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Do monetary policy transparency and central bank communication reduce interest rate disagreement?

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Abstract

Yes. This study produces evidence that monetary policy transparency and communication policy of the Bank of England have information content in reducing disagreement about interest rate forecasts. Different from most extant studies employing the transparency index derived from official documents of the central banks, this study extends the literature by using a recently developed market-based monetary transparency index. Moreover, this study analyzes forecast disagreement in a multivariate perspective based on survey data of short- and long-term rates over short and long horizons. This study characterizes several patterns on forecast disagreement related to maturities of interest rates, forecast horizons, recessions, forward guidance, credibility, transparency, and communication policy. Interestingly, disagreement among the Monetary Policy Committee in policy rate decisions is associated with lower disagreement among professional forecasters on interest rate outlook, whereas neither announcement of changes in policy rates nor publication of inflation reports affects forecast disagreement. These results have important implications for monetary policymakers in managing market expectations of interest rates.

KEYWORDS

central bank communication, disagreement, monetary policy, monetary policy committee, transparency

1 | INTRODUCTION

There is a growing concern among academics and practitioners that monetary policy works mainly through managing market expectations (e.g., Blinder, Ehrmann, Fratzscher, Haan, & Jansen, 2008; de Mendonca & Galveas, 2013; Ehrmann, Eijffinger, & Fratzscher, 2012; Jitmaneeroj, Lamla, & Wood, 2019; van der Cruijsen, Eijffinger, & Hoogduin, 2010). As Woodford (2001) states: "If the beliefs of market participants are diffuse and poorly informed, this is difficult, and monetary policy will necessarily be a fairly blunt instrument of stabilization policy ...." In this respect, most central banks have improved monetary policy transparency, as a high degree of transparency of policy decisions should result in a common understanding among central bank watchers, which in turn brings with it reductions in forecast disagreement (e.g., Ehrmann & Fratzscher, 2009; Montes, Oliveira, Curi, & Nicolay, 2016; Neuenkirch, 2012; Swanson, 2006; Trabelsi, 2016). Forecast disagreement about the state of the economy has important implications for the conduct of monetary policy. Large disagreement provides a signal to central banks regarding the level of uncertainty perceived by market participants (Ehrmann et al., 2012). More often than not, the literature has extensively focused on the influence of

transparency on disagreement about inflation expectations (e.g., de Mendonca & Filho, 2017; Glas & Hartmann, 2016; Montes et al., 2016; Siklos, 2013; Trabelsi, 2016). Unlike this strand of literature, the current study contributes to the limited studies on the effect of transparency and communication policy of the Bank of England (BOE) on disagreement about interest rate forecasts in the following aspects.

First, the precise measures of monetary policy transparency depend on several attributes that are not directly observable. The most commonly used transparency index is constructed from the official document and information disclosure by central banks to the public (e.g., Dincer & Eichengreen, 2014; Eijffinger & Geraats, 2006; Siklos, 2011). This type of transparency index tends to be affected by a subjective judgment of researchers in assigning the transparency scores. Moreover, it is usually available at the annual frequency since institutional characteristics of central banks rarely change in short periods (de Mendonca & Galveas, 2013; Kia, 2017; Montes et al., 2016). For these reasons, Kia (2011) argued that what was important for monetary policy transparency was how market participants understood the implementation of monetary policy, rather than what policymakers intended to convey to the market. Given the limitations of such a document-based transparency index, our study is believed to be the first attempt to apply Kia's (2011) methodology to construct the market-based transparency index, which reflects market perceptions of the BOE monetary policy actions.

Second, the BOE has moved toward greater transparency of policy decisions by engaging in several elements of communication policy that enable market participants to obtain thorough information about the monetary policy and to understand factors on which the BOE bases its formulation of monetary policy (Chortareas, Jitmaneeroj, & Wood, 2012; Ehrmann & Fratzscher, 2009). In turn, this should allow central bank watchers to better anticipate the future course of interest rates. To this end, this study examines which element of monetary policy communication (i.e., the publication of inflation reports, disagreement among the Monetary Policy Commission (MPC) in policy rate decisions, and the announcement of changes in policy rates) is effective in achieving the objective of reducing disagreement about interest rate forecasts.

Third, extant studies on the association between monetary policy transparency and disagreement about interest rate forecasts have focused almost exclusively on short-term interest rates (Howells & Mariscal, 2007; Swanson, 2006). Nevertheless, the effect of monetary policy is not always described by its direct effect on short-term rates, but rather long-term rates which play a crucial role as a primary transmission channel of monetary policy to real economy activity (Herrmann & Schroeder, 2008; Papadamou, 2013). To stimulate economic activities, central banks should be able to influence a whole spectrum of interest rates and market expectations for interest rates (Blinder et al., 2008). Besides, while the short-horizon predictability is likely to be relevant to financial markets since unanticipated policy decisions typically cause a repositioning of market participants, the long-horizon predictability can be more pertinent to the real economy since investment decisions consider the entire future course of interest rates over investment horizons (Ehrmann & Fratzscher, 2009). To address these issues, this study broadens the analysis by accounting for the likelihood that the extent of disagreement may differ depending on maturities and horizons of interest rate forecasts. In doing so, disagreement is analyzed for four cases: SMSH (short maturity–short horizon), SMLH (short maturity–long horizon), LMSH (long maturity–short horizon), and LMLH (long maturity–long horizon).

Finally, recent studies show that analyzing forecast disagreement in a multivariate perspective is more suitable than treating forecast disagreement about each variable separately (e.g., Banternghansa & McCracken, 2009; Dovern, 2015; Drager & Lamla, 2017). In this sense, the current study not only examines disagreement in the context of interest rate expectations for each case of SMSH, SMLH, LMSH, and LMLH but also investigates these cases simultaneously in a panel data framework. Professional forecasters who believed in the expectations hypothesis of the term structure of interest rates would likely adjust their forecasts of short- and long-term rates over short- and long-horizons as their information set has changed over time (Blinder et al., 2008; Jitmaneeroj & Wood, 2013). In addition, this study considers that disagreement on interest rate forecasts tends to be driven by disagreement about gross domestic product (GDP), inflation, and unemployment forecasts (Carlstrom & Jacobson, 2015; Drager & Lamla, 2017; Jitmaneeroj et al., 2019; Swanson, 2006). The logic for doing so is based on the possibility that professional forecasters construct their interest rate expectations in a congruent manner that jointly describes their views of the term structure of interest rates and the states of the economy.

The results of this study reveal a number of important patterns on disagreement about interest rate forecasts related to maturities of interest rates, forecast horizons, recessions, forward guidance, credibility, transparency, and elements of central bank communication. Increased transparency and central bank communication indeed serve as a coordination tool among market participants, and hence reduce forecast disagreement about interest rate outlook. Most importantly, disagreement among

MPC members in making policy rate decisions significantly lowers disagreement among professional forecasters regarding interest rate expectations, whereas neither the announcement of changes in policy rates nor the publication of inflation reports has a significant effect.

This study provides important implications for monetary policymakers. When deciding on improvements in transparency of policy decisions in order to steer market expectations of interest rates over the term structure, policymakers should take into account the fact that the impact of monetary policy transparency on disagreement depends on maturities of interest rates and forecast horizons. To be more specific, disagreement about long-horizon (short-maturity) forecasts is more susceptible to monetary policy transparency than disagreement about short-horizon (long-maturity) forecasts. Furthermore, policymakers of the BOE should conduct communication policy in an individualistic way by disclosing the diversity of voting records of the MPC members.

The rest of this paper is organized in the following way. Section 2 presents a brief review of the related studies on the effect of monetary policy transparency and central bank communication on forecast disagreement. Section 3 outlines the construction of the market-based transparency index and the methodology for the empirical analysis. Section 4 describes a dataset. Section 5 reports the empirical findings as well as some robustness checks. Finally, Section 6 concludes the results, draws some policy implications, and suggests future avenues for empirical research.

2 | LITERATURE REVIEW

2.1 | Monetary policy transparency and disagreement about interest rate forecasts

The monetary policy rule should be defined as a starting point for investigating the determinants of disagreement about interest rate expectations. Swanson (2006) set up a simple monetary policy rule which postulated that the policy interest rate (i_t) was totally explained by the policy function (f) and the state of the economy (X_t); that is, $i_t = f(X_t)$. In a similar manner, Carlstrom and Jacobson (2015) and Drager and Lamla (2017) used the well-known theoretical concept of the Taylor rule to explain disagreement on interest rate forecasts. Any forecast disagreement on inflation and/or economic growth should feed into disagreement about interest rate expectations. Based on these types of monetary policy rule, less disagreement among interest rate forecasts may be due to greater monetary policy transparency, which leads to more aligned views about the policy function or less forecast disagreement on the state of the economy (i.e., inflation, GDP, and unemployment).

Focusing first on the transparency factor, most central banks typically enhance transparency of policy decisions by providing information about the policy function and the state of the economy such as estimates of potential GDP, inflation objective, and unemployment target as part of a forward guidance policy. Increased transparency practices should help market participants understand the monetary policy moves, thereby resulting in less disagreement about interest rate forecasts. Few studies examine the influence of monetary policy transparency on disagreement of interest rate expectations. Swanson (2006) found that the increase in Federal Reserve transparency was significantly associated with the reduction in disagreement about the short-term interest rates in the USA. By contrast, Howells and Mariscal (2007) documented that the decline in disagreement on UK interest rate forecasts was largely explained by the narrowing of disagreement on inflation forecasts, and thus it remains far from clear that monetary policy transparency has yet to contribute to the decrease in disagreement about interest rate forecasts. More recently, Ehrmann et al. (2012) used various proxies for monetary policy transparency in 12 advanced economies to examine the link between transparency and disagreement among private agents' forecasts. They showed that greater transparency and central bank communication enabled forecasters to update their forecasts in response to new information in a smoother manner, thereby leading to less disagreement on macroeconomic forecasts including GDP, unemployment, and interest rates. Likewise, Dovern, Fritsche, and Slacalek (2012) investigated the determinants of disagreement on various macroeconomic forecasts for G7 countries. For disagreement on interest rate forecasts, they found that credible monetary policy helped anchor interest rate expectations, which in turn made forecasters disagree less on interest rate outlook. It is noted that none of these studies use the market-based transparency index, which reflects market participants' perceptions of the monetary policy actions (Kia, 2017).

Besides monetary policy transparency, disagreement about the state of the economy possibly affects disagreement on interest rate forecasts. Using forecast disagreement as a proxy for uncertainty, earlier studies found that disagreement on interest rate forecasts tends to be driven by forecast disagreement about GDP, inflation, and unemployment (e.g., Carlstrom & Jacobson, 2015; Drager & Lamla, 2017; Howells & Mariscal, 2007; Swanson, 2006). For example, Swanson (2006) used disagreement about GDP and inflation forecasts as measures of macroeconomic uncertainty and found that

disagreement on inflation (GDP) forecasts positively impacts disagreement about interest rates forecasts at 1-year (one-quarter) ahead only. In a similar vein, Drager and Lamla (2017) examined the determinants of disagreement on the US interest rate forecasts in a Taylor-rule setting and showed that disagreement about inflation forecasts was a main driver whereas disagreement on unemployment forecasts had insignificant or even negative effects.

In addition to the determinants of forecast disagreement that have been implied from the monetary policy rule, the parallel studies consider a number of additional determinants to explain disagreement among professional forecasters regarding macroeconomic forecasts. For instance, disagreement on agents' expectations for macroeconomic variables has a positive relationship with the volatility of such predicted variables (e.g., Capistran & Timmermann, 2009; Carlstrom & Jacobson, 2015; Swanson, 2006). This implies that lower (higher) disagreement about interest rate forecasts may be attributable to decreased (increased) volatility in interest rates. Despite no clear theoretical background about the relationship between forecast disagreement and the state of the business cycle, some studies find strong evidence that disagreement on macroeconomic forecasts is relatively high during recessions (e.g., Dopke & Fritsche, 2006; Ehrmann al., 2012; Glas & Hartmann, 2016).

