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Abstract
This paper investigates the instantaneous and dynamic effects of ECB forward guidance announcements on the term structure of private short-term interest rate expectations. We estimate the static and dynamic impact of forward guidance on private agents' expectations about future short-term interest rates using a high-frequency methodology and an ARCH model, complemented with local projections. We find that ECB forward guidance announcements decrease most of the term structure of private short-term interest rate expectations, this being robust to several specifications. The effect is stronger on longer maturities and persistent.

Keywords: Central bank communication, Short-term interest rate expectations, OIS.

JEL Classification: E43, E52, E58.

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1. Introduction

After the European Central Bank (ECB) cut the main refinancing operations rate towards its effective lower bound (ELB) in 2010, forward guidance became one of the only tools available to provide monetary accommodation and support for market participants' anticipation of a sustained period of low interest rates (Eggertson and Woodford, 2003), together with liquidity provisions and asset purchases. "*The Governing Council expects the key interest rates to remain at present or lower levels for an extended period of time*." With this statement pronounced on July 4th 2013 after the meeting of ECB Board of Governors, Mario Draghi adopted this new communication strategy. On January 9th 2014, Mario Draghi reinforced the use of this communication policy: "*we firmly reiterate our forward guidance that we continue to expect the key ECB interest rates to remain at present or lower levels for an extended period of time*". This paper aims to investigate the impact of these forward guidance announcements on private short-term interest rate expectations using a high-frequency identification and an ARCH model, estimated both in a static fashion and with local projections *à la* Jorda (2005) for measuring dynamic effects.

Because long-term interest rates – a key determinant of private decisions – depend on expected short-term interest rates plus a term premium, central banks over the last decades have enhanced transparency of their actions and communication to the public in order to better signal future policy decisions, shape private expectations and optimise their policy outcomes (see e.g. Geraats, 2002; Woodford, 2005; King, Lu and Pasten, 2008, Reis, 2013). The question of whether central bank communication has been successful to affect financial markets or to help predict policy decisions has given rise to an abundant literature surveyed by Blinder et al. (2008). However, the question of its transmission mechanism and why central bank communication affects private beliefs remains a much more open question. Gürkaynak, Sack and Swanson (2005a) have shown the importance of information about the future policy path embedded in FOMC statements that do affect financial markets. Two usual candidates for the information revealed to private agents by central bank communication are signals about policymakers' views about the current and future state of the economy and signals about their reaction function (their objectives and responses to them). This paper explores the second dimension which would include, for instance, the forward guidance policy and the commitment to deviate from a given policy rule.

Two types of forward guidance policy have been used by central banks so far. The FOMC adopted time-contingent commitment from December 2008 to December 2012, when it was replaced by a state-contingent commitment conditional on the evolution of the labour market. The Bank of England also introduced state-contingent forward guidance conditional on unemployment in August 2013. Similarly, the Bank of Japan used state-contingent forward guidance conditional on inflation between October 2010 and March 2013. The Bank of Canada implemented time-contingent forward guidance between April 2009 and April 2010, while the Swedish Riksbank during two periods between April 2009 and July 2010 and between February 2013 and December 2014. Finally, the ECB implemented time-contingent forward guidance without referring to an end date or a precise period of time.

However, an announcement that interest rates will remain low is ambiguous: it may reflect an anticipation of bad economic fundamentals or an anticipation of a more accommodative monetary policy.[1] In the absence of non-nested information sets, forward guidance is a pure

[1] Baeriswyl and Cornand (2010), Hubert and Maule (2016) and Melosi (2016) analyse situations where monetary policy decisions signal central bank's information to the private sector.

commitment mechanism: a promise by the central bank to keep future policy rates lower than its policy rule suggests. Campbell et al. (2012) introduced the distinction between Delphic and Odyssean forward guidance. The former describes the central bank communication about future macroeconomic fundamentals while the latter consists of statements that bind policymakers to future courses of action. They suggest for the US that the market participants' interpretation of FOMC's announcements is Delphic. Campbell et al. (2016) show that responses of private expectations to movements in policy rates on FOMC announcement days can be attributed in part to Delphic forward guidance. Odyssean forward guidance remains a possibility as a large fraction of futures rates' variability on announcement days remains unexplained. Andrade, Gaballo, Mengus and Mojon (2015) find that forward guidance reduces the dispersion of professional forecasts for interest rates but has no effect on their dispersion for output or inflation. Bletzinger and Wieland (2016) analyse whether the ECB forward guidance follows the outcome of a simple policy rule, so is only about transparency, or deviates from it, signalling a more accommodating policy stance.

