

The Riksbank purchase government bonds with the aim of making monetary policy more expansionary and supporting a development whereby inflation returns to the target of 2 per cent. Our analysis shows to what extent the purchases have had an effect on interest rates, exchange rates and asset prices. Our assessment is that the purchases have contributed to making Swedish interest rates lower than they otherwise would have been. This has contributed to reducing the interest rate differential in relation to other countries and led to the krona being at a weaker level than it otherwise would have been. Seen in relation to the value of the bonds the Riksbank has purchased, the effects are in line with those observed in other countries.

Effects of the Riksbank's government bond purchases on financial prices

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In connection with the monetary policy decision taken in October 2014, the Riksbank cut the repo rate to zero and stated that the Riksbank, like central banks in other countries where the policy rate was approaching zero, could take more supplementary measures if monetary policy needed to be more expansionary.

There is limited experience of negative policy rates, which is one argument for proceeding cautiously with cuts to the policy rate to negative levels.² In this kind of situation, it may be desirable to supplement the cuts with other measures to make monetary policy more expansionary. One such supplementary measure is the purchase of government bonds. Several central banks have turned to such purchases following the financial crisis of 2008-2009 in order to make monetary policy more expansionary, as the traditional policy rate has approached what is considered to be its lower limit.³

At the monetary policy meeting in February 2015, the Executive Board decided to cut the repo rate to -0.10 per cent, and at the same time announced limited purchases of government bonds of SEK 10 billion.⁴ The Riksbank also announced that it was prepared to quickly buy bonds on a larger scale if needed.⁵ Purchases have since increased on three occasions. The announced purchases of government securities currently amount to SEK 135 billion, measured as the "face value" or the size of the bond loan. This corresponds to approximately 23 per cent of the outstanding stock of nominal government bonds. The market value of the purchases represents around 4 per cent of annual GDP.⁶

In this commentary we assess the effects the Riksbank's purchases of government bonds have had on Swedish financial markets so far. As government bond purchases have been used by other central banks in recent years, it is also possible to compare the effects in Sweden with the effects observed in other countries.

The analysis shows that Swedish government bond yields are lower than they would have been without the Riksbank's government bond purchases. Our interpretation of the results also indicates that the purchases have contributed to reducing the interest rate differential in relation to other countries, and that the krona has been weaker than it otherwise would have been. The effects of Swedish government bond yields are in line with the effects observed in other countries.

1. We would like to thank Jan Alsterlind, Mikael Apel, Meredith Beechey-Österholm, Charlotta Edler, Ola Melander, Johan Molin and Ulf Söderström for their comments.

2. See Alsterlind, Armelius, Forsman, Jönsson and Wretman (2015).

3. Central banks in the United States, United Kingdom, euro area, Japan and Switzerland, for example.

4. To find out more about the reasons behind the decision to purchase government bonds, see the Monetary Policy Reports and minutes of monetary policy meetings from 2015.

5. The Riksbank also made it clear that it has other tools, for example the purchase of other assets, loans to companies via loans to private banks, as well as exchange rate interventions. See the article in the February 2015 Monetary Policy Report.

6. The bond loans the Riksbank has decided to purchase have a face value of SEK 135 billion, which is the amount the bond holder receives on the expiry date. However, as market rates have generally been lower than the bonds' coupon rate, the market value (present value) of the bonds and the future pay-outs is higher than the face value. The Riksbank purchased bonds for around SEK 115 billion until the end of September, but the face value of these bonds is SEK 96 billion.

How do we assess the effects of the Riksbank's government bond purchases?

The purpose of the purchases is to make monetary policy more expansionary and to ensure that inflation rises towards the target of 2 per cent. A discussion about how the purchases make monetary policy more expansionary can be found in the commentaries by Alsterlind, Erikson, Sandström and Vestin (2015), "Hur kan köp av statsobligationer göra penningpolitiken mer expansiv?" (How can government bond purchases make monetary policy more expansionary?), and in the article "The Riksbank's supplementary monetary policy measures" in the Monetary Policy Report from February 2015. As there is a time lag before monetary policy has an effect on inflation, an early assessment such as this one must focus on studying the effects of government bond purchases on financial conditions in the form of interest rates, the exchange rate and other asset prices. We also assess how different measures of inflation expectations seems to have been influenced by the Riksbank's measures.⁷

This commentary focuses on these effects, as the bond purchases are intended to have an impact on the economy by influencing asset prices, among other things. Alsterlind, Erikson, Sandström and Vestin (2015) describe different ways this can occur, with the most relevant for this assessment being the signalling channel, premium channel and portfolio channel.

The signalling channel, via which the central bank's bond purchases signal that the policy rate may remain low for a long time, pushes down market rates when market participants expect a lower repo rate level in the future. The premium channel affects interest rates levels as the Riksbank's purchases reduce the supply of government bonds for private actors. If there are market participants who need to hold these bonds, this will push down government bond yields by reducing the so-called premium. Both of these channels lead to lower Swedish government bond yields in relation to other countries' yields, which should also coincide with a weaker exchange rate. It is therefore natural to assess how the Riksbank's bond purchases have affected government bond yields, yield differentials in relation to other countries and the exchange rate.

