the actual new additional homes – or beds – are in actual fact larger than the aggregate statistics show.

To avoid the problems related to homes of different sizes being built, one can make certain assumptions regarding how many people live in homes of different sizes and then calculate the number of potential beds created over the past 40 years. If the increase in

15 Over the past decades, the Swedish population has largely increased through immigration (see Chart A3 in the Appendix). This means that the demand for housing has increased in the near term.

the population is greater than the number of new beds, one can claim that there is a deficit in the number of completed homes. Chart 4 shows the ratio between the increase in the population and the number of new beds. If the ratio is higher than 1, the increase in the population has been greater than the number of new beds, and vice versa. The chart shows that the ratio has been above 1 from the beginning of the 1990s and onwards. In other words, not enough new homes have been built to meet the increase in the population.

Chart 4. Population increase per newly-built bed
Ratio

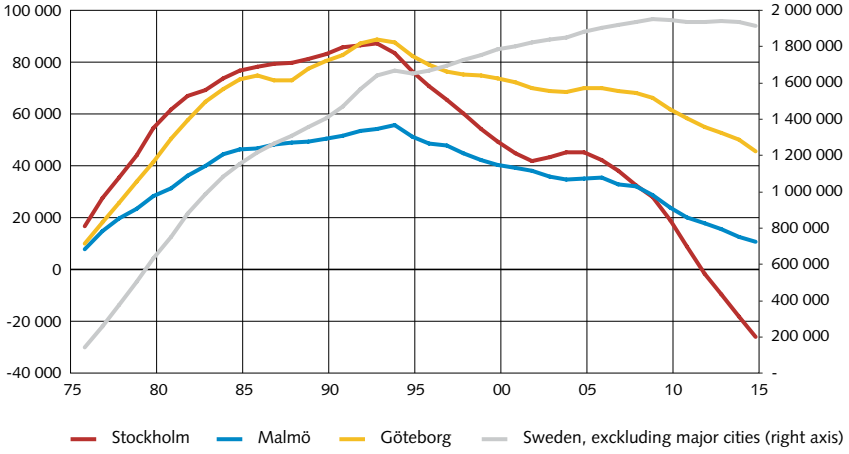


Note. The number of beds is based on the assumption of how many people live in the different sized homes. An apartment is assumed to contain 1-3 people, while a detached house is assumed to contain 1-5 people.

Sources: Statistics Sweden and the Riksbank

However, these calculations do not take into account the expansive housing construction in connection with the million homes programme and the fact that in the 1970s and 1980s there was probably a surplus of housing and thereby of beds. However, it is reasonable to assume that the surplus will gradually be filled by newly-arrived people. If one compares the surplus and deficit of beds over time and adjusts for the homes that have been demolished, it is possible to see whether there is such a store of beds, or whether there is a shortage of beds. This cumulative total is illustrated in Chart 5, where one can see that it was not until 2011 that the surplus of beds in the Stockholm region, for instance, came to an end. In other metropolitan regions there is still a small surplus, even if this has quickly shrunk in connection with the large increase in the population and with urbanisation. In Sweden as a whole, on the other hand, there is a substantial surplus of beds.

Chart 5. Cumulative deficit and surplus of beds
Number



Note. The number of beds is based on the assumption of how many people live in the different sized homes. An apartment is assumed to contain 1-3 people, while a detached house is assumed to contain 1-5 people.

Sources: Statistics Sweden and the Riksbank

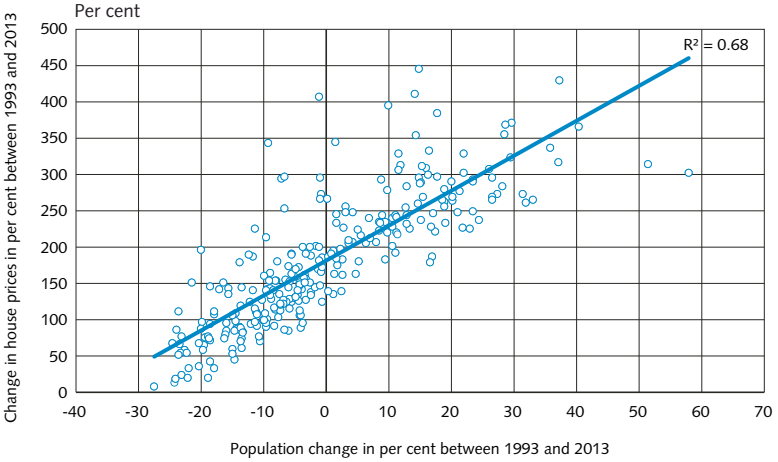
As different assumptions can be made with regard to the number of people in different sized homes, the results of this type of calculation should of course be interpreted with caution, and should perhaps be regarded as a theoretical measure of how large the supply would be if new builds will used in an optimal way.[16] But on the whole, the calculations imply that the shortage of housing in nominal terms has not been as great in Sweden during most of the 1900s and 2000s. However, the large surplus of beds in the nation as a whole implies that a large share of the homes in Sweden is located in regions where demand is not as great as in metropolitan regions. This indicates that there is an imbalance between supply and demand in Sweden, rather than an absolute deficit of homes.

The calculations also show that the substantial urbanisation and population increase during the 1990s and onwards have meant that the earlier supply surplus in many metropolitan regions has rapidly disappeared. When few apartments were built there, at the same time as the population increased, there was greater competition for the existing homes, which could have pushed up housing prices in these regions. As shown in Chart 6, there is also a clear connection in Sweden's municipalities between how house prices have developed and how the population has increased or decreased within the municipality. The higher the population growth a municipality has experienced, the more housing prices in the municipality have risen.

16 Alternative calculations, using different starting years and other assumption on the number of people who live in the homes, gives roughly the same pattern as shown in Chart 5. On the other hand, the levels of the deficit and surplus differ.

Chart 6. Correlation between changes in house prices and population for Sweden's municipalities between 1993 and 2013

Per cent



Note. Each point shows the percentage change in the price of nominal one- or two-dwelling buildings and in the number of inhabitants in Swedish municipalities between 1993 and 2013. The price of single-family houses is calculated at the average price in each municipality.

