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# **Market Participants' Forecasts of Financial Variables – Can Survey Data Outperform the Random Walk?**

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# Market Participants' Forecasts of Financial Variables – Can Survey Data Outperform the Random Walk?\*

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## Abstract

In this paper, we evaluate the forecasting precision of survey expectations of the four financial variables in the Prospera survey commissioned by Sveriges Riksbank – one of Sweden's most important economic surveys. Our analysis shows that the market participants in the survey are able to significantly outperform the random walk for only one horizon and variable, namely the three-month horizon for the repo rate. At the longest horizon for the repo rate, and at all horizons for the five-year government bond yield, the random walk significantly outperforms the market participants. For the exchange-rate data studied – SEK/USD and SEK/EUR – no significant differences in forecasting precision can be established. It accordingly seems that while the Prospera survey might be informative regarding the market participants' expectations, it does not carry much information about the actual future developments of the exchange rates and interest rates covered by the survey.

*JEL Classification:* E47, G17

*Keywords:* Out-of-sample forecasts, Exchange rates, Interest rates

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# 1. Introduction

The expectations of financial market agents regarding macroeconomic developments are generally of interest to policy makers such as central banks – a fact which lies behind surveys such as the Federal Reserve Bank of New York’s *Survey of Market Participants*. But while it, since actions tend to depend on expectations, is relevant for policy makers to know what these market participants think, it is less clear if these survey expectations carry much information about the actual future developments of the variables they refer to.

In this paper we address the issue of the forecasting performance of survey data which rely on financial market participants as respondents. More specifically, we assess the forecasting precision regarding the four financial variables – two exchange rates and two interest rates – in Sveriges Riksbank’s survey on inflation expectations, commonly referred to as “*the Prospera survey*”. As has been well known for decades now, financial variables such as exchange rates and interest rates are difficult to forecast and it is a challenging task to outperform a random-walk forecast.<sup>1</sup> Our focus is accordingly to establish whether the survey forecasts’ forecasting precision is superior to that of the random-walk benchmark. By providing information concerning this, we follow a line of research which similarly has studied the forecasting properties of survey expectations of exchange rates and interest rates; see, for example, Friedman (1979, 1980), Dominguez (1986), Greer (2003), Mitchell and Pearce (2007) and Ince and Molodtsova (2017).<sup>2</sup>

## 2. Data

The Prospera survey began in 1995 in response to Sweden’s adoption of an inflation-targeting regime. It started out with a focus on inflation expectations but has been augmented at several time points; the first financial variable was added in 1998. Currently, approximately 200 respondents take part in the survey. These are divided into five categories: money-market players, employee organisations, employer organisations, manufacturing companies and trade companies. Our focus will be on the respondents in the survey who participate in financial markets, that is, the money-market players; these constitute around a quarter of the total number of respondents.

We evaluate expectations for the four financial variables in the survey. These are the SEK/USD and SEK/EUR exchange rates, the five-year government bond yield and the repo rate (which is the policy rate of