The portfolio channel works through the reduction of the supply of government bonds following the Riksbank's purchases which leads to more investors seeking other more risky investment alternatives. We therefore also look at the effects on mortgage and corporate bond yields as well as on the Swedish stock market to see whether the rates and prices linked to these assets are also affected. However, it is likely that this type of effect is harder to identify as it can happen gradually.⁸

We have chosen to assess the purchases of government bonds by studying the immediate effects on financial markets following the announcement of a new monetary policy decision.⁹ If the decision is totally or partially unexpected by market participants, the new information is taken into account in financial assets prices directly after the decision has been made public. To ensure the information is reflected adequately in asset prices, we measure the effect of the announcement as the change over the entire day of the announcement.¹⁰ The advantage of studying these reactions is that we can be relatively sure that they have been caused by the Riksbank's measures. However, the measures can also influence financial asset prices on other occasions. If market participants have fully or partially predicted the measures announced by the Riksbank, for example, then this is reflected in asset prices even before the announcement. However, as this can occur gradually over a long period, it can be much more difficult to identify these effects and link it to the bond purchases announced by the Riksbank.

7. We mainly study the effects of nominal financial asset prices, but it is via lower *real* financial asset prices that the purchases are expected to influence the economy. See Alsterlind, Erikson, Sandström and Vestin (2015).

8. The Bank of England has carried out studies of volume and flow effects on the portfolio level of government bond purchases. See Joyce, Liu and Tonk (2014) who indicate that balancing the portfolio can be done gradually.

9. This method is a type of "event study", which has been a common way of assessing similar central bank measures in other countries. See for example Gagnon, Raskin, Remache and Sack (2011).

10. From the previous day's closing figure through to the announcement day's closing figure. Of course, this relatively long time interval means that other major events during the announcement day can also influence the financial prices we study, but we use control variables to exclude the influence of factors other than the Riksbank's announcement.

Experiences from other countries who have conducted government bond purchases have shown that these purchases have had notable effects on market rates, particularly on rates which are closely connected to the purchases announced by the central bank, for example government bond yields.¹¹

In this economic commentary we do not discuss in detail the potential effects that the purchases of government bonds announced by the Riksbank have had on the stability of the Swedish financial system. It could be noted, however, that the more expansionary monetary policy in part has an effect in the form of increased risk-taking. This can create greater vulnerability in the financial system if it leads to assets becoming overvalued or if other types of risks are not priced in full. Lower mortgage bond rates as well as mortgage interest rates are also contributing to the rising trends in housing prices and household debt.¹²

Effects following the announcements of the Riksbank's purchases of government bonds

Announcement effects on market prices occur when new information is announced and discounted by market participants. Announcements which do not lead to any reaction can be interpreted as such that either the information was already known or the new information did not influence market prices. When studying the effects of the Riksbank's announcements of government bond purchases, we have chosen the four occasions on which the Riksbank announced new government bond purchases. Two of these decisions can be considered best suited for measuring the effect of purchasing government bonds: 18 March and 2 July. These announcements covered relatively large purchases that we deem to have been largely unexpected.

The effects we can identify on the announcement days are, however, not necessarily the total effect of the purchases. Firstly, effects from the measure could also have occurred before the announcement if there had been speculation that the Riksbank would be taking that measure. Effects on assets other than government bonds, via the portfolio channel, could also occur after the announcement. Secondly, the Riksbank's decision concerning the repo rate on the same occasion also affects asset prices and separating the effects coming from these two measures is a delicate task. Based on the historical correlations between the repo rate and government bond yields, we can measure whether the effects on government bond yields on the occasions we study were bigger than on announcements that did not involve new bond purchases. In order to do this, we need to determine the extent to which the different repo rate decisions are unexpected, because it is unexpected changes which influence market rates. The unexpected changes are shown in Chart 1, and are calculated as the difference between the actual and expected repo rate decision that we measure using interest rate derivatives. In addition to this, we also control for changes in the repo rate path and for movements in international interest rate movements and their historical correlations with Swedish government bond yields.

Government bond yields fell

The announcements in February, March and July led to clear falls in government bond yields, see Table 1 and Chart 2.¹³ During the announcement days, government bond yields fell in total by around 30 points. The assessment is that this was largely an effect of both a lower repo rate and announced purchases of government bonds.

11. See for example Baumeister and Benati (2013), Christensen and Rudebusch (2012), Chung, Laforde, Reifschneider and Williams (2012), Curdia and Ferrero (2013), Gagnon, Raskin, Remache and Sack (2011), Ihrig, Klee, Li, Schulte and Wei (2012), Li and Wei (2014) and Williams (2014). Several of these studies have analysed these announcement effects in the same way we do.

12. For further discussion about the consequences for financial stability due to lower interest rates, see the Financial Stability Report 2015:1.

13. We study changes in market prices from closure the previous day up to closure on the same day as the announcement.

Table 1. Changes in market listings immediately after Riksbank monetary policy meetings with announced government bond purchases

Basis points and percentage change

	12-FEB	18-MAR	29-APR	2-JUL	TOTAL
2-year government bond	-12	-10	+5	-11	-28
5-year government bond	-16	-12	+7	-13	-34
10-year government bond	-11	-15	+7	-9	-28
Yield differential Sweden-Germany, 2-year	-12	-8	+1	-10	-29
Yield differential Sweden-Germany, 5-year	-14	-7	-2	-14	-37
Yield differential Sweden-Germany, 10-year	-8	-7	-6	-11	-32
2-year mortgage bond	-9	-10	+3	-11	-27
5-year mortgage bond	-10	-11	+8	-7	-20
5-year corporate bond	-8	-12	+7	-4	-17
Krona index (KIX)	+1.2%	+1.1%	-1.4%	+1.4%	+2.3%
SEK per EUR	+1.4%	+1.3%	-0.9%	+1.4%	+3.2%
SEK per USD	+0.8%	+0.9%	-2.5%	+1.4%	+0.6%

Note. The changes refer to the difference between the closing figure from the previous day up to the closing figure on the same day. All bond yields are interpolated to fixed maturities and calculated as zero coupon yields. Positive exchange rate fluctuations are the same as a depreciation of the krona.