Sources: Statistics Sweden and the Riksbank

SEVERAL ANALYSTS BELIEVE THAT THERE ARE HOUSING SHORTAGES IN MANY PARTS OF THE COUNTRY

The low level of housing construction in recent decades in relation to the growth in the population has contributed to the apparent housing shortages in many parts of Sweden. Swedish National Board of Housing, Building and Planning (2012a) has estimated, for instance, that there was a shortage of between 90 000 and 160 000 homes in Sweden in 2012. The biggest shortage was in the Stockholm region, where the deficit was estimated at between 28 000 and 51 000 homes.[17, 18] Stockholm Chamber of Commerce (2014) believes that the deficit in the Stockholm region is even larger, around 120 000 homes, given the increase in the population seen in the region in recent years.

The number of inhabitants per home has also risen in the Stockholm region, other metropolitan regions and several growth regions in recent years. According to Swedish National Board of Housing, Building and Planning (2013a), the differences between the different parts of the country are, however, considerable and in 12 of Sweden's 21 countries the number of inhabitants has actually declined over a long period of time. In the

17 The deficit in housing is defined by Swedish National Board of Housing, Building and Planning (2012a) as the difference between the current stock and what would be required to eliminate excessive housing prices. Excessive price refers to the price rise that exceeds the rise caused by the increase in population.

18 Later studies, such as Swedish National Board of Housing, Building and Planning (2014a), state that the deficit is slightly lower given the deviation from the average household size between 1990 and 2013.

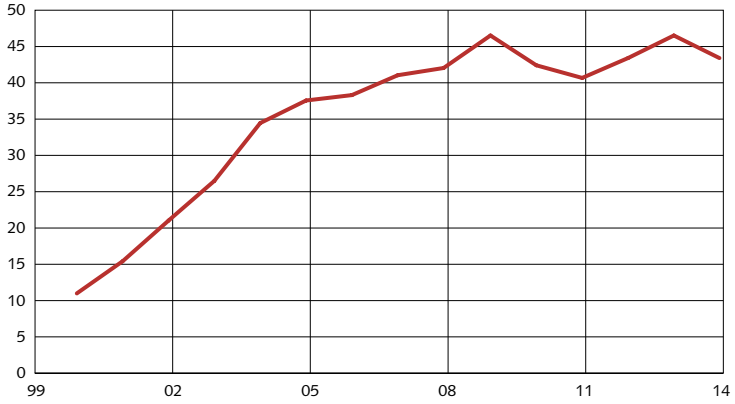
country as a whole, the number of inhabitants per home has remained fairly constant in recent decades, after falling substantially from the 1960s to the beginning of the 2000s.[19]

However, it is difficult to try to measure the housing shortage quantitatively like this. The results are very dependent on how one chooses to define the housing shortage.[20] As mentioned earlier, estimates are sensitive to various assumptions regarding people's living forms, for instance. Another problem is that a large part of the demand surplus in many cases is not captured by the quantitative models. It is for example difficult to estimate how many households actually want to move to a certain town or region but don't because they can't find anywhere to live there. Furthermore, there can be a surplus of a certain type of home that is not suitable for the households, who then do not move for that reason. Swedish National Board of Housing, Building and Planning (2014d) states for example that the Swedish market for tenant-owned housing is accessible by large groups of people, but only in certain locations. The housing shortage is thus partly a shortage of housing in areas where people would prefer to live.[21]

There are however some qualitative indicators that constantly track the supply side of the housing market and that can supplement the quantitative studies. Such an indicator is the Swedish National Board of Housing, Building and Planning's annual housing market survey that poses questions to Sweden's 290 municipalities on how they perceive the housing situation in their area. The most recent housing market survey indicates that there is a housing shortage in several parts of the country and that the shortage has grown more acute in recent years. At the end of the 1990s, only 11 per cent of the municipalities said that there was a housing shortage (see Chart 7). The percentage has now increased to more than 40 per cent.[22]

19 See Charts A.4 and A.5 in the Appendix.
20 See, for example, Bergendahl et al. (2015) for a detailed discussion of how the housing shortage can be defined.
21 Swedish National Board of Housing, Building and Planning (2014d) and Swedish National Board of Housing, Building and Planning (2015c) conclude that in locations where the supply of land is greatest, that is, outside city/town centres, people's willingness to pay falls rapidly to levels that make it difficult to build new tenant-owned housing at a profit. This is also true of peripheral areas that are considered to have good communications.
22 See also Swedish National Board of Housing, Building and Planning (2015c).

Chart 7. Percentage of municipalities reporting a housing shortage in Sweden
Per cent



Note. The fact that municipalities report a housing shortage does not necessarily mean there is a need to build new homes. One disadvantage with the Swedish National Board of Housing, Building and Planning's housing market survey is that the municipalities do not state how large the shortage is (for further information, see Swedish National Board of Housing, Building and Planning (2013b)).

Source: Swedish National Board of Housing, Building and Planning

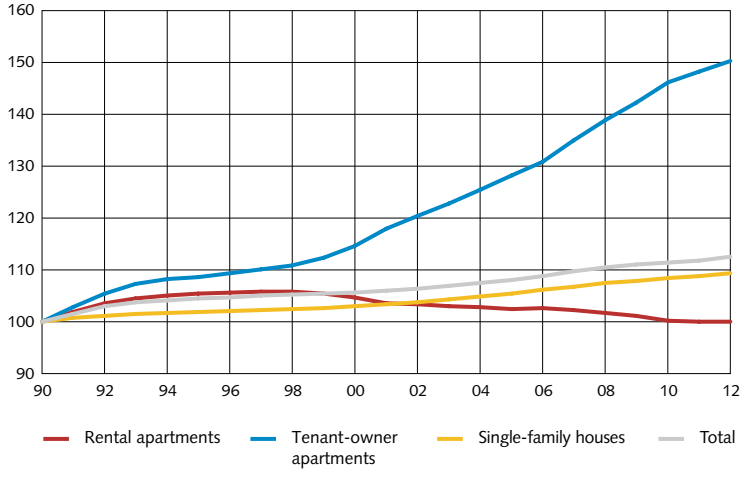
According to Sweden's municipalities, there is above all a shortage of housing for groups that cannot afford or do not have the possibility otherwise to buy their own home, such as pensioners, newly arrived migrants, students or single parents. An increasing number of municipalities have therefore said that there is a particular shortage of rented accommodation. In 2013, for example, 246 municipalities, or almost 85 per cent, stated that there was a lack of rented accommodation in their area. Even municipalities that said there is a balance, or even a surplus of homes, consider the supply of rented accommodation to be lower than the demand. A good 30 per cent of the municipalities consider there to be a shortage of tenant-owned housing in their area.

