

Central Banks in Parliaments

A text analysis approach to *accountability practices* and an application to the ECB, the Fed and the BoE

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Abstract

As central banks expanded their role during the global financial crisis, demand for public scrutiny of their actions increased. This posed new challenges to the balance between central bank accountability and independence. While this context reignited the debate on how to keep unelected institutions accountable, empirical assessments of central bank accountability have been scarce due to the limitations of existing measures, which mainly focussed on statutory provisions for accountability. This paper first investigates the relationship between central bank accountability and independence in light of recent developments. Then it introduces a new methodology to assess empirically the response of central banks to the crisis based on *accountability practices* rather than the evolution of statutory provisions. Using text analysis techniques it detects the key topics and evolution of sentiments in the exchanges between central banks and elected representatives. Applying this methodology to the interactions of three central banks, the European Central Bank, the Federal Reserve and the Bank of England, with their respective parliaments since 1999, the paper finds that the central banks' objectives play a relevant role in determining the topic of discussion, in contrast to some critiques around the inability of politicians to focus on the central bank's mandate. At the same time, it also shows that the crisis impacted the respective salience of topics discussed at hearings, with different patterns for each central bank. Second, the paper finds that positive and negative sentiments are mainly driven by the distance of actual inflation to the central banks' inflation aim and by uncertainty. Moreover, it shows that while sentiments dropped in all three cases during the crisis, they undertook different paths in the post-crisis period.

JEL codes: E02; E52; E58.

Keywords: central bank accountability; central bank independence; text analysis; sentiment analysis.

Non-technical summary

During the past 30 years, independence has been a cornerstone of central banking. Since the Global Crisis, however, there has been debate over whether it is legitimate to grant independence to unelected powers in a democracy. As a result, increased attention has been paid to central bank accountability, in particular the obligation for the central bank to explain and justify decisions to citizens and their elected representatives – as the necessary counterpart to independence.

However, assessing the right balance between independence and accountability is rather challenging. Thus far, while discussions on accountability mainly relied on anecdotal evidence related to individual central banks, some empirical analyses attempted to compare accountability across central banks by looking at their statutes. Nevertheless, this literature evaluates only the legal framework in which central bank accountability is enshrined, without providing a perspective on accountability practices, i.e. the way in which accountability is discharged. This leaves a number of relevant questions unanswered: do central banks and elected representatives debate on the central banks' mandate? And how has the discussion evolved during the crisis? Moreover, focussing on statutes provides a rather static perspective on accountability. As the only sources of variations for frameworks are central banks' reforms, these analyses leave the impression that central banks did not adjust to the new demand for public scrutiny that emerged from the crisis.

This paper seeks to fill this gap proposing a new methodology to assess empirically the evolution of central bank *accountability practices*, rather than statutory provisions. The paper focusses on central banks' parliamentary hearings, arguably the most relevant and common accountability channel among central banks, to track how the interactions between central banks and parliaments evolved to respond to new demand for scrutiny. Applying text and sentiment analysis techniques to the transcripts of the hearings, the paper identifies the topics and the sentiments that characterised the interaction between the two institutions.

The methodology introduced is applicable across central banks, allowing for international comparisons. This paper proposes an application to three central banks, the European Central Bank, the Bank of England and the Federal Reserve, which are held accountable respectively by European Parliament, the British Parliament and the US Congress. Using the transcripts of their quarterly exchanges from the beginning of 1999 to the end of 2018, the paper compares the evolution of the focus and of the tones of the hearings. It finds that, contrary to criticisms, the central banks' objectives play a relevant role in determining the topic of discussion. Nevertheless, it also finds that the crisis triggered a shift in the debate, even if with different patterns, timings and intensity across the three central banks. Regarding the tones, it finds that while sentiments fell during the crisis, they remained overall stable in the hearings of the Federal Reserve and of the European Central Bank, while the ones of the Bank of England presented higher volatility. Panel data regressions suggest that the shifts in sentiments are mainly correlated with accountability concerns, i.e. the distance of actual inflation from the inflation target, and uncertainty.

Accountability pertains to a civic and moral obligation inherent in the political order.
Tommaso Padoa-Schioppa (2000)

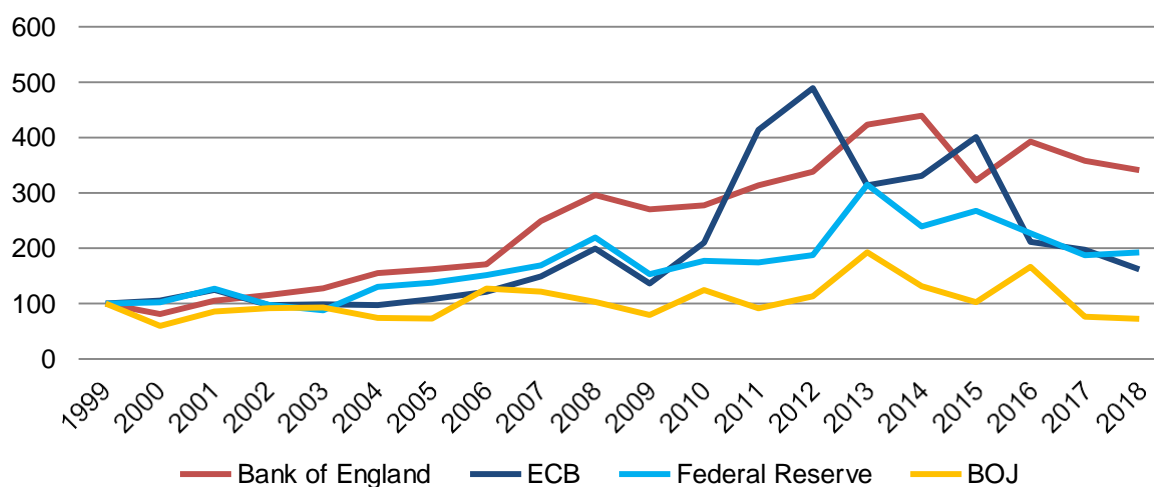
1. Introduction

Central bank accountability is generally considered the necessary counterpart to central bank independence. Delegation of responsibilities to unelected institutions might give rise to a perceived democratic deficit over time, even when they originate from a democratic decision. For such delegation to be acceptable in a constitutional democracy, unelected officials need to be accountable to democratically elected institutions, which represent the view of the people. This principle became even more important in the recent financial crisis.

On the one hand, the adoption of non-standard measures and of a variety of instruments other than interest rates to cope with the crisis made the scrutiny of monetary policy more complicated and created a serious challenge for central banks in terms of their outreach and their accountability (Coeuré 2018; Praet 2017). On the other hand, the increased awareness of the key role of central banks during the crisis led to increased attention being paid to the design and implications of their policies (see Figure 1).

Figure 1: Media attention on the ECB, the Federal Reserve, the Bank of England and the Bank of Japan

(number of newspaper articles citing the ECB, the Federal Reserve, the Bank of England and the Bank of Japan, year 1999=100)

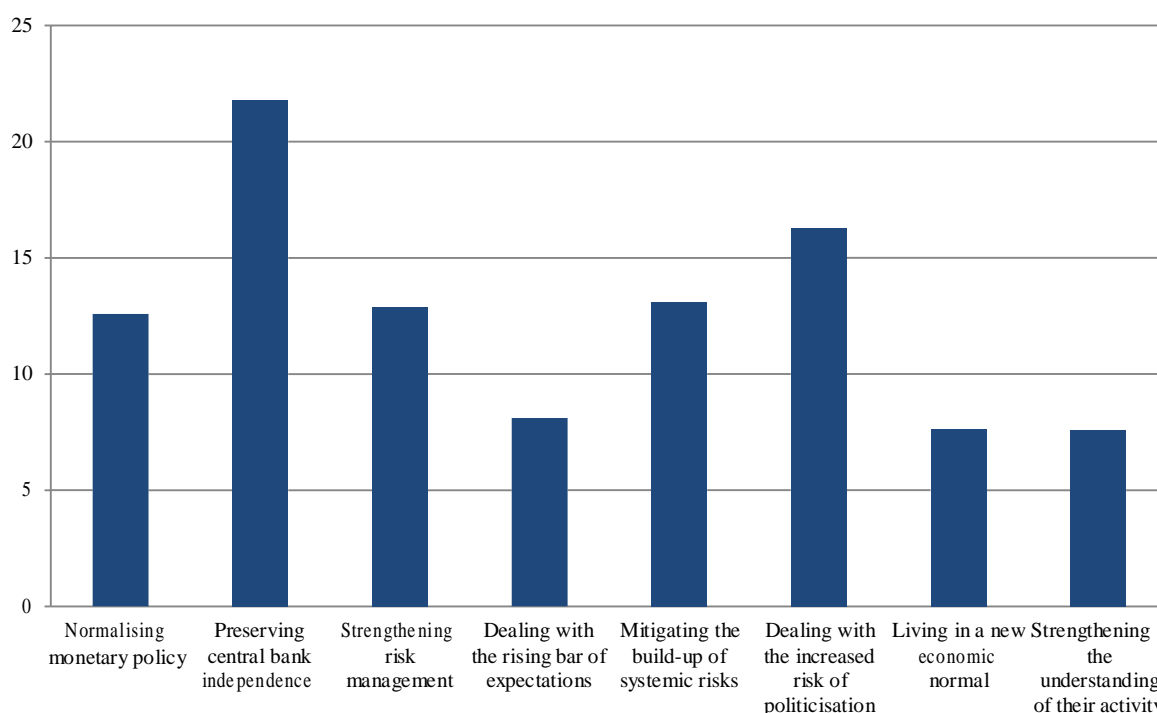


Sources: authors' elaboration on Factiva data, 2018.

This context revived the debate around the legitimacy of granting independence to unelected powers in constitutional democracies (Tucker 2018). This perception was also reinforced by the fact that legal framework for monetary policy accountability and independence remained largely unchanged (Chang 2017). This is seen by some as a mismatch that negatively affected public opinion towards central banks, increasing threats toward their independence (Goodhart and Lastra 2018; Merler 2018). Moreover, with the emergence of populist forces during the crisis, the institutional tenets of central banks have been increasingly challenged. Buiter (2016), De Haan and Eijffinger (2017), Goodhart and Lastra (2018), Rodrik (2018), den Haan et al. (2017), Reichlin (2018) described the change of public perception toward central banks, arguing that the rise of populism might have put their independence at risk (for a review, see Merler 2018).

As this time, in contrast to the past, critical voices dominate (Issing 2018; Masciandaro and Romelli, 2015), central bankers around the world saw the need to defend the principle of central bank independence. This was also confirmed by a survey we conducted among thirty experts working on institutional matters in their respective central banks worldwide (Figure 2). As a consequence, the role of accountability gained even more relevance in keeping central bank independence acceptable.

Figure 2: The main challenges central banks were facing in 2019



Sources: authors' elaboration on a survey conducted in January 2019 among 30 central bank staff working on institutional matters in their respective central banks.

Note: central Banks covered in the sample were the following: Central Bank of Malta, Central Bank of Luxembourg, Reserve bank of Australia, Bank of Mexico, Federal Reserve, European Central Bank, Bank of Ghana, Central Bank of Ireland, Bank of Estonia, Croatian National Bank, National Bank of Ukraine, Central Bank of Norway, Danmarks Nationalbank, Central Bank of Brazil, Swiss National Bank, Sveriges Riskbank, National Bank of Belgium, Bank of Portugal, Deutsche Bundesbank, Netherlands Bank, Central Bank of Cyprus, Bank of England. Moreover, representatives of the IMF and FSB also participated in the survey.

Remarkably, while the debate focused on the importance of central bank accountability, little attention has been given to the need for measuring it. Moreover, the debate has largely been based on anecdotal evidence and a discussion of specific cases of individual central banks. In

the absence of empirical and objective measures, a number of questions have remained hence unanswered.