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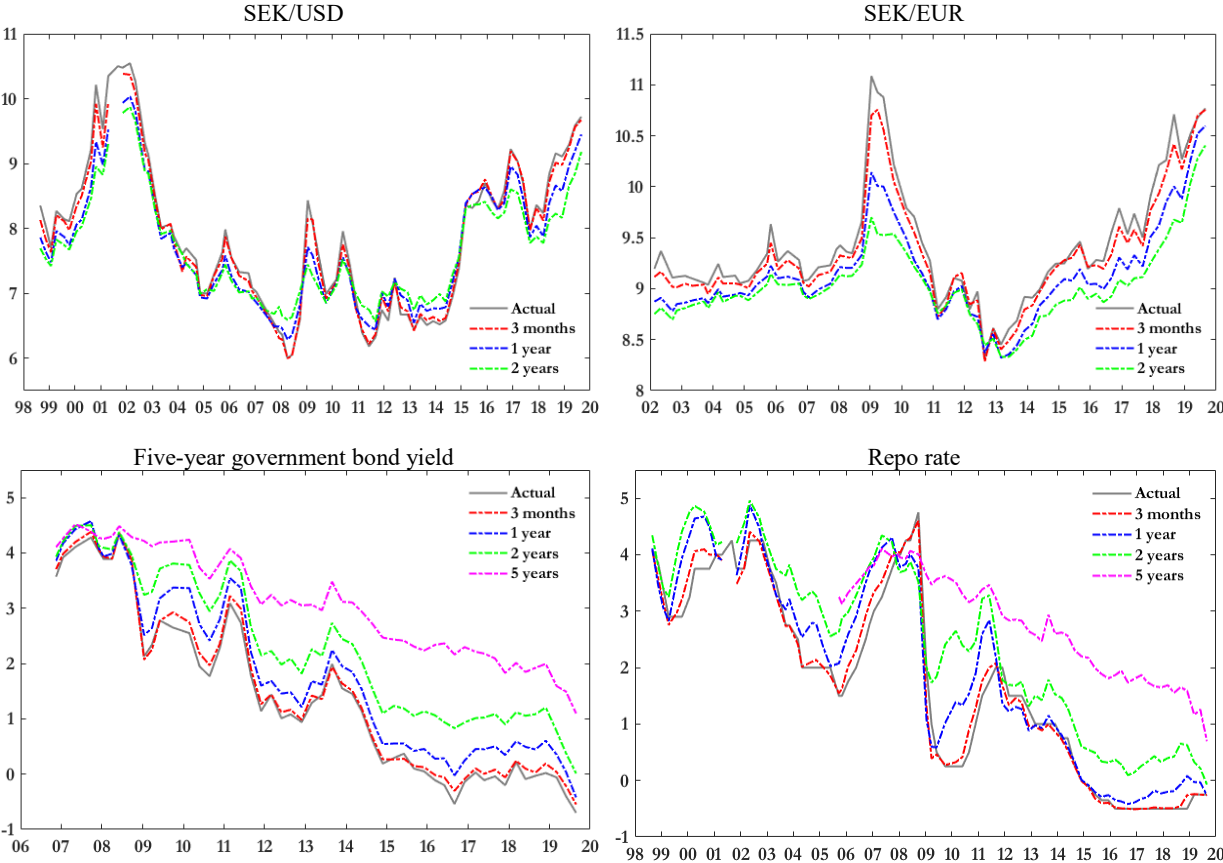
<sup>1</sup> See Elliott and Baier (1979) and Meese and Rogoff (1983a, 1983b) for important early contributions. More recent additions to a fairly voluminous literature documenting this includes Duffee (2002), Diebold and Li (2006), Bauer (2017), Kunze (2019) and Ren *et al.* (2019). Rossi (2013) provides a good overview on exchange-rate prediction in which she also neatly summarises the general finding in this field (p. 1063): “... *that the answer to the question: ‘Are exchange rates predictable?’ is, ‘It depends’...*”.

<sup>2</sup> In addition, our study is related to those of Jonsson and Österholm (2011, 2012) where the expectations in the Prospera survey concerning inflation and wage growth were analysed.

Sveriges Riksbank). For the two exchange rates, respondents state their expectations for three different horizons: three months, one year and two years; for the five-year government bond yield and the repo rate, they in addition state their expectation for the five-year horizon. It should be noted that respondents who are not money-market players only answer the question concerning the repo rate.

We study the time series that receive the primary attention in this survey, namely those created by taking the mean over respondents at each point in time.<sup>3</sup> The survey was originally conducted four times per year but since September 2009, the money-market players are interviewed every month.<sup>4</sup> We accordingly employ both quarterly and monthly series; details regarding the different samples are given in Tables 1 and 2 below. Quarterly data for money-market players are shown in Figure 1. Monthly data for money-market players and quarterly data concerning the repo-rate expectations for all five categories of respondents can be found in Figures A1 and A2 in the appendix respectively.

**Figure 1. Expectations of money-market players – quarterly data.**



Note: Percent on vertical axes for five-year government bond rate and repo rate.

<sup>3</sup> Micro data for each respondent are not publicly available. Summary measures – such as the mean, median, lowest value, highest value and standard deviation – are what is being published and discussed, with a strong focus on the mean.

<sup>4</sup> In 2001, the survey was only conducted three times though.

### 3. Empirical analysis

We denote by  $\hat{y}_{t+h|t}^x$  the forecast at horizon  $h$  generated at time  $t$  by “forecaster”  $x$ ,  $x \in \{Prospera, RW\}$ . The random-walk forecast – which sometimes is called a naïve forecast – simply states that the future value will be equal to the last observed value for the variable in question; we accordingly construct it by setting  $\hat{y}_{t+h|t}^{RW} = y_t$ , where  $y_t$  is the value observed at the close of business on the day the survey was conducted.

