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Responses of Swiss interest rates and stock prices to ECB policy surprises

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Abstract

We employ local projections to analyse the responses of Swiss asset prices to scheduled policy decisions of the European Central Bank (ECB) as a case study of ECB policy spillovers to European countries outside the euro area. Focusing on ECB policy shocks that are related to different policy instruments of the ECB, our empirical results leave the impression that surprises related to the ECB target policy rate and to the ECB's longer-term forward guidance or its asset purchases tend to move Swiss interest rates and stock prices in the same direction. Shocks explicitly designed to capture pure ECB monetary policy and information effect shocks are weakly associated with movements in Swiss asset prices on average.

Keywords Bond, Local projection, International spillovers, Monetary policy, Stock

JEL Classification E43, E52, G15

1 Introduction

Monetary policy actions aim at influencing macroeconomic variables, such as inflation or employment, but the immediate effects of monetary policy are primarily visible on financial markets (Bernanke & Kuttner, 2005).

Monetary policy decisions in major economies influence not only domestic asset prices but also international financial markets. For example, it is well documented both empirically (Ammer et al., 2010; Brusa et al., 2020; Ehrmann & Fratzscher, 2009; Miranda-Agrippino & Rey, 2020; Thorbecke, 1997; Wongswan, 2009) and theoretically, e.g. Jiang et al. (2020), that US monetary policy decisions affect asset markets worldwide. Research on the impact of the monetary policy decisions of the European Central Bank (ECB), the central bank of the second main currency area, on global financial markets, on the US or on blocks of non-euro area economies highlights that unanticipated ECB policy decisions significantly affect international financial markets albeit to a lesser degree than US monetary policy (Ca' Zorzi et al., 2023; Miranda-Agrippino & Nenova, 2022; Potjagailo, 2017).

Our paper contributes to the literature analysing the impact of ECB policy on non-euro area asset markets by using local projections (Jordà, 2005) to empirically evaluate the responses of Swiss interest rates (interest swap rates) as well as stock market indices to ECB policy surprises. We believe Switzerland to be an interesting case study of the international spillovers of ECB policy because foreign monetary policy has a strong impact on consumer price inflation and economic developments in Switzerland and thus on Swiss monetary policy (Jordan, 2016). Moreover, the Swiss economy is tightly linked with the euro area.[1] Hence, evaluating the responses of Swiss interest rates and stock prices to ECB policy decisions helps to understand the economic mechanisms through which changes in ECB policy transmit to European economies outside the euro area. Thus, our paper

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[1] For example, the weight of the euro area in the Swiss National Bank's trade-weighted Swiss franc exchange rate index varied between 40% and 60% from 2002 to 2020.

is related to ter Ellen et al. (2020), who analyse spillovers from ECB policy to asset prices in Denmark, Norway and Sweden and Falagiarda et al. (2015), who assess whether the ECB's unconventional monetary policy measures from 2007 to 2015 affect financial markets in the Czech Republic, Hungary, Poland and Romania.

Our analysis complements that of Bernhard and Ebner (2017), who evaluate the impact of foreign central banks' unconventional monetary policy measures, approximated by changes in futures on long-term government bond yields, on Swiss asset markets. Our assessments extend this analysis by exploiting recent advances in measuring monetary policy surprises to distinguish between pure monetary policy shocks and shocks associated with other, non-monetary information (e.g. economic outlook) that market participants infer from the ECB policy decision. In a second step, we evaluate the impact of high-frequency ECB policy surprises related to specific policy instruments (policy rate, forward guidance, asset purchases) of the ECB (Bu et al., 2021; Ciminelli et al., 2022; Altavilla et al., 2019) on Swiss stock prices and interest rates.

In contrast to Bernhard and Ebner (2017), we do not examine exchange rate reactions to ECB policy surprises because the SNB either imposed a minimum exchange rate against the euro or, if necessary from a monetary policy point of view, directly intervened in foreign exchange markets in large parts of our sample period (Swiss National Bank, 2020). Moreover, we focus on scheduled ECB meetings and remove all ECB policy decisions that took place within a time window of two days before or after Swiss National Bank (SNB) or US Fed policy announcements from our sample. We do this to ensure that we mainly capture the spillover effects resulting from the regular ECB policy decisions to Swiss asset prices. We focus on scheduled meetings because unscheduled policy decisions typically take place in response to extraordinary events, e.g. the outbreak of the coronavirus pandemic, thus making it difficult to empirically distinguish between the monetary policy effects and the impact of the extraordinary events on asset prices.

We first evaluate the responses of Swiss stock prices and interest rates of different maturities to the ECB monetary policy and information effect shocks. We find that Swiss stock prices do not react to these ECB policy shocks in a statistically significant way over the sample period from 2004 to 2023. The responses of Swiss interest rates to the ECB monetary policy shocks are mostly insignificant as well. This finding changes when we assess the responses of Swiss asset prices to ECB monetary policy and information effect shocks across subsample periods distinguishing between a period of unconstrained policy rates and a period during which the ECB policy rates reached their effective lower bounds (ELB). The pure monetary policy shocks have significant, short-term effects on Swiss interest rates in the pre-ELB period, but not in the ELB period. By contrast, the ECB information effect shocks seem to affect Swiss asset prices predominantly in the ELB period. The evidence of information effects in Swiss asset prices is in line with the general literature (Campbell et al., 2012; Campbell et al., 2016; Cieslak & Schrimpf, 2019; Jarociński & Karadi, 2020; Kroencke et al., 2021; Nakamura & Steinsson, 2018) and in particular in line with Canetg and Kaufmann (2022) who find information effects in a broad range of Swiss asset prices resulting from the signalling effects of the auctioning of bills denominated in Swiss franc (CHF) by the SNB. However, the ELB subsample period coincides with times during which the SNB actively intervened on foreign exchange markets. One cannot rule out that the exchange rate interventions of the Swiss National Bank (SNB) occurred at the time of ECB policy decisions. This could not only have had a direct impact on Swiss franc exchange rates but also indirectly on the sensitivities of other Swiss asset prices to ECB policy surprises, because the exchange rate might have acted as either shock absorber or shock propagator without the foreign exchange market interventions.

In addition, we assess the reaction of Swiss asset prices to ECB policy surprises that are related to specific policy instruments. This assessment is based on high-frequency measures of ECB policy surprises by Altavilla et al. (2019). They show that one common factor describes the variation in euro area interest rates during a short time window around the ECB's press release best. This factor is interpretable as a reflection of policy rate surprises (*Target*). In the conference window, they find three types of surprises. One seems to be related to the short-term timing of future policy rate changes (*Timing*). Another surprise reflects the ECB's guidance on the future longer-term path of the policy rate (forward guidance, *FG*). The third factor reflects surprise changes in long-term euro area interest rates and is rotated in such a way that it is interpretable as reflecting surprises related to the ECB's asset purchase programmes (*QE*).

The corresponding local projections show that *Target* surprises on average move Swiss stock prices and interest rates in the same direction on impact. However, this pattern changes over the projection horizon. By contrast, *FG* and *QE* surprises do not have a significant immediate impact on Swiss asset prices. It seems to be the case that their full effects take time to build up. At their peaks, both *FG* and *QE* surprises significantly affect Swiss interest rates and stock prices. Restrictive (expansionary) *FG* and *QE* surprises are associated with decreasing (increasing) Swiss long-term interest rates and Swiss stock prices.