2.2 | Central bank communication and interest rate forecasts

Like many central banks, the BOE implements monetary policy by setting policy rates at very short-term interest rates and uses the term structure of interest rates as a transmission channel of monetary policy to influence real economy activity. According to the expectations hypothesis of the term structure of interest rates, expectations about future policy rates, rather than the current level of policy rates, mainly affect longer term interest rates (Blinder et al., 2008; Jitmaneeroj & Wood, 2013). To steer market expectations, the BOE provides guidance about future policy moves. For example, prior to August 2004 the MPC stated that their forecasts were conditional on the assumption that the policy rates remained constant from the starting date of their forecasts until the next 2-year horizon.[1] Without this assumption, there are virtually an infinite number of possible expected paths of policy rates, thus potentially making agents' expectations less aligned to each other (Goodhart, 2001). Effective communication strategy should shape market expectations in such a way that interest rates are likely to evolve in the future, and hence market participants disagree less on the future course of interest rates.

The BOE has moved toward greater transparency by engaging in several elements of central bank communication such as publicizing an increasing amount of information relevant to the monetary policy, disclosing the voting records of individual MPC members, and stating the assumption that underlines their forecasts. These various forms of central bank communication enable market participants to obtain thorough information about the monetary policy and a better understanding of factors on which the BOE bases its formulation of monetary policy (Ehrmann & Fratzscher, 2009). Central bank communication has been proxied by the publication of inflation reports, the disclosure of the MPC voting records, and the announcement of changes in policy rates. These aspects of institutional design are expected to increase the transparency of monetary policy and facilitate communication policy to anchor market expectations (e.g., Chortareas et al., 2012; El-Shagi & Jung, 2015; Gerlach-Kristen, 2004; Horvath, Smidkova, & Zapal, 2013).

Few studies explore whether several elements of the BOE's communication strategy influence interest rate expectations. Gerlach-Kristen (2004) demonstrated that the disclosure of the MPC's voting records enhanced monetary policy transparency and helped predict the future course of policy rates. In a similar fashion, Ehrmann and Fratzscher (2009) demonstrated that more diffused communication among MPC members worsened the ability of agents to predict future policy decisions. Chortareas et al. (2012) documented that disagreement among the MPC members in making policy rate decisions and the announcement of changes in policy rates affected interest rate expectations, whereas the publication of inflation reports had no effect. Recently, El-Shagi and Jung (2015) found that the minutes of the MPC meetings provided agents with useful information in forecasting future monetary policy decisions.

3 | ANALYTICAL FRAMEWORK

3.1 | The construction of Kia's (2011) market-based transparency index

Monetary policy transparency has many facets and nuances (Dincer & Eichengreen, 2014; Siklos, 2011). The first focus is to define transparency as specifically as possible in order to avoid confusion. As defined by

[1]A forecast conditioned on a constant policy rate does not provide a clear signal about the future path of policy rates, and hence has only a limited effect on market expectations about the future policy rate path. Since August 2004, the main scenario for the projections has conditioned on market expectations (Woodford, 2007).

Sundararajan, Das, and Yossifov (2003), monetary policy transparency refers to "an environment in which the objectives of the policy; its legal, institutional, and economic framework; policy decisions and their rationale; data and information related to monetary and financial policies; and the accountability of the policymaking body are provided to the public in an understandable, accessible and timely basis." To this end, Kia's (2011) market-based transparency index is based on the extent to which money market participants understand the monetary policy decisions taken at the meetings with/without changes in the policy rate and also the intermeeting days on which the policy rate is changed/unchanged. In this context, the understanding of monetary policy disclosure is equated with transparency.

Most measures of transparency are in the forms of the nonindex indicator using descriptive accounts of transparency (Blinder, Goodhart, Hildebrand, Lipton, & Wyplosz, 2001), the survey-based transparency index (Fry, Julius, Roger, & Sterne, 2000; Sundararajan et al., 2003), and the transparency index derived from official documents and information provided by central banks (Dincer & Eichengreen, 2014; Eijffinger & Geraats, 2006; Papadamou, Sidiropoulos, & Spyromitros, 2015; Siklos, 2013; Trabelsi, 2016). Nonetheless, Kia (2011) argued that these types of transparency measures had limitations because of their cross-sectional forms or their availabilities only at the annual frequency. To overcome these problems, the market-based transparency index suitable for interval observations shorter than a year has been used in recent studies (Kia, 2017; Papadamou & Arvanitis, 2014). Most importantly, the market-based transparency index reflects market perceptions of monetary policy actions. This implies that not only how central banks convey information to public but also how market participants interpret the information released by central banks are necessary for achieving greater monetary policy transparency.

Following the methodology pioneered by Kia (2011), the market-based transparency index of the BOE can be constructed by the following steps. The event day is defined as the day on which the MPC meets with/without changes in the official bank rate and also the intermeeting days on which the official bank rate is changed/unchanged. For each event day, the absolute value of the deviation of the official bank rate minus the 3-month Treasury bill rate from the trend differential at each event date is computed as $|D_t| = |\mathrm{Diff}_t - \mathrm{TDiff}_t|$, where Diff_t is the difference between the official bank rate and the 3-month Treasury bill rate on the event day, and TDiff_t is the arithmetic average of Diff_t between the current event day and the previous event day. The market-based transparency index on the event day is then calculated as

$$\mathrm{TRI}_t = \frac{100}{e^{|D_t|}}, \tag{1}$$

where TRI_t is the market-based transparency index on the event day. If D_t equals zero, the maximum Tindex_t will be 100. For each nonevent day, the estimated value of D_t is calculated as $\widehat{D}_t = |\mathrm{Diff}_t - \mathrm{ADiff}_t|$, where $\widehat{D}_t$ is the estimated value of D_t.

$$\mathrm{ADiff}_t = \frac{\sum_{i=1}^{k} \mathrm{Diff}_{t-i}}{N},$$

where k is the previous event day and N is the number of days since the previous event day. Equation 1 will also be used to calculate the transparency index for nonevent days by replacing D_t with $\widehat{D}_t$. After getting the market-based transparency index on both event and nonevent days at the daily frequency, the monthly transparency index is constructed as the monthly average of the daily transparency index.

It is noted that Kia's (2011) transparency index measures the perception of monetary policy announcements and actions without isolating the effects of shocks that could possibly affect transparency. The perceived level of monetary policy transparency might differ from the actual transparency unless market participants perceive the central bank as transparent as a consequence of transparency increases (de Haan, Eijffinger, & Waller, 2005). Nevertheless, transparency perception is important in its own right. Several studies show that perceived transparency impacts the behavior of economic agents by anchoring inflation expectations and enhancing trust in the central banks (e.g. Horvath & Katuscakova, 2016; van der Cruijsen et al., 2010). Therefore, research into the influence of transparency perception on forecast disagreement among market participants is particularly apropos.

3.2 | The effect of monetary policy transparency and central bank communication on disagreement about interest rate forecasts

The main aim of this study is to analyze whether monetary policy transparency and communication policy of the BOE are effective in achieving the objective of reducing disagreement about interest rate forecasts. In accordance with Sundararajan et al.'s (2003) definition of transparency, this study uses the market-based transparency index as a measure of monetary policy transparency (Kia, 2011, 2017; Papadamou & Arvanitis, 2014). Following Blinder et al. (2008), we define central bank

communication as "the provision of information by the central bank to the public regarding such matters as the objectives of monetary policy, the monetary policy strategy, the economic outlook, and the outlook for future policy decisions." In this respect, elements of monetary policy communication are proxied by the publication of inflation reports, disagreement among the MPC in policy rate decisions, and the announcement of changes in policy rates (Chortareas et al., 2012; Ehrmann & Sondermann, 2012; Reeves & Sawicki, 2007).[2] Other than these two factors of our main interest, we consider other factors that could affect disagreement about interest rate forecasts. We estimate a set of regressions with the inclusion of several control variables, including the volatility of interest rates, the dummy variable representing the UK's recessions, forecast disagreement about the state of the economy (i.e., GDP, inflation, and unemployment), unconventional monetary policy actions (i.e., asset purchase facility and forward guidance), and central bank credibility. The rationales of these control variables are briefly explained as follows.

First, macroeconomic variables may be harder to anticipate when there are high levels of volatility and underlying macroeconomic uncertainty (e.g., Atalla, Joutz, & Pierru, 2016; Capistran & Timmermann, 2009; Carlstrom & Jacobson, 2015; Swanson, 2006). In this respect, disagreement about interest rate forecasts is relatively high during periods of high uncertainty such as recessions (e.g., Dopke & Fritsche, 2006; Dovern et al., 2012). Second, when making forecasts, market participants tend to construct their forecasts of several macroeconomic variables in a congruent manner that jointly describes their opinions of the state of the economy as a whole (Banternghansa & McCracken, 2009; Dovern, 2015). As a result, disagreement in agents' projections for several macroeconomic variables tends to be correlated with one another. Third, since the Great Recession the BOE has undertaken unprecedented forms of monetary policy such as asset purchase facility and forward guidance. Recent studies show that unconventional monetary policy actions have been associated with the reduction in disagreement about interest rate forecasts (Jitmaneeroj et al., 2019; Kool & Thornton, 2015). Finally, as the central bank aims to manage the private sector's expectations, the effectiveness of monetary policy depends on the credibility economic agents have in central bank's ability to achieve its objectives (e.g., Blinder, 2000; Cecchetti & Krause, 2002; de Haan et al., 2005; Dovern et al., 2012; Henckel, Menzies, Moffatt, & Zizzo, 2019). Central bank credibility is therefore crucial for the conduct of monetary policy and a stable macroeconomic environment (e.g., Bordo & Siklos, 2015; de Mendonça, 2007; Montes & Bastos, 2014). The enhancement of central bank credibility helps mitigate the dispersion of market expectations about the future paths of macroeconomic variables such as inflation and interest rates (e.g., Ciro & Zapata, 2019; Montes & Curi, 2017; Oliveira & Curi, 2016). Furthermore, monetary policy transparency will be more effective when the central bank is credible, implying mutually complementary effects between transparency and credibility of the central bank (Eichler, Littke, & Tonzer, 2017; Faust & Svensson, 2001).

This study uses panel data analysis to simultaneously examine the determinants of disagreement across four cases of interest rate forecasts: SMSH (short maturity–short horizon), SMLH (short maturity–long horizon), LMSH (long maturity–short horizon), and LMLH (long maturity–long horizon). A complete regression model is presented in the following form:

$$\begin{aligned} \mathrm{DIS}_{it}^{\mathrm{INT}} = {} & \alpha_i + \beta_1 \mathrm{TRI}_{it} + \beta_2 D_{it}^{\mathrm{REC}} + \beta_3 \mathrm{VOL}_{it} \\ & + \beta_4 \mathrm{DIS}_{it}^{\mathrm{GDP}} + \beta_5 \mathrm{DIS}_{it}^{\mathrm{INF}} + \beta_6 \mathrm{DIS}_{it}^{\mathrm{UNE}} \\ & + \beta_7 D_{it}^{\mathrm{BANK}} + \beta_8 D_{it}^{\mathrm{IR}} + \beta_9 D_{it}^{\mathrm{MPC}} + \beta_{10} D_{it}^{\mathrm{APF}} \\ & + \beta_{11} D_{it}^{\mathrm{FWD}} + \beta_{12} \mathrm{CRI}_{it} + \beta_{13} \mathrm{TRI}_{it} \times \mathrm{CRI}_{it} \\ & + \varepsilon_{it}, \end{aligned} \tag{2}$$

where i denotes the ith case of interest rate forecasts, t denotes the tth month, α_i is a case-fixed effect, β_1 to β_9 are parameters, and ε_{it} is the error term. The case-fixed effect controls for time-invariant characteristics of each case that cannot be directly observed but which influence i's forecast disagreement. $\mathrm{DIS}_{it}^{\mathrm{INT}}$ is disagreement about interest rate forecasts. TRI_{it} is the market-based transparency index. CRI_{it} is the credibility index. D_{it}^{REC} is a dummy variable that equals 1 during recessions and 0 otherwise. Following Campos, Dent, Fry, and Reid (2011) and Mitchell, Solomou, and Weale (2012), the full sample period in this study contains two recessions: the UK's entry into and subsequent exit from the Exchange Rate Mechanism (March 1990 to March 1993) and the financial crisis (April 2008 to September 2009). VOL_{it} is the volatility of forecasted interest rates, which is proxied by the standard

[2]Although we focus on only three proxies for the BOE's monetary policy communication, we note that in practice the modalities of information disclosure by the BOE are numerous, including release of minutes, speeches, interviews, press conferences, written statements, reports (i.e., inflation reports and financial stability reports), background documents, research working papers, website and, most often, blogs or chats with the public. Considering these modalities should provide further insights into the benefit of central bank communication to the reduction in forecast disagreement. We are grateful to the anonymous referee for these suggestions.

deviation of interest rates over the month prior to the survey date.[3] DIS_{it}^{GDP}, DIS_{it}^{INF}, and DIS_{it}^{UNE} are disagreement about real GDP growth, inflation, and unemployment forecasts, respectively.