For horizon  $h$  we evaluate  $N_h$  forecasts generated at dates  $t_1, t_2, \dots, t_{N_h}$ . The forecast  $\hat{y}_{t_i+h|t_i}^x$  is compared to the outcome  $y_{t_i+h}$  and we calculate the forecast error as  $e_{t_i+h|t_i}^x = y_{t_i+h} - \hat{y}_{t_i+h|t_i}^x$ . In order to compare forecasting precision, we calculate root mean squared forecast errors ( $RMSFE_h^x$ ) as

$$RMSFE_h^x = \sqrt{\frac{1}{N_h} \sum_{i=1}^{N_h} (e_{t_i+h|t_i}^x)^2}. \quad (1)$$

For all four variables, we compare the forecasting precision of the money-market players’ survey expectations with that of a random-walk forecast in Table 1. In Table 2, we report the forecasting precision of the repo-rate expectations of all respondent groups and the random-walk forecast.

We also conduct a Diebold-Mariano test (Diebold and Mariano, 1995) to assess whether differences in forecasting precision are statistically significant. Consistent with our use of the RMSFE as an evaluation criterion, the test is conducted assuming a quadratic loss function. That is, we run the regression

$$\left(e_{t+h|t}^{Prospera}\right)^2 - \left(e_{t+h|t}^{RW}\right)^2 = c + v_{t+h}, \quad (2)$$

where  $c$  is a regression intercept, and  $v_{t+h}$  is an error term. The test statistic is the  $t$ -statistic on the regression intercept  $c$ .<sup>5</sup> Results from the Diebold-Mariano test are shown in Tables 3 and 4.

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<sup>5</sup> Newey-West standard errors are used to calculate  $t$ -statistics.

**Table 1. RMSFEs – money-market players for all financial variables in the Prospera survey.**

	Monthly			Quarterly		
	Sample	Prospera	Random walk	Sample	Prospera	Random walk
<b>SEK/USD</b>						
3 months	2009M09-2019M07 (119)	0.367	0.364	1998Q3-2019Q2 (83)	0.424	0.426
1 year	2009M09-2018M10 (110)	0.761	0.789	1998Q3-2018Q3 (80)	0.957	0.987
2 years	2009M09-2017M10 (98)	0.942	1.046	1998Q3-2017Q3 (76)	1.231	1.334
<b>SEK/EUR</b>						
3 months	2009M09-2019M07 (119)	0.260	0.241	2002Q1-2019Q2 (70)	0.306	0.282
1 year	2009M09-2018M10 (110)	0.597	0.493	2002Q1-2018Q3 (67)	0.638	0.575
2 years	2009M09-2017M10 (98)	0.899	0.725	2002Q1-2017Q3 (63)	0.839	0.784
<b>Five-year bond yield</b>						
3 months	2009M09-2019M07 (119)	0.392	0.347	2006Q4-2019Q2 (51)	0.484	0.453
1 year	2009M09-2018M10 (110)	0.999	0.735	2006Q4-2018Q3 (48)	1.028	0.832
2 years	2009M09-2017M10 (98)	1.768	0.964	2006Q4-2017Q3 (44)	1.692	1.080
5 years	2009M09-2014M10 (62)	3.509	1.931	2006Q4-2014Q3 (32)	3.315	2.106
<b>Repo rate</b>						
3 months	2009M09-2019M07 (119)	0.107	0.193	1998Q3-2019Q2 (83)	0.339	0.421
1 year	2009M09-2018M10 (110)	0.501	0.600	1998Q3-2018Q3 (80)	0.923	1.083
2 years	2009M09-2017M10 (98)	1.310	0.898	1998Q3-2017Q3 (76)	1.646	1.569
5 years	2009M09-2014M10 (62)	3.385	1.551	2005Q3-2014Q3 (37)	3.004	1.779

Note: Sample dates refer to when the survey was conducted. RMSFEs are given in percentage points for five-year government bond yield and repo rate. Number of observations,  $N_h$ , in parentheses ().