For these types of ECB policy shocks, we do not find significant differences between pre-ELB and ELB periods.

While it is tempting to link the local projection results of the two different sets of ECB policy surprises, we note that the correlations between the different policy shocks are low and in most cases statistically insignificant. This suggests that the shocks are to most extent independent of each other and the respective results have to be interpreted separately.

Taken together, our main empirical results show that there are statistically significant spillover effects from scheduled ECB policy decisions to Swiss asset prices. Moreover, the responses of Swiss asset prices to the different policy surprises leave the impression of market participants mainly reacting to non-monetary news inferred from the ECB's policy decisions. However, the economic importance of the ECB policy surprises following regular policy decisions tends to be small.

The remainder of the paper is organized as follows. Section 2 briefly describes the construction of the ECB policy surprises that we use in our empirical assessments. Section 3 introduces the empirical framework to evaluate the responses of Swiss interest rates and stock returns to ECB policy surprises. We provide details on the data in Sect. 4. Section 5 presents the main empirical results. Section 6 concludes.

2 Measuring euro area policy surprises

We evaluate potential spillovers from ECB policy decisions to Swiss asset markets, i.e. stock prices and interest rates (CHF interest swap rates). This evaluation relies on two different approaches to identify ECB policy shocks. The first approach distinguishes between pure monetary shocks and non-monetary (information effect) shocks. The second approach distinguishes between policy surprises related to different policy instruments of the ECB. This section briefly describes the two identification approaches. We kindly refer the reader to the original references for technical details.

2.1 Pure monetary policy versus information effect shocks

We follow the identification approach of Bu et al. (2021) to estimate a pure monetary policy shock from yields of government bonds of euro area countries. The general idea behind the identification of pure monetary policy shocks by Bu et al. (2021) is that all interest rate movements can be decomposed into a monetary and a non-monetary component. Then, we would expect the variance of the monetary component to be higher on ECB announcement days than on days at which no ECB policy decision is announced. We can thus exploit identification through heteroscedasticity as in Rigobon and Sack (2004).

We follow Bu et al. (2021) and use the two-year euro government bond yield as reference rate, i.e. we normalize the unobserved monetary policy shock such that it has a one-to-one relationship with the two-year government bond yield. The two-year yield is convenient for this purpose because this tenor is short enough to be directly influenced by a move in the ECB policy rates. At the same time, the tenor is long enough such that the ELB of the policy rates is not binding. Furthermore, we chose five labour days before an announcement as "non-monetary" day for the identification-through-heteroscedasticity approach to eliminate day-of-week effects.

The first step to estimate pure monetary policy shocks is to run an instrumental variable time series regression. This regression provides the sensitivities of daily changes in government bond yields across the maturity spectrum (one to thirty years) to monetary policy as reflected in the reference interest rate, i.e. the two-year government bond yield in our case. The second step is a cross-sectional regression of daily changes in government bond yields on the estimated sensitivity index from the first-stage time series regression at each point in time. The series of coefficients from the second-stage regression is the time series of pure monetary policy shocks.

The advantage of the Bu et al. (2021) approach of shock identification is that it does not rely on high-frequency data. Daily data are sufficient to estimate the shocks. In addition, the approach gives a unified measure of monetary policy shocks covering periods during which the ELB on policy rates was binding and periods unconstrained by the ELB.

We calculate information effect shocks by adding a third step to the procedure, as proposed by Ciminelli et al. (2022). The idea is that all changes in interest rates that cannot be explained by monetary policy shocks on policy announcement days must be non-monetary shocks. We can thus regress the changes in our reference interest rate (the two-year government bond yield) on our identified monetary policy shocks and the residuals of this regression will be non-monetary shocks. We use the terms "non-monetary" or "information effect" shocks interchangeably.

Figure 1 depicts the resulting shock series for the sample period from October 2004 to March 2023 based on days of scheduled ECB monetary policy decisions. We remove ECB policy decisions that occurred within a time window of two days before or after an announcement of the SNB or the Fed from our sample. This gives us a total of 169 observations. Positive (negative) values indicate restrictive (expansionary) surprises. The beginning of the sample period is restricted by the availability of euro denominated government bond yield data to estimate the shocks.

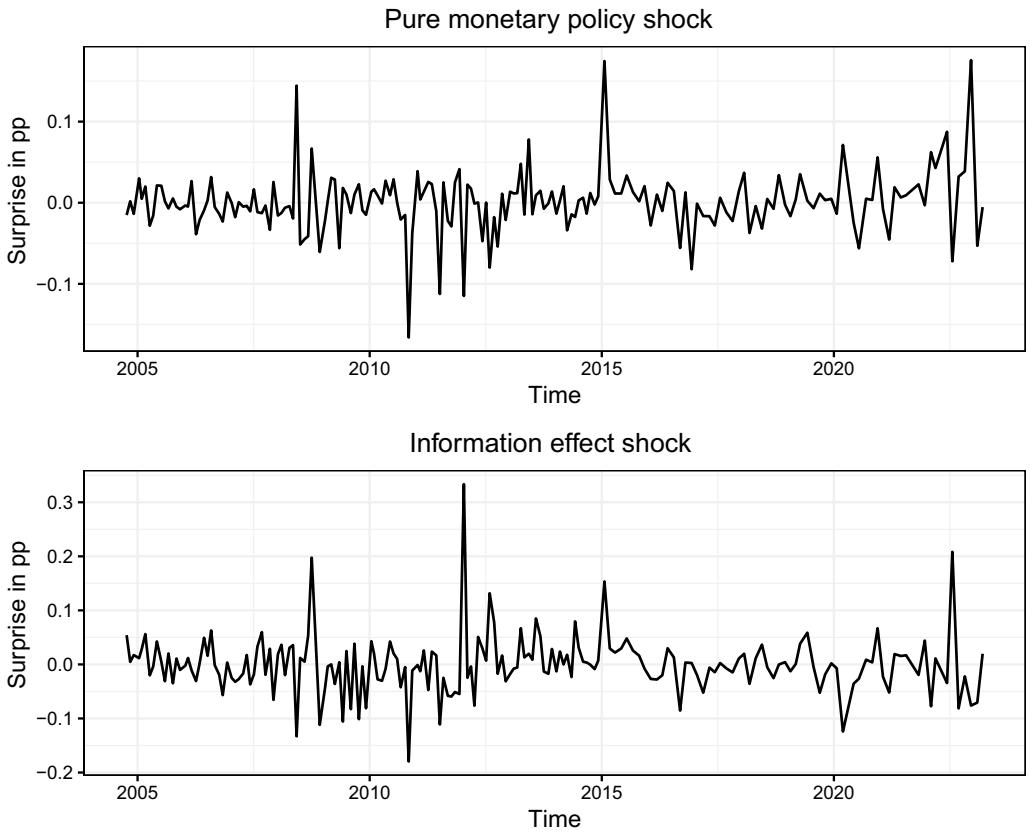


Fig. 1 Pure ECB monetary policy and information effect shocks. *Notes:* This figure depicts estimates of pure monetary policy and information effect shocks from ECB policy decisions between October 2004 and March 2023. Positive (negative) values indicate a restrictive (expansionary) surprise

The two shock series exhibit different patterns but share the similarity that pronounced spikes occurred during the period of the global financial crisis and the euro area sovereign debt crisis. After a period of little variation between 2015 and 2019, one observes more volatile movements since 2020, driven by the outbreak of the coronavirus pandemic, the Russian invasion of Ukraine and the lifting of policy rates into positive territory after the marked increase in inflation.

