Life Before Super Thursday: Disentangling the Information Effect

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In this paper we identify the effect of central bank information releases on agents' expectations exploiting institutional features of the Bank of England news release process and high-frequency data. Whereas the literature typically jointly observes the informational and the monetary policy effects, we exploit the fact that the Bank of England, before August 2015, used to release (a) the Monetary Policy Committee communications, (b) the Monetary Policy Committee minutes, and (c) its economic outlook report (the *Inflation Report*) on three separate business days. Through this methodology, we are able to identify "pure" information shocks. Our results suggest that information effects are a key driver of market reactions to central bank's announcements, and that their salience is comparable to the one of pure monetary shocks. Whereas the bulk of the literature makes use of monthly surveys in order to capture output expectations, we exploit the government liabilities *yield curve slope* as inverse proxy of output expectations in a high-frequency exercise, and show that some of the conventional results are overturned. We find strong evidence of information effects not only on output, yet on inflation expectations as well. According to our results, the information effect quantitatively dominates the monetary policy effect on inflation expectations. Vice versa, the monetary policy effect dominates the information effect on output expectations.

Keywords: Monetary Policy, High-Frequency Identification, External Instruments, Information Effect

JEL Classification: E30, E40, E50

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1. Introduction

One of the main channels through which monetary policy operates is the management of agents' expectations about future economic conditions. Understanding through which channels monetary policy announcements affect agents' expectations is therefore an issue of primary importance for central banking. Recent literature has shown that central bank communications affect markets' expectations via primarily two channels: the conventional monetary policy channel and the *information effect*. The pivotal idea underlying the concept of information effect is that, when central banks announce their policy decisions, they reveal information about the state of the economy and their beliefs about the future developments of the current economic conditions.

The recent literature argues that the information effect can be quantitatively more important than the conventional monetary policy effect on agents' expectations. Nakamura and Steinsson (2018), using data from the Survey of Professional Forecasters, show that agents negatively revise their expectations in response to expansionary forward guidance shocks. This finding suggests that agents' expectations might be reacting to concerns that the central bank is signaling unpleasant news about the future economic outcome. Therefore, in their contribution, the information effect is on average more powerful on output than the conventional monetary effect, as it overturns the conventional sign of the output response. A remarkable limitation of their study, and more generally, of the high-frequency identification literature (as for instance Gurkanyak et. al 2005, or Cesa-Bianchi et al. 2016), is that monetary policy shocks and information shocks are jointly observed. Therefore, the conventional approach used in the literature does not allow to tell apart the effect of monetary policy from the one of information shocks.

In this paper we exploit an institutional feature of the Pre August 2015 Bank of England news release process in order to identify the relative importance of the information and the monetary policy components of central bank communication. The identification issue is due to the fact that, conventionally, central banks release jointly monetary policy decisions, the motivation of their policy decisions, and their outlook about the state of the economy. Nevertheless, before the introduction of the so-called *Super Thursday*[1] in August 2015, the Bank of England used to release monetary policy communications and news about the economy at different moments. Prior to August 2015, the three most relevant documents for financial markets were regularly released in distinct days in the following order: (1) the Monetary Policy Committee[2] statement containing the interest rate decision (at monthly

[1]Main UK newspapers named *Super Thursday* the day in which the Bank of England would release its three major pieces of information (its decision on policy rates, the Minutes of the Monetary Policy Committee's meeting, and the quarterly Inflation report).

[2]Henceforth we will adopt the standard acronym MPC.

frequency), (2) the Inflation Report (one week later, every third MPC meeting), and (3) the MPC Meeting Minutes (two weeks later, following every meeting). The Inflation Report is released quarterly and serves two purposes. First (1), it "provides a comprehensive and forward-looking framework for discussion among Monetary Policy Committee members as an aid to decision-making", and second (2) allows the Bank's staff to "share its thinking and explain the reasons for their decisions". Therefore, the Inflation Report represents, for the financial sector, an important source of information regarding the future economic outlook and the Bank's beliefs about the future. Most importantly, up to that date, interest rate decisions were published without any accompanying explanation[3]. Therefore, the MPC Minutes were the only instrument available to investors to understand the motivations underlying the Bank's decision.

The information release process was, therefore, composed by three stages, as explained in Figure 1, where we illustrate the sequence of news released by the Bank of England during the first quarter of 2011. First, the central bank releases the monetary policy decision, and agents form some conjectures (beliefs) with respect to the motivations of the decisions and the informational content of the announcement. Second, if Inflation Report is released, agents acknowledge the Bank's perspective about future economic developments, and update their beliefs for the first time. Third, the MPC Minutes are released. Therefore, agents acknowledge the actual motivations behind the the monetary policy decision, and update their beliefs for the second time. Therefore, by using daily data, we are able to disentangle the effect of the Inflation Report and the MPC Minutes on market expectations from the effect of monetary policy measures and estimate their effect on the economy. We use these estimates to infer the response of the economy to monetary policy and informational shocks, and to decompose the effects of these components on the post-2015 sample (in progress).

The article is structured as follows. In section 2 we review the literature adopting high-frequency identification methods in monetary policy analysis and attempting to identify the information effects. In Section 3 we describe the data used in the paper, in section. In Section 4 we describe the empirical methodology and our identification strategy. In Section 5 we review the results of our estimation. In Section 6 we analyze the dynamic effects of the novel information shocks we identified. Section 7 concludes the paper.

[3] This is a unique feature that characterizes this institutional setup, as the Bank of England at that time, was the only one among the world leading central banks publishing its rate decision without any justification motivating the announced policy decisions (The Guardian, 6th August 2015).

Table 1: Information Release Schedule for the Federal Reserve, the European Central Bank, and the Bank of England

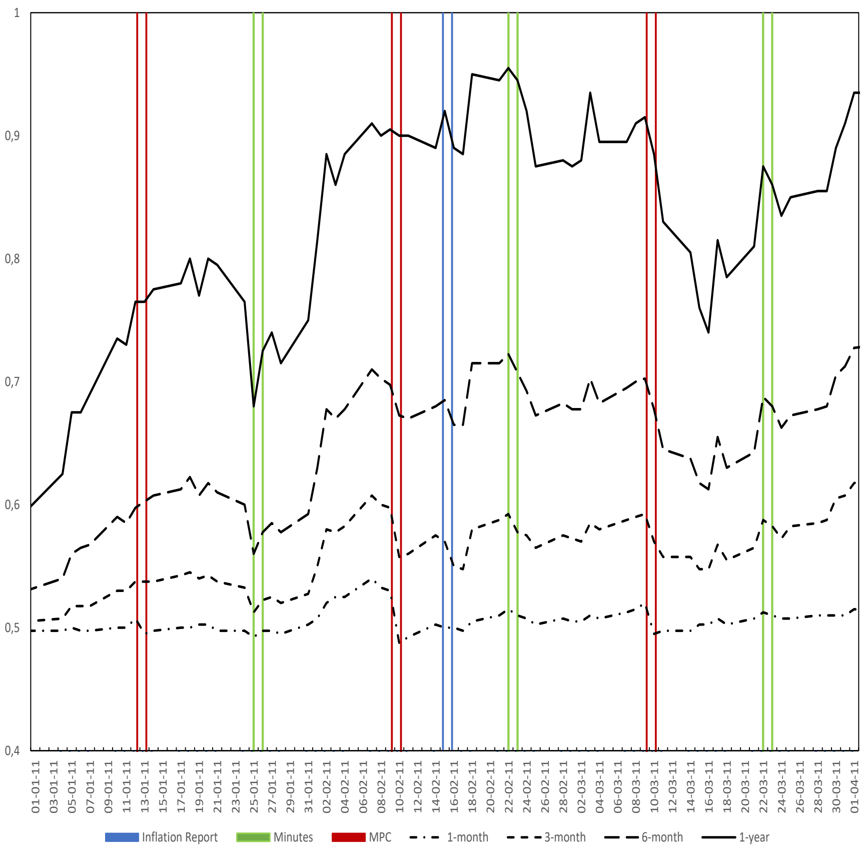
	Monetary Policy Decision	Minutes Release	Economic Outlook Report Release	Press Conference
Federal Reserve (FOMC)	Every 6 Weeks	3 Weeks After the FOMC Meeting (Every 6 Weeks)	Jointly with the FOMC Meeting (Quarterly)	Jointly with the FOMC Meeting (Every 6 Weeks)
European Central Bank (Governing Council)	Every 6 Weeks	4 Weeks After the Governing Council Decision (Every 6 Weeks)	Jointly with the Governing Council Decision (Quarterly)	Jointly with the Governing Council Decision (Every 6 Weeks)
Bank of England (MPC) (pre-August 2015)	Every 4 Weeks	2 Weeks After the MPC Meeting(Every 4 Weeks)	1 Week After the MPC Meeting (Quarterly)	With the Inflation Report Release Only(Quarterly)
Bank of England (MPC) (post-August 2015)	Every 6 Weeks	Jointly with the MPC Meeting (Every 6 Weeks)	Jointly with the MPC Meeting (Quarterly)	With the Inflation Report Release Only(Quarterly)

2. Related Literature

This paper is methodologically related to the literature developing high-frequency methods, and therefore to the pioneering contributions of Cook and Hahn (1989) and Kuttner (2001), who first use high-frequency data in order to study the impact of Fed announcements on interest rates and money issuances; and to the one of Cochrane and Piazzesi (2002), who first propose high-frequency identification with daily data as an alternative to VAR in a spirit close to the one of this paper.