**Table 2. RMSFEs – different respondent groups for the repo rate.**

Horizon	Sample	Money market	Employee	Employer	Manufacturing	Trade	Random walk
3 months	2006Q4-2019Q2 (51)	0.382	0.396	0.396	0.401	0.395	0.462
1 year	2006Q4-2018Q3 (48)	0.979	1.083	1.078	1.113	1.090	1.212
2 years	2006Q4-2017Q3 (44)	1.822	1.785	1.812	1.783	1.804	1.688
5 years	2006Q4-2014Q3 (32)	3.127	2.635	2.745	2.570	2.621	1.901

Note: Quarterly data. Sample dates refer to when the survey was conducted. RMSFEs are given in percentage points. Number of observations,  $N_h$ , in parentheses ().

**Table 3. Results from Diebold-Mariano tests – money-market players versus random-walk forecast for all financial variables in the Prospera survey.**

	Monthly		Quarterly	
	Sample	$\hat{c}$	Sample	$\hat{c}$
<b>SEK/USD</b>				
3 months	2009M09-2019M07 (119)	0.00	1998Q3-2019Q2 (83)	-0.00
1 year	2009M09-2018M10 (110)	-0.04	1998Q3-2018Q3 (80)	-0.06
2 years	2009M09-2017M10 (98)	-0.21	1998Q3-2017Q3 (76)	-0.26
<b>SEK/EUR</b>				
3 months	2009M09-2019M07 (119)	0.01	2002Q1-2019Q2 (70)	0.01
1 year	2009M09-2018M10 (110)	0.11	2002Q1-2018Q3 (67)	0.08
2 years	2009M09-2017M10 (98)	0.28	2002Q1-2017Q3 (63)	0.09
<b>Five-year bond yield</b>				
3 months	2009M09-2019M07 (119)	0.03 <sup>b</sup>	2006Q4-2019Q2 (51)	0.03 <sup>a</sup>
1 year	2009M09-2018M10 (110)	0.46 <sup>a</sup>	2006Q4-2018Q3 (48)	0.36 <sup>a</sup>
2 years	2009M09-2017M10 (98)	2.19 <sup>a</sup>	2006Q4-2017Q3 (44)	1.70 <sup>a</sup>
5 years	2009M09-2014M10 (62)	8.58 <sup>a</sup>	2006Q4-2014Q3 (32)	6.55 <sup>a</sup>
<b>Repo rate</b>				
3 months	2009M09-2019M07 (119)	-0.03 <sup>b</sup>	1998Q3-2019Q2 (83)	-0.06 <sup>a</sup>
1 year	2009M09-2018M10 (110)	-0.11	1998Q3-2018Q3 (80)	-0.32
2 years	2009M09-2017M10 (98)	0.91 <sup>b</sup>	1998Q3-2017Q3 (76)	0.25
5 years	2009M09-2014M10 (62)	9.05 <sup>a</sup>	2005Q3-2014Q3 (37)	5.86 <sup>a</sup>

Note: Entries in table give the estimate, denoted by  $\hat{c}$ , of the intercept from the test equation (2). Sample dates refer to when the survey was conducted. a and b indicate significant results at the 1 and 5 percent level respectively based on Newey-West standard errors. Number of observations,  $N_h$ , in parentheses ().

**Table 4. Results from Diebold-Mariano tests – different respondent groups versus random-walk forecast for the repo rate.**

Horizon	Sample	Money market	Employee	Employer	Manufacturing	Trade
3 months	2006Q4-2019Q2 (51)	-0.07 <sup>b</sup>	-0.06 <sup>b</sup>	-0.06	-0.05	-0.06
1 year	2006Q4-2018Q3 (48)	-0.51	-0.30	-0.31	-0.23	-0.28
2 years	2006Q4-2017Q3 (44)	0.47	0.33	0.43	0.33	0.41
5 years	2006Q4-2014Q3 (32)	6.16 <sup>a</sup>	3.33 <sup>a</sup>	3.92 <sup>a</sup>	2.99 <sup>a</sup>	3.26 <sup>a</sup>

Note: Quarterly data. Entries in table give the estimate, denoted by  $\hat{c}$ , of the intercept from the test equation (2). Sample dates refer to when the survey was conducted. a and b indicate significant results at the 1 and 5 percent level respectively based on Newey-West standard errors. Number of observations,  $N_h$ , in parentheses ().



As can be seen from Table 1, the Prospera expectations of the SEK/USD exchange rate show very similar precision to that of a random-walk forecast when looking at the three-month and one-year horizons. At the two-year horizon, the RMSFE of the Prospera expectations are ten (eight) percent lower than those of the random-walk forecast when looking at the monthly (quarterly) data. Regardless of forecasting horizon though, differences are not statistically significant according to the Diebold-Mariano test.

