Themes and Topics in Parliamentary Oversight Hearings: A New Direction in Textual Data Analysis

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Abstract:

This paper contributes to the growing empirical work on deliberation in legislatures by focusing on the methodology that underpins the textual analysis of parliamentary hearings. An important criticism of textual analysis (both proprietary and open-source) is that it is often difficult to replicate, given the unique features of each software. We explore this criticism by focusing on UK Select Committee Hearings on economic policy oversight during the 2010-2015 Parliament. We challenge the robustness of the output using both thematic, proprietary software (Alceste and T-Lab) and an open-source topic model (Structural Topic Model). We use unique functions available in T-Lab – in conjunction with the open-source software, R – to identify new trends and reinforce existing findings. Our overall focus is not only to suggest a multi-method approach to the textual analysis of parliamentary data, but also to explore more substantive aspects of parliamentary oversight, such as: (1) the extent to which oversight varies between unelected and elected policy makers; (2) whether there exist clear differences between MPs and peers as they deliberate in roughly equivalent committee hearings; and (3) whether parliamentarians conduct oversight more forcefully or more along partisan lines when they are challenging fellow politicians as opposed to central bank officials. Initial findings suggest consistent differences in deliberative styles between types of hearings (fiscal, monetary, financial stability) and between chambers (Commons, Lords).

1 Introduction

We pursue two broad goals in this paper. First, we seek to better understand the form and quality of deliberation in UK parliamentary select committee hearings on economic policy oversight. Inasmuch as these hearings are a key venue for public accountability, they entail a reciprocal dialogue between parliamentarians and both central bankers and Treasury ministers. The latter are under a statutory obligation to provide explanations for objectives held and decisions taken, and in this context, the central purpose of the hearings is deliberation. This paper contributes to the growing empirical work on deliberation by focusing on oversight of monetary policy, financial stability and fiscal policy in both the upper and lower houses of Parliament. Whereas the Treasury Select Committee (TSC) in the House of Commons has sole statutory authority to scrutinise both the Bank of England and the Treasury, the Lords Economic Affairs Committee (EAC) also exercises its own power to hold hearings with these two groups. Hence, studying deliberation in both the TSC and the EAC allows us to vary the deliberative setting to include (1) an elected body (the TSC) questioning both unelected officials from the Bank and elected ministers from the Treasury; and (2) an unelected body (the EAC) similarly questioning both unelected and elected witnesses. The first goal of this study therefore is to gauge the extent to which oversight varies between unelected and elected policy makers, but also to ascertain whether there exist clear differences between MPs and peers as they deliberate in roughly equivalent committee hearings. Relatedly, how have the greater powers of the BoE together with the pursuit of both non-partisan unity and greater assertiveness by select committees shaped the nature of economic policy oversight in the UK? Previously it was found that the during the financial crisis period (during the previous Labour Government), the Treasury Committee conducted oversight with less partisan rhetoric and more substantive deliberation than its congressional committee counterparts (Schonhardt-Bailey (2014)). But, did this change with the subsequent Conservative-Liberal Democrat Government? Andrew Tyrie, Chairman of the TSC, argues in his 2015 book that "Select Committees are now much more effective scrutineers and investigators than they were even five years ago" (Tyrie 2015, p. 33). Does this more effective oversight mean better deliberation in hearings? This study addresses these questions by examining the verbatim transcripts from the hearings of the Treasury Committee and the hearings of the Economic Affairs Committee on monetary policy, financial stability and fiscal policy, for the whole of the 2010-15 Conservative-Liberal Democrat Coalition Government. Textual analysis software is employed to analyse these data in their entirety.

Reliance on textual analysis software is not without its pitfalls, as some have noted (Grimmer & Stewart (2013)). As our second broad goal, we systematically challenge the

robustness of our findings. In so doing, we introduce a methodological approach to textual analysis which combines two previously disparate software toolkits. The aim of our methodological approach is to (1) demonstrate a means by which proprietary (commercial) automated content analysis software can be validated through a series of empirical challenges to the robustness of the findings, and through this validation process, we; (2) map out the complementarities between the two forms of automated textual analysis, which have previously had (as far as we know) no overlap in usage. The validation aim is in direct response to criticism from some methodologists who have dismissed commercial quantitative textual analysis software because "(i)t is often difficult, and sometimes impossible, to validate the output" (Grimmer & Stewart 2013, p. 271) . We agree that it may be difficult but it is certainly not impossible to validate the output. Our second methodological aim brings together two approaches to automated content analysis – thematic and topic modelling – which have previously had little in common (Grimmer & Stewart (2013), Illia et al. (2014)). We demonstrate that while these approaches have different assumptions, algorithms and forms of output, there is nonetheless a common foundation upon which to deepen our understanding of the text under investigation, and using this foundation, there is opportunity to expand the toolkit for automated textual analysis. In short, we argue that by conducting multiple automated content analyses on the same corpus and thereby identifying core threads of the argumentative structure of the content that re-emerge under each analysis, we enhance the certainty as to the validity of our findings. Moreover, in this process, we outline more clearly the commonalities and differences between "themes" and "topics" in political texts. Finally, we argue that our multi-analytic approach facilitates a better understanding of the discourse of parliamentary oversight hearings.

2 Measuring Deliberation in Parliament

(This section is a summary of a more detailed overview of the empirical literature on deliberation in legislatures (Schonhardt-Bailey (2015)).) Scholars of deliberative democracy unfortunately lack a clear consensus on how best to conceptualise "deliberation" (Bachtiger et al. 2010, p. 35); most would agree, however, that deliberative discourse contains reasoned argument. Measuring empirically the existence, the extent and the quality of such reasoned argument in real world settings remains a formidable task. Nonetheless recent studies have sought to gain traction on the empirics of deliberation by isolating and then measuring one or two critical dimensions (e.g., "information" (Mucciaroni & Quirk (2006)); or "open-mindedness" (Barabas (2004))). We adopt this same stance on deliberation, but with the intent being to measure what is arguably the core feature of monetary and fiscal policy

accountability–that is, the provision of explanations for objectives held and decisions taken. Specifically, legislators are expected to challenge Bank and Treasury officials and ministers on their policy decisions and these individuals are, in turn, expected to provide reasons for their decisions. Effective deliberation between politicians and both unelected officials and elected ministers who are being held to account is thus one of engagement and reciprocity (i.e., participants talk to one another and take up others' points).

Previous empirical studies of deliberation in legislatures have typically analysed floor debates, with legislators deliberating the merits of legislation (Steiner et al. (2004), Quirk (2005), Mucciaroni & Quirk (2006), Bachtiger & Hangartner (2010)). In contrast, in this paper (a) the focus is on the varying dialogues between elected legislators and unelected officials and elected ministers; (b) the deliberation itself occurs in committees; and (c) the purpose is to hold both the Bank of England and the Treasury to account, thereby providing a link between economic policy decision making and the will of the voting public. This study thus constitutes a specific type of legislative deliberation. The approach here is also novel in that it does not examine the ex-ante controls that legislators might seek to devise over agencies (i.e., as in principal agent theories (Bawn (1995), Huber & Shipan (2000), Huber & Shipan (2002)), but rather focuses on economic policy hearings. These hearings are an ex-post form of oversight and as such are less well understood by political scientists (McGrath 2013, p. 349), or when examined, are done so in terms of the number of hearings rather than their substantive content (Feinstein (2014)). This study focuses on a specific form of deliberation in committees with legislators and witnesses from both the central bank and Treasury, where the accountability of the latter requires a critical and robust exchange of views between the two sets of participants. And, to be effective, the reciprocal dialogue must allow for a distribution of expertise across the major themes pertaining to economic policy decisions. *In short, deliberation must entail a critical review of the decisions of the witnesses giving testimony across all relevant issues.*

3 Select Committees

3.1 Treasury Select Committee and Economic Affairs Committee

Elsewhere the broader context for the study of UK Select Committee hearings is discussed in depth (Schonhardt-Bailey (2015)). Nonetheless some brief context is required for the hearings on economic policy oversight by both the Commons' Treasury Select Committee and the Lords' Economic Affairs Committee for the 2010-15 Parliament. Following on from that, we explain the structure of our data.

The Treasury Select Committee (TSC) is responsible for overseeing the spending, policies

and administration of both the Treasury and the Bank of England. Scrutiny of the Treasury is most conspicuous in the form of an inquiry into the Budget statement. Following each spring's Budget statement, the committee gathers evidence from witnesses (including the Chancellor of the Exchequer) on the Government's proposals, and then publishes its recommendations and conclusions. In turn, the Government responds to the committee's findings, often incorporating information from the Office for Budget Responsibility.

Similar to other independent central banks, the Bank of England is subject to formal legislative oversight. The objective of UK monetary policy is laid down in the 1998 Bank of England Act, where the stated priority is price stability and "subject to that", the legislation mandates the Bank to support the Government's policies for growth and employment. The Bank pursues an inflation target (currently 2%) which is set by the government. The Bank is independent with respect to the instruments chosen (usually a short-term interest rate, but recently quantitative easing via asset purchases) to achieve the objective of low inflation, without interference from political actors. The Bank's Monetary Policy Committee (MPC) is tasked with formulating monetary policy decisions. With respect to financial stability, financial services reforms of 2012/13 created the Bank's Financial Policy Committee (FPC), which has statutory responsibility for financial stability by lessening the scope for systemic risks and preventing the likelihood of future financial crises (or reducing their impact).

The Treasury Select Committee conducts hearings with representatives from the Bank's MPC[1] and FPC on their policy decisions. In contrast to fiscal policy, the Treasury committee does not produce a subsequent report following these monetary policy and financial stability oversight hearings.

Committees in the House of Lords operate quite differently from those in the House of Commons. Most importantly, Lords committees do not scrutinise government departments in the way that Commons committees do. Instead, Lords committees are more thematically constructed, focusing on four main areas–economics, Europe, science and the UK constitution. And, because individuals typically become peers based on years of experience and excellence in their fields, committees in the upper house typically exploit this expertise in the composition of committee memberships. Whereas since 2010, members in Commons committees are elected with party groups and chairs are elected in a secret ballot by the whole chamber, members of committees in the Lords are appointed by more traditional means–namely, via the whips. Broadly speaking, investigative committees in the Lords have a reputation for investigating issues that are both "more strategic" and "more technical"–thereby reflecting the expertise of their members (Russell 2013, p. 210). In a recent comparison of Commons and Lords committees, Russell has described the latter as "less adversarial" in hearings with experts (Russell 2013, p. 211).

The Economic Affairs Committee (EAC) is responsible for reviewing economic affairs–which, broadly defined, may range from tax avoidance to the economic ramifications of shale gas. The EAC conducts occasional hearings, some of which contribute to formal reports and others are meant as information gathering exercises. Of significance is that the EAC is a relatively new committee, growing from ad hoc status in 1998 (to monitor the new MPC, as the Blair-Brown Labour Government made the Bank independent) to permanency in 2001.