The perception that the shortage of tenant-owned housing is not just a problem for metropolitan regions is also indicated by the survey distributed by the Swedish Union of Tenants to 185 public housing companies in 2014. Their survey indicates that housing waiting-lists are getting longer and that it can take several years to find rented accommodation in many parts of the country. According to Swedish Housing Crisis Committee (2014), it is particularly difficult to obtain rented accommodation in Stockholm, where the waiting lists have almost doubled between 2009 and 2013, from 4 years to 8 years.

Many rented homes have been converted into tenant-owned housing

The shortage of rented accommodation in Sweden depends to a large extent on its very low net addition over the last decades (see Chart 8). According to Swedish National Board of Housing, Building and Planning (2012a), the number of rented properties has only increased marginally between 1990 and 2011, while the number of tenant-owned properties has increased by more than 300 000 during the same period. One reason for this development is that a large proportion of the country's rented homes have been converted into tenant-owned housing. Between 1991 and 2011, around 201 000 new rented homes were indeed built in Sweden but at the same time about 181 000 were converted to tenant-owned housing. The biggest share of conversions took place in the Stockholm region. For every rented home built in Stockholm between 1991 and 2010, three disappeared as a result of conversions.

Chart 8. Change in number of homes 1990-2012, different forms of housing
Index, 1990 = 100



Source: Statistics Sweden

The possibilities for conversion have contributed to more households owning their homes. At the end of 2014, 62 per cent of the housing stock was either a single-family dwelling or a tenant-owned apartment (see Table 1).[23] This is an increase of around 5 percentage points compared to 1992.

Table 1. Composition of the Swedish housing stock at the end of 2014

	NUMBER OF HOMES	SHARE OF TOTAL STOCK %
Privately owned homes	1 842 044	39
Tenant-owned homes	1 028 079	22
Rented homes	1 491 923	32
Special needs homes	226 731	5
Other units	77 855	2
Total	4 666 632	100

Note. Special needs homes are homes for older people, persons with disabilities and students. Other units are buildings that are not intended for housing purposes, e.g. buildings intended for business activities or with some kind of social function.

Source: Statistics Sweden, National Apartment Register

When housing prices rose, more housing was built, but not enough

On an efficiently-functioning market, supply is expected to increase when the price rises as a result of increased demand. The rising housing prices of recent decades should therefore, all else being equal, have led to increased housing construction as more new build projects are becoming profitable.

Profitability for new construction in the housing market can be related to the relationship between the market price of an existing home and the total construction cost of producing a new, similar home. This ratio is known as Tobin's Q and is based on the neoclassical investment model presented in Tobin (1969). The model was originally adapted to capital markets, but when applied to the housing market Tobin's Q can be expressed as:

$$(1) \qquad Tobin's\ Q = \frac{Market\ price\ of\ an\ existing\ home}{Total\ production\ cost\ of\ a\ new,\ similiar\ home}$$

Equation 1 shows that if Tobin's Q is above 1, this is a signal that it is profitable to build a new home, while a value below 1 indicates that investment would not be profitable.[24] If Tobin's Q is 1, this means that the cost of buying an existing house and building a new one is the same. In other words, one can say that the market is in balance if Tobin's Q is 1. On

23 Tenant-owned housing is of course not personally owned property as the tenancy-owner only owns the right of disposal on the apartment. In a legal sense, tenant-owned housing is classed as personal property. The property is owned by the housing cooperative, of which the tenant is a member.

24 The research is not unanimous as to how Tobin's Q should be defined, for instance, whether both land and building costs should be included in the production cost. Moreover, Englund (2011) argues that, considering the long lead times in the construction process, it is the expected housing price a couple of years ahead that is significant, rather than the prevailing market price that is significant for the propensity to invest. The construction companies' yield requirements may also mean that Tobin's Q often needs to be higher than one for a construction project to begin.

an efficient market, the participants who build homes will adapt their building to demand in this way and in the long run Tobin's Q is therefore expected to assume a value of 1.[25]

The Institute for Housing and Urban Research (IBF) has calculated Tobin's Q in all municipalities in Sweden for the years 1981-2010, based on sale prices and production costs for single-family houses (see Table 2). Their calculations show that in 2010 it was profitable to build a new single-family house in 32 per cent of the country's municipalities. This was an increase on 2001, when 12 per cent of the country's municipalities showed a Tobin's Q above 1 and on 2006, when 30 per cent were above 1.

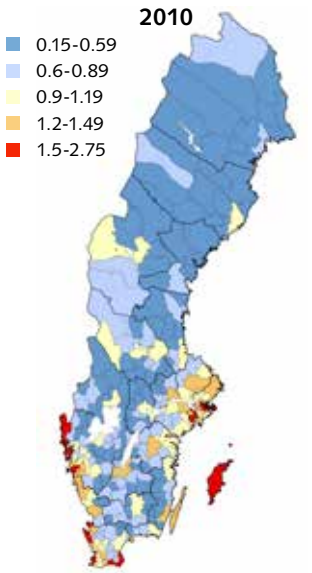
However, profitability has been different in different parts of the country. In most metropolitan regions, growth regions and attractive holiday spots, Tobin's Q was much higher than 1 in 2010, while it was much lower than 1 in the majority of Sweden's municipalities. The ratio for Sweden as a whole was 1.08 in 2010. Rapidly rising housing prices in recent years have contributed to Tobin's Q having increased further in several municipalities, such as the Stockholm region.[26]

Table 2. Municipalities with highest Tobin's Q in Sweden, 2006 and 2010

MUNICIPALITY	TOBIN'S Q (2006)	MUNICIPALITY	TOBIN'S Q (2010)
Sundbyberg	2.79	Danderyd	2.75
Solna	2.74	Sotenäs	2.53
Danderyd	2.50	Lidingö	2.43
Lidingö	2.45	Solna	2.36
Sotenäs	2.21	Vaxholm	2.29
Stockholm	2.14	Båstad	2.27
Nacka	2.12	Nacka	2.21
Båstad	1.92	Tanum	2.10
Tanum	1.88	Sundbyberg	2.04
Vellinge	1.81	Stockholm	2.02
Öckerö	1.81	Höganäs	2.02
Malmö	1.80	Lysekil	1.90

Note. Tobin's Q states the ratio between the market value (the selling price) of a single-family dwelling and its production cost. See Swedish National Board of Housing, Building and Planning (2011a) for further information.