These communication policies have given rise to an abundant theoretical literature. Carlstrom, Fuerst, and Paustian (2015), Del Negro, Giannoni and Patterson (2015), McKay, Nakamura, and Steinsson (2015) and Kiley (2016) focus on optimal monetary policy under Odyssean guidance and its macroeconomic effects. Bassetto (2015) studies the optimal communication of central banks' forward guidance policies and the resulting cheap talk problems. Gavin, Keen, Richter and Throckmorton (2014) show that the accomodative effect of forward guidance is offset by the underlying central bank predictions of near-term economic growth, while Gaballo (2016) documents that imperfect information reduces the efficiency of forward guidance. Boneva, Harrison and Waldron (2015) analyse the benefits of threshold-based forward guidance to stimulate the economy, as an insurance against the asymmetric effects of shocks and a credible announcement.

On the empirical side, the evidence about how forward guidance policies impact the macroeconomy is rather homogenous. Gertler and Karadi (2015), Bundick and Smith (2016), Ben Zeev, Gunn, and Khan (2015) and D'Amico and King (2016) find that real activity and prices decline after a positive forward guidance shock. Gertler and Karadi (2015) also find that the response of long-term interest rates cannot be explained by the expected path of short rates, which should be the main channel through which forward guidance operates. The transmission channels of forward guidance and in particular the horizons at which it would lower expected future interest rates are much less documented. The objective of this paper is then to quantify the effect of forward guidance on policy expectations.

This paper is therefore also related to the literature assessing the value of publishing interest rate forecasts, a form of forward guidance, and to the literature about the predictability of future policy decisions.[2] Rudebush and Williams (2008) show that publication of interest rate projections better aligns the expectations of the public and the central bank. Andersson and Hofmann (2009) assess whether the publication in New Zealand of the central bank interest rate path enhances the central bank ability to influence expectations. Moessner and Nelson (2008) find that providing forecasts of future policy rates does not lead private agents to systematically overweight policy rate guidance. Mirkov and Natvik (2016) find that, in New Zealand and Norway, announced interest rate paths have explanatory power for current policy decisions. Moessner (2015) find that FOMC policy rate guidance announcements led to a significant reduction in real yields, but that breakeven inflation rates were not affected.

[2] Jansen and De Haan (2009), Hayo and Neuenkirch (2010), Middeldorp (2011), Sturm and De Haan (2011) have analyzed how other forms of central bank communication may help predict future policy decisions.

Raskin (2013) shows that date-based guidance led to a change in market perceptions of the FOMC's reaction function. Svensson (2015) documents mixed outcomes in Sweden and New Zealand, about whether the market has anticipated the published policy rate path (its predictability) and whether market expectations line up with the path after publication (its credibility). Filardo and Hofmann (2014) show that forward guidance has reduced the volatility of near-term expectations of the future path of policy rates, but that the effects on the level of interest rate expectations are less clear. Kool and Thornton (2014) test whether forward guidance improved market participants' ability to forecast future short-term and long-term rates, and find small, often insignificant, results.

Because private-sector decisions and the transmission channel of forward guidance depend on the entire path of expected future short-term interest rates, not just the current short-term rate, this paper investigates the effect of forward guidance on the term structure of policy expectations. We use the same high-frequency methodology as the literature about the impact of macroeconomic news and policy announcements on financial market variables (see e.g. Gürkaynak, Sack and Swanson, 2005b, or Swanson and Williams, 2014). We estimate the effect of ECB forward guidance announcements on revisions in private beliefs about future policy, i.e. changes in private short-term interest rate expectations at maturities from 1 month to 10 years ahead, measured with Overnight Indexed Swaps (OIS). As common with financial variables and because of evidence of "volatility clustering", we use an autoregressive conditional heteroskedasticity (ARCH) model developed by Engle (1982) to properly account for the presence of heteroskedasticity. We estimate the dynamic effects using the local projections method of Jorda (2005).