2.2 Distinguishing between different policy instruments

We use the approach and the replication code of Altavilla et al. (2019) to measure ECB policy surprises related to different policy instruments. This approach relies on high-frequency interest rate data on days of scheduled ECB monetary policy decisions. We take the high-frequency data from the Euro Area Monetary Policy Database (EA-MPD), which is publicly available. We work with data from January 2002 until June 2020 and again remove ECB policy decisions that occurred within a time window of two days before or after an announcement of the SNB or the Fed from our sample which gives us a sample of 201 observations.

Altavilla et al. (2019) take into account that the ECB Governing Council communicates policy decisions in two separate steps, a press release and then a press conference 45 min later. They analyse changes in risk-free euro area interest rates of different maturities in short time windows around the press release and the press conference. The underlying assumption of this high-frequency identification is that interest rate changes in those short time windows primarily reflect ECB policy surprises and no other economic news.

Their analysis reveals that one common latent factor summarizes most of the variation of risk-free rates in the press release window. In the conference window, they find that three common factors describe the common variation of euro area risk-free rates best.

Based on the methodologies of Gürkaynak et al. (2005) and Swanson (2021), Altavilla et al. (2019) impose economically justified restrictions and rotate the latent factors to give each of them a structural interpretation. They show that the latent factor in the press release window primarily reflects surprise changes in short-term interest rates (one-month OIS) and thus should be related to the ECB target policy rate. This factor is labelled *Target*. In

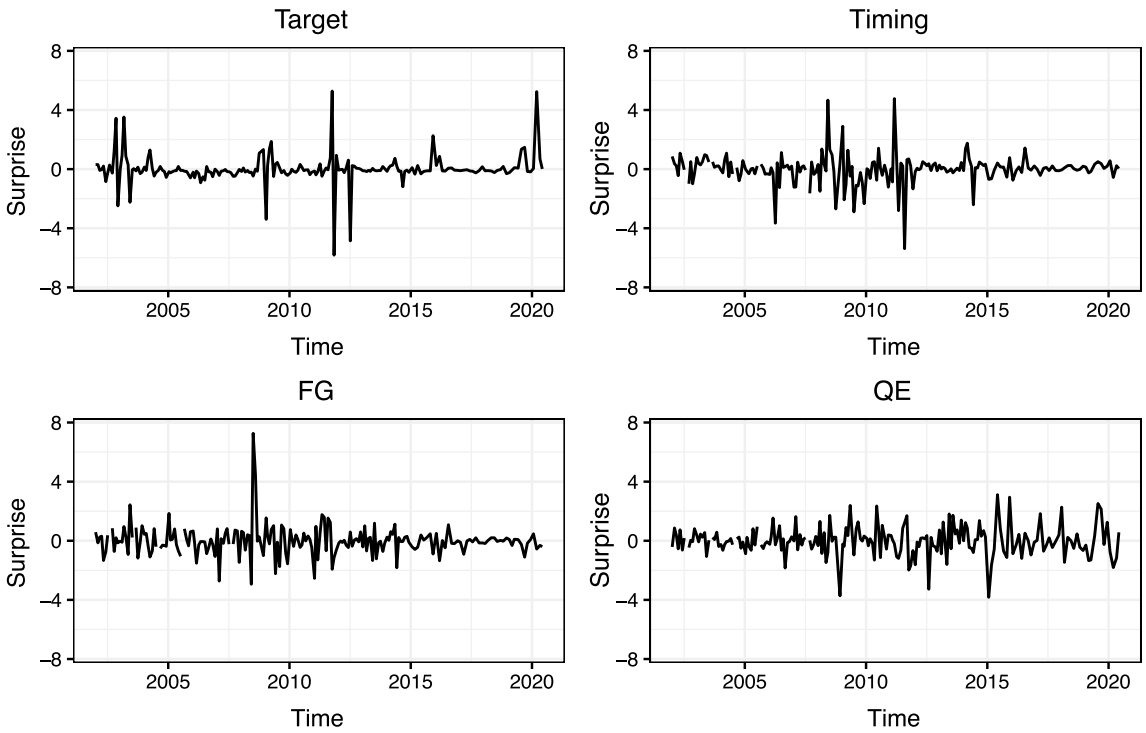


Fig. 2 ECB policy surprises: Altavilla et al. (2019) *Notes:* This figure depicts the four ECB policy surprises from January 2002 to June 2020. Policy surprises take the form of surprises with respect to the ECB policy rate (*Target*), the ECB's short-term (*Timing*) and longer-term forward guidance (*FG*) and asset purchases by the ECB (*QE*). Positive (negative) values indicate a restrictive (expansionary) surprise

the conference window, the three latent interest rate factors appear to reflect two types of forward guidance surprises and surprises regarding the ECB's bond purchase programmes. Altavilla et al. (2019) label the first forward guidance factor *Timing*, because of its impact on shorter-term interest rates. This factor seems to be associated with surprises regarding the timing of changes in the target policy rate. The second forward guidance factor is associated with medium-term interest rates. This factor is referred to as *Forward Guidance* (*FG*), but it should be noted that both *Timing* and *FG* reflect the ECB's forward guidance. The third factor in the conference window is associated with movements in long-term interest rates. Following Swanson (2021), Altavilla et al. (2019) rotate this factor in such a way that it can be interpreted as surprise related to the ECB bond purchase programmes, which started in 2014. Hence, the abbreviation of this factor is *QE*.

Note that restrictive (expansionary) surprises, irrespective of the type of surprise, increase (decrease) euro area interest rates (Altavilla et al., 2019).

Compared with other approaches to estimate ECB policy surprises, e.g. ter Ellen et al. (2020), the identification mechanism of Altavilla et al. (2019) has the advantage of explicitly distinguishing between the two separate steps (press release and subsequent press conference) of the ECB's policy communication. Moreover, this distinction allows for the identification of factors that help researchers to differentiate between the multiple dimensions of the ECB policy communication related to different policy instruments.

Figure 2 depicts the four policy surprises in the sample period from January 2002 to June 2020. The different ECB policy surprises (*Target*, *Timing*, *FG*, *QE*) are defined in such a way that positive values of the surprises indicate restrictive policy surprises and negative values indicate expansionary policy surprises.

A couple of observations are noteworthy. First, strong surprises related to the ECB's policy rate are rare in our sample period. Exceptions were the time of the Iraq war in 2003, the sovereign debt crisis in the euro area in 2011 and 2012 and the outbreak of the coronavirus pandemic in March 2020. Second, the two forward guidance factors (*Timing* and *FG*) spiked often during the global financial crisis and the euro area debt crisis. This suggests that the press conferences of the ECB provided news that particularly affected medium-term interest rates. Interestingly, there were little pronounced surprises related to the ECB's forward guidance in the latter half of our sample period. This stands in contrast to the *QE* factor.