Sources: Institute for Housing and Urban Research (IBF) and Swedish National Board of Housing, Building and Planning

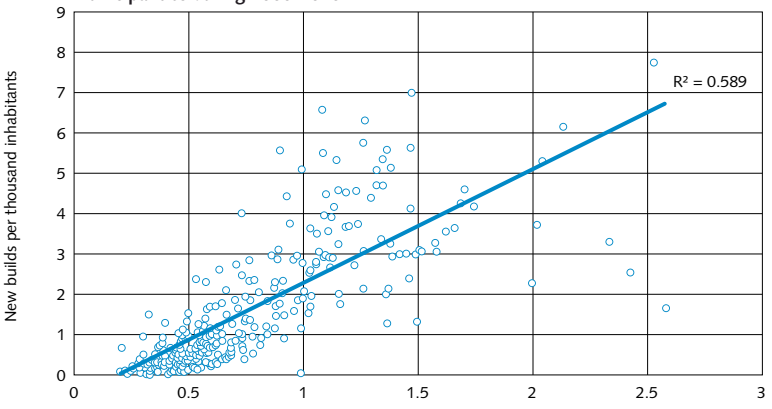


On the basis of these calculations, it would thus have been profitable to build a new single-family house in some regions during most of the 2000s and particularly in metropolitan areas. Consultant firm WSP also shows that there is a relatively high correlation between how many homes are built and how high Tobin's Q has been in a municipality.[27] According to their calculations, one can use the level of Tobin's Q to explain around 60 per cent of the variation in housing construction between Sweden's municipalities during the period

25 See also Topel and Rosen (1988) and Berg and Berger (2005).
26 See Swedish National Board of Housing, Building and Planning (2015c).
27 Sørensen (2013) also claims, unlike for instance Englund (2011), that housing investment in Sweden has responded more to developments in housing prices than has been the case in many other comparable countries, even if the level of construction has still been low.

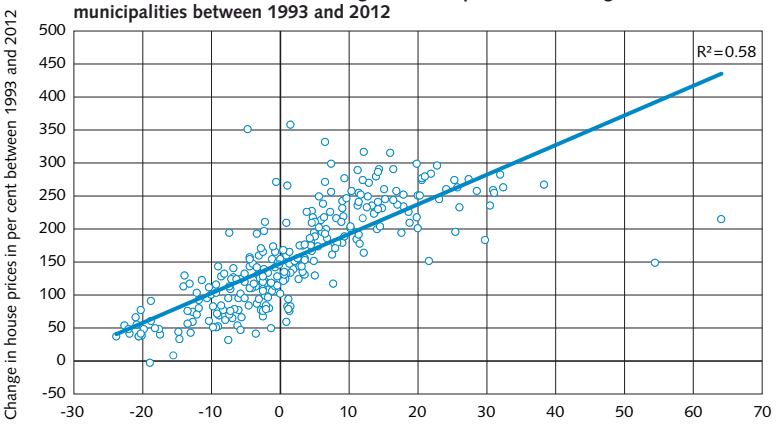
2000-2010 (see Chart 9). There is also a similar correlation for how prices of single-family dwellings have developed in relation to how many new homes have been built in the municipality during the period 1993-2012. As shown in Chart 10, the number of homes has increased most in municipalities that have also had the largest price rises.

Chart 9. Correlation between Tobin's Q and housing construction in Sweden's municipalities during 2000-2010



Source: TMR (2014)

Chart 10. Correlation between changes in house prices and housing stock for Sweden's municipalities between 1993 and 2012



Note. Each point shows the percentage change in the price of nominal single-family houses and in the number of homes in Swedish municipalities between 1993 and 2012. The price of single-family houses is calculated at the average price in each municipality.

Sources: Statistics Sweden and the Riksbank

The rising housing prices have thus contributed to increased construction in many municipalities. But even if construction in these regions has been higher than in other parts of the country, it has still been very low in relation to how much has been built historically

and to the pace at which the population has grown. According to Swedish National Board of Housing, Building and Planning (2014b), total construction of single-family dwellings in the three metropolitan regions has been too small in relation to demand since the beginning of 1995. On the other hand, new housing production was far too high up to 1985 and in a balance between 1985 and 1995.

Lind (2003) and Englund (2011) say that even if the value of Tobin's Q affects the incentive for private and public housing companies to build a new house, there are other factors, of a more structural nature, which can also affect the house-builder's willingness to invest. If one studies how Tobin's Q has developed over time, it is also clear that construction in, for instance, the Stockholm region is held back by other factors, as the ratio has gradually increased since the beginning of the 1990s.[28] It is clear that it is not solely profitability that affects housing construction from the fact that the variation in construction increases the higher Tobin's Q a municipality shows (see Chart 9). In other words, the greater the profitability is, the more of the construction appears to be explained by other factors.

Why haven't more homes been built in Sweden?

Despite high Tobin's Q in many parts of the country and a high population growth, housing construction in many regions has not been sufficient. The debate on why more housing has not been built in Sweden has also intensified in recent years, with more inquiries and reports attempting to illustrate the problems on the supply side.[29] There is also relatively broad agreement that it is not one single factor that has meant more housing is not being built; it is rather the result of an interplay between several different factors.

IT MAY BE PROFITABLE FOR VARIOUS ACTORS NOT TO BUILD MORE

A game theory view as to why more housing is not being built is put forward by Lind (2013), who says that the municipalities and construction companies can regard it as rational not to build more housing than necessary. It is, for instance, far from obvious that it is in the interests of the individual municipality to build new housing, as this can be linked to negative external effects for the households already living in the municipality. A larger supply of housing can, for instance, lead to a fall in the prices of the housing already available in the municipality. Green areas may shrink and noise pollution may be increased, which can also push prices down.

