Online Appendix

A Crisis-Stricken Countries' Fiscal Stance and Sovereign-Bond Yield Spreads

This section provides suggestive evidence indicating that the fiscal discipline view encountered mounting empirical anomalies during the euro crisis. In particular, I argue that, before the ECB's commitment to unlimited bond purchases in Summer 2012, the evolution of crisis-stricken countries' sovereign bond yields appeared to be increasingly disconnected from the development of their fiscal fundamentals.

This is well shown by Figure A1, which plots sovereign bond yield spreads vis-à-vis Germany against cyclically adjusted primary balances (CAPBs) in Greece, Ireland, Italy, Portugal, and Spain. CAPBs show the underlying government fiscal stance when cyclical movements and interest payments are removed. The graph shows CAPB forecasts from the European Commission, which provide a more accurate picture of real time fiscal expectations than historical data.

It can be noticed that in the 2009-2012 period improvements in the fiscal stance of crisis-stricken countries were matched with an increasing trend in their sovereign bond rates[1]. The general mismatch between fiscal stances and government bond rates was in line with the argument of the "systemic risk" perspective, and highlighted the pitfalls of the fiscal discipline view in explaining the developments of the euro crisis.

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[1]Ireland partly constitutes an exception: fiscal consolidation was associated with significant reduction in Irish yields well before Draghi's "whatever it takes" pledge.

Figure A1: 10-Year Government Bond Yield Spreads and Cyclically Adjusted Primary Balances in Euro Area Crisis-Stricken Countries
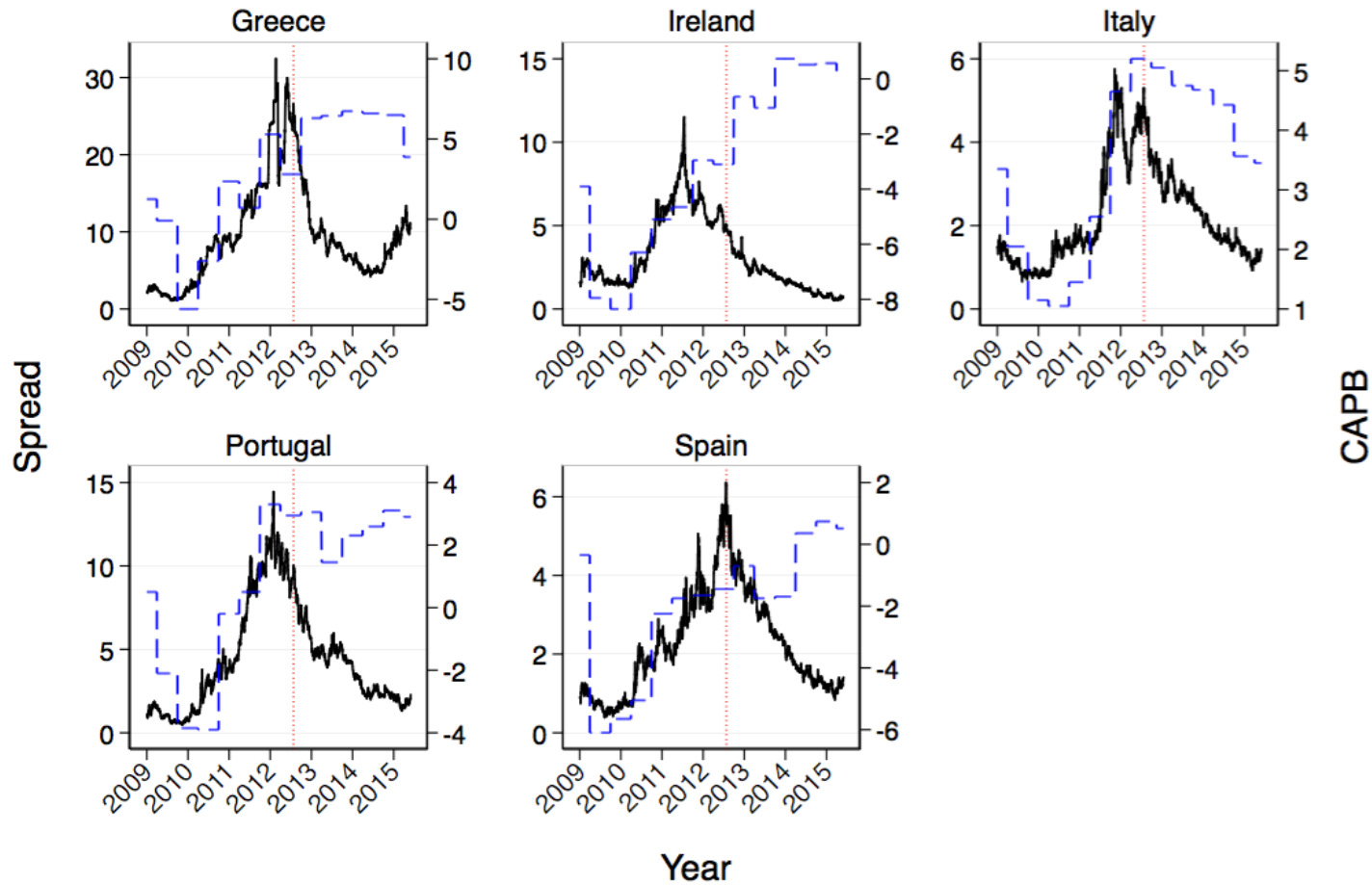
NOTES: This figure presents sovereign bond yield spreads (continuous black lines) and cyclically adjusted primary balances (CAPBs) (dashed blue lines) in euro area crisis-stricken countries. Spreads are given by the difference in yield vis-à-vis Germany for 10-year government bonds. CAPBs are given by the mean of year t and year $t+1$ forecasts. Data on bond yields are at a daily frequency and are retrieved from Eurostat. Data on CAPB are at half-yearly frequency and are retrieved from the European Commission's fiscal forecasts. The vertical red lines corresponds to the day of Mario Draghi's famous "whatever it takes" pledge, i.e. 26 July 2012.