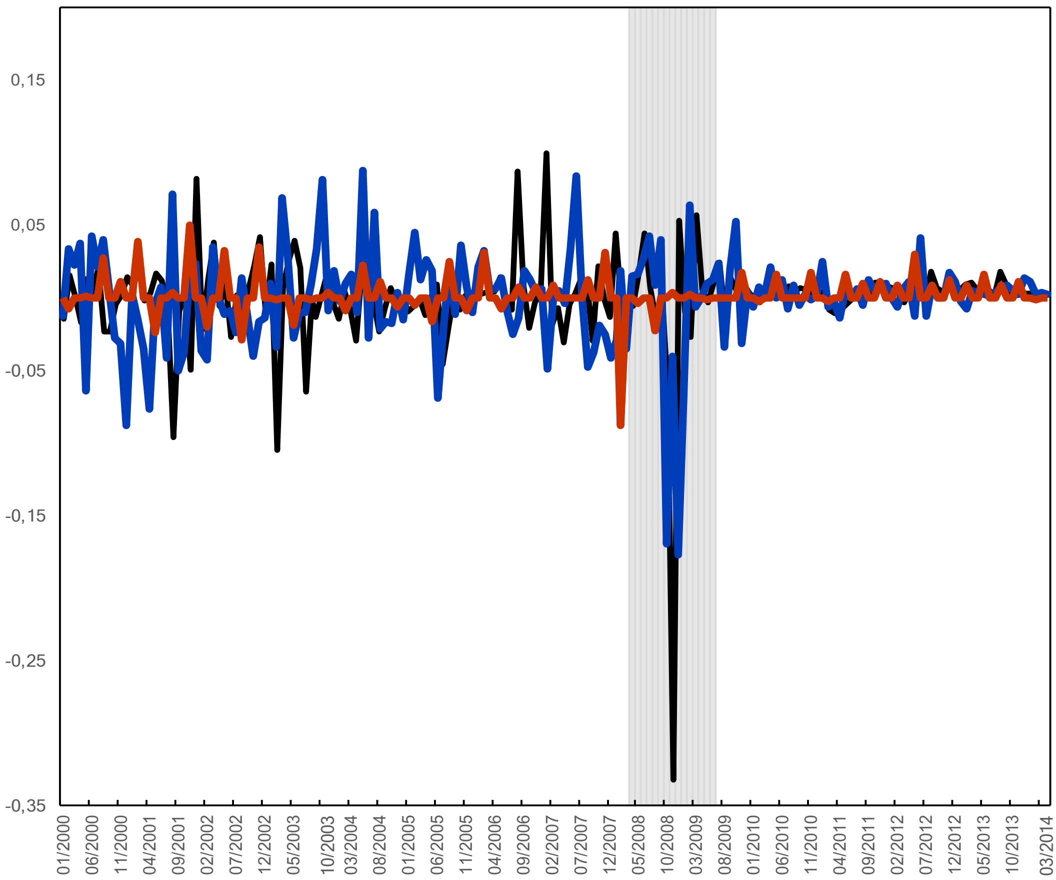
Our paper is closely connected to the literature using high-frequency methods to capture the effects of monetary announcements, starting from the seminal contributions of Gurkanyak et al. (2005) and Campbell et al. (2012), who provide evidence of the effectiveness of forward guidance announcements using high-frequency market interest rate responses following Federal Open Market Committee meetings. Among the most notable contributions, Hanson and Stein (2015) find monetary policy to affect bonds at long maturities, in contrast to conventional business cycle models, and Gertler and Karadi (2015) show high-frequency identification delivers estimates in line with VAR analysis and identify a strong effect of forward guidance policies on short term rates. Among the more recent papers, Miranda-Agrippino and Ricco (2018) expand on the Campbell et al. (2012) approach using market expectations as represented by survey data to capture the informational component of forward guidance announcements.

Figure 1: OIS Rates and Monetary Surprises - Extract From 2011Q1



The figure displays 1-month, 3-month, 6-month, and 1-year OIS spot rates between January and March 2011. Red lines define MPC meeting dates, green lines define MPC Minutes release dates, and blue lines define Inflation Report release dates. Source: authors' computations on Bank of England data

Figure 2: Monetary and Information Surprise Series
(January 2000 - April 2014)



The figure displays the Dynamic Principal Components extracted from the OIS curve variation during announcement and news release dates, aggregated at monthly frequency. Red lines represents the OIS curve response to Inflation Report surprises, the blue line represents the OIS curve response to MPC Minute release surprises, the black line represents the OIS curve response to MPC Announcements. Source: Bank of England and authors' computations

Our paper is further related to the literature exploiting high-frequency identification techniques in order to gauge the effect of unconventional monetary policies. Krishnamurty and Vissing-Jorgensen (2011) find evidence that quantitative easing measures affected several classes of assets, including long-term bonds. Rosa (2012) studies the effect of quantitative easing using data from financial newspaper, news releases, and find quantitative easing to qualitatively have similar results to conventional interest rate cuts. Wright (2012) combines a VAR with a high-frequency approach, finding that unconventional monetary policies have significant but short-lived effects. Gilchrist et al. (2015) using daily data, conclude that the effect of unconventional policies on real borrowing costs is comparable to that of conventional policy.

Furthermore, our paper relates to the more general literature concerning the identification of information effects on the macroeconomy. In particular, to the seminal paper of Romer and Romer (2000), who show that central banks' information set is typically greater than the private sector's one, and attribute long term interest rate dynamics in response to monetary announcements to the disclosure from the central bank of news about the future economic conditions.

Our contribution is connected to the literature aiming to identify the effect of informational shocks through the development of structural dynamic stochastic models of general equilibrium. Melosi (2017) develops a DSGE model in which the central bank signals its views about future economic outlook to firms and agents. His model is able to explain stylised facts about the persistence of inflation and the sluggishness of disinflationary processes. Tang (2017) studies an economy in which agents have partial information and a perfectly informed central bank provides public signals about the fundamentals of the economy. In her contribution, signaling has a discipline effect as it drives agents to align their expectations to fundamentals of the economy. Andrade et al. (2019) identify the response of informational shocks via a structural model in which agents disagree on the interpretation of forward guidance announcements, having different beliefs about the informational content of such announcements. Kisacikoglu (2018) analyses high frequency movements of the yield curve around monetary announcement episodes by combining event studies and a no-arbitrage term structure in a new Keynesian model with partial information and stochastic habit formation.

Our paper is strictly related to papers studying the effect of forward guidance announcements on market expectations, in the tradition of Gurkanyak et al.(2005), who use high-frequency data in order to study the effect of monetary policy announcements. In the same spirit, Jarocinski and Karadi (2018) and Andrade and Ferroni (2016) use high-frequency data of asset prices and sign restrictions to disentangle policy shocks from other news shocks. The paper which most closely relates to our paper is Cieslak and Schrimpf (2018), who study the effect of non-monetary events on the macroeconomy using high-frequency techniques. Cieslak and Schrimpf (2018) observe a number of communication releases by four major central banks and exploit the comovement of interest rates and asset prices jointly with monotonicity restrictions across the yield curve in order to tell apart the information from the monetary policy effect. Our contribution differs from the previous studies because our identification strategy allows for the identification of "pure" information shocks, i.e. information disclosure shocks which abstract from any monetary policy communication. This difference is crucial because under the most conventional institutional structure, as in the bulk of the episodes studied by the literature, news release from the central bank are always accompanied by monetary policy communications.

Eventually, the paper is closely related to three other papers which make use of the same identification strategy, yet focus on different aspects. Gerko and Rey (2017) study the effect on aggregate macro variables of monetary and informational shocks in the US and the UK economy. Hubert (2019) study the interaction of monetary policy and information shocks. Hansen et al. (2019) use text analysis techniques in order to extract the informational content of such announcements. Our paper differs from their contribution since it focuses on the expectation channel, and in particular contributes to the understanding of the effects of informational shocks on output and inflation expectations dynamics.

3. Data Description

We obtain the dates and times of MPC meetings, MPC minute releases and Inflation report releases from the Voting History and the Schedule of the Release Dates available on the Bank of England website (https://www.bankofengland.co.uk/about/people/monetary-policy-committee and https://www.bankofengland.co.uk/news/). Our database includes 437 announcements and news release episodes from January 2000 to July 2015, including 188 monetary policy decision announcement, 187 MPC Minutes release, and 62 Inflation Report releases.

In order to construct our measure of monetary policy and monetary information shocks, we make use of daily (close-to-close) UK Sterling Overnight Index Swap (OIS) rates. OIS rates are typically the rate for overnight unsecured lending between banks, as the Federal Funds Rate for US Dollars, Eonia for Euros, or Sonia for Sterling. These rates, priced by the market in real-time, incorporate information about the expectations of the monetary policy stance at a given horizon. Lloyd (2018) shows that OIS rates can be used as globally comparable empirical measure of investors' expectations of future short-term interest rates. Our OIS data come from two sources. We use OIS rates from January

2009 up to July 2015 with tenors from 1 to 60 months available on the Bank of England website at https://www.bankofengland.co.uk/statistics/yield-curves; and data from ICAP, available on Refinitiv Datastream from January 2000 up to July 2015 with tenors from 1 to 12 months.

We construct a measure of inflation expectations using two different strategies. First, we use data from the Inflation-Linked Government Liability Curve from January 2000 up to July 2015, from the Bank of England website, available at https://www.bankofengland.co.uk/statistics/yield-curves at 2.5-years, 5-years, and 10 years. Second, we infer inflation expectations from inflation swaps data from ICAP, available on Refinitiv Datastream at 1-year, 2-years, 5-years, and 10 years.

In order to build a real-time measure of output expectations, we measure the slope of the Government Liability Curve (commonly referred to as the *yield curve*) using the following specifications: (a) the difference between nominal rates at 10 years and 2 years, (b) the difference between nominal rates at 10 years and 1 year, (c) the difference between real rates at 10 years and 6 months, and (d) the difference between real rates at 10 years and 3 months. We use the yield curve slope because it is one of the few indices available at high-frequency and was found to be an important predictor of economic activity by papers like Estrella and Mishkin (1996), Ang et al. (2007), and Smets and Tsatsaronis (1997). More importantly, the financial sector considers yield curve inversions as a harbinger of future economic contractions. Note that the accuracy of the yield curve in predicting GDP fluctuations is not crucial for this proxy to be used as an indicator of expected future GDP growth. By contrast, our contribution relies on the assumption that financial markets believe the yield curve to be an important predictor of future economic activity, and therefore price the slope according to their expectations about future GDP growth. For that reason, although we consider different specifications of the yield curve, we consider the spread between 10 years and 2 years as our baseline specification, being the most widely used by financial operators (Bauer and Mertens, 2018).