For the SEK/EUR exchange rate, the money-market players as an aggregate have a higher RMSFE than the random walk regardless of forecasting horizon and sample frequency. The differences are fairly large at the one- and two-year horizon for the quarterly data – 21 and 24 percent respectively – but as can be seen from Table 3, they are not found to be statistically significant. Overall, the results regarding the exchange rate expectations do not indicate that the survey expectations are more accurate than a random-walk forecast.

Turning to the five-year government bond yield, the money-market players' expectations are clearly outperformed by the random-walk forecast. The differences in forecasting performance are in all cases significant at the five percent level (or lower). At the two longest horizons, the differences are also highly economically significant. It is very clear that the survey respondents have not anticipated the downward trend in the five-year government bond rate that we have seen during this period.

Concerning the repo-rate expectations, we note that at the two shortest forecast horizons, the Prospera expectations have a lower RMSFE than the random-walk forecast. It is only at the three-month horizon that the difference is statistically significant though (regardless of frequency). However, at the two- and five-year horizons, the random-walk forecast instead has a lower RMSFE than the Prospera expectations. The difference is statistically significant for both sample frequencies at the five-year horizon but only at the monthly frequency at the two-year horizon.

One possible explanation for the finding that the Prospera expectations are better than a random-walk forecast at short horizons but worse at long is that the money-market players put effort into understanding the Riksbank's actions and that this pays off at short horizons. At longer horizons though, the repo rate is a function of variables that the money-market players are not able to predict with high enough precision in order to outperform the random-walk forecast. However, it also seems likely that the commonly made assumption that interest rates are mean reverting may have contributed to the survey expectations' poor performance at long

horizons.<sup>6</sup> Looking, for example, at Figure 1, the expectations of both the repo rate and the five-year government bond yield show clear signs of having some kind of mean reversion built in to them. During the sample, interest rates have typically been lower than what has been considered normal; combining this fact with an assumption of mean reversion is consistent with the survey expectations of both the repo rate and the five-year government bond yield – with only a few exceptions – having been higher the longer the forecast horizon. The assumption of mean-reverting nominal interest rates is certainly not unreasonable. But in the low-interest-rate environment which has been an important feature of the samples studied, it might have made respondents more inclined to predict rising interest rates than what was motivated by the data.

Having compared the money-market players' expectations to the random-walk forecast, we finally compare the repo-rate expectations of all respondents in the survey to the random-walk forecast. Table 2 gives RMSFEs for all respondent groups, as well as that of the random-walk forecast.

All groups have an RMSFE around 15 percent lower than the random-walk forecast's at the three-month horizon; the difference in forecasting precision is only significant (at the five percent level) for money-market players and employee organisations though. At the one-year horizon, most groups have an RMSFE that is around ten percent lower than the random-walk forecast's, except money-market players whose RMSFE is almost 20 percent lower; it can be noted though that none of these differences is statistically significant. At the two-year horizon, the random-walk forecast has the lowest RMSFE but the differences are not very large; the RMSFEs of the five respondent groups are all around six to eight percent higher but none of these differences is statistically significant. Finally, at the five-year horizon, it can be noted that the money-market players – who have the lowest RMSFEs at the two shortest horizons – is the group with the highest RMSFE by far. While the other groups have an RMSFE that is around 40 percent higher than the random-walk forecast's, the money-market players's RMSFE is 64 percent higher. All of these differences are also statistically significant at the one percent level according to the Diebold-Mariano test. We accordingly conclude that at longer horizons the money-market players' expectations do not appear to have much to offer in terms of information about where the repo rate is heading.

## 4. Conclusions

It is a stylised fact that it is difficult to outperform a random-walk forecast when it comes to forecasting exchange rates and interest rates. However, if anyone should be able to succeed in this task, it seems reasonable

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<sup>6</sup> Mean reversion in nominal interest rates is assumed in many economic models, often based on a real interest rate which has a constant steady-state value; see, for example, the discussion in Beechey *et al.* (2009). Empirical support for this assumption is plentiful – Wu and Chen (2001) provide just one example – but it is not undisputed. The fact that nominal interest rates often are modelled as having a unit root offers one illustration of the opposing viewpoint when it comes to the issue of mean reversion; see, for example, Engle and Granger's (1987) seminal paper on cointegration.