3.2 Data

As outlined above, the Treasury Select Committee holds regular hearings with MPC members on the Bank of England's Quarterly Inflation Report[2] and with FPC members of the Bank on the Financial Stability Report.[3], and with the Chancellor of the Exchequer on the government's budget. In contrast, the hearings of the Economic Affairs Committee are less frequent for both monetary and fiscal policy, and for the period of this study it held no hearings on the Financial Stability Report[4]. Appendix A lists the hearings included for each committee for the 2010-15 Conservative-Liberal Democratic Government: in total, thirty for the TSC (sixteen on monetary policy, seven on financial stability, and seven on fiscal policy), and seven for the EAC (four for monetary and three for fiscal policy). Further appendices in (Schonhardt-Bailey (2015)) provide details of the committee memberships and partisan affiliations, and a full list of witnesses who gave oral evidence in each committee hearing, along with the committee members appearing for each hearing.

The data are initially structured into five text files, comprised of the above hearings for each committee–that is, each committee's hearings on economic policy are separated into those covering monetary policy, financial stability and fiscal policy. The text files are structured so that each speech or remark constitutes a "case", and each is identified (or "tagged") with identifying characteristics–the name of the speaker, his or her party affiliation (including "crossbenchers" for the Lords and "no party" for central bank officials and Treasury witnesses), the speaker's role (committee chair, committee member, MPC internal member, MPC external member, Chancellor, Treasury staff), and the date of the hearing. All the hearing transcripts are analysed in their entirety.

4 Our Methodological Approach

We identify and explore two broad approaches to automated textual analysis, each with different assumptions as to the context in which words appear in a text. The first approach–which we call "thematic" (and elsewhere is referred to as keyword-in-context, or KWIC [Illia et al. (2014)])–assumes that speakers of textual data convey meaning in a distinctly thematic

fashion, so that it is not just the words that help to classify content but also the context in which the words appear. Thematic approaches to textual data are particularly effective in settings in which the form of argumentation or deliberation is of research interest, as it allows one to capture the sequencing, reciprocal and interactive nature of the argumentative structure. In the pre-processing stage, words are reduced to their lemmas and aspects of the text such a punctuation are retained in order to identify how words appear together in a section of text. Software using this approach employs co-occurrence analysis to examine the bivariate associations between words and phrases in order to map out concept clouds (specifically, the existence of words and phrases that tend to co-occur in a statistically significant way), and the relationships between concept clouds within a single corpus. Aside from the use of the chi and phi coefficients to measure associations, this approach also relies upon multiple spatial representations of the associations (correspondence analysis, dendrograms [or distance trees]) to capture relationships between themes in the corpus and independent variables which identify unique characteristics of the authors of the text (names, party affiliation, role, etc) and the setting (speech, hearing, date, place). A second approach to automated content analysis is topic modelling. Topic models (Blei & Lafferty (2006), Blei & Lafferty (2009)) have been employed to capture the content of political texts (Grimmer (2010), Quinn et al. (2010), Proksch & Slapin (2014)), where the task is automatically to classify the contents of documents into "topics". These models do not conceptualise the text under investigation as inherently argumentative or deliberative–and particularly not in a way that would require a reciprocal and interactive mode of communication among the participants. Rather, these models conceptualise the textual data more as what Goodin (Goodin (2000)) describes as "notice posting"–that is, more as a one-way flow of communication. So, for these models, the order of words and the order of phrases in a document do not inform the analysis;[5] rather, the text is viewed as a "bag of words." Instead of lemmatisation, these models further simplify the vocabulary by reducing words to a single root ("stemming")–where, for example, *institution, institutions, institutional* might all conform to institution. As one review of this approach notes (Grimmer & Stewart 2013, p. 272), stemming is a "crude" but "faster" form of "lemmatisation", with the latter employing word and sentence context (including punctuation) and dictionaries for a richer, more nuanced mapping of the text.

Thematic and topic modelling both seek to provide the researcher with valid output. The key difference is that widely used thematic software (for a full list, see (Illia et al. (2014))) are commercial software and so the complete algorithms are not open-source, whereas most topic models in academic research are open-source software. This leaves the critics of thematic approaches arguing that "it is difficult to know if the methods included in the commercially

available software are optimal for the particular problem at hand" (Grimmer & Stewart 2013, p. 271). We seek to address this difficulty. Our key task in examining the parliamentary oversight hearings is to ascertain the extent to which witnesses are effectively held to account. Do they answer the questions asked? Is the dialogue reciprocal or diversionary? Are parliamentarians more interested in making partisan jabs than in uncovering and understanding the reasons for decisions made and actions taken? The empirical goal is to establish a robust methodology which is "optimal" for this particular problem and which provides us with a means to validate our output.[6]

5 Cluster Matching

The Treasury Select Committee (TSC) and the Economic Affairs Committee (EAC) hold hearings based on a variety of policy areas. As such, we can neatly segregate the data into five distinct corpora as follows: TSC Monetary Policy, TSC Financial Stability, TSC Fiscal Policy, EAC Monetary Policy, and EAC Fiscal Policy. In this section we analyse each of these independently using the software Alceste, forming classes using the words contained only in a given hearing. We then compare the results obtained with those from an additional proprietary software, T-Lab, which we apply on an identical dataset. As a further robustness check, we compare results obtained with T-Lab and Alceste with those derived from fitting a Structural Topic Model (STM) to a dataset which combines the five corpora into a single collection.

The three approaches are similar in that they constitute unsupervised classification methods, which allow us to analyse the discourse in UK select committees without pre-coding or pre-classifying the original documents. An important criticism of unsupervised textual analysis methods is that they are often difficult to replicate, given the unique features of each software. We suggest that, by using different approaches, it is possible to validate the results obtained with a particular software – in this case, Alceste – therefore increasing the robustness of the results obtained.

Our validation method proceeds by first fitting the algorithms of the three software. We then interpret separately the output produced by each software. Finally, we compare the content of the resulting thematic classes in order to assess to what extent the classification produced by Alceste can be replicated using different classification methods. In the remaining part of this section, we briefly outline the algorithm employed by each software, followed by a comparison of the classes and topics formed in each case.

5.1 Alceste

Alceste is a proprietary thematic analysis software, meaning it considers co-occurrences across lexical units (key words) to form stable classes that are representative of the text. The software proceeds by identifying a set of 'gauged sentences' (or Elementary Context Units, ECUs), from a pre-existing division of the text specified by the user (Schonhardt-Bailey (2005)). This constitutes the sampling unit of the analysis. In our case, it is represented by single interventions in committees hearings.

Using the occurrence of words in each ECU, Alceste builds the classification using a iterative descending hierarchical classification algorithm which decomposes the classes until a predetermined number of iterations fails to result in further significant divisions (Reinert (1998)). More specifically, it operates upon the corpus as follows:

1. Parsing of the vocabulary.
2. Transforming the corpus into a sequence of Elementary Context Units (ECUs) containing lemmas and operates a descending classification which produce stable classes of these ECUs, leaving what does not fit in these classes remain unclassified.
3. For each stable class, it operates a series of statistical characterisations, thereby forming a lexical world.
4. The lexical world is free to be interpreted by the operator.

Step 4 –class interpretation and labelling– is the most important for substantive interpretation. It requires the researcher to apply semantic meaning to a list of characteristic lemmas and ECUs ordered by their ϕ and χ^2 values. This involves first looking at the list of the most representative words for each semantic class and, second, analysing the ECUs most strongly associated with each class. The labelling process is repeated for each class, until the user has assigned a label to all lists – after which, more complex analyses (i.e. dendrograms, correspondence analysis etc.) can begin. This process was applied to each of our five corpora individually. The results of the labelling process are displayed in Table 1.

Table 1: Alceste Class Labels

Corpus	Label
TSC MP	Bank of England Lending Facilities
TSC MP	Real Economy, Productivity & Competitiveness
TSC MP	Monetary Policy Decisions & Decision Making Process
TSC MP	Inflation Forecast & Outlook for Inflation
TSC MP	Forward Guidance & Outlook for Monetary Policy
TSC FP	Tax and Benefits
TSC FP	Budget Process and Role of Ministers
TSC FP	Budget Leaks
TSC FP	Economic Effects of Budget
TSC FP	Public Deficit and Debt
TSC FS	Bank Capital, Leverage & Lending Capacity
TSC FS	Housing & Household Indebtedness
TSC FS	Governance of the Bank of England
TSC FS	Barclays and LIBOR
EAC MP	Pensions, Savings & Annuities
EAC MP	Real Economy & Economic Forecasts
EAC MP	Financial Stability & Macro Prudential Policy
EAC MP	Banking & Bank Regulation
EAC MP	Too Big to Fail & Bank Resolution
EAC MP	Stress Testing Banks & Bank Lending
EAC FP	Energy, Energy Prices, Gas & Shale Oil
EAC FP	Real Economy & Bank Lending
EAC FP	Financial Services & Regulation
EAC FP	Scotland & Regions

5.2 T-Lab

Similar to Alceste, T-Lab employs a thematic approach to classification, considering co-occurrences between lexical units. As well as being algorithmically independent, T-Lab also offers more opportunities to tailor its methods to the particular research question and data. As such, this brief description of methods will also justify any methodological or algorithmic decisions.

To begin, unlike in Alceste, the classification of lemmas is conducted using the Term frequency–inverse document frequency measure (or tf-idf for short). The tf-idf was first proposed by Salton (1989) and has the following form; where for every term i in j document (N documents in total):

$$w_{i,j} = \frac{tf_{i,j}}{\max f_{i,j}} \times \log \frac{N}{df_i}$$

T-Lab can use a supervised (ascending) classification, unsupervised (descending) classification or a mixture of both, We choose the latter by using an unsupervised classification method and then refining these results using a supervised method. T-Lab provides two variants for seeding the algorithms: bisecting K-means, or PDDP and K-means. The two methods vary by how the seeds of each bisection are calculated. A bisecting k-means analysis gains its seeds for each bisection through an iterative algorithm. In the PDDP (Principal Direction Divisive Partitioning) and K-means method, the seeds are computed through a Singular Value Decomposition (see Boley (1998)). Once the seeds have been selected they are then used for each K-means bisection, much like the first method (Lancia (2017)). As for deciding the most appropriate seeding to use, (Savaresi & Boley 2004, p. 361) compared the two methods and concluded "the best compromise between computational effort and cluster quality is to use K-means initialised with the PDDP result". Hence, to obtain the best results with the computational resources available, in his thematic analysis we run an unsupervised clustering using the PDDP and K-means process.

Once the initial clusters have been calculated, T-Lab gives the option to refine the results of the obtained partition. The first variant is a Naive Bayes Classifier, which allows the analyst to remove from the analysis all context units that do not pass a given criteria. A second method to refine the partition is offered by a reclassification based on typical words, which performs a supervised classification by considering the characteristic lemmas as items of a category dictionary. This second method is more selective and hence tends to harbour a lower ECU classification rate. Despite this, we select this refining method because: (1) the loss of elementary contexts is only marginally greater than the alternative; and (2) it arguably offers a more precise and rigorous classification.

