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The Implications of Central Bank Transparency for Uncertainty and Disagreement*

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Highlights

- Explore the effects of increased transparency, inflation targeting and forward guidance on aggregate uncertainty, common uncertainty and disagreement.
- Provide evidence that increased transparency reduces mainly common uncertainty.
- Looking at disagreement only understates benefits of transparency.

Abstract

Using survey data from 25 economies we provide evidence that greater transparency surrounding monetary policy reduces uncertainty of interest rates and inflation, primarily by reducing uncertainty that is common to agents rather than disagreement between agents. This suggests that studies that focus on disagreement as a proxy for uncertainty understate the benefits of monetary policy transparency. The adoption of inflation targets and forward guidance are both associated with lower uncertainty, although inflation targets have a stronger impact on reducing uncertainty than forward guidance. Moreover, there are diminishing benefits from ever higher levels of transparency. Taken as a whole, our results support the contention that clarity of communication is as important as the magnitude of transparency.

Keywords

Central bank transparency, Uncertainty, Disagreement, Monetary policy

1. Introduction

Central banks argue that the effectiveness of the transmission channel increases if people have a sound understanding of monetary policy goals and strategies (see e.g. Bernanke, 2007). One element to facilitate this understanding is central bank transparency. A number of studies find that greater transparency of policy decisions result in a common understanding among central bank watchers, which in turn brings with it reductions in forecast disagreement (e.g., Swanson, 2006; Ehrmann and Fratzscher, 2011; Neuenkirch, 2012; Montes et al., 2016; Trabelsi, 2016). The contention that more transparency also improves the efficiency of monetary policy making is supported by several studies (e.g. Blinder et al., 2008; Ehrmann et al. 2012) and explains the marked global trend for greater transparency in the framework and implementation of monetary policy (e.g., Geraats, 2009; Dincer and Eichengreen 2014).

However, a counter view exists that increases in central bank transparency do not necessarily improve the understanding and efficacy of monetary policy. Morris and Shin (2002) show that public statements act as a focal point that can result in individuals placing too great a weight on public information and insufficient weight to private information. This gives rise to the potential that private information is crowded out as individuals overreact to the public signal which implies that greater transparency may reduce disagreement, but not improve the accuracy of expectations. Indeed, as Amato et al. (2002) highlight, "A central bank that relies on signals from the economy in its role as a vigilant observer of developments will find itself without a compass if the private information of the individual agents is prevented from finding an expression in their decisions" (Amato et al., 2002, p.497).

Whether or not transparency can become detrimental is an empirical question; it is possible that increases in the volume and clarity of public information provided by central banks complement private information and this results in a reduction of disagreement and an overall improvement in the quality of forecasts. Alternatively, if private information is crowded out by increased public information, disagreement may reduce but the average quality of forecasts deteriorates due to the loss of that private information.

To test for the effects of transparency researchers typically look at expectations or disagreement (e.g. Ehrmann et al., 2012 or Siklos, 2013). In contrast to Siklos (2013) we use a decomposition of forecast uncertainty due to Barron et al. (1998) and Lahiri and Sheng (2010) that enables us to test the crowding out hypothesis while distinguishing between the effect on disagreement with that on shared or common uncertainty.

Using this decomposition, we can explore the effects of increased transparency separately on aggregate uncertainty, common uncertainty and disagreement. This approach enables us to assess whether the effect of transparency is relevant for all measures, whether it is homogeneous and whether it has similar effects on forecasts of policy variables (i.e., short- and long-term interest rates) and the primary policy target (inflation). To assess these questions empirically we use a wide range of countries and years and a variety of indicators to measure transparency (i.e. inflation targeting, forward guidance, and a transparency index). We show that transparency reduces both uncertainty and disagreement. In addition, we can make some relevant qualifications. Transparency has a stronger effect on uncertainty than on disagreement. Increases in central bank transparency benefits all economies up to an optimal level of transparency, but the benefits are greatest for economies that do not have an inflation target. Inflation targeting and transparency measured by an index affect the uncertainty and disagreement of all three expectation variables. Forward guidance affects uncertainty and disagreement of interest rates but only disagreement of inflation.

The remainder of this paper is organized in the following way. Section 2 reviews the literature. Section 3 presents the methodological framework and the data set. Section 4 reports the empirical findings as well as robustness checks. Finally, Section 5 concludes.

2. Literature review

Most empirical studies that examine the effect of transparency on expectations and uncertainty[1] use survey data to construct measures of the dispersion of individual forecasts around the average forecast, giving a measure of disagreement, or around the outcome, giving the mean forecast error as a proxy for uncertainty (e.g., Capistran and Timmerman, 2009; Siklos, 2013; Dovern, 2015). The formal relationship between these two measures is explored in the context of forecasting accounting data in a series of papers by Barron et al. (1998) and further developed by Lahiri and Sheng (2010). In this framework, the two measures can be seen as estimates of two additive components of total uncertainty which formally distinguishes between uncertainty that is common to all agents and uncertainty associated with disagreement.

A problem with much of the empirical literature is the disconnect between the properties of the theoretical notion of uncertainty that is relevant to the literature with those of the empirical measure; the theoretical need is for an ex ante measure which captures probabilistic uncertainty at the time expectations are made but the commonly used mean forecast error is an ex post measure which can be highly skewed as a consequence of completely unforeseen events. This problem is discussed by Ehrmann et al. (2012) who follow Capistran and Timmerman (2009) by using the conditional volatility of the variable that is forecasted as a

[1] In what follows we use the term "uncertainty" as it is customarily used in this literature. Strictly speaking, the literature on the effect of central bank communication is relating to the subjective probabilities of risk rather than the more elusive Knightian uncertainty.

control. We address the problem more directly by following Lahiri and Sheng (2010) and using estimates of the conditional volatility as an estimate of ex ante uncertainty.

The potential for public sources of information to crowd out private information is most closely associated with the work of Morris and Shin (2002). The potential for public information to both convey fundamental information and act as a focal point for private beliefs, with the potential of the former crowding out the latter, was applied to monetary policy in Amato et al. (2002).

A similar theoretical outcome is provided by Dale et al. (2011) who start from the premise that both central banks and private agents base their decisions and expectations on imperfect information and an imperfect understanding of the economy. Additional information provided by the central bank can have a negative effect due to private agents being unable to properly evaluate the reliability of the information and consequently placing excessive weight on uncertain information. Hence only the provision of certain information is unambiguously a good thing and the production of "noisy information" can result in bad decisions by the private sector. To illustrate this they contrast the provision of a forecast, which they describe as uncertain or imperfect information, with that of an inflation target, which is more precise and less imperfect. They demonstrate that the provision of a precise inflation target has a positive effect on the public's ability to form expectations but this can be off-set by the simultaneous provision of imperfect forecasts which distracts from the more precise information.

Dale et al. (2011) briefly consider other types of information. For example, they suggest that informing the public of the outcome of a policy meeting comes under the category of "more precise" information whereas pronouncements about the future path of policy are more imperfect. According to this, Odyssean forms of forward guidance will generally provide

clear and unambiguous advice whereas Delphic formats of forward guidance will generally be associated with less clear information which could be counter-productive. Similarly, policy decisions made by a single decision maker are less noisy than decisions made by a committee working to majority decision making.

Premised on the arguments for the potential for there to be too much information, van der Cruijsen et al. (2010) examine the relationship between transparency and inflation persistency. They suggest an optimal level of transparency with inflation persistence declining but at a diminishing rate until the gains to further increases in transparency are outweighed by the costs due to information overload and the potential for too much transparency to exacerbate the complexity of monetary policy thereby creating uncertainty amongst agents external to the decision making (see also Demertzis and Hoeberichts 2007). As discussed by van der Cruijsen et al. (2010), the ideas underlying the notion of an optimal level of transparency relate to the type and quality of information. More recently, Neuenkirch (2013) examines the impact of central bank transparency on the forecast bias in 25 emerging money markets over the period of 1998 to 2009. His results reveal that all subcategories of the Eijffinger and Geraats (2006) transparency index reduce the expectations bias and that there exists an optimal intermediate degree of transparency.

A number of studies have provided evidence that has suggested the accuracy of interest rate forecasts has improved and the dispersion of forecasts has declined as a result of greater transparency of monetary policy (Swanson 2006; Berger et al. 2009; Bauer et al. 2006; Middeldorp 2011; Ehrmann et al. 2012; Lahiri and Sheng 2010). Similar results have been found for inflation forecasts (Swanson 2006; Crowe 2010; Crowe and Meade 2008; Ehrmann et al. 2012). These results have, however, been questioned. For example, Howells and Mariscal (2008) argue that the decline in dispersion of interest rate forecasts has been due to the reduction in uncertainty of the macro environment. Of more direct relevance to the

hypotheses examined in this paper, Kool and Thornton (2015) show that forward guidance has been associated with: i) reduced dispersion of forecasts of interest rates in New Zealand, Norway and Sweden but not in the USA; and ii) limited evidence for improved accuracy of forecasts of short term interest rates but no improvement for forecasts of long rates. Similarly, for inflation forecasts Siklos (2013) reports evidence which shows that greater central bank transparency tends to increase disagreement.

3. Methodological framework and data

Our framework is in the spirit of Barron et al. (1998) and follows that of Davies and Lahiri (1995), Lahiri and Sheng (2010) and Ozturk and Sheng (forthcoming) who decompose forecast errors into common and idiosyncratic components. Given a forecast, F_{ith}, made by agent i over horizon h for target year t, the forecast error is defined as

$$e_{ith} = A_{th} - F_{ith} \tag{1}$$

where A_{th} is the actual outcome for the variable of interest. The forecast error can be decomposed into two components: errors due to shocks that are common to all forecasters, λ_{th}, and individual or idiosyncratic errors, ε_{ith}, due to agents having access to different information sets and models or alternative interpretations of the same information

$$e_{ith} = \lambda_{th} + \varepsilon_{ith} \tag{2}$$

The common component, λ_{th}, is in turn the sum of common shocks during the forecast horizon, v_{tj}

$$\lambda_{th} = \sum_{j=1}^{h} v_{tj} \tag{3}$$

The decomposition of uncertainty, U_{th}, into common and idiosyncratic components is presented in equation (4).

$$U_{th} = \sigma^2_{\lambda|th} + \frac{1}{N}\sum_{i-1}^{N}\sigma^2_{\varepsilon|ith} \tag{4}$$

The second term on the right-hand side, the idiosyncratic component, is generally estimated as the dispersion of forecasts around the mean, d_{th}

$$d_{th} \equiv \frac{1}{N-1}\sum_{i=1}^{N}\left(F_{ith} - F_{th}\right)^2 = \frac{1}{N-1}\sum_{i=1}^{N}\left(\varepsilon_{ith} - \frac{1}{N}\sum_{j=1}^{N}\varepsilon_{jth}\right)^2 \tag{5}$$

We consider two approaches to estimate the common component, $\sigma^2_{\lambda|th}$ in equation (4). One, an ex post measure of uncertainty based on Barron et al. (1998) estimates the common component, $\sigma^2_{\lambda|th}$, as the squared error of the mean forecast

$$U_{th} = \left(A_t - F_{th}\right)^2 + d_{th} \tag{6}$$

The observed deviations of individual forecasts around the mean are generally regarded to be a reasonable measure of uncertainty associated with different information sets and interpretation of that information. The Morris and Shin proposal that there can be too much transparency would mean that increased transparency gives rise to a reduction in dispersion, d_{th}, but not the mean forecast error, $\left(A_t - F_{th}\right)^2$.