B   Coding Scheme, Classification Model and Summary Statistics

This section describes the procedure followed to apply classification and regression trees (CART) to identify paragraphs on fiscal policy and sovereign debt in ECB Executive Board Members' inter-meeting speeches. First, I select a random sample of 1000 paragraphs from the text corpus of all speeches. Second, I develop a coding scheme to identify the paragraphs of interest. I aim to select paragraphs containing the following types of statements:

(1) Statements on fiscal consolidation and sovereign debt sustainability in euro area member states. These may include references to deterioration or improvement of fiscal fundamentals, as well as financial, economic or political effects of fiscal austerity.

(2) Statements on fiscal interventions in euro area member states. These may include references to domestic automatic stabilisers, welfare transfers and bail-out of institutions under financial stress.

(3) Statements on fiscal governance, fiscal policy coordination, and fiscal integration in the euro area. These may include references to fiscal surveillance, fiscal institutions, and Eurobonds.

Third, based on this coding scheme, I label paragraphs in the sample as being relevant the topic of interest or non-relevant. Fourth, I convert text into a structured form. I rely on the classic "bag-of-words" approach and convert each paragraph into a vector $[t_0, t_1, \ldots, t_j, \ldots, t_n]$ that contains all of the n unique words in the sample. t_j denotes the number of times word j is mentioned in the paragraph. I use this vector to build a term-frequency matrix $tf(M, n)$, where M is the number of paragraphs and n is the number of words. Thus, each cell ij in the term-frequency matrix indicates $t_{i,j}$ – i.e., the number of times term j occurs in paragraph i. Then, I multiply term counts by the inverse document frequency in order to downweight words that are likely to have low discriminative power. The inverse document frequency measures the frequency of occurrence of a term across all documents:

$$idf_j = \log \frac{M}{m : j \in m}$$

where m is the number of paragraphs containing term j. The resulting tf-idf matrix is used as an input to the CART algorithm. CART are a method that relies on repeated partitioning of the data to estimate the conditional distribution of a response given a set of explanatory variables (Jones and Linder 2015). Let the outcome of interest be a vector of observations $y = (y1, ..., yn)^{\mathrm{T}}$ and the set of explanatory variables or predictors a matrix $X = (x_1, ..., x_{\mathrm{p}})$, where $x_{\mathrm{j}} = (x_{1\mathrm{j}}, ..., x_{\mathrm{nj}})^{\mathrm{T}}$ for $j \in 1, ..., p$. Here Y is a binary variable that takes value 1 if the paragraph is relevant to the topic of interest, and 0 otherwise. X is given by the tf-idf matrix. The goal of the algorithm is to partition y conditional on the values of X in such a way that the resulting subgroups of y are as homogeneous as possible. In this context, the CART algorithm identifies words that have high discriminating value to predict

whether a paragraph is related to the topic of interest, and splits the data in two classes, based on whether or not each unit of analysis is predicted to belong to the set of paragraphs of interest.

To evaluate the performance of CART, I use two evaluation criteria – namely, accuracy and precision. Accuracy is the proportion of correct predictions among all predictions. Precision is the proportion of documents correctly assigned to a category among all of the documents assigned to that category. I train the classifier on a subsample of 667 paragraphs and test it on 333 paragraphs. Table A1 reports these measures.