Assessing empirically the balance between accountability and independence is not a trivial exercise. When faced with this challenge, the literature mainly relied on indexes developed by economists to measure the degree of central bank independence and accountability as enshrined in laws and regulations (see De Grauwe and Gros 2009 for a review). However, as the criteria used in such indexes are built on statutory provisions, they inevitably show very low variation through time, giving rise to the impression that central banks frameworks did not adequately match changing accountability demands.

In this paper we go beyond such measures and propose a new approach to empirically evaluate central bank accountability. We build on Fraccaroli, Giovannini and Jamet (2018) to introduce a new methodology to assess the response of the central banks institutional frameworks in response to the crisis based on *accountability practices* rather than on the evolution of statutory provisions. Our approach is based on a text-based technique which is now increasingly used in the literature on central banking (two recent examples being Shapiro and Wilson 2019 and Schmeling and Wagner 2019). We apply this methodology to the cases of the hearings in parliament of the European Central Bank (ECB), the Federal Reserve (Fed) and the Bank of England (BoE), focusing on their central banking functions – thus leaving aside the supervisory functions and the accountability provisions applicable to them.

We find that, while the legal provisions on accountability remained unchanged, displaying hence no variation in the central banks' accountability and independence indexes, the relation between central banks and their parliaments has de facto evolved in response to the public demand for greater scrutiny of central banks' actions.

The paper is structured as follows. In the next section we define central bank accountability and its relationship with independence. We then review existing empirical measures used in the literature to evaluate accountability and highlight their limitations. Section 3 introduces our text-based methodology to account for central bank accountability in practice and discusses the construction of a novel dataset for applying it. Sections 4 and 5 describe the data and apply the methodology to the ECB, BoE and Fed and display the results. The final section concludes.

2. Central bank accountability and independence

2.1 The relationship between central bank accountability and independence

Central bank accountability can be understood as the legal and political obligation of a central bank to explain and justify its decisions to citizens and their elected representatives. As noted by the BIS (2009), accountability has three main characteristics: (i) scrutiny by others; (ii) regular accounting for one's actions; and (iii) the risk of negative repercussions, if performance is considered unsatisfactory. As accountability centres on an evaluation of performance, this is translated in practical terms, in the establishment of a legal obligation for the central bank to testify before its principal(s). The latter is eventually the people as represented by the parliament or the government (or other institutions) according to the jurisdiction in which they operate. In this setting, the central bank explains and justifies its

policy decisions to democratically elected bodies through a number of tools, such as hearings and exchanges of views, reports and written replies.

Accountability is generally considered more important when central banks enjoy a greater degree of autonomy. Its rationale can be envisaged in a principal-agent framework, where powers are delegated to an agent to be exercised independently of its principal (Fратиanni et al. 1997; Gailmard 2012). In this set-up, as noted by Fischer (1995), accountability is needed for two main reasons. First, it sets incentives for the central bank to meet its goals; and second it provides democratic oversight of its policies.

On the one hand, empirical evidence suggests that granting independence from political power to the central bank to be conducive to maintaining price stability, as it shields the central bank from short-term pressures driven by the political business cycle (Alesina and Summers 1993; Berger, de Haan and Eijffinger 2000; Cukierman, Webb and Neyapti 1992; Grilli, Masciandaro and Tabellini 1991; Cukierman 1992; Hayo and Hefeker 2002, de Haan, Masciandaro and Quintyn 2008). On the other hand, there must be some provisions in place to ensure that independent agents respect their mandate (Stiglitz 1998; Forder 2002; Buiters 2008).

The logic just discussed was at basis for the creation of independent central banks, which were entrusted with specific mandates by democratically elected bodies. Padoa-Schioppa (2000, p. 29) summarised the rationale for accountability as follows:

Accountability is an essential and constituent element of a democratic political order. In such an order, institutions and bodies with the power to affect the lives and welfare of the community must be subject to the scrutiny of the citizens or of their elected representatives. This is particularly relevant for those policy fields – such as central banking – where decisions are consciously removed from the day-to-day influences of the political arena. Thus, accountability pertains to a civic and moral obligation inherent in the political order, and is not directly related to what could be termed the ‘economic order’.

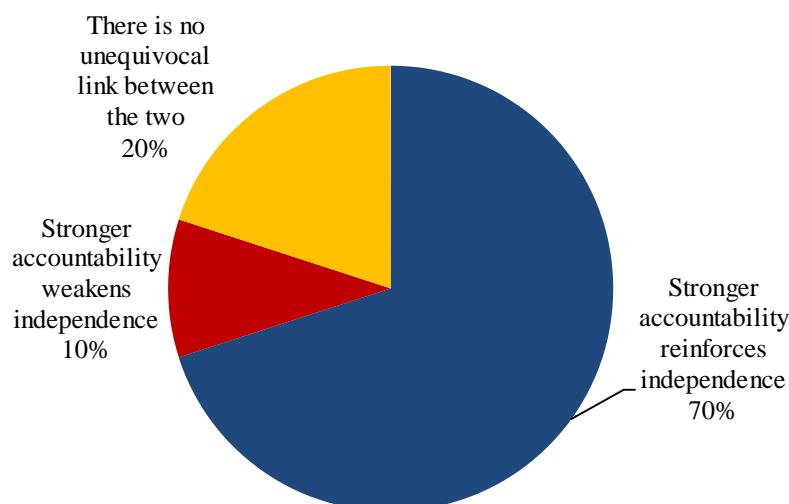
The legitimacy of central banks’ independence therefore relies on their accountability, which ensures that independence does not lead to arbitrariness and that the mandate is fulfilled. This link between accountability and independence and the fact that strengthening one aspect requires enhancing also the other, was confirmed by the survey we conducted (Figure 3) and is mentioned in several speeches of the three central banks analysed in this paper (see below a few examples):

For the ECB independence and accountability are two sides of the same coin. The ECB was given a democratic mandate. Independence ensures that the ECB can act in line with its mandate. Accountability, on the other hand, ensures that the ECB does act in line with its mandate (Coeuré 2017).

Consistent with the principle of accountability, the Fed is allowed to determine the settings of policy without political interference (this is what is meant by “central bank independence”) (Bernanke 2016).

The Bank places the utmost importance on both its accountability through the Treasury Committee to Parliament and its accountability more broadly to the citizens of the United Kingdom” (Bank of England 2014).

Figure 3: The relationship between central bank independence and accountability



Sources: authors' elaboration on a survey conducted in January 2019 among 30 central bank staff working on institutional matters in their respective central banks.

The positive correlation found in the literature between accountability and independence is to some extent a by-product of how indexes measuring these aspects are constructed (see section below). For example, having a clearly defined mandate is considered as increasing independence, as it makes it more difficult for politicians to pressure the central bank into pursuing other objectives outside its mandate. At the same time, it is seen as enhancing accountability, as it is easier for democratically elected bodies to scrutinise central bank performance against a single clearly defined objective rather than against multiple and vague ones.¹

On other aspects, however, the relationship between these two features is less direct. For example, the requirement for the central bank to hold parliamentary hearings certainly increases accountability, but does not necessarily affect positively or negatively independence. The positive effect of parliamentary hearings on independence may derive from the fact that the more the central bank is able to explain its decisions and respond to concerns expressed by parliamentarians, the more the case for its independence is strengthened. However, parliamentarians might also use hearings to exert political pressure on the central bank beyond or in contradiction with its mandate, rather than to scrutinise its performance in pursuing its objective(s). In such case, hearings would have a negative effect on independence. For this reason, in some cases independence and accountability are interpreted as a trade-off rather than two complementary concepts (De Haan, Amtenbrink and Eijffinger 2000). A case in point is the possibility to dismiss the governor: while this may be seen as increasing accountability, it may also be considered as limiting independence.

2.2 Empirical measures of central bank accountability and independence in the literature

The use of empirical measures for comparing central bank accountability and independence is challenging. As central banks are institutions embedded in their specific political and legal

¹ As noted by Issing (1999) 'The more clearly and precisely [the central bank's] mandate is defined, the easier it will also be in a democracy to monitor the performance of the central bank'.

national context, they are characterised by different governance traits and legal foundations² that make cross-country comparisons more difficult (for a review of these differences, see Frisell, Roszbach and Spagnolo 2008, Hasan and Mester 2008, and BIS 2009). Moreover, while generally central banks are accountable to parliaments or the executive branch of government, there are some variations depending on the federal or unitary structure of the state in which they operate. According to the BIS (2009), out of a sample of 47 countries, central banks are accountable to parliament in 64% of the cases, to the minister of finance in 30%, to the government or its head in 21%, to the head of state in 9% and to other bodies (e.g. cantons in Switzerland or private shareholders in South Africa and other cases) in 17% of the cases.

Despite these differences, researchers have attempted to identify a number of common criteria to evaluate the statutory accountability of central banks. Accountability indexes were built on the example of the widely diffused central bank independence indexes (Bade and Parkin 1988; Alesina 1989; Grilli, Masciandaro and Tabellini 1991; Cukierman, Webb and Neyapti 1992), which were also constructed on the basis of central banks' legal frameworks. These indexes are based on the selection of a number of common criteria related to accountability and independence that are applicable to the statutes of most, if not all, central banks at international level. Each central bank is then assigned a score for accountability and independence based on the number of matches between its statute and the pre-defined criteria.

Briault, Haldane and King (1996) represents one of the first examples. Their index computes the degree of accountability on the basis of the following quarter of binary criteria, summed up in a single index:

1. Whether the central bank is subject to external monitoring by parliament;
2. Whether the minutes of the meetings in which monetary policy is decided are published;
3. Whether the central bank publishes an inflation or monetary policy report of some kind in addition to the standard bulletins;
4. Whether there is a clause that allows the government to override a decision of the central bank.

De Haan et al. (1999) proposed a more detailed index distinguishing between three macro-aspects of accountability, namely (1) clarity of the monetary policy objective, (2) transparency of monetary policy and (3) final responsibility of monetary policy. Consistently with the previous approach, these three categories were composed of binary criteria which summed up to generate a single number to proxy the degree of accountability (see Appendix for the full list of criteria). Such index has been used by De Haan and Eijffinger (2000), Eijffinger and Hoerberichts (2002) and Sousa (2002).

Bini-Smaghi and Gros (2000) proposed a third measure based on a qualitative assessment of 15 criteria divided across three categories:

1. ex ante accountability, which is related to the definition of the central bank objectives, its targets and the extent to which the central bank makes public its view on how monetary policy targets affect other policies;

²The legal foundations of central banks tend to be based on constitutions and central bank statutes, but also on a number of additional regulations, formal letters or agreements.

2. ex post accountability, which refers to instruments held by democratically elected bodies to hold the central bank accountable, such as public hearings and meetings;
3. procedures, which is related to the transparency of the central bank vis-à-vis the parliament and the public, rather than on procedural aspects of accountability. Criteria related to procedures are in fact whether the central bank publishes its minutes or the votes of its members. The only aspect strictly related to accountability in this case is whether central bank hearings in parliament include a Q&A session.