Once the partitions have been refined, the researcher then assigns meaning to each class

in a similar way to that in section 5.1. The final labels are displayed in Table 2.

Table 2: T-Lab Class Labels

Corpus	Label
TSC MP	Outlook for inflation and Inflation Expectations
TSC MP	Bank Lending to SMEs
TSC MP	Scotland and Foreign Exchange Reserves
TSC MP	Real Economy and House Price Growth
TSC MP	Quantitative Easing Discussions
TSC FP	Housing Benefit
TSC FP	Fiscal Deficit and Government Debt
TSC FP	Ministerial/Cabinet Involvement in the Budget Process
TSC FP	Income Tax Rates
TSC FP	Bank Lending to SMEs
TSC FS	Bank Stress Tests, Mortgage Lending and House Prices
TSC FS	Bank of England Governance and FPC/MPC
TSC FS	LIBOR
TSC FS	Parliament and Govt Roles in respect of FPC/PRA
EAC MP	Inflation Outlook and the Economy
EAC MP	Bank Capital and Lending
EAC MP	Scottish Referendum
EAC MP	Leverage Ratio for Banks
EAC MP	QE and Pension Investment
EAC MP	Bank Policy Committee Decision Making
EAC FP	Tax Measures (Notably Energy)
EAC FP	Financial Crisis/International Debt Problems (especially Ireland)
EAC FP	EU/Financial Services/Regulation
EAC FP	Scotland

5.3 Structural Topic Model

Our final method is the structural topic model (STM), which employs a different approach to textual classification. The two prior approaches consider co-occurrences, and by extension assume the position of words with respect to one another carries significant semantic implications. Topic models on the other hand, follow a 'bag of words' approach. A bag of words model is a simplifying characterisation where documents are represented as vector of word frequencies. Each entry of the vector is constituted by the frequency with which a particular term occurs in the document.

STM builds upon previous topic models, including the Latent Dirichlet Allocation (LDA) (Blei et al. (2003)) and Correlated Topic Model (CTM) (Blei & Lafferty (2007)). Similar to LDA, the STM is a generative model of the text: its algorithm defines a data-generating

process for each document and then observed word frequencies are used to find the most likely values for the model parameters.

Topics are conceived as joint probability distributions over documents and words. A single topic is defined as a mixture over words where each word has a probability of belonging to a given topic. A document is itself a mixture of topics – that is, a single document can be composed of multiple different topics depending on its constituent words. More specifically, topical *content* refers to the probability that a given word from the vocabulary can be found within a document, whilst topical *prevalences* refer to the probability a particular document belongs to a topic. Topic content is used for identifying the hidden semantic structures within the documents, while topic prevalences are used for analysing the occurrence of a given semantic class within a particular document.

The key innovation of the STM is the inclusion of document level meta-data (covariates) into the analysis (see Roberts et al. (2014)). In each case, each document (in our case each intervention in the hearing) is assigned a list of covariates (i.e. chamber, party, etc). This allows the user to examine the relationships between topics and document level covariates to gain a deeper understanding of the text. In particular, it allows the researcher to condition the analysis of topic prevalence across the set of covariates. We will refer to this particular feature of STM in a subsequent section.

With respect to fitting the algorithm to the corpus, two features of STM should be noted. First, the user must define the number of topics, K, prior to the analysis. In this case, we opt for a model with K=30 topics after exploring the performances for alternative specifications ranging from 25 to 40 topics. Such topic range was suggested by exploring model performance for the held-out likelihood, a commonly used metric of model fit for topic model (Wallach et al. (2009)), for the dataset of interest. We describe this method in detail in Appendix B. Furthermore, as mentioned a key feature of STM is the possibility of comparing topic prevalence across hearings. For this reason, we fit the algorithm to the a dataset comprising the five hearings combined.

We report the labels obtained from the STM fit with K= 30 topics in Table 3. These are obtained by analysing the topical content for each semantic class identified by the algorithm, a process which is analogous to that carried out for Alceste and T-Lab. Topical content remains qualitatively similar when a slightly larger number of topics is allowed.

From Table 3 it can be noted that the algorithm derives a series of 'discussion topics' which exhibit high probability on terms such as 'ask' or 'yes' (for example, topic 3 in Table 3), and as a consequence, are of little substantive interest. Typically themes consisting predominantly of non-substantive discussion words are absent or less prevalent in thematic software, since the number of obtained classes is smaller.[7] However, when the discourse

under investigation contains a large share of unique contextual language – e.g. parliamentary/legislative committee rhetoric – this can appear as a unique theme (Schonhardt-Bailey (2006)).

Table 3: STM Topic Labels

Topic #	Label
1	Labour Market/Economic Growth
2	Bank Lending to SMEs
3	Policy Discussion/Form of Policy
4	LIBOR
5	Real Economy/Investment
6	Path of Expected Inflation
7	Housing Market/New Home Building
8	Quantitative Easing
9	Policy Discussion
10	FPC/Household Debt
11	Transmission of Policy to the Economy
12	European Union
13	Policy Discussion
14	Accountability to the TSC
15	Rebalancing of Debt and Imbalances
16	Borrowing Costs/Transmission of Monetary Policy
17	FPC/Bank Capital and Stress Tests
18	Policy Discussion
19	Eurozone/Global Risks to the UK
20	Scotland
21	Monetary & Fiscal Policy Mix
22	Policy Discussion
23	Bank of England Governance/Oversight Committee
24	Fiscal Outlook
25	(Reform of) Bank Regulation
26	(Reform of) Bank Capital
27	Fiscal Policy/Tax and Benefits
28	Public Spending Controls
29	MPC Process and Transparency
30	Financial Market Volatility

5.4 Matching Topics and Themes

To follow our aim of producing robust textual analysis results, we must compare outputs from these various methodologies. A high proportion of matching topics and themes would imply that our results are representative of the true nature of committee discourse. However, a lower matching proportion would suggest that our outputs are more a result of model choice than input data.

This paper aims to demonstrate robustness of our Alceste findings, and hence we will attempt to match those results with T-Lab and the STM respectively. Matching labels may lead to inaccuracies caused by the sequential nature of labelling, leaving the results more prone to human biases/errors. At the same time, all three methods provide lists of characteristic words, and it is these that we compare when matching classes. In the cases in which a correspondence is not immediately clear from the list of characteristic words, we compare the representative ECUs produced in the Alceste detailed report with documents closely associated with each term in both T-Lab and STM. Below we report the labels for classes which exhibit similar linguistic content across the different software. Specifically, Table 4 matches T-Lab classes to the Alceste output, and Table 5 matches STM topics to the Alceste output. Appendix D reports a detailed overview of the characteristic words used to derive each label and compare software output.

When matching classes from Alceste and T-Lab, only those from the same corpus can be compared. For example, a T-Lab class from a financial stability hearing cannot be matched with an Alceste class from monetary policy, because they originated from different sets of documents. After comparing characteristic words and lemmas from both programs, the results of the matchings are displayed in Table 4. We obtain a matching rate of 0.75 (18 out of 24). That is, 75% of classes identified in Alceste reemerge when the documents are examined in T-Lab, thereby reinforcing the hypothesis that these semantic structures reflect the true nature of committee dialogue.

Table 5 matches our output from the Structural Topic Model with that from Alceste. A difference between the classification in STM and Alceste is that some STM topics can be related to more than one thematic class. This is because STM has been run on the whole corpus while Alceste has been used on the five hearings separately. Most likely, this does not relate to differences in software; it rather depends on the different level of aggregation in the dataset. Supporting this view, general themes (for example, related to the economic trends etc.) that appear in more than one type of committee hearing tend to be grouped under a single topic. Some topics are not matched to a thematic class. Again, this is likely due to the different corpora used. A further reason is the different parameters applied to STM - the higher number of topics (30) used with respect to about 24 thematic classes. In

order to reconcile the five hearings Alceste classification with the combined hearings STM classification, we specify a 25 class thematic analysis in Appendix C. The reason we do not use this, is because a pre-requisite of thematic software is the existence of a unifying conceptual discourse – mixing hearings across chambers and across policy types violates this prerequisite. Despite these differences, we are able to recover most of the classes produced in Alceste from the topic model.[8] Overall, we see the reemergence of all the semantic structures uncovered by Alceste.

We have employed two methods to reinforce our clustering analysis from Alceste. Using T-Lab, a similar but distinct thematic textual software, 75% of the classes are reinforced. Using a topic model with different underlying assumptions and corpus, we are still able to recover most of the thematic classes identified by Alceste: about 70% of the topics identified by STM finds correspondence in the Alceste output. Given this high level of correspondence across all three models, we can move on to study topic/class prevalences across our tagged covariates.

Table 4: Alceste Classes and their Matching T-Lab Classes

Corpus	Alceste Label	Matching T-Lab Class
TSC MP	Bank of England Lending Facilities	Bank Lending to SMEs
TSC MP	Real Economy, Productivity & Competitiveness	Real Economy and House Price Growth
TSC MP	Monetary Policy Decisions & Decision Making Process	Quantitative Easing Discussions
TSC MP	Inflation Forecast & Outlook for Inflation	Outlook for Inflation and Inflation Expectations
TSC MP	Forward Guidance & Outlook for Monetary Policy	-
TSC FP	Tax and Benefits	Income Tax Rates
TSC FP	Budget Process and Role of Ministers	Ministerial/Cabinet Involvement in the Budget Process
TSC FP	Budget Leaks	-
TSC FP	Economic Effects of Budget	Bank Lending to SMEs
TSC FP	Public Deficit and Debt	Fiscal Deficit and Government Debt
TSC FS	Bank Capital, Leverage & Lending Capacity	-
TSC FS	Housing & Household Indebtedness	Bank Stress Tests, Mortgage Lending and House Prices
TSC FS	Governance of the Bank of England	Bank of England Governance and FPC/MPC
TSC FS	Barclays and LIBOR	LIBOR
EAC MP	Pensions, Savings & Annuities	QE and Pension Investment
EAC MP	Real Economy & Economic Forecasts	Inflation Outlook and the Economy
EAC MP	Financial Stability & Macro Prudential Policy	Leverage Ratio for Banks
EAC MP	Banking & Bank Regulation	-
EAC MP	Too Big to Fail & Bank Resolution	Bank Capital and Lending
EAC MP	Stress Testing Banks & Bank Lending	-
EAC FP	Energy, Energy Prices, Gas & Shale Oil	Tax Measures (Notably Energy)
EAC FP	Real Economy & Bank Lending	-
EAC FP	Financial Services & Regulation	EU/Financial Services/Regulation
EAC FP	Scotland & Regions	Scotland

Note: The table matches the labels of the semantic classes produced by Alceste with T-Lab clusters which exhibit a similar linguistic content. Appendix D reports a detailed overview of the characteristic words produced by the two software.