In Sweden, the municipalities have a monopoly on planning, which means that it is the municipalities that determine how local land should be used and built on. Lind (2013) says that if a municipality owns a lot of land, it may be rational not to build on too much of the land at once, as this could lead to fall in the price of the land. A low, but even level

28 See TMR (2014) and Chart A6 in the Appendix.
29 See, for example, Bergendahl et al. (2015), New Construction Commission (2014), and Swedish Housing Crisis Committee (2014).

of construction may be in the best interests of the municipalities, as it can maximise their long-term incomes. If many other land-owners think in the same way, few will build and prices will continue to rise. Bergendahl et al. (2015) say that one of the most important reasons why more housing has not been built in Sweden is that the supply of land has not increased at the same pace as demand, which could be partly explained by the municipal monopoly on planning.

Despite high demand and high housing prices, it may also be rational for private market participants not to build more. One reason for this is that the construction industry in Sweden is characterised by a shortage of competition with major entry barriers and a small number of large participants, making it difficult for new companies to become established.[30] The large construction companies can thus make use of their oligopoly position and charge higher prices, which holds back construction.

Bergendahl et al. (2015) say, however, that it is difficult to find both theoretical and empirical evidence for the low level of housing construction being largely the result of a lack of competition in the construction industry. For instance, several foreign participants have become established on the Swedish construction market in recent years, which indicates that the market is nevertheless subject to competition if prices are rising and profits increasing.

LAND PRICES AND CONSTRUCTION COSTS HAVE RISEN

Another factor that is often highlighted as an explanation as to why more homes have not been built is that it is expensive to build new housing in Sweden, and much more expensive than in many other countries. This is based on arguments such as planning, construction and environmental legislation making substantial demands on new housing. For instance, there are noise pollution limits that must not be exceeded, there must be elevators installed and toilets must be adapted for the handicapped, and so on. Moreover, the cold climate in Sweden entails different structural requirements than in, for instance, southern Europe, which pushes up costs for those who build.

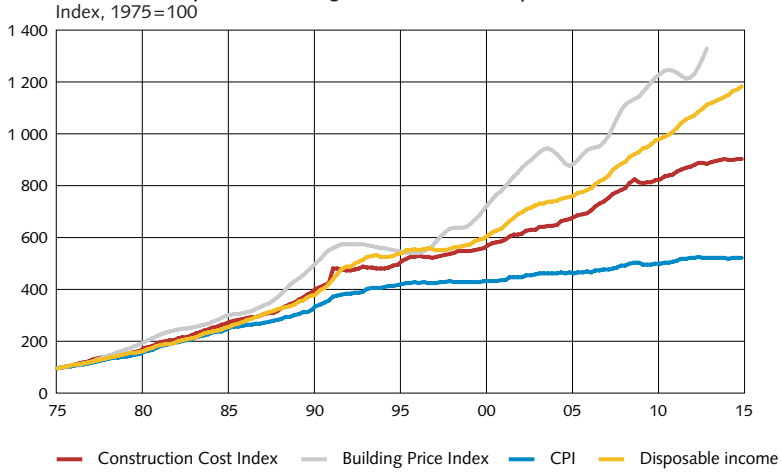
In recent decades, construction costs have increased by a relatively large amount in Sweden. Chart 11 shows how construction costs have developed in relation to the consumer price index (CPI) and disposable income for the household sector. The chart shows that construction costs (that is, production costs excluding land costs) have increased much faster than the CPI since the beginning of the 1990s, but somewhat more slowly than household incomes.[31] The chart also shows Statistics Sweden's building price index, where the land cost is included (that is, what the building contractor pays). The building

30 Swedish Competition Authority (2011) has illustrated the fact that the construction and civil engineering sector in Sweden is characterised by a lack of competition in various parts of the production and distribution chain. However, there have long been competition problems in the construction industry and this has also been a constant theme of inquiries into the sector, at least from the 1960s and onwards.

31 Since part of the production costs is labour (which is expected to follow developments in income) and part is material costs (which are expected to follow the CPI), the total building costs should be lower than developments in income, but higher than the CPI.

price index has increased much faster than both household income and the CPI, which indicates that land prices have also risen substantially in recent decades.[32]

Chart 11. Development of building costs, the CPI and disposable income
Index, 1975=100



Note. Building costs are the factor price index that measures production costs. The building price index measures price changes for residential buildings, adjusted for changes in quality and regional differences.

Source: Statistics Sweden

It thus appears as though construction costs have increased relatively substantially in Sweden in recent years. Sweden has also often had high construction costs in comparisons with other countries in Europe. According to Eurostat, construction costs in Sweden are a good 65 per cent higher than the average costs in EU15. But according to Swedish National Board of Housing, Building and Planning (2014c), the differences are exaggerated as they are not so large if one instead compares with countries that have conditions similar to those in Sweden, for instance, Norway, Denmark and the Netherlands.[33] In Norway, construction costs have also increased faster than in Sweden. Nevertheless, construction has been higher in Norway.[34]

To summarise, construction costs have thus been rising for a long period of time. But this does not distinguish Sweden in comparisons with other comparable countries and therefore it does not explain why more housing has not been built in Sweden. Moreover, the results of the Tobin's Q analysis show that it would have been profitable to build more in many municipalities. This implies that it is not high construction costs that are the main reason for the low level of construction.

32 However, the building price index has been criticised for not taking into account the improvement in the quality of housing over time, which means that the measure to some extent overestimated building costs.
33 However, Swedish National Board of Housing, Building and Planning (2014c) says that cost comparisons between countries are often misleading as housing is a heterogeneous product and there is a lack of comparable statistics.
34 See Chart A1 in the Appendix.

STATE SUBSIDIES HAVE DECLINED

Parallel with the higher construction costs, state subsidies to construction companies have also declined in recent decades. According to Swedish Construction Federation (2004), housing subsidies declined from 3 per cent of GDP in 1991 to 0.7 per cent in 2003. Previously, the higher state subsidies meant that both private and municipal building contractors took a relatively small financial risk in building new housing. But as both the investment subsidies and interest rate guarantees have been phased out, the financial risk linked to new build projects has increased. This seems to have reduced the construction companies' willingness to invest in new builds and in particular in rental properties.[35]

LAND AND PLANNING PROCESSES TAKE TOO LONG

A further obstacle that holds back housing construction is the long processes required for land acquisition and planning, which considerably prolong the building process as a whole. It also increases the financial risk linked to the building project. The economic situation can change during the time the home is being built, which can affect the companies' possibilities to fund construction and also households' demand for housing. Moreover, the construction work often has to be approved both in terms of the zooning plan and planning permission from the municipality. It is also possible to appeal against a municipal decision and in many cases both the zooning plans and building permission are subject to appeal. If the planning process is also protracted and uncertain and fewer companies are involved as developers, there may be relatively few land areas that can be built on at any given time. Once the land is ready for development, it has to be auctioned off and then the land prices may rise, which affects the profitability of the construction project.