Sources: The Riksbank, Macrobond and Thomson Reuters

In **February** the Riksbank lowered the repo rate by 10 basis points, of which 4 were unexpected. This was no great surprise historically speaking (see Chart 1), but the Riksbank also announced that it would purchase government bonds with maturities up to 5 years for SEK 10 billion, and that if necessary it would take further measures (for example more purchases or interest rate cuts), even between the ordinary monetary policy decisions. The large falls in government bond yields during that day are judged to be a result of this communication regarding potential further measures.

Based on historical patterns, 5- to 10-year yields would have fallen by around 4-5 basis points each as a result of the surprising repo rate decision and interest rate adjustments abroad, see Chart 3a. However, the actual decline was 16 and 11 basis points respectively, and we link the extra effect to the Riksbank's communication. It was both a question of expectations surrounding a lower repo rate over a longer period and expectations that there could be further bond purchases in the future. The announced purchase volume was most likely unexpected, but only represented a small part of the announcement effect as the volume was relatively small.

In order to understand the yield change more clearly, we use financial models for the yield curve which divides up a long-term yield into two parts: the expected average short-term yield (controlled by traditional monetary policy) and a premium.¹⁴ We then analyze the average effects we see in the models on Swedish government bond yields. The analysis shows that a large proportion of the interest rate adjustments were due to expectations of a lower future repo rate level, see Charts 4a-c. This implies that if the purchases of government bonds played a part in February, this occurred mainly via the signalling channel and to a lesser extent via a change in the premiums.

In mid-**March**, between two regular monetary policy meetings, the Executive Board decided to cut the repo rate by a further 15 basis points, to increase purchases of government bonds by SEK 30 billion and to also purchase bonds with maturities longer than 5 years. There had been speculations among market participants that the rapid strengthening of the krona at the beginning of the month could lead to the Riksbank acting prematurely, but there was no indication in market pricing of expectations of any kind of repo rate cut before the next ordinary monetary policy decision. The repo rate cut was therefore totally unexpected, which can be seen in Chart 1. Interest rates fell sharply after the announcement of the decision. On this occasion, a greater fall occurred in *long-term* government bond yields, which could be linked to the Riksbank's announcement that it would also purchase bonds with maturities longer than 5 years. The long-term bond yields were affected more than

14. See the article "Perspectives on monetary policy expectations and forward rates" in Monetary Policy Report, February 2013, for a discussion about this decomposition. We use two varieties of this kind of model, which have been applied to Swedish zero coupon yields for government bonds. The first is based on Joslin, Singleton and Zhu (2011), and the other is based on Bauer, Rudebusch and Wu (2012).

could have been expected based on the historical correlation between an unexpected repo rate adjustment and government bond yield adjustments, even after we check for the effect of international interest rate adjustments. See Chart 3b. The 10-year yield fell by 15 basis points and 5 of these are assessed as being due to the announced purchases. On this occasion effects seem to have occurred mainly through an adjustment in premiums which drove long-term yields down, which would suggest that the effect of the Riksbank's announcement happened by reducing the available volume of government bonds for private investors and thereby lowering interest rates.¹⁵

When, contrary to market expectations, the repo rate was not cut at the monetary policy meeting in **April**, government bond yields actually rose instead. Our measure of how surprised market participants were shows that the repo rate was 7 basis points higher than expected. New purchases of SEK 40-50 billion were of course announced, but this was in all likelihood expected to a large extent, as a number of market participants had speculated about further purchases. The government bond yields increased by 5 to 7 basis points across all maturities. Almost the entire reaction to government bond yields can be explained by the surprise caused by the repo rate decision and a normal reaction to simultaneous fluctuations in foreign interest rates, see Chart 3c. The announced purchases do not therefore appear to have contributed to the announcement effect, which confirms that the purchases were already discounted in government bond yields.

The decision announced on 2 **July** was to cut the repo rate by 10 basis points and to purchase government bonds for a further SEK 45 billion up until the end of the year (135 billion in total). The rate cut came largely as a surprise to market participants, where 9 basis points out of 10 were unexpected, which contributed to the fall in government bond yields. The falls in the 5- and 10- year yields were 13 and 9 basis points respectively, which is 8 and 6 basis points greater respectively than the average historical reaction, see Chart 3d. Market participants speculations ahead of the decision were that further government bond purchases were possible, but our assessment is that there were relatively few participants who considered this as their main scenario. For this reason, a large proportion of the announced 45 billion can be considered a surprise, which contributed to the relatively large reaction we saw in long-term government bond yields.

All in all, the analysis indicates that the Riksbank's bond purchases have had an effect on government bond yields. On the one hand this appears to be due to premium adjustments. However, the purchases also appear to have been interpreted to a certain extent as a signal that the repo rate is expected to remain low for a long time.

Big movements in the krona and shrinking yield differential compared to Germany

An important factor in the Executive Board's decision to purchase government bonds has been to avoid letting the krona strengthen too much in relation to the Riksbank's forecast, in a situation where inflation has already been low for a long time. When the European Central Bank launched an extensive asset purchasing programme at the beginning of the year, there was a risk of a general depreciation of the euro leading to a stronger krona. The Riksbank's measures in 2015 have contributed to a fall in yield differentials in relation to other countries and ensured that the krona has not strengthened too quickly, which is important if inflation is to be able to rise towards the Riksbank's target.

In connection with the announcement of the Riksbank's purchases, the yield differentials between Swedish and German government bonds have fallen, which we deem to be due to the Riksbank's monetary policy. The yield differentials fell after the decisions in February, March and July, while the announcement in April left the yield differentials on bonds up to 5 years basically unchanged while the 10-year yield differential fell slightly, see Chart 5. To a large extent, the change in yield differentials

¹⁵. See Alsterlind, Erikson, Sandström and Vestin (2015).

after the announcement in April were a result of a sharp rise in German bond yields during the day the announcement was made. Otherwise, the change in yield differentials on these days has mainly been driven by Swedish monetary policy, in the form of both repo rate cuts and the purchase of government bonds (see above).