Table 5: Alceste Classes and their Matching STM Topics

Corpus	Alceste Label	Matching STM Topic
TSC MP	Bank of England Lending Facilities	(2) Bank Lending to SMEs
TSC MP	Real Economy, Productivity & Competitiveness	(1) Labour Market/Economic Growth
TSC MP	Monetary Policy Decisions & Decision Making Process	(29) MPC Process and Transparency
TSC MP	Inflation Forecast & Outlook for Inflation	(6) Path of Expected Inflation
TSC MP	Forward Guidance & Outlook for Monetary Policy	(6) Path of Expected Inflation
TSC FP	Tax and Benefits	(27) Fiscal Policy/Tax and Benefits
TSC FP	Budget Process and Role of Ministers	(4) LIBOR
TSC FP	Budget Leaks	(14) Accountability to the TSC
TSC FP	Economic Effects of Budget	(5) Real Economy/Investment
TSC FP	Public Deficit and Debt	(15) Rebalancing of Debt and Imbalances
TSC FS	Bank Capital, Leverage & Lending Capacity	(26) (Reform of) Bank Capital
TSC FS	Housing & Household Indebtedness	(7) Housing Market/New Home Building
TSC FS	Governance of the Bank of England	(23) Bank of England Governance/Oversight Committee
TSC FS	Barclays and LIBOR	(4) LIBOR
EAC MP	Pensions, Savings & Annuities	(11) Transmission of Policy to the Economy
EAC MP	Real Economy & Economic Forecasts	(6) Path of Expected Inflation
EAC MP	Financial Stability & Macro Prudential Policy	(10) FPC/Household Debt
EAC MP	Banking & Bank Regulation	(26) (Reform of) Bank Capital
EAC MP	Too Big to Fail & Bank Resolution	(25) (Reform of) Bank Regulation
EAC MP	Stress Testing Banks & Bank Lending	(17) FPC/Bank Capital and Stress Tests
EAC FP	Energy, Energy Prices, Gas & Shale Oil	(5) Real Economy/Investment
EAC FP	Real Economy & Bank Lending	(16) Borrowing Costs/Transmission of Monetary Policy
EAC FP	Financial Services & Regulation	(12) European Union
EAC FP	Scotland & Regions	(20) Scotland

Note: The table matches the labels of the semantic classes produced by Alceste with STM topics which exhibit a similar linguistic content. Appendix D reports a detailed overview of the characteristic words produced by the two software.

6 Topic/Class Prevalences

To gain a more in-depth understanding of committee dialogue, we can examine the relationships between clusters and tagged covariates. The ways in which thematic software and structural topic models study cluster prevalence are distinct yet complementary. Alceste (and T-Lab) model these relationships spatially, using a correspondence analysis. On the other hand, STM calculate covariate effects on latent topics with uncertainty, presenting the results as either point estimations, or difference estimations if the covariate is binary. As with section 5, the similar and independent methods employed by these programs provide the opportunity to assess the robustness of our results, and build upon them.

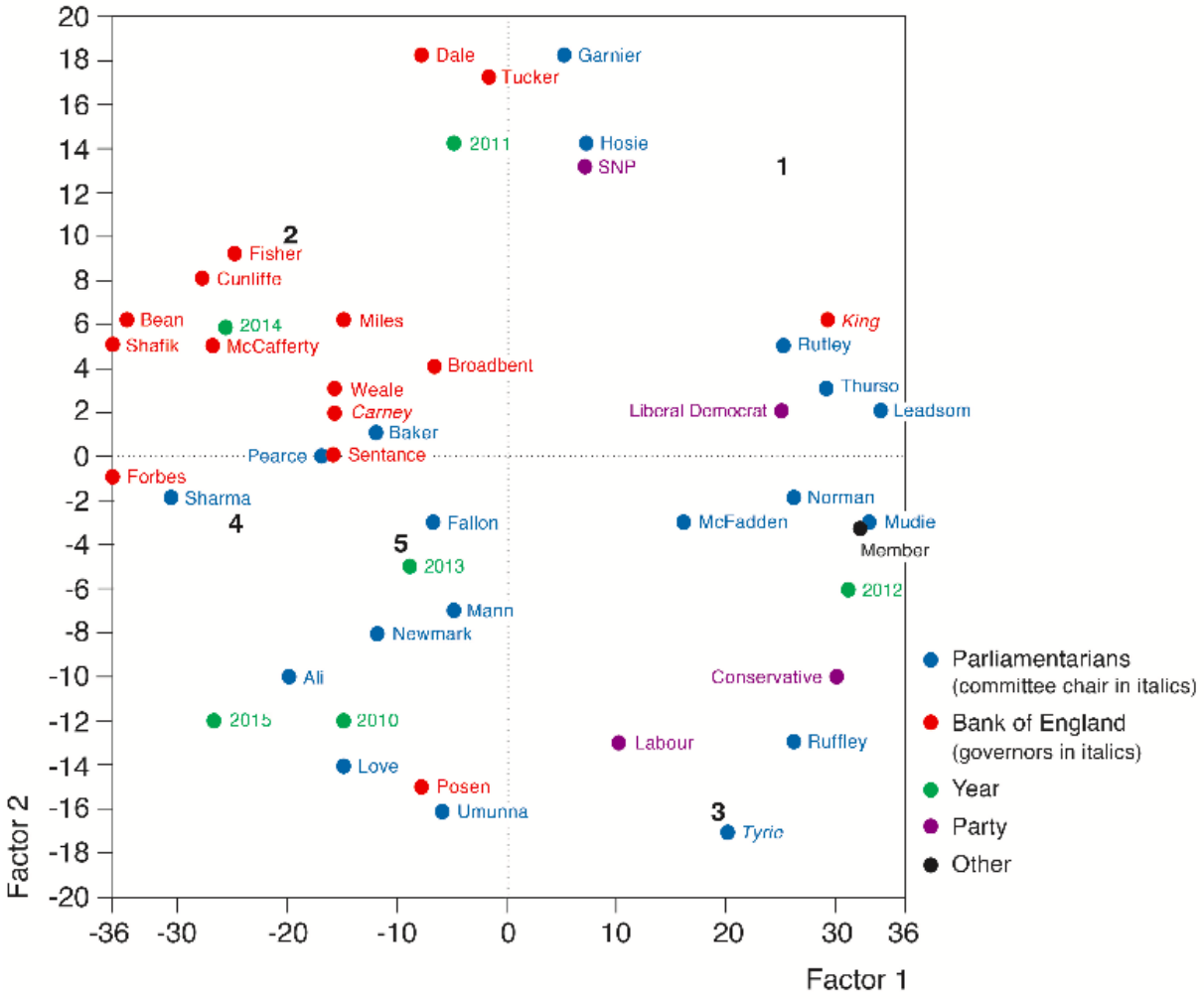
6.1 Correspondence Analysis

A correspondence analysis estimates the spatial relationships between classes and tagged covariates. As a type of factorial analysis, it extracts factors with the property of summarising significant information. Each factor can be interpreted as a spatial dimension that is represented by an axis whose centre is the value"0", and diverges towards both extremes, so that tagged covariates (tags) on opposite poles are the most weakly associated. As such, the positions of the tags is contingent on associations rather than coordinates, with the distance reflecting the degree of co-occurrence. The first factor aims to account for the maximum variation, and the second factor aims to account for the maximum of remaining variation, and so on. Hence, the total variation is divided into components along principal axes. In general, the dimensionality of the system is one less than the number of identified classes in the profile, see Greenacre (1993). The correspondence analysis provides a framework for the researcher to formulate her interpretation, rather than providing unambiguous conclusions.

An individual two dimensional representation of a correspondence analysis has been produced for each of the five corpus. For the first corpus (TSC Monetary Policy), we replicate the full analysis conducted in Schonhardt-Bailey (2015). The key findings are then summarised for the remaining four corpora.

Figure 1 shows a two-dimensional representation of the correspondence analysis for the Treasury Select Committee's monetary policy hearings. That is, the two factors capturing the most and second most variation are assigned to the horizontal and vertical axes respectively. These two factors account for 66.4% of the total variation.

Figure 1: Correspondence Analysis for TSC Monetary Policy



	% Association	% Cumulative
Factor 1	36.5	36.5
Factor 2	29.9	66.4

Class **1**	Bank of England Lending Facilities
Class **2**	Real Economy, Productivity & Competitiveness
Class **3**	Monetary Policy Decisions & Decision Making Process
Class **4**	Inflation Forecast & Outlook for Inflation
Class **5**	Forward Guidance & Outlook for Monetary Policy

To begin, we observe a close proximity of both MPC and TSC members to four of the five classes. The one exception is class 3 - Monetary Policy Decisions & Decision Making Process - where only Chairman Tyrie one other MP (Ruffley) form the cluster surrounding this theme. Moreover, the close proximity of both the Conservative and Labour party tags to the class 3 tag indicates a strong cross-party consensus on the importance of challenging the Bank on its institutional decision making process and governance. In short, with the exception of this class, the TSC's monetary policy hearings exhibit a reciprocal dialogue between legislators and experts (that is, around each theme, members of both the MPC and TSC converge, meaning that both engage in the thematic dialogue (see Schonhardt-Bailey (2015)).

There are two further noteworthy observations. First, the horizontal factor appears to delineate between two types of oversight. In the left quadrants, the real economy, inflation forecast and forward guidance all pertain to economic policy, whereas the right quadrants focus on issues of accountability and governance. Second, there is a large disparity between the two Bank of England governors - Mervyn King (until 2012) and Mark Carney (2013 onwards). King's tag is nearer to class 1 and Carney closer to classes 2, 4 and 5. This is a direct result of changes in the Bank's activities post-financial crisis - there is a movement from the Funding for Lending Scheme to the new era of effective lower bound monetary policy.

An equivalent to Figure 1 is created for each of the remaining four hearing types, but these are not shown here (these are fully reported Schonhardt-Bailey (2015)). The process of examining the spatial relationships between clusters and tags for each corpus bears the following observations.

For the TSC's fiscal policy hearings, the cumulative variation captured in a two-dimensional graph is a mere 57%, and thus the spatial representation may be less substantively robust. Nonetheless, we observe a positioning of George Osborne and Danny Alexander in roughly the centre of the spatial graph (0,0), though slightly nearer to class 5 - Public Deficit and Debt. Fiscal policy oversight entails a "one vs. many", where a single treasury official is standing alone against the committee. This means that the opportunity for the fiscal policy witnesses to be situated in proximity to multiple classes is impossible. We also find a clear partisan split, with the Conservatives focussing on budget leaks and Labour in close proximity to the Tax and Benefits class.