The time required before building can start varies substantially from one building project to the next in Sweden. Although the average time before building can commence in Sweden does not differ from other countries, there is a greater risk that it may take considerably longer.[36] Lind (2003) says that these long lead times create uncertainty for the participants in the market and that this means that only a few financially strong companies have the resources to begin various new build projects.[37] This hampers competition in the market and can lead to less building.[38] International studies have also shown that stricter regulations are often followed by fewer homes being built and that prices become higher.[39]

35 See Veidekke (2015) and Evidens (2015).
36 See Chart A7 in the Appendix.
37 Swedish National Board of Housing, Building and Planning (2011) says that the financing conditions for large construction companies have been good during the 2000s. However, the conditions for smaller companies have been poorer.
38 The importance of good knowledge of Swedish construction conditions makes it difficult for foreign companies to become established in the market, which can inhibit competition.
39 See, for instance, Luger and Temkin (2000) and Boulhouwer and deVries (2002).

RENT REGULATIONS CAN INCREASE THE RISKS AND REDUCE PROFITABILITY

One factor that hampers the construction of rental properties in Sweden is the regulations on the Swedish rental market. Eriksson and Lind (2005) say that today's rent regulations can in several different ways lead to fewer rented homes being built. For example, it becomes less profitable to build new rental properties when the rent has to be set lower than the price that would be set in the market. Moreover, poorly worded rent regulations can lead to major differences in the rents for new and existing rented accommodation. If demand then falls, it will mainly affect the new stock first, as they often have higher rents. This makes it more risky for construction companies to build new rented accommodation. The risk is particularly high in the parts of the country where housing waiting-lists are much shorter than they are in the cities.

But Eriksson and Lind (2005) nevertheless claim that these factors are not sufficient to explain why so few new rental properties are being built in Sweden. Instead, they draw the conclusion that the construction companies have chosen to build tenant-owned housing instead of rented accommodation as it has been more beneficial in tax terms and more people are willing to pay for tenant-owned housing.[40] They also say that the economic climate has made it more profitable to build tenant-owned housing, as investors have often got their money back quickly when housing prices and the stock market have risen. In other words, the profitability for construction companies has been greater if they have built tenant-owned properties and single-family dwellings instead of rental properties.

Attempts to increase housing construction

There are thus several explanations as to why more housing has not been built in Sweden since the early 1990s. It also means that probably more measures are required to resolve the problems with housing shortages. Over the past decade, the Riksdag (the Swedish parliament) and the government have also investigated which measures might promote housing construction. More than 60 different housing inquiries have been appointed in recent years, for instance, to examine how the processing of appeals can be made more efficient to speed up the building process.[41] The inquiries also proposed that fewer detailed plans should be required, that the planning processes should be simplified, that higher demands should be made for the municipalities to revise guidelines for development agreements and land allocation, that the municipalities should not be allowed to make specific requirements regarding what housing is build, that the regulations regarding the protection of right to use beaches should be amended and that construction companies should not need to follow the same rules when building homes for students and young people. In recent years new guidelines regarding noise pollution have also been introduced, which should make it easier for the construction companies to build smaller apartments, in particular.

40 For example, Housing Taxation Committee (2014) says that the property charge in connection with company taxation means that the returns on investment in rental properties are subject to double taxation.

41 See the Ministry of Health and Social Affairs (2013).

However, politicians have tried earlier to make it easier to build new homes, particularly rented accommodation. In 2006, for instance, the utility value system was supplemented with presumptive rents for new-builds, in order to increase the incentive for building new rented accommodation.[42] In practice, this has meant that a property owner has the possibility to charge market rents for newly-produced rental apartments during an exceptional period. This period was first set at 10 years, but was extended to 15 years in 2011. However, Lindbeck (2013) says that these amendments will not be sufficient to boost the construction of rental accommodation, as investors do not want to build new properties if they will face price controls that limit the return on them after a few years.

There have also been some tax changes that could affect housing construction. In 2008, for instance, the property tax was replaced by a property charge, which gave more households a lower cost of living. This could mean that more housing is built, as households' demand for housing will then increase. The cut in property tax was partly financed by raising the tax on capital gains to 22 per cent. On the other hand, the tax increase can have had a negative effect on mobility in the market and the utilisation of the existing housing stock, as the incentives to move may decline.[43]

The trade organisation for builders of single-family dwellings, TMF, also says that fewer homes were built after Finansinspektionen (the Swedish Financial Supervisory Authority) introduced a loan-to-value limit in October 2010. They say that a loan-to-value limit makes it more difficult for first-time buyers, as it means they need to have a larger deposit to buy a home. This reduces the demand for newly-produced single-family dwellings. The association of estate agents Association of Estate Agents (2013) says that the requirements made by the loan-to-value limit have prevented many first-time buyers from entering the market.

Use of the existing housing stock can be improved

Although the measures proposed may have contributed to more housing being built, newly-built homes will nevertheless be a very small addition to the total stock of housing.[44] It is therefore also important to investigate how one can make better use of the existing housing stock to resolve the housing shortage in Sweden, particularly in the short term.[45] According to Swedish National Board of Housing, Building and Planning (2013c), 90 per cent of the welfare losses caused by the way current rental market regulations are designed could be avoided if existing housing was utilised more efficiently.

42 A presumptive rent is the rent for new-build homes agreed on by the landlord and the tenants' association.
43 Caldera et al. (2011) say that high transaction costs have a negative effect on the housing market and point out at the same time that less strictly regulated rents have a positive effect.
44 During 2014, around 30 000 new single-family dwellings and multi-family dwellings were completed, which corresponds to less than 1 per cent of the total stock of single-family dwellings and multi-family dwellings.
45 One sign that the housing stock is being used inefficiently is that the number of inhabitants per home is increasing in metropolitan regions, but falling in other regions, which implies that homes are not located in the parts of Sweden where demand is highest.