Table 1 Correlation between different measures of ECB policy surprises

	Target	Timing	FG	QE	info
Target					
Timing	−0.06				
FG	−0.21**	0.00			
QE	−0.10	0.00	0.02		
Info	−0.15	−0.15	0.15	−0.06	
Mopo	0.13	0.05	−0.24**	−0.08	−0.03

This table presents pairwise correlations between different ECB policy shocks for the time period between October 2004 and June 2020. The correlations between Target surprises and the other policy shocks are based on 152 observations. A sample of 150 observations underlies the other pairwise correlations. Asterisks indicate significant correlations

$^{*}p < 0.1; ^{**}p < 0.05; ^{***}p < 0.01$

This measure of surprise movements in long-term euro area interest rates became more volatile during the global financial crisis and remained volatile thereafter.

Hence, judged from their variation over time, both *FG* and *QE* surprises appear to be most pronounced in periods before these two tools gained prominence in 2013 and 2014. We interpret this finding as evidence of ECB press conferences providing news that were relevant for medium-term and long-term euro interest rates even before the ECB explicitly gave forward guidance and directly intervened on government bond markets.

Is there any relation between these ECB policy shocks and the shocks introduced in Sect. 2.1? Table 1 provides the pairwise correlations between the six different ECB policy shocks that we use in our empirical analyses. In general, the correlation coefficients are close to zero suggesting that there is little overlapping information between the different policy shocks. In statistical terms, only the relatively low negative correlations between the *FG* shock and the *Target* shock as well as the one between the *FG* shock and the measure of the pure monetary policy shock (mopo) are significant. This suggests that the Swiss asset price responses to the different sets of ECB policy surprises are largely independent of each other and should be interpreted separately.

3 Empirical framework

Similar to Altavilla et al. (2019), ter Ellen et al. (2020) and Swanson (2021), we run local projections (Jordà, 2005) of the following form

$$\Delta X_{t+h} = \eta \Delta X_{t-1} + \beta_h MoPo_t + \gamma_h Info_t + \epsilon_{t,h} \quad (1)$$

or

$$\Delta X_{t+h} = \eta \Delta X_{t-1} + \beta_h Target_t + \gamma_h Timing_t + \delta_h FG_t + \zeta_h QE_t + \epsilon_{t,h} \quad (2)$$

to assess the sensitivities of Swiss asset price changes to ECB policy surprises.

In the local projections, ΔX_{t+h} is the cumulative change in the asset price of interest (log changes of the Swiss stock index or the difference in Swiss government bond yields or OIS rates) from the day before the shock until $t + h$ (with t representing the day of a policy announcement), i.e. $\Delta X_{t+h} = X_{t+h} - X_{t-1}$. The local projections give us impulse responses to evaluate the significance and the persistence of the effects of the ECB policy surprises without restricting the shape of the responses.

MoPo and *Info* abbreviate the estimates of pure monetary policy and information effect shocks based on Bu et al. (2021) and Ciminelli et al. (2022). *Target*, *Timing*, *FG* and *QE* are the ECB policy shocks from Altavilla et al. (2019).

We show the outcomes of the local projections by displaying the coefficients on impact of the shock (at $h = 0$) and the coefficients at the projection horizon at which the respective shock reaches its peak effect (maximum projection horizon: 30 days). The horizons at which shocks reach their peak effects differ across assets and we occasionally provide this information in the text. In addition, the Internet Appendix shows the time series of the local projection coefficients over the projection horizon from which this information can also be inferred. Error bars represent the 90% confidence intervals around the estimates of the local projection coefficients based on Newey-West corrected standard errors that take autocorrelation and heteroscedasticity into account.

4 Data

We use the Swiss Performance Index (SPI) to assess the responses of the Swiss stock market to ECB policy surprises. The SPI covers basically all listed Swiss firms on the SIX exchange which is also the source of the stock market data.

Since the Swiss government bond market is relatively illiquid (on average not much more than 20 bonds traded), we focus our discussion on CHF interest rate swap rates to assess the sensitivity of Swiss interest rates to ECB policy decisions. From the beginning of the respective sample periods (depending on the different ECB shock series) until the end of 2021, we work with interest rate swaps that use the six-month CHF Libor as floating leg. After the discontinuation of CHF Libor rates we link these series with OIS rates based on the Swiss average overnight interest rate (SARON). The swap rates are from Bloomberg. We abbreviate the swap rates with OIS in the subsequence, but note that the underlying floating interest rate in these swaps changed over time.

In the case of the stock indices, ΔX_t in Eqs. (1) and (2) represents the difference in the log closing value of the index on the day of a scheduled ECB policy meeting, t, and the closing value of the respective index on day $t-1$.

In the case of OIS rates, ΔX_t represents the change in Swiss OIS rates from the morning of the day of a scheduled ECB policy meeting, t, to the morning of the day after the policy meeting, $t+1$ to be in line with the timing of Swiss government bond yields that we use in robustness checks.[2]

To estimate the pure ECB monetary policy and information effect shocks, we follow Bu et al. (2021) and construct euro area government bond yields with maturities between 1 year and 30 years from information about the Nelson–Siegel–Svensson term structure coefficients provided by the BIS monetary and economic database. These coefficients are also publicly available from the ECB website and start in October 2004.

5 Empirical results

This section summarizes our main results. We first show the results from local projections of Swiss interest rates and stock prices on the ECB monetary policy and information effect shocks. Then, we present the outcomes from our evaluations of how Swiss asset prices react to ECB policy surprises that are linked to specific policy instruments of the ECB. Finally, we provide evidence on the question of whether the sensitivities to the ECB policy shocks differ between periods of constrained or unconstrained ECB policy rates.

5.1 Responses of Swiss stock prices and interest rates to ECB pure monetary policy and information effect shocks

This section presents the results from local projections of changes in Swiss stock prices and Swiss interest rates on the estimated pure ECB monetary policy and the corresponding information effect shock. These shocks reflect information from the whole term structure of interest rates on monetary policy announcement days and are calculated from daily euro area government bond yield data on 169 announcement days after discarding 17 observations which overlap with SNB and Fed policy announcements.

Figure 3 summarizes the results of the local projections for the Swiss stock market (upper panel) and the ten-year OIS rate (lower panel), which is representative for CHF interest rates of all maturities.[3] For each shock, pure monetary policy (MoPo) or information effect (Info), the figure depicts the local projection coefficients as a dot and the 90% confidence interval based on autocorrelation and heteroscedasticity adjusted standard errors around the coefficient estimate as error bar. It does so for two projection horizons. The first is the response on impact of the shock. The second is the peak effect of the shock during the projection horizon of 30 working days. We define the peak effect as the highest local projection coefficient in absolute value.

The effects of the ECB pure monetary policy and information effect shocks on the Swiss stock market are in the upper panel of Fig. 3. These responses show that Swiss stock prices tend to fall in response to the pure monetary policy shock inferred from the ECB policy decision (left column). This is true for both the impact effect and the peak effect, which is reached after about eight trading days. However, the point estimates are imprecisely measured and statistically not different from zero.