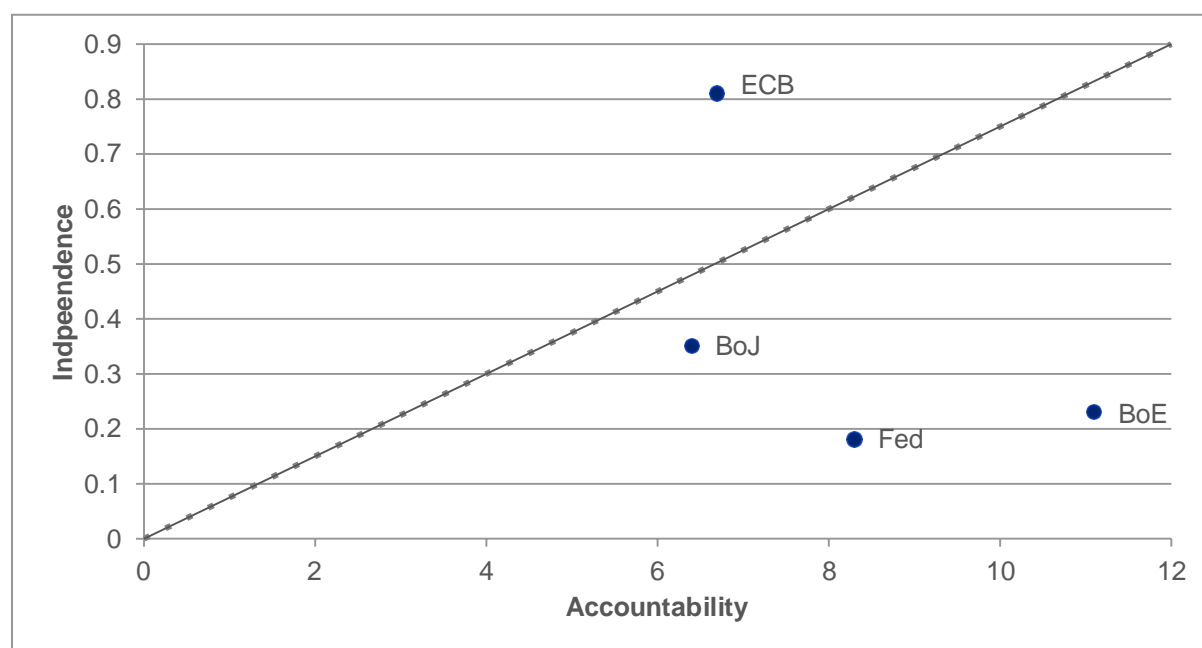
The same authors proposed a slightly different measure which disentangles aspects of accountability inherent in the monetary policy objectives and strategy from accountability aspects related to communication, among which they include parliamentary hearings, and transparency, in terms of publications of the central bank's analytical tools³ (Bini-Smaghi and Gros 2001).

The first advantage of such measures is that they are easily applicable to virtually all central banks, despite the great heterogeneity in governance, thus allowing for international comparisons. The second advantage of these indexes is that they provide an easy and immediate comparison between the degree of independence of a central bank and its degree of accountability. This feature is particularly relevant if we consider these two characteristics as inevitably two necessary complements. By combining independence and accountability indexes, it is in fact possible to compare the respective balance applicable to each central bank. Such comparison in turn may be used to identify whether an authority is under(over)-'performing' in one of the two aspects.

Following De Grauwe and Gros (2008), we ranked four central banks - the ECB, the Fed, the BoE and the Bank of Japan -, according to their average rank in accountability (using the indexed discussed above) and plotted it against their degree of independence (computed as an average between three recent updates in the literature) (see Figure 4).

³Namely, macroeconomic models used data on targets and indicators, and inflation forecasts.

Figure 4: Accountability and independence of the ECB, the Fed, the BoE and the Bank of Japan (BoJ)



Sources: De Grauwe and Gros (2008), Garriga (2016), Bodea and Hicks (2015), Dincer and Eichengreen (2014) and ECB calculations. Notes: The higher the value, the higher the degree of accountability and independence respectively. The index used to calculate accountability was computed as an average of five different indexes of accountability developed in the literature and updated in 2009 by De Grauwe and Gros. The independence index was calculated as an average of the updates by Dincer and Eichengreen in 2014, Bodea and Hicks in 2015 and Garriga in 2016, who found no change in the index for the four central banks since the 1990s. These three works updated the independence indexes using the methodology developed by Cukierman, Webb and Neyapti in 1992. See Dincer and Eichengreen (2014) and Cukierman, Webb and Neyapti (1992).

Based on this comparison, the ECB features as the most independent central bank, followed by the BoE and the Bank of Japan, whereas the Fed is the least independent. On the other hand, the BoE results as the most accountable, followed by the Fed and the ECB, whereas the Bank of Japan is the least accountable of the four. This graphical representation seems also to reject the idea of a positive and constant link between accountability and independence. The four central banks do not appear aligned along the dashed line balancing independence and accountability statutory provisions.

23 Limitations of accountability and independence measures

These indexes led much of the empirical research on central bank accountability and independence, providing the basis for a number of critiques. While theoretical arguments suggested that accountability and independence should go hand in hand (King 1998; Geraats 2001), empirical findings based on these indexes displayed a negative relationship between the two. Briault, Haldane and King (1996) observed that transparency, an aspect of accountability, has been pursued more actively by central banks with lower independence. De Haan, Amtenbrink and Eijffinger (1999), De Haan and Eijffinger (2000) and Sousa (2001);

2002) presented evidence that accountability is negatively related to independence.⁴ This led to the conclusions that central banks suffered from an ‘accountability deficit’ which needed to be fixed by reforming their statutes.⁵

Nevertheless, there are major limitations associated to these measures. The first derives from the difficulty of defining accountability and independence as two distinct concepts that can be subject to comparisons. Their criteria tend in fact to overlap. On the one hand, having a clear statutory prioritisation of objectives increases both independence and accountability scores,⁶ creating a necessarily positive relationship between the two concepts. On the other hand, the government’s right to instruct the central bank decreases independence but increases accountability in these indexes,⁷ generating a negative relationship between the two.

These apparent contradictions are the reflection of the current debate on the relationship between independence and accountability mentioned in the previous section, and in particular whether these aspects should be seen as a trade-off, or whether it is possible for a central bank to be both more accountable and more independent.⁸ In this setting, it is worth questioning whether an optimal balance between independence and accountability may actually be drawn based on these indexes, as previously done in the literature.

A second limitation derives from the low variation to which independence and accountability measures are subject to, due to the dependence of their variability on reforms in central bank laws. For example, in its twenty years of history, the ECB has experienced no change in its independence and accountability indexes,⁹ as the relevant statutory provisions for its central banking role, which are enshrined in primary law, have not been reformed. The same applies to older central banks. Recent updates of these indexes¹⁰ reported change neither in the Fed’s degree of independence during the crisis, nor in the BoE’s since it gained independence in the 1990s. For the Bank of Japan, the latest change in its degree of independence dates back to the major reform to its statute in 1998. For what concerns accountability indexes, the latest available update is less recent but reported no change (De Grauwe and Gros 2008).¹¹

⁴ De Grauwe and Gros (2008) identified a negative, but not significant, relationship between independence and accountability on a sample of 15 EU central banks. They argued that this lack of relationship may be due to social and political factors.

⁵ For instance, Sousa (2002, p. 14) suggested to increase de jure accountability ‘not only imposing legal requirements for the central bank to report to parliament and to explain its behaviour, but also empowering parliament with instruments to monitor more accurately the policy decisions’, as well as by ‘making clear legal statements and establishing objectives prioritisation’. It is worth to notice that these are all aspects related to the statutory indexes we described in the previous section. Interestingly, Sousa calls also for an improvement of de facto accountability, but then refers only to de facto transparency.

⁶ For accountability indexes, the criteria of reference are the following: criterion 1 in De Haan et al. (1999); criterion 1 in Bini-Smaghi and Gros (2000). For independence, criterion 3 of Cukierman, Webb and Neyapti (1992).

⁷ In this case, for accountability indexes the criteria of reference are criterion 9 in De Haan et al. (1999);

⁸ In this regards, it is worth mentioning the speech by ECB Executive Board Member Yves Mersch, whom argued for a positive relationship between independence and accountability stating that accountability ‘ensures that independence does not lead to arbitrariness and that the mandate is fulfilled. So, proper accountability arrangements strengthen the case for independence. And they reinforce each other as cornerstones of central banks’ legitimacy and effectiveness’ (Mersch 2017).

⁹ Here we refer to the ECB in its central banking capacity, not considering hence its supervisory role.

¹⁰ Updates of central bank independence indexes have been provided by Garriga (2016) and Bodea and Hicks (2015).

¹¹ This does not hold for supervisory functions, which are not however the focus of this paper. Major reforms on supervision (and its accountability) occurred in the ECB with the establishment of the SSM in 2014 and in the Bank of England with the establishment of the Prudential Regulatory Authority (PRA) in 2013.

While the stability of the indexes through time cannot be considered a problem *per se*, as the indexes are describing changes in central banks' laws, it is important therefore to notice that they describe a specific dimension of the relationship between accountability and independence, which is far from providing a holistic picture of such interplay. This dimension is in fact based on an institutional, incentive-based, long run perspective, and does not provide information on the continuous evolution and changes in the interactions and practices between the two institutions. In other words, while providing essential insights on the *de jure* setting of the accountability framework, such perspective does not highlight the way in which the central bank *de facto* interacts with its parliament. In this context, in fact, the Bank of Japan results as the least accountable central bank in the sample, as we showed in Figure 2. However, the Bank of Japan is one of the central bank which has held by far the highest number of parliamentary appearances for accountability reasons. In 2005 and 2006, the Bank of Japan appeared before the Diet (the Japanese parliament) respectively 33 and 35 times, hence more frequently than the Fed's appearances (21 and 15 times respectively) and the ECB's (5 times in both years) (Shirakawa 2008; Heckel 2014).

3. A new methodology using text analysis

The limitations of the existing accountability measures imply that they can only provide incomplete empirical evidence of how accountability evolved during the crisis. To overcome this difficulty, this section introduces a new methodology to assess accountability based on practices, rather than statutory provisions. The objective of this method is to track, analyse and compare accountability practices of various central banks within their respective existing frameworks for accountability and independence.

3.1 Assessing the content of accountability in practice

We first apply text analysis to the transcripts of central banks' parliamentary hearings in order to track the focus of parliamentarians on the central bank objective. We use a dictionary technique which consists in first creating a list of key words able to capture a specific topic and secondly in matching these words with those present in the transcripts. In this way, we obtain a measure of the intensity of the focus on a specific topic, based on the frequency of key words' occurrence in the transcripts. In this sense, our technique is similar to the index built by Baker, Bloom and Davies (2016) to measure economic policy uncertainty. This method has the advantage of producing a measure of the focus on the topics which is independent from our subjective judgement.

To investigate whether parliamentary debates actually focussed on central banks' monetary policy objective, we hence create a list of key words related to the topic of price stability. By computing the number of occurrences of related key words in the transcripts, we are able to understand how intensely the debate focussed on the central banks' objective, price stability. The advantage of applying this method to the cases of the ECB and of the BoE is that they both have a clearer prioritisation of price stability as their primary objective.

While the time series of key words occurrences allows us to understand the evolution of the focus on the objective through time, it is necessary to compare price stability with the evolution of other topics that may be competing with and/or complementing the discussion on price stability. To do so, we create two other lists of text related to major topics of

discussions, namely the crisis and financial stability. All the key words selected for the three lists are available in the appendix.

The lists on price and financial stability are based on common English words related to inflation and crisis, which abstract from the specifics of the European case. They hence have the advantage of being applicable to transcripts in English of other central banks, providing an overview of the evolution of topics in other countries. Nevertheless, the cost associated to generality stems from the omission of those words used to address central bank-specific monetary policy programmes of the three central banks.¹² For this reason, scores on monetary policy might be underestimated. However, since we are interested in comparability over time and across central banks, a parsimonious and general dictionary better suits the purposes of our research question.

3.2 Capturing the tone of accountability in practice

We apply a similar methodology also to measure the tone of hearings. Following the literature on sentiment analysis applied to texts, it is possible to calculate the degree of positive and negative sentiments of parliamentary hearings, to proxy the tone used during hearings both by central bank representatives and by parliamentarians.