There have been big exchange rate fluctuations in connection to all monetary policy decisions during the period. For example, in connection with the decision on 18 March, the krona depreciated by about 1 per cent, and after the decision on 2 July, it weakened by about 1.5 per cent, see Table 1 and Chart 6a-c. Given historical links between changed yield differentials in relation to other countries and the exchange rate, the latter has moved in the expected direction on the announcement days but the movements have been slightly larger than normal.¹⁶ Since the Riksbank's bond purchases have had an impact on government bond yields and yield differentials in relation to other countries, our assessment is that the impacts of the announcements on the exchange rate depends partly on the government bond purchases.

Difficult to assess effects on yields and prices of more risky assets

The yields on mortgage and corporate bonds have generally followed government bond yields after the Riksbank's announcements in 2015, see Table 1 and Chart 7.¹⁷ Yields on such bonds with longer maturities, 5 years, have moved less than yields on equivalent government bonds, however, and the yield differential between higher-risk bond types and government bonds has therefore increased slightly on these occasions.

A broad index for the Swedish stock market has moved in line with other European markets on announcement days but the upturns in connection to the decisions in February and March were greater in Sweden than on other major European stock markets.

Yields and prices of high-risk assets have been influenced by the Riksbank's announcements, but it is difficult to show that the government bond purchases have had larger effects than the effects that cuts to the repo rate normally have on these assets. It is likely, however, that the Riksbank's purchases have a gradual influence on high-risk assets, via the portfolio channel, which makes it difficult to measure the effect by only studying the announcement dates.¹⁸

Inflation expectations have stabilised

We evaluate the effect on inflation expectations using two measures: questionnaire surveys and the inflation compensation which constitutes the difference between yields on nominal and real government bonds. The survey measures cannot be used to study the effects of announcements, but in Chart 8 we can see that inflation expectations from the Prospera survey were falling right up until the Riksbank's decision in February. Since then, most of these measures have stabilised or risen slightly. We see the same pattern for the inflation compensation measures in Chart 9. These measures, which we can follow on a day-to-day basis, rose most often in connection with the announcements of new government bond purchases and interest rate cuts, especially after the announcement in March. Even though it is difficult to determine what proportion of these effects on the inflation compensation are due to unexpected repo rate changes and unexpected government bond purchases respectively, these measures nevertheless indicate that the announced monetary policy in its entirety has contributed to a stabilisation in inflation expectations. This also means that real rates have fallen in connection with the announcements.

16. This is also true if you look at exchange rate movements in relation to surprises in the repo rate.

17. We have chosen not to study the effects of announcements on lending rates to households and companies since these are normally adjusted with a time lag, which makes it difficult to link changes to the Riksbank's purchases.

18. To study the portfolio channel more closely, we need to estimate how these prices and yields would have developed if the Riksbank had *not* bought government bonds and in this way be able to compare with the actual development.

The effects of the Riksbank's purchases on a par with those of other central banks

The analysis above gives us an idea of how much the Riksbank's purchases have influenced the yields on government bonds when the announcements were made. So that we, in the next stage, can compare *the effectiveness* of the measures with international experiences, we need to consider how surprised market participants were by the size of the announced purchases. In this way, we can calculate measures that show how large the effect on government bond yields are for a certain volume of unexpected purchases.

As mentioned earlier, we have attempted to assess the degree to which the announced purchases were expected. It would have been desirable to have more exact and quantitative data on the expectations of purchases, but we will have to make do with estimates based on comments and market newsletters from market participants and we therefore give these estimates as intervals.¹⁹

Here we have chosen to focus on the two announcements with the biggest and most evident surprises regarding government bond purchases, the March and the July announcements, see Table 2.²⁰ The decision to extend purchases by SEK 30 billion that was announced in March 2015, between two regular monetary policy meetings, can be considered unexpected to a high degree. There was some speculation among market participants beforehand, but their comments after the announcement nevertheless indicated that the announced purchase was largely unexpected. Our assessment is therefore that SEK 20-30 billion were unexpected. The decision taken in July, to purchase a further SEK 45 billion, is also assumed to have been unexpected to a large extent. Some market participants felt that there was some likelihood of further purchases being announced, but the consensus nevertheless was that it would not happen.²¹ We assess SEK 25-40 billion of the announced amount to have been unexpected.

Table 2 presents a comparison of the standardised announcement effects on 10-year government bond yields from purchases of government bonds in March and June respectively, with the corresponding effects of the Federal Reserve's government bond purchases in the US.²² We create the comparison by standardising the effect so that it is given as basis points per unexpected purchase worth 4 per cent of GDP, which for Sweden represents SEK 160 billion.²³ The two differing calculations paint largely the same picture. The 10-year yields are calculated to have fallen by 24 to 35, or by 19 to 30, basis points respectively for purchases worth 4 per cent of GDP, which is close to the results of international studies which principally fall within an interval of 20 to 40 basis points.²⁴

According to our calculations, the total effect of the announced purchases of SEK 135 billion, which corresponds to about 4 per cent of GDP in market value and coincides with our standardisation, should have pushed down 10-year government bond yields by 19 to 35 basis points.²⁵ The total calculated effect is therefore independent of how

19. To get a complete picture of the expectations relating to government bond purchases, information is needed about expectations regarding the size of the purchases, their distribution over time and the holding period, for example by surveying market participants.

20. If we include the announcements in February and April, where the unexpected purchase volume can be assumed to be relatively small, we risk obtaining misleading results. When we standardise the effect of the purchases, making an assumption that the effects are linear in relation to the volume, minor measurement errors can be amplified and take on too much significance.