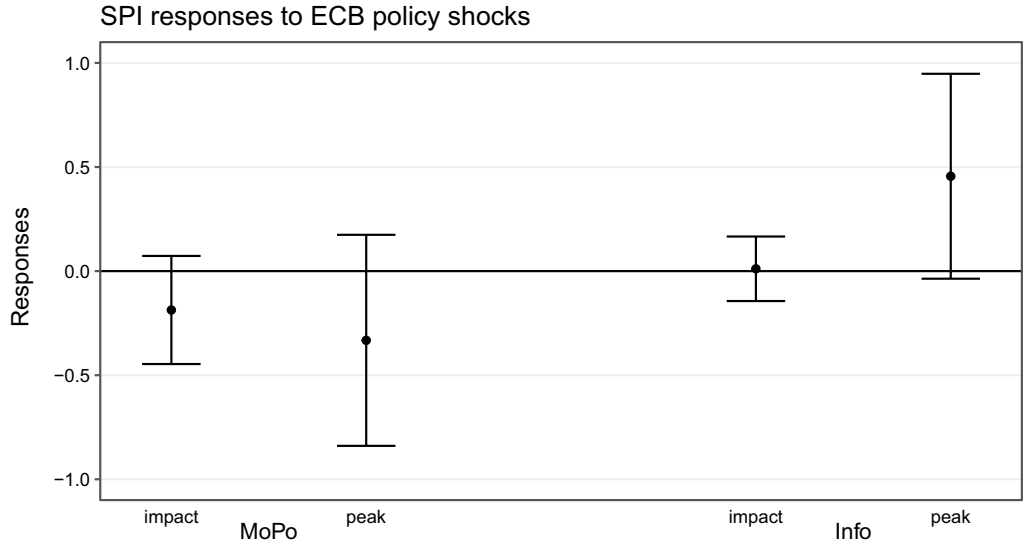
The response of the Swiss stock market to the information effect shock is basically zero on impact. The full effect of this shock takes time to build up. Its peak occurs after 25 trading days and suggests that a restrictive information effect shock resulting from the communication of the ECB policy decision tends to be good news for the Swiss stock market. Again, the local projection coefficient is imprecisely estimated. The confidence interval includes zero.

The lower panel of Fig. 3 provides the corresponding results for the ten-year CHF OIS rate. Restrictive ECB monetary policy shocks temporarily raise Swiss government bond yields but these effects are statistically insignificant both on impact and at the peak effect of the pure monetary policy shock. By contrast, CHF OIS rates fall in response to a restrictive ECB information effect shock. The sign of the response is in line with the literature on information effect shocks. For example, adverse news about the economic outlook in the euro area could be associated with lower CHF interest rates because the prospect of a cooling euro area economy, the biggest Swiss trading partner, may also be associated with a slowdown in Swiss economic activity and thus lower interest rates. However, the confidence bands of the local projection coefficients are relatively wide and tend to include zero.[4]

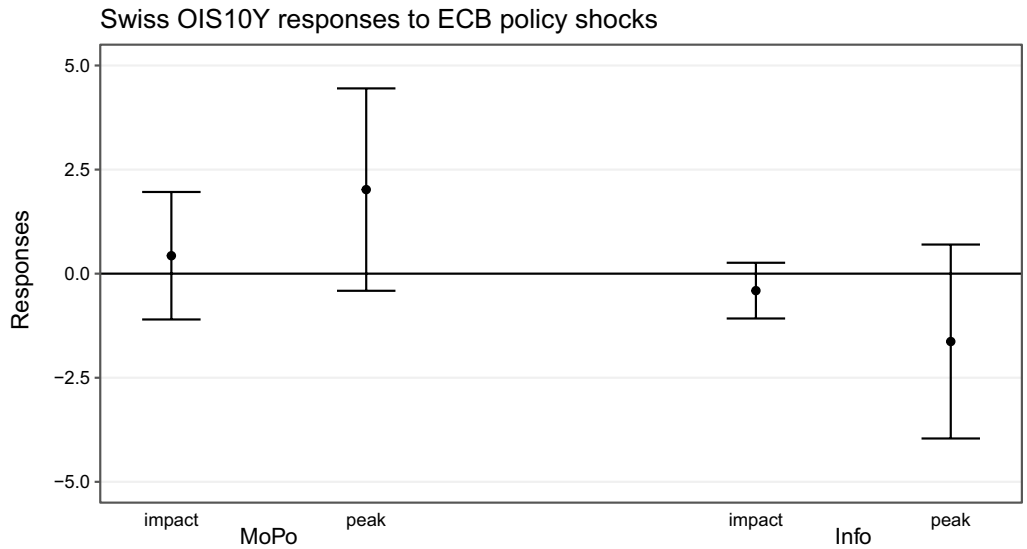
[2] We find qualitatively similar results for Swiss government bond yields as for OIS rates. These results are in the separate Internet Appendix to this paper.

[3] We report the results for other maturities and for Swiss government bond yields of different maturities in the separate Internet Appendix to this paper.

[4] The signs and magnitudes of the responses to these types of ECB policy shocks are less precisely estimated but qualitative similar to the responses of euro area asset prices. We report the local projection coefficients of euro area asset prices in the separate Internet Appendix to this paper.



(a) ***SPI***



(b) ***OIS10Y***

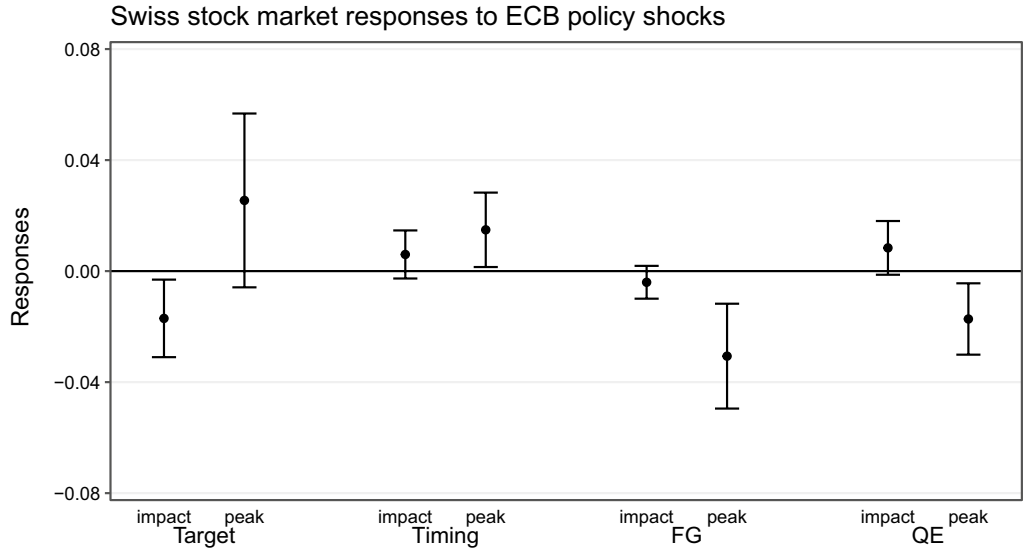
Fig. 3 Responses of Swiss asset prices to ECB pure monetary policy and information shocks

In sum, the local projections suggest that the monetary policy and information effect news provided by regular, scheduled ECB policy decisions do not affect Swiss asset prices in a statistically significant way. Even though the sign of the responses are interpretable economically, the effects of these daily measures of ECB policy shocks appear to be too noisy to find a significant link between Swiss asset prices and ECB policy shocks.