In order to assess the effect of information shocks on the macroeconomy, we use equity prices from the UK stock market (from January 2000 up to July 2015) from 2 different indices: the FTSE 100 (mainly including large multinational companies), the FTSE 250 (more broadly focused on UK-based companies), and the FTSE All-Share (any company listed in the UK). Equity price data come from Thomson Reuters.

In order to control for the effect of exogenous news, we make use of the UK Economic Calendar (available on Bloomberg website at https://www.bloomberg.com/markets/economic-calendar), which contains all the release dates of economic and financial news from January 2011 up to July 2019 and includes information about the time of the release, kind of data, the degree of expected volatility in response to the release, and the market reaction to the release.

Furthermore, in order to measure market reaction to economic news, we make use of the Citi Economic Surprise Index from January 2003 to July 2015, available on Refinitiv Datastream. The Citi Economic Surprise Index measures the overall market reactions to the release of economic news. The index takes positive values when most data releases are coming in above consensus, whereas it takes negative values when the majority of reports are coming in below consensus.

4. Empirical Methodology

Identification of information shocks

We employ a high-frequency identification scheme in order to cleanly disentangle central bank information shocks which can be considered exogenous. Given the institutional peculiarities of the Bank of England communication release schedule prior to August 2015, using a high-frequency approach allows us to extract the informational content from each of the three different releases. Furthermore, by focusing on financial markets expectations for inflation and output, we can cleanly see the effect of each type of shock, which is a novelty of our paper.

Expectations of monetary policy. A number of financial markets instruments can be used to convey expectations with respect to the path for monetary policy of a given central bank, and in particular, the key policy rate. In the US, for example, Fed funds futures are used to convey expectations of the path for the Fed Funds (Target) Rate. In the UK, an often quoted measure is the GBP overnight index swap (OIS) curve (Lloyd, 2018). The curve is made up of tenors, which is the duration or time-to-maturity of each section of the curve. For illustration, the 1 month tenor is the expectation of Bank Rate in one month, whereas the 24 month tenor is the expectation of Bank Rate in 24 months' time, and so on. Hence by using the informational content of the whole curve, as opposed to solely certain tenors as if often the case, we capture information effects relating to forward guidance.

Identifying the shock. We compute the change in each tenor along the whole of the OIS curve between t and $t-1$, where t is the day of release for the Bank Rate announcement (BR), the MPC minutes (MIN), or the Inflation Report (IR). Yields are reported as close of business on each day for which a yield is published. Hence the change in an OIS tenor directly reflects new informational content from the central bank release which was unanticipated by financial market participants. From this we obtain a curve of changes, as defined in Equation (1), where $k = \{\text{BR}, \text{MIN}, \text{IR}\}$ determines the type of release in question, and m is the tenor.

$$\mathcal{O}_{t,m,k} = OIS_{t,m,k} - OIS_{t-1,m,k} \tag{1}$$

Constructing the shock series. In order to exploit the informational content of the whole OIS curve, we take the first dynamic principal component of equation (1) for each k separately. Hence we obtain three separate series of shocks: one for the Bank Rate announcement; one for the release of the MPC minutes; and one for the release of the Inflation Report. We denote this $i_{t,k}$. An advantage of our approach is that we are able to incorporate all the information conveyed by the whole of the OIS curve, as opposed to arbitrarily relying on some author selected tenors. In specifications using ICAP OIS data, we have expectations of monetary policy up to a year from t whereas in specifications including Bank of England OIS data, we have expectations of monetary policy up to five years from t. Furthermore, using a high-frequency identification means that our shocks for the MPC minutes and Inflation Report reflect only central bank information, and one can plausibly argue that the OIS curve would not be markedly affected by other events not related to the central bank releases in such a short time frame.

Choice of principal component analsysis methodology. To construct the first principal component, we opt for DPCA, over classical static PCA. This is due to the time series nature of our data and also the high correlation that exists between tenors. In the static PCA case, data is assumed to be i.i.d., and $Var(Y_t) = \text{diag}$ and $Cov(Y_{t+h,t}) = \text{diag}$, however this latter assumption is in general not true in a time series setting, and certainly not for all h. DPCA is robust to this (Ketelaere, Hubert, and Schmitt, 2015; Shumway and Stoffer, 2017; Brillinger, 2001; Hormann, Kidzinski, and Hallin, 2012). Equally, the elegance of the DPCA methodology means that if it were not needed (i.e., and a static PCA could be implemented correctly), the resulting principal component scores obtained would be equal for the DPCA and the SPCA methodologies. This means that in a time series setting, it is preferable to opt for DPCA (Ketelaere, Hubert, and Schmitt, 2015).

How information shocks affect expectations

Our primary aim is to better understand how central bank information shocks affect expectations, of inflation and of output, and to ascertain whether the effect is different to that of monetary policy shocks.

The model. In order to do this, we estimate equation (2). We follow the standard procedure of Gurkaynak et al. (2005) whereby we regress our shock variables on a selection of variables of interest, as detailed in Section 3. Given our shock variables were obtained using a high frequency identification scheme, the dependent variables we consider need to reflect the same time frame in order to minimise noise in our estimation or influence from other variables.

$$s_{t,k} = \alpha_k + \gamma_k i_{t,k} + \epsilon_t \tag{2}$$

$i_{t,k}$ is the series which measures the unexpected change in the OIS curve for a given k. $s_{t,k}$ is the change in some variable between t and $t-1$, depending on the type of release indexed by k, where t corresponds to the date of the release of information k. ϵ_t is the error term and α and γ are parameters. Estimation is by OLS and using Newey-West standard errors.

The results from our regression analysis are elaborated on in Section 4.

Sensitivity analysis

Economic data is released almost daily, and often there is financial market volatility. These two factors may introduce noise into our estimation. In the Appendix, we show that this should not be of material concern as the mean of positive versus negative news is zero. Furthermore, for robustness, we re-estimate all results including as independent variable the Citi Economic Surprise Index (for the UK and the G10, separately) and an index of volatility (the CBOE VIX and FTSE100 Vol Index, separately). Our results are found to be robust.

Tracing out the dynamic effects

In order to trace out dynamic effects of our shock variables, we estimate a Structural VAR with daily data. Although our three shock variables are observed, and could instead be used in a Proxy-SVAR approach (Stock & Watson (2012) and Mertens & Ravn (2013)) or Local Projection-IV approach (Jorda, 2005), Plagborg-Moller and Wolf (2019) and Noh (2018) show that including the shock variables in a recursive (i.e., Cholesky) SVAR where the shock variables are ordered first, à la Ramey (2011), is valid even under non-invertability and requires less stringent assumptions than the Proxy-SVAR. Furthermore it is equivalent to IRFs obtained from LP-IV.

Hence in each SVAR estimated, we include our three shocks first and another variable last, thus taking the form $y_t = [i_{t,k=BR}, i_{t,k=IR}, i_{t,k=MIN}, s_t]'$. For this exercise we use daily data, meaning the shock variables take value 0 on days when there is no monetary policy event, and the value of the DPCA series described in the section above when there is the release of the Bank Rate, MPC minutes, or Inflation Report. s_t is the daily change of the variables we consider and detail in Section 3.

The ordering of the shock variables is due to the scheduling of release (i.e., first the Bank Rate announcement, then a week later the inflation report, and then a week later the minutes). However for robustness purposes we try different orders and find no discernable difference in our results.

Impulse response functions are produced, with the results reported and discussed in Section 6.

5. Identifying Information Surprises

Table 2 shows our baseline estimates of information shocks and monetary policy shocks on Inflation Swaps at 1, 2, 5, and 10 years, and Inflation-Linked Government Bonds at 2.5, 5, and 10 years as a proxy for inflation expectations. The results included in any cell are obtained via an OLS regression as discussed in Section (4). In each one of them, the independent variable is the dynamic principal component extracted from the daily variation of the tenors of the OIS curve along the whole curve in the corresponding episodes, whereas the dependent variable is the change in inflation swap yields or Inflation-Linked government bonds. In the first line we display the estimated coefficients computed via the regression discussed in Section (4), in the second line we present the Newey-West standard errors and in the third line the adjusted R2 statistics.

We find that the effects of contractionary monetary policy and information shocks on inflation expectations are strongly significant for each of the considered proxies. This result is of particular relevance as in the seminal paper from Nakamura and Steinssonn (2018), who adopt the same methodology but are not able to study pure information shocks, effects of monetary policy are found to be surprisingly insignificant at any horizon. Our findings suggest instead that agents' inflation expectations rise in response to both monetary policy and information shocks. On one side, a positive sign on Inflation Reports and MPC Minutes suggests that, when the central bank releases positive news about the future, the markets expect higher inflation and therefore, higher interest rates. On the other hand, a positive sign on the announcement column suggests that, when the central bank raises its policy rate (or equivalently expectations of future policy rates), agents interpret the central bank's decision as a response to concerns about future inflationary pressures. Therefore, the sign of the reactions to both monetary policy and information shocks seems to be driven by the information effect rather than by the conventional monetary policy sign.

Our findings suggest that the information effect is, on average, more powerful than the conventional monetary policy effect. Conventional theory would predict in fact that inflation expectations should react negatively to contractionary monetary policy shocks. By contrast, we find robust evidence that agent's response to monetary policy shocks is negative. This sign could be possibly interpreted via two different theories: either (i) agents have expectations consistent to Neo-Fisherian models, or, more likely (ii) the information effect dominates the conventional monetary policy effect. The second conjecture finds support in the fact that information shocks, in the GLC-based specification, have a consistently more powerful effect on agents' expectations with respect to monetary policy announcements (whereas in the Swaps-based specification the effect is quantitatively similar, although markedly greater in terms of explained volatility).