There are also many proposals regarding how the existing housing stock can be better utilised. Swedish National Board of Housing, Building and Planning (2014a) and Lindbeck (2013) highlight, for instance, the need to review the regulations on the rental market to reduce the long waiting lists for rented accommodation, particularly in the Stockholm region. Moreover, they argue that the tax on capital gains should be lowered to reduce the transaction costs and facilitate mobility in the market. New Construction Commission (2014) also argues in favour of a long-term reduction in this tax.

Some measures have been taken by politicians in recent years to try to ensure more efficient use of the existing stock of housing. In the middle of 2012, for instance, subletting of tenant-owner apartments was made easier by adapting the rents to market conditions.[46] This proposal meant that it is now possible to charge a higher rent for subletting than has previously been the case. The purpose of this measure was to try to increase mobility on the market and to manage the long waiting lists on the existing rental market.[47]

Summary and concluding remarks

In recent decades, residential housing construction in Sweden has been low from an historical perspective, as well as in comparison with other countries and in relation to the needs arising from a rapidly-growing population and the process of urbanisation. The historically-low housing construction has also coincided with a period when households' demand for housing has increased substantially as a result of favourable economic conditions. Both quantitative and qualitative studies indicate that this has contributed to the housing shortages arising now in several parts of the country.

At the same time, it is difficult to define the concept of housing shortage. There are indications that there is sufficient housing in Sweden, but that much of this is in regions where demand is lower. From this perspective, there is an imbalance between supply and demand rather than an absolute deficit of housing. The housing shortage is thus perhaps mainly a shortage of housing in areas where people would prefer to live. Such an imbalance is difficult to resolve by building more, as access to land is often limited in such attractive areas. It is therefore important to remember that new builds are only a small part of a large existing housing stock. More efficient use of the existing stock thus has a decisive significance for how the housing shortage can be resolved, particularly in the near term.

But when the population is growing rapidly and urbanisation is increasing at the same time as the demand for housing is increasing, it is nevertheless necessary to build more homes. In particular, it is necessary to build housing in different forms that will suit different types of household. Although the higher housing prices have contributed to more being

46 Statistics from Blocket Bostad indicate that this amendment to the law has contributed to a sharp rise in rents for subletting. For instance, the rent for a studio apartment in the Stockholm region was around 30 per cent higher in 2014 than in 2012. Moreover, the amendment has contributed to more sublets coming out onto the market. During 2013, for instance, the supply of sublet apartments increased by a total of 33 per cent in Stockholm municipality, compared with the previous year.

47 Bergendahl et al. (2015) stress that the utility value system leads to an increase in transaction costs, mainly in the form of searching time.

built in many regions, particularly in recent years, if one studies developments over a longer time horizon, there have nevertheless been too few homes build in relation to demand. This applies in particular to rented accommodation. It is a problem as different types of housing are needed, for instance, to make it easier for people to move to areas where there are jobs and educational courses.

There are explanations for the low level of housing construction in Sweden. For instance, the Swedish housing policy was changed at the beginning of the 1990s, partly by reducing state subsidies for new builds, which affected the profitability of some times of construction project. New builds are also affected by poor incentives for both private and municipal actors, which may mean that they will not want to build more housing than they already are building. At the same time, there are laws and regulations that hamper competition on the market, which can lead to higher construction costs and fewer homes. These interacting factors hamper housing construction and thus contribute to the housing shortage prevailing in several parts of the country. The housing shortage leads to considerable social costs and other negative external effects for society.

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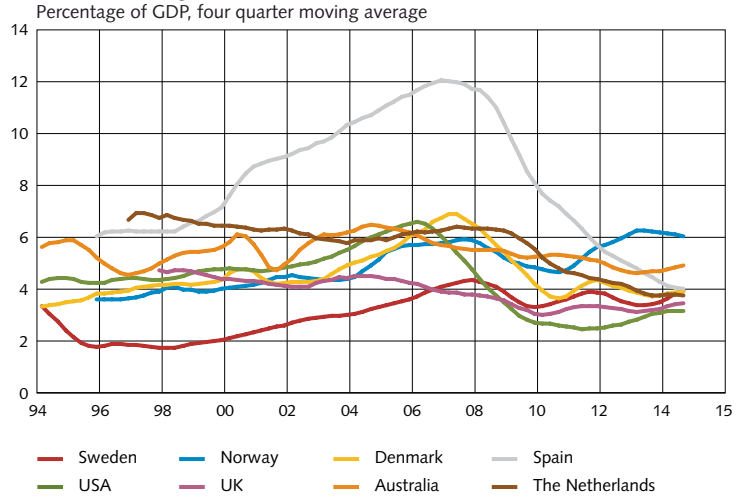
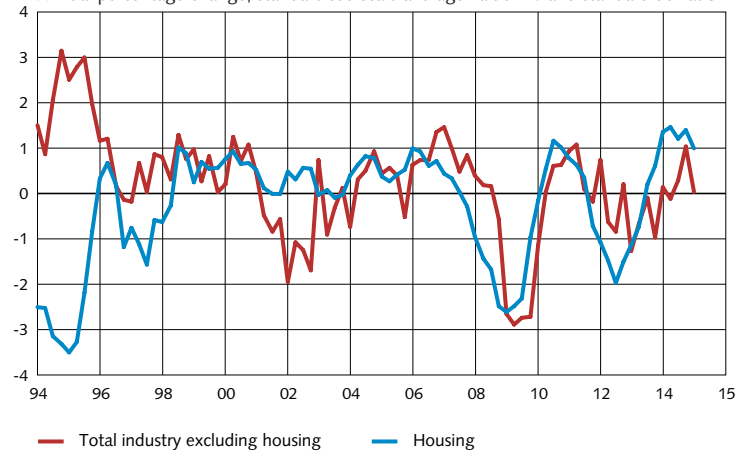
Appendix

Chart A1. Housing investment in different countries
Percentage of GDP, four quarter moving average