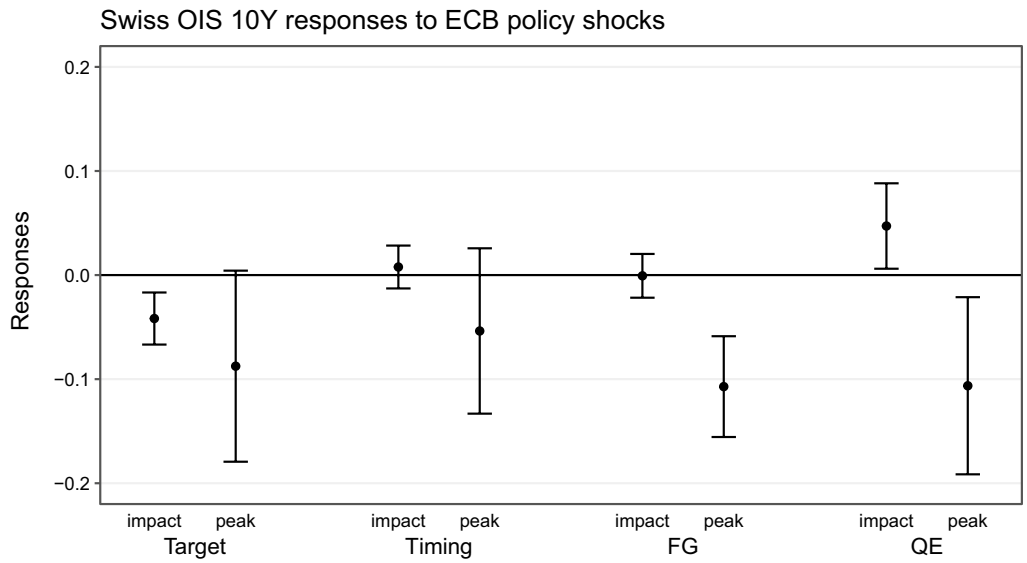
Next, we turn to the question of whether proxies of ECB policy shocks derived from high-frequency interest rate movements in short time windows around ECB policy announcements provide a cleaner picture of the link between Swiss asset prices and ECB policy decisions.

5.2 Swiss stock price and interest rate reactions to high-frequency ECB policy surprises

In this section, we assess whether ECB policy surprises that are interpretable as reflecting unanticipated changes in a particular policy instrument of the ECB have significant effects on Swiss asset prices. We use the high-frequency policy surprises of Altavilla et al. (2019) for that purpose. The sample period differs from the one for the pure monetary policy and information effect shocks



(a) ***SPI***



(b) ***OIS10Y***

Fig. 4 Responses of Swiss asset prices to ECB policy shocks during press release and press conference window

and runs from January 2002 to June 2020 restricted by data availability to estimate the surprise series. This gives us a sample of 201 observations after discarding 24 observations which were close to SNB and Fed policy announcements.

Figure 4 summarizes the results. Again, the upper panel provides the local projection results for the SPI, the broad Swiss stock market index. The lower panel shows the corresponding estimates for the ten-year CHF OIS rate, which are representative for OIS rates with different maturities.

We start with the discussion of stock market responses to the *Target* surprise, i.e. the policy surprises from the press release of the ECB policy decision, in the left column of the upper panel of Fig. 4. On impact, a restrictive *Target* surprise is associated with a fall in the Swiss stock market. This effect is statistically significant. A restrictive 25 basis points *Target* surprise lowers the SPI by more than two percent on impact. The peak effect (after 28 working days) appears to be positive and is larger but statistically insignificant. That said, the biggest *Target* surprise following a

regular policy decision in our sample period amounted to slightly more than five basis points. In general, the economic magnitudes of the responses of changes in Swiss asset prices to the high-frequency ECB policy shocks tend to be relatively small economically. One potential reason could be our focus on scheduled ECB meetings and ignoring ECB meetings that took place in the vicinity of SNB or, more importantly, Fed decisions.

Next, we discuss the stock market effects of the *Timing* surprise, which is one of the three types of surprises identified by Altavilla et al. (2019) in the press conference window accompanying the release of its policy decision. This surprise is interpretable as reflecting forward guidance about the short-term path of the ECB target policy rate. Both on impact and at its peak, a restrictive *Timing* surprise is associated with increasing Swiss stock prices. The effect on impact is insignificant, whereas the peak effect (after 27 days) is borderline significant. It turns out that the coefficient at this particular projection horizon is the only significant estimate. All of the other local projection coefficients are indistinguishable from zero which suggests that the *Timing* basically leaves Swiss asset prices unaffected.

Surprises related to longer-term forward guidance by the ECB do not affect Swiss stock markets significantly on impact, but restrictive *FG* surprises tend to lower Swiss stock prices when they reach their peak effect after about six or seven working days. This could reflect that adverse news about the euro area economy, the biggest trading partner of Switzerland, could be associated with worse business prospects for Swiss firms.

The stock market effects of the *QE* surprise look similar to the effects of *FG*. On impact, *QE* surprises do not affect the Swiss stock market in a significant way. This finding pertains to most of the local projection horizons. However, the *QE* surprises reach their peak effects after more than 20 working days and then restrictive *QE* surprises are associated with lower Swiss stock prices. In this respect, *FG* and *QE* surprises have similar effects on the Swiss stock market.

The lower panel of Fig. 4 presents the corresponding results for the responses of changes in the ten-year CHF OIS rate to the four different ECB policy surprises. *Target* surprises seem to affect Swiss interest rates significantly on impact. Restrictive surprises are not only associated with falling Swiss stock prices but also falling long-term interest rates. Since the *Target* surprises move both stock prices and interest rates in the same direction, this evidence could reflect short-term information effects resulting from the press release of the ECB policy decision. This result is somewhat surprising because one might have thought that surprise increases in the ECB policy rate could be associated with market participants expecting the SNB to follow suit and also raise its policy rate, which would then contribute to higher Swiss interest rates. However, our results suggest that this is not the case.