Using the observed deviations of average forecasts around the outcome in equation (6) as a measure of common uncertainty is problematic from both a conceptual and practical perspective. As an ex post measure of variability it is subject to sharp variations due to realized extreme events, which may or may not have been anticipated, which distort it as a temporal measure of uncertainty. This gives rise to the second approach which follows that of Lahiri and Sheng (2010) and uses an estimate of the common component obtained from a

GARCH model and represented as $\hat{\sigma}^2_{\lambda|th}$ also in conjunction with the dispersion of forecasts, d_{th}

$$\hat{U}_{th} = \hat{\sigma}^2_{\lambda|th} + d_{th} \quad (7)$$

Our primary objective is to test whether increases in central bank communication is always a good thing. Models developed by Morris and Shin (2002), Dale et al. (2011) and Kool et al. (2011) give rise to what we can describe as the crowding out hypothesis which suggests that improved communications, be it through forward guidance, inflation targeting or simply more transparent communication as reflected in an improved transparency score, will result in a reduction in dispersion but not necessarily a decline in the uncertainty or accuracy of forecasts. The decomposition presented in equation (7) enables us to test this hypothesis by estimating the effect of measures or indicators of central bank transparency on total uncertainty and its component parts, disagreement and common uncertainty.

The widely held view that more transparency is a good thing is represented by hypothesis H1A while the alternative crowding out argument due to Morris and Shin and others is represented by H1B. A milder version in which there is no significant effect on common uncertainty is provided by H1C.

H1A: Increases in central bank communication reduce both disagreement and common uncertainty

H1B: Increases in central bank communication reduce disagreement but increases common uncertainty

H1C: Increases in central bank communication reduce disagreement but have no effect on common uncertainty

A more nuanced variation of the above hypotheses is due to van der Cruijsen et al. (2010) and others who suggest there are limits to benefits from increased communication. A mild version of the hypothesis that arises from this is that the benefits of increases in communication diminish at higher levels of transparency while a stronger version is that the benefits are eventually exceeded by the costs of transparency, giving us hypotheses H2A and H2B respectively.

H2A: Increases in central bank communication reduce disagreement and common uncertainty, but at a diminishing rate

H2B: Increases in central bank communication reduce disagreement and common uncertainty, but at a diminishing rate such that there is an optimal level of transparency

We use forecast data of interest rates and CPI inflation from Consensus Economics covering the G7, Europe (October 1989 to end 2013) as well as Asia Pacific (January 1995 to end 2013). This database is well known and used in earlier studies (e.g. Chortareas et al., 2012; Jitmaneeroj and Wood, 2013; Siklos 2013; Bauer and Neuenkirch, 2017). Notably previous research focused mainly on the G7 countries often ignoring the Asian Pacific sample or vice versa. Using the two databases we are able to consider the effects of central bank communication on up to 25 economies. While forecasters are asked to provide interest rate forecasts at 3- and 12-month horizons, they forecast CPI inflation for current and next years. To capture resulting seasonality effects, we include monthly dummy variable in our empirical models.[2]

We use both binary indicators and an index to signify differences in transparency. Inflation targeting has been identified as a clear and unambiguous signal to agents about the central bank's inflation objective. The dummy variable, IT, takes the value of 1 during the

[2] Adding dummy variables is a standard way to address seasonality. For a more advanced procedure see Knüppel and Vlaadu (2016).

inflation targeting period in each economy and zero otherwise (see Table 1).[3] Forward guidance is an additional tool that increases transparency and consequently according to H1A we would expect a lower dispersion and uncertainty in countries with forward guidance. Moreover, given that one of the primary motivations for adopting forward guidance is to increase the effectiveness of monetary policy when short term rates are already at the lower bound (Dincer and Eichengreen 2014) we are particularly interested in the effect of forward guidance on long term rates and longer horizon forecasts. We use the dummy variable, FG, which takes the value of 1 during the forward guidance period in each country and zero otherwise.[4] However, we are conscious that a binary indicator is problematic given that forward guidance has been applied very differently across the central banks in terms of content and guidance. Furthermore, even within individual central banks there have been substantial revisions in terms of the style and content of the delivery of forward guidance. Consequently, given these observations it is unclear whether we should observe a strong relationship between our crude binary measure of forward guidance and disagreement and uncertainty.

[Table 1: The adoption of inflation targeting and forward guidance]

In addition to the IT and FG dummy variables, we use the index of transparency constructed by Dincer and Eichengreen (2014). This index is constructed by the summation of indicators relating to political, economic, procedural, policy and operational transparency and can lie between 0 and 15. In practice, the lowest transparency score for our sample is 1 for China during the years 1998 to 2001, and the highest score is 15 for Sweden from 2002 through to the end of the sample period. The trend for greater central bank transparency

[3] The date of inflation targeting adoption in each country is derived from Cecchetti and Hakkio (2010) and Hammond (2012). As pointed out by Little and Romano (2008), monetary policy for the Eurozone, Japan, and Switzerland can be regarded as inflation targeting although they pursue other policy goals in addition to the price stability objective. This study therefore considers the Eurozone, Japan and Switzerland as inflation targeters.

[4] The date of forward guidance adoption in each country is obtained from Campbell *et al.*, (2012), Kool and Thornton (2015), Detmers and Nautz (2012) and Svensson (2015).

identified by Dincer and Eichengreen (2014) can be seen in the graphs presented in Figure 1, not just with the upward trend for average transparency but also the increasing proportion of central banks adopting inflation targeting and/or forward guidance.

[Figure 1: Increasing central bank communication]

The mean and median values of the two components of aggregate uncertainty for each of the variables of interest are presented in Table 2. Some consistent patterns are evident. First, the mean is larger than the corresponding median in almost all cases, often substantially so. Second, a comparison of short and long horizons shows the latter to be significantly larger than the former for both the measure of common uncertainty and disagreement. The difference between short and long horizons is much larger for common uncertainty than disagreement. Third, the importance of common uncertainty to aggregate uncertainty increases in both absolute and relative terms as we move from short to long horizons. Median values of disagreement tend to be comparable in magnitude to the corresponding value of common uncertainty at the short horizon whereas the importance of common uncertainty relative to disagreement increases over the long horizon.

[Table 2: Mean comparison test between short and long forecast horizons]

4. Empirical results

4.1 The effect of the monetary policy regime – binary distinctions

To test for the effect of adopting either an inflation target or forward guidance on components of uncertainty we estimate the regression presented in equation (8) with binary indicators for whether the central bank adopted an inflation target, IT, or forward guidance, FG, as our main

points of focus. The regressions are estimated with country and annual fixed effects in addition to macro control variables, M_{it}.

$$UC_{it} = \alpha_i + \sum_{y=1989}^{2013} \tau_y D_{yt} + \sum_{m=2}^{12} \varphi_m D_{mt} + \beta_{IT} IT_{it} + \beta_{FG} FG_{it} + \gamma M_{it} + \varepsilon_{it} \quad (8)$$

where UC_{it} is the uncertainty component (i.e., aggregate uncertainty, common uncertainty or disagreement) of country i at month t, D_{yt} is a yearly dummy variable to capture time varying uncertainty, D_{mt} is a monthly dummy variable to capture seasonality in forecasts, IT_{it} is an inflation targeting dummy variable that takes a value of 1 during inflation targeting periods and zero otherwise, FG_{it} is a forward guidance dummy variable that takes a value of 1 during the forward guidance periods and zero otherwise, M_{it} is a set of economic control variables, ε_{it} is the error term, τ_y, φ_m, β_{IT}, and β_{FG} are parameters, and γ is a coefficient vector associated with control variables. We include a number of control variables that have been identified in the literature as having potential impact on forecast uncertainty and disagreement (e.g., Dopke and Fritsche, 2006; van der Cruijsen and Demertzis, 2007; Patton and Timmermann, 2010; Dovern et al., 2012; Ehrmann et al., 2012; Lamla and Maag, 2012; Hartmann and Roestel, 2013; Posso and Tawadros, 2013; Siklos, 2013). Accordingly, our control variables are the lagged 1-month changes in dollar exchange rates, the change in WTI crude oil price, and unemployment rate, in addition to the output gap, the term spread defined as the difference between a 10-year government bond yield and a 3-month money market rate and the corresponding level variable for inflation, short-term or long-term rate.[5] We use standard errors that are robust to suspected heteroscedasticity and within panel autocorrelation.

[5] All data is from Datastream Professional. The output gap is estimated by Oxford Economics in the form: 100×(ln(real GDP) - ln(potential output)). Please note furthermore, that we estimated different specifications of our model where we added additional control variables to the M vector. For instance we accounted for economic policy uncertainty (Baker et al., 2016) and controlled for potential business cycle effects by adding and interacting recession period dummy variables. Results remain qualitatively identical and are available on request.

The results reported in Table 3 show that IT is associated with significantly lower measures of both common uncertainty and disagreement for each of the three variables for both short and long horizons, in support of H1A. Although with one exception the IT coefficients are significant at the 1% level, the size of the IT effect is relatively modest for disagreement when compared to the corresponding effect for common uncertainty. This indicates that the beneficial effects of IT in reducing aggregate uncertainty are primarily due to the reduction of common uncertainty and less to the reduction of disagreement.

[Table 3: The influence of inflation targeting and forward guidance on uncertainty components]

Forward guidance is associated with reductions in both disagreement and common uncertainty for long and short term interest rates, with the reductions in disagreement being similar in magnitude to the corresponding reduction associated with IT. By contrast, forward guidance is associated with reductions in disagreement over CPI but increases, albeit insignificant, in common uncertainty for CPI. As with inflation targeting, the effect of forward guidance on common uncertainty is much larger than on disagreement. When interpreting these results, it should be noted that, with the exception of the US, countries that adopt forward guidance already have inflation targets (Table 1), implying that for those countries a forward guidance effect is additional to the effect of inflation targeting.

The results reported in Table 3 are consistent with forward guidance providing agents with greater clarity about the policy makers' intentions regarding policy instruments, resulting in reductions in both common uncertainty and disagreement for policy targets of both short and long term interest rates, in support of H1A. But the effect of forward guidance on the policy objective of inflation is limited to reducing disagreement without reducing the systematic component of uncertainty relating to inflation, consistent with H1C.

Notably, those results are not only statistically significant but also economically meaningful. For this purpose we compare the influence of all explanatory variables on the dependent variable in terms of a one standard deviation shock. Out of eight explanatory variables for aggregate uncertainty over the short term, IT ranks third for CPI, fifth for STR and first for LTR. For aggregate uncertainty over the longer horizon, IT ranks fifth for CPI, second for STR and fifth for LTR. For the results reported in Table 4, the effect of the economic relevance of the transparency index is ranked either first or second in every estimation.

4.2 The nonlinear effect of monetary policy transparency

The relationship between uncertainty components and Dincer and Eichengreen's measure of the transparency of monetary policy, TR, is estimated using equation 9 and reported in table 4. There are a number of reasons why the relationship might not be linear. According to Dale et al. (2011) the production of "noisy information" can result in bad decisions by the private sector. From this perspective, some of the metrics which constitute the Dincer-Eichengreen transparency index are likely to be unambiguous in their interpretation and therefore have a positive effect on expectations, for example a clear policy objective such as an inflation target, while others may be seen as more noisy and open to interpretation, such as forecasts and the publication of minutes of committee meetings. Non-linear effects will be likely if marginal increases in the transparency index scores are achieved by the adoption of ever less reliable or more ambiguous communication mechanisms. We therefore include a squared term, TR^2, to allow for non-linear relationships and we consider possible turning points.[6]

$$UC_{it} = \alpha_i + \sum_{y=1989}^{2013} \tau_y D_{yt} + \sum_{m=2}^{12} \varphi_m D_{mt} + \beta_{TR} TR_{it} + \beta_{TR2} TR_{it}^2 + \gamma M_{it} + \varepsilon_{it} \quad (9)$$

[Table 4: The influence of monetary policy transparency on uncertainty components]

[6] In unreported results, cubed terms were included but they only provided a slight twist to the relationship without fundamentally changing it and with little effect on the fit.