Following earlier research, this study uses dummy variables to measure information content of communication policy (e.g., Bredin, Gavin, & O'Reilly, 2005; Chortareas et al., 2012; Ehrmann & Sondermann, 2012; Montes et al., 2016; Reeves & Sawicki, 2007). D_{it}^{BANK}, D_{it}^{IR}, and D_{it}^{MPC} are dummy variables for the announcement of changes in policy rates, the publication of inflation reports, and disagreement among MPC members disclosed in the publication of voting records, respectively.[4] These dummies take on the value of 1 in the presence of information content occurring during the month prior to the survey date and 0 otherwise.[5] It is noted that this study measures forecast disagreement by means of the standard deviation of the responses across individual forecasters in any given time period (e.g., Andrade, Crump, Eusepi, & Moench, 2016; Coibion & Gorodnichenko, 2012; Ehrmann & Fratzscher, 2009; Siklos, 2013).

Given the unprecedented form of monetary policy undertaken by the BOE since the Great Recession, we consider asset purchase facility and forward guidance as proxies for unconventional monetary policy actions. Hofmann and Zhu (2013) showed that the large-scale asset purchases by the Federal Reserve and Bank of England significantly affected inflation expectations, but their quantitative importance is uncertain. According to Dale, Orphanides, and Osterholm (2011), Odyssean forms of forward guidance will generally provide clear and unambiguous advice. Of more direct relevance to the hypotheses examined in this paper, Kool and Thornton (2015) and Jitmaneeroj et al. (2019) showed that forward guidance was associated with reduced dispersion of forecasts of interest rates. To control for the potential role of unconventional monetary policy, we use dummy variables to measure asset purchase decision (D_{it}^{APF}) and forward guidance (D_{it}^{FWD}). First implemented in March 2009, asset purchase decision was changed seven times during our sample period.[6] D_{it}^{APF} takes on the value of 1 if asset purchase decision is changed in the month prior to the survey date and 0 otherwise. The BOE has engaged in forward guidance since August 2013 (Jitmaneeroj et al., 2019). D_{it}^{FWD} takes the value of 1 during the forward guidance period and 0 otherwise.

In this study, central bank credibility is defined as the extent to which the public believes that a shift in policy has taken place when, indeed, such a shift has actually occurred (Cukierman, 1986). If an inflation target is explicitly defined by the central bank, credibility can be measured by the difference between the expected inflation and the inflation target (Cecchetti & Krause, 2002; de Mendonça, 2007; Svensson, 2000). The index captures the variations in central bank credibility in a way compatible with the inflation targeting framework. The further realized inflation deviates from the announced target, the less credible is the central bank. While the BOE established a range of 1–4% for annual RPIX inflation from October 1992 to May 1997, it did not clearly define the target level of inflation during this period (Benati, 2005; Cobham, 2003). From June 1997 to December 2003, the target for RPIX was 2.5%. Since January 2004, the target for CPI inflation has been 2%. With reference to the credibility index proposed by de Mendonça (2007), the BOE's credibility index can be constructed as follows:

$$\mathrm{CRI}_t = \begin{Bmatrix} 1 \text{ if } E_t(\pi) = \pi^* \\ 1 - \frac{1}{\pi^{\mathrm{Lower}} - \pi^*}\left[E_t(\pi) - \pi^*\right] \text{ if } \pi^{\mathrm{Lower}} < E_t(\pi) < \pi^* \\ 1 - \frac{1}{\pi^{\mathrm{Upper}} - \pi^*}\left[E_t(\pi) - \pi^*\right] \text{ if } \pi^{\mathrm{Upper}} > E_t(\pi) > \pi^* \\ 0 \text{ if } E_t(\pi) \geq \pi^{\mathrm{Upper}} \text{ or } E_t(\pi) \leq \pi^{\mathrm{Lower}} \end{Bmatrix}, \tag{3}$$

where $E_t(\pi)$ denotes inflation expectations formed at time t, π^* denotes the target level of inflation, and π^{Lower} (π^{Upper}) denotes the lower (upper) bound of the tolerance interval.

In addition to estimating the complete regression model in Equation 2, this study estimates different

[3]The lag of one month is applied to variables relevant to shocks and central bank communication, as the surveys are often conducted during the first week of the month. Responders are not aware of the shocks and central bank actions which will take place after the survey even if they have some expectations about them.

[4]While dummy variables are admittedly not the best possible method, they are used regularly to address the absence or presence of policy actions (e.g., Chortareas et al., 2012; Ehrmann & Sondermann, 2012; Reeves & Sawicki, 2007).

[5]During a sample period, there are a total of 201 MPC meetings, of which in 105 at least one member votes for the higher or lower official bank rate. It is noted that D_{it}^{MPC} reflects disagreement among the MPC members, but not necessarily communication strategy. Furthermore, there are three different situations in which D_{it}^{MPC} could possibly be zero: the absence of disagreement among MPC members; the prevoting record publication period; and no meeting month. For dummy variable to capture the announcement of changes in policy rates, D_{it}^{BANK} could possibly be zero for no-meeting months and no change in policy rates.

[6]With reference to information from the BOE website, an asset purchase decision was made seven times during our sample period: March 5, 2009 (£75 bn), May 7, 2009 (£125 bn), August 6, 2009 (£175 bn), November 5, 2009 (£200 bn), October 6, 2011 (£275 bn), February 9, 2012 (£325 bn), and July 4, 2012 (£375 bn).

variants of the complete model as robustness checks. According to theoretical underpinnings and literature review, the estimated coefficients are expected to be negative for the market-based transparency index, the proxies for central bank communication, asset repurchase facility, forward guidance, the credibility index, and the interaction term between the transparency and credibility indices ($\beta_1 < 0$, $\beta_7 < 0$, $\beta_8 < 0$, $\beta_9 < 0$, $\beta_{10} < 0$, $\beta_{11} < 0$, $\beta_{12} < 0$, and $\beta_{13} < 0$) and positive for the remaining variables ($\beta_2 > 0$, $\beta_3 > 0$, $\beta_4 > 0$, $\beta_5 > 0$, and $\beta_6 > 0$).

4 | THE DATASET

Survey data are taken from Consensus Economics, whose dataset has been used extensively in many empirical works (e.g., Dovern, 2015; Jitmaneeroj & Wood, 2013; Lahiri & Sheng, 2010). Since October 1989, Consensus Economics has asked a number of professional forecasters each month to provide their forecasts of several macroeconomic variables. The institution names of forecasters are published alongside their forecasts in the publication. One would expect that professional forecasters have an incentive to perform well since their forecast performance is likely to impact on the reputation of their employers. The sample in this study covers the period from October 1989 to February 2014, consisting of 293 monthly observations.[7] Survey data used in this study include disagreement measured by the cross-sectional dispersion of interest rates, inflation, GDP growth, and unemployment forecasts. It is noted that forecasts of these variables are formulated by different patterns, as described below.

For interest rate forecasts, professional forecasters provide the fixed-horizon forecasts of 3-month interbank rates and 10-year gilt yields for 3- and 12-month horizons. Unlike interest rate forecasts, inflation, GDP growth, and unemployment forecasts are formulated by the fixed-event basis. Specifically, professional forecasters are asked to forecast the percentage change in GDP, RPI (RPIX), and unemployment from the previous year-end to the two target dates: the end of the current calendar year (short-horizon forecasts) and the end of the next calendar year (long-horizon forecasts).[8] This is an important feature of the fixed-event forecasts since the short (long)-horizon forecasts made in any month during the same calendar year for the current (next) calendar year are for the same variable.[9]

As explained by Dovern and Hartmann (2017), disagreement should be measured from the fixed-horizon forecasts because the time-varying forecast horizons of the fixed-event forecasts introduce seasonal effects into the disagreement. As the survey date is closer to the target date of the fixed-event forecasts, forecasters tend to be more aligned in their expectations since they gain more information over time. Thus disagreement tends to decrease as the forecast horizon shortens. Measuring disagreement from the fixed-event forecasts seems misleading, as some parts of the forecast dispersion are due to the time-varying forecast horizons. To overcome this problem, several studies use the fixed-event forecasts to approximate the fixed-horizon forecasts (e.g., Dovern et al., 2012; Montes et al., 2016; Oliveira & Curi, 2016). As noted by Johnson (2002) and Crowe (2010), the long-horizon forecast is more useful in anticipating macroeconomic uncertainty because it is more varied across professional forecasters than the short-horizon forecast. For this reason, this study approximates disagreement about inflation, GDP growth, and unemployment forecasts for the next 12 months as a measure of forecast disagreement about the state of the economy. As shown in Equation 4, the fixed-horizon forecast for 12 months ahead is approximated by an average of the forecasts for the ends of the current and next calendar years weighted by their share in forecasting horizons (Dovern et al., 2012):

$$F^{\mathrm{fh}}_{y0,m,12} = \omega_1 F^{\mathrm{fe}}_{y0,m,y0} + \omega_2 F^{\mathrm{fe}}_{y0,m,y1}, \tag{4}$$

where $\omega_1+\omega_2 = 1$; $\omega_1 = \dfrac{12-m}{12}$ and $\omega_2 = \dfrac{m}{12}$ for $m = 1, 2, 3, \ldots, 12$. $F^{\mathrm{fh}}_{y0,m,12}$ is the fixed-horizon forecast for 12 months ahead made in month m of the current year y_0. $F^{\mathrm{fe}}_{y0,m,y0}$ is the fixed-event forecast for the end of the current calendar year y_0 made in month m of the current year y_0. $F^{\mathrm{fe}}_{y0,m,y1}$ is the fixed-event forecast for the end of the next calendar year y_1 made in month m of the current year y_0.