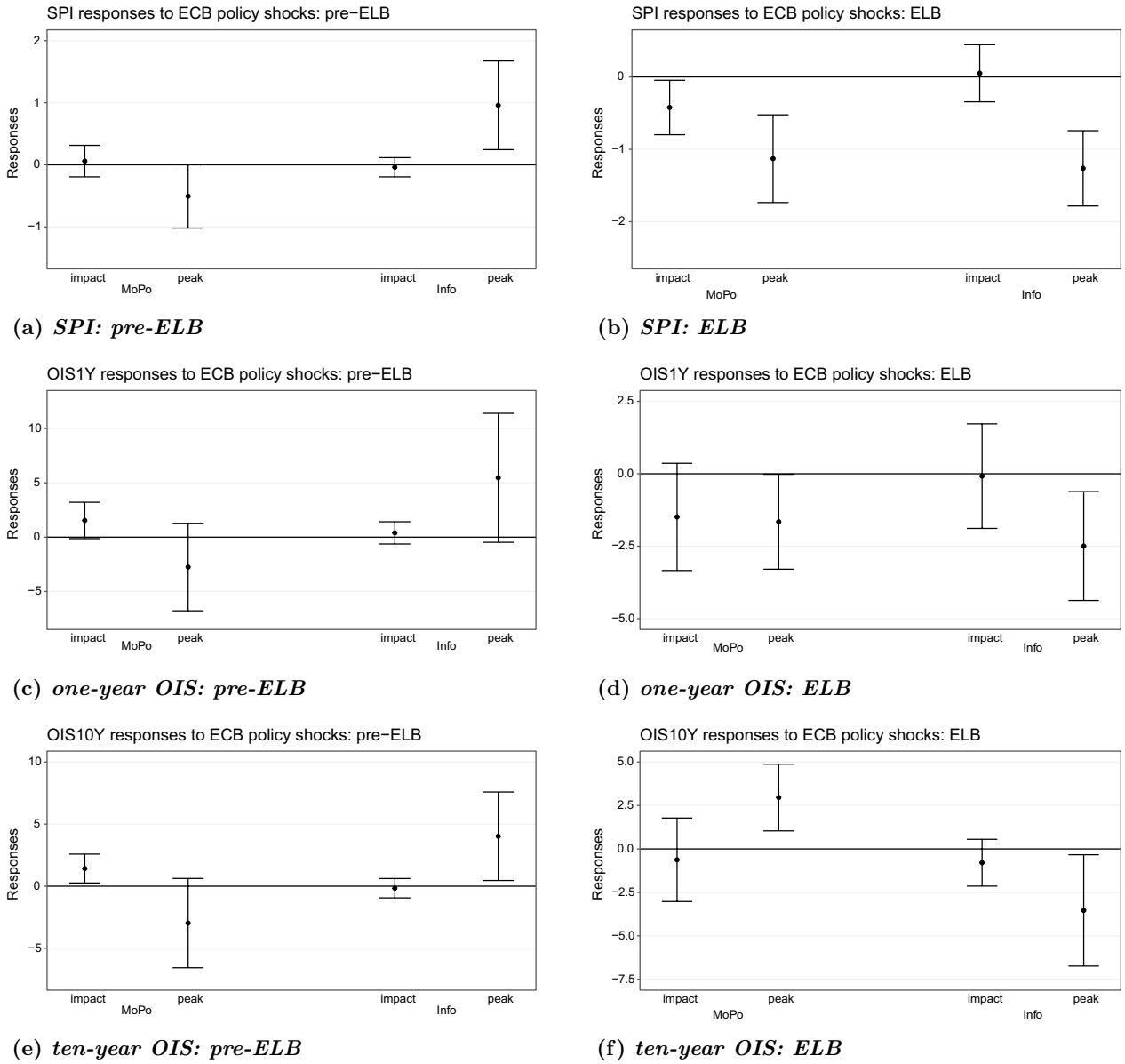
While short-term forward guidance of the ECB (*Timing*) does not have any significant effect on Swiss interest rates, longer-term forward guidance (*FG*) does. On impact, the response of the ten-year CHF OIS rate to *FG* surprises is weak and insignificant. However, this changes with the projection horizon. We find that restrictive *FG* surprises significantly lower Swiss interest rates when this surprise reaches its peak effects after four working days. It stays significant up to projection horizons of 25 days (reported in the Internet Appendix). Similar to the *Target* surprise, the *FG* surprise moves stock prices and interest rates in the same direction. The local projections show that both Swiss stock prices and OIS rates fall in response to a restrictive *FG* surprise. One could interpret this observation as reflection of information effects or non-monetary news inferred from the press conference that accompanies the ECB policy decision.

Similar to *Target* surprises and *FG* surprises, the ECB's *QE* surprises also tend to move Swiss stock prices and interest rates in the same direction. On impact, a restrictive *QE* surprise leads to a rise in the ten-year OIS rates and increasing stock prices. However, when it reaches its peak effect, a restrictive *QE* surprise is associated with lower stock prices and lower long-term CHF interest rates.

5.3 Does the effective lower bound for ECB policy rates matter?

Our main empirical results suggest that Swiss asset prices respond to ECB policy decisions in a way that is consistent with information effects resulting from the communication of the ECB policy decision, because the ECB policy shocks move both Swiss stock prices and CHF interest rates in the same direction. This observation begs the question of whether the responses of Swiss asset prices to ECB policy shocks were stable in our full sample periods or depended on policy rates being close to or away from the ELB.

Therefore, we assess the reactions of Swiss asset prices to the ECB policy shocks for two subsample periods. The first subsample covers the period from October 2004 (for the pure monetary policy and information effect shocks) or from January 2002 (for the high-frequency policy surprises) to June 2012 during which the different ECB policy rates were greater than zero. The second subsample period ranges from July 2012 to July 2022 (June 2020 for the high-frequency policy surprises) and covers the period of ECB policy rates at their perceived ELBs.



(a) ***SPI: pre-ELB*** (b) ***SPI: ELB***

(c) ***one-year OIS: pre-ELB*** (d) ***one-year OIS: ELB***

(e) ***ten-year OIS: pre-ELB*** (f) ***ten-year OIS: ELB***

Fig. 5 Responses of Swiss asset prices to ECB policy shocks: Does the effective lower bound matter?

We thus exclude the post-ELB period from our sample because it is too short for a subsample analysis. In addition, we note that the perception of the ELB shifted over time. In 2012, zero was considered the ELB for policy rates. Later in our sample, policy rates declined into negative territory. Furthermore, the ELB subsample period coincides with times during which the SNB actively intervened on foreign exchange markets. If exchange rate interventions of the SNB coincided with ECB policy decisions, these interventions could have had an impact on the sensitivities to ECB policy shocks depending on the CHF exchange rate acting as shock propagator or shock absorber.

Figure 5 presents the coefficients from local projections of changes in one-year and ten-year CHF OIS rates and SPI returns on the pure ECB monetary policy shock and the associated information effect shock. We have 79 observations in the ELB period and 87 observations in the pre-ELB period. The left column presents the three figures for the pre-ELB subsample period. The right column gives the corresponding results for the ELB period. As in the previous sections, we focus on the impact and

the peak effect of the ECB policy shocks. We additionally show results for the one-year OIS rate because our empirical results for short-term interest rates differ somewhat from the evidence for longer-term rates across the two subsamples.

In the first row of Fig. 5, we observe that the Swiss stock market does not significantly respond to the ECB pure monetary policy shock in the pre-ELB period on impact. The response is basically zero. However, when the pure monetary policy shock reaches its peak effect, we find that a restrictive shock lowers Swiss stock prices. The sign of the Swiss stock market reaction to this shock is hence as expected from a monetary policy shock. The information effect shock does not lead to a Swiss stock market reaction on impact but nonetheless significantly affects Swiss stock prices during the projection horizon. The peak effect of a restrictive (expansionary) information effect shock is associated with a rise (fall) in Swiss stock prices. Interestingly, the sign of this response reverses when we look at the local projections for the ELB-period in the right column of Fig. 5. During the ELB, a restrictive information effect shock is associated with a decline in the broad Swiss stock market index under study. In addition, we find that the results for the pure monetary policy shock are even stronger than in the pre-ELB period. A restrictive (expansionary) pure monetary policy shock leads to lower (higher) Swiss stock prices on impact and when the shock reaches its peak effect.