The results for common uncertainty and disagreement share similar features, each with significant negative coefficients for TR and positive coefficients for TR^2 giving rise to non-linear transparency effects, declining to a minimum of between 8.4 and 12.2. This should be seen in the context of the TR index ranging from 1 to 15 with a median score of 9.5, thereby supporting hypothesis H2B. The negative relationship between transparency and disagreement is in line with Ehrmann et al. (2012) but in contrast to the results presented in Siklos (2013) who find that central bank transparency tends to increase forecast disagreement in most economies, with the exception of the Eurozone and the US.

Where the results differ is in the size of the effects. The effect of transparency on common uncertainty is much larger than on disagreement, especially for STR and LTR. This pattern of results is similar to that which is seen with the results from the regressions reported in Table 3, although the difference between the effect of transparency on common uncertainty relative to disagreement is more pronounced than is the corresponding difference due to the binary effects of IT and FG reported in Table 3, especially with the results for both short and long term interest rates.

4.3 The effect of monetary policy transparency: inflation targeting versus non-inflation targeting

Developing the argument of Dale et al. (2011), a clear and precise inflation target should unambiguously improve the quality of forecasts, whereas once inflation targeting is stripped out of the Dincer-Eichengreen transparency index many of the remaining components can be considered in the category of "noisy" information which may have a negative effect on uncertainty which can potentially counter the benefits of a clear inflation target. This gives rise to the possibility of greater transparency as measured by the Dincer-Eichengreen index

being more beneficial for countries that do not have an inflation target than for countries that do.

The results for non-IT countries are reported in panels A1 and B1 of Table 5 while those for IT countries are reported in panels A2 and B2. Focusing first on non-IT countries, with the exception of common uncertainty surrounding long horizon CPI forecasts, the results are broadly consistent with those in Table 4 with transparency having a negative effect on both common uncertainty and disagreement, but this negative effect decreases before bottoming out for transparency scores of between 8.9 and 10.6. These turning points tend to be slightly lower than those reported in Table 4, although the non-IT sample does tend to have lower transparency scores than the IT sample, with a median score of 8.5 for non-IT countries compared to 10 for IT countries.

[Table 5: The influence of monetary policy transparency on uncertainty components for inflation and non-inflation targeting]

The results for IT countries are more complex. For the policy instruments, STR and LTR, the effects of greater transparency are broadly beneficial for common uncertainty but not for disagreement. In detail, greater transparency reduces common uncertainty at a diminishing rate for both STR and LTR over the long horizon, and for LTR over the short horizon, but the effect is insignificant for short horizon STR. The effect of increased transparency on disagreement over STR and LTR is insignificant, with the exception of the short horizon for LTR for which increases in transparency are associated with an increase in disagreement. Turning to the results for CPI, transparency has no significant effect on disagreement surrounding either short or long horizon forecasts of CPI but it has a non-linear positive effect on the common uncertainty surrounding short horizon CPI forecasts and has no significant effect on the common uncertainty of long horizon CPI forecasts.

Putting the results for CPI as reported in Table 5 alongside those reported in Table 3, it can be seen that while the adoption of inflation targeting has a clear beneficial effect in reducing both common uncertainty and disagreement of inflation forecasts, additional increases in transparency over and above the adoption of IT either has no significant effect or, in the case of near term common uncertainty, can potentially undermine the positive effects of IT.

4.4 Robustness Analysis

4.4.1 Propensity Score Matching and Ex-Post Measure of Uncertainty

To address any biases resulting from the likelihood that the sample of economies with central banks that have adopted IT are likely to differ from those that have not, we use propensity score matching (see also Crowe 2010). Propensity score matching allows making two sub samples more similar by weighting the data appropriately. For this purpose, we match the first and second moments of our forecast variables CPI, STR and LTR.

We also repeat the regressions reported above using the more conventional ex post measure of uncertainty obtained from the deviation of forecasts from outcome. As argued above, although this measure is commonly used in the literature, the fact that it is an ex post measure renders it inappropriate as a measure of uncertainty.

The coefficients of interest from equation 8 are reported in table 6. The ex ante results correspond to those reported in Table 3, are presented alongside the corresponding coefficients using the ex post measure of common uncertainty and those for both common uncertainty and disagreement using propensity score matching (PSM). With one exception, the results are qualitatively similar to those reported in Table 3, with the same results for tests of significance and, for those coefficients that are significant, the same signs. The exception is the effect of FG on long horizon LTR which is significant at the 10% level for ex ante and

PSM, but insignificant for the ex post measure. For the most part, the economic significance of the results is also similar. The exception being the ex post results for the effect of forward guidance on STR uncertainty, with a smaller effect for the short horizon and a larger effect for the long horizon.

[Table 6: Alternative estimates of dummy variable effects]

The results for the effect of transparency on our ex post measures of common uncertainty are reported in Table 7 alongside the corresponding results for ex ante common uncertainty from Table 4. Again, the results are qualitatively similar. The optimal turning point at which the reduction in uncertainty peaks is very similar irrespective of how uncertainty is calculated. There is some variation in the magnitude of the impact of transparency, but the overall narrative remains unchanged.

[Table 7: Comparison of ex ante and ex post results for common uncertainty]

4.4.2 Emerging vs Developed Economies

As there might be a difference between the effect of IT and Transparency on the uncertainty measures in developed and emerging countries we split the sample according to the developed countries definition of the International Monetary Fund and report the results in Tables 8 and 9.[7] First of all we would like to highlight that the general result of a differential effect of common uncertainty and disagreement holds for both sub-samples. That said we can further qualify our results by noting that over the short horizon, IT and transparency is more important for emerging countries than for developed countries in reducing aggregate uncertainty, common uncertainty and disagreement. This could be explained by the nonlinearity of transparency we have documented earlier. At lower levels the effect is much stronger. By contrast, over the long horizon the benefit of the adoption of IT by the central

[7] Please note that we need to drop FG from these results since forward guidance has only been adopted by developed economies.

bank of an emerging economy is restricted to reducing common uncertainty and disagreement over STR and not LTR or CPI. Increases in transparency has no significant effects for any long horizon uncertainty measures for emerging economies.

[Table 8: The influence of inflation targeting on uncertainty components for emerging and developed economies]

[Table 9: The influence of monetary policy transparency on uncertainty components for emerging and developed economies]

5. Conclusion

In this paper we examine the consequence of central banks providing more information via increased transparency, inflation targeting and forward guidance. Several papers deliver empirical evidence demonstrating that advances in communication and increased transparency by central banks reduce disagreement. However, disagreement is only one element worth looking at. Following the decomposition of Barron et al. (1998) and Lahiri and Sheng (2010) we look at aggregate uncertainty, common uncertainty and disagreement jointly. This enables us to test the crowding out hypothesis due to Morris and Shin (2002) and others.

Using survey data from 25 economies, covering not only the standard Western countries but the Asian countries as well, we provide evidence that IT, FG and transparency significantly affect uncertainty and disagreement of expectation of inflation as well as expectations of short- and long-term interest rates. Notably the effects of IT, FG and transparency are quite different. While in most cases IT and transparency significantly reduces uncertainty according to all measures used, the effect on aggregate uncertainty is mainly due to the impact on common uncertainty and less on disagreement. This implies that previous studies that have focused on the impact of transparency on disagreement tend to

underestimate the benefits of monetary policy transparency in managing market expectations, especially if disagreement is used as a proxy for uncertainty

Furthermore, the effects are of course different across our measures of transparency: IT, FG and the transparency index. In summary, the most effective measure for achieving a reduction of uncertainty is the adoption of IT. Forward guidance has additional benefits for expectations of interest rates but has less clear benefits for uncertainty surrounding inflation. Increases in central bank transparency benefits all economies up to an optimal level of transparency, but the benefits are greatest for economies that do not have an inflation target. In terms of both disagreement and common uncertainty, the most beneficial combination is to adopt IT in addition to FG and to have a high, but not too high, level of central bank transparency.

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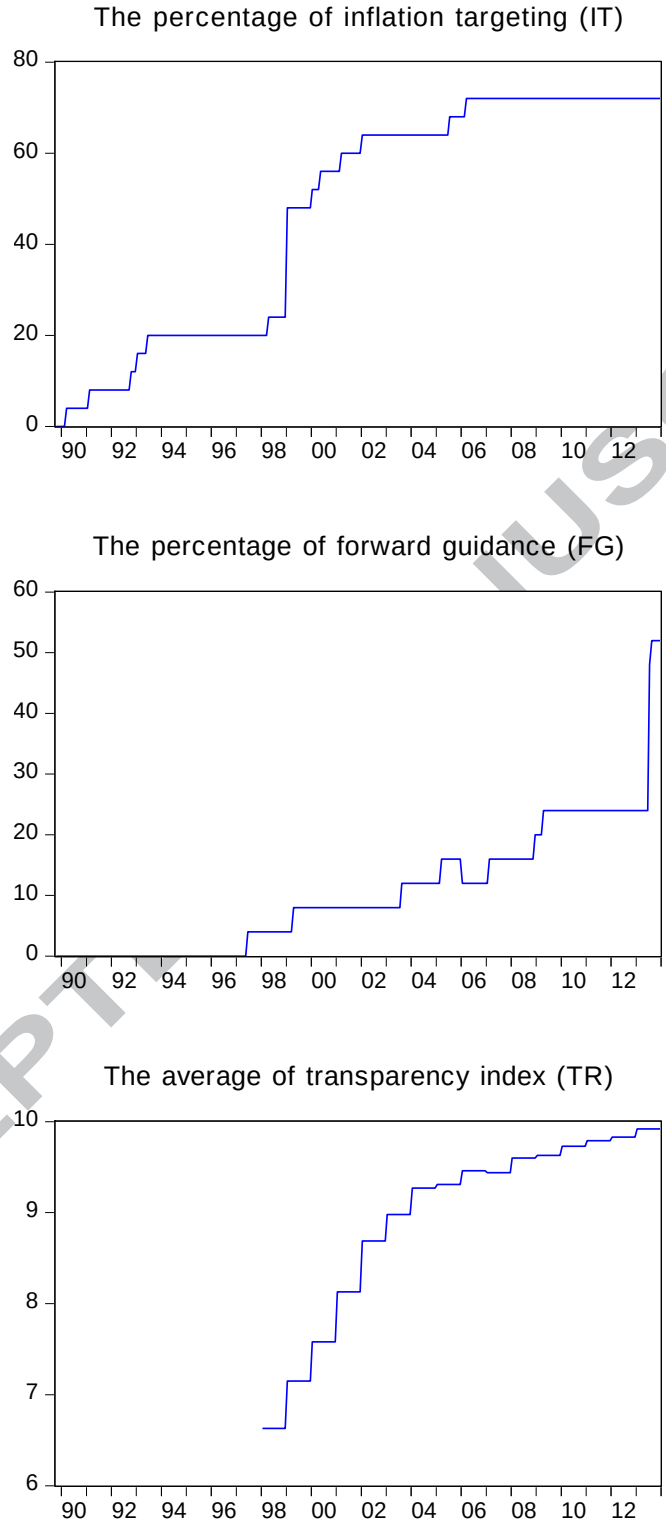
Figure 1: Increasing central bank communication



Notes: This figure plots the time evolution of central bank communication as measured by the percentage of inflation targeting, the percentage of forward guidance, and the average of transparency index across all countries over the period of October 1989 to December 2013. The transparency index of Dincer and Eichengreen (2014) is not available prior to 1998.