We find that ECB forward guidance announcements have decreased the full term structure of private short-term interest rate expectations. The result is stronger on longer maturities and is persistent. The result is robust to different estimation models (GARCH or TARCH), to different estimation windows, and to controlling for the inclusion of ECB and private macroeconomic forecasts in the empirical specification. The latter test suggests that the effect of these announcements is more about the stance of future policy than about revealing macroeconomic information. This is consistent with the sign of the effect of forward guidance announcement: while the statement is about keeping interest rates at "*present or lower levels*", the effect on policy expectations is strongly negative.

The rest of the paper is organized as follows. Section 2 describes the data, section 3 the empirical strategy, section 4 the estimates. Section 5 concludes.

2. Data

Our dependent variables are the different maturities, from 1-month to 10-year, of 3-month Eonia OIS for the euro area as they are good proxies of expectations of future short-term interest rates. OIS are instruments that allow financial institutions to swap the interest rates they are paying without having to refinance or change the terms of loans they have taken from other financial institutions. Typically, when two financial institutions create an OIS, one of the institutions is swapping a floating interest rate and the other institution is swapping a fixed short-term interest rate at a given maturity. Under absence of arbitrage, OIS rates reflect risk-adjusted financial market participants' expectations of the average policy rate over the horizon corresponding to the maturity of the swap (for instance, from 6-month to 10-year in Christensen and Rudebusch, 2012). The data set, collected from Datastream, has a daily frequency and, because of data availability across maturities, our sample spans from August 2005 to June 2015, so estimates are comparable across the term structure.

Following the literature about the impact of macroeconomic news and policy announcements on financial market variables, we use a dummy variable taking the value of one to single out dates of ECB forward guidance announcements and therefore measure their effect. On those days, no other non-standard policy measures were announced, so this dummy variable only captures forward guidance announcements and does not capture other non-standard policy announcements.[3] However, because conventional monetary policy decisions are taken the same day as forward guidance communication, our analysis requires controlling for the effect of monetary surprises. We follow Kuttner (2001)'s methodology to identify monetary policy shocks using changes in the price of futures contracts. For a monetary policy event on day d of the month m, the monetary shock can be derived from the variation in the rate implied by current-month futures contracts on that day. The price of the future being computed as the average monthly rate, the change in the futures rate must be augmented by a factor related to the number of days in the month affected by the change. S_t is the unexpected interest rate variation, i.e. the monetary shock, $f^0_{m,d}$ is the current-month futures rate and D is the number of days in the month and d the day of the decision:

$$S_t = \frac{D}{D-d}(f^0_{m,d} - f^0_{m,d-1}) \quad (1)$$

Our dataset also includes returns of the Eurostoxx50 which could potentially correlate with changes in private interest rate expectations. In the same vein, commodity prices and financial instability can also explain changes in our dependent variables. We thus include in our specification changes in WTI oil prices and the level of a variable capturing financial stress in the euro area, the Composite Indicator of Systemic Stress (CISS) interpolated from weekly to daily frequency. Finally, we control that changes in our dependent variable are not driven by changes in private sentiment by including the Economic Sentiment Indicator (ESI) of the European Commission.

3. Empirical Methodology

3.1. Baseline analysis

We use a high-frequency methodology to estimate the effects of forward guidance, which consists in focusing on movements in OIS in a narrow window around ECB meetings. The key assumption is that the reaction of interest rate expectations that are continually affected by various factors can be specifically attributed to monetary policy news on the day of the policy announcement, or said differently that there is no other macroeconomic news during that window. Since interest rate expectations adjust in real-time to news about the macroeconomy, movements in interest rate expectations during the window of a policy announcement only reflect the effect of news about monetary policy. This is crucial for identification since it strips out the endogenous variation in interest rate expectations associated with other shocks than monetary news.