5 | EMPIRICAL RESULTS

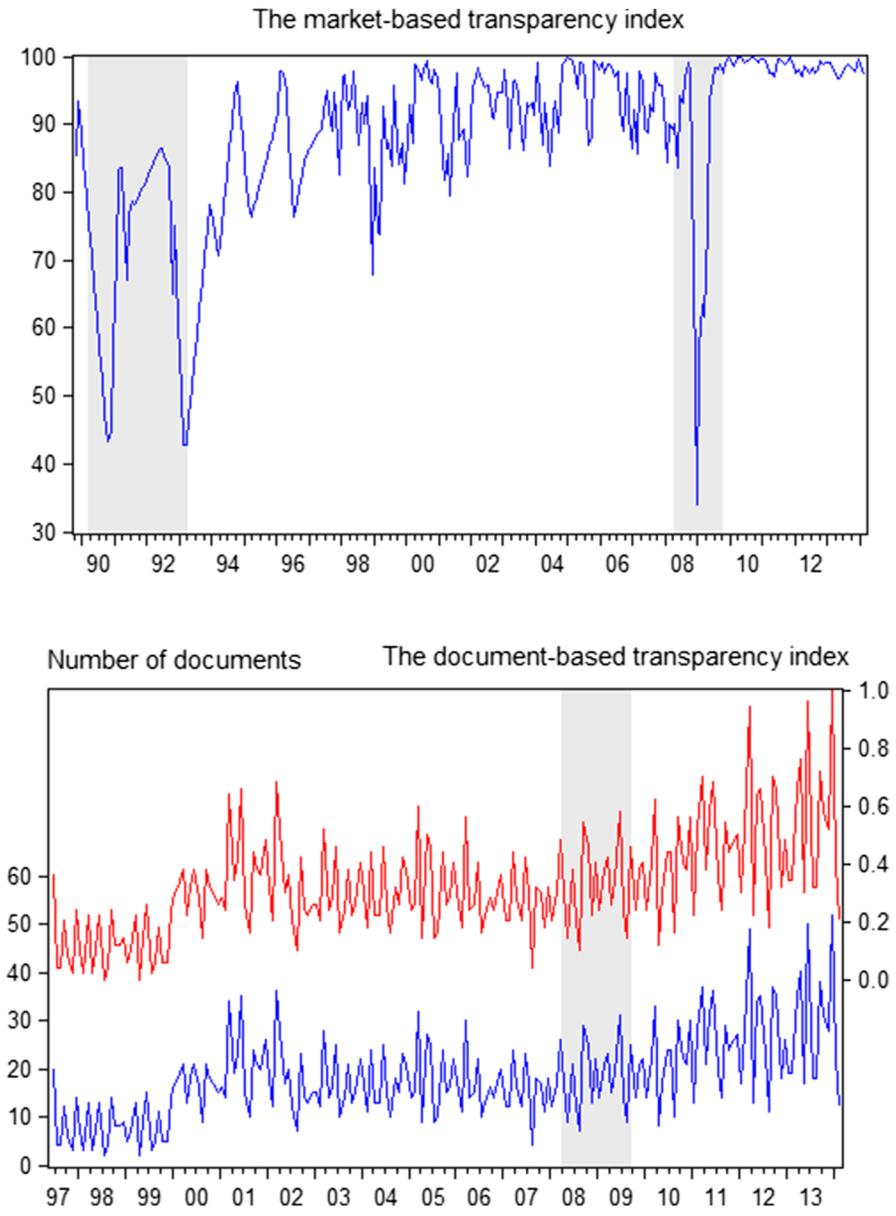
5.1 | Time evolution of the market-based transparency index

In Figure 1a, we plot time evolution of the monthly market-based transparency index based on Kia (2011).

[7]We are thankful for a research donation from the Bank of England, which has enabled us to purchase the Consensus Economics data up to February 2014.

[8]Since April 1997, the forecasted variable has changed from the percentage change in the retail price–headline rate (RPI) to the percentage change in retail prices–underlying rate (RPIX).

[9]For example, in January 2013, professional forecasters report their expectations of inflation for the ends of 2013 and 2014. Thus, for each year that is being forecasted, each professional forecaster provides a total of 24 forecasts, with forecast horizons varying from 1 to 24 months.



Notes: Based on the methodology of Kia (2011), the monthly market-based transparency index is constructed from 1989:10 to 2014:02. The document-based transparency index is based on the number of documents (i.e., news, publications, speeches, and events) which are relevant to monetary policy and released in each month. Due to data availability, the monthly document-based transparency index is constructed from 1997:06 to 2014:02. The market-based transparency index ranges from 0 to 100. The document-based transparency index ranges from 0 to 1. Shaded regions indicate the UK's recessions (1990:03 – 1993:03; 2008:04 – 2009:09) dated by Campos *et al.* (2011) and Mitchell *et al.* (2012).

FIGURE 1 The transparency index. (a) the market-based transparency index. (b) the document-based transparency index. Based on the methodology of Kia (2011), the monthly market-based transparency index is constructed from 1989:10 to 2014:02. The document-based transparency index is based on the number of documents (i.e., news, publications, speeches, and events) that are relevant to monetary policy and released in each month. Due to data availability, the monthly document-based transparency index is constructed from 1997:06 to 2014:02. The market-based transparency index ranges from 0 to 100. The document-based transparency index ranges from 0 to 1. Shaded regions indicate the UK's recessions (1990:03 to 1993:03; 2008:04 to 2009:09) dated by Campos et al. (2011) and Mitchell et al. (2012). The red line represents the document-based transparency index. The blue line represents the number of documents [Colour figure can be viewed at wileyonlinelibrary.com]

The shaded regions indicate recession periods dated by Campos et al. (2011) and Mitchell et al. (2012). Although the market-based transparency index apparently displays an upward trend over the full sample period, it sharply drops during two recessions. The former is in the early 1990s around the UK's entry into the Exchange Rate Mechanism in October 1990 and the subsequent exit in September 1992. The latter is during the recent 2008–09

financial crisis. Dramatic decreases in the market-based transparency index is possibly due to high uncertainty during recessions. As noted by Kia (2011, 2017), the market-based transparency index seems to exhibit downward biases during recessions and financial crises since it is formulated under the assumption of no uncertainty. Besides, the index reflects changes in market participants' understanding of changes in policy frameworks. As a consequence, the market-based transparency index is likely to fluctuate due to changes in monetary policy frameworks and exogenous shocks.

During the period under consideration, the UK has experienced three distinct monetary policy frameworks: the period of exchange rate targeting (October 1, 1989, to September 15, 1992), inflation targeting with interest rates set by the UK government (September 16, 1992, to May 5, 1997), and inflation targeting with the BOE enjoying economic independence and interest rates set by the MPC (May 6, 1997 to February 28, 2014). Given these developments in the UK's monetary policy, it is important to examine whether the market-based transparency index differs across monetary policy frameworks. Table 1 reports descriptive statistics of the market-based transparency index and the Wilcoxon/Mann–Whitney test of median equality between subperiods. Compared to the mean, the median is less affected by outliers and more suitable for comparing data across subperiods. Descriptive statistics are therefore interpreted using the median instead of the mean. The medians of the transparency index in subperiods 1–3 are 79.686, 80.490, and 96.129, respectively. Although the median of the transparency index in subperiod 2 is greater than that of subperiod 1, the Wilcoxon/Mann–Whitney test shows that both transparency indices are statistically indifferent. Overall, the market-based transparency index tends to capture the increase in transparency generated by improvements in monetary policy frameworks.

Despite its advantages in terms of higher frequency and less subjective judgment, Kia's (2011) market-based transparency index as a proxy for monetary policy transparency should be used with some caution because of its assumptions. First, the market-based transparency index measures the perception of monetary policy announcements and actions with the assumption of no uncertainty. This implies that it does not isolate the effect of shocks that could possibly impact perceived transparency of market participants. Moreover, the market-based transparency index is calculated using the spread between the policy rates and the Treasury bill rates. Although this spread can be considered as an indicator of the stance of monetary policy (e.g., Bernanke & Blinder, 1992; Simon, 1990), it could reflect any market tension due to unexpected changes in the structure of the banking system and in the credibility of the government to pay its debt. As a consequence, this transparency index might not appropriately reflect the level of perceived transparency of market participants, especially during periods of high uncertainty such as recession periods.

Second, the market-based transparency index assumes that the policy rates and the Treasury bill rates are cointegrated. In general, when the central bank decides to change the policy rates, adjustments in short-term money market rates occur, and hence both rates tend to be cointegrated (e.g., Kia, 2010; Sarno & Thornton, 2003). To examine whether this assumption holds for

TABLE 1 Descriptive statistics of the transparency index

							Test of median equality		
Period	**Mean**	**Median**	**Max.**	**Min.**	**SD**	**Obs.**	**Subperiods 1 and 2**	**Subperiods 2 and 3**	**Subperiods 1 and 3**
Panel A: Market-based transparency index									
1989:10–1992:09 (subperiod 1)	75.148	79.686	93.483	43.184	13.206	36			
1992:10–1997:04 (subperiod 2)	77.880	80.490	97.681	42.820	13.801	55	1.08	8.50***	8.24***
1997:05–2014:02 (subperiod 3)	93.055	96.129	99.894	34.039	8.402	202	(0.2786)	(0.0000)	(0.0000)
1989:10–2014:02 (full sample)	88.007	91.929	99.894	34.039	12.730	293			
Panel B: Document-based transparency index									
1997:06–2014:02	0.323	0.300	1.000	0.000	0.182	201			

Note. This table reports descriptive statistics of the market-based and document-based transparency indices. The market-based transparency index ranges from 0 to 100. The document-based transparency index ranges from 0 to 1. For the market-based transparency index, a whole sample period is from 1989:10 to 2014:02, which is classified into three subperiods by monetary policy frameworks: subperiod 1 (1989:10 to 1992:09), subperiod 2 (1992:10 to 1997:04), and subperiod 3 (1997:05 to 2014:02). Due to data availability, the document-based transparency index can be constructed from 1997:06 to 2014:02. Reported descriptive statistics include mean, median, maximum and minimum values, standard deviation, and the number of observations. The test of median equality across subperiods is based on the Wilcoxon/Mann–Whitney statistic, and the corresponding *p*-value is shown in parentheses. Asterisks signify statistical significance at ***1%, **5%, and *10%.

the UK, we report in Table 2 the descriptive statistics, unit root tests, and cointegration tests of the end-of month official bank rates and 3-month Treasury bill rates from October 1989 to February 2014. The results suggest that both interest rates contain unit root and are cointegrated.[10] Hence this assumption seems valid in our study.

Finally, the market-based transparency index assumes that economic agents are forward looking in forming their expectations with reference to the state of the economy. Under this assumption, an announcement about the new or changed policy can alter market participants' expectations and, through their response, change the way the economy evolves. In the literature, some studies find evidence in support of forward-looking expectations in the case of the UK. For instance, Caporale and Williams (2001) show that the forward-looking model in which the degree of financial deregulation influences the behavior of consumers is able to explain the UK consumption patterns and to help shed light on the transmission and effect of interest rate policy. Besides, Chortareas et al. (2012) find that the announcement of a change in the official bank rate is associated with a significant reduction in the percentage of professional forecasters whose forecasts are biased.

5.2 | Time evolution of disagreement about interest rate forecasts

This study measures forecast disagreement by means of the standard deviation of the responses across individual forecasters. Table 3 displays descriptive statistics of the four time series of disagreement about interest rate forecasts (i.e., SMSH, SMLH, LMSH, and LMLH). To understand the general pattern on disagreement across maturities and forecast horizons, we plot disagreement about interest rate forecasts in Figure 2. There are three interesting characteristics of disagreement about interest rate forecasts.

First, the medians of SMSH, SMLH, LMSH, and LMLH in Table 3 are 0.218, 0.472, 0.249, and 0.419, respectively. These results indicate a clear pattern in the relationship between disagreement and forecast horizons. For both maturities of interest rates, forecasters disagree more as the forecast horizon increases. This is in line with previous studies that document that forecast disagreement increases with the forecast horizon (Andrade et al., 2016; Dovern, 2015; Leduc, Rudebusch, & Weidner, 2009). However, the association between disagreement and maturities of interest rates depends on forecast horizons. As the maturity of interest rates lengthens, forecasters disagree more (less) at the short (long) forecast horizon. These conclusions also hold true if the means are used rather than the medians.