Table 1: The adoptions of inflation targeting and forward guidance

Country	The adoption of inflation targeting	The adoption of forward guidance	Transparency index: mean	Transparency index: standard deviation
Australia	Jun-93	n/a	9.50	1.26
Canada	Feb-91	Apr-09	10.81	0.25
China	n/a	n/a	2.53	1.02
Eurozone	Jan-99	Jul-13	10.41	0.99
France	Jan-99	n/a	10.41	0.99
Germany	Jan-99	n/a	10.41	0.99
Hong Kong (Quarterly)	n/a	n/a	6.94	0.77
India	n/a	n/a	2.50	0.52
Indonesia	Jul-05	n/a	7.13	2.13
Italy	Jan-99	n/a	10.41	0.99
Japan	Mar-06	Apr-99	9.34	1.19
Malaysia	n/a	n/a	5.81	0.51
Netherlands	Jan-99	n/a	10.41	0.99
New Zealand	Mar-90	Jun-97	13.63	0.90
Norway	Mar-01	Mar-05	9.03	1.68
Philippines	Jan-02	n/a	8.53	2.26
Singapore	n/a	n/a	4.75	1.00
South Korea	Apr-98	n/a	8.47	0.90
Spain	Nov-94	n/a	10.41	0.99
Sweden	Jan-93	Feb-07	13.94	2.02
Switzerland	Jan-00	n/a	9.09	1.40
Taiwan	n/a	n/a	n/a	n/a
Thailand	May-00	n/a	7.50	2.41
United Kingdom	Oct-92	Aug-13	12.22	0.41
United States	n/a	Aug-03	10.53	0.88

Notes: The date of inflation targeting adoption in each country is derived from Cecchetti and Hakkio (2010) and Hammond (2012). Spain terminated the inflation targeting in December 1998. As pointed out by Little and Romano (2008), monetary policy of Eurozone, Japan, and Switzerland can be regarded as inflation targeting although they pursue other policy goals in addition to the price stability objective. The date of forward guidance adoption in each country is obtained from Campbell et al. (2012), Detmers and Nautz (2012), Cool and Thornton (2015), and Svensson (2015). United States terminated forward guidance in December 2005 and readopted in December 2008. For France, Germany, Italy, Netherlands, and Spain, the adoption of inflation targeting and forward guidance from 1999 follows Eurozone. The transparency indices over the period of 1998 to 2013 are derived from Dincer and Eichengreen (2014).

Table 2: Mean and median comparison between short and long forecast horizons

Country	Obs.	Common uncertainty				Disagreement			
		Short horizon		Long horizon		Short horizon		Long horizon	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median
Panel A: Consumer price inflation (CPI)									
Australia	278	0.297	0.038	2.433	0.802	0.083	0.051	0.221	0.120
Canada	291	0.113	0.032	1.132	0.175	0.048	0.037	0.124	0.114
China	229	2.011	0.368	15.695	4.137	0.575	0.251	1.395	0.738
Eurozone	133	0.115	0.019	1.334	0.305	0.017	0.016	0.048	0.039
France	291	0.074	0.014	0.599	0.310	0.031	0.023	0.062	0.053
Germany	291	0.201	0.049	0.868	0.245	0.051	0.030	0.194	0.159
Hong Kong	229	0.746	0.105	8.788	2.789	0.308	0.170	0.765	0.514
India	229	4.467	0.994	10.576	4.377	0.856	0.585	1.026	0.888
Indonesia	204	8.418	0.440	151.646	5.745	8.690	0.479	8.219	0.903
Italy	291	0.093	0.017	0.850	0.444	0.035	0.020	0.110	0.062
Japan	291	0.086	0.023	0.543	0.242	0.060	0.042	0.139	0.104
Malaysia	229	0.739	0.103	2.560	0.813	0.313	0.090	0.667	0.224
Netherlands	228	0.048	0.025	0.632	0.188	0.045	0.029	0.120	0.097
New Zealand	229	0.213	0.042	1.219	0.502	0.127	0.074	0.183	0.140
Norway	187	0.113	0.028	0.750	0.433	0.072	0.049	0.116	0.087
Philippines	57	0.368	0.111	0.567	0.430	0.212	0.128	0.408	0.319
Singapore	229	1.396	0.183	6.114	1.346	0.167	0.086	0.272	0.179
South Korea	229	0.423	0.047	2.675	0.681	0.252	0.080	0.470	0.190
Spain	228	0.147	0.039	1.462	0.561	0.048	0.028	0.124	0.082
Sweden	228	0.234	0.056	1.826	1.231	0.060	0.038	0.133	0.107
Switzerland	187	0.061	0.017	0.810	0.300	0.050	0.039	0.121	0.085
Taiwan	229	0.633	0.205	2.489	1.061	0.140	0.101	0.263	0.196
Thailand	229	0.729	0.103	5.938	1.245	0.456	0.164	1.052	0.335
United Kingdom	291	0.935	0.675	1.563	1.098	0.117	0.037	0.319	0.183
United States	291	0.123	0.021	1.000	0.353	0.054	0.032	0.202	0.164
Panel B: Short term interest rates (STR)									
Australia	278	0.505	0.077	4.148	1.385	0.047	0.031	0.256	0.137
Canada	244	0.595	0.063	2.885	0.941	0.065	0.042	0.236	0.194
China	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Eurozone	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
France	291	0.578	0.076	2.255	0.918	0.059	0.033	0.155	0.120
Germany	291	0.179	0.050	1.693	0.848	0.045	0.033	0.197	0.168
Hong Kong	229	1.460	0.097	4.033	1.105	0.131	0.059	0.260	0.201
India	229	2.431	0.406	6.896	1.944	0.375	0.186	0.682	0.410
Indonesia	226	44.328	2.013	142.651	7.441	4.406	0.612	5.747	1.168
Italy	291	0.925	0.098	3.714	1.235	0.078	0.033	0.175	0.116
Japan	291	0.145	0.007	1.178	0.096	0.019	0.011	0.067	0.043
Malaysia	229	0.637	0.018	2.842	0.213	0.085	0.031	0.289	0.088
Netherlands	228	0.231	0.050	1.870	0.736	0.033	0.023	0.121	0.101
New Zealand	229	0.693	0.115	3.197	1.429	0.084	0.039	0.257	0.170
Norway	187	0.643	0.051	3.489	0.965	0.068	0.034	0.167	0.140
Philippines	27	2.755	12.902	8.927	18.348	0.367	0.181	0.237	0.061
Singapore	229	1.384	0.040	1.824	0.668	0.119	0.035	0.213	0.118
South Korea	229	4.983	0.099	8.584	0.884	0.506	0.072	0.556	0.260
Spain	228	0.202	0.066	2.476	1.073	0.036	0.025	0.120	0.088
Sweden	228	0.288	0.077	3.935	0.989	0.049	0.036	0.163	0.123
Switzerland	187	0.453	0.018	1.582	0.487	0.027	0.017	0.105	0.084
Taiwan	227	0.602	0.100	2.018	0.412	0.119	0.059	0.211	0.137
Thailand	229	6.942	0.168	19.887	2.065	0.808	0.094	1.121	0.267
United Kingdom	291	0.396	0.060	2.520	0.843	0.071	0.048	0.325	0.225
United States	291	0.427	0.046	3.983	1.179	0.047	0.037	0.202	0.175

Table 2: Mean and median comparison between short and long forecast horizons (continued)

Country	Obs.	Common uncertainty				Disagreement			
		Short horizon		Long horizon		Short horizon		Long horizon	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median
Panel C: Long term interest rates (LTR)									
Australia	278	0.467	0.265	1.639	0.871	0.078	0.064	0.206	0.165
Canada	291	0.326	0.181	0.801	0.803	0.086	0.066	0.199	0.166
China	126	0.075	0.020	0.826	0.168	0.033	0.020	0.119	0.083
Eurozone	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
France	291	0.291	0.143	0.849	0.777	0.059	0.044	0.127	0.109
Germany	291	0.270	0.155	0.839	0.830	0.066	0.056	0.180	0.169
Hong Kong	229	0.335	0.009	2.030	0.293	0.061	0.026	0.159	0.125
India	229	5.550	1.331	4.450	3.172	0.224	0.137	0.501	0.280
Indonesia	131	4.108	0.974	7.953	5.099	0.621	0.327	1.184	0.861
Italy	291	0.554	0.147	2.707	0.680	0.120	0.065	0.191	0.127
Japan	291	0.297	0.059	0.600	0.310	0.039	0.028	0.100	0.080
Malaysia	229	0.300	0.010	1.351	0.098	0.129	0.029	0.300	0.079
Netherlands	228	0.211	0.131	0.631	0.777	0.052	0.039	0.132	0.110
New Zealand	229	0.406	0.182	0.798	0.348	0.096	0.070	0.167	0.124
Norway	187	0.252	0.145	0.917	0.759	0.066	0.040	0.131	0.102
Philippines	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Singapore	222	0.095	0.004	0.253	0.022	0.060	0.026	0.111	0.066
South Korea	162	0.489	0.182	1.367	0.605	0.134	0.080	0.313	0.240
Spain	228	0.312	0.153	2.096	0.734	0.103	0.058	0.177	0.131
Sweden	228	0.316	0.183	2.034	0.833	0.069	0.053	0.156	0.128
Switzerland	187	0.153	0.080	0.505	0.554	0.039	0.030	0.080	0.068
Taiwan	94	0.082	0.027	0.333	0.156	0.037	0.022	0.098	0.063
Thailand	229	4.432	1.027	5.896	2.010	0.166	0.079	0.506	0.197
United Kingdom	291	0.414	0.179	0.827	0.408	0.084	0.062	0.206	0.177
United States	291	0.343	0.191	0.798	0.848	0.068	0.059	0.186	0.172

Notes: This table reports the mean and median measures of common uncertainty and disagreement. Following Lahiri and Sheng (2010), aggregate uncertainty equals the combination of common uncertainty and disagreement as shown in equation (7).

Table 3: The influence of inflation targeting and forward guidance on uncertainty components

Component	Variable	β_{IT}	β_{FG}	γ_{OIL}	γ_{SPREAD}	γ_{FOREX}	γ_{GAP}	γ_{UNE}	γ_{LEVEL}	$Adj.R^2$
Panel A: Short horizon										
Aggregate uncertainty	CPI	-0.567*** (0.065)	-0.041 (0.068)	0.216** (0.108)	0.004 (0.015)	5.496*** (0.440)	-0.038*** (0.009)	0.092* (0.053)	0.166*** (0.013)	12.15%
	STR	-0.898*** (0.301)	-0.762*** (0.283)	0.357 (0.428)	-0.885*** (0.078)	33.741*** (1.709)	-0.489*** (0.034)	0.895*** (0.209)	0.669*** (0.048)	25.25%
	LTR	-1.018*** (0.137)	-0.278** (0.129)	0.578*** (0.192)	-0.212*** (0.027)	7.216*** (0.775)	-0.167*** (0.015)	0.494*** (0.095)	0.147*** (0.022)	9.95%
Common uncertainty	CPI	-0.532*** (0.058)	0.016 (0.061)	0.174* (0.097)	0.061*** (0.013)	2.400*** (0.394)	-0.013 (0.008)	0.089* (0.048)	0.143*** (0.011)	8.53%
	STR	-0.743*** (0.286)	-0.672** (0.269)	0.336 (0.406)	-0.825*** (0.074)	30.867*** (1.622)	-0.445*** (0.032)	0.938*** (0.198)	0.625*** (0.046)	24.34%
	LTR	-0.988*** (0.133)	-0.247** (0.126)	0.509*** (0.187)	-0.202*** (0.026)	6.445*** (0.755)	-0.157*** (0.015)	0.461*** (0.092)	0.124*** (0.021)	9.29%
Disagreement	CPI	-0.035* (0.020)	-0.056*** (0.021)	0.042 (0.034)	-0.056*** (0.005)	3.096*** (0.137)	-0.025*** (0.003)	0.004 (0.017)	0.023*** (0.004)	16.93%
	STR	-0.155*** (0.026)	-0.089*** (0.024)	0.021 (0.037)	-0.060*** (0.007)	2.874*** (0.146)	-0.044*** (0.003)	-0.043** (0.018)	0.044*** (0.004)	20.85%
	LTR	-0.030** (0.012)	-0.032*** (0.011)	0.069*** (0.017)	-0.010*** (0.002)	0.771*** (0.069)	-0.010*** (0.001)	0.033*** (0.008)	0.023*** (0.002)	7.31%
Panel B: Long horizon										
Aggregate uncertainty	CPI	-1.335*** (0.306)	0.223 (0.320)	2.861*** (0.510)	-0.715*** (0.070)	16.403*** (2.077)	-0.334*** (0.042)	0.991*** (0.251)	0.675*** (0.060)	8.42%
	STR	-5.398*** (0.755)	-0.609 (0.711)	1.643 (1.074)	-0.035 (0.195)	22.985*** (4.286)	0.284*** (0.084)	0.969* (0.524)	1.326*** (0.120)	12.69%
	LTR	-1.132*** (0.229)	-0.427** (0.215)	-1.261*** (0.322)	-0.811*** (0.045)	20.575*** (1.296)	-0.433*** (0.026)	0.054 (0.158)	0.602*** (0.036)	19.89%
Common uncertainty	CPI	-1.231*** (0.290)	0.378 (0.303)	2.989*** (0.483)	-0.546*** (0.067)	9.032*** (1.966)	-0.265*** (0.040)	0.966*** (0.238)	0.618*** (0.056)	6.36%
	STR	-5.109*** (0.749)	-0.476 (0.705)	1.818* (1.065)	0.026 (0.194)	18.372*** (4.253)	0.341*** (0.084)	0.967* (0.520)	1.246*** (0.119)	11.64%
	LTR	-1.017*** (0.215)	-0.360* (0.203)	-1.175*** (0.303)	-0.748*** (0.042)	17.915*** (1.221)	-0.408*** (0.024)	0.039 (0.149)	0.551*** (0.034)	18.79%
Disagreement	CPI	-0.104** (0.045)	-0.156*** (0.047)	-0.128* (0.075)	-0.169*** (0.010)	7.371*** (0.307)	-0.069*** (0.006)	0.025 (0.037)	0.057*** (0.009)	17.63%
	STR	-0.288*** (0.036)	-0.133*** (0.034)	-0.176*** (0.051)	-0.061*** (0.009)	4.614*** (0.204)	-0.057*** (0.004)	0.003 (0.025)	0.080*** (0.006)	24.35%
	LTR	-0.115*** (0.034)	-0.068** (0.032)	-0.086* (0.048)	-0.063*** (0.007)	2.661*** (0.192)	-0.025*** (0.004)	0.015 (0.023)	0.051*** (0.005)	8.83%