The second and the third rows of Fig. 5 depict the responses of one-year and ten-year OIS rates to the pure ECB monetary policy and the information effect shocks inferred from the term structure of euro area government bond yields. The responses of the short-term and long-term interest rates to the two shocks in the pre-ELB period are similar. The pure monetary policy shock raises both short-term and long-term interest rates on impact, but this effect dissipates quickly. The peak effect of a restrictive pure monetary policy shock is even negative but statistically insignificant. By contrast, the information effect shock does not affect interest rates on impact, but a restrictive information effect shock eventually leads to rising short-term and long-term CHF interest rates. This pattern changes quite a bit in the ELB period. In this subsample, restrictive pure monetary policy shocks are associated with falling short-term interest rates on impact and at its peak effect. This observation is puzzling. However, the peak effect of such a restrictive shock on long-term interest rates is positive as expected from a restrictive pure monetary policy shock. We do not observe such differences between short-term and long-term interest rate responses to the ECB's information effect shock. On impact the responses are basically zero. When the shock has its full effect over the projection horizon, a restrictive information effect shock is associated with both lower short-term and lower long-term interest rates. Hence, in line with the literature, the ECB's information effect shock moves Swiss stock prices and CHF interest rates in the same direction during the ELB period.

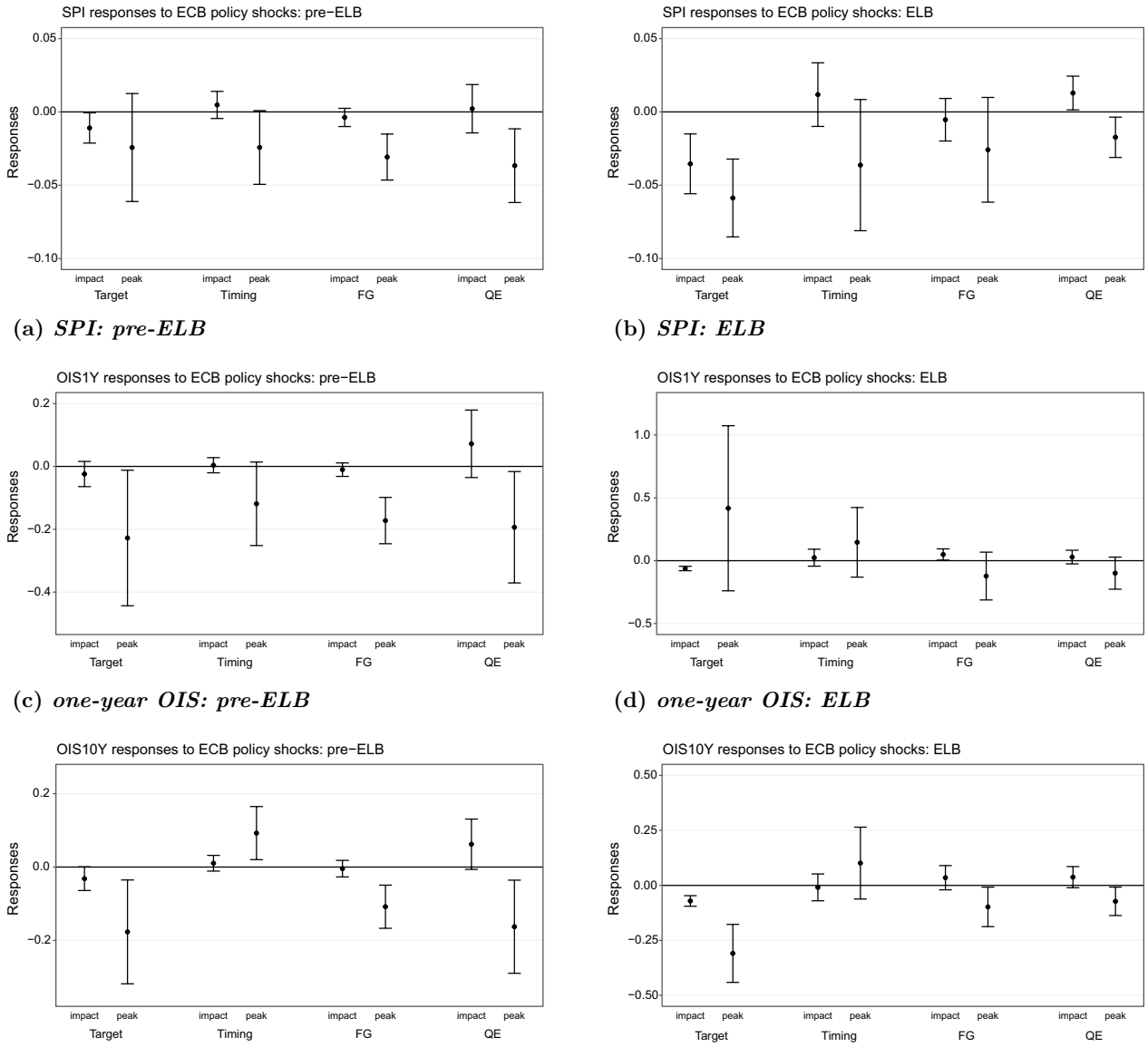
Next, we discuss the results for the responses to the high-frequency policy shocks which are summarized in Fig. 6. Here, we work with 116 observations before the ELB and 62 observations in the ELB period. In general, the local projection results are qualitatively similar to the full sample evidence and do not differ materially across the two subsample periods. Restrictive surprises during the press release window or during the conference window tend to be associated with falling Swiss stock prices as shown in the first row of Fig. 6. This finding applies to both the pre-ELB and the ELB period. It is most pronounced for the *Target* surprise from the press release window but also pertains to the *FG* and *QE* surprises when they reach their peak effects. The second and the third rows present the responses of the one-year and ten-year OIS rates, which highlight that the different ECB policy surprises tend to move the CHF interest rates in the same direction as Swiss stock prices. In addition, the CHF interest rate reactions during the ELB period are qualitatively similar to the respective responses in the pre-ELB period.

In sum, these findings suggest that market participants infer news from the press release of an ECB policy decision and from the accompanying press conference that tend to move Swiss stock prices and CHF interest rates in the same direction. This finding could be interpreted as resulting from information effects in Swiss asset prices that follow from the communication of ECB policy decisions.

6 Conclusions

We used Switzerland as a case study to analyse the patterns of ECB monetary policy spillovers to financial markets of European countries outside the euro area. This analysis relied on local projections of changes in Swiss stock prices and CHF interest rates on different types of ECB policy shocks. We distinguished between pure monetary policy and information effect shocks and ECB policy surprises related to different policy instruments (target policy rate, short-term and long-term forward guidance, asset purchases) of the ECB in our empirical analysis.

Our results document the presence of statistically significant spillover effects from regular, scheduled ECB policy decisions to Swiss asset prices. The patterns in the responses of Swiss asset prices to the different types of ECB policy shocks leave the impression that



(a) ***SPI: pre-ELB*** (b) ***SPI: ELB***

(c) ***one-year OIS: pre-ELB*** (d) ***one-year OIS: ELB***

(e) ***ten-year OIS: pre-ELB*** (f) ***ten-year OIS: ELB***

Fig. 6 Responses of Swiss asset prices to ECB policy shocks: Does the effective lower bound matter?

non-monetary information inferred from the communication of the ECB policy decisions mainly drives Swiss asset prices. Subsample results distinguishing between the period of constrained ECB policy rates by the ELB and the period before policy rates hit the ELB corroborate this finding.

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All authors contributed equally to this research project.

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Availability of data and material
All data and code to replicate the empirical results of this paper are available upon request.

Declarations

Competing interests
The authors declare that they have no competing interests.

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