Second, disagreements about interest rate forecasts in Figure 2 vary over time and display a common time-varying component to some degree. The extent of comovement between different series of disagreement is reported in Table 4. Correlation coefficients across all cases range between 0.4049 and 0.7704 and are significantly different from zero at conventional levels of significance. The strong comovement of disagreement across maturities and horizons of interest rate forecasts suggests that the variation in disagreement over time is not just noise (Ballantyne, Ballantyne, Gillitzer, Jacobs, & Rankin, 2016). This provides supporting evidence that forecasters construct their interest rate forecasts of different maturities and horizons in a congruous manner that jointly describes their outlook for the term structure of interest rates.

Finally, all cases of disagreement exhibit downward time trends and are apparently related to the UK's recessions in the early 1990s and the late 2000s. Disagreement was high in the early 1990s recession possibly due to a tightening of short-term interest rates to match European interest rates during the UK's entry into the Exchange Rate Mechanism in October 1990 and a reduction in short-term interest rates during the subsequent exit in September 1992 (Thomas, Hills, & Dimsdale, 2010). After the 1990s, disagreement gradually declined but jumped sharply around the recent 2008–09 financial crisis. To assess the downward time trends and the impact of recessions, we estimate different variants of the following regression model for each case of disagreement about interest rate forecasts:

$$\mathrm{DIS}_t^{\mathrm{INT}} = \alpha + \beta_1 \mathrm{Trend}_t + \beta_2 D_t^{\mathrm{REC}} + \varepsilon_t, \tag{5}$$

where $\mathrm{DIS}_t^{\mathrm{INT}}$ is disagreement about interest rate forecasts at month t, Trend_t is a linear time trend in months, D_t^{REC} is a dummy variable that equals 1 during recessions and 0 otherwise, ε_t is the error term, α is the constant coefficient, and β_1 and β_2 are the slope coefficients. When disagreement is regressed on the constant term only, the estimation results in Table 5 show that the average values of disagreement are 0.2424 (SMSH), 0.5304 (SMLH), 0.2694 (LMSH), and 0.4333 (LMLH). After all explanatory variables in Equation 4 are included, the estimated coefficients on a linear time trend are statistically significant at the 1% level for all cases (SMSH = −0.0003,

[10]The augmented Dickey–Fuller (ADF) test with drift and linear trend is performed under the null hypothesis that the interest rate contains unit roots. The Johansen approach is used for a cointegration test between both rates. The ADF unit root and Johansen cointegration tests with several specifications are conducted, but the conclusion is unchanged.

TABLE 2 Unit root and cointegration tests of official bank rates and 3-month Treasury bill rates

							ADF unit root test	Johansen cointegration test	
							t-stat.	Trace-stat.	
Variable	Mean	Median	Max.	Min.	SD	Obs.		None	At most 1
Official bank rates	5.205	5.250	14.880	0.500	3.517	293	−3.16*		
								97.05***	11.00*
3-month Treasury bill rates	5.081	5.040	15.170	0.230	3.508	293	−3.41*		

Note. This table reports descriptive statistics, unit root tests, and cointegration tests of the end-of month official bank rates and 3-month Treasury bill rates over the period 1989:10 to 2014:02. Reported descriptive statistics include mean, median, maximum and minimum values, standard deviation, and the number of observations. The Augmented Dickey–Fuller (ADF) test with drift and linear trend is performed under the null hypothesis that the variable contains unit roots. Schwarz information criterion is used for the selection of lag length, with 2 lags for official bank rates and 4 lags for 3-month Treasury bill rates. The Johansen approach is used for cointegration test between official bank rates and 3-month Treasury bill rates. The hypothesized number of cointegrating relationship is zero and at most one, with the trace statistic critical value of 25.87 and 12.52 at the 5% and 10% levels, respectively. The lag length of the Johansen VAR framework is selected by Schwarz information criterion, with the appropriate lag length of 1 lag. The ADF unit root and Johansen cointegration tests with several specifications are performed, but the conclusion is unchanged. Asterisks signify statistical significance at

***1%, **5%, and *10%.

TABLE 3 Descriptive statistics of disagreement about interest rate forecasts

Case	Mean	Median	Max.	Min.	SD	Skewness	Kurtosis
SMSH	0.242	0.218	0.803	0.049	0.106	1.666	7.633
SMLH	0.530	0.472	1.186	0.130	0.204	0.783	3.014
LMSH	0.269	0.249	1.006	0.087	0.104	2.682	16.206
LMLH	0.433	0.419	1.058	0.175	0.133	0.903	4.695

Note. This table reports descriptive statistics of forecast disagreement. SMSH and SMLH denote the forecasts for 3-month interbank rates at 3 months and 12 months ahead, respectively. LMSH and LMLH denote the forecasts for 10-year gilt yields at 3 months and 12 months ahead, respectively. The sample period is from 1989:10 to 2014:02. Reported descriptive statistics include mean, median, maximum, minimum, standard deviation, skewness, and kurtosis.

SMLH = −0.0012, LMSH = −0.0002, and LMLH = −0.005). These results imply that, for a given maturity (forecast horizon), the long forecast horizon (short maturity) exhibits a greater downward time trend than does the short forecast horizon (long maturity). Put differently, the speed of convergence among forecasters regarding their interest rate outlook is higher for the long forecast horizon (short maturity) than the short forecast horizon (long maturity). Besides, the estimated coefficients on a recession dummy suggest that disagreement during recessions rises about 49% (SMSH), 32% (SMLH), 38% (LMSH), and 25% (LMLH), with reference to the average values of disagreement over a whole sample period. This implies that, for a given forecast horizon (maturity), recessions tend to have more impact on short-maturity (short-horizon) than long-maturity (long-horizon) forecasts. This finding seems reasonable since macroeconomic uncertainty during recessions is skewed toward the short-term interest rate, which is typically used as a monetary policy instrument (Ballantyne et al., 2016).

What might be the underlying causes for a significant downward trend in disagreement about interest rate forecasts? Decreases in disagreement over time could be due to various factors. For instance, professional forecasters may possess similar prior beliefs, access a common information set, interpret the public information set in a similar manner, or converge in their forecasting models (Davies, Lahiri, & Sheng, 2011; Lahiri & Sheng, 2010). Other than these factors, monetary policy transparency tends to play a central role in the decline in disagreement about interest rate forecasts (Swanson, 2006). Over the last two decades or so, the reduction in macroeconomic volatility, the so-called "Great Moderation," has been a widespread characteristic of the major industrialized countries. Summers (2005) and Cecchetti, Lagunes, and Krause (2006) demonstrated that the movement of central banks toward greater transparency is one of the key explanations for the Great Moderation. A better monetary policy can bring about lower and more stable inflation as well as make the environment more favorable for economic activities, thus leading to a more stable state of the economy. Moreover, much literature finds that disagreement in agents' projections for macroeconomic variables is positively correlated with the volatility of such predicted variables (e.g., Capistran & Timmermann,

2009; Carlstrom & Jacobson, 2015; Ehrmann & Fratzscher, 2009; Swanson, 2006). In other words, a greater stability of macroeconomic variables results in a lower degree of forecast disagreement. Taken altogether, it can be deduced that disagreement about interest rate forecasts has fallen in part due to increased transparency.

5.3 | Panel data analysis of the impact of monetary policy transparency on forecast disagreement about interest rate forecasts

As discussed above, monetary policy transparency aims to reduce information asymmetry between policymakers and market participants, which in turn leads to an alignment of views of the future path of interest rates. Due to high correlations of disagreement across maturities of interest rates and forecast horizons, this subsection uses panel data analysis to investigate whether transparency affects disagreement about interest rate forecasts.[11] Table 6 presents estimations of Equation 2 in various submodels by using the case-fixed effects panel estimator, in which coefficients other than the constant are restricted to be the same for all cases of interest rate forecasts (i.e., SMSH, SMLH, LMSH, and LMLH).[12]

With the main objective of observing the impact of transparency on forecast disagreement, the first empirical analysis is straightforward. Model 1 uses the market-based transparency index as the only explanatory variable for disagreement on interest rate forecasts. The estimated coefficient on the transparency index is −0.0097 and is statistically significant at the 1% level, with an adjusted *R*-squared of 35.29%. This result implies that increases in transparency bring about a significant reduction in forecast disagreement. This raises an important question of whether the influence of transparency on forecast disagreement is robust when a number of potential determinants of disagreement on interest rate forecasts are incorporated into the model. In response to this concern, Models 2–4 include a dummy variable for recessions, the volatility of forecasted interest rates, and forecast disagreement about the state of the economy (i.e., real GDP growth, inflation, and unemployment), respectively. Finally, Model 5 is a model incorporating all of these control variables.

As expected, the estimated coefficients on all control variables in Models 2–5, except for disagreement about GDP forecasts, have positive signs and are highly significant at the 1% significance level, with the adjusted *R*-squared ranging from 41.26% to 52.92%. This indicates that increases in control variables raise disagreement among forecasters regarding interest rate outlook. The effects of control variables on forecast disagreement are compatible with those reported in the literature (e.g., Dovern et al., 2012; Drager & Lamla, 2017; Ehrmann et al., 2012; Howells & Mariscal, 2007; Swanson, 2006). These findings seem justifiable since high levels of recent interest rate volatility are likely to reflect a large extent of underlying economic uncertainty, which in turn makes it difficult for market participants to agree on the future path of interest rates (Ehrmann & Fratzscher, 2009). Moreover, recent studies find that agents tend to construct their macroeconomic forecasts in a congruent manner that jointly describes their views of the state of the economy, thus leading to high correlations among forecast disagreement of different macroeconomic variables such as interest rate, inflation, GDP, and unemployment (e.g., Banternghansa & McCracken, 2009; Dovern, 2015; Drager & Lamla, 2017; Swanson, 2006).

The most outstanding result derived from Models 2–5 is that the estimated coefficient on the market-based transparency index in any model specification is still negative and highly statistically significant at the 1% level, although its magnitude slightly decreases when more control variables are added. This result does not depend on the specific regressions being estimated with different control variables. To sum up, the findings in Table 6 provide robust evidence in support of the proposition that the increase in monetary policy transparency leads to a reduction in disagreement about interest rate outlook.

5.4 | Panel data analysis of the impact of central bank communication on forecast disagreement about interest rate forecasts

Once greater transparency results in less disagreement on interest rate forecasts, central bank communication

[11]We fit the models by using the fixed-effects (within-regression) estimator. In the unreported results of Hausman test for endogeneity, the null hypothesis that the preferred model is random effects is rejected at the 5% level of significance. This implies that a fixed-effects specification is appropriate for our dataset, rather than the random-effects model.

[12]Some studies provide evidence of non-linearity in the effect of transparency on the dispersion of expectations (e.g., Eijffinger & Geraats, 2006; Jitmaneeroj et al., 2019; Neuenkirch, 2013; van der Cruijsen et al., 2010). This is related to the discussion of Morris and Shin (2002) where too much transparency might have a detrimental effect on the quality of forecasts and with that expectations formation. We therefore include in equation (2) a squared term of the market-based transparency index to allow for non-linear relationships. However, the unreported results reveal insignificant non-linear relationship in any model. The squared term only provides a slight twist to the relationship without fundamentally changing it and with little effect on the fit. The conflicting results are possibly because our study uses the market-based transparency index whereas the aforementioned studies are based on the transparency index derived from official documents and information provided by central banks.

becomes an important tool for enhancing monetary policy transparency. It is of interest to examine whether elements of central bank communication affect forecast disagreement. For this purpose, we extend from Model 5 to Model 6 by including proxies: the publication of inflation reports, the announcement of changes in policy rates, and disagreement among the MPC members in making policy rate decisions. Moreover, we control for the potential role of unconventional monetary policy, including purchase facility and forward guidance undertaken by the BOE. As monetary policy transparency will be more effective when the central bank is credible, we also include the credibility index and its interaction with the transparency index. It is noted that the voting records of individual MPC members and the tolerance interval of inflation target for computing the credibility index are not available prior to June 1997. Therefore, Model 6 can be estimated for the period of June 1997 to February 2014.