Note: This table reports estimation results of equation (9): $UC_{it} = \alpha_i + \sum_{y=1989}^{2013} \tau_y D_{yt} + \sum_{m=2}^{12} \varphi_m D_{mt} + \beta_{IT} IT_{it} + \beta_{FG} FG_{it} + \gamma M_{it} + \varepsilon_{it}$. UC_{it} is the uncertainty component: aggregate uncertainty, common uncertainty, and disagreement. Dummy IT_{it} takes the value 1 for country i where the country operates an inflation targeting at month t and zero otherwise. Dummy FG_{it} takes the value 1 for country i where the central bank has been identified as operating forward guidance and zero otherwise. M_{it} is a set of control variables: the lagged 1-month change in WTI crude oil price (OIL), the term spread (SPREAD), the lagged 1-month change in exchange rates (FOREX), the output gap (GAP), the unemployment rate (UNE) and the level of underlying variables (LEVEL). Robust standard errors are reported in the parentheses. ***, ** and * signify statistical significance at 1, 5, and 10 percent respectively.

Table 4: The influence of monetary policy transparency on uncertainty components

Component	Variable	β_{TR}	β_{TR2}	γ_{OIL}	γ_{SPREAD}	γ_{FOREX}	γ_{GAP}	γ_{UNE}	γ_{LEVEL}	$Adj.R^2$	Turning Point	Max/ Min
Panel A: Short horizon												
Aggregate uncertainty	CPI	-0.834*** (0.072)	0.035*** (0.004)	-0.066 (0.140)	0.037* (0.021)	5.234*** (0.538)	0.001 (0.012)	0.115* (0.063)	0.222*** (0.016)	15.83%	11.86	Min
	STR	-4.654*** (0.258)	0.232*** (0.013)	0.477 (0.480)	0.022 (0.101)	23.170*** (1.794)	-0.253*** (0.038)	1.189*** (0.214)	0.926*** (0.077)	28.96%	10.01	Min
	LTR	-2.956*** (0.131)	0.137*** (0.007)	0.180 (0.241)	-0.102*** (0.036)	4.884*** (0.914)	-0.095*** (0.019)	0.714*** (0.110)	0.191*** (0.039)	22.58%	10.79	Min
Common uncertainty	CPI	-0.534*** (0.065)	0.022*** (0.003)	0.011 (0.126)	0.126*** (0.019)	1.607*** (0.484)	0.019* (0.010)	0.105* (0.057)	0.176*** (0.014)	9.34%	12.23	Min
	STR	-4.041*** (0.245)	0.203*** (0.013)	0.536 (0.456)	0.048 (0.096)	20.805*** (1.704)	-0.225*** (0.036)	1.224*** (0.204)	0.860*** (0.073)	26.59%	9.95	Min
	LTR	-2.891*** (0.128)	0.133*** (0.007)	0.110 (0.235)	-0.096*** (0.035)	4.158*** (0.892)	-0.086*** (0.019)	0.681*** (0.107)	0.155*** (0.038)	21.82%	10.87	Min
Disagreement	CPI	-0.301*** (0.022)	0.013*** (0.001)	-0.076* (0.043)	-0.089*** (0.006)	3.627*** (0.167)	-0.018*** (0.004)	0.010 (0.020)	0.047*** (0.005)	28.03%	11.26	Min
	STR	-0.613*** (0.023)	0.029*** (0.001)	-0.059 (0.044)	-0.025*** (0.009)	2.366*** (0.163)	-0.027*** (0.003)	-0.034* (0.019)	0.066*** (0.007)	36.66%	10.42	Min
	LTR	-0.065*** (0.012)	0.004*** (0.001)	0.070*** (0.023)	-0.005 (0.003)	0.727*** (0.086)	-0.009*** (0.002)	0.033*** (0.010)	0.036*** (0.004)	8.98%	8.35	Min
Panel B: Long horizon												
Aggregate uncertainty	CPI	-3.401*** (0.343)	0.150*** (0.018)	2.234*** (0.661)	-1.188*** (0.099)	19.652*** (2.545)	-0.341*** (0.054)	1.223*** (0.299)	1.096*** (0.076)	16.45%	11.32	Min
	STR	-8.324*** (0.454)	0.412*** (0.023)	-0.993 (0.845)	0.019 (0.178)	39.708*** (3.156)	0.061 (0.067)	0.877** (0.377)	1.408*** (0.135)	25.93%	10.09	Min
	LTR	-3.460*** (0.201)	0.165*** (0.010)	-1.892*** (0.369)	-0.560*** (0.055)	19.351*** (1.399)	-0.213*** (0.029)	0.151 (0.168)	0.671*** (0.059)	25.28%	10.48	Min
Common uncertainty	CPI	-2.679*** (0.328)	0.118*** (0.018)	2.612*** (0.632)	-0.949*** (0.094)	11.463*** (2.434)	-0.289*** (0.052)	1.167*** (0.286)	0.982*** (0.072)	12.33%	11.32	Min
	STR	-7.630*** (0.445)	0.379*** (0.023)	-0.713 (0.827)	0.036 (0.174)	35.761*** (3.090)	0.094 (0.065)	0.838** (0.369)	1.303*** (0.132)	23.46%	10.06	Min
	LTR	-3.178*** (0.187)	0.151*** (0.010)	-1.681*** (0.343)	-0.482*** (0.052)	16.398*** (1.302)	-0.194*** (0.027)	0.117 (0.156)	0.593*** (0.055)	23.69%	10.52	Min
Disagreement	CPI	-0.723*** (0.050)	0.032*** (0.003)	-0.379*** (0.096)	-0.239*** (0.014)	8.189*** (0.369)	-0.052*** (0.008)	0.056 (0.043)	0.114*** (0.011)	28.93%	11.28	Min
	STR	-0.694*** (0.032)	0.033*** (0.002)	-0.280*** (0.059)	-0.017 (0.012)	3.947*** (0.220)	-0.033*** (0.005)	0.039 (0.026)	0.105*** (0.009)	34.88%	10.47	Min
	LTR	-0.283*** (0.035)	0.014*** (0.002)	-0.211*** (0.064)	-0.078*** (0.010)	2.953*** (0.243)	-0.019*** (0.005)	0.033 (0.029)	0.078*** (0.010)	12.00%	10.08	Min

Note: This table reports estimation results of equation (10): $UC_{it} = \alpha_i + \sum_{y=1989}^{2013} \tau_y D_{yt} + \sum_{m=2}^{12} \varphi_m D_{mt} + \beta_{TR} TR_{it} + \beta_{TR2} TR_{it}^2 + \gamma M_{it} + \varepsilon_{it}$. UC_{it} is the uncertainty component: aggregate uncertainty, common uncertainty, and disagreement. TR_{it} is a transparency index of Dincer and Eichengreen (2014). M_{it} is a set of control variables: the lagged 1-month change in WTI crude oil price (OIL), the term spread (SPREAD), the lagged 1-month change in exchange rates (FOREX), the output gap (GAP), the unemployment rate (UNE) and the level of underlying variables (LEVEL). Robust standard errors are reported in the parentheses. Min/Max indicates whether the turning point is minimum (Min) or maximum (Max) point. ***, ** and * signify statistical significance at 1, 5, and 10 percent respectively.

Table 5: The influence of monetary policy transparency on uncertainty components for inflation and non-inflation targeting