We use a dictionary technique similar to the one applied to detect topics. Our methodology is based on the example of Schumacher et al. (2016) and Nyman et al. (2018). While the former use positive and negative text bags to compute the sentiments in speeches by EU heads of government and EU institutions, the latter compute a sentiment ratio estimate based on the difference between words related to excitement and words related to anxiety matched in news, in order to measure how narratives affect financial behaviour. In our case, we combine the two methodologies. First of all, we match terms contained in the transcripts with two lists of positive and negative terms.¹³ Then, we compute positive and negative scores based on the count of words matched with each bag in each transcript. Once we obtained these scores, we take the difference between positive and negative terms, to get an estimate of net sentiments. Moreover, we weight net sentiments by the total number of terms in each transcript, to prevent the length of hearings from inflating sentiments upward or downward due to a larger number of terms rather than due to the intensity of the tones. Formally:

$$\text{Net Sentiment Ratio} = \frac{|\text{Positive Terms Matched}| - |\text{Negative Terms Matched}|}{\text{Total Terms in Transcript}}$$

Where t is a parliamentary hearing transcript, n_t is the number of terms contained in transcript t , and p_t and n_t are, respectively, the number of positive and negative terms matched in each transcript.

¹² For example, the use of a single list on monetary policy does not allow us to detect when participants of the debate referred to the same topic by using Eurozone-specific words like Asset Purchase Programme (or APP), Public Sector Purchase Programme (PSPP) or Targeted longer-term refinancing operations (TLTROs).

¹³ The two lists were created by Bing Liu and collaborators for the tidytext R package. The lists contain 2,006 positive terms and 4,782 terms, and can be found at this [link](#) and this [link](#) respectively. As these bags have been created externally to evaluate tones on texts in general, they do not necessarily fit with the lexicon adopted for parliamentary debates. For this reason we removed some terms that did not match with positive or negative tones. For example, we removed the word ‘accommodative’ from the positive text bag, as such term has a descriptive connotation when referring to monetary policy, and not necessarily a positive one as in common texts. Another example is the word ‘pretty’, that we also removed from the positive text bag, as such term is unlikely to be used by speakers as a positive adjective, and is more likely used as a neutral adverb. Following our changes, the list of positive words amount to 1,968 terms, whereas the list of negative ones to 4,789.

4. Data

This section describes the three central banks' accountability arrangements and the textual data we collected for the central banks' parliamentary hearings. Parliamentary hearings are a common practice in central banks accountability frameworks and arguably represent their main accountability tool.

Transcripts of parliamentary hearings allow to construct a novel dataset which has so far been rarely used in the analysis of central banks activities. They constitute a rich source of information, as the heterogeneity of topics discussed in parliamentary hearings tend to be higher than in other forum where central bank speak (e.g. press conferences, speeches, etc.). While text analysis techniques have been previously used in central banking research (see Bholat et al. 2015 for a review), applications have mostly focussed on central bank communication and transparency in general (Lucca and Trebbi 2009; Apel and Blix-Grimaldi 2012; Coenen et al. 2017; Tobback, Nardelli and Martens 2017; Hansen, McMahon and Prat 2018; Shapiro and Wilson 2019; Schmeling and Wagner 2019) rather than on accountability. To our knowledge, the only application of text analysis techniques to the transcripts of parliamentary hearings is the work by Schonhardt-Bailey (2013), who examined, among other sources, the Federal Reserve's congressional hearing.

Importantly, in all three cases we focussed only on the monetary policy side, excluding the accountability arrangements related to the supervisory functions of the three institutions. Although each of the three central banks appears before its respective parliament with similar frequency, their accountability arrangements differ under some aspects, which it is important to highlight to better understand the result of the analysis.

4.1 Regular parliamentary hearings

4.1.1 The BoE and the Treasury Committee

The BoE is held accountable by the House of Commons Treasury Committee through regular hearings, which typically take place when the Bank of England Inflation Report is published. In these reports, the BoE explains changes in its policies which are then discussed by the Treasury Committee, which is responsible for overseeing the spending, policies and administration of the BoE. Differently from the ECB and the Fed, the BoE Governor is accompanied by other members of the Monetary Policy Committee during the hearings.

While the Treasury Committee has sole statutory authority to scrutinise the BoE, also the Economic Affairs Committee of the House of Lords exercises its power to hold hearings with the BoE (Schonhardt-Bailey 2015; Sanders, Lisi and Schonhardt-Bailey 2018).

The textual data we collected is however dominated by hearings before the House of Commons' Treasury Committee, which are 58, against only 8 hearings before the House of Lords' Economic Affairs Committee, which are the only available transcripts online for the period of our study. We included both sets of hearings as the separation of tasks between the two committees is "not necessarily clear", as argued by Russell (2013). However, Russell (2013) also noted that while the Treasury Committee is officially responsible to hold the BoE accountable for its policy, the Economic Affairs Committee focusses more on issues related to administration, clarification and simplification. Our database on the BoE comprehends 66

transcripts of the hearings from 1999 to 2018, including the mandates of three governors, namely those of Edward George (1993-2003), Mervyn King (2003-2013) and Mark Carney (2013-).

4.1.2 The ECB and the European Parliament's ECON Committee

The ECB's accountability obligations are set out explicitly in primary EU law. Article 284(3) of the Treaty on the Functioning of European Union (TFEU) and Article 15.3 of the Statute of the European System of Central Banks and of the European Central Bank provide that the ECB is primarily accountable to the European Parliament, as the representative of EU citizens. A cornerstone of this accountability framework is the "Monetary Dialogue", i.e. the ECB President's participation in the regular public quarterly hearings before the Committee on Economic and Monetary Affairs (ECON committee), where he delivers a statement on the ECB's actions and answers questions from Members of the European Parliament (MEPs) attending the hearing.¹⁴

Our text data for the case of the ECB hence relies on the transcripts of the Monetary Dialogues for the period 1999-2018.¹⁵ This time span covers three ECB presidencies, including those of Wim Duisenberg (1998-2003), Jean-Claude Trichet (2003-2011) and Mario Draghi (2011-).¹⁶

4.1.3 The Fed and the Congress

The Fed is accountable to the public and the US Congress. Although the formalisation of the hearings took place in the Humphrey-Hawkins Act in 1978,¹⁷ the Fed appeared before Congress since 1976. The Federal Reports Elimination and Sunset Act of 1995 provided for the cessation of the legal requirements for the Humphrey-Hawkins Act reports to Congress after 1999, but the Fed and Congress agreed to continue their reporting arrangements (Schonhardt-Bailey 2013).

According to these practices, the Chair of the Board of Governors of the Fed appears twice before the Senate committee on Banking, Housing and Urban Affairs and twice before the House committee on Financial Services. In such hearings the Fed chairman reports to congress on its Semiannual Monetary Policy Report, which focusses on recent economic developments and on the Fed's plans for monetary policy, and replies to congressmen's questions.

Our database for the Fed consists therefore of four hearings per year, two before the Senate and two before the House, from 2000 to 2018, covering the chairmanships of Alan Greenspan (1987-2006), Ben Bernanke (2006-2014), Janet Yellen (2014-2018) and Jerome Powell (2018-). A part of the oversight hearings, Fed chairmen appear before Congress for

¹⁴ For an overview of the other accountability tools between the two institutions, see Fraccaroli, Giovannini and Jamet (2018)

¹⁵ We excluded ten transcripts, for which the European Parliament did not provide transcripts fully translated in English.

¹⁶ ECB representatives appear before the European Parliament on a number of other occasions. For example, every year the ECB Vice-President presents the ECB Annual Report to the ECON committee, which is also presented by the ECB President to the plenary. We however decided not to include these two types of exchanges as transcripts of the first one are not available, whereas the second one has a different structure from the Monetary Dialogues, as MEPs' questions are collected and the President addresses them altogether in his conclusions.

¹⁷ Formally known as the Full Employment and Balanced Growth Act of 1978 (P.L. 95-523).

reconfirmation hearings. This was the case for Volcker (1998), Greenspan (1992, 1996, 2000, 2004) and Bernanke (2009). However, also in this case we comprehend in our textual database only semiannual hearings to ensure consistency.

4.2 Text pre-processing

We collected for each central bank the transcripts of their parliamentary hearings from 1999 to 2018, which are available in all three cases on the website of the respective parliaments. In all three cases, transcripts are provided in English. Then, we pre-processed the text in each transcript. This implied tokenising the text, i.e. splitting raw character strings into individual elements, removing English stopwords (e.g. ‘the’, ‘for’, ‘and’), numbers, punctuation and white spaces. Descriptive statistics of the three databases following the pre-processing are summarised in Table 1.

Table 1: Data description

	ECB	Fed	BoE
Number of transcripts	67	64	66
Average number of words per transcript	6.773,88	13.907,78	8.367,21
Total number of words	453.850	890.098	552.236

Note: values relative to the average number of words and to the total number of words refer to the transcripts after cleaning the data from stopwords, numbers and white spaces.

5. Discharging accountability in practice: the evolution of parliamentary debates

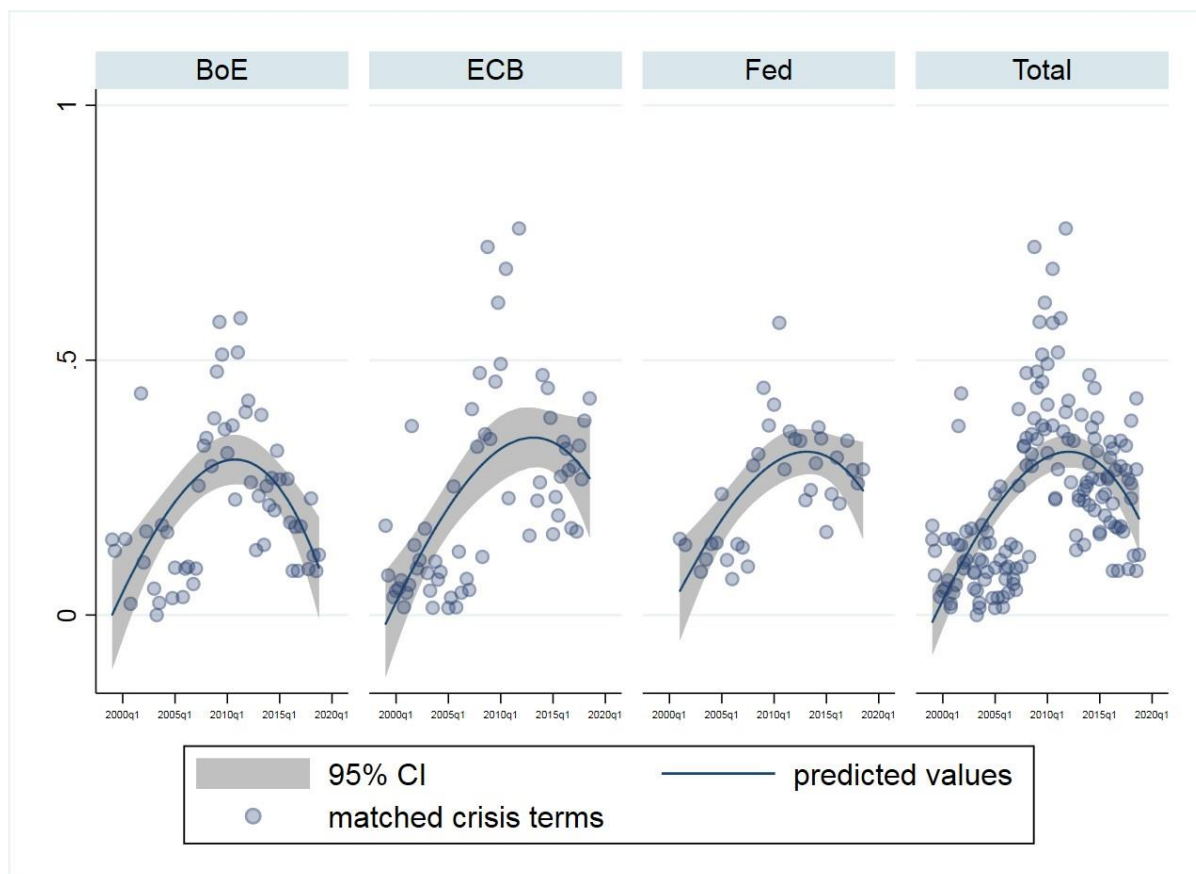
Using the methodology presented in section 3, we are able to describe the evolution of the topics and the tones of the parliamentary hearings in the three cases.