MPC Minutes, by contrast, have smaller effects. This suggests that either (i) financial markets were able to correctly interpret the motivations underlying the central bank's interest rate decisions (therefore, clarifications were poorly effective), or (ii) MPC Minutes contain less relevant information for asset pricing with respect to Inflation Report releases. This second hypothesis is supported by the fact that the Inflation Report contains a much greater amount of information with respect to the MPC Minutes, including the bank's forecasts about future economic variables and the bank's interpretation of current economic developments. Notably, the Inflation Report releases explain a great deal of the daily variance of inflation expectations, and their capability of explaining inflation expectation dynamics, is greater and more persistent than monetary policy announcements. As shown in Table 2, adjusted R2 for Inflation Report Releases explain approximately the 40-50% of the daily inflation expectation variance from 1 up to 5-years ahead - roughly 2.5 greater than monetary policy announcements at 1-year and up to 10 times greater at 10-years. The poor explanatory power of monetary policy shocks in the long run is consistent with the long-run neutrality hypothesis of monetary policy. By contrast, shocks involving information releases have much more persistent effects and can affect long term dynamics. The small, but significant long term effects of monetary policy might well also be related to information effects. Our monetary announcement shocks, contain indeed an information component, as they contribute to shaping agents' beliefs. These latter findings are robust across the two different proxies we proposed.

In Table 3 we present our baseline estimates of information and monetary policy shocks on the slope of the Government Liabilities Curve, computed as the spread between 10-years bonds and 3-months, 6-months, 1-year, and 2-years, as a proxy for output expectations. We consider the 10y-2y spread to be our baseline specification, being the most widely used in the financial markets (Bauer and Mertens, 2018). We consider here a specification of the yield curve in nominal terms, as the latter is more commonly used in financial markets and by the bulk of the economic literature (e.g. Ang et al. 2006) compared to the real version.

Finding an output expectation proxy based on real time data is not an easy task. So far, authors like Nakamura and Steinsson (2018), have focused on monthly surveys such as the Survey of Professional Forecasters. The main idea here is that the yield curve slope proxies the expected probability of occurrence of a recession, and is therefore an inverse proxy for output expectations. The use of the yield curve is particularly convenient because in contrast to survey data, it is available in real time, and can therefore be employed in high-frequency empirical exercises.

As for the previous table, the results are obtained via the OLS regression described in Section (4). In each one of them, the independent variable is the dynamic principal component extracted from the daily variation of the tenors of the OIS curve along the whole curve in the corresponding episodes, whereas the dependent variable is the change in the slope of the Government Liabilities Curve. A positive sign in the estimated coefficients indicates a steepening of the yield curve, vice versa a negative sign indicates a flattening of the yield curve. Therefore, a positive sign correspond to an improvement in future output expectations, and a negative sign as a worsening of future output expectations.

In contrast to Nakamura and Steinsson (2018), we find robust evidence that contractionary monetary surprises have a negative effect on output expectations. Stated in other words, we find that the conventional monetary policy effect dominates the information effect for output expectations. The difference between our results and the ones of Nakamura and Steinsson (2018) might have either an economic or an econometric interpretation. Trivially, this difference might stem from the use of a different high-frequency instrument, which delivers a better identification. Alternatively, this hypothesis might arise from institutional differences. The information effect on output might indeed be weaker for the Bank of England given that its mandate does not concern output nor employment concerns (in contrast with the Fed). Another explanation is that the shock we are observing has a much smaller deal of informational content, as the announcements then, were not accompanied by any explanation. Nevertheless, we find evidence that contractionary information shocks deliver a worsening of output expectations, consolidating the former, or the identification hypothesis.

Remarkably, for our baseline specification (10y-2y), the share of variance explained by the Inflation Report is quite high (0.41), yet insignificant for the specifications considering horizons of less than 1 year. Nevertheless, the insignificance might be simply stemming from the fact that financial markets typically focus on the 10y-2y specification. On the other hand, the negative reaction of output expectations to contractionary monetary shocks is robust across all of the specifications.

Eventually, in Table 4 we show our baseline estimates for the information and monetary policy shocks on the FTSE 100 (the share index of the 100 companies listed on the London Stock Exchange with the highest market capitalisation) and the FTSE All-Share (a capitalisation-weighted index, comprising around 600 of more than 2,000 companies traded on the London Stock Exchange) as a proxy for equity prices. As for the previous exercises, the results included in the table are obtained via the OLS regression as discussed in Section (4). In each one of them, the independent variable is the dynamic principal component extracted from the daily variation of the tenors of the OIS curve along the whole curve in the corresponding episodes, whereas the dependent variable is the daily change of the selected equity indices. In the first line we display the estimated coefficients computed via the regression discussed in Section (4), in the second line we present the Newey-West standard errors and in the third line the adjusted R2 statistics.

We find some evidence of a limited information effects on equity prices. We find that the effects of contractionary monetary policy and information shocks are significant at the 10% level, yet only for the MPC Minutes and the Monetary Policy Announcements. The signs of the estimated coefficients indicate that the information effect dominates the conventional monetary policy sign. While conventional theory would suggest that equity prices would shrink in response to expectations of contractionary monetary policy shocks, we find some evidence that equity prices instead, rise. This result is most likely due to the positive inflationary news, which triggered the expectations of a monetary contraction. Nevertheless, the fraction of the variance explained by the shocks is quite limited.

Table 2: Response of Output Expectations to Monetary Policy and Information Shocks

	Inflation Report	Minutes	Announcement
10y-2y Spread	-0.009*** (0.001) 0.41	-0.005*** (0.001) 0.20	-0.006*** (0.002) 0.22
10y-1y Spread	-0.006*** (0.001) 0.13	-0.004*** (0.001) 0.07	-0.006*** (0.002) 0.15
10y-6m Spread	-0.001 (0.002) 0.00	0.000 (0.001) 0.00	-0.005*** (0.001) 0.08
10y-3m Spread	0.002 (0.002) 0.00	0.001 (0.001) 0.00	-0.004*** (0.002) 0.04
No. of Observations	62	187	188

The first line shows the estimated coefficient in response to a contractionary shock in the OIS curve due to the corresponding event. The second line indicates the Newey-West standard errors, and the third the adjusted R2.

Table 3: Response of Inflation Expectations to Monetary Policy and Information Shocks

	Inflation Report	Minutes	Announcement
GBP Swaps 1y	0.008*** (0.001) 0.38	0.004** (0.002) 0.04	0.013*** (0.003) 0.17
GBP Swaps 2y	0.008*** (0.001) 0.45	0.004** (0.002) 0.09	0.011*** (0.002) 0.18
GBP Swaps 5y	0.007*** (0.001) 0.47	0.004* (0.002) 0.09	0.007*** (0.001) 0.15
GBP Swaps 10y	0.002*** (0.000) 0.11	0.003** (0.001) 0.07	0.002*** (0.000) 0.01
BoE GLC 2.5y	0.155*** (0.040) 0.46	0.085** (0.036) 0.16	0.044* (0.025) 0.03
BoE GLC 5y	0.087*** (0.027) 0.32	0.053* (0.020) 0.14	0.028 (0.017) 0.03
BoE GLC 10y	0.024* (0.013) 0.03	0.031*** (0.010) 0.08	0.012** (0.006) 0.01
No. of Observations	62	187	188

The first line shows the estimated coefficient in response to a contractionary shock in the OIS curve due to the corresponding event. The second line indicates the Newey-West standard errors, and the third the adjusted R2.

Table 4: Response of Equity Prices to Monetary Policy and Information Shocks

	Inflation Report	Minutes	Announcement
FTSE 100	0.021	0.066*	0.038*
	(0.036)	(0.035)	(0.020)
	0.00	0.03	0.01
FTSE All Share	0.028	0.062*	0.036*
	(0.034)	(0.033)	(0.019)
	0.00	0.02	0.00
No. of Observations	62	187	188

The first line shows the estimated coefficient in response to a contractionary shock in the OIS curve due to the corresponding event. The second line indicates the Newey-West standard errors, and the third the adjusted R2.

6. The Dynamic Effect of Information Shocks

In Figures 3 and 4, we plot the impulse response functions we obtain from the SVAR analysis explained in Section 4, in response to a contractionary shock of 0,01 standard deviations triggered by a MPC announcement, an Inflation Report, and a Minute release shock. The solid line represents the dynamic response from a Bank Rate shock, the dashed line the dynamic response from a Minute Release shock, and the dotted line from an Inflation Report release shock. The IRFs are reported as accumulated responses with standard errors constructed using Monte Carlo methods.

In the first five panels, we show the dynamic effect of the identified monetary and information shocks on inflation expectations at 1 year, 2 years, 2.5 years, 5 years, and 10 years using Inflation Swaps. Our results suggest that the effect of informational shocks is qualitatively similar to the one of monetary shocks. For all the specification, inflation expectations rise in response to a contractionary shocks suggesting that, for all the specifications, for the information kinds of shock, the information effect dominates the monetary policy effect. Whereas conventional theory suggests that inflation should slow down consequently a contractionary monetary policy shock, agents expect that inflation should rise. Similarly as in Section 5, this indicates that, for what concerns the monetary policy shock, agents react to the concern that the announcement of the central bank might be motivated by a bad economic outlook about the future state of the economy. On the other hand, a rise in inflation expectations due a contractionary news shock, indicates that when the central bank announces expectations of inflationary dynamics, the markets expect future policy rates to rise. Quantitatively the effect of monetary shocks decrease in the expectation horizon. At the impact, a monetary shock has an effect of 0,01 standard deviations on 1-year ahead inflation expectations, while its effectiveness is reduced by 10 times on 10-year ahead inflation expectations, i.e. the effectiveness curve decays almost linearly. As for informational shocks, they have of roughly 0.1-0.2 at the impact on 1-year ahead inflation expectations, their effectiveness increase in the medium term (2.5 and 5 years ahead) and decreases at 10 years. Whereas monetary shocks are comparatively more effective on inflation expectations at short maturities, informational shocks are more effective than monetary shocks at long maturities.

In the following four panels, we investigate the dynamic response of the yield curve slope in response to monetary and informational shocks for four different specifications: 10 years minus 3 months, 10 years minus 6 months, 10 years minus 1 year, and 10 years minus 2 years. When the yield curve slope rises, the expected probability of a recession drops, therefore output expectations improve. By contrast, when the yield curve slope drops, a recession becomes more likely, therefore output expectations worsen. Note that our preferred specification is the 10y-2m, being the most utilised among the financial operators. For all the specifications the yield curve slope drops in response to a contractionary monetary policy announcement. This finding indicates that the monetary effect dominates the information effect, i.e. financial markets expect the monetary policy measure to more than compensate the contractionary news which might have led the central bank to take that measure. Such a result can be easily rationalised within the context of a monetary policy approach involving a strong response to inflationary dynamics and a milder response to output expansions. On the other hand informational shocks are poorly effective on output when we consider specification of the yield curve up to very short maturities (6m-1y). This might be explained by the fact that the central bank information release might be more focused on news about future inflation rather than news about future output. Nevertheless, both the minute release and the inflation report shock trigger a drop in output expectation for our preferred specification, suggesting a dominant role for the conventional monetary policy effect. Eventually, similarly to inflation expectations, equity price rise in response to contractionary shocks, suggesting the information effect might be of great importance for their determination.