Component	Variable	β_{TR}	β_{TR2}	γ_{OIL}	γ_{SPREAD}	γ_{FOREX}	γ_{GAP}	γ_{UNE}	γ_{LEVEL}	$Adj.R^2$	Turning Point	Max/ Min
Panel A1: Short horizon – Non-inflation targeting economies												
Aggregate uncertainty	CPI	-0.929*** (0.207)	0.046*** (0.013)	0.239 (0.315)	-0.010 (0.050)	11.368*** (1.371)	0.005 (0.029)	-0.211 (0.255)	0.276*** (0.036)	16.81%	10.11	Min
	STR	-4.329*** (0.612)	0.242*** (0.038)	2.816*** (0.958)	-1.046*** (0.276)	24.848*** (3.972)	0.100 (0.071)	0.888 (0.738)	0.280 (0.192)	19.31%	8.95	Min
	LTR	-2.388*** (0.303)	0.116*** (0.019)	1.618*** (0.459)	-0.446*** (0.075)	9.204*** (1.992)	0.063* (0.035)	-0.788** (0.371)	-0.369*** (0.094)	10.57%	10.30	Min
Common uncertainty	CPI	-0.752*** (0.191)	0.038*** (0.012)	0.268 (0.292)	0.186*** (0.046)	3.875*** (1.269)	0.004 (0.027)	-0.350 (0.236)	0.249*** (0.033)	9.97%	10.00	Min
	STR	-3.959*** (0.573)	0.222*** (0.035)	2.755*** (0.897)	-0.907*** (0.259)	21.997*** (3.720)	0.094 (0.067)	1.157* (0.691)	0.262 (0.180)	18.14%	8.93	Min
	LTR	-2.216*** (0.298)	0.107*** (0.018)	1.516*** (0.453)	-0.444*** (0.074)	8.305*** (1.962)	0.061* (0.035)	-0.753** (0.366)	-0.379*** (0.093)	9.58%	10.35	Min
Disagreement	CPI	-0.177*** (0.056)	0.008** (0.003)	-0.030 (0.086)	-0.196*** (0.014)	7.493*** (0.373)	0.001 (0.008)	0.139** (0.069)	0.027*** (0.010)	41.57%	10.57	Min
	STR	-0.370*** (0.058)	0.020*** (0.004)	0.061 (0.092)	-0.139*** (0.026)	2.851*** (0.380)	0.006 (0.007)	-0.269*** (0.070)	0.018 (0.018)	21.68%	9.21	Min
	LTR	-0.173*** (0.019)	0.009*** (0.001)	0.102*** (0.028)	-0.002 (0.005)	0.900*** (0.123)	0.003 (0.002)	-0.034 (0.023)	0.010* (0.006)	14.74%	9.70	Min
Panel A2: Short horizon –Inflation targeting economies												
Aggregate uncertainty	CPI	0.223*** (0.073)	-0.012*** (0.003)	0.278*** (0.077)	0.038*** (0.012)	0.710** (0.285)	-0.020*** (0.006)	0.052* (0.029)	0.116*** (0.010)	11.81%	9.16	Max
	STR	0.538 (0.458)	-0.008 (0.021)	0.644 (0.476)	0.486*** (0.091)	14.543*** (1.735)	-0.310*** (0.041)	1.616*** (0.178)	1.153*** (0.070)	17.30%	34.01	Max
	LTR	-1.241*** (0.202)	0.056*** (0.009)	0.252 (0.209)	-0.163*** (0.033)	0.799 (0.762)	-0.164*** (0.018)	0.396*** (0.078)	0.198*** (0.031)	7.54%	11.01	Min
Common uncertainty	CPI	0.180*** (0.059)	-0.010*** (0.003)	0.097 (0.062)	0.033*** (0.010)	0.461** (0.229)	-0.007 (0.005)	0.054** (0.023)	0.069*** (0.008)	7.02%	8.80	Max
	STR	0.555 (0.454)	-0.009 (0.021)	0.501 (0.471)	0.471*** (0.090)	13.726*** (1.717)	-0.285*** (0.041)	1.597*** (0.176)	1.091*** (0.069)	16.07%	29.21	Max
	LTR	-1.319*** (0.189)	0.059*** (0.009)	0.181 (0.196)	-0.146*** (0.031)	0.195 (0.714)	-0.143*** (0.017)	0.347*** (0.073)	0.144*** (0.029)	6.88%	11.25	Min
Disagreement	CPI	0.043 (0.027)	-0.002 (0.001)	0.181*** (0.028)	0.005 (0.004)	0.248** (0.105)	-0.013*** (0.002)	-0.002 (0.011)	0.047*** (0.004)	15.39%	11.01	Max
	STR	-0.017 (0.029)	0.002 (0.001)	0.143*** (0.030)	0.015*** (0.006)	0.817*** (0.111)	-0.026*** (0.003)	0.019* (0.011)	0.062*** (0.004)	13.92%	5.23	Min
	LTR	0.078*** (0.033)	-0.002 (0.002)	0.072** (0.034)	-0.018*** (0.005)	0.604*** (0.124)	-0.021*** (0.003)	0.050*** (0.013)	0.054*** (0.005)	7.64%	17.28	Max

Table 5: The influence of monetary policy transparency on uncertainty components for inflation and non-inflation targeting (continued)

Component	Variable	β_{TR}	β_{TR2}	γ_{OIL}	γ_{SPREAD}	γ_{FOREX}	γ_{GAP}	γ_{UNE}	γ_{LEVEL}	$Adj.R^2$	Turning Point	Max/ Min
Panel B1: Long horizon – Non-inflation targeting economies												
Aggregate uncertainty	CPI	-0.982 (0.980)	0.026 (0.060)	7.135*** (1.493)	-2.842*** (0.236)	29.457*** (6.502)	-0.442*** (0.137)	2.582** (1.209)	1.324*** (0.169)	17.46%	18.87	Min
	STR	-3.845*** (1.116)	0.234*** (0.068)	6.346*** (1.747)	-1.852*** (0.504)	70.718*** (7.243)	0.441*** (0.130)	-5.583*** (1.345)	0.857** (0.350)	24.47%	8.22	Min
	LTR	-1.668*** (0.425)	0.089*** (0.026)	0.345 (0.646)	-1.235*** (0.105)	35.250*** (2.799)	0.116** (0.050)	-0.955* (0.522)	0.544*** (0.132)	30.32%	9.35	Min
Common uncertainty	CPI	-0.630 (0.952)	0.010 (0.059)	7.500*** (1.450)	-2.286*** (0.230)	12.570** (6.313)	-0.383*** (0.133)	2.153* (1.174)	1.179*** (0.164)	11.98%	30.71	Min
	STR	-3.471*** (1.096)	0.214*** (0.067)	6.579*** (1.716)	-1.653*** (0.495)	64.709*** (7.115)	0.432*** (0.128)	-5.437*** (1.321)	0.819** (0.344)	22.26%	8.10	Min
	LTR	-1.458*** (0.383)	0.079*** (0.023)	0.608 (0.581)	-1.017*** (0.095)	30.137*** (2.519)	0.107** (0.045)	-0.893* (0.470)	0.547*** (0.119)	28.60%	9.21	Min
Disagreement	CPI	-0.352*** (0.130)	0.016** (0.008)	-0.364* (0.198)	-0.556*** (0.031)	16.887*** (0.864)	-0.059*** (0.018)	0.429*** (0.161)	0.145*** (0.022)	42.76%	11.16	Min
	STR	-0.374*** (0.080)	0.020*** (0.005)	-0.233* (0.126)	-0.198*** (0.036)	6.009*** (0.521)	0.009 (0.009)	-0.146 (0.097)	0.038 (0.025)	27.70%	9.46	Min
	LTR	-0.210*** (0.096)	0.010* (0.006)	-0.263* (0.146)	-0.218*** (0.024)	5.113*** (0.632)	0.009 (0.011)	-0.062 (0.118)	-0.002 (0.030)	14.07%	10.48	Min
Panel B2: Long horizon –Inflation targeting economies												
Aggregate uncertainty	CPI	-0.244 (0.338)	0.004 (0.016)	-0.023 (0.357)	-0.012 (0.056)	5.616*** (1.317)	-0.009 (0.030)	0.848*** (0.134)	0.820*** (0.045)	14.99%	27.30	Min
	STR	-2.053*** (0.592)	0.107*** (0.027)	-0.002 (0.614)	-0.276** (0.118)	9.129*** (2.240)	0.061 (0.054)	0.149 (0.229)	0.646*** (0.090)	10.30%	9.56	Min
	LTR	-3.082*** (0.383)	0.143*** (0.018)	-0.751* (0.397)	-0.255*** (0.063)	1.257 (1.446)	-0.349*** (0.035)	0.145 (0.148)	0.371*** (0.058)	8.39%	10.74	Min
Common uncertainty	CPI	-0.257 (0.329)	0.005 (0.015)	-0.289 (0.348)	-0.023 (0.055)	5.314*** (1.281)	0.006 (0.029)	0.827*** (0.130)	0.772*** (0.044)	14.33%	25.78	Min
	STR	-2.026*** (0.594)	0.105*** (0.027)	-0.137 (0.617)	-0.297** (0.118)	8.209*** (2.249)	0.094* (0.054)	0.099 (0.230)	0.572*** (0.090)	9.67%	9.61	Min
	LTR	-3.115*** (0.377)	0.144*** (0.017)	-0.885** (0.391)	-0.250*** (0.062)	0.901 (1.426)	-0.331*** (0.034)	0.142 (0.146)	0.326*** (0.057)	7.96%	10.81	Min
Disagreement	CPI	0.013 (0.027)	-0.001 (0.001)	0.267*** (0.028)	0.011** (0.004)	0.301*** (0.104)	-0.015*** (0.002)	0.021** (0.011)	0.048*** (0.004)	15.10%	12.44	Max
	STR	-0.027 (0.038)	0.002 (0.002)	0.135*** (0.040)	0.021*** (0.008)	0.920*** (0.145)	-0.033*** (0.003)	0.050*** (0.015)	0.073*** (0.006)	11.75%	6.80	Min
	LTR	0.033 (0.032)	-0.001 (0.001)	0.134*** (0.033)	-0.005 (0.005)	0.356*** (0.122)	-0.018*** (0.003)	0.003 (0.012)	0.045*** (0.005)	6.15%	28.50	Max

Note: This table reports estimation results of equation (10): $UC_{it} = \alpha_i + \sum_{y=1989}^{2013} \tau_y D_{yt} + \sum_{m=2}^{12} \varphi_m D_{mt} + \beta_{TR} TR_{it} + \beta_{TR2} TR_{it}^2 + \gamma M_{it} + \varepsilon_{it}$. UC_{it} is the uncertainty component: aggregate uncertainty, common uncertainty, and disagreement. TR_{it} is a transparency index of Dincer and Eichengreen (2014). M_{it} is a set of control variables: the lagged 1-month change in WTI crude oil price (OIL), the term spread (SPREAD), the lagged 1-month change in exchange rates (FOREX), the output gap (GAP), the unemployment rate (UNE) and the level of underlying variables (LEVEL). Robust standard errors are reported in the parentheses. Min/Max indicates whether the turning point is minimum (Min) or maximum (Max) point. ***, ** and * signify statistical significance at 1, 5, and 10 percent respectively.

Table 6: Alternative estimates of dummy variable effects

Component	Measure	CPI-SH	CPI-LH	STR-SH	STR-LH	LTR-SH	LTR-LH
Panel A: Coefficient on inflation targeting dummy (β_{IT})							
Common uncertainty	ex ante	-0.532*** (0.058)	-1.231*** (0.290)	-0.743*** (0.286)	-5.109*** (0.749)	-0.988*** (0.133)	-1.017*** (0.215)
	ex post	-0.499*** (0.070)	-1.034*** (0.256)	-0.409*** (0.148)	-3.185*** (0.611)	-1.075*** (0.139)	-0.873*** (0.212)
	PSM	-0.418*** (0.066)	-1.192*** (0.281)	-0.685*** (0.219)	-4.826*** (0.567)	-0.814*** (0.114)	-1.006*** (0.201)
Disagreement	ex ante	-0.035* (0.020)	-0.104** (0.045)	-0.155*** (0.026)	-0.288*** (0.036)	-0.030** (0.012)	-0.115*** (0.034)
	PSM	-0.029** (0.013)	-0.090** (0.035)	-0.131*** (0.019)	-0.247*** (0.028)	-0.025*** (0.009)	-0.103*** (0.030)
Panel B: Coefficient on forward guidance dummy (β_{FG})							
Common uncertainty	ex ante	0.016 (0.061)	0.378 (0.303)	-0.672** (0.269)	-0.476 (0.705)	-0.247** (0.126)	-0.360* (0.203)
	ex post	0.006 (0.073)	0.386 (0.267)	-0.466** (0.213)	-0.593 (0.575)	-0.375* (0.215)	-0.408 (0.252)
	PSM	0.012 (0.053)	0.317 (0.281)	-0.538*** (0.198)	-0.402 (0.483)	-0.216** (0.105)	-0.327* (0.188)
Disagreement	ex ante	-0.056*** (0.021)	-0.156*** (0.047)	-0.089*** (0.024)	-0.133*** (0.034)	-0.032*** (0.011)	-0.068** (0.032)
	PSM	-0.051*** (0.018)	-0.128*** (0.039)	-0.074*** (0.016)	-0.117*** (0.027)	-0.025*** (0.009)	-0.053*** (0.020)

Note: This table compares coefficients on inflation targeting (β_{IT}) and forward guidance dummy variables (β_{FG}) estimated from equation (9) for short horizon (SH) and long horizon (LH) forecasts for inflation (CPI), short-term rates (STR) and long-term rates (LTR). Robust standard errors are reported in the parentheses. ***, ** and * signify statistical significance at 1, 5, and 10 percent respectively. To address any biases resulting from the likelihood that the sample of economies with central banks that have adopted IT are likely to differ substantially from those that have not, we use propensity score matching (PSM) (see also Crowe 2010). The variables used for PSM include the cross-sectional dispersion of professional forecasts of inflation, short-term interest rates and long-term interest rates and the consensus mean forecast of these variables. The ex ante results correspond to those reported in Table 3. The ex post results are based on ex post measure of uncertainty obtained from the deviation of forecasts from outcome (Barron et al. 1998)