5.1 The content of the parliamentary debate over the years

We are interested in understanding whether central banks and parliamentarians focussed the debates on their objectives. In a principal-agent framework, the purpose of accountability hearings is to allow the principal to monitor whether the agent has pursued the objective it was assigned. Topic analysis is useful in this sense as it allows us to verify whether the discussion focussed on matters related to the central bank’s objective or not. Importantly, as described in the previous section, the central banks under analysis have different mandates, with the ECB and the BoE having price stability as primary objective, whereas the Fed’s statute does not foresee a hierarchy between its multiple objectives, namely price stability, maximum employment and moderate long-term interest rates.

As a preliminary test of the performance of our methodology, we check whether discussions on the crisis follow our expectations. We chose the topic of the crisis as it is easily identifiable in a specific time frame (even if it might not coincide precisely) and as it occurred in all three cases with comparable intensity. In Figure 5, we plot the scores obtained by the text bag associated with the crisis for each central bank.

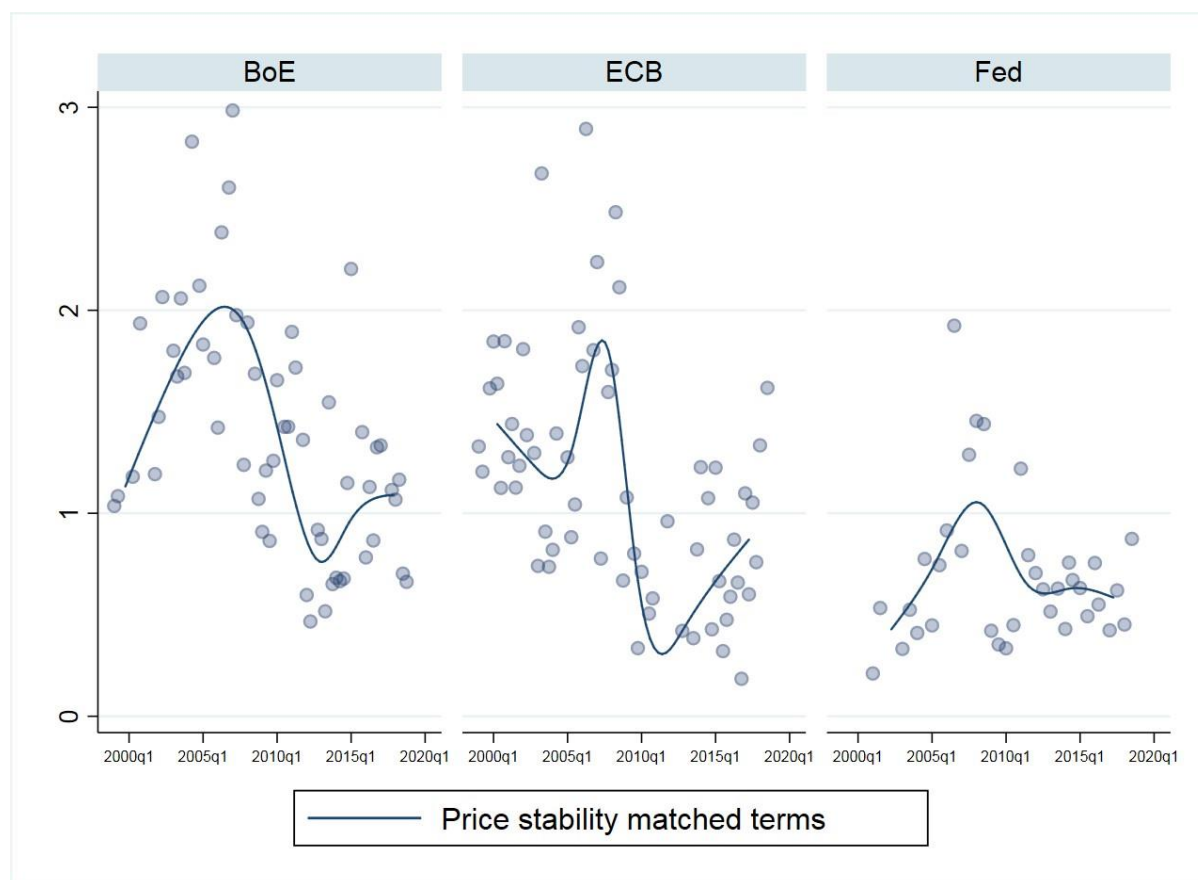
Figure 5: Occurrence of terms related to the crisis in parliamentary hearings, by central bank (1999-2018)



From a visual inspection, the crisis dictionary seems to perform well. In all three cases, the crisis becomes more prominent in the years corresponding to the outburst of the Great Recession, i.e. 2007 and 2008, to then reach its peak around 2010. The peak is particularly pronounced in the euro area as in 2010 the crisis turned into a sovereign debt crisis in several Member States.

We now focus on the mandates of central banks. As it features among the objectives of all three central banks, we would expect price stability to be one a key topic of parliamentary hearings for all three cases. To test this, we match the text bag of price stability with the transcripts of each central bank's parliamentary hearings. Results are displayed in Figure 6.

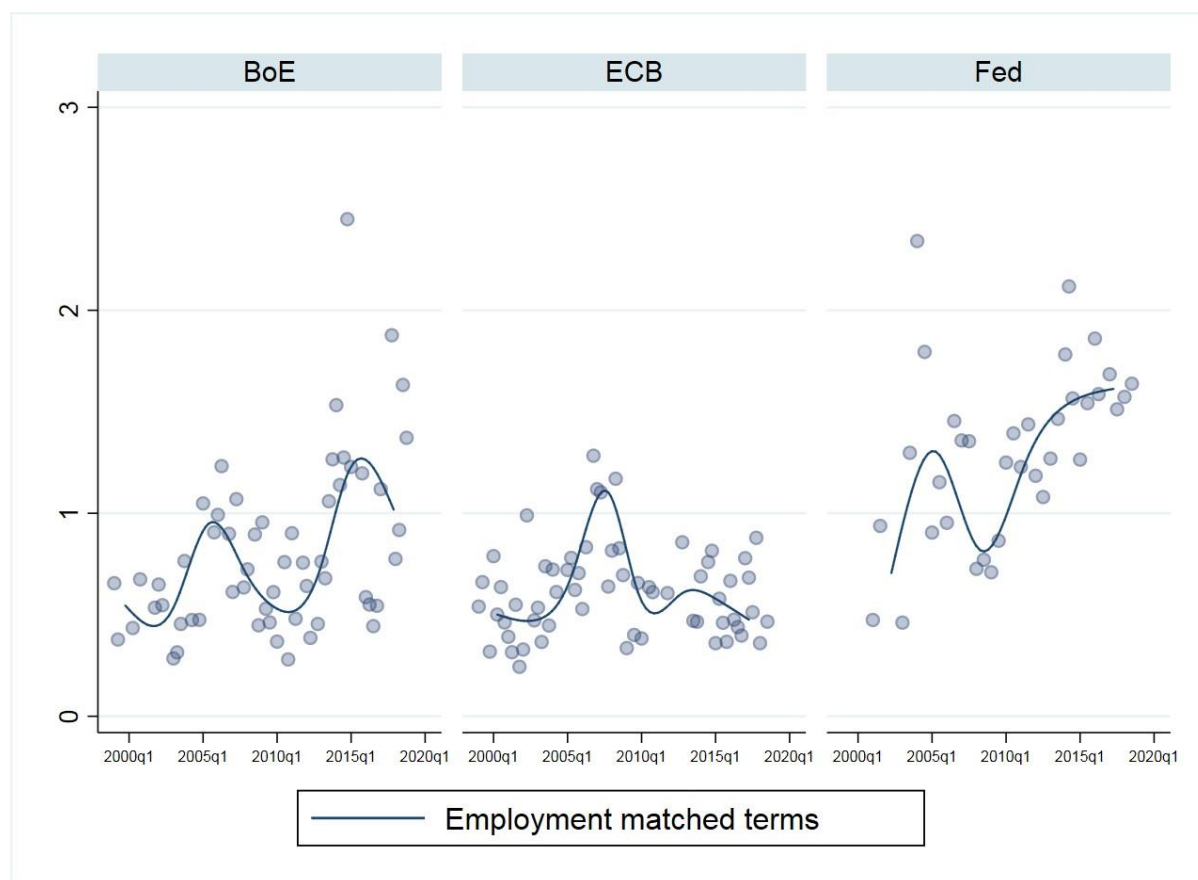
Figure 6: Occurrence of terms related to price stability in parliamentary hearings, by central bank (1999-2018)



Overall, inflationary matters have been more discussed in the hearings of the BoE and of the ECB, the two central banks that have price stability as their primary mandate, than in the hearings of the Fed, for which price stability represents one among its multiple objectives. Despite these differences, debates on price stability followed a similar path in all three central banks, reporting higher values in pre-crisis years, to then fall when the crisis hit their respective economy. The drop occurs in fact around 2007-2009 in the UK and in the US, whereas it occurs in 2010 for the euro area. An intuitive interpretation of this movement is that concerns related to the crisis soon began to dominate the debate at the expenses of price stability considerations.

The relevance of the central bank mandate in driving the focus of discussion is further confirmed by the comparison of discussions around the topic of employment. The Fed, which has maximum employment as one of its objectives, is in fact the central bank that debates the issue with parliamentarians the most: as shown in Figure 7, the Fed tends to have higher scores than the BoE and the ECB on the employment text bag.