Furthermore, we compute the variance decomposition of each shock in each instance for each IRF. On average, each shock contributes between 1% and 3% of the variance decomposition. Whilst this figure may appear small, it is important to remember that each month has approximately twenty days of data yet would only have two shocks, or at most three shocks occurring during months when the Inflation Report is released. Hence in this context, the figure of contribution can be argued to be plausible.

7. Conclusion

We exploit the institutional features of the Pre-August 2015 news release process of the Bank of England, combined with a high-frequency identification approach to estimate the causal effect of information shocks. The information shocks that we identify have large effects on inflation and output expectations, and limited effects on equity prices.

We find information shocks to persistently affect both short and long-term inflation expectations. In contrast to Nakamura and Steinssonn (2018), we find that the information effects dominates the conventional monetary policy effect on inflation expectations, whereas the monetary policy effect dominates the information effect on output expectations.

In sharp contrast with the implications of perfect information models, we show that the release of information by the central bank has massive effects on private sector beliefs, providing support to imperfect information models as in Tang (2015) or Melosi (2017). We interpret the increase in inflation expectations after monetary tightenings, Inflation Report releases, and MPC minutes releases as evidence of information effects.

Consistently to Nakamura and Steinsson (2018), we find strong evidence for both channels: the conventional monetary policy channel and the information effect. The main implication of our analysis is that the sign of a market reaction to a monetary announcement is strictly reliant on the informational content of such announcements.

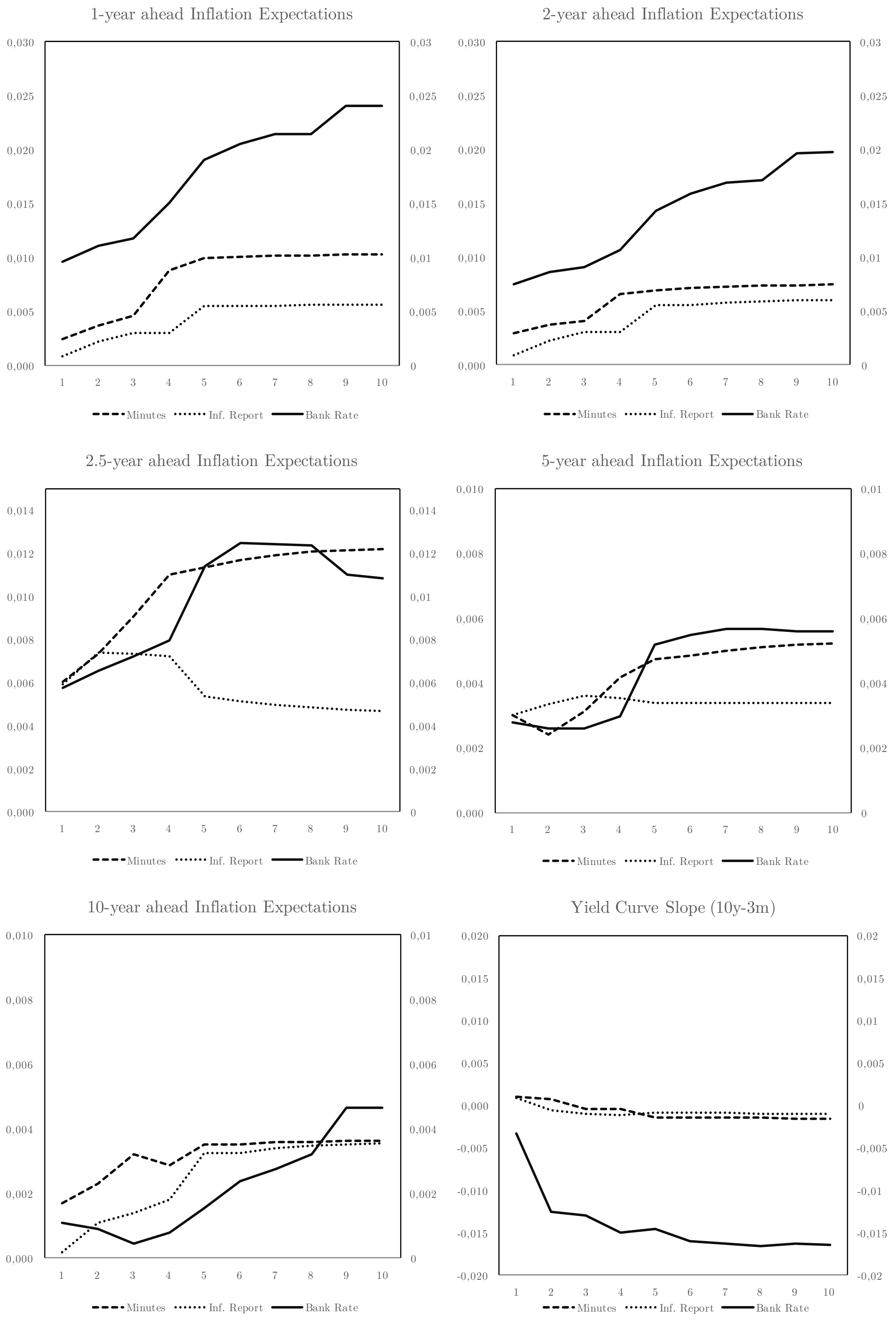


Figure 3: Dynamic Response of Inflation Expectations, Output Expectations, and Equity Prices to MPC Announcements, Inflation Report Release, and Minutes Releases, obtained via Local Projections. The x-axis is expressed in days.

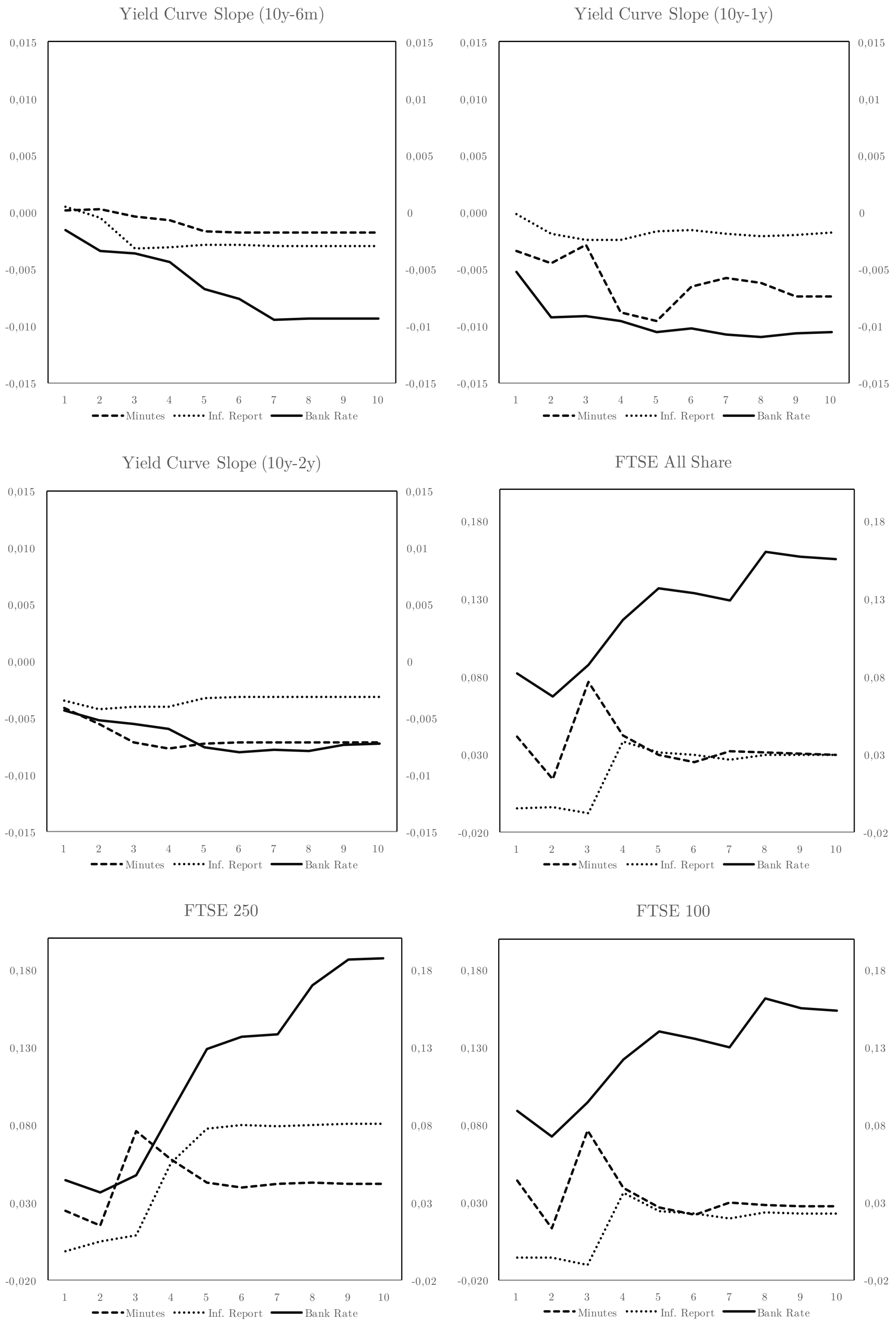


Figure 4: Dynamic Response of Inflation Expectations, Output Expectations, and Equity Prices to MPC Announcements, Inflation Report Release, and Minutes Releases, obtained via Local Projections. The x-axis is expressed in days.