Moving on to the TSC financial stability hearings, we observe a lower degree of reciprocity with classes 2 and 3 experiencing clusterings of both FPC and TSC members, but class 1 (Bank Capital, Leverage, & Lending Capacity) is predominantly the remit of BoE internal FPC members (Bailey, Haldane and Fisher). Discourse surrounding the LIBOR

fixing scandal and the resignation of Barclay's CEO Bob Diamond is in close proximity to Chairman Tyrie and other TSC members. It may be the case that TSC members exhibit greater interest in those areas with a high media focus.

The correspondence graph for EAC's monetary policy hearings exhibits a close overlap in word co-occurrence between classes 5 and 6 (Too Big to Fail & Bank Resolution, and Stress Testing Banks & Bank Lending) respectively. As a result, the focal points for these classes can not be statistically confirmed and are therefore not plotted. Regardless, there appears to be a partisan divide between the Conservatives and Labour tags. This is primarily due to Chairman MacGregor's predominant focus being on the theme of pensions (class 1). Finally, there is once again a horizontal factor divide between classes focussing on macroeconomic issues and those focussing on financial stability.

When conducting the thematic clustering of EAC fiscal policy hearings in Alceste, the classification rate for ECUs was only 46%, a particularly low value. Given its classification rate, the correspondence graph could not be produced.

Having summarised the Alceste findings, we move on to utilising topic prevalences in the STM.

6.2 Point Estimations

An important feature of STM is the possibility to test statistically hypotheses concerning the relationships between specific variables and topical prevalence. Existing topic model implementations (including STM) do not allow for visualising patterns of association between relevant covariates and clusters through correspondence analysis.

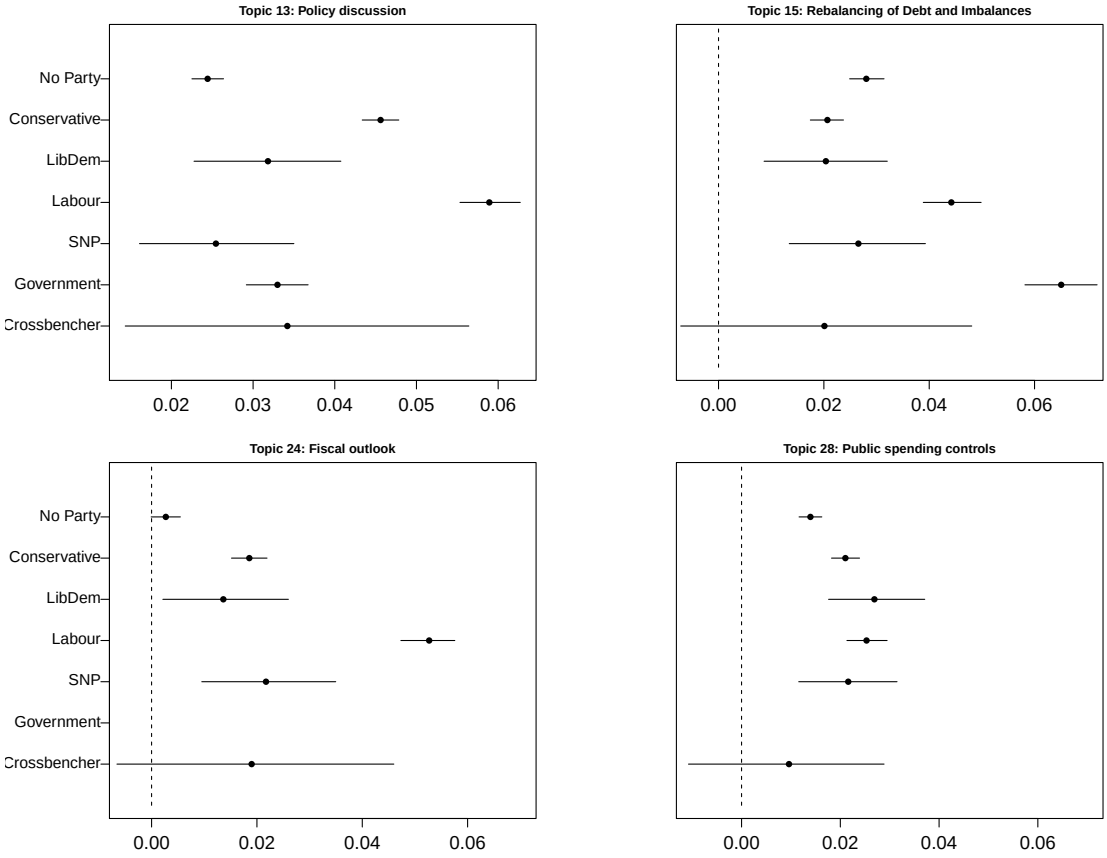
At the same time, STM can test statistically the relationship between variables of interest and topical prevalence across a single dimension. In what follows, we shall test topic prevalence along two policy dimensions, namely (i) the effect of partisanship, and (ii) differences between the House of Commons and the House of Lords, with a particular focus on monetary policy oversight. These results both reinforce conclusions from Alceste's correspondence analysis, and in themselves uncover further insights.

6.2.1 Partisanship

In this section, we address whether partisanship affects select committee hearings on specific policy issues. In our correspondence analyses (section 6.1), we find evidence of variations in the position of party labels. For example, in the TSC's fiscal policy hearings the Conservatives focussed on budget leaks, whereas Labour was in close proximity to the "Tax and Benefits" class. The STM allows us to build upon these observations with a greater degree of certainty.

Figure 2 reports point estimates for topic proportions related to fiscal policy, using their labels from Table 3. Here, "no party" signifies Bank of England officials, "government" signifies Government ministers (primarily Chancellor George Osborne in Fiscal policy hearings). Crossbencher refers to non-partisan peers in the Lords' committee. These estimates are equivalent to the conditional probability of observing a particular topic in the text given the party affiliation of the speaker; the intervals reported in the figure are for 95% confidence. For instance, in topic 28 (Public Spending Controls), the confidence intervals all overlap which means there is no statistically significant difference in the probability of any of the partisan cohorts to speak on this theme.

Figure 2: By-party Topic Proportions for Fiscal Policy

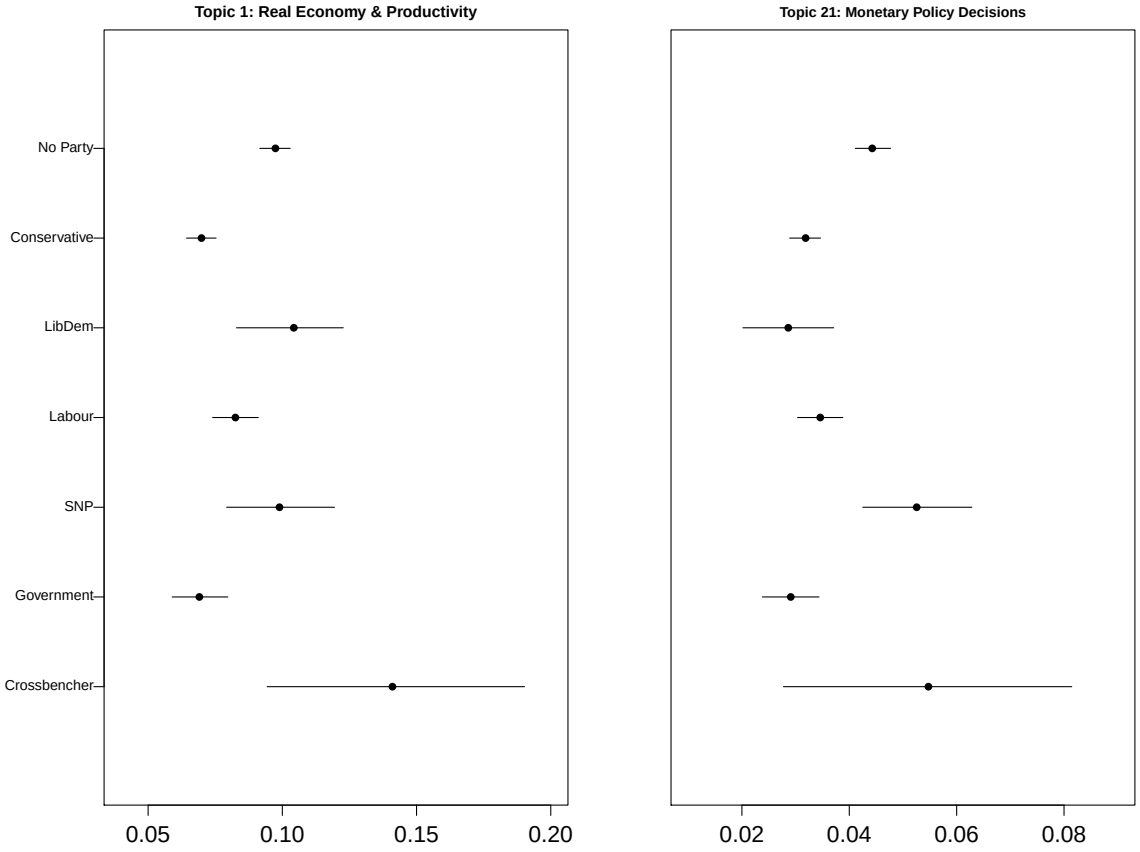


Using this metric, divisions along partisan lines are clear. Speakers from the Labour Party exhibit a significantly higher probability of engaging with topics related to the distributive issues (topic 24) than those from other parties. At the same time, speakers from

the Government (again primarily the Chancellor) exhibit a greater proportion of attention to deficit and debt (Topic 15). The latter is consistent with the finding in section 6.1 that the Government's discourse is evenly distributed across most classes, but is slightly pulled towards class 5 - Public Deficit and Debt.

At the same time, the results in Figure 2 suggest the existence of an ideological divide. Labour Party members engage more frequently with redistributive aspects of the budget while members of the Government talk more frequently about implications for debt and deficits. This is consistent with existing accounts of party ideological positioning on economic policy (see Laver & Garry (2000); Laver et al. (2003)).