Figure 7: Occurrence of terms related to employment in parliamentary hearings, by central bank (1999-2018)

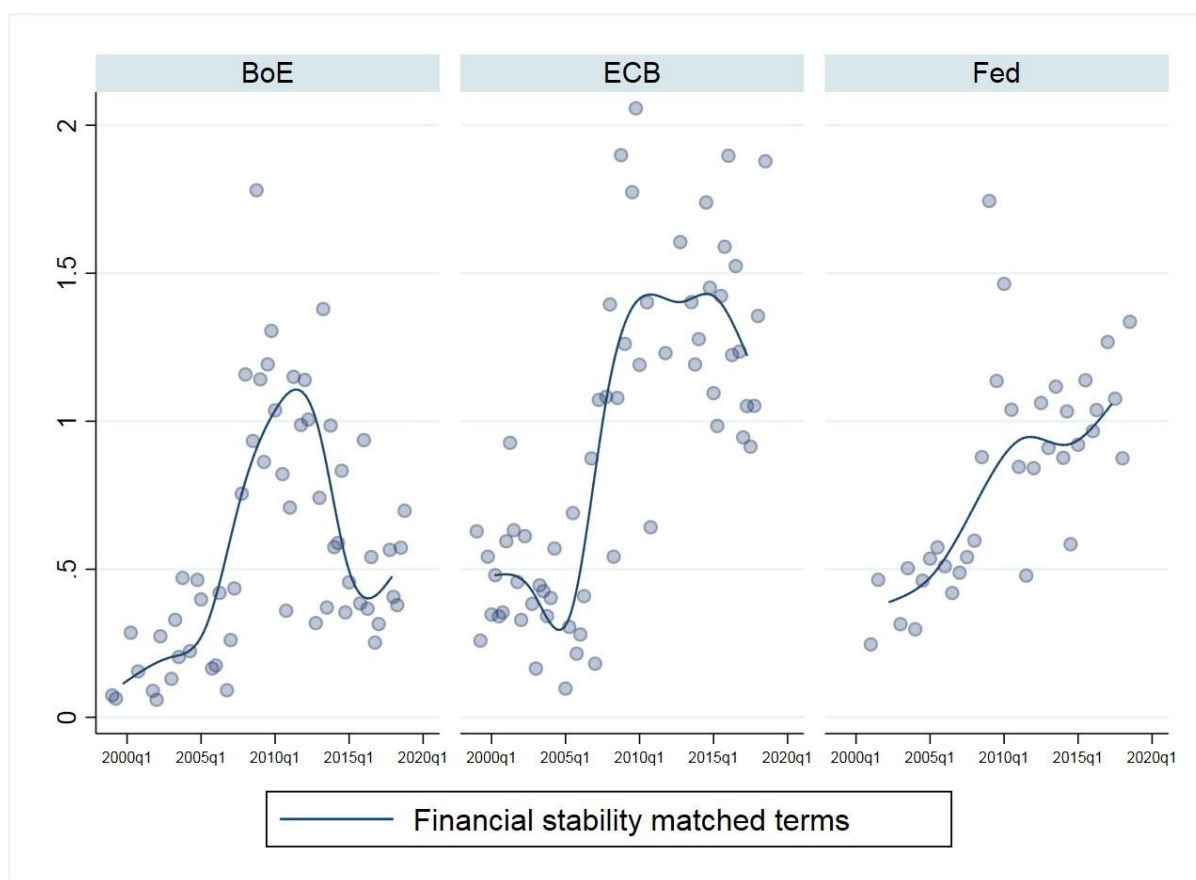


Financial stability represents another topic of relevance for the discussion between central banks and parliamentarians. In line with our expectations, in all three cases financial stability becomes a more prominent topic with the crisis. This change might be not only driven by the increased attention to systemic risks paid by the actors involved, but also by the enhanced role of the central banks during the crisis in addressing financial stability concerns in view of their relevance to the price stability objective.

Figure 8 shows that in the post-crisis period attention toward financial stability undertook different paths across the three cases. While discussions on financial stability decreased substantially for the case of the BoE around year 2013, they remained quite prominent in the debate of the ECB and of the Fed. This phenomenon might be driven by the reform of the Financial Services Act 2012 United Kingdom, creating a parallel arrangement for supervisory accountability.¹⁸ These hearings, as the ones of the Chair of the Supervisory Board of the ECB, are excluded from our analysis, which focusses on the central banking side rather than the supervisory side. Interestingly, while the reform of supervision for the BoE is followed by a drop in the discussion on financial stability, the same does not hold for the ECB, which had a similar reform in November 2014, when the Single Supervisory Mechanism was established and supervisory responsibilities were transferred to the ECB.

¹⁸The Financial Services Act, which entered into force in April 2013, consisted in the transfer of prudential responsibilities from the Financial Services Authority, an independent supervisor, to the BoE (through the Prudential Regulatory Authority). Through the transfer, the reform established a parallel arrangement for supervisory accountability, where separate hearings of the BoE were held on Financial Stability Reports.

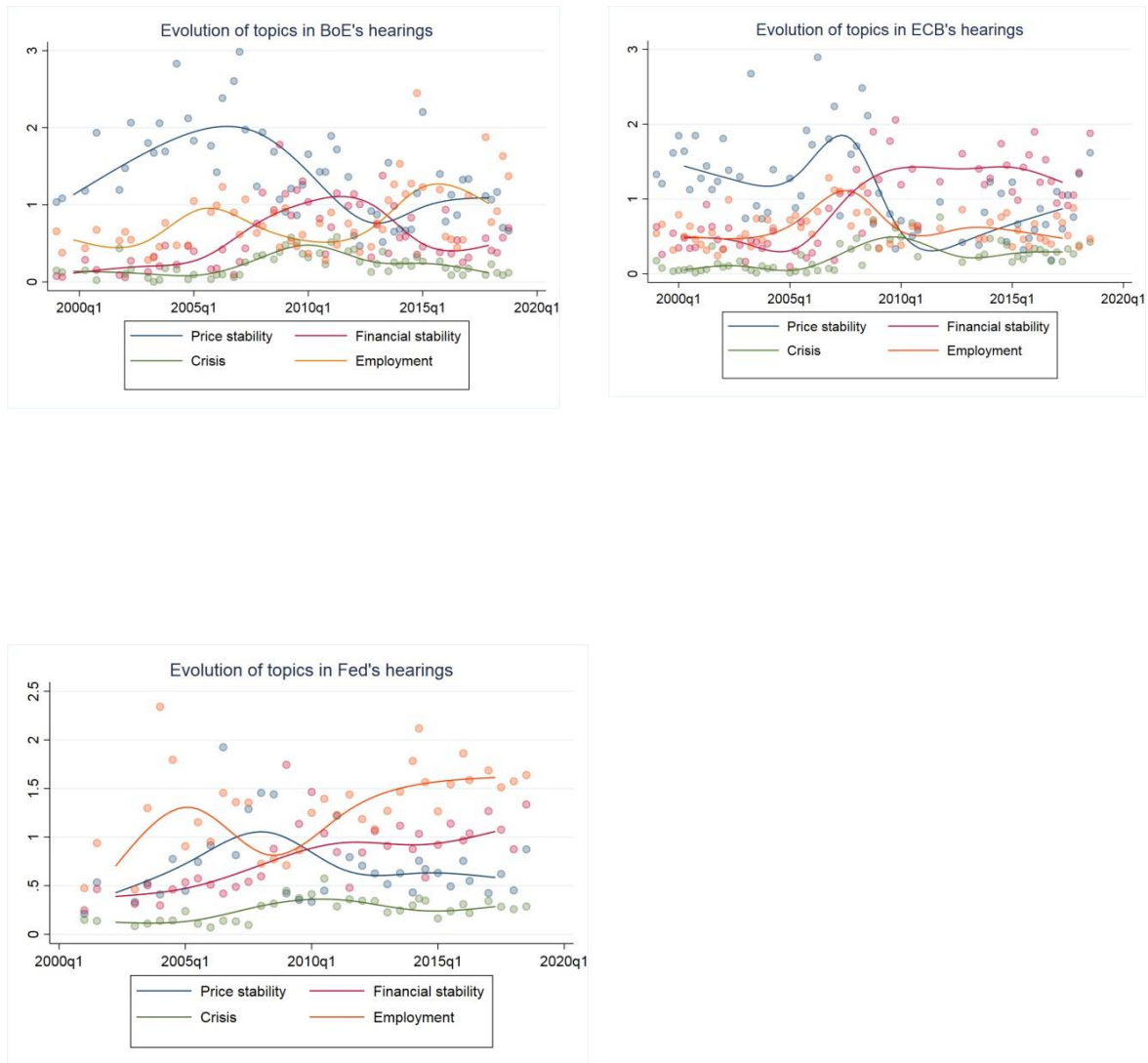
Figure 8: Occurrence of terms related to financial stability in parliamentary hearings, by central bank (1999-2018)



While these figures provide us with a comparison across central banks for a given topic, in Figure 9 we compare the relative salience of each topic for a given central banks. For each central bank, we plot the absolute number of terms matched for the text bags on price stability, financial stability, crisis and employment.¹⁹ This allows us to understand whether, for example, price stability was discussed more than financial stability for a specific central bank.

¹⁹The absolute number of terms matched is a useful metric only for within-central bank comparison due to the heterogeneity of length in transcripts' hearings.

Figure 9: Evolution of topics by central bank (1999-2018)



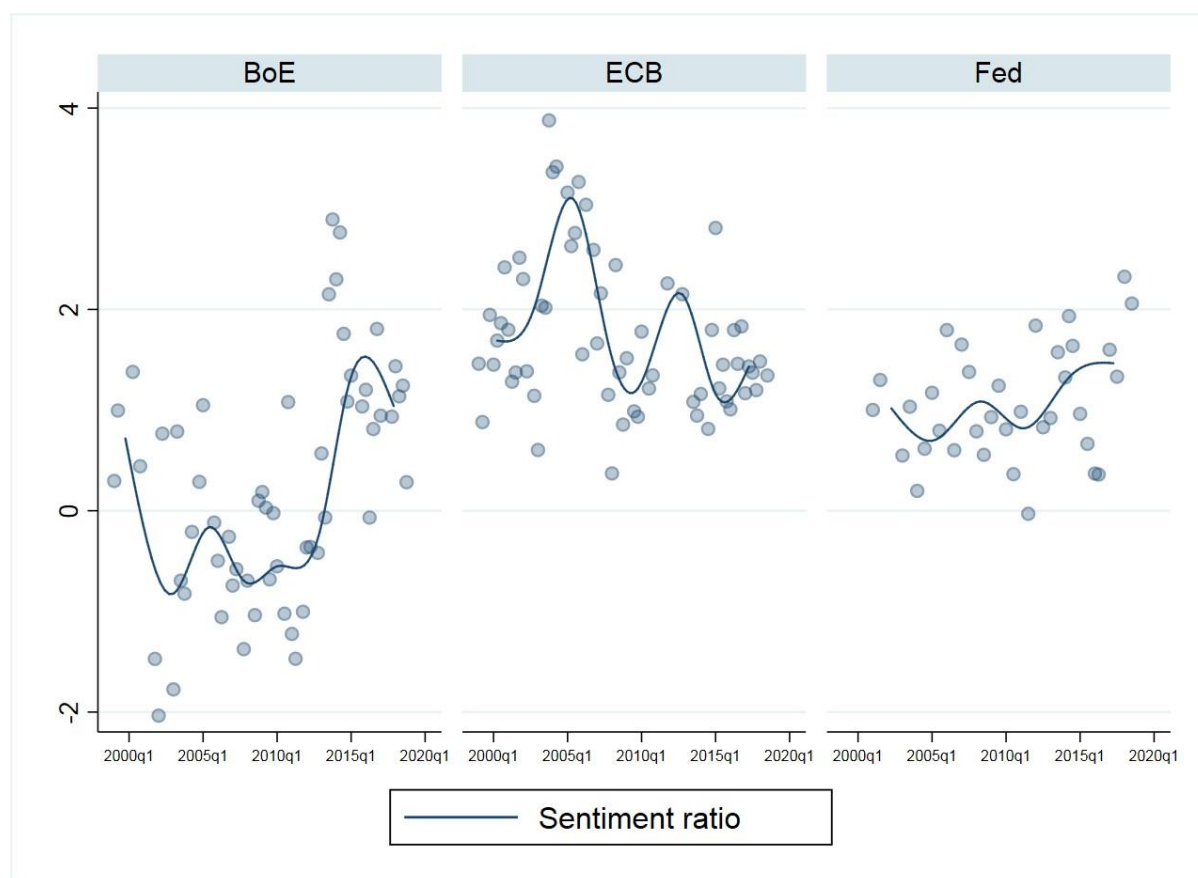
Overall, these findings provide new insights on a concern that emerged throughout the crisis, i.e. the ability of elected representatives to scrutinise the performance of the central bank in reaching its objective(s). The data seems to suggest that parliamentarians were able to confront the central banks on technical matters related to their objectives, making full use of the accountability channels, in spite of the variety of the impact of the crisis on the respect salience of various topics.