Table 7: Comparison of ex ante and ex post results for common uncertainty

Estimates	Measure	CPI-SH	CPI-LH	STR-SH	STR-LH	LTR-SH	LTR-LH
β_{TR}	ex ante	-0.534*** (0.065)	-2.679*** (0.328)	-4.041*** (0.245)	-7.630*** (0.445)	-2.891*** (0.128)	-3.178*** (0.187)
	ex post	-0.704*** (0.080)	-3.932*** (0.282)	-2.609*** (0.207)	-6.593*** (0.399)	-2.849*** (0.128)	-3.152*** (0.188)
β_{TR2}	ex ante	0.022*** (0.003)	0.118*** (0.018)	0.203*** (0.013)	0.379*** (0.023)	0.133*** (0.007)	0.151*** (0.010)
	ex post	0.029*** (0.004)	0.181*** (0.015)	0.135*** (0.011)	0.334*** (0.021)	0.131*** (0.007)	0.160*** (0.010)
Turning point	ex ante	12.23	11.32	9.95	10.06	10.87	10.52
	ex post	12.05	10.89	9.69	9.87	10.87	9.88
Impact at turning point	ex ante	-3.24	-15.21	-20.11	-38.40	-15.71	-16.72
	ex post	-4.27	-21.35	-12.61	-32.54	-15.49	-15.52

Note: This table compares coefficients on the transparency index (β_{TR}), its squared term (β_{TR2}), and turning point estimated from equation (10) for short horizon (SH) and long horizon (LH) forecasts for inflation (CPI), short-term rates (STR) and long-term rates (LTR). Robust standard errors are reported in the parentheses. ***, ** and * signify statistical significance at 1, 5, and 10 percent respectively. Impact at turning point is the reduction in uncertainty brought about by moving from zero transparency to the turning point. The ex ante results correspond to those reported in Table 3. The ex post results are based on ex post measure of uncertainty obtained from the deviation of forecasts from outcome (Barron et al. 1998).

Table 8: The influence of inflation targeting on uncertainty components for emerging and developed economies

Component	Variable	β_{IT}	γ_{OIL}	γ_{SPREAD}	γ_{FOREX}	γ_{GAP}	γ_{UNE}	γ_{LEVEL}	$Adj.R^2$
Panel A1: Short horizon – Emerging economies									
Aggregate uncertainty	CPI	-1.365*** (0.264)	0.932** (0.455)	0.232*** (0.046)	14.793*** (1.437)	-0.089*** (0.028)	0.017 (0.165)	0.475*** (0.039)	34.14%
	STR	-2.752* (1.668)	9.782*** (2.366)	-1.516*** (0.371)	40.614*** (6.983)	-1.543*** (0.138)	1.725** (0.791)	2.222*** (0.281)	54.62%
	LTR	-7.527*** (0.781)	4.758*** (1.017)	-0.438*** (0.102)	16.553*** (3.265)	-0.525*** (0.064)	1.060*** (0.369)	0.175 (0.130)	35.29%
Common uncertainty	CPI	-1.326*** (0.232)	0.574 (0.400)	0.316*** (0.040)	5.843*** (1.262)	-0.037 (0.025)	0.045 (0.145)	0.395*** (0.034)	25.40%
	STR	-2.180* (1.205)	9.076*** (2.276)	-1.422*** (0.357)	34.883*** (6.718)	-1.407*** (0.133)	1.977*** (0.761)	2.103*** (0.270)	52.64%
	LTR	-7.216*** (0.760)	4.306*** (0.991)	-0.405*** (0.100)	15.267*** (3.181)	-0.499*** (0.062)	0.972*** (0.360)	0.095 (0.127)	34.84%
Disagreement	CPI	-0.039 (0.099)	0.358** (0.170)	-0.083*** (0.017)	8.950*** (0.536)	-0.052*** (0.010)	-0.028 (0.062)	0.080*** (0.015)	42.56%
	STR	-0.572*** (0.151)	0.706*** (0.214)	-0.093*** (0.034)	5.731*** (0.632)	-0.136*** (0.013)	-0.252*** (0.072)	0.119*** (0.025)	48.58%
	LTR	-0.311*** (0.074)	0.452*** (0.096)	-0.033*** (0.010)	1.287*** (0.308)	-0.026*** (0.006)	0.088** (0.035)	0.080*** (0.012)	15.85%
Panel A2: Short horizon – Developed economies									
Aggregate uncertainty	CPI	-0.429*** (0.052)	0.160* (0.087)	-0.014 (0.013)	2.050*** (0.386)	-0.013* (0.008)	0.048 (0.047)	0.057*** (0.011)	6.73%
	STR	-0.351*** (0.116)	0.716*** (0.166)	0.082** (0.032)	10.196*** (0.733)	-0.052*** (0.014)	0.262*** (0.090)	0.265*** (0.018)	12.24%
	LTR	-0.112*** (0.037)	0.108** (0.054)	0.054*** (0.008)	0.680*** (0.237)	-0.005 (0.005)	-0.017 (0.029)	0.090*** (0.006)	7.51%
Common uncertainty	CPI	-0.410*** (0.050)	0.030 (0.083)	-0.016 (0.013)	1.797*** (0.367)	-0.007 (0.007)	0.028 (0.045)	0.049*** (0.010)	5.65%
	STR	-0.340*** (0.112)	0.680*** (0.160)	0.075** (0.031)	9.686*** (0.707)	-0.048*** (0.014)	0.244*** (0.087)	0.246*** (0.018)	11.61%
	LTR	-0.090** (0.036)	0.070 (0.052)	0.047*** (0.008)	0.438* (0.231)	0.000*** (0.004)	-0.031 (0.028)	0.078*** (0.006)	5.86%
Disagreement	CPI	-0.019** (0.008)	0.130*** (0.013)	0.002 (0.002)	0.253*** (0.057)	-0.006*** (0.001)	0.020*** (0.007)	0.008*** (0.002)	16.22%
	STR	-0.012 (0.007)	0.036*** (0.010)	0.007*** (0.002)	0.510*** (0.045)	-0.004*** (0.001)	0.019*** (0.006)	0.019*** (0.001)	13.34%
	LTR	-0.022*** (0.006)	0.038*** (0.008)	0.007*** (0.001)	0.242*** (0.036)	-0.005*** (0.001)	0.014*** (0.004)	0.012*** (0.001)	9.60%

Table 8: The influence of inflation targeting on uncertainty components for emerging and developed economies (continued)

Component	Variable	β_{IT}	γ_{OIL}	γ_{SPREAD}	γ_{FOREX}	γ_{GAP}	γ_{UNE}	γ_{LEVEL}	$Adj.R^2$
Panel B1: Long horizon – Emerging economies									
Aggregate uncertainty	CPI	-1.506 (1.139)	12.436*** (1.961)	-0.417** (0.198)	57.401*** (6.195)	-0.608*** (0.121)	1.238* (0.713)	1.937*** (0.169)	34.48%
	STR	-44.931*** (4.650)	26.580*** (6.594)	-0.365 (1.034)	-6.908 (19.461)	1.917*** (0.385)	-3.566 (2.205)	1.535* (0.782)	34.34%
	LTR	-1.474 (1.154)	4.333*** (1.503)	-1.640*** (0.151)	52.649*** (4.826)	-0.840*** (0.095)	0.333 (0.545)	0.982*** (0.192)	44.03%
Common uncertainty	CPI	-1.381 (1.061)	12.365*** (1.826)	-0.116 (0.185)	36.407*** (5.767)	-0.473*** (0.113)	1.206* (0.664)	1.831*** (0.157)	28.68%
	STR	-44.036*** (4.648)	26.526*** (6.592)	-0.205 (1.034)	-17.516 (19.452)	2.067*** (0.385)	-3.441 (2.204)	1.406* (0.782)	32.52%
	LTR	-1.228 (1.078)	4.184*** (1.404)	-1.508*** (0.141)	46.306*** (4.509)	-0.796*** (0.088)	0.312 (0.510)	0.897*** (0.179)	42.14%
Disagreement	CPI	-0.125 (0.222)	0.071 (0.383)	-0.301*** (0.039)	20.995*** (1.209)	-0.135*** (0.024)	0.032 (0.139)	0.106*** (0.033)	44.46%
	STR	-0.895*** (0.205)	0.054 (0.291)	-0.160*** (0.046)	10.608*** (0.860)	-0.150*** (0.017)	-0.125 (0.097)	0.130*** (0.035)	52.29%
	LTR	-0.246 (0.215)	0.149 (0.280)	-0.133*** (0.028)	6.343*** (0.899)	-0.045** (0.018)	0.021 (0.102)	0.085** (0.036)	19.47%
Panel B2: Long horizon – Developed economies									
Aggregate uncertainty	CPI	-0.527** (0.269)	1.875*** (0.446)	-0.493*** (0.069)	-1.854 (1.981)	-0.170*** (0.040)	0.801*** (0.242)	0.122** (0.056)	1.83%
	STR	-1.252*** (0.266)	-0.260 (0.380)	0.131* (0.073)	5.940*** (1.679)	-0.072** (0.032)	0.544*** (0.207)	0.875*** (0.042)	16.73%
	LTR	-0.070 (0.136)	-0.916*** (0.195)	-0.098*** (0.030)	-1.124 (0.861)	-0.224*** (0.017)	-0.202* (0.106)	0.397*** (0.022)	14.15%
Common uncertainty	CPI	-0.496* (0.263)	1.662*** (0.437)	-0.496*** (0.068)	-2.233 (1.940)	-0.148*** (0.039)	0.753*** (0.237)	0.109** (0.055)	1.78%
	STR	-1.243*** (0.264)	-0.276 (0.378)	0.088 (0.073)	5.435*** (1.673)	-0.061* (0.032)	0.526** (0.206)	0.829*** (0.042)	15.71%
	LTR	-0.044 (0.136)	-0.939*** (0.194)	-0.106*** (0.030)	-1.324 (0.858)	-0.213*** (0.017)	-0.198* (0.106)	0.368*** (0.022)	12.82%
Disagreement	CPI	-0.032** (0.015)	0.213*** (0.025)	0.003 (0.004)	0.379*** (0.113)	-0.022*** (0.002)	0.049*** (0.014)	0.013*** (0.003)	6.04%
	STR	-0.009 (0.011)	0.016 (0.016)	0.043*** (0.003)	0.504*** (0.069)	-0.011*** (0.001)	0.017** (0.009)	0.045*** (0.002)	23.19%
	LTR	-0.025*** (0.008)	0.023* (0.012)	0.007*** (0.002)	0.201*** (0.052)	-0.011*** (0.001)	-0.004 (0.006)	0.029*** (0.001)	16.42%

Note: This table reports estimation results of equation (9): $UC_{it} = \alpha_i + \sum_{y=1989}^{2013} \tau_y D_{yt} + \sum_{m=2}^{12} \varphi_m D_{mt} + \beta_{IT} IT_{it} + \beta_{FG} FG_{it} + \gamma M_{it} + \varepsilon_{it}$. UC_{it} is the uncertainty component: aggregate uncertainty, common uncertainty, and disagreement. Dummy IT_{it} takes the value 1 for country i where the country operates an inflation targeting at month t and zero otherwise. To compare between emerging and developed economies, Dummy FG_{it} is excluded from equation (9) as none of emerging economies adopts forward guidance during our sample periods. Following IMF definition, developed economies include Australia, Canada, Eurozone, France, Germany, Hong Kong, Italy, Japan, Netherlands, New Zealand, Norway, Singapore, South Korea, Spain, Sweden, Switzerland, Taiwan, United Kingdom and United States. The remaining economies are emerging economies. M_{it} is a set of control variables: the lagged 1-month change in WTI crude oil price (OIL), the term spread (SPREAD), the lagged 1-month change in exchange rates (FOREX), the output gap (GAP), the unemployment rate (UNE) and the level of underlying variables (LEVEL). Robust standard errors are reported in the parentheses. ***, ** and * signify statistical significance at 1, 5, and 10 percent respectively.