21. For example, in a questionnaire answered by investors conducted by SEB, only 15 per cent of respondents said that they believed further purchases would be announced.

22. The studies we use to represent the international results are: Baumeister and Benati (2013), Christensen and Rudebusch (2012), Chung, Laforte, Reifschneider and Williams (2012), Curdia and Ferrero (2013), Gagnon, Raskin, Remache and Sack (2011), Ihrig, Klee, Li, Schulte and Wei (2012), and Li and Wei (2014). See also Williams (2014) for a similar summary.

23. We choose to standardise based on the market-valued purchases as a percentage of GDP in order to relate the purchases to the size of the economy. We could also standardise the purchases in other ways, for example as a proportion of outstanding stock. The standardisation is based on an assumption that the effects can be scaled up and down in a linear manner. If the effects are decreasing or increasing in relation to the purchase volume, this type of calculation is a misleading indicator of the effectiveness of the purchases.

24. The Swedish result calculations are of course sensitive to the assumptions made as regards how much of the announced volumes were unexpected, and to how the methods are designed for isolating the part of the announcement effect that comes from the bond purchases.

25. The quantitative estimate of the effect is presented as an interval and is dependent on our assumption regarding the extent to which the announced purchases were unexpected and which of the two announcement dates we choose to study.

big the effects were on the announcement days. Our assessment is that the impact of the purchases on yields is the same regardless of whether market participants factor in new purchases before or in connection with their announcement. The international upturn in long-term yields during the spring has helped to push Swedish long-term government bond yields higher than they were before the Riksbank started buying government bonds. However, the government bond yields are probably lower than they would have been without the purchases and our interpretation of the results also indicates that the purchases have helped to hold down the yield differentials in relation to other countries and have led to a weaker krona than otherwise would have been the case.²⁶

Table 2. A comparison of standardised effects on government bond yields

	RIKSBANK ANNOUNCEMENT 18 MARCH	RIKSBANK ANNOUNCEMENT 2 JULY	INTERNATIONAL STUDIES
Unexpected share of the announced purchases*	20-30 billion	25-40 billion	
Approximate market value**	24-36 billion	30-48 billion	
10-YEAR GOVERNMENT BOND YIELD			
Announcement effect of announced purchases***	-5 bp	-6 bp	
Yield change per 160 billion or 4% of GDP in unexpected purchases (market-valued)****	-24 to -35 bp	-19 to -30 bp	≈-20 to -40 bp

Note. * Our assessments based on market participants' market newsletters and comments before and after the decision. Purchase volumes are given in nominal amounts.

** The market value is calculated based on the assumption that it is 20 per cent higher than the nominal amount, which tallies with the Riksbank's holdings at the end of September.

*** Yield changes refer to changes in interpolated zero coupon yields with fixed maturities. The part of the changes linked to the Riksbank's announced purchases is calculated as the part that cannot be explained by changes in the repo rate or foreign interest rates.

**** The standardised yield change is calculated by multiplying the yield change caused by announced purchases by the ratio of 160 billion to the market value for the unexpected part of the purchase volume. The interval for the standardised yield change from studies of the Federal Reserve's government bond purchases is based on: Baumeister and Benati (2013), Christensen and Rudebusch (2012), Chung, Laforte, Reifschneider and Williams (2012), Curdia and Ferrero (2013), Gagnon, Raskin, Remache and Sack (2011), Ihrig, Klee, Li, Schulte and Wei (2012), and Li and Wei (2014). The mean value for these studies is 33 basis points and only one or two studies fall outside the given interval. See also Williams (2014) for a similar summary.

Source: The Riksbank

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26. For example, the 10-year yield differential with Germany (which can be assumed to be more affected by government bond purchases than by repo rate cuts) was 11 basis points on average in July, August and September 2015, compared with 33 basis points on average in November, December 2014 and January 2015, before the Riksbank began its purchases.

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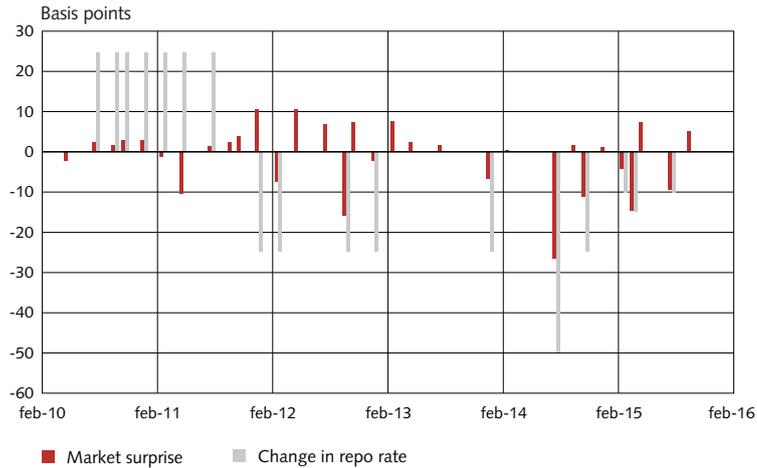
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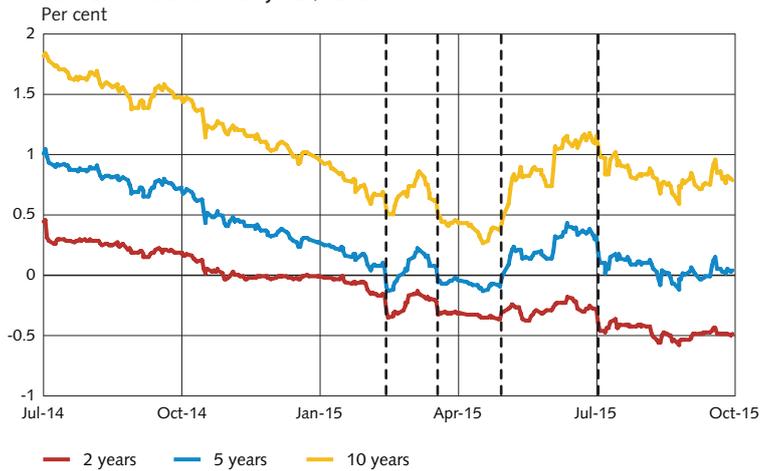
Charts