As common with financial variables, the variance of our dependent variables changes over time. We therefore use an ARCH (autoregressive conditional heteroskedasticity) model to treat heteroskedasticity as a variance to be properly modelled and take into account this "volatility clustering". The estimated equations are the following:

$$\Delta r^E_{t,m} = \beta_0 + \beta_1 FG_t + \beta_2 S_t + \beta_3 M_t + \varepsilon_t, \ \varepsilon_t \sim (0, \sigma^2_t) \quad (2)$$

$$\sigma^2_t = \gamma_0 + \sum_{i=1}^{p} \gamma_i \, \varepsilon^2_{t-i} \quad (3)$$

[3] The one of July 4th 2013 is available at: www.ecb.europa.eu/press/pressconf/2013/html/is130704.en.html and the one of January 9th 2014 at www.ecb.europa.eu/press/pressconf/2014/html/is140109.en.html.

where $\Delta r_{t,h}^{E}$ is the change between t and t-1 in euro area interest rate expectations for horizon m, FG_t is the ECB forward guidance dummy, S_t is monetary surprises à la Kuttner (2001), and M_t is a vector of controls including the CISS, the Eurostoxx50 returns, oil price daily variations and the ESI index. The number of lags p in the variance equation is determined by their significance and set to one.[4] We are particularly interested in the β_1 coefficient which should be interpreted as the effect of ECB forward guidance on revisions of interest rate expectations controlling for the monetary decision and some other financial developments captured by the M_t vector that might have potentially occurred the same days.

3.2. Dynamic analysis

We also investigate the dynamic effects of forward guidance and assess how persistent are the effects of these announcements. We use the local projections method of Jorda (2005). Impulse response functions obtained from VARs may be imposing excessive restrictions on the endogenous dynamics, so that estimates derived from more flexible approaches as local projections, might be preferable. Another advantage is the robustness of local projections to model misspecification to estimate dynamic responses to exogenous shocks.

Considering that exogenous shocks have been identified beforehand, Jorda (2005) suggests estimating a set of regressions representing the impulse response of the dependent variable at the horizon h to a given exogenous shock ϵ_t at time t:

$$y_{t+h} = \alpha_h + \beta_h \epsilon_t + \phi_h(L) X_t + \eta_{t+h} \quad (4)$$

where y_{t+h} is the dependent variable at the horizon h, ϵ_t represents the given exogenous shock, $\phi_h(L)$ is a polynomial lag operator, and X_t is a vector of control variables. In our case, rather than using OLS, we estimate the ARCH model of equations (2)-(3) so that the variable of interest is $\Delta r_{t,m}^{E}$ the daily change in euro area interest rate expectations for horizon h, the exogenous shock is the forward guidance variable FG_t and the vector X_t encompasses the vectors S_t and M_t from equation (2) and $\eta_{t+h}$is estimated as in equation (3).

4. Estimates

We assess the impact of ECB forward guidance on interest rate expectations at horizons 1, 3, 6 and 9 months, and 1, 2, 3, 5 and 10 years. Our estimation sample starts in August 2005 so we have 2576 observations for each maturity. Table 1 shows the benchmark results. The β_1 coefficient associated with forward guidance announcements is negative and significant for horizons from 9 months to 5 years ahead. The peak effect is on the latter maturities. For instance, FG announcements decreased by 5 basis points private interest rate expectations at the 3-year horizon. The β_2 coefficient associated with monetary surprises is positive and significant from horizons 1 month to 3 years ahead indicating that a restrictive monetary shock at date t increase future expected interest rates. These results show that ECB forward guidance announcements decreased private short-term interest rate expectations at maturities around the medium-run, consistently with the horizon of these announcements.

We estimate various alternative specifications in Table 2 to assess the robustness of the baseline result. First, we focus on the two dates of forward guidance announcements separately. The effect of the first announcement is significant and negative at all maturities. The effect of the second announcement is much smaller. Second, we test an alternative

[4] We assess the sensitivity of the results to this choice in the robustness section.

ARCH specification with four lags in the variance equation or alternative estimation methods such as TARCH and GARCH models. Threshold ARCH enables to take into account the asymmetric nature of positive and negative innovations: positive and negative shocks have a different effect on volatility. On financial markets, downward movements ("bad news") are followed by higher market volatility than upward movements ("good news"). GARCH models enable to take into account the variance of lagged residuals in the variance equation. All three specifications confirm the previous result.