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Appendix

A1. Data and Event Tables

Table 5: Data Table

Data	Source	Description
OIS Rates	Bank of England	Daily measure of the expected Bank Rates from 1 up to 60 months ahead from January 2009 up to July 2015, derived from Overnight Index Swap contracts.
OIS Rates	ICAP via Datastream	Daily measure of the expected Bank Rates from 1 up to 12 months ahead from January 2000 up to July 2015, derived from Overnight Index Swap contracts.
Gilt Yields	Bank of England	Interest rates paid on securities issued by the UK government at 1-year, 2-years, 5-years, and 10-years.
Inflation-Linked Gilt Yields	Bank of England	Interest rates paid on securities issued by the UK government whose payments are linked to changes in the inflation rate, at 1-year, 2-years, 5-years, and 10-years.
Inflation Swaps	ICAP via Datastream	Daily measure of Expected Inflation derived from inflation swaps - derivative contracts in which one party can transfer inflation risk to a counterparty in exchange for a fixed payment.
FTSE 100	Datastream	Daily Returns of the FTSE 250 Index, a share index of the 250 companies listed on the London Stock Exchange with the highest market capitalisation.
FTSE 250	Datastream	Daily Returns of the FTSE 100 Index, a share index of the 100 companies listed on the London Stock Exchange with the highest market capitalisation.
FTSE All-Share	Datastream	Daily Returns of the FTSE All-Share, a capitalisation-weighted index comprising around 600 of more than 2,000 companies traded on the London Stock Exchange.
Citi Economic Surprise Index	Datastream	Daily measure of the Surprise of the UK financial markets, defined as weighted historical standard deviations of data surprises (actual releases vs Bloomberg survey median).

Table 6: Bank of England Release Schedule - Part 1/5

MPC Announcements	MPC Minutes	Inflation Report
13/1/2000	26/1/2000	
10/2/2000	23/2/2000	17/2/2000
9/3/2000	22/3/2000	
6/4/2000	19/4/2000	
4/5/2000	17/5/2000	10/5/2000
7/6/2000	21/6/2000	
6/7/2000	19/7/2000	
3/8/2000	16/8/2000	16/8/2000
7/9/2000	20/9/2000	
5/10/2000	18/10/2000	
9/11/2000	22/11/2000	9/11/2000
7/12/2000	20/12/2000	
11/1/2001	24/1/2001	
8/2/2001	21/2/2001	14/2/2001
8/3/2001	21/3/2001	
5/4/2001	18/4/2001	
10/5/2001	23/5/2001	16/5/2001
6/6/2001	20/6/2001	
5/7/2001	18/7/2001	
2/8/2001	15/8/2001	8/8/2001
6/9/2001		
18/9/2001	19/9/2001	
4/10/2001	17/10/2001	
8/11/2001	21/11/2001	14/11/2001
5/12/2001	19/12/2001	
10/1/2002	23/1/2002	
7/2/2002	20/2/2002	13/2/2002
7/3/2002	20/3/2002	
4/4/2002	17/4/2002	
9/5/2002	22/5/2002	15/5/2002
6/6/2002	19/6/2002	
4/7/2002	17/7/2002	
1/8/2002	14/8/2002	7/8/2002
5/9/2002	18/9/2002	
10/10/2002	23/10/2002	
7/11/2002	20/11/2002	13/11/2002
5/12/2002	18/12/2002	
9/1/2003	22/1/2003	

Table 7: Bank of England Release Schedule - Part 2/5

MPC Announcements	MPC Minutes	Inflation Report
6/2/2003	19/2/2003	12/2/2003
6/3/2003	19/3/2003	
10/4/2003	23/4/2003	
8/5/2003	21/5/2003	15/5/2003
5/6/2003	18/6/2003	
10/7/2003	23/7/2003	
7/8/2003	20/8/2003	13/8/2003
4/9/2003	17/9/2003	
9/10/2003	22/10/2003	
6/11/2003	19/11/2003	12/11/2003
4/12/2003	17/12/2003	
8/1/2004	21/1/2004	
5/2/2004	18/2/2004	11/2/2004
4/3/2004	17/3/2004	
8/4/2004	21/4/2004	
6/5/2004	19/5/2004	12/5/2004
10/6/2004	23/6/2004	
8/7/2004	21/7/2004	
5/8/2004	18/8/2004	11/8/2004
9/9/2004	22/9/2004	
7/10/2004	20/10/2004	
4/11/2004	17/11/2004	10/11/2004
9/12/2004	22/12/2004	
13/1/2005	26/1/2005	
10/2/2005	23/2/2005	16/2/2005
10/3/2005	23/3/2005	
7/4/2005	20/4/2005	
9/5/2005	18/5/2005	11/5/2005
9/6/2005	22/6/2005	
7/7/2005	20/7/2005	
4/8/2005	17/8/2005	10/8/2005
8/9/2005	21/9/2005	
6/10/2005	19/10/2005	
10/11/2005	23/11/2005	16/11/2005
8/12/2005	21/12/2005	
12/1/2006	25/1/2006	
9/2/2006	22/2/2006	15/2/2006
9/3/2006	22/3/2006	

Table 8: Bank of England Release Schedule - Part 3/5

MPC Announcements	MPC Minutes	Inflation Report
11/1/2007	24/1/2007	
8/2/2007	21/2/2007	14/2/2007
8/3/2007	21/3/2007	
5/4/2007	18/4/2007	
10/5/2007	23/5/2007	6/5/2007
7/6/2007	20/6/2007	
5/7/2007	18/7/2007	
2/8/2007	15/8/2007	8/8/2007
6/9/2007	19/9/2007	
4/10/2007	17/10/2007	
8/11/2007	21/11/2007	14/11/2007
6/12/2007	19/12/2007	
10/1/2008	23/1/2008	
7/2/2008	20/2/2008	13/2/2008
6/3/2008	19/3/2008	
10/4/2008	23/4/2008	
8/5/2008	21/5/2008	14/5/2008
5/6/2008	18/6/2008	
10/7/2008	23/7/2008	
7/8/2008	20/8/2008	13/8/2008
4/9/2008	17/9/2008	
8/10/2008	22/10/2008	
6/11/2008	19/11/2008	12/11/2008
4/12/2008	17/12/2008	
8/1/2009	21/1/2009	
5/2/2009	18/2/2009	11/2/2009
5/3/2009	18/3/2009	
9/4/2009	22/4/2009	
7/5/2009	20/5/2009	13/5/2009

Table 9: Bank of England Release Schedule - Part 4/5

MPC Announcements	MPC Minutes	Inflation Report
4/6/2009	17/6/2009	
9/7/2009	22/7/2009	
6/8/2009	19/8/2009	12/8/2009
10/9/2009	23/9/2009	
8/10/2009	21/10/2009	
5/11/2009	18/11/2009	11/11/2009
10/12/2009	23/12/2009	
7/1/2010	20/1/2010	
4/2/2010	17/2/2010	10/2/2010
4/3/2010	17/3/2010	
8/4/2010	21/4/2010	
10/5/2010	19/5/2010	12/5/2010
10/6/2010	23/6/2010	
8/7/2010	21/7/2010	
5/8/2010	18/8/2010	11/8/2010
9/9/2010	22/9/2010	
7/10/2010	20/10/2010	
4/11/2010	17/11/2010	10/11/2010
9/12/2010	22/12/2010	
13/1/2011	26/1/2011	
10/2/2011	23/2/2011	16/2/2011
10/3/2011	23/3/2011	
7/4/2011	20/4/2011	
5/5/2011	18/5/2011	11/5/2011
9/6/2011	22/6/2011	
7/7/2011	20/7/2011	
4/8/2011	17/8/2011	10/8/2011
8/9/2011	21/9/2011	
6/10/2011	19/10/2011	
10/11/2011	23/11/2011	16/11/2011
8/12/2011	21/12/2011	
12/1/2012	25/1/2012	
9/2/2012	22/2/2012	15/2/2012
8/3/2012	21/3/2012	
5/4/2012	18/4/2012	
10/5/2012	23/5/2012	16/5/2012
7/6/2012	20/6/2012	
5/7/2012	18/7/2012	

Table 10: Bank of England Release Schedule - Part 5/5

MPC Announcements	MPC Minutes	Inflation Report
2/8/2012	15/8/2012	8/8/2012
6/9/2012	19/9/2012	
4/10/2012	17/10/2012	
8/11/2012	21/11/2012	14/11/2012
6/12/2012	19/12/2012	
10/1/2013	23/1/2013	
7/2/2013	20/2/2013	13/2/2013
7/3/2013	20/3/2013	
4/4/2013	17/4/2013	
9/5/2013	22/5/2013	15/5/2013
6/6/2013	19/6/2013	
4/7/2013	17/7/2013	
1/8/2013	14/8/2013	7/8/2013
5/9/2013	18/9/2013	
10/10/2013	23/10/2013	
7/11/2013	20/11/2013	13/11/2013
5/12/2013	18/12/2013	
9/1/2014	22/1/2014	
6/2/2014	19/2/2014	12/2/2014
6/3/2014	19/3/2014	
10/4/2014	23/4/2014	
8/5/2014	21/5/2014	14/5/2014
5/6/2014	18/6/2014	
10/7/2014	23/7/2014	
7/8/2014	20/8/2014	13/8/2014
4/9/2014	17/9/2014	
9/10/2014	22/10/2014	
6/11/2014	19/11/2014	12/11/2014
4/12/2014	17/12/2014	
8/1/2015	21/1/2015	
5/2/2015	18/2/2015	12/2/2015
5/3/2015	18/3/2015	
9/4/2015	22/4/2015	
11/5/2015	20/5/2015	13/5/2015
4/6/2015	17/6/2015	
9/7/2015	22/7/2015	

A2. Do our three surprise series correlate?