Table 9: The influence of monetary policy transparency on uncertainty components for emerging and developed economies

Component	Variable	β_{TR}	β_{TR2}	γ_{OIL}	γ_{SPREAD}	γ_{FOREX}	γ_{GAP}	γ_{UNE}	γ_{LEVEL}	$Adj.R^2$	Turning Point	Max/ Min
Panel A1: Short horizon – Emerging economies												
Aggregate uncertainty	CPI	-1.208*** (0.308)	0.051** (0.025)	0.647 (0.485)	0.258*** (0.068)	10.303*** (1.860)	0.138*** (0.047)	0.236 (0.181)	0.438*** (0.042)	36.72%	11.81	Min
	STR	-6.031*** (1.396)	0.407*** (0.111)	10.054*** (2.335)	-0.230 (0.418)	6.513 (8.567)	-0.551*** (0.210)	1.942** (0.812)	2.704*** (0.320)	45.87%	7.40	Min
	LTR	-2.450*** (0.687)	0.029 (0.056)	4.102*** (1.078)	-0.549*** (0.150)	4.610 (4.288)	-0.191* (0.100)	2.120*** (0.410)	0.146 (0.160)	37.22%	42.29	Min
Common uncertainty	CPI	-0.993*** (0.273)	0.048** (0.022)	0.329 (0.429)	0.504*** (0.060)	2.422 (1.646)	0.111*** (0.041)	0.274* (0.160)	0.405*** (0.037)	27.53%	10.30	Min
	STR	-5.184*** (1.341)	0.361*** (0.106)	9.261*** (2.242)	-0.107 (0.402)	4.149 (8.227)	-0.498** (0.202)	2.138*** (0.779)	2.554*** (0.307)	42.54%	7.18	Min
	LTR	-2.406*** (0.671)	0.023 (0.054)	3.612*** (1.054)	-0.509*** (0.146)	3.554 (4.193)	-0.177* (0.098)	2.067*** (0.401)	0.064 (0.156)	36.45%	51.40	Min
Disagreement	CPI	-0.214*** (0.102)	0.003 (0.008)	0.317** (0.161)	-0.247*** (0.022)	7.881*** (0.617)	0.027* (0.015)	-0.038 (0.060)	0.033** (0.014)	56.34%	36.46	Min
	STR	-0.847** (0.125)	0.047*** (0.010)	0.793*** (0.210)	-0.123*** (0.038)	2.364*** (0.770)	-0.053*** (0.019)	-0.196*** (0.073)	0.151*** (0.029)	55.10%	9.10	Min
	LTR	-0.044*** (0.067)	0.006 (0.005)	0.490*** (0.105)	-0.040*** (0.015)	1.057** (0.416)	-0.015 (0.010)	0.053 (0.040)	0.082*** (0.015)	13.98%	3.95	Min
Panel A2: Short horizon – Developed economies												
Aggregate uncertainty	CPI	-0.123 (0.077)	0.004 (0.004)	0.056 (0.114)	0.036** (0.018)	1.831*** (0.461)	0.004 (0.010)	-0.007 (0.055)	0.010 (0.015)	4.82%	15.29	Min
	STR	-2.060*** (0.132)	0.096*** (0.006)	1.439*** (0.195)	0.014 (0.043)	8.756*** (0.786)	0.010 (0.015)	0.305*** (0.094)	0.109*** (0.033)	18.61%	10.73	Min
	LTR	-0.261*** (0.037)	0.012*** (0.002)	0.082 (0.054)	0.060*** (0.008)	0.949*** (0.218)	-0.001 (0.004)	0.001 (0.026)	0.046*** (0.009)	6.15%	10.74	Min
Common uncertainty	CPI	-0.070 (0.072)	0.001 (0.004)	-0.092 (0.107)	0.030* (0.017)	1.565*** (0.436)	0.010 (0.009)	-0.024 (0.052)	0.017 (0.014)	3.30%	26.56	Min
	STR	-1.911*** (0.127)	0.089*** (0.006)	1.389*** (0.187)	0.008 (0.041)	8.252*** (0.755)	0.013 (0.014)	0.282*** (0.090)	0.090*** (0.031)	17.78%	10.73	Min
	LTR	-0.208*** (0.035)	0.009*** (0.002)	0.045 (0.052)	0.050*** (0.008)	0.703*** (0.210)	0.005 (0.004)	-0.012 (0.025)	0.032*** (0.009)	3.85%	11.20	Min
Disagreement	CPI	-0.054*** (0.012)	0.003*** (0.001)	0.147*** (0.018)	0.007** (0.003)	0.266*** (0.072)	-0.006*** (0.001)	0.017* (0.009)	-0.007*** (0.002)	16.87%	9.87	Min
	STR	-0.149*** (0.008)	0.007*** (0.000)	0.050*** (0.012)	0.006** (0.003)	0.505*** (0.050)	-0.003*** (0.001)	0.023*** (0.006)	0.018*** (0.002)	21.16%	10.69	Min
	LTR	-0.053*** (0.007)	0.003*** (0.000)	0.038*** (0.010)	0.010*** (0.001)	0.246*** (0.039)	-0.006*** (0.001)	0.013*** (0.005)	0.013*** (0.002)	14.55%	9.26	Min

Table 9: The influence of monetary policy transparency on uncertainty components for emerging and developed economies (continued)

Component	Variable	β_{TR}	β_{TR2}	γ_{OIL}	γ_{SPREAD}	γ_{FOREX}	γ_{GAP}	γ_{UNE}	γ_{LEVEL}	$Adj.R^2$	Turning Point	Max/ Min
Panel B1: Long horizon – Emerging economies												
Aggregate uncertainty	CPI	-3.563 (1.246)	0.078 (0.099)	12.042 (1.961)	-1.567 (0.274)	34.458 (7.523)	0.414 (0.188)	1.482 (0.733)	1.597 (0.169)	44.46%	22.69	Min
	STR	-13.698 (2.507)	0.650 (0.199)	12.401 (4.192)	-0.419 (0.751)	59.088 (15.383)	1.055 (0.377)	1.705 (1.457)	1.540 (0.575)	38.34%	10.54	Min
	LTR	0.016 (0.942)	-0.186 (0.076)	2.946 (1.479)	-1.920 (0.205)	33.602 (5.884)	-0.136 (0.137)	0.290 (0.562)	0.873 (0.219)	46.07%	0.04	Max
Common uncertainty	CPI	-3.115 (1.191)	0.079 (0.095)	12.132 (1.874)	-0.903 (0.262)	16.176 (7.190)	0.353 (0.180)	1.447 (0.700)	1.600 (0.162)	36.22%	19.60	Min
	STR	-12.793 (2.478)	0.607 (0.197)	12.224 (4.143)	-0.261 (0.742)	54.564 (15.201)	1.073 (0.373)	1.717 (1.440)	1.327 (0.568)	34.46%	10.53	Min
	LTR	0.269 (0.879)	-0.195 (0.071)	2.729 (1.380)	-1.647 (0.192)	30.651 (5.489)	-0.168 (0.128)	0.312 (0.524)	0.681 (0.204)	43.49%	0.69	Max
Disagreement	CPI	-0.448 (0.228)	-0.001 (0.018)	-0.090 (0.358)	-0.664 (0.050)	18.282 (1.373)	0.060 (0.034)	0.034 (0.134)	-0.003 (0.031)	57.93%	n/a	n/a
	STR	-0.905 (0.167)	0.043 (0.013)	0.178 (0.278)	-0.158 (0.050)	4.524 (1.022)	-0.018 (0.025)	-0.012 (0.097)	0.212 (0.038)	55.80%	10.59	Min
	LTR	-0.254 (0.187)	0.008 (0.015)	0.217 (0.294)	-0.273 (0.041)	2.951 (1.171)	0.032 (0.027)	-0.022 (0.112)	0.192 (0.044)	24.30%	15.13	Min
Panel B2: Long horizon – Developed economies												
Aggregate uncertainty	CPI	-0.483 (0.423)	0.020 (0.021)	1.429** (0.627)	-0.812*** (0.098)	2.726 (2.546)	-0.283*** (0.053)	0.946*** (0.304)	0.294*** (0.085)	2.09%	11.79	Min
	STR	-1.042*** (0.276)	0.070*** (0.013)	0.255 (0.407)	-0.140 (0.089)	9.492*** (1.642)	0.045 (0.031)	0.348* (0.196)	0.852*** (0.068)	18.01%	7.84	Min
	LTR	-1.058*** (0.125)	0.052*** (0.006)	-0.564*** (0.184)	0.022 (0.028)	-0.459 (0.743)	-0.094*** (0.014)	-0.247*** (0.089)	0.221*** (0.031)	5.71%	10.16	Min
Common uncertainty	CPI	-0.297 (0.415)	0.011 (0.021)	1.106* (0.614)	-0.807*** (0.096)	2.591 (2.493)	-0.255*** (0.052)	0.891*** (0.298)	0.255*** (0.083)	1.95%	13.12	Min
	STR	-0.923*** (0.274)	0.064*** (0.013)	0.144 (0.405)	-0.158* (0.088)	8.976*** (1.633)	0.051 (0.031)	0.332* (0.195)	0.830*** (0.068)	17.81%	7.19	Min
	LTR	-0.982*** (0.124)	0.049*** (0.006)	-0.616*** (0.183)	0.012 (0.028)	-0.709 (0.738)	-0.086*** (0.014)	-0.253*** (0.088)	0.218*** (0.031)	5.12%	10.10	Min
Disagreement	CPI	-0.186*** (0.022)	0.009*** (0.001)	0.323*** (0.033)	-0.005 (0.005)	0.135 (0.134)	-0.028*** (0.003)	0.056*** (0.016)	0.039*** (0.004)	10.11%	10.15	Min
	STR	-0.119*** (0.010)	0.005*** (0.001)	0.111*** (0.015)	0.019*** (0.003)	0.516*** (0.062)	-0.006*** (0.001)	0.016** (0.007)	0.022*** (0.003)	16.57%	10.85	Min
	LTR	-0.077*** (0.009)	0.003*** (0.000)	0.052*** (0.013)	0.010*** (0.002)	0.250*** (0.054)	-0.008*** (0.001)	0.006 (0.006)	0.003 (0.002)	10.44%	11.04	Min

Note: This table reports estimation results of equation (10): $UC_{it} = \alpha_i + \sum_{y=1989}^{2013} \tau_y D_{yt} + \sum_{m=2}^{12} \varphi_m D_{mt} + \beta_{TR} TR_{it} + \beta_{TR2} TR_{it}^2 + \gamma M_{it} + \varepsilon_{it}$. UC_{it} is the uncertainty component: aggregate uncertainty, common uncertainty, and disagreement. Following IMF definition, developed economies include Australia, Canada, Eurozone, France, Germany, Hong Kong, Italy, Japan, Netherlands, New Zealand, Norway, Singapore, South Korea, Spain, Sweden, Switzerland, Taiwan, United Kingdom and United States. The remaining economies are emerging economies. TR_{it} is a transparency index of Dincer and Eichengreen (2014). M_{it} is a set of control variables: the lagged 1-month change in WTI crude oil price (OIL), the term spread (SPREAD), the lagged 1-month change in exchange rates (FOREX), the output gap (GAP), the unemployment rate (UNE) and the level of underlying variables (LEVEL). Robust standard errors are reported in the parentheses. Min/Max indicates whether the turning point is minimum (Min) or maximum (Max) point. ***, ** and * signify statistical significance at 1, 5, and 10 percent respectively.

The Implications of Central Bank Transparency for Uncertainty and Disagreement

Highlights

- Explore the effects of increased transparency, inflation targeting and forward guidance on aggregate uncertainty, common uncertainty and disagreement.
- Provide evidence that increased transparency reduces mainly common uncertainty.
- Looking at disagreement only understates benefits of transparency.