Third, because forward guidance announcements may be interpreted a signal of a bad economic outlook (Delphic), we assess whether controlling for the central bank macroeconomic information set (measured with ECB projections) modifies the baseline results. The ECB/Eurosystem staff macroeconomic projections for the euro area are produced quarterly since June 2004. They are published in March, June, September and December and are presented as ranges for annual percentage changes in inflation and real GDP. We also control for private agents' macroeconomic information set. The ECB's SPF is a quarterly survey of expectations of inflation, real GDP growth and unemployment in the euro area. Participants are experts affiliated with financial or non- financial institutions. SPF forecasts are produced in February, May, August and November. We also test whether including changes in an ECB shadow rate or US Kuttner (2001)'s monetary surprises modifies our estimation. We include the shadow rate calculated by Wu and Xia (2016) as an overall measure of the monetary policy stance representing both conventional and unconventional tools in the interest rate space. Because Kuttner surprises are based on reactions from market participants to policy announcements, they may capture some of the reaction to forward guidance, so we test the effect of removing them. We also test whether removing controls modifies the estimation. The effect of forward guidance announcements remains negative and significant in all cases. Fourth, although this goes against the very objective of high-frequency studies of isolating an event from others and should reduce the precision of the estimation, we increase the window over which we assess the response of changes in interest rate expectations from t+1 to t+4. All four estimations show a negative effect, and this effect is at work on longer maturities when the window widens.

Finally, Figure 1 plots the results from estimating the dynamic effects, over the following 20 business days, of forward guidance announcements on 9-month, 1-, 2-, 3-, 5- and 10-year OIS.[5] Estimates show that the effect of forward guidance announcements on maturities until 1 year is small. Starting from the 2-year maturity to the 10-year one, the cumulated effect is stronger, highly persistent and tends to increase. The effect is also stronger with maturities.

5. Conclusion

This paper tests the effect of ECB forward guidance announcements on private short-term interest rate expectations using a high-frequency methodology and an ARCH model, complemented with local projections. We find that forward guidance announcements decrease the full term structure of private short-term interest rate expectations. This result is stronger on longer maturities and persistent. Controlling for ECB and private macroeconomic information sets in the empirical specification does not alter the negative effect of ECB forward guidance announcement on policy expectations. This suggests that the effect of these announcements is more about the stance of future ECB monetary policy than about signalling a bad macroeconomic outlook.

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[5] Results for other maturities are available from the authors upon request.

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Table 1: Baseline estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	oieur1m	oieur3m	oieur6m	oieur9m	oieur1y	oieur2y	oieur3y	oieur5y	oieur10y
					Mean Equation				
FG	-0.004	-0.002	-0.011	-0.019**	-0.021**	-0.033**	-0.050**	-0.054*	-0.009
	[0.00]	[0.00]	[0.01]	[0.01]	[0.01]	[0.02]	[0.03]	[0.03]	[0.03]
kutt_eonia	0.284***	0.450***	0.517***	0.545***	0.557***	0.478***	0.312***	0.172	0.038
	[0.09]	[0.07]	[0.11]	[0.14]	[0.17]	[0.17]	[0.11]	[0.11]	[0.10]
ciss	-0.001	-0.003***	-0.001	0.000	-0.002	-0.002*	-0.002*	-0.001	0.001
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
r_euro50	0.001	0.001*	0.005***	0.004***	0.008***	0.011***	0.015***	0.016***	0.016***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
oil	0.001	0.002***	0.002*	0.002	0.001	0.001	0.001	0.001	0.001
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
esi	0.001**	0.003***	0.002*	0.002***	0.002**	0.001	0.001	0.001	0.002
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
constant	0.000	0.000	0.001	0.001	0.000	-0.001	-0.001*	-0.001	-0.001
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
					Variance equation				
arch(1)	1.237***	1.000***	0.825***	0.745***	0.465***	0.387***	0.246***	0.192***	0.180***
	[0.27]	[0.27]	[0.20]	[0.21]	[0.12]	[0.09]	[0.05]	[0.04]	[0.04]
constant	0.000***	0.000***	0.000***	0.000***	0.000***	0.001***	0.001***	0.001***	0.001***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
N	2576	2576	2576	2576	2576	2576	2576	2576	2576