Chart 1. Repo rate changes and market surprises at monetary policy announcements since 2010



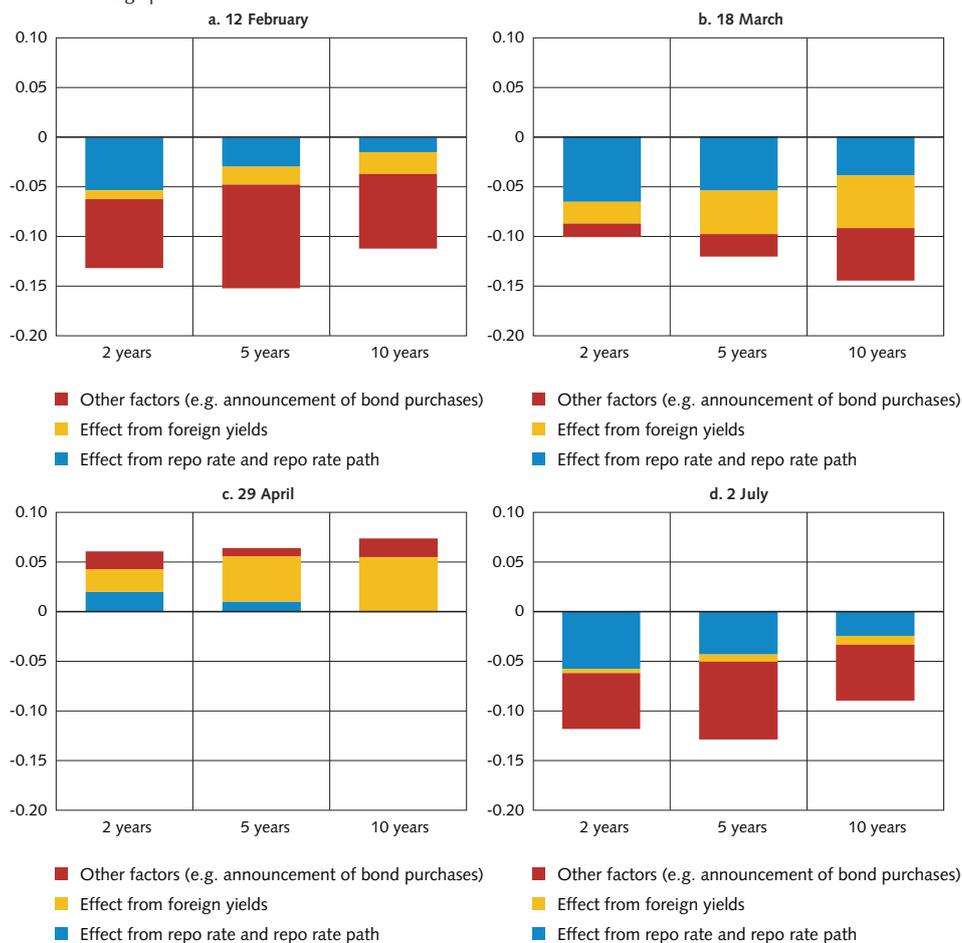
Note. The market surprise is here defined as difference between the decided change in the repo rate and the expected change according to market pricing. It is calculated ex post based on the change in yield on a 1-month STINA-swap just before to just after the announcement, which normally comes at 9.30 am (decision on 18 March announced in the afternoon). See Kuttner (2001) for the general calculation principle.
Source: The Riksbank

Chart 2. Government bond yields, Sweden



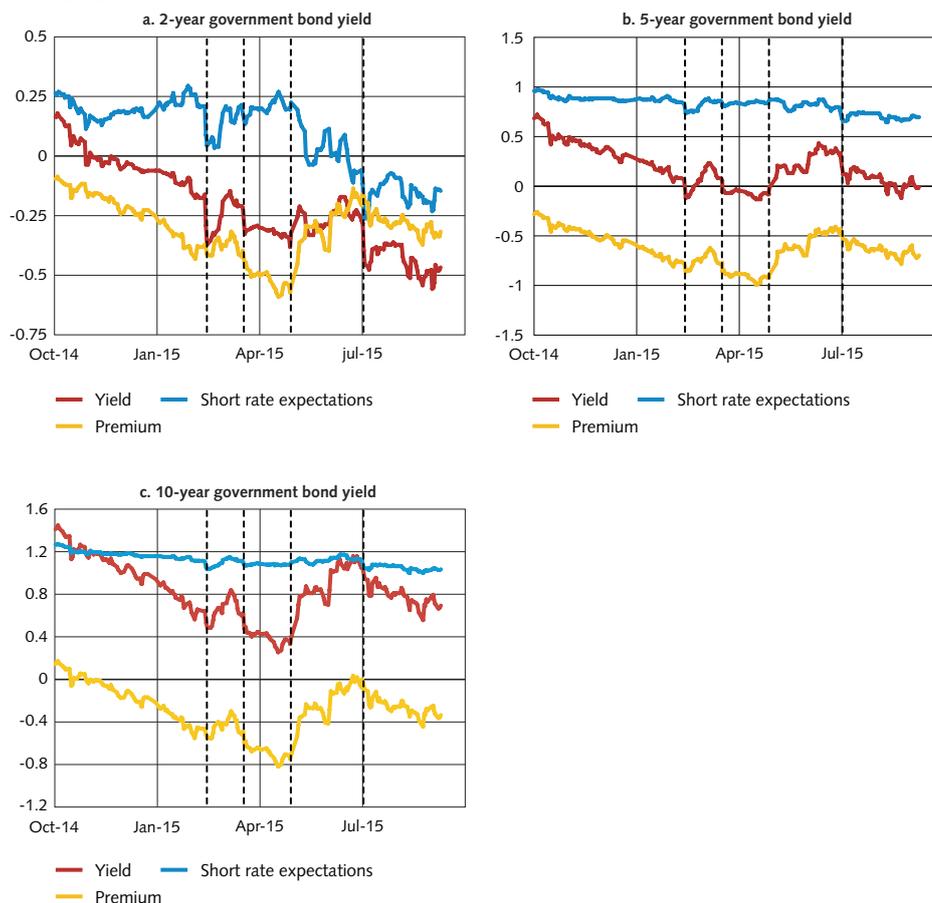
Note. All bond yields are interpolated to fixed maturities and calculated as zero coupon yields. Vertical lines mark announcements of government bond purchases.
Source: The Riksbank