Table 11: Correlations Between MPC Announcement, Minute Release, Inflation Report surprise series (Monthly Frequency)

Series	MPC Announcement	MPC Minutes	Inflation Report	Sample	N
MPC Announcement	-	0.04	-0.01	*Monthly*	*172*
	-	(0.56)	(0.85)	*2000M1-2014M4*	
MPC Minutes	0.04	-	0.00	*Monthly*	*172*
	(0.56)	-	(0.98)	*2000M1-2014M4*	
Inflation Report	-0.01	0.00	-	*Monthly*	*172*
	(0.85)	(0.98)	-	*2000M1-2014M4*	

Table 12: Correlations Between MPC Announcement, Minute Release, Inflation Report surprise series (Monthly Frequency, months including Inflation Report releases only)

Series	MPC Announcement	MPC Minutes	Inflation Report	Sample	N
MPC Announcement	-	0.17	-0.08	*Monthly*	*57*
	-	(0.20)	(0.54)	*2000Q1-2014Q2*	
MPC Minutes	0.17	-	0.04	*Monthly*	*57*
	(0.20)	-	(0.74)	*2000Q1-2014Q2*	
Inflation Report	-0.08	0.04	-	*Monthly*	*57*
	(0.54)	(0.74)	-	*2000Q1-2014Q2*	

Table 13: Correlation Coefficients of our MPC Announcement, Minute Release, Inflation Report surprise series (Quarterly Frequency)

Series	MPC Announcement	MPC Minutes	Inflation Report	Sample	N
MPC Announcement	-	0.49	0.58	*Quarterly*	*58*
	-	(0.00)	(0.00)	*2000Q1-2014Q2*	
MPC Minutes	0.49	-	0.51	*Quarterly*	*58*
	(0.00)	-	(0.00)	*2000Q1-2014Q2*	
Inflation Report	0.58	0.51	-	*Quarterly*	*58*
	(0.00)	(0.00)	-	*2000Q1-2014Q2*	

These table show the cross-correlation coefficients of our MPC announcement, MPC minute release, and Inflation Report release surprise series at monthly and quarterly (aggregated) frequences. In the first table all months are taken into account. In the second table, only the months in which Inflation reports were released are included into the sample. The numbers reported in the table are the correlation coefficients (first line, without brackets), and the p-values obtained from the Pearson Correlation test (second line, within brackets).

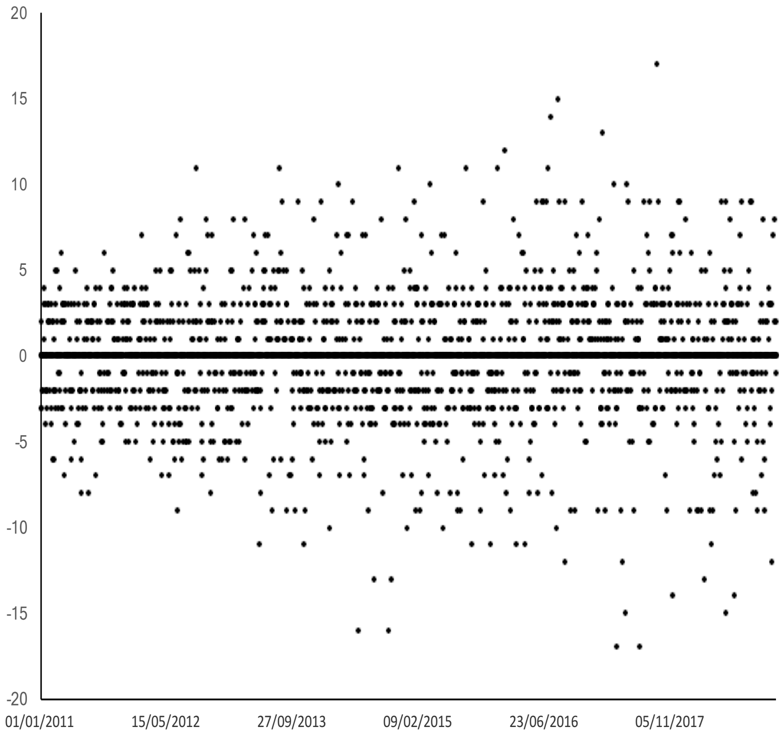
A3. Correlation with Other Shocks

Table 14: Correlation Coefficients of our instruments with other shocks identified in the literature

Series	MPC Decision	MPC Minutes	Inflation Report	Sample	N
UK Monetary	0.17	0.02	-0.14	*Monthly*	*97*
Cloyne Huertgen (2016)	(0.10)	(0.87)	(0.16)	*2000M1-2007M12*	
UK Bank Rate	0.78	-0.25	-0.12	*Monthly*	*182*
Gerko Rey (2017)	(0.00)	(0.00)	(0.10)	*2000M1-2015M1*	
UK Minutes	-0.05	0.44	0.04	*Monthly*	*182*
Gerko Rey (2017)	(0.46)	(0.00)	(0.61)	*2000M1-2015M1*	
UK IR Shock	0.14	-0.04	0.30	*Monthly*	*182*
Gerko Rey (2017)	(0.05)	(0.62)	(0.00)	*2000M1-2015M1*	
UK Monetary	0.76	0.02	-0.14	*Monthly*	*187*
Cesa-Bianchi et al. (2018)	(0.00)	(0.82)	(0.05)	*2000M1-2015M6*	
UK Fiscal	-0.03	0.14	0.03	*Quarterly*	*53*
Cloyne (2013)	(0.85)	(0.32)	(0.85)	*2000Q1-2009Q3*	
UK Productivity	-0.06	-0.06	-0.17	*Quarterly*	*62*
Office for National Statistics	(0.62)	(0.65)	(0.18)	*2000Q1-2015Q3*	
UK Policy Uncertainty	-0.11	-0.05	-0.05	*Monthly*	*189*
Baker et al. (2016)	(0.14)	(0.46)	(0.52)	*2000M1-2015M8*	
UK Macro Uncertainty	-0.13	-0.05	-0.05	*Monthly*	*97*
Redl (2018)	(0.19)	(0.60)	(0.65)	*2000M1-2015M8*	
UK Financial Uncertainty	-0.25	-0.05	-0.07	*Monthly*	*189*
Redl (2018)	(0.00)	(0.53)	(0.31)	*2000M1-2015M8*	
Global Oil	-0.16	-0.05	0.03	*Monthly*	*189*
Baumeister Hamilton (2018)	(0.02)	(0.46)	(0.70)	*2000M1-2015M8*	
Global Oil	0.15	0.11	-0.10	*Monthly*	*189*
Kanzig (2019)	(0.05)	(0.13)	(0.17)	*2000M1-2015M8*	

This table shows the correlation coefficients of our MPC announcement, MPC minute release, and Inflation Report release surprise series with a set of different shocks from other authors in the literature. The numbers reported in the table are the correlation coefficients (first line), and the p-values obtained from the Pearson Correlation test (in brackets). Whenever quarterly frequency series are not available, we aggregate our surprise series by summing across months.

Figure 5: Our Daily Non-Monetary Surprise Index



A4. Do Macroeconomic News Matter?

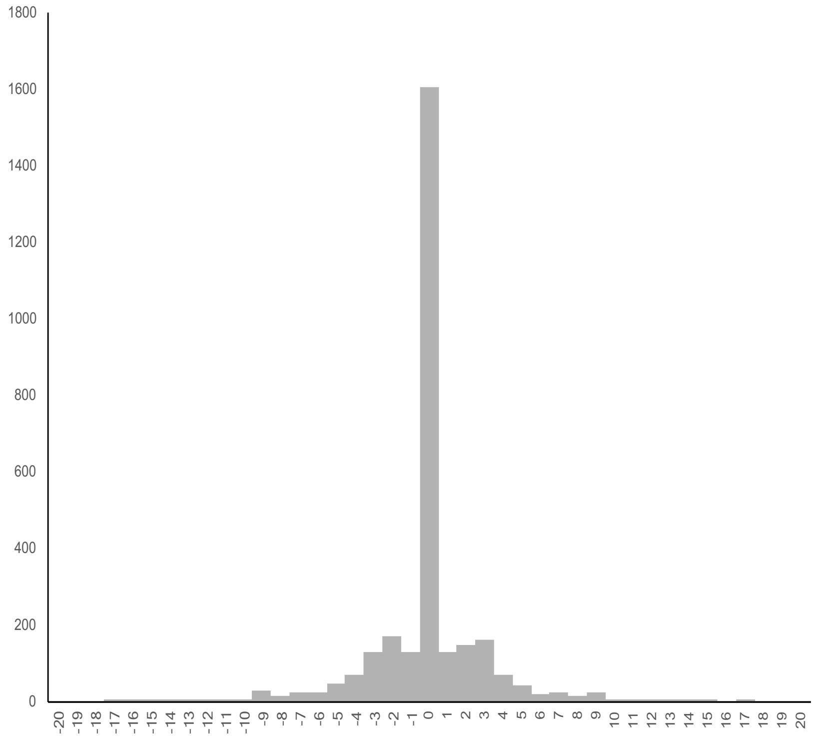
In this section, we address the concerns that, the release of news unrelated to the monetary policy and the information announcements might affect our results. We therefore proceed as follows:

1. We consider the Bloomberg UK Economic Calendar between January 2011 and July 2019[4]. The Bloomberg UK Economic Calendar lists all the economic and financial news releases and includes data about release date, release time, type of data, expected volatility in response to the news, and the market surprise (whether the news was in line / better / worse than market expectations). Between January 2011 and July 2019, the calendar contains 6354 news, distributed over 2902 days.

2. We construct a non-monetary surprise index as follows. We attribute a score to each news. We construct the score attributed to each news as follows. We attribute a relevance of 1 if the expected volatility is low, 2 if it is moderate, and 3 if it is high. We attribute a negative sign if the news is worse than market expectations, a zero sign if the news is in line with the consensus, and positive if the market is positively surprised by the news. We then sum up the overall daily contribution of external news in each date between January 2011 and July 2019.

[4]The sample choice is constrained by data availability, as only news from January 2011 to July 2019 are available in a computable format.

Figure 6: Distribution of the Non-Monetary News Surprise Index



3. We then run a t-test in order to check whether the mean of our index is statistically different from zero. Results are presented in the following table:

Table 15: Results of the t-Test (against the null hypothesis of zero mean)

t-Test	
Mean	-0.07
Variance	8.43
Observations	2902
t Stat	-1.34
P(T<=t)	0.18
t Critical	1.96

Under $\alpha = 0.05$, we cannot reject the null hypothesis that the mean of the news is statistically different from zero. We therefore infer that market reactions with respect to non-monetary news are very likely to have a mean not significantly different from zero. This evidence suggests that market expectations distribution with respect to the revealed news have zero mean, as shown in the Figure below. We can therefore conclude that the presence of non-monetary macroeconomic and financial news is not likely to have affected our results.