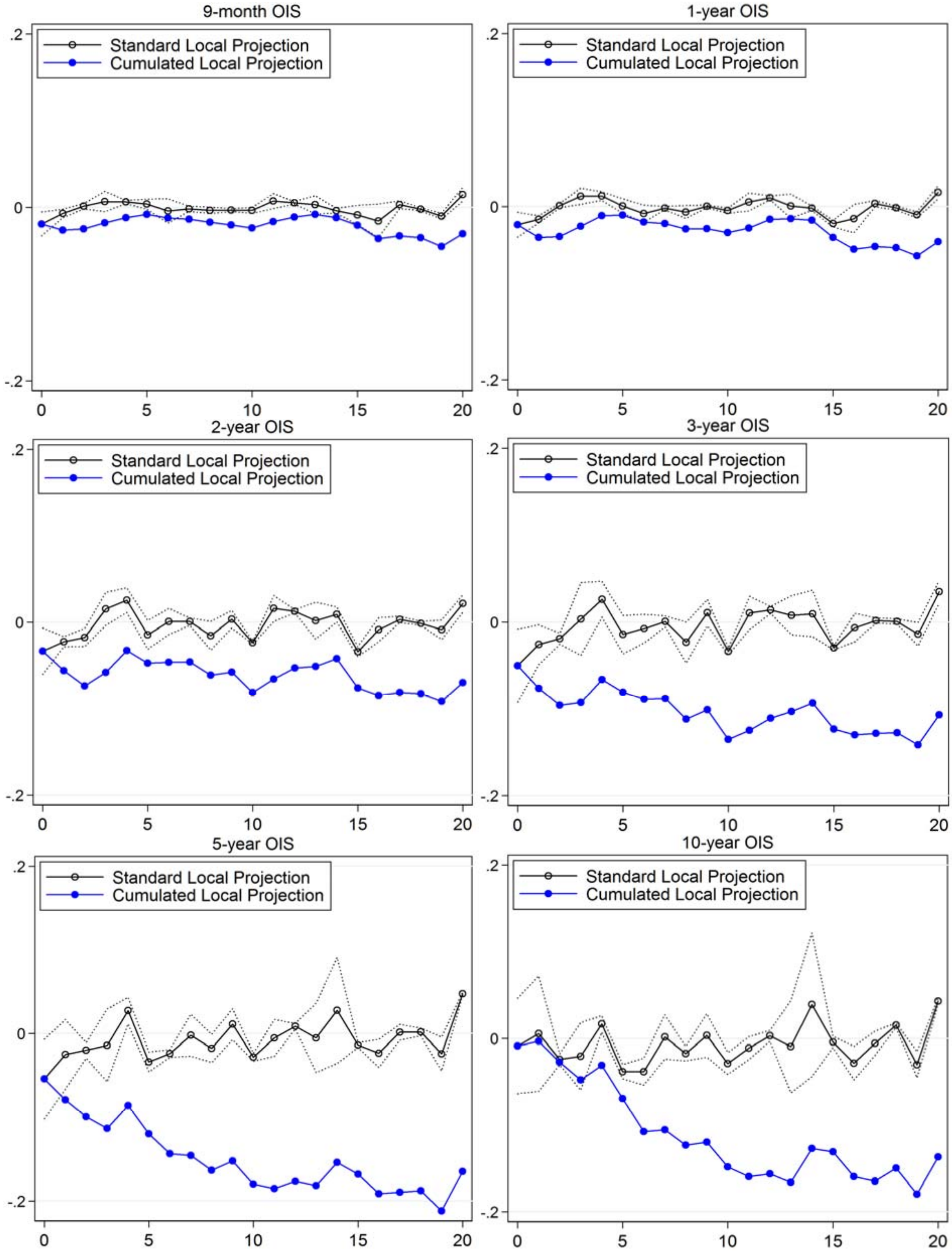
Note: Robust standard errors in brackets. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Each column corresponds to equations (1) and (2) for a different horizon.