5.2 The tone of the parliamentary debate

Figure 10 plots the scores for the sentiment ratios by central bank to account for the tone of the debate. Sentiment ratios fall in 2007-2010, although with different intensity and starting

from different levels. Nevertheless, sentiments are heterogeneous across central banks. They are less volatile in the case of the Fed and overall the ECB displays the most positive score.

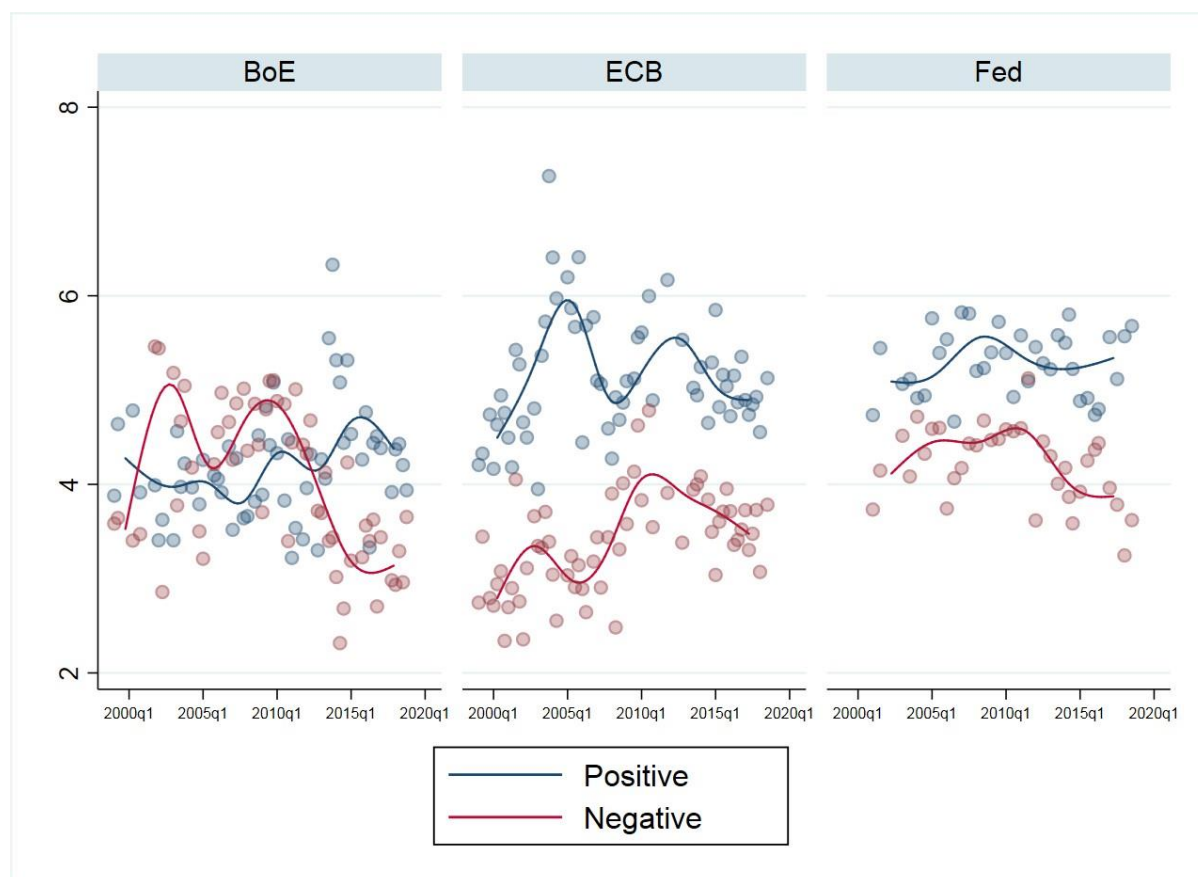
Figure 10: Net sentiment ratios by central bank



Interestingly, while sentiments seemed to follow similar patterns in the period of the crisis for all three cases, they undertook very different paths in more recent years.

While Figure 10 provides an overview of the evolution of sentiments, it does not show whether changes are mainly determined by shifts in positive or negative sentiments. Due to the structure of the scores' equation, lower (higher) sentiments might be driven both by an increase (decrease) in negative sentiments or a decrease (increase) in positive sentiments. Figure 11 thus shows the evolution of two measures of positive and negative tones separately. It emerges that while (positive and negative) tones in the Fed parliamentary hearings tend to be quite stable over time, in the ECB case positive tones tend to vary more and thus have a larger impact on net sentiment. Finally, the net sentiment in the BoE hearings seems to be largely driven by evolution of negative tones.

Figure 11: Positive and negative tone indexes by central bank



A relevant question that remains unresolved regards the actual content captured by our measure of sentiments. Negative sentiments, for example, might proxy not only for a negative, aggressive or confrontational tone in the discussion, but also for depictions by the speakers of a negative economic outlook. The two are however likely to be related, as we would expect that a worst economic performance leads to a more negative assessment of the central bank's performance.

To test for this, we run a panel data regression with country fixed effects²⁰ of sentiment ratios on a number of variables. In particular, we control for (1) the absolute distance (both upward and downward) of the CPI inflation rate (π) from 2% which is the definition of price stability common to the three central banks²¹, (2) the rate of unemployment and (3) a text-based measure of uncertainty. We build this last variable based on Baker, Bloom and Davies (2016), and create a measure based on the matches of the uncertainty-related words in the transcripts.²² We first regress sentiment ratios score on each of these three variables separately, and secondly on all the variables simultaneously. Results are displayed in Table 2.

²⁰ We did not include time fixed effects after we failed to reject the null hypothesis that the coefficients for all years and quarters are jointly equal to zero.

²¹ Specifically, the ECB aims to maintain inflation rates below, but close to, 2% over the medium term.

²² In practical terms, we create a dictionary based on three words: uncertain, uncertainty and uncertainties.

Table 2:

	(1)	(2)	(3)	(4)
<u>Dep. Variable:</u>				
<u>Sentiment Ratios</u>				
$ \pi - 2\% $	-0.293** (0.0583)			-0.287** (0.0530)
Unemployment rate		-0.0967** (0.0112)		-0.0618 (0.0332)
Uncertainty			-3.052*** (0.240)	-3.325*** (0.117)
Observations	153	153	153	153
R-squared	0.058	0.024	0.055	0.131
Number of central banks	3	3	3	3
Country FE	YES	YES	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Distance from the inflation aim is negatively and significantly correlated with sentiments (Tab. 2, Col. 1), suggesting that the more central banks deviate from their inflation aim, the more net sentiments will worsen, due to either higher negative sentiments or lower positive sentiments. This suggests that sentiments are driven by accountability concerns: as the agent deviates from its mandate, the principal tends to have a more negative tone towards it. Moreover, it could be expected that a more negative tone is also related to worse economic conditions. This seems to be confirmed by the significant negative correlation between sentiments and unemployment (Tab. 2, Col. 2): as unemployment grows, sentiments worsen. More generally, also uncertainty is negatively correlated with sentiments, suggesting that as uncertainty mounts, sentiments crumble (Tab. 2, Col. 3). Economic conditions might however be correlated with uncertainty and the distance to the inflation aim. Indeed, when we control for all these three variables together, unemployment is not significant any more, whereas distance from the inflation target and uncertainty remain significant (Tab. 2, Col. 4). Following these results, whose analysis is limited to showing correlation rather than establishing any principle of causation, we can infer that changes in sentiments are driven mostly by accountability and uncertainty concerns. This can be interpreted as a ‘reaction function’ of parliamentarians’ tone to deviations from the inflation aim, which also factors in uncertainty.

As a further robustness check, we regress sentiments on the text-based measure developed by Apel and Blix-Grimaldi (2012) to capture hawkish and dovish stances in monetary policy. Their technique consists in building two dictionaries associated to hawkish and dovish stances on monetary policy. By applying these measures to the Riksbank’s minutes, they find that they are useful to predict future policy rate decisions. Their dictionaries are useful for our purpose of disentangling sentiments from negative economic considerations. We therefore run the same dictionaries developed by Apel and Blix-Grimaldi on the transcripts to capture

when speakers display hawkish or dovish sentiments. From these scores, we extract a hawkish-dovish ratio, based on the difference between the hawkish and dovish score divided by the number of total words in the transcript, similarly to the sentiment ratio. Results are displayed in Table 3.

Table 3

	(1)	(2)	(3)	(4)
<hr/>				
Dep. Variable: Sentiment Ratios				
<hr/>				
Hawk.-Dov. ratio	4.334** (0.696)	3.432** (0.436)	3.432** (0.436)	3.275* (1.099)
Unemployment rate		-0.0441 (0.0256)	-0.0441 (0.0256)	-0.0447 (0.0392)
π - 2%		-0.259** (0.0410)	-0.259** (0.0410)	-0.285** (0.0355)
Uncertainty				-3.292*** (0.0242)
Observations	153	153	153	153
R-squared	0.024	0.081	0.081	0.144
Number of CBank	3	3	3	3
Country FE	YES	YES	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

When regressing sentiment ratios on the hawkish-dovish score, the coefficient is positive and significant. The correlation between positive and hawkish sentiment is however not surprising. In fact, the hawkish dictionary associates economic-related nouns (i.e. inflation, growth...) to a set of adjectives that are overall positive, like “stronger”, “higher”, as they are believed to prelude a hawkish policy stance. The reverse holds for dovish adjectives which include, for example, “weaker” and “decreasing”. While the significance holds when we control for unemployment and distance from the inflation target, it weakens significantly when we include also our measure of uncertainty. As displayed in Tab. 3 Col. 4, sentiments are hence correlated to the deviations from the inflation target and to uncertainty more significantly than the hawkish-dovish ratio.

6. Conclusions

This paper introduced a new methodology to assess central bank accountability based on a systematic process to extract valuable data from accountability practices between central

banks and parliaments. Applying dictionary-based techniques to the transcripts of the parliamentary hearings of the ECB, the BoE and the Fed, we are able to identify the evolution of the topics debated and of the tones of the discussions. This methodology allows us first of all to inspect whether central banks and parliaments used their accountability arrangements to indeed discuss issues related to the central bank's mandate. Secondly, it allows us to investigate whether the tone of the debates remained unchanged throughout the crisis. Our findings show that, in contrast to what has been argued by some critics, the distribution of topics overall reflects a focus on the mandate. The crisis represented a turning point that raised the prominence of financial-stability concerns. However, the crisis impacted heterogeneously across the three cases. Furthermore, we find that while parliamentarians' tone deteriorated during the crisis in the euro area, the UK and the US, they tended to follow different patterns both in the pre-crisis and post-crisis period, with different degrees of volatility. Interestingly, preliminary regression analyses suggest that sentiments are mostly driven by distance of actual inflation to central banks inflation aim and uncertainty, allowing to identify an accountability 'reaction function', whereby parliamentarians' tone react to deviations from the inflation aim, also factoring in uncertainty.

This paper also presents a new approach and new data that provide a basis for further research. While dictionary-based techniques have been largely applied to various text data – from central banks' speeches to parliamentary debates –, this is to our knowledge the first application of such methods to central banks' parliamentary hearings, which provide a rich source of new data. More importantly, this paper introduces a methodology applicable to other central banks that hold parliamentary hearings, allowing for further comparisons of central bank accountability beyond the three cases we analysed. Looking forwards, further attempts could improve the literature on central bank accountability by looking in more details into the various speakers involved in hearings. For instance, future research could look at whether shifts in sentiments are mainly driven by the central bank or by parliamentarians, or whether the individual characteristics of parliamentarians play a role in explaining the tone and focus of their participation in hearings. Moreover, the possible interaction between uncertainty and the distance of actual inflation to central banks' aim in determining the tone of hearings could be investigated. Therefore, while our contribution already provides new insights on central bank's in parliaments, it also opens promising avenues for further research.