Chart 3. Explanatory factors for changes in government bond yields on announcement days
Percentage points



Note. Zero coupon yields for Swedish government bonds. The division into factors which have contributed to the change is based upon an explanatory model which is in turn based on the yield change being influenced by conventional monetary policy on monetary policy announcement days (unexpected changes to the repo rate and changes to the Riksbank's repo rate path), along with changes to foreign government bond yields (captured by KIX4-weighted yields with a 5-year maturity). The part of the yield change which cannot be linked to these factors is due to other events. In this study, we interpret that part as the announcement effect which occurred due to the Riksbank's announced purchases of government bonds on the same day. The historical correlations have been estimated separately for each maturity and refer to all monetary policy decision dates during the period 2003 to 2014. Source: The Riksbank

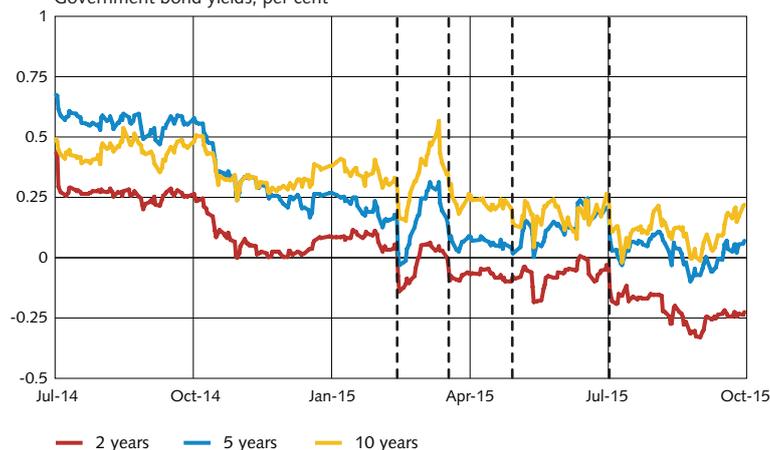
Chart 4. Decomposition of government bond yields
Per cent



Note. A government bond yield can be divided into two components: The expected return from continuous investment at a short-term rate, and a premium which can be influenced by supply and demand factors for government bonds, for example. The current decomposition is an average of the decomposition done with two financial models for the yield curve. The first is based on Joslin, Singleton and Zhu (2011), and the other is based on Bauer, Rudebusch and Wu (2012). All bond yields are interpolated to fixed maturities and calculated as zero coupon rates. Vertical lines mark announcements of government bond purchases.

Source: The Riksbank

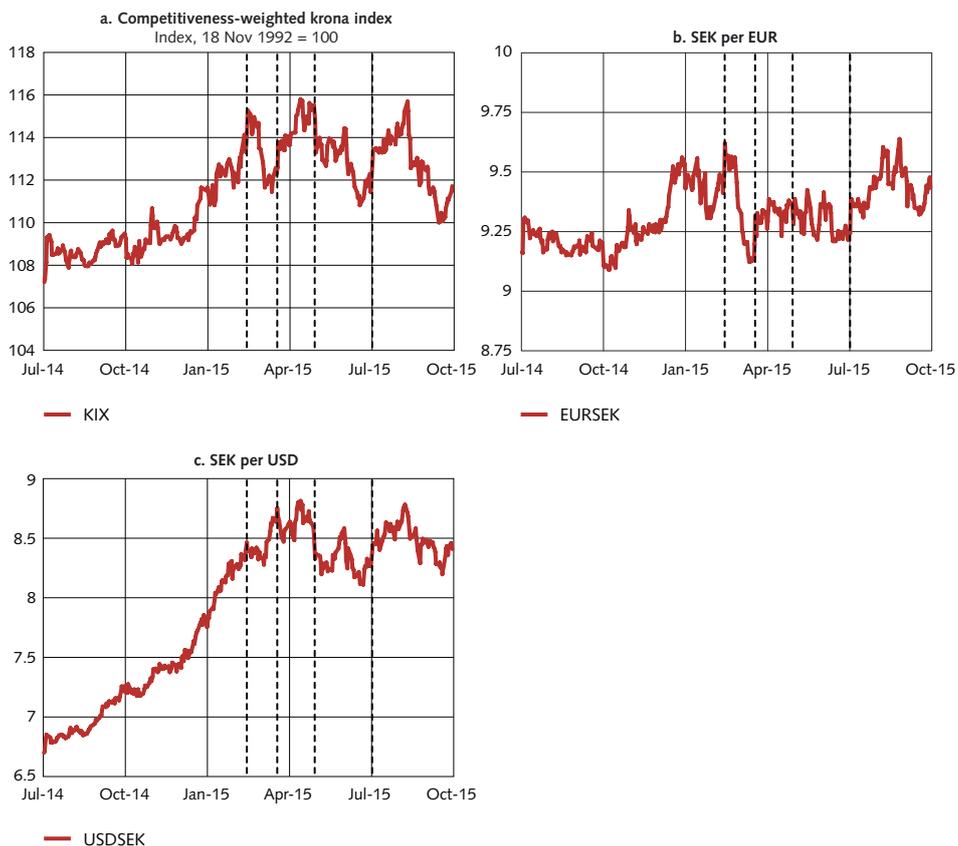
Chart 5. Yield differential with Germany
Government bond yields, per cent