Figure 3: By-party Topic Proportions for Non-politicised Policy Area

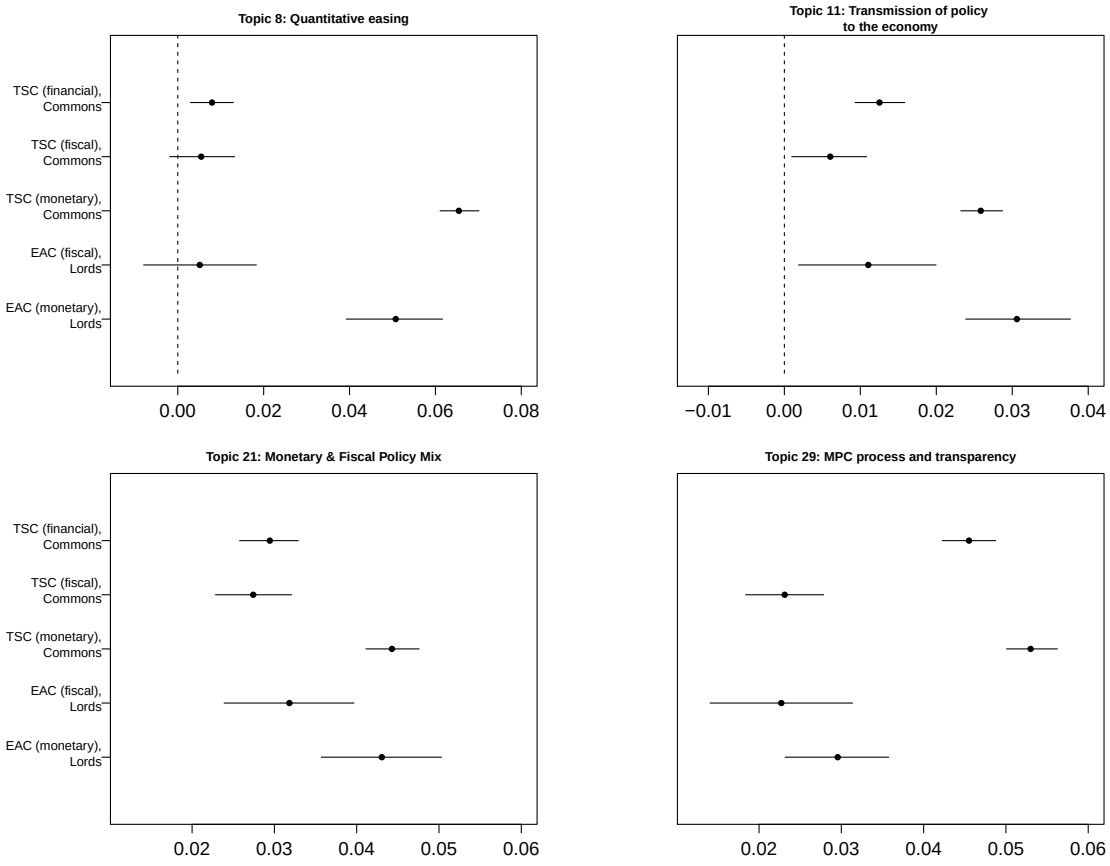


To further understand this partisan divide, we should consider cases where the party narrative is less prominent. As an example, Figure 3 reports the point estimates of topic prevalences across parties for discussions related to the real economy (topic 1) and con-

cerning the analysis of monetary policy decisions (topic 21). As expected, in these cases the partisan divide is less evident. This is particularly true for speakers from the Labour and the Conservative parties, who instead exhibit large differences in topic proportions for fiscal topics (Figure 2 above). These considerations suggest a partisan divide in deliberation emerges more clearly in the case of fiscal policy oversight (politically more contested) as opposed to monetary policy, where a broad cross-party consensus on the fundamentals of policy appears to exist.

6.2.2 Chamber Affiliation

Figure 4: By-committee topic proportions for monetary policy

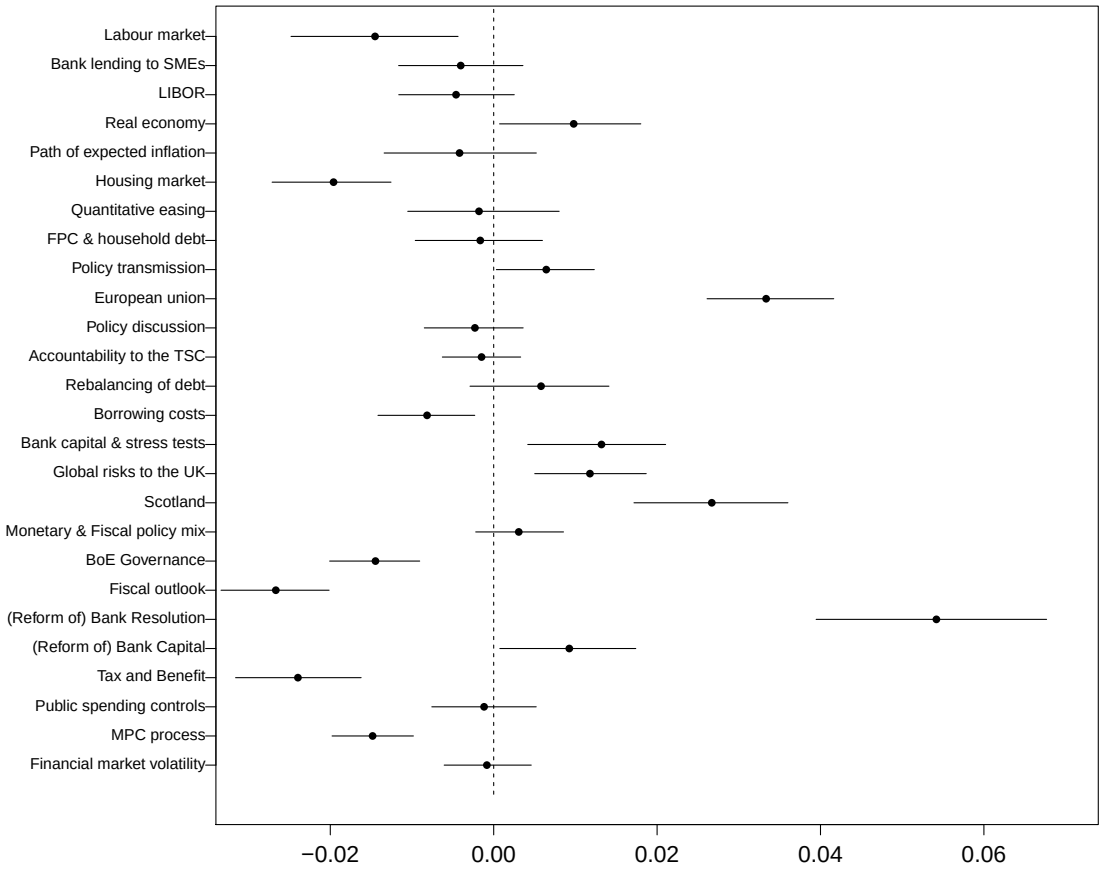


An equivalent question can be posed regarding the effect of chamber affiliation (Commons for TSC, and Lords for EAC) on topic proportions. To test this, Figure 4 reports point

estimates of STM topic proportions for each committee for topics related to oversight of the Bank of England.

In line with our Alceste findings, the figure shows that TSC hearings exhibit a higher topical prevalence on topic 29 (MPC decision-making process). This is not true only for TSC hearings on monetary policy but also for those on financial stability. At the same time, these results indicate no statistical difference between TSC and EAC on other aspects of monetary decisions (i.e. the confidence intervals overlap). Hence they confirm the idea that TSC committee members are comparatively more focussed on discussing the internal decision making processes of the Bank of England (e.g. for the MPC this included its transparency).

Figure 5: Differences in topic proportions by Chamber



To further investigate the effect of chamber affiliation on dialogue, Figure 5 shows the estimated differences between topics addressed in the House of Commons and the House of

Lords, for the full set of (non-discussion) topics identified by the model. Note that differently from the point estimates presented in figures 2-4, Figure 5 reports the expected difference in topic proportions for EAC hearings as compared to TSC, with a those to the right of 0 being more prevalent in the Lords and those to the left more prevalent in the Commons. In this case, estimates are obtained by controlling for both party affiliations and the type of policy hearing.

In line with the idea that deliberation in the EAC reflects the expertise of committee members, we see a positive and significant difference for a number of technical topics including for example topic 5 (Real Economy/Investment), 12 (European Union) and 26 ((Reform of) Bank Regulation).

Overall we find a significant amount of correlation between the correspondence analysis for Alceste, and our point estimations from the STM. Furthermore, the STM provides an array of further insights at the 95% significance level.

7 Conclusion

We have sought two goals in this paper–one substantive and one methodological. Our substantive goal contains two lines of enquiry. First, we have explored how economic policy oversight might vary according to who and what is being held to account. In particular, to what extent does partisanship shape oversight hearings on fiscal policy relative to monetary policy and financial stability? In the case of the former, backbench parliamentarians are holding front-bench parliamentarians to account; in the latter, parliamentarians are holding unelected policy experts to account. Does the nature of the deliberative process systematically vary according to these differences? Our second substantive has been the institutional context for oversight hearings–that is, House of Commons versus House of Lords. Both chambers have select committees that oversee economic policy, even though the TSC is the primary oversight committee (the Commons' TSC has the statutory responsibility for conducting oversight, although the Lords' EAC nonetheless conducts its own investigations into various aspects of economic policy). Our question here is, does deliberation in the (elected) committee of MPs differ from deliberation occurring in the (unelected) committee of peers?

Thematic and topic model textual analysis approaches are consistent in the following findings. First, fiscal policy hearings are clearly distinct in their partisan content. However, each textual analysis approach captures a different dimension of this partisan story. Thematic software finds virtually no partisan cleavage between the two main parties (Conservative / Labour) in monetary policy, but in fiscal policy, MPs of the minority party (Labour) tend to have a greater say in questioning the Conservative chancellor. The cor-

respondence analysis in thematic software also captures the impact of this partisanship on the deliberative process. That is, hearings with Bank officials tend to exhibit greater reciprocity in deliberation, whereas those on fiscal policy exhibit more of a "talking across" one another phenomenon. In monetary policy, MPs and peers tend to converge with MPC members on each theme (with the exception of the them of monetary policy decision making, where Chairman Tyree was more singularly focused). In fiscal policy, the chancellor tends to speak to one theme, while committee members focus on other themes.

The STM analysis adds to the partisan story the ability to gauge point estimates for topic proportions across different topics, and so allows us to observe that Labour Party committee members have a significantly higher probability of engaging with topics related to distributive issues that members from the other parties. And, witnesses from the Government (namely, Chancellor Osborne) exhibit a greater proportion of attention to the topic of the deficit and debt.

Our second substantive line of enquiry focuses on the differences between the Commons' committee and the Lords' committee. From the thematic software (particularly evident in the correspondence analysis), we saw that the TSC was uniquely focused on issues of the institutional governance of the Bank of England and the process of decision making within the MPC (e.g., transparency), whereas the EAC appeared to divide attention among a number of lesser related topics (e.g., Scotland, energy policy). From the STM, we could explore the array of topics for each committee, across all the policy hearings. From Figure 5, we could observe the expected difference in the topic proportions for the EAC relative to the TSC. Here, the differences became more prominent–e.g., for the EAC, reforming bank resolution and bank capital, Scotland, and the EU were particularly distinctive topics; while for the TSC, the areas of predominant focus included fiscal outlook, tax and benefits, housing, the labour market, Bank of England governance, and the process of MPC decision making.

These findings could be explored in far greater detail and their relevance to accountability, oversight and deliberation could be further analysed. This, however, is the task for a forthcoming book manuscript.