to expect it to be professionals with expertise in the field. In this paper we have accordingly evaluated the forecasting precision of the money-market players' expectations of the financial variables in the Prospera survey. Our results show that the survey participants are able to significantly outperform a random-walk forecast only at the three-month horizon for the repo rate. At the longest horizon for the repo rate, and at all horizons for the five-year government bond yield, the random-walk forecast instead significantly outperforms the money-market players' expectations. For the SEK/USD and SEK/EUR exchange-rates, no statistically significant differences in forecasting precision were established. Our results hence reflect the literature on this topic fairly well. A common finding in many studies – regardless of whether exchange rates or interest rates are studied – is that there is mixed evidence regarding the survey data's ability to outperform a random-walk benchmark; see, for example, Mitchell and Pearce (2007) and Ince and Molodtsova (2017). We conclude that while the Prospera survey might be informative regarding the market participants' expectations, it does not seem to carry much information about the actual future developments of the exchange rates and interest rates covered by the survey.

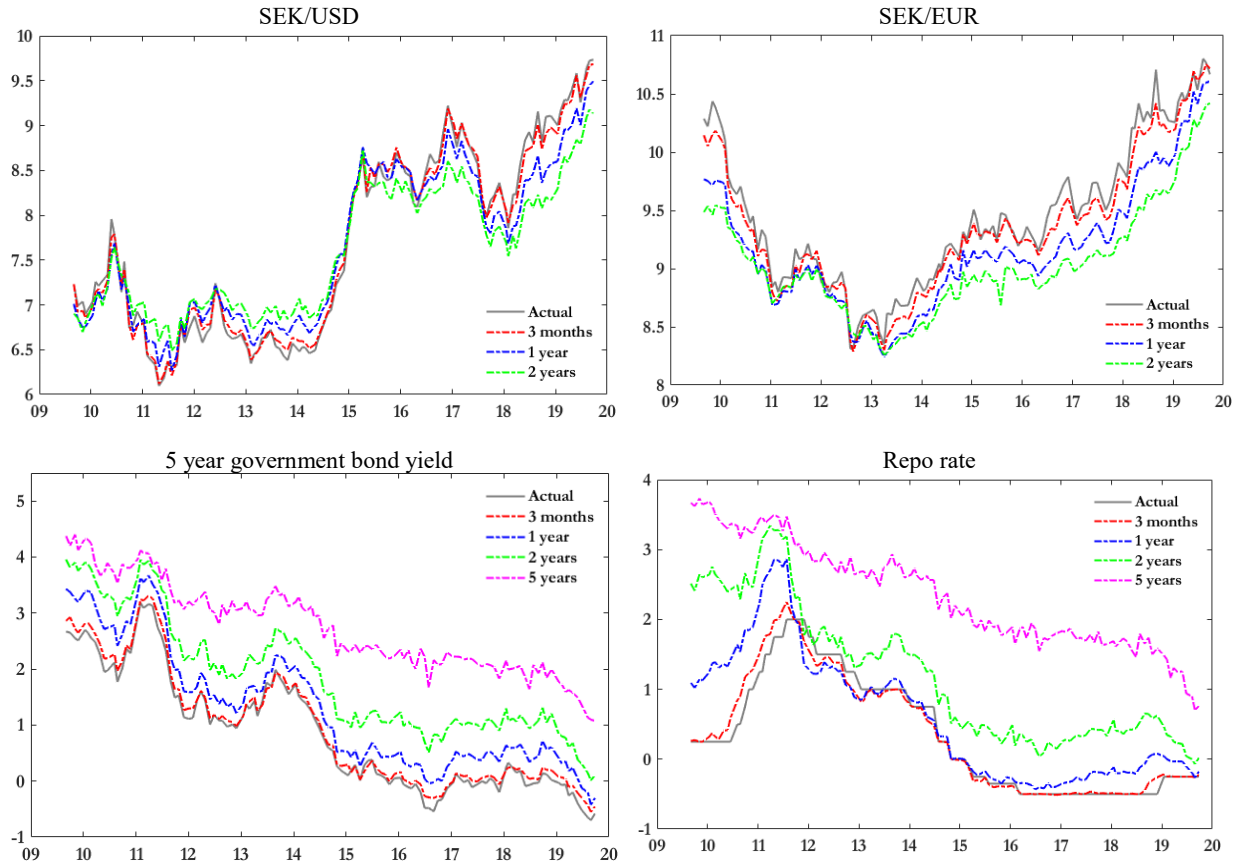
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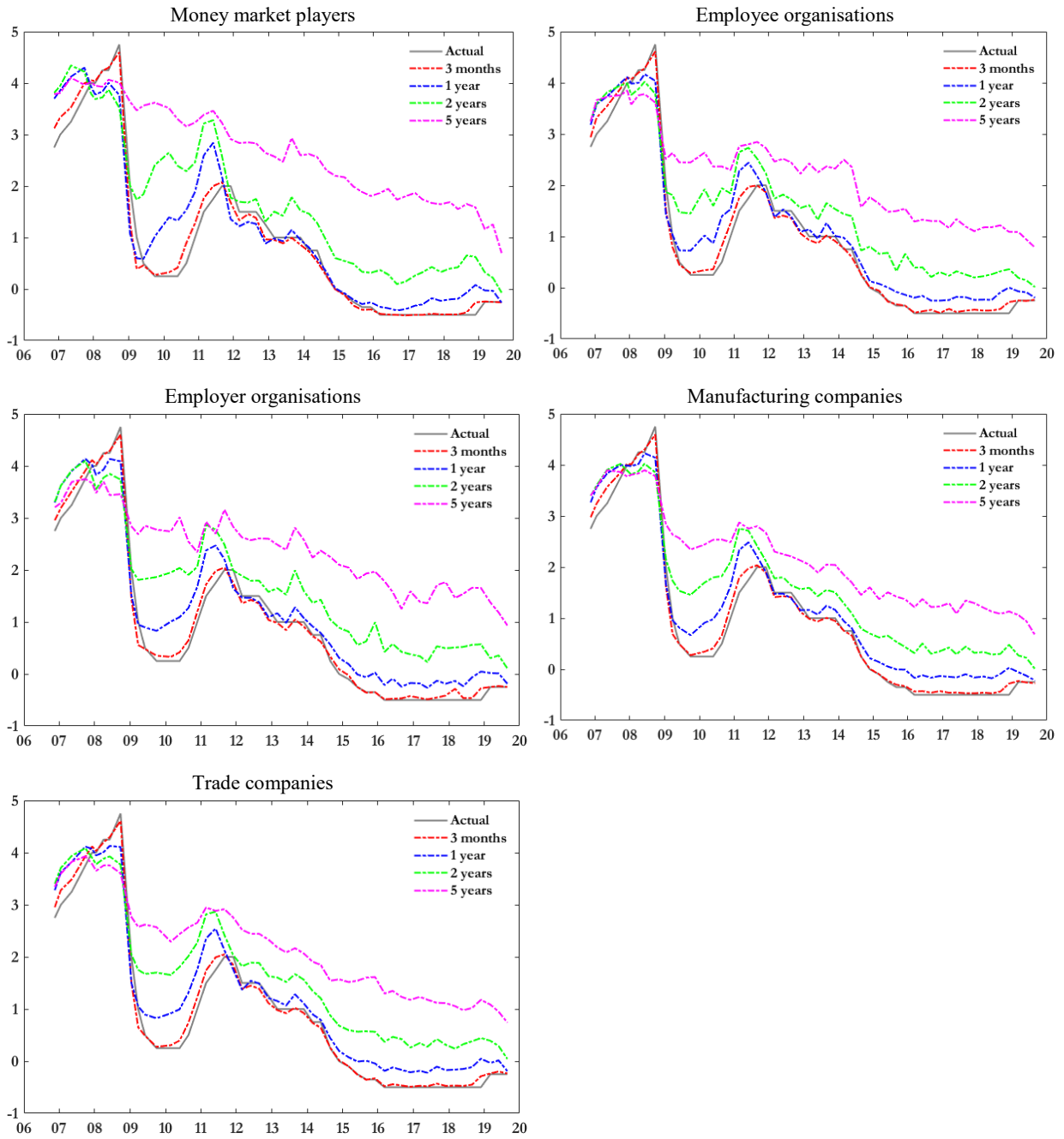
# Appendix

**Figure A1. Expectations of money-market players – monthly data.**



Note: Percent on vertical axes for five-year government bond yield and repo rate.

**Figure A2. Repo-rate expectations – quarterly data for different respondent groups.**



Note: Percent on vertical axes.