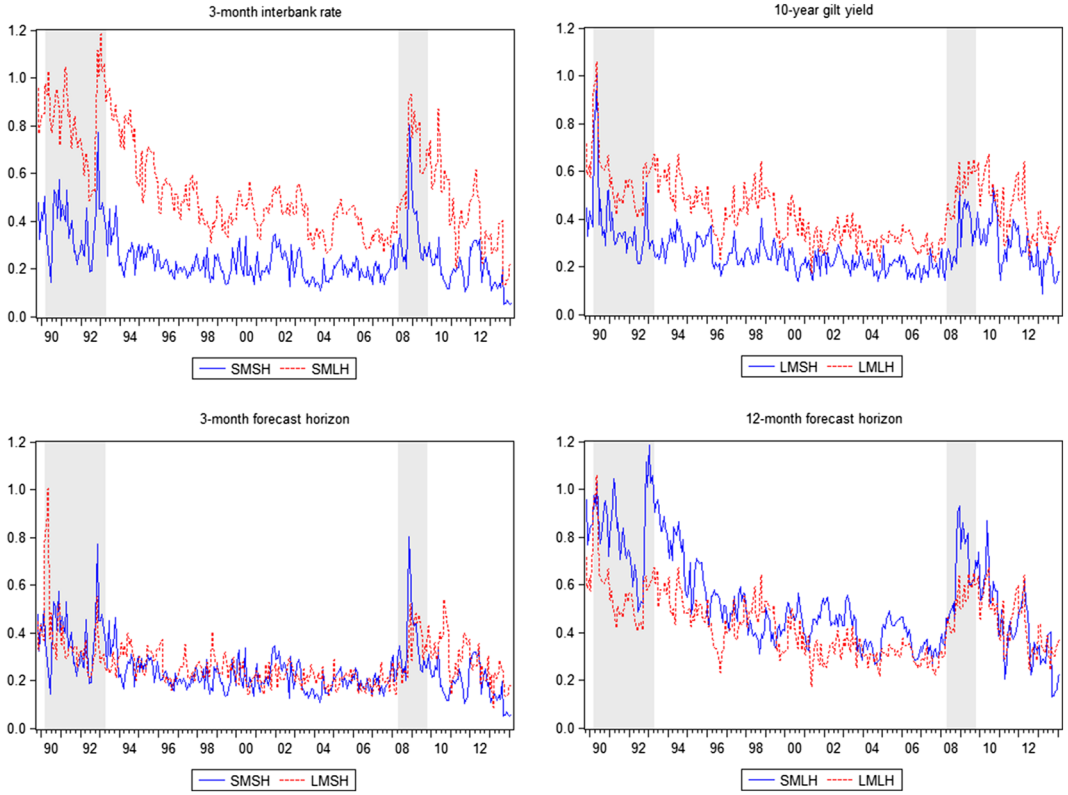
From the results of Model 6 in Table 6, the coefficient estimates on dummy variables for asset purchase facility and forward guidance are negative. This suggests that both unconventional monetary policy actions have additional benefits for expectations of interest rates by reducing disagreement among forecasters. However, only the effect of forward guidance is highly statistically significant. Our results are consistent with forward guidance providing economic agents with greater clarity about policymakers' intentions regarding policy instruments, resulting in the reduction in forecast disagreement (Jitmaneeroj et al., 2019; Kool & Thornton, 2015).

The coefficient estimate on the credibility index is negative, implying that enhanced credibility of the central bank tends to reduce the dispersion of market expectations (e.g., Ciro & Zapata, 2019: Montes & Curi, 2017; Oliveira & Curi, 2016).[13] Nevertheless, the effect of credibility is insignificant at any conventional significance level. More interestingly, though, is the coefficient estimate on the interaction term between the transparency and credibility indices, which is significantly negative at the 5% level. A negative value for the effect of the interaction term implies that the higher the credibility, the greater (more negative) is the effect of transparency on forecast disagreement. Similarly, the higher the transparency, the greater (more negative) is the effect of credibility on forecast disagreement. Therefore, central bank transparency and credibility are considered to be complements in reducing disagreement about interest rate forecasts.

The results of Model 6 also reveal that the estimated coefficient of any proxy for elements of central bank communication is negative. This suggests that central bank communication somewhat guides market expectations in such a way that professional forecasters disagree less on the future path of interest rates. For the publication of inflation reports and the announcement of changes in policy rates, their negative associations with forecast disagreement should not be too surprising. As Ehrmann and Fratzscher (2009) pointed out, if there is a change in policy rates at the preceding meeting, forecasts for the subsequent decision will be less diverse. Moreover, the timing and magnitude of changes to the policy rate impact market interest rates, as market participants adjust their expectations (Chortareas et al., 2012). Market participants usually pay much attention to the inflation report because it is considered to be good practice in central bank communication and provides useful insights into the direction of interest rates (Blinder et al., 2008).

The negative relationship between disagreement among MPC members and forecast disagreement seems to contrast with the notion that central banks should communicate in a collegial manner, since the diversity of opinions among MPC members may endanger clarity (Issing, 2005). This result may be counterintuitive at first glance. If disagreement within the MPC is regarded as a measure of monetary policy uncertainty, disagreement among professional forecasters may be expected to increase. A possible explanation for this surprising result is that while, on the one hand, the individualistic nature of the MPC with its occasionally "fractious" postmeeting statements may bring about monetary policy uncertainty, on the other hand the disclosure of dissenting voting records of individual MPC members conveys real information (Blinder, 2004). In turn, this helps market participants understand uncertainty surrounding monetary policy decisions and better anticipate the future course of monetary policy with reduced uncertainty. Moreover, disagreement among MPC members is likely to pre-date changes in policy rates and therefore provides some useful hints regarding future interest rates (Chortareas et al., 2012; Horvath et al., 2013). For these reasons, disagreement among professional forecasts for interest rates decreases when there is disagreement among the MPC members in policy rate decisions.

[13]The reported results of this study are based on the credibility index proposed by de Mendonça (2007). However, we also use the credibility index of Cecchetti and Krause (2002) to verify whether the results depend on our choices for indices of central bank credibility. Although both indices are in the range of 0 and 1, the latter index tends to display lower variation than the former. This is possibly because Cecchetti and Krause assume that the index equals 0 if expected inflation is greater than 20%, while de Mendonça considers the lower and upper bounds of the tolerance interval of the target inflation. Qualitatively, the results of both credibility indices are very similar, with Cecchetti and Krause's credibility index providing slightly lower values of the adjusted *R*-squared.



Notes: Disagreement is measured by the standard deviation of the cross section of reported professional forecasts. SMSH and SMLH denote the forecasts for 3-month interbank rates at 3-month and 12-month ahead, respectively. LMSH and LMLH denote the forecasts for 10-year gilt yields at 3-month and 12-month ahead, respectively. The sample period is from 1989:10 to 2014:02. Shaded regions indicate the UK's recessions (1990:03 – 1993:03; 2008:04 – 2009:09) dated by Campos *et al*. (2011) and Mitchell *et al*. (2012).

FIGURE 2 Disagreement about interest rate forecasts. (a) Comparisons of disagreement about interest rate forecasts across forecast horizons. (b) Comparisons of disagreement about interest rate forecasts across maturities. Disagreement is measured by the standard deviation of the cross-section of reported professional forecasts. SMSH and SMLH denote the forecasts for 3-month interbank rates at 3 months and 12 months ahead, respectively. LMSH and LMLH denote the forecasts for 10-year gilt yields at 3 months and 12 months ahead, respectively. The sample period is from 1989:10 to 2014:02. Shaded regions indicate the UK's recessions (1990:03 to 1993:03; 2008:04 to 2009:09) dated by Campos et al. (2011) and Mitchell et al. (2012) [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 4 Correlations of disagreement about interest rate forecasts

	SMSH	SMLH	LMSH	LMLH
SMSH	1			
SMLH	0.7471*** (19.18)	1		
LMSH	0.4049*** (7.55)	0.6022*** (12.866)	1	
LMLH	0.4842*** (9.44)	0.7432*** (18.95)	0.7704*** (20.61)	1

Note. This table reports correlations of disagreement about interest rate forecasts. SMSH and SMLH denote the forecasts for 3-month interbank rates at 3 months and 12 months ahead, respectively. LMSH and LMLH denote the forecasts for 10-year gilt yields at 3 months and 12 months ahead, respectively. The sample period is from 1989:10 to 2014:02. The *t*-statistics are shown in parentheses. Asterisks signify statistical significance at

***1%, **5%, and *10%.

It is worth noting that, among three proxies for central bank communication, only disagreement within the MPC has a significant impact on disagreement among professional forecasters at the 5% level. The general conclusion emerging from this result is that disagreement among MPC members helps market participants to produce more aligned interest rate expectations, whereas the announcement of changes in policy rates and the publication of inflation reports have no significant influence. This finding has important implications for monetary policymakers. The disclosure of voting records showing the heterogeneity among MPC members is desirable for better conducting

TABLE 5 Time-varying disagreement about interest rate forecasts

Case	Constant (α)	Linear time trend (β_1)	D_t^{REC} (β_2)	Adj. R^2
SMSH	0.2424*** (39.03)			0.0000
	0.2644*** (23.36)	−0.0003*** (−5.09)	0.1292*** (9.63)	0.3591
SMLH	0.5304*** (44.41)			0.0000
	0.6609*** (35.01)	−0.0012*** (−11.25)	0.2136*** (9.56)	0.5182
LMSH	0.2694*** (44.33)			0.0000
	0.2781*** (22.75)	−0.0002 *** (−2.92)	0.1066*** (7.36)	0.2201
LMLH	0.4333*** (55.65)			0.0000
	0.4832*** (32.34)	−0.0005*** (−6.05)	0.1207*** (6.82)	0.2894

Note. This table reports the estimation results of Equation 5. Disagreement about interest rate forecasts is the dependent variable. Linear time trend in months and a dummy variable for the UK's recessions are the independent variables. SMSH and SMLH denote the forecasts for 3-month interbank rates at 3 months and 12 months ahead, respectively. LMSH and LMLH denote the forecasts for 10-year gilt yields at 3 months and 12 months ahead, respectively. The sample period is from 1989:10 to 2014:02. Robust *t*-statistics are shown in parentheses. Asterisks signify statistical significance at

***1%, **5%, and *10%.

monetary policy without information asymmetry between central banks and market participants. Therefore, the BOE should communicate in an individualistic way by conveying the diversity of opinions among MPC members regarding their decisions on policy rates.

5.5 | Case-by-case analysis of the impact of monetary policy transparency and central bank communication on disagreement about interest rate forecasts

Although panel data analysis provides a solid conclusion that increased monetary policy transparency and individualistic communication policy lower forecast disagreement, it may conceal information about heterogeneous effects on different cases of forecast disagreement (i.e., SMSH, SMLH, LMSH, and LMLH). The analysis in this subsection accounts for the possibility that transparency and central bank communication affect forecast disagreement depending on the maturity of interest rates and the length of forecast horizons.

Models 1–6 are reestimated for each case of SMSH, SMLH, LMSH, and LMLH. It is evidently clear that the results of case-by-case analysis reported in Table 7 are broadly consistent with those of the panel data analysis presented in Table 6. As before, the estimated coefficients of all control variables have expected signs, but their significance levels drop in most cases. The weakening effects of control variables most likely reflect a small sample size. Although the increase in transparency brings with it reductions in forecast disagreement of all cases, the estimated coefficient of the transparency index in Table 7 reveals that the influence of transparency on forecast disagreement depends on maturities of interest rates and forecast horizons. For a given maturity (forecast horizon), monetary policy transparency has a greater effect on forecast disagreement at the long forecast horizon (short maturity) than the short forecast horizon (long maturity). In other words, disagreement about long-horizon (short-maturity) forecasts is more sensitive to the degree of monetary policy transparency than disagreement about short-horizon (long-maturity) forecasts. These findings seem reasonable since the BOE generally uses the short-term interest rate as a monetary policy instrument and, given the forward-looking nature of the BOE monetary policy, the time horizon between a change in monetary policy and its effects on the real economy is around 1–2 years (Miles, 2014).