Our second goal in this paper is methodological. We have sought to address the concerns of some critics who argue that thematic textual analysis software which is not open-source cannot be validated. We argue that this is not the case. First, the classification findings of the Alceste software are replicated using another independent thematic software, T-Lab, with 75% of the classification finding direct matches. One could, of course, also argue that the R version of Alceste–Iramuteq–is open-source, and so analyses could be replicated using that software as well. However, here we have sought to address what we perceive to be the

primary criticism against thematic software–namely, its proprietary, so-called "black box" algorithms. We argue that an approach which allows for multiple tests on the classification output can indeed provide a valid test of the findings.

Taking the analysis further, we have employed the STM approach to challenge the findings of the thematic textual analysis software. Although fundamental differences in assumptions and algorithms exist between these two approaches, we nonetheless find that about 70% of the topics identified in the STM correspond to the Alceste output. In short, the two approaches are actually quite complementary.

Indeed, by employing multiple textual analysis approaches, we deepen our understanding of both the underlying content of the corpora, but we also allow for a broader methodological toolkit. From the thematic analysis, we better understand the potential for reciprocal discussions within a group setting (which is a key concern for deliberative democracy), while from the STM, we can generate both point estimates and differences in topic proportions. Arguably, our use of multiple textual analysis software lessens the elegance of the analysis as one is forced to explain a much broader array of methodologies; however, our simple point is that thematic and topic approaches complement rather than conflict with one another.

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Notes

[1]A rotation of members of the Monetary Policy Committee testify on the Inflation Report. The MPC consists of both internal and external members, with the former comprised of the Governor, two Deputy Governors, the Executive Director for Markets and the Chief Economist. There are four external members and apart from their position on the MPC these individuals hold no other position at the BoE. MPC members rotate before the TSC, but the delegation almost always includes the Governor.

[2]The Bank of England publishes the Inflation Report quarterly (February, May, August and November). The Treasury Select Committee does not necessarily hold hearings on each of the reports.

[3]The Bank of England publishes the Financial Stability Report semi-annually (July, December). This study includes the hearings on these reports from their statutory origin in 2013

[4]Financial Stability hearings began in the TSC with the "interim FPC" in 2012. Following the passage of financial services legislation in 2013, the Financial Stability Committee formally came into existence.

[5]Beyond, possibly, bigrams or trigrams.

[6]Typically, automated content analysis of text seeks to infer a particular meaning or interpretation from the text. Moreover, applications of the scientific method require that the specific methodology used be validated – that is, the methodology is indeed measuring what the researcher claims it is measuring. Applying the concept of validity to the automated content analysis of text can take a number of forms (Neuendorf (2002), Krippendorff (2004)), and can be sorted into typologies (Krippendorff 2004, p. 319). Here, we focus on a specific validation step which can be applied to proprietary software for textual analysis.

[7]One feature of T-Lab is that the number of classes can be set by the user, similarly as in topic modelling. When the number of classes in T-Lab is set at 25 for the combined set of documents used in this paper, for instance, a discussion topic does emerge (class 17 in Appendix C).

[8]Once again, the reader can refer to Appendix D for a detailed overview of the comparison process between the two software.

A List of Hearings

House of Commons Treasury Select Committee:

Monetary Policy Hearings:

28 July 2010, Inflation Report
10 November 2010, Inflation Report
1 March 2011, Inflation Report
28 June 2011, Inflation Report
25 October 2011 [Quantitative Easing]
28 November 2011, Inflation Report
29 February 2012, Inflation Report
26 June 2012, Inflation Report
27 November 2012, Inflation Report
25 June 2013, Inflation Report
12 September 2013, Inflation Report
26 November 2013, Inflation Report
24 June 2014, Inflation Report
10 September 2014, Inflation Report
25 November 2014, Inflation Report
24 February 2015, Inflation Report

Fiscal Policy Hearings:

15 July 2010 [Budget]
4 November 2010 [Spending Round]
29 March 2011 [Budget]
27 March 2012 [Budget]
26 March 2013 [Budget]
11 July 2013 [Spending Round]
17 December 2014 Autumn Statement

Financial Stability Reports and Hearings 2011-2015

17 January 2012: (December 2011 FSR)
17 July 2012: (June 2012 FSR)

15 January 2013: (November 2012 FSR)
2 July 2013: (June 2013 FSR)
15 January 2014: (November 2013 FSR)
15 July 2014: (June 2014 FSR)
14 January 2015: (December 2014 FSR)

House of Lords Economic Affairs Committee:

Monetary Policy Hearings:

16 November 2010: Meeting with the Governor
27 March 2012: Economic Outlook (Meeting with Governor and MPC members)
17 December 2013: Meeting with the Governor of the Bank of England
10 March 2015: Meeting with the Governor of the Bank of England

Fiscal Policy Hearings:

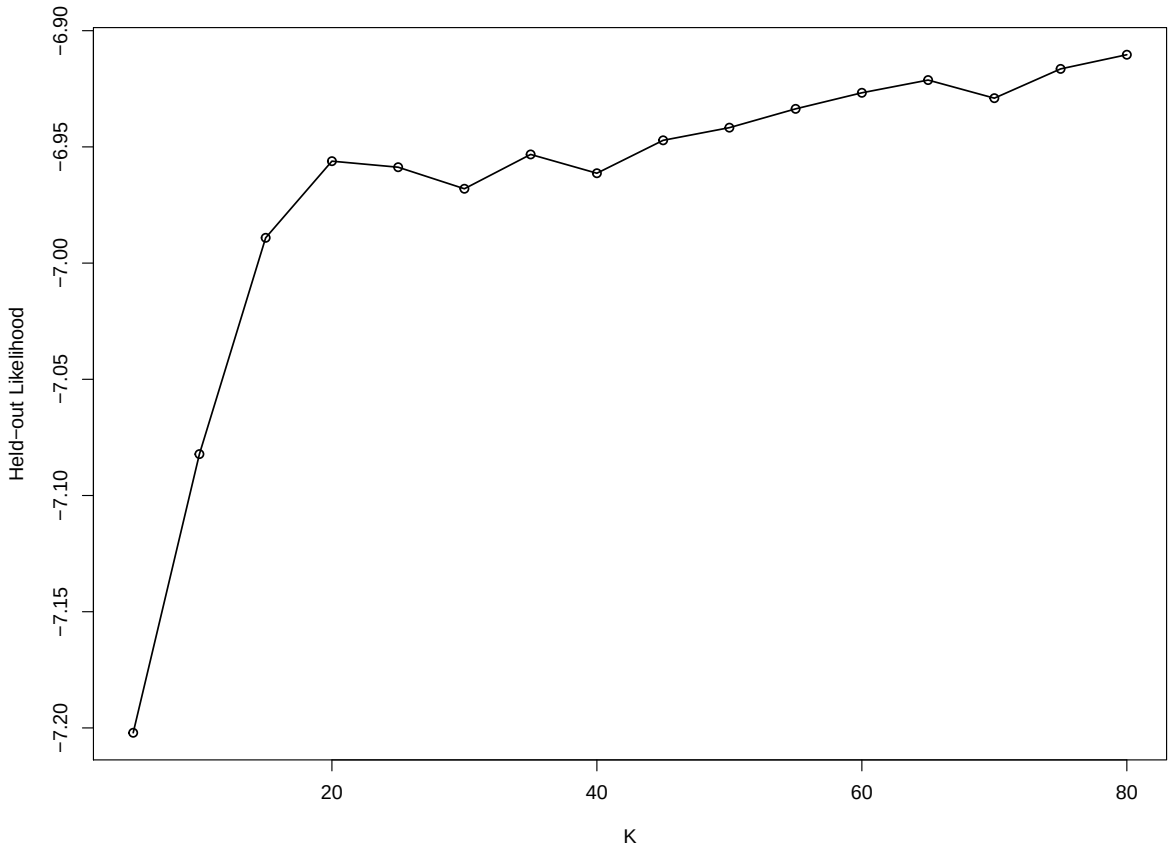
30 November 2010: Economic Outlook (Meeting with Chancellor and Treasury Staff)
8 December 2011: Economic Outlook (Meeting with Chancellor and Treasury Staff)
4 February 2014: Meeting with the Chancellor of the Exchequer

B Model selection in STM

The held-out likelihood is the probability that a given model correctly predicts a set of words intentionally left out from the estimation, namely the estimation of words probability after some of those words have been removed from the text. The essence of this method is to check which model gives the best out-of-sample predictions, i.e. it is able to better explain the left-out set of words.

The held-out likelihood for a sequence of K = 5, 10, 15 ... 80 topics is reported in Figure 6. The Figure shows that the held-out likelihood is low for models with less than 20 topics, it remains broadly stable for K between 20 to 40 topics, and it marginally increases afterwards. While Figure 6 suggests a model with 80 topics would provide the best model fit among those considered, increasing the number of topics to 80 would probably imply loss of generality for the interpretation, as topics become over-identified (see Grün & Hornik (2011), p. 13). In general, interpretability is also an important criterion for choosing the

Figure 6: Held-out Likelihood for $K = 5, 10, ..., 80$



number of topics (Blei (2012)).

Taking these considerations into account, we opt for a model with K=30 topics after exploring the performances for alternative specifications ranging from 25 to 40 topics (the shaded grey area in Figure 6). Figure 6 suggests models in this range provide a reasonable fit of the text; at the same time, the limited number of topics should allow direct comparison with the semantic classes derived in Alceste and T-Lab.

C 25-class T-Lab Clustering

Table 6: Characteristic Words and Labels for a 25-Class Thematic Analysis

	Characteristic Words	Label
1	labour capacity spare market gap	Spare Capacity and Labour Markets
2	benefit housing House child claim	Unemployment and Housing Benefits
3	banks scheme lend fund incentive	Lending and Bank Lending Scheme
4	F_P_C power P_R_A board recommendation	FPC/PRA
5	inflation target percent remit expectation	Inflation Targeting and Expectations
6	billion plan pounds spend set_out	Public Speding and Budget
7	union monetary arrangement currency euro	EMU and Fiscal Integration
8	yield gilt asset_purchases Q_E unwind	Quantitative Easing
9	treasury official secretary minister press	Treasury Department and Officials
10	economy export rebalancing consumption recovery	International Trade and Demand
11	reserves deposit hong G_D_P kong	Foreign Currency Reserves
12	unite united rest kingdom solution	United Kingdom
13	bond assets buy corporate purchase	Asset Purchasing
14	institution regulation capital leverage requirement	Leverage Ratios/Capital Requirements
15	interest_rates raise rate long-term low	Interest Rates
16	tax budget chancellor _YR_MARCH12 penny	Taxation (particularly income tax)
17	question answer ask quick _R_CHAIR	Questioning (disc.)
18	issue service governor majority financial	Finance and Scottish Independance
19	price risk inflation energy commodity	Price Changes and Inflation
20	growth productivity wage average data	Productivity and Wage Growth
21	public expenditure deficit decision political	Public Expenditure and the Defecit
22	home build local social building	Housing Policy
23	contingency event okay have– but–	Bank of England Contingency Planning
24	monetary policy guidance tighten stance	Path of Monetary Policy/Forward Guidance
25	small enterprise business medium-sized company	SMEs

Note: A 25 class model is chosen because this is equivalent to the number of non-discussion STM topics.