Note. Yield differentials between Sweden and Germany. All bond yields are interpolated to fixed maturities and calculated as zero coupon yields. Vertical lines mark announcements of government bond purchases.

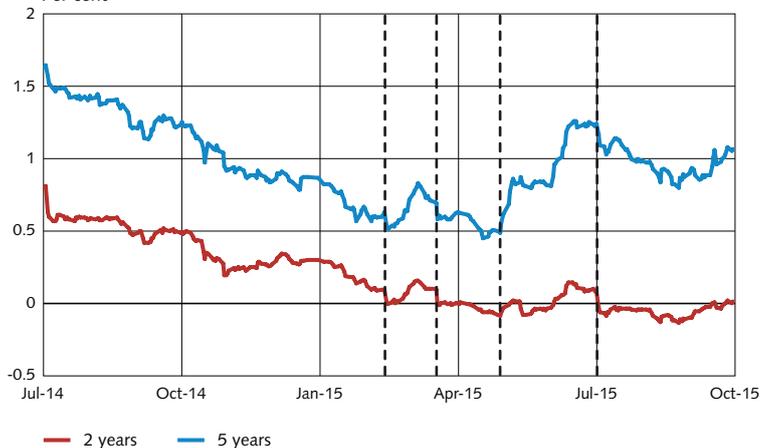
Source: The Riksbank and Reuters

Chart 6. Exchange rate



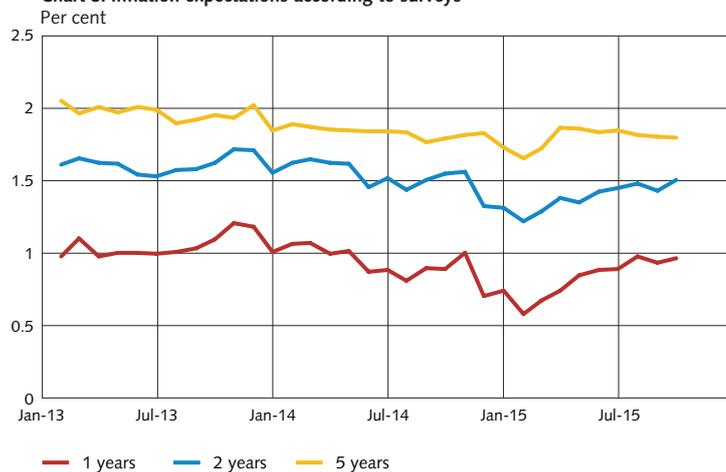
Note. Nominal competitiveness-weighted krona index calculated daily and based on a fixing rate that is submitted by the Swedish banks at 9.15-9.45 am to NASDAQ OMX. The krona against the euro and dollar are closing rates. Vertical lines mark announcements of government bond purchases.
Source: The Riksbank & Macrobond

Chart 7. Mortgage bond yields, Sweden
Per cent



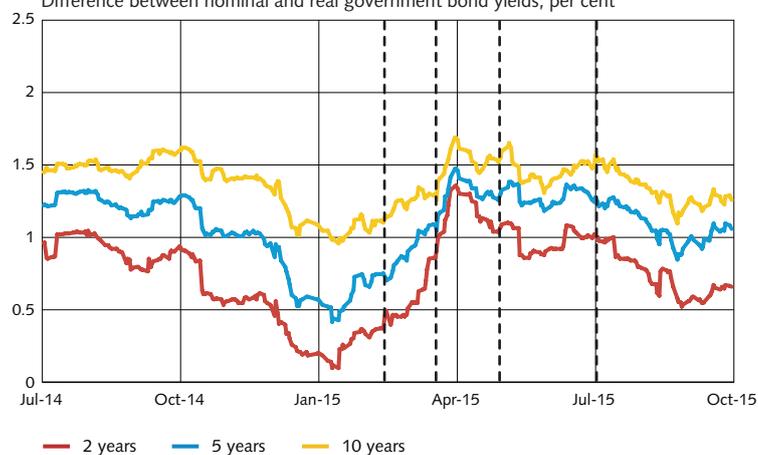
Note. All bond yields are interpolated to fixed maturities and calculated as zero coupon yields. Vertical lines mark announcements of government bond purchases.
Source: The Riksbank

Chart 8. Inflation expectations according to surveys



Note. Mean value for money market participants. Refers to CPI.
Source: TNS Sifo Prospera

Chart 9. Inflation compensation in nominal government bonds
Difference between nominal and real government bond yields, per cent



Note. Calculated as the yield differentials between nominal and real government bonds and refers to the CPI. Could be seen as a rough measure of inflation expectations, but could also be influenced by other factors. All bond yields are interpolated to fixed maturities and calculated as zero coupon yields. Vertical lines mark announcements of government bond purchases.
Source: The Riksbank