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7. Appendix

7.1 Central Bank Accountability Indexes - Measures of accountability in the literature as updated by De Grauwe and Gros (2008) and authors (2018)

Briault et al. (1996)

		De Grauwe and Gros (2008)			
		ECB	FED	BoE	BoJ
1	Monitoring by Parliament	1	1	1	1
2	Publication of the minutes of the decision-making bodies' meetings	0	1	1	1

3	Publication of monetary or inflation reports	0	0	1	0
4	Existence of some kind of override mechanism	0	1	1	1
	Total score	1	3	4	3
	Ranking	4	2	1	2

De Haan et al. (1999)

		De Grauwe and Gros (2008)			
		ECB	FED	BoE	BoJ
Monetary Policy Objective					
1	Central Bank objective defined by the Central Bank law	1	1	1	1
2	Clear prioritization	1	0	1	0
3	Clear definition	0	0	1	0
4	Quantification by Central Bank law (or based on documents based on law)	0	0	1	0
Total for objectives		2	1	4	1
Ranking		2	3	1	3
Transparency of Monetary Policy					
5	Must publish inflation or monetary reports in addition to standard bulletins/reports	0	1	1	0
6	Are the minutes of the monetary policy meetings published within a reasonable time after the meeting	0	1	1	0
7	Must explain publicly to which extent it has reached its objective(s)	1	1	1	1

Total for transparency		1	3	3	1
Ranking		2	1	1	2
Final responsibility of Monetary Policy					
8	Monitoring by the Parliament (besides annual report)	1	1	1	1
9	Has the government right to give instructions?	0	0	1	1
10	Is there some kind of procedure for the implementation of an override mechanism?	0	1	1	1
11	Has the CB possibility of an appeal in case of an instruction?	0	0	0	0
12	Can the CB law be changed by a simple majority in the Parliament?	0	1	1	1
13	Is past performance a ground for the dismissal of a CB governor?	0	0	0	0
Total for final responsibility		1	3	4	4
Ranking		3	2	1	1
Total Accountability		4	7	11	6
Ranking		4	2	1	3

Bini-Smaghi and Gros (2000)

		De Grauwe and Gros (2008)			
		ECB	FED	BoE	BoJ
Ex ante accountability					
1	Clear definition of the objective of price stability	1	0	1	0
2	Announcement of the operational target	1	1	1	1

3	Announcement of the intermediate target	0	0	1	0
4	Announcement of indicators for assessing monetary policy	1	1	0	0
5	Explanation of how monetary policy targets affect other policies and objectives	0.5	0.5	0.5	0.5
Total for ex ante accountability		3.5	2.5	3.5	1.5
Ranking		1	2	1	3
Ex post accountability					
6	Publication of data on intermediate target (or explanation of possible deviation)	0	1	1	0
7	Publication of inflation forecast and deviation from target	0	1	1	0
8	Explanation of main policy measures (or absence thereof) and underlying reasons	1	1	1	1
9	Explanation of how these measures affect other policies	0	0	0	0
Total for ex post accountability		1	3	3	1
Ranking		2	1	1	2
Procedures of accountability					
10	Regular public reports covering issues 1-8 above	1	1	1	1
11	Hearings in Parliament with	1	1	1	1

	Q&A				
12	Participation of government representative at meetings of the decision-making bodies (as observers)	1	0	1	1
13	Publication of summary minutes	0	1	1	1
14	Publication of detailed minutes	0	1	0	0
15	Publication of the votes of the members of the decision-making bodies	0	1	1	1
Total for procedures of accountability		3	5	5	4.5
Ranking		2	3	3	1
Total Accountability		7.5	10.5	11.5	7
Ranking		3	2	1	4

Bini-Smaghi and Gros (2001)

		De Grauwe and Gros (2008)			
		ECB	FED	BoE	BoJ
Monetary policy objective(s)					
1	Definition of the ultimate objective	2	1	2	2
2	Quantification of the objective	1	0	2	0
Total for Monetary policy objective(s)		3	1	4	2
Ranking		2	4	1	3
Monetary policy strategy					
3	Announcement of the strategy (operational target)	2	2	2	2
4	Announcement of the intermediate target	0	0	2	0
5	Announcement of indicators	2	1	0	0
Total for Monetary policy strategy		4	3	4	2

Ranking	1	2	1	3
Publication of data/model/forecasts				
6 Macro model used	1	2	2	0
7 Data on intermediate targets	2	1	2	0
8 Inflation forecasts	1	2	2	0
Total for Publication of data/model/forecasts	4	5	6	0
Ranking	3	2	1	4
Communication strategy				
9 Parliamentary hearings	2	2	2	2
10 Frequency of reports	2	0	1	2
11 Press conferences	2	0	2	2
12 Publication of press releases	2	2	2	0
13 Statement on future moves	1	1	0	0
14 Publication of minutes	0	2	2	2
15 Publication of individual votes	0	2	2	2
Total for Communication strategy	9	9	11	8
Ranking	2	2	1	3
Total score	20	18	25	12
Ranking	2	3	1	4

Hughes-Hallet and Libich (2006)

		De Grauwe and Gros (2008)			
		ECB	FED	BoE	BoJ
1	Monitoring by Parliament (besides annual report)	1	1	1	1
2	Has the government the right to give instructions?	0	0	1	1
3	Is there some kind of procedure for the implementation of an override mechanism?	0	1	1	1

4	Has the central bank the possibility of an appeal in case of an instruction?	0	0	0	0
5	Can the CB law be changed by a simple majority in the Parliament?	0	1	1	1
6	Is past performance a ground for the dismissal of a CB governor?	0	0	0	0
	Total score	1	3	4	4
	Ranking	3	2	1	1

7.2 List of key words for text analysis on selected topics

Price stability key words: price(s), inflate, inflation, inflationary, HICP, CPI, deflation, deflator, deflationary, deflate, hyperinflation, hyperinflationary.

Crisis key words: crisis, crises, recession(s), recessionary, bust(s), stagnate, stagnation(s), stagnating, bubble(s), crash(es), slump(s), downturn(s), default(s), defaulting, turmoil(s).

Financial stability key words: financial (in)stability, bank (in)stability, (financial) crisis, financial stress, financial risk, systemic risk, contagion, financial shocks, bubble, financial imbalance, misalignment, credit growth, banks, insurers, hedge funds, investment funds, financial markets, securities markets, leverage, capital, derivatives, off-balance sheet exposures, special purpose vehicles, off-balance sheet vehicles, payment systems, settlement systems, central securities depositories, non-performing loans, NPLs, non-performing exposures, foreign currency loans, correlated exposures.

Employment key words: employ(-ee/-er), (un)employment, underemployment, firing, fixed-term, full-time, part-time, inactivity, job(s), jobless, labo(u)r, labo(u)r force, labo(u)r market, self-employed, temporary, vacancy(-ies), work(er), workers, working, working (age/time), works.

Uncertainty key words: uncertain, uncertain (-y/-ies).

7.3 Examples of text bags

Example of crisis text bag – Monetary Dialogue, 9 July 2018

Below we provide an example of speech by Finnish MEP Nils Torvalds during the Monetary Dialogue with the ECB of 9 July 2018. This example is particularly interesting because it does not address directly price stability, but rather focuses on the possibility of a crisis. The words matched by our code with the crisis text bag are in bold and underlined.

Mr. Nils Torvalds (ALDE). – *I have two questions for you. I guess that you know the writings of Hans-Werner Sinn very well, especially since one of his books contains the title ‘The next **crash** will be the Draghi **crash**’. He has constantly been critical of the TARGET balances and, when you look at the Italian TARGET balance – that is his obsession, yes, that’s right – it is EUR 500 billion. How much of a **crisis** is that and do the TARGET balances show some indication of problems in the system? Regarding the second question, I’m going to be the rapporteur for the next annual report on the ECB. There is a Finnish saying, which when you translate it into English, says that ‘the goat is the gardener’. On the one hand, you are controlling and supervising the banks, but on the other hand you are, in a way, the goat in the garden. Do you find this problematic or should I, in the report, ask for a division of labour?*

Example of positive net sentiments – Monetary Dialogue, 15 June 2015

As previously done for the text bags related to topics, we test the performance of our text bags and provide an example. We selected the speech by French MEP Goulard, from the political group ALDE (liberals) during the Monetary Dialogue of 15 June 2015, because it is the shortest one of the hearing. The following text displays in green the words that our algorithm categorised as positive, in red the negative ones.

Ms. Sylvie Goulard (ALDE). – *Well, **good** afternoon, Mr Draghi! I would like to **thank** you for being with us and for all that you do for us. We follow very carefully what you do for Europe and we **support** your efforts to be **constructive** and – if I may say so – to stick to the rules for **fairness** and for credibility. But I am **worried**. You have said again, as you did in Helsinki, and as you did in Frankfurt at the Süddeutsche Zeitung Finance Day, that the euro area is **unfinished** business, an **unfinished** construction, and that we need a quantum leap. Are you sure that the governments understand what ‘quantum leap’ means, and would you say that they are not doing what it takes to safeguard growth and investment? If we **lose** a Member State or if there is, at least, a default, I **fear** that all the efforts we have made to strengthen investment and to **support** growth will vanish.*

As we can witness from the text, she addressed the ECB President with a relatively balanced tone, showing her general support for the ECB’s policy, but raising concerns regarding the economic consequences of the political stalemate. The code seems to describe fairly well the tone of the speaker. By detecting six positive terms and five negative ones, it provides a net score that is quite balanced but generally positive and supportive. In the appendix we provide an alternative example of a longer speech characterised by a more negative tone.

Example of negative net sentiments – Monetary Dialogue, 15 June 2015

Mr Miguel Urbán Crespo (GUE/NGL). - First of all, **thank** you for being here, Mr Draghi. As you will know, Greek GDP has **fallen** by 25% since the Memorandum of Understanding conditions were applied, and their impact on the economy has been greater than anything seen since World **War** Two. We are in a type of economic **war** in which the sovereignty and **liberty** of the people of Greece are systematically being **violated**. According to the audit on Greece conducted by the Greek Parliament, which will be presented next Thursday in Athens, serious **irregularities** detected in the management of the **debt crisis** are attributable to the institutions of the former Troika, in particular. Since September 2012, the European Central Bank has been able to purchase an **unlimited** quantity of public bonds from EU Member States via the outright monetary transactions programme. However, not a single Greek Government bond has been purchased via this programme. The Bank has made these purchases conditional on decisions under the European Stability Mechanism, which is a non democratic institution that basically answers to the political interests of the French and German Governments. Mr Draghi, is this not **violating** Article 130 of the Treaty on the Functioning of the European Union, which prohibits the ECB from taking instructions from any outside body or institution? Is it not especially serious when, in this case, it is not a democratically-elected institution? In the same way, your institution has not allowed Greece to access the quantitative easing programme, preventing it since March this year – which just happened to be when Syriza's **won** the election – from purchasing Greek bonds on the secondary market. Could this not be viewed, Mr Draghi, as an act of political **discrimination** which has diverted the European Central Bank from its course in **failing** to comply with the principle of neutrality to which it should adhere? 15-06-2015 7 Might it not be that the ECB is being used as a means of **blackmailing** Greece in the negotiations it is conducting with the European institutions and in the Brussels Group, thereby **violating** the sovereignty of the Greek people expressed at the urns on 25 January? Suicides in Greece have risen by 20% as a result of the way that the **debt crisis** has been managed, while child **poverty** rate there has doubled – today, two in every five Greek children are living below the **poverty** threshold – and three million Greeks have dropped out of the social security system and have no access to healthcare services. Mr Draghi, does this not genuinely look to you like an economic **war** scenario and the result of the economic **war crimes** to which the Greek people are being **subjected**?