D Matching Software Outputs

Alceste and Structural Topic Model:

TSC Monetary Policy:

Alceste class 1: lend, small, bank, size, enterprise
Topic 2: bank lend small fund credit compani busi
Alceste label: Bank of England Lending Facilities
STM: Bank Lending to SMEs

Alceste class 2: growth econom income product
Topic 1: growth economi product recoveri see unemploy data pick labourmarket
Alceste label: Real Economy, Productivity & Competitiveness
STM: Labour Market/Economic Growth

Alceste class 3: monetary_polic; committee, discuss, decision
Topic 29: view discuss decis committe differ meet whether member monetarypolicycommitte
Alceste Label: Monetary Policy Decisions & Decision Making Process
STM label: MPC Process and Transparency

Alceste class 4: inflation forecast target look expect
Topic 6: inflat percent expect target forecast look mediumterm rise forwardguid will guidanc
Alceste Label: Inflation Forecast, Expectations & Outlook for Inflation
STM label: Path of Expected Inflation

Alceste class 5: guidance, interest_rate, threshold, tighten, forward_guidan
Topic 6: inflat percent expect target forecast look mediumterm rise forwardguid guidanc
Alceste Label: Forward Guidance & Outlook for Monetary Policy
STM label: Path of Expected Inflation

TSC Fiscal Policy:

Alceste class 1: tax income benefit people percent system
Topic 27: tax percent peopl increas pound cut work measur benefit take fair system incom
Alceste Label: Housing & Household Indebtedness
STM label: Fiscal Policy / Tax and Benefits

Alceste class 2: department, cabinet contract ring process secretary minister
Topic 4: process minist involv consult secretari treasuri prime chief offici part
Alceste Label: Budget Process and Role of Ministers
STM label: LIBOR

Alceste class 3: committee chancellor brief office_for_budg budget inform
Topic 14: committe think made interest public good inform
Alceste Label: Budget Leaks
STM label: Accountability to the TSC

Alceste class 4: small sector businesses private bank fund regional
Topic 5: invest job busi project privatesector will new industri creat region
Alceste Label: Economic Effects of Budget
STM label: Real Economy/Investment

Alceste class 5: deficit, structural, fiscal budget_deficit, fiscal, world
Topic 15: economi countri debt econom deficit problem export challeng growth world
Alceste Label: Public Deficit and Debt
STM label: Rebalancing of Debt and Imbalances

TSC Financial Stability:

Alceste class 1: capital bank asset ratio sheet institution
Topic 26: bank capit liquid balancesheet account asset fsa crisi posit hold
Alceste Label: Bank Capital, Leverage, & Lending Capacity
STM label: (Reform of) Bank Capital

Alceste class 2: price, market, econom, debt mortgage rate interest_rates rise income
Topic 7: scheme hous will new home mortgag suppli housepric build increas
Alceste Label: Housing & Household Indebtedness
STM label: Housing Market/New Home Building

Alceste class 3: committee court board decision oversight chancellor parliament report
Topic 23: report suggest evid review respons independ court board oversightcommitte
Alceste Label: Governance of the Bank of England

STM label: Bank of England Governance/Oversight Committee

Alceste class 4: ask governor thank answer andrew subject helpful conference new_york_fed
Topic 4: libor cabinet perman depart discuss contract situat bba work
Alceste Label: Barclays and LIBOR
STM label: LIBOR

EAC Monetary Policy:

Alceste class 1: assets asset_purchas gilt yield pension purchase private
Topic 11: interestr, mean, therefor, might, effect, pension, rise, obvious, suppos
Alceste Label: Pensions, Savings & Annuities
STM label: Transmission of Policy to the Economy

Alceste class 2: inflation growth percent interest_rate price consistent
Topic 6: inflat percent expect target forecast look mediumterm
Alceste Label: Real Economy & Economic Forecast
STM label: Path of Expected Inflation

Alceste class 3: prudent financial_policy prudential_regu supervis prudential_regu financial_servic financial_stabili
Topic 10: risk financialst take financialpolicycommitte tool perspect mortgag type potenti term fpc debt respons valu action stabil
Alceste Label: Financial Stability & Macro Prudential Policy
STM label: FPC/Household Debt

Alceste class 4: want political auditors competitivenes reform politic
Topic 26: air system incom analysi impact make includ chang welfar way
Alceste Label: Banking & Bank Regulation
STM label: (Reform of) Bank Capital

Alceste class 5: fail buffer big institut border trouble bail systemically taxpayer
Topic 25: bank regul problem fail issu structur big competit new way import system rule
Alceste Label: Too Big to Fail & Bank Resolution
STM label: (Reform of) Bank Regulation

Alceste class 6: test ring fence stress standard resilient individual capitalised
?Topic 17: fpc power set institut need leverageratio capit system stresstest will bank
Alceste Label: Stress Testing Banks & Bank Lending
STM label: FPC/Bank Capital and Stress Tests

EAC Fiscal Policy:

Alceste class 1: gas regime shale local oil region energy
Topic 5: region particular peopl support area price part help publicsector countri oil
Alceste Label: Energy, Energy Prices, Gas & Shale Oil
STM label: Real Economy/Investment

Alceste class 2: percent medium small credit enterprise
Topic 16: rate cost peopl pay borrow high look
Alceste Label: Real Economy & Bank Lending
STM label: Borrowing Costs/Transmission of Monetary Policy

Alceste class 3: financial regul service european_unio bank prudent legislat centre proper
Topic 12: nation countri control requir european will london british legisl europeanunion
Alceste Label: Financial Services & Regulation
STM label: European Union

Alceste class 4: scotland scottish establish arrangement fiscal
Topic 20: unit state kingdom reserv scotland global relat gdp
Alceste Label: Scotland & Regions
STM label: Scotland

Alceste and T-Lab:

TSC Monetary Policy:

Alceste class 1: lend, small, bank, size, enterprise
T-Lab class 2: bank lend small enterprise medium-sized fund
Alceste label: Bank of England Lending Facilities
T-Lab label: Bank Lending to SMEs

Alceste class 2: growth econom income product
T-Lab class 4: growth price interest_rates house income consumption
Alceste label: Real Economy, Productivity & Competitiveness
T-Lab label: Real Economy and House Price Growth

Alceste class 3: monetary_polic committee discuss decision
T-Lab class 5: gilt quantitatice_easing monetary_policy_committee asset
Alceste Label: Monetary Policy Decisions & Decision Making Process
T-Lab label: Quantitative Easing Discussions

Alceste class 4: inflation forecast target look expect
T-Lab class 1: inflation percent forecast labour target expectation
Alceste Label: Inflation Forecast, Expectations & Outlook for Inflation
T-Lab label: Outlook fro Inflation and Inflation Expectations

Alceste class 5: guidance, interest_rate, threshold, tighten, forward_guidan
UNMATCHED

TSC Fiscal Policy:

Alceste class 1: tax income benefit people percent system
T-Lab class 4: tax rate pounds income billion increase measure oil
Alceste Label: Housing & Household Indebtedness
T-Lab label: Income Tax Rates

Alceste class 2: department, cabinet contract ring process secretary minister
T-Lab class 3: department process minister secretary contract prime chief
Alceste Label: Budget Process and Role of Ministers
T-Lab label: Ministerial/Cabinet Involvement in the Budget Process

Alceste class 3: committee chancellor brief office_for_budg budget inform
UNMATCHED

Alceste class 4: small sector businesses private bank fund regional
T-Lab class 5: bank banks committee small business lend
Alceste Label: Economic Effects of Budget

T-Lab Label: Bank Lending to SMEs

Alceste class 5: deficit, structural, fiscal budget_deficit, fiscal, world
T-Lab class 2: economy debt deficit economic country fiscal structural UK
Alceste Label: Public Deficit and Debt
T-Lab label: Fiscal Deficit and Government Debt

TSC Financial Stability:

Alceste class 1: capital bank asset ratio sheet institution
UNMATCHED

Alceste class 2: price, market, econom, debt mortgage rate interest_rates rise income
T-Lab class 1: risk lend mortgage price house capital UK asset economy debt
Alceste Label: Housing & Household Indebtedness
T-Lab label: Bank Stress Tests, Mortgage Lending and House Prices

Alceste class 3: committee court board decision oversight chancellor parliament report
T-Lab class 2: Committee oversight member M_P_C decision court view
Alceste Label: Governance of the Bank of England
T-Lab label: Bank of England Governance and FPC/MPC

Alceste class 4: ask governor thank answer andrew subject helpful conference new_york_fed
T-Lab class 3: L_I_B_O_R B_B_A barclays evidence consultation week dark
Alceste Label: Barclays and LIBOR
T-Lab label: LIBOR

EAC Monetary Policy:

Alceste class 1: assets asset_purchas gilt yield pension purchase private
T-Lab class 5: asset pension gilt yield annuity purchase buy Q_E
Alceste Label: Pensions, Savings & Annuities
T-Lab label: QE and Pension Investment

Alceste class 2: inflation growth percent interest_rate price consistent
T-Lab class 1: inflation growth economy target percent productivity expectation price

Alceste Label: Real Economy & Economic Forecasts
T-Lab label: Inflation Outlook and the Economy

Alceste class 3: prudent financial_policy prudential_regu supervis prudential_regu financial_servic financial_stabili
T-Lab class 4: leverage institution ratio system regulation prudential supervision Basel Alceste Label: Financial Stability & Macro Prudential Policy
T-Lab label: Leverage Ratio for Banks

Alceste class 4: want political auditors competitivenes reform politic
UNMATCHED

Alceste class 5: fail buffer big institut border trouble bail systemically taxpayer
T-Lab class 2: banks capital banking_system debt requirement Irish global lend
Alceste Label: Too Big to Fail & Bank Resolution
T-Lab label: Bank Capital and Lending

Alceste class 6: test ring fence stress standard resilient individual capitalised
UNMATCHED

EAC Fiscal Policy:

Alceste class 1: gas regime shale local oil region energy
T-Lab class 1: tax impact carbon spend decade benefit local rate pricel
Alceste Label: Energy, Energy Prices, Gas & Shale Oil
T-Lab label: Tax Measures (notably energy)

Alceste class 2: percent medium small credit enterprise
UNMATCHED

Alceste class 3: financial regul service european_unio bank prudent legislat centre proper
T-Lab class 3: financial bank service Vickers sector banks regulation ask regulator
Alceste Label: Financial Services & Regulation
T-Lab label: EU/Financial Services/Regulation

Alceste class 4: scotland scottish establish arrangement fiscal

T-Lab class 4: fiscal union scotland vote monetary political scottish bad
Alceste Label: Scotland & Regions
T-Lab label: Scotland