Table 2: Robustness analysis

	(1) oieur1m	(2) oieur3m	(3) oieur6m	(4) oieur9m	(5) oieur1y	(6) oieur2y	(7) oieur3y	(8) oieur5y	(9) oieur10y
				Two dummies					
FG 04/07/2013	-0.009***	-0.004*	-0.024***	-0.032***	-0.034***	-0.057***	-0.085***	-0.090***	-0.045***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
FG 09/01/2014	0.001	0.001	0.002***	-0.006***	-0.006***	-0.003***	-0.004***	0.000	0.012***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
				GARCH(1,1)					
FG	-0.010***	-0.003*	-0.012***	-0.017***	-0.015***	-0.016	-0.025	-0.022	-0.003
	[0.00]	[0.00]	[0.00]	[0.01]	[0.01]	[0.01]	[0.02]	[0.02]	[0.02]
				TARCH(1,1)					
FG	-0.004	-0.002	-0.012	-0.020**	-0.021**	-0.034**	-0.051**	-0.054*	-0.008
	[0.00]	[0.00]	[0.01]	[0.01]	[0.01]	[0.02]	[0.03]	[0.03]	[0.03]
				ARCH(4)					
FG	-0.012***	-0.003	-0.013***	-0.019***	-0.018***	-0.027**	-0.041*	-0.045	-0.007
	[0.00]	[0.00]	[0.00]	[0.01]	[0.01]	[0.01]	[0.02]	[0.03]	[0.03]
				Including the EA shadow rate					
FG	0.000	-0.006	-0.011	-0.015**	-0.018**	-0.030*	-0.042*	-0.049*	0.003
	[0.00]	[0.00]	[0.01]	[0.01]	[0.01]	[0.02]	[0.02]	[0.03]	[0.03]
				Including ECB and SPF forecasts					
FG	-0.004	-0.002	-0.01	-0.019**	-0.021**	-0.033**	-0.049*	-0.051*	-0.003
	[0.00]	[0.00]	[0.01]	[0.01]	[0.01]	[0.02]	[0.03]	[0.03]	[0.04]
				Including US FFR Kuttner surprises					
FG	-0.004	-0.001	-0.011	-0.019**	-0.021**	-0.033**	-0.051**	-0.054*	-0.009
	[0.00]	[0.00]	[0.01]	[0.01]	[0.01]	[0.02]	[0.03]	[0.03]	[0.03]
				Removing Kuttner surprises					
FG	-0.006	-0.005	-0.014	-0.023*	-0.025**	-0.036*	-0.052*	-0.055*	-0.009
	[0.00]	[0.00]	[0.01]	[0.01]	[0.01]	[0.02]	[0.03]	[0.03]	[0.03]
				Removing controls					
FG	-0.003	0.000	-0.008*	-0.015***	-0.013***	-0.022***	-0.035**	-0.041**	-0.004
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.01]	[0.01]	[0.02]	[0.01]
				Δr^E between t+1 and t-1					
FG	-0.002	-0.006*	-0.010*	-0.023**	-0.031***	-0.048***	-0.057***	-0.049*	0.008
	[0.00]	[0.00]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.02]	[0.02]
				Δr^E between t+2 and t-1					
FG	-0.008***	-0.006**	-0.009*	-0.021**	-0.029***	-0.050***	-0.071***	-0.071***	-0.030
	[0.00]	[0.00]	[0.00]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.02]
				Δr^E between t+3 and t-1					
FG	0.004	0.000	-0.001	-0.009	-0.014	-0.028	-0.066*	-0.092***	-0.044***
	[0.01]	[0.01]	[0.01]	[0.01]	[0.02]	[0.03]	[0.04]	[0.02]	[0.00]
				Δr^E between t+4 and t-1					
FG	-0.002	0.000	-0.005	-0.003	0.000	-0.018	-0.046**	-0.068***	-0.014
	[0.00]	[0.01]	[0.02]	[0.02]	[0.01]	[0.02]	[0.02]	[0.02]	[0.02]

Note: Robust standard errors in brackets. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Each column corresponds to equations (1) and (2) for a different horizon.

Figure 1: Local projection estimates



Note: Impulse responses to a Forward Guidance announcement, over the following 20 business days, estimated with equations (2)-(3) using local projections as described in equation (4) with 90 per cent confidence intervals and the cumulated effect of horizon specific estimates.