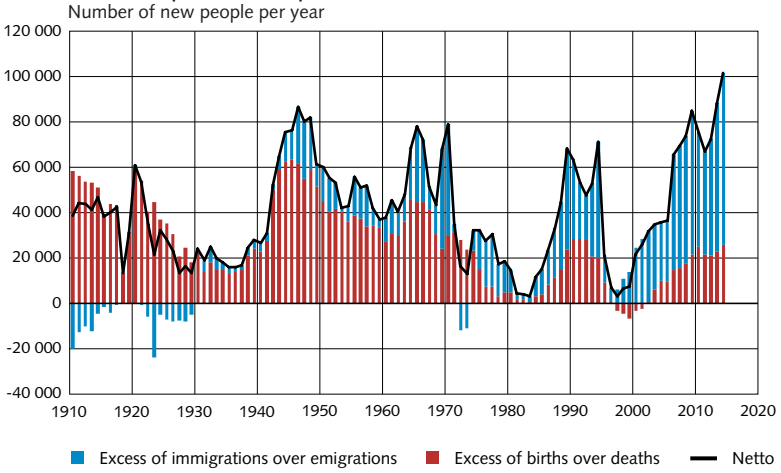
Sources: Reuters EcoWin and the Riksbank

Chart A2. Investment in the business sector in Sweden
Annual percentage change, standardised scale average value = 0 and standard deviation = 1



Sources: Statistics Sweden and the Riksbank

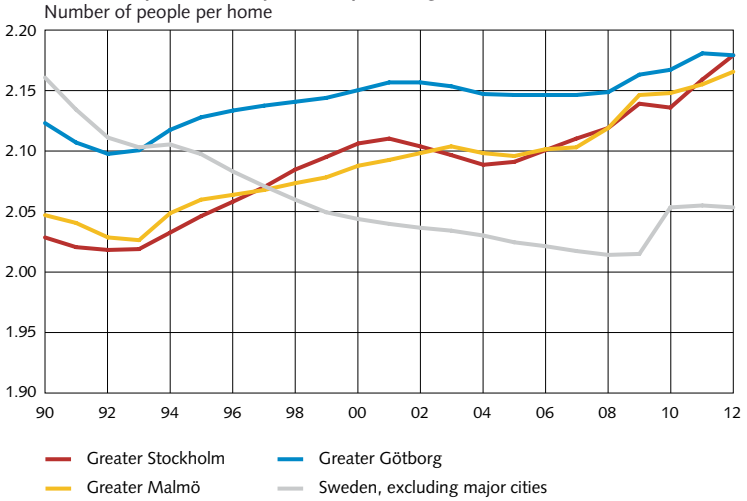
Chart A3. Population development in Sweden
Number of new people per year



Note. Birth surplus is defined as the difference between the number of people being born and the number of people dying. Immigration surplus is defined as the difference between the number of people immigrating and the number of people emigrating.

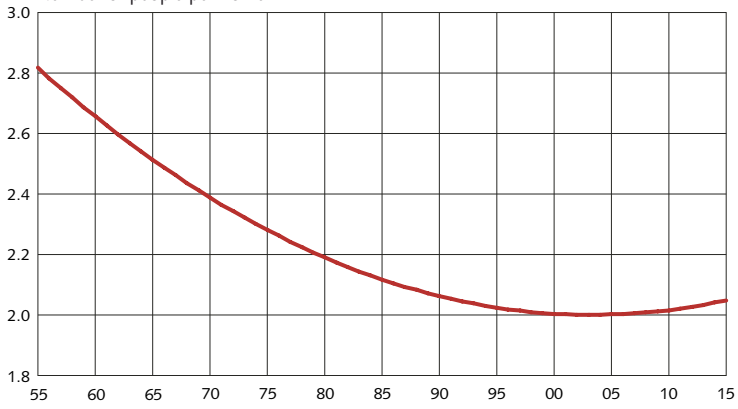
Source: Statistics Sweden

Chart A4. Population density for metropolitan regions and the rest of Sweden since 1990
Number of people per home



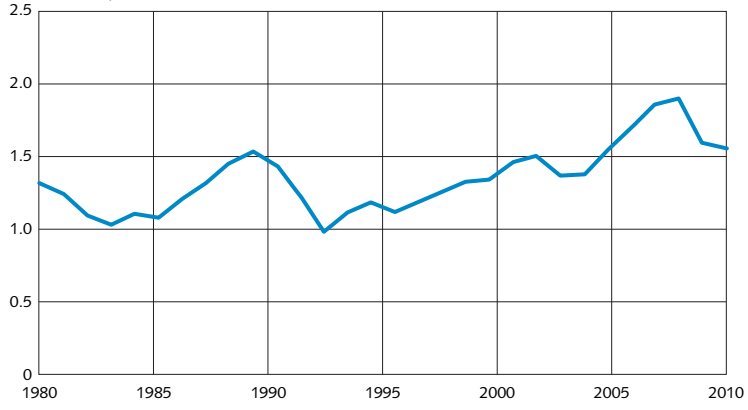
Sources: Statistics Sweden and the Riksbank

Chart A5. Population density in Sweden since 1960
Number of people per home



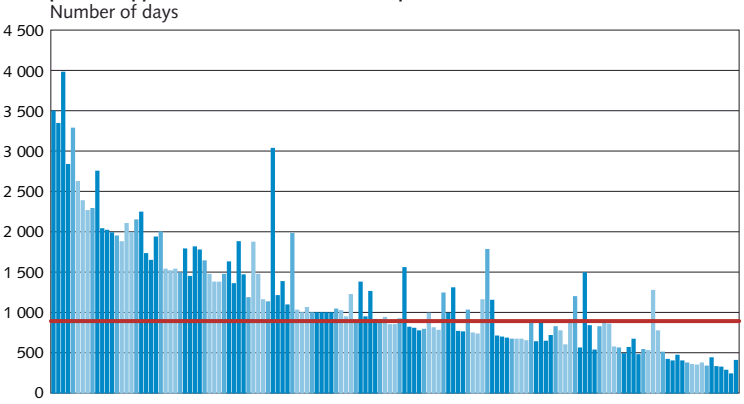
Source: Swedish National Board of Housing, Building and Planning

Chart A6. Average Tobin's Q for the municipalities in Stockholm county during the period 1981-2010
Tobin's Q



Source: WSP's working of data from Statistics Sweden and Institute for Housing Research (IBF) at Uppsala University

Chart A7. Time, including waiting time before active project start, to adoption and possible appeal of more than 150 detailed plans in Sweden
Number of days



Source: Stadsbyggnadsbenchen (Benchmark cooperation between 9 municipalities in Stockholm)

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