Robustness and sensitivity checks

Sensitivity to data and subsamples

In the main analysis for our findings discussed in Section 5, we use ICAP data on OIS curves and have a sample from January 2000 to July 2015, inclusive, with tenors 1m to 12m in increments of 1m. However, two issues may arise. Firstly, it maybe that our results are sensitive to the data provider chosen. Indeed, we opted for ICAP brokerage data due to it offering the longest time series history. Other sources, including the Bank of England, exist, albeit with much shorter histories. Bank of England OIS curve data is published from January 2009 onwards, but includes tenors 1m to 60m in increments of 1m. Secondly, it maybe that the financial crisis of 2008/2009 is driving our results.

Hence we re-evaluate our analysis but under the following conditions:

a. Using Bank of England OIS data, tenors 1m to 12m; this ascertains if the source provider matters

b. Using ICAP OIS data, all tenors, from January 2010 to July 2015; this ascertains if our results are driven by the financial crisis

c. Using ICAP OIS data, all tenors, December 2007 and before; this ascertains if our results are driven by the financial crisis

From the above sensitivity analysis, our key results are unchanged. All reported variables (coefficient, standard error, and adjusted-R-squared) remain in line with our base analysis. For brevity, we report results from (a) with respect to inflation expectations using GBP Inflation Swaps. All other results are available on request.

Table A1: Response of Inflation Expectations to Monetary Policy and Information Shocks
Bank of England Data

	Inflation Report	Minutes	Announcement
GBP Swaps 1y	0.003***	0.001**	0.005**
	(0.001)	(0.001)	(0.002)
	0.43	0.03	0.05
GBP Swaps 2y	0.004***	0.001**	0.004**
	(0.001)	(0.001)	(0.002)
	0.56	0.05	0.06
GBP Swaps 5y	0.004***	0.001*	0.003
	(0.001)	(0.001)	(0.002)
	0.51	0.04	0.06
GBP Swaps 10y	0.002***	0.001**	0.002
	(0.000)	(0.000)	(0.002)
	0.41	0.08	0.05

Notes: *** denotes statistical significance at the 1% level, ** denotes statistical significance at the 5% level, and * denotes statistical significance at the 10% level. Newey-West HAC robust standard errors are reported in parenthesis below the coefficient estimates. The third line in each panel is the adjusted-R-squared value.

Sensitivity to omitted variables

As noted in Section 4, whilst our three shock variables are cleanly identified, it is important to consider whether or not our dependent variables are maybe responding to other macroeconomic news released during the same time frame or to general financial market volatility as opposed to the monetary policy and information shocks which we have identified.

Macroeconomic news surprises: There is a large literature on how asset prices are affected by macroeconomic news (GÃ¼rkaynak and Wright, 2013), and in particular, whether or not this news is in-line with expectations, above expectations, or below expectations (Caruso, 2019). In order to consider this, we re-estimate Section 4.2 in the following specification:

$$s_{t,k} = \alpha_k + \gamma_k i_{t,k} + \delta_k \mathcal{S}_{t,k} + \varepsilon_t$$

As previously, $i_{t,k}$ is the series which measures the unexpected change in the OIS curve for a given k. $s_{t,k}$ is the change in some variable between t and $t-1$, depending on the type of release indexed by k, where t corresponds to the date of the release of information k. ε_t is the error term and α and γ are parameters. Estimation is by OLS and using Newey-West standard errors.

δ_k is a parameter associated to $\mathcal{S}_{t,k}$. $\mathcal{S}_{t,k}$ is the Citi Economic Surprise Index where t is the day which information k is released. The Citi Economic Surprise Index measures quantitatively macroeconomic news surprises, calculated as the difference between the realised data value and the median consensus forecast value (obtained from sources such as Bloomberg and Refinitiv), with data being weighted for importance to financial markets. Given this, there cannot be concerns about the economic surprise index containing expectations about the monetary policy releases, at least for the minutes and the inflation report, since no forecasts regarding these are provided. Consensus forecasts are available for the Bank Rate, however, although a growing literature argues that financial markets more often than not correctly anticipate key policy rate changes (Wilhelmsen and Zaghini, 2011).

We consider four specifications: 1) $\mathcal{S}$ is the UK economic surprise index; 2) $\mathcal{S}$ is the G10 economic surprise index; 3) $\mathcal{S}$ is the change in the UK economic surprise index between t and $t-1$; and 4) $\mathcal{S}$ is the change in the G10 economic surprise index between t and $t-1$. Indeed, given global interconnectedness, it maybe that UK yields are responding to movements in foreign yields driven by foreign macroeconomic news surprises.

Publication of the Citi Economic Surprised Indices began in January 2003, and hence we can only conduct this robust check from January 2003 to July 2015.

In each instance, our results remain robust. The shock remains statistically significant at the same confidence level as in the baseline analysis, and the adjusted-R-squared is comparable, as is the magnitude of the coefficient. Moreover, more often than not, the surprise index variable is statistically insignificant. For brevity, we report results from (1) with respect to inflation expectations using GBP Inflation Swaps. All other results are available on request.

Table A2: Response of Inflation Expectations to Monetary Policy and Information Shocks with Citi UK Economics Surprise Index

	Inflation Report	Surprise Index	Minutes	Surprise Index	Announcement	Surprise Index
GBP Swaps 1y	0.008***	0.000	0.003	0.000	0.013***	0.000
	(0.001)	(0.000)	(0.002)	(0.000)	(0.003)	(0.000)
	0.36		0.06		0.17	
GBP Swaps 2y	0.008***	0.000	0.004**	0.000	0.011***	0.000
	(0.001)	(0.000)	(0.002)	(0.000)	(0.002)	(0.000)
	0.44		0.09		0.18	
GBP Swaps 5y	0.007***	0.000	0.004**	0.000	0.007***	0.000
	(0.001)	(0.000)	(0.002)	(0.000)	(0.001)	(0.000)
	0.46		0.08		0.14	
GBP Swaps 10y	0.002***	0.000	0.003*	0.000	0.002***	0.000
	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)
	0.15		0.07		0.00	

Notes: *** denotes statistical significance at the 1% level, ** denotes statistical significance at the 5% level, and * denotes statistical significance at the 10% level. Newey-West HAC robust standard errors are reported in parenthesis below the coefficient estimates. The third line in each panel is the adjusted-R-squared value.

Financial market volatility: Volatility is a common phenomena of financial markets, so much so that there exist trading strategies based around this (Hirota et al., 2018). Volatility can be caused by a variety of factors, such as speculative trading (Hirota et al., 2018), political declarations (see for instance Bloomberg, 2019 on Donald Trump's Tweets), geopolitics (Smales, 2019), etc. In order to ascertain if what we are capturing is market volatility, as opposed to central bank information effects, we re-estimate Section 4.2 in the following specification:

$$s_{t,k} = \alpha_k + \gamma_k i_{t,k} + \delta_k \mathcal{V}_{t,k} + \varepsilon_t$$

As previously, $i_{t,k}$ is the series which measures the unexpected change in the OIS curve for a given k. $s_{t,k}$ is the change in some variable between t and $t-1$, depending on the type of release indexed by k, where t corresponds to the date of the release of information k. ε_t is the error term and α and γ are parameters. Estimation is by OLS and using Newey-West standard errors.

δ_k is a parameter associated to $\mathcal{S}_{t,k}$. $\mathcal{S}_{t,k}$ is the Citi Economic Surprise Index where t is the day which information k is released. The Citi Economic Surprise Index measures quantitatively macroeconomic news surprises, calculated as the difference between the realised data value and the median consensus forecast value (obtained from sources such as Bloomberg and Refinitiv), with data being weighted for importance to financial markets. Given this, there cannot be concerns about the economic surprise index containing expectations about the monetary policy releases, at least for the minutes and the inflation report, since no forecasts regarding these are provided. Consensus forecasts are available for the Bank Rate, however, although a growing literature argues that financial markets more often than not correctly anticipate key policy rate changes (Poole, et al.).

We consider four specifications: 1) $\mathcal{V}$ is the CBOE VIX Index at close of trading on t; 2) $\mathcal{V}$ is the FTSE 100 Volatility Index at close of trading on t; 3) $\mathcal{V}$ is the change in the CBOE VIX Index between t and $t-1$; and 4) $\mathcal{V}$ is the change in the FTSE 100 Volatility Index between t and $t-1$. Indeed, given global interconnectedness, it maybe that UK yields are responding to movements in foreign market volatility.

Sensitivity analyses including the CBOE VIX and the FTSE 100 Volatility Index are for the full January 2000 to July 2015.

In each instance, our results remain robust. The shock remains statistically significant at the same confidence level as in the baseline analysis, and the adjusted-R-squared is comparable, as is the magnitude of the coefficient. Moreover, more often than not, the volatility index variable is statistically insignificant. For brevity, we report results from (1) with respect to inflation expectations using GBP Inflation Swaps. All other results are available on request.

Table A3: Response of Inflation Expectations to Monetary Policy and Information Shocks with UK FTSE 100 Vol Index

	Inflation Report	Volatility Index	Minutes	Volatility Index	Announcement	Volatility Index
GBP Swaps 1y	0.007***	0.000	0.003	-0.001	0.013***	-0.001
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
	0.36		0.04		0.17	
GBP Swaps 2y	0.009***	-0.001	0.004**	-0.001	0.010***	-0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
	0.47		0.11		0.18	
GBP Swaps 5y	0.005***	-0.001*	0.002**	-0.001	0.006***	-0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
	0.52		0.14		0.16	
GBP Swaps 10y	0.002	0.000	0.002	-0.001	0.001***	0.000
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
	0.08		0.11		0.00	

Notes: *** denotes statistical significance at the 1% level, ** denotes statistical significance at the 5% level, and * denotes statistical significance at the 10% level. Newey-West HAC robust standard errors are reported in parenthesis below the coefficient estimates. The third line in each panel is the adjusted-R-squared value.