For the effects of central bank communication, the major difference between two sets of results in Tables 6 and 7 is the impact of disagreement within the MPC on disagreement among forecasters in forming interest rate expectations. To be more specific, panel data analysis in Table 6 provides strong evidence that disagreement among the MPC assists professional forecasters to produce more converged interest rate expectations. Nevertheless, case-by-case regression analysis in Table 7 indicates that disagreement within the MPC reduces disagreement among forecasters at the short horizon only (i.e., SMSH and LHSH). This phenomenon arises possibly because disagreement among the MPC tends to precede a change in the policy rate over the subsequent few months, and hence it tends to affect forecast disagreement at the short horizon rather than the long horizon (Chortareas et al., 2012).

TABLE 6 Panel data analysis of the impacts of transparency and communication policy on disagreement about interest rate forecasts

Model	Transparency index (β_1)	D_{it}^{REC} (β_2)	Interest rate volatility (β_3)	GDP forecast disagreement (β_4)	Inflation forecast disagreement (β_5)	Unemployment forecast disagreement (β_6)	D_{it}^{BANK} (β_7)	D_{it}^{IR} (β_8)	D_{it}^{MPC} (β_9)	D_{it}^{APF} (β_{10})	D_{it}^{FWD} (β_{11})	Credibility index (β_{12})	Transparency × credibility (β_{13})	Adj. R^2
1	−0.0097***	—	—	—	—	—	—	—	—	—	—	—	—	0.3529
	(−25.23)	—	—	—	—	—	—	—	—	—	—	—	—	
2	−0.0091***	0.0858***	—	—	—	—	—	—	—	—	—	—	—	0.4126
	(−24.59)	(10.89)	—	—	—	—	—	—	—	—	—	—	—	
3	−0.0083***	—	0.1675***	—	—	—	—	—	—	—	—	—	—	0.4038
	(−20.91)	—	(9.98)	—	—	—	—	—	—	—	—	—	—	
4	−0.0056***	—	—	0.0092	0.1853***	0.1594***	—	—	—	—	—	—	—	0.5037
	(−12.88)	—	—	(0.37)	(10.81)	(8.18)	—	—	—	—	—	—	—	
5	−0.0051***	0.0283***	0.1098***	0.0087	0.1638***	0.1220***	—	—	—	—	—	—	—	0.5292
	(−11.73)	(3.45)	(7.15)	(0.36)	(9.62)	(6.03)	—	—	—	—	—	—	—	
6	−0.0068***	0.0637***	0.0902***	0.0252	0.1874***	0.0807***	−0.0109	−0.0101	−0.0142**	−0.0016	−0.0509***	−0.1108	−0.0021**	0.4336
	(−6.52)	(5.65)	(4.24)	(1.09)	(6.66)	(3.46)	(−1.30)	(−1.62)	(−2.26)	(−0.09)	(−2.83)	(−1.07)	(−2.01)	

Note. This table reports the case-fixed effects estimation of Equation 2 in which coefficients other than the constant are restricted to be the same for all cases of interest rate forecasts (i.e., SMSH, SMLH, LMSH, and LMLH). The sample period of Models 1–5 is from 1989:10 to 2014:02. Since the voting records of the MPC and the credibility index are not available before 1997:06, the sample period of Model 6 is from 1997:06 to 2014:02. Owing to space limitations, the estimated constant term is unreported. Robust *t*-statistics are reported in parentheses. Asterisks signify statistical significance at

***1%, **5%, and *10%, respectively.

TABLE 7 Case-by-case analysis of the impacts of transparency and communication policy on disagreement about interest rate forecasts

Model	Transparency index (β_1)	${}_{it}^{D}\text{REC}$ (β_2)	Interest rate volatility (β_3)	GDP forecast disagreement (β_4)	Inflation forecast disagreement (β_5)	Unemployment forecast disagreement (β_6)	D_{it}^{BANK} (β_7)	D_{it}^{IR} (β_8)	D_{it}^{MPC} (β_9)	D_{it}^{APF} (β_{10})	D_{it}^{FWD} (β_{11})	Credibility index (β_{12})	Transparency × credibility (β_{13})	Adj. R^2
Panel A: 3-month interbank rates at 3-month forecast horizon (SMSH)														
1	−0.0050***	—	—	—	—	—	—	—	—	—	—	—	—	0.3462
	(−12.48)	—		—	—	—	—	—	—	—	—	—	—	
2	−0.0047***	0.0518***	—	—	—	—	—	—	—	—	—	—	—	0.3835
	(−12.00)	(4.31)		—	—	—	—	—	—	—	—	—	—	
3	−0.0037***	—	0.1402***	—	—	—	—	—	—	—	—	—	—	0.4203
	(−8.64)	—	(6.18)	—	—	—	—	—	—	—	—	—	—	
4	−0.0045***	—	—	0.0489	0.1208***	0.1444***	—	—	—	—	—	—	—	0.3738
	(−11.24)	—	—	(1.13)	(3.69)	(2.90)	—	—	—	—	—	—	—	
5	−0.0026***	0.0253**	0.1309***	0.0125	0.1163***	0.1060***	—	—	—	—	—	—	—	0.4632
	(−5.31)	(2.29)	(5.98)	(0.786)	(2.94)	(2.75)	—	—	—	—	—	—	—	
6	−0.0031**	0.0598***	0.0537*	0.0561	0.1494***	0.0584*	−0.0155	−0.0003	−0.0192**	−0.0149	−0.0468	−0.1011	−0.0020	0.4301
	(−2.37)	(3.18)	(1.78)	(1.45)	(3.14)	(1.83)	(−1.12)	(−0.03)	(−2.02)	(−0.53)	(−1.56)	(−1.0)	(−1.11)	
Panel B: 3-month interbank rates at 12-month forecast horizon (SMLH)														
1	−0.0109***	—	—	—	—	—	—	—	—	—	—	—	—	0.4547
	(−15.64)	—	—	—	—	—	—	—	—	—	—	—	—	
2	−0.0103***	0.1089***	—	—	—	—	—	—	—	—	—	—	—	0.4999
	(−15.29)	(5.23)	—	—	—	—	—	—	—	—	—	—	—	
3	−0.0102***	—	0.1764***	—	—	—	—	—	—	—	—	—	—	0.4589
	(−12.89)	—	(2.81)	—	—	—	—	—	—	—	—	—	—	
4	−0.0054***	—	—	0.0266	0.4154***	0.1141***	—	—	—	—	—	—	—	0.6698
	(−7.69)	—	—	(0.46)	(10.51)	(2.65)	—	—	—	—	—	—	—	
5	−0.0035***	0.0220**	0.1466**	0.0262	0.3125***	0.1172***	—	—	—	—	—	—	—	0.7052
	(−4.78)	(2.09)	(2.28)	(0.49)	(6.67)	(2.80)	—	—	—	—	—	—	—	
6	−0.0147***	0.0910***	0.0106*	0.0148	0.2942***	0.0902*	−0.0071	−0.0006	−0.0248	−0.0354	−0.0981**	−0.2243	−0.0043*	0.5167
	(−3.12)	(3.38)	(1.82)	(1.13)	(4.32)	(1.83)	(−0.36)	(−0.04)	(−1.09)	(−0.88)	(−2.30)	(−0.87)	(−1.91)	
Panel C: 10-year gilt yields at 3-month forecast horizon (LMSH)														
1	−0.0029***	—	—	—	—	—	—	—	—	—	—	—	—	0.1208
	(−6.41)	—	—	—	—	—	—	—	—	—	—	—	—	

(Continues)

TABLE 7 (Continued)

Model	Transparency index (β_1)	$_{it}D^{REC}$ (β_2)	Interest rate volatility (β_3)	GDP forecast disagreement (β_4)	Inflation forecast disagreement (β_5)	Unemployment forecast disagreement (β_6)	D_{it}^{BANK} (β_7)	D_{it}^{IR} (β_8)	D_{it}^{MPC} (β_9)	D_{it}^{APF} (β_{10})	D_{it}^{FWD} (β_{11})	Credibility index (β_{12})	Transparency × credibility (β_{13})	Adj. R^2
2	−0.0024***	0.0909***	—	—	—	—	—	—	—	—	—	—	—	0.2445
	(−5.72)	(6.98)		—	—	—	—	—	—	—	—	—	—	
3	−0.0016***	—	0.2692***	—	—	—	—	—	—	—	—	—	—	0.2839
	(−3.62)	—	(8.20)	—	—	—	—	—	—	—	—	—	—	
4	−0.0022***	—	—	0.0157	0.1156***	0.2345***	—	—	—	—	—	—	—	0.2523
	(−5.02)	—	—	(0.34)	(3.56)	(2.86)	—	—	—	—	—	—	—	
5	−0.0011***	0.0326**	0.2163***	0.0257	0.0990***	0.2052***	—	—	—	—	—	—	—	0.4684
	(−2.66)	(2.35)	(7.43)	(0.62)	(3.37)	(2.86)	—	—	—	—	—	—	—	
6	−0.0017**	0.0410***	0.0941***	0.0606	0.1003***	0.1566***	−0.0019	−0.0142	−0.0106**	−0.0140	−0.0505**	−0.2010	−0.0026*	0.5395
	(−2.11)	(2.72)	(3.03)	(1.44)	(2.68)	(5.00)	(−0.17)	(−1.31)	(−2.07)	(−0.62)	(−2.11)	(−1.39)	(−1.81)	
Panel D: 10-year gilt yields at 12-month forecast horizon (LMLH)														
1	−0.0049***	—	—	—	—	—	—	—	—	—	—	—	—	0.2149
	(−8.99)	—	—	—	—	—	—	—	—	—	—	—	—	
2	−0.0044***	0.0977***	—	—	—	—	—	—	—	—	—	—	—	0.3015
	(−8.44)	(6.09)		—	—	—	—	—	—	—	—	—	—	
3	−0.0039***	—	0.1978***	—	—	—	—	—	—	—	—	—	—	0.2667
	(−6.96)	—	(4.65)	—	—	—	—	—	—	—	—	—	—	
4	−0.0043***	—	—	0.0457	0.2096***	0.1715***	—	—	—	—	—	—	—	0.5460
	(−5.58)	—	—	(1.04)	(6.85)	(5.23)	—	—	—	—	—	—	—	
5	−0.0042***	0.0383***	0.0777**	0.0654	0.2652***	0.1232***	—	—	—	—	—	—	—	0.5608
	(−5.43)	(2.68)	(2.21)	(1.43)	(6.99)	(3.56)	—	—	—	—	—	—	—	
6	−0.0072***	0.0511**	0.0294*	0.1325	0.2450***	0.1527***	−0.0045	−0.0165	−0.0097	−0.0291	−0.0045	−0.2175	−0.0028*	0.4528
	(−3.27)	(2.23)	(1.83)	(1.51)	(4.61)	(3.35)	(−0.27)	(−1.32)	(−1.28)	(−0.82)	(−0.12)	(−1.47)	(−1.84)	

Note. This table reports the estimations of Equation 2 for each case of interest rate forecasts. The sample period of Models 1–5 is from 1989:10 to 2014:02. Since the voting records of the MPC and the credibility index are not available before 1997:06, the sample period of Model 6 is from 1997:06 to 2014:02. Asterisks ***, ** and * signify statistical significance at

***1%, **5%, and *10%.

TABLE 8 Robustness checks

Model	Transparency index (β_1)	D_{it}^{REC} (β_2)	Interest rate volatility (β_3)	GDP forecast disagreement (β_4)	Inflation forecast disagreement (β_5)	Unemployment forecast disagreement (β_6)	D_{it}^{BANK} (β_7)	D_{it}^{IR} (β_8)	D_{it}^{MPC} (β_9)	D_{it}^{APF} (β_{10})	D_{it}^{FWD} (β_{11})	Credibility index (β_{12})	Transparency × credibility (β_{13})	Adj. R^2
Panel A: The one-month lagged market-based transparency index														
1	−0.0056***	—	—	—	—	—	—	—	—	—	—	—	—	0.3522
	(−25.14)	—		—	—	—	—	—	—	—	—	—	—	
2	−0.0091***	0.0865***	—	—	—	—	—	—	—	—	—	—	—	0.4115
	(−24.45)	(11.03)		—	—	—	—	—	—	—	—	—	—	
3	−0.0083***	—	0.1678***	—	—	—	—	—	—	—	—	—	—	0.4017
	(−20.99)	—	(9.81)	—	—	—	—	—	—	—	—	—	—	
4	−0.0055***	—	—	0.0073	0.1847***	0.1575***	—	—	—	—	—	—	—	0.5008
	(−12.63)	—	—	(0.29)	(10.72)	(8.11)	—	—	—	—	—	—	—	
5	−0.0051***	0.0301***	0.1076***	0.0111	0.1625***	0.1191***	—	—	—	—	—	—	—	0.5264
	(−11.59)	(3.67)	(7.00)	(0.46)	(9.50)	(5.90)	—	—	—	—	—	—	—	
6	−0.0069***	0.0589***	0.1233***	0.0209	0.1945***	0.0906***	−0.0123	−0.0104	−0.0125**	−0.0051	−0.0546***	−0.1242	−0.0025*	0.4431
	(−6.62)	(5.24)	(6.02)	(0.91)	(7.24)	(3.92)	(−1.52)	(−1.46)	(−2.01)	(−0.31)	(−3.04)	(−1.53)	(−1.87)	
Panel B: The quasi-standard deviation as a measure of disagreement														
1	−0.0097***	—	—	—	—	—	—	—	—	—	—	—	—	0.3382
	(−23.39)	—		—	—	—	—	—	—	—	—	—	—	
2	−0.0093***	0.0867***	—	—	—	—	—	—	—	—	—	—	—	0.4052
	(−23.49)	(10.98)		—	—	—	—	—	—	—	—	—	—	
3	−0.0083***	—	0.1643***	—	—	—	—	—	—	—	—	—	—	0.3909
	(−19.44)	—	(9.63)	—	—	—	—	—	—	—	—	—	—	
4	−0.0050***	—	—	0.0110	0.1952***	0.1581***	—	—	—	—	—	—	—	0.5010
	(−10.55)	—	—	(0.44)	(11.10)	(8.12)	—	—	—	—	—	—	—	
5	−0.0046***	0.0265***	0.1069***	0.0262	0.1718***	0.1220***	—	—	—	—	—	—	—	0.5266
	(−9.71)	(3.19)	(6.90)	(1.06)	(9.76)	(6.03)	—	—	—	—	—	—	—	
6	−0.0061***	0.0214**	0.0916**	0.0160	0.2120***	0.0918***	−0.0137	−0.0092	−0.0128**	−0.0048	−0.0511***	−0.1178	−0.0021*	0.4237
	(−3.16)	(2.08)	(2.46)	(1.43)	(7.39)	(4.12)	(−1.41)	(−1.09)	(−2.29)	(−0.43)	(−2.97)	(−1.40)	(−1.74)	
Panel C: The document-based transparency index														
6	−0.0332*	0.0548***	0.0932***	0.0346	0.1956***	0.0755***	−0.0062	−0.0124	−0.0147**	−0.0002	−0.0487***	−0.1516*	−0.0280*	0.4319
	(−1.84)	(4.78)	(5.02)	(1.46)	(7.26)	(3.49)	(−0.85)	(−1.02)	(−2.02)	(−0.01)	(−2.66)	(−1.77)	(−1.83)	

Note. This table reports the robustness checks of the results in Table 6. See note to Table 6 for more detailed description. Asterisks ***, ** and * signify statistical significance at ***1%, **5%, and *10%.

5.6 | Robustness checks

As pointed out by Papadamou and Arvanitis (2014), monetary policy transparency in the current month may impact the degree of understanding of agents in the next month or so. The first concern is that the results reported above do not allow for enough time lags between monetary policy transparency and forecast disagreement. To address this possible problem, Equation 2 is reestimated by lagging the market-based transparency index by 1 month. As this robustness check reduces the number of observations that can be used in the estimations, it is limited to a 1-month lag effect. The results of this robustness test in panel A of Table 8 are qualitatively similar to those in Table 6, with a slight reduction in the level of significance of the estimated coefficients on the transparency index and the dummy variable for disagreement among the MPC as well as the adjusted *R*-squared of the model. This weakening of the findings most likely reflects a small sample size.

The second concern is that the standard deviation of the cross-section of forecasts is used as a proxy for disagreement among forecasters. However, some parallel studies argue that the quasi-standard deviation, defined as half the difference between the 84th and 16th percentiles of the sample of individual point forecasts, is more robust to outliers than the standard deviation (Boero, Smith, & Wallis, 2008; Bowles et al., 2007; Giordani & Soderlind, 2003). In response to this concern, another robustness test is performed by reestimating Equation 2 using the quasi-standard deviation as an alternative measure of forecast disagreement. As reported in panel B of Table 8, the estimated coefficients on the transparency index and the dummy variable representing disagreement among the MPC in all models are qualitatively similar to those of Table 6. This suggests that using the quasi-standard deviation as a proxy for disagreement does not change the previous conclusions.

The final concern is that the findings of this study are based on Kia's (2011) market-based transparency index. With reference to the definition of transparency proposed by Sundararajan et al. (2003), such an index considers transparency as agents' understanding of monetary policy disclosures. However, this is not the entire story concerning the transparency of monetary policy. We thus consider monetary policy transparency in the context of Geraats (2002), who proposed that transparency could be defined as "the extent to which monetary authorities disclose information that is relevant for the policymaking process." In this sense, we count the number of documents (i.e., news, publications, speeches, and events) that are relevant to monetary policy and released in each month during the period of June 1997 to February 2014.[14] To construct the monthly transparency index, we rescale the number of documents in the range of 0–1 by min–max normalization. The number of documents and document-based transparency are displayed in Figure 1b. It can be seen that, on average, the BOE has released an increasing number of documents over time. The momentum seems to have accelerated since the recent 2008–09 financial crisis. This finding implies that the BOE has subscribed to greater transparency. Similar to the market-based transparency index in Figure 1a, the document-based transparency index exhibits an upward trend, with a correlation between both indices of around 0.31. For a robustness check of our findings in Table 6, we reestimate Equation 2 by using the document-based transparency index in place of the market-based transparency index. The results of Model 6 in panel C of Table 8 suggest that the coefficient estimate of the document-based transparency index is still negative, but the significance level drops to 10%. However, the effect of central bank credibility improves, becoming significant at the 10% significance level. Overall, both transparency indices provide qualitatively similar results.

In summary, despite some variations across the estimated models in Table 8, the results of all robustness tests are broadly in line with those in Table 6. This study therefore provides robust empirical evidence that increased monetary policy transparency and communication policy of the BOE do indeed steer market expectations in such a way that professional forecasters disagree less on the future path of short- and long-term interest rates at short and long horizons.

6 | CONCLUDING REMARKS, POLICY IMPLICATIONS, AND LIMITATIONS OF THE STUDY

The current study aims to explore whether increased monetary policy transparency and communication policy of the BOE lower disagreement about interest rate forecasts. While most studies use the transparency scores constructed from official document and information released by central banks, this study is believed to be the first attempt to apply Kia's (2011) methodology to produce a market-based transparency index that reflects market perceptions of the BOE's monetary policy actions, rather than what policymakers intend to convey to the market.

[14]We collect data from https://www.bankofengland.co.uk/news. In particular, we use the filer provided by the BOE to select news, publications, speeches, and events relevant to monetary policy. As the data used to calculate the document-based transparency index are not available prior to June 1997, Models 1–5 could not be estimated in panel C of Table 8.

Furthermore, this study considers three proxies for the information content of monetary policy communication: disagreement among the MPC in policy rate decisions, the announcement of a change or no change in the policy rate constituting the actual monetary policy decisions, and the release of inflation reports conveying to the public the overall thinking and analysis behind the BOE's decisions on monetary policy. These three aspects of institutional design are expected to heighten monetary policy transparency and facilitate central bank communication to manage market expectations about the future course of interest rates.

Based on professional forecasts for the 3-month interbank rates and 10-year gilt yields over the period of October 1989 to February 2014, this study provides a number of interesting findings. First, there is a clear pattern on the relationship between disagreement and forecast horizons. For both maturities of interest rates, forecasters disagree more as the forecast horizon increases. However, the association between disagreement and maturities of interest rates depends on forecast horizons. As the maturity of interest rates lengthens, professional forecasts disagree more (less) at the short (long) forecast horizon. Second, there is strong comovement of disagreement across maturities and horizons of interest rate forecasts. This implies that forecasters construct their interest rate forecasts in a congruent manner that jointly describes their views of the term structure of interest rates. Third, interest rate forecasts for the long horizon (short maturity) exhibit a higher speed of convergence among forecasters than those for the short horizon (long maturity). Fourth, for a given forecast horizon (maturity), recessions tend to have more impact on short-maturity (short-horizon) than long-maturity (long-horizon) forecasts. Fifth, greater transparency leads to a reduction in disagreement about interest rate outlook. Transparency and credibility are considered to be complements in reducing disagreement about interest rate forecasts. Disagreement on the long horizon (short maturity) is more responsive to the degree of transparency than disagreement on the short horizon (long maturity). Finally, disagreement among MPC members in making policy rate decisions reduces disagreement among forecasters in making interest rate forecasts, while the announcement of changes in policy rates and the publication of inflation reports have insignificant influence.

The important policy implication derived from this study is that greater transparency and central bank communication do indeed act in a helpful way in guiding market expectations of interest rates, lowering asymmetric information between central banks and the public, and hence reducing disagreement about the future path of interest rates. To manage market expectations, policymakers should be aware that the influence of monetary policy transparency on forecast disagreement tends to depend on maturities of interest rates and forecast horizons. In addition, a high convergence among market participants regarding their interest rate outlook can be viewed as an indication of central bank achievement in steering market expectations. It is therefore important for the BOE to enhance monetary policy transparency and to provide monetary policy communication in an individualistic way by conveying the diversity of voting records of individual MPC members.

While our study yields invaluable insights into the benefit of the BOE's transparency and communication to the reduction in forecast disagreement, its limitations suggest future directions for empirical research.[15] Other than the market-based transparency index, the questionnaire-based transparency index could reflect nowadays the transparency degree of the BOE (e.g., forward guidance, disclosure of more detailed economic outlook, communication with the general public, and asset purchase facility) and could provide a clearer effect of recent transparency and communication innovations on managing market expectations (Al-Mashat et al., 2018; Horvath & Vasko, 2016). Moreover, we are conscious that binary indicators in our regression models are somewhat problematic given that the BOE's communication policy and forward guidance have been applied very differently in terms of content and guidance. Over our sample period, there have been substantial revisions in terms of the style and content of the delivery of the BOE's policy communication and forward guidance. Given these observations, future research should perform content analysis (e.g., text mining and Flesch–Kincaid readability test) to capture monetary policy inclination and to provide invaluable insight into the effect of central bank communication (Bholat, Hansen, Santos, & Schonhardt-Bailey, 2015; Jansen, 2011).

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions. Alternatively, the data used throughout the analysis are available through subscription at Consensus Economics and Thomson Reuters Eikon.

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