Table A1: Evaluation Criteria of CART

Evaluation Criterion	Score
Accuracy	0.994
Precision	0.926

NOTES: This table presents results of performance evaluation of a classification tree employed to identify paragraphs on fiscal policy and sovereign debt issues in the corpus of ECB Executive Board members' inter-meeting speeches.

The CART classifier appears to perform very well, as nearly all of the relevant paragraphs in the test set are identified. However, it is important to notice that the high value of the results for the evaluation criteria are also due to the highly imbalanced nature of the two classes. Indeed, fiscal paragraphs are a small minority of all paragraphs in the training and test sets. Hence, the classifier could reach high levels of accuracy even by simply classifying all paragraphs as non-fiscal. An accurate inspection of the results ensures this is not the case: 25 out of 27 fiscal paragraphs in the test set are correctly classified by CART. Also, the choice of employing CART is due to its superior performance vis-à-vis other models. For instance, a Support Vector-Machines model can classify correctly only 17 out of 27 fiscal paragraphs in the test set.

After applying automated classification to the text corpus, I subset and maintain only the paragraphs that are predicted as relevant. The new corpus consists of 3,772 paragraphs and is used to run the unsupervised scaling model. As explained in Section 4.3, the performance of the classifier is also validated by results from the scaling model.

Table A2 reports summary statistics for the data I use in my empirical analysis. The table presents the absolute number of speeches and paragraphs, as well as the volume of fiscal communication – i.e., the number of paragraphs selected by CART as a share of total paragraphs – by Board member between 2009 and 2017.

Table A2: Summary Statistics of ECB Executive Board Members' Fiscal Communication

Board Member	Speeches	Total Paragraphs	Fiscal Paragraphs	Fiscal Vol. (%)
Asmussen	37	1750	133	7.6
Bini Smaghi	67	3546	242	6.8
Cœuré	132	6375	430	6.7
Constâncio	108	5949	290	3.9
Draghi	143	6069	359	5.9
González-Páramo	45	2342	201	8.6
Lautenschläger	45	1675	17	1
Mersch	93	3676	148	4
Papademos	14	570	34	6
Praet	90	3690	263	7.1
Trichet	119	5324	320	6
Tumpel-Gugerell	44	1562	64	4.1
Stark	33	1603	204	12.7

NOTES: This table presents summary statistics of ECB Executive Board members' communication in the 2009-2017 period. Fiscal volume is defined as the number of paragraphs about fiscal policy and sovereign debt identified by the CART classifier as a share of total paragraphs by Board member.

C   Structural Topic Models

I make use of an alternative quantitative text analysis approach based on topic models to validate the findings of the paper. This section describes the advantages and disadvantages of Structural Topic Models (STM) vis-à-vis Wordfish, explains the procedure I use to determine the number of topics to estimate, and presents the results.

First, I employ STM to detect the presence and evolution of word clusters that are ascribable to the fiscal discipline view and the systemic risk perspective. STM allows researchers to discover topics in a text corpus and conduct hypothesis testing about the relationship between topics and document metadata (Roberts et al. 2014; Roberts et al. 2016).

Compared to Wordfish, STM (as any other mixed-membership topic models) suffers from the disadvantage that the results of its estimation procedure are potentially sensitive to starting values of the parameters (Roberts et al. 2016). For instance, one of the key parameters that has to be set initially by the researcher is the number of topics (i.e., word clusters) to estimate. This introduces an element of arbitrariness that is absent with Wordfish.

Nonetheless, STM has the advantage that it may isolate word clusters that are related to the two main euro crisis narratives, and separate them from other, potentially confounding, topics. A direct implication is that STM may be useful to assess this paper's hypotheses also when applied to the whole corpus of fiscal communication, including the pre-crisis period, from 2002 to 2017. On the contrary, including fiscal communication from the pre-crisis period in the Wordfish estimation introduces confounding content that does not allow to identify a latent dimension that is insightful for the study of euro crisis narratives.

I use STM to analyse the corpus of fiscal paragraphs obtained in Section 3.2, after applying the same text pre-processing choices used before estimating the Wordfish model. Following the indication of Roberts et al. (2016), to reduce STM's sensitivity to starting values of the parameters in the model, I use an initialization based on the method of moments, known as a spectral initialization. While this choice provides more stable results across different parameter values, the number of estimated topics necessarily affects the substantive interpretation of the word clusters. Thus, I run models iteratively and choose the number of topics based on interpretability (Chang et al. 2009). Also, to verify that the output is not simply an artefact of the selected number of topics, I run the same analysis with a different number of estimated topics yielding inferior interpretability of the results.

A topic model with 6 topics yields topics that are easy to interpret, and gives a sufficiently fine-grained view over the fiscal discipline and the systemic risk perspectives. The model includes year- and Board member-specific covariates. Table A3 gives an overview of such topics. In bold is indicated the label I have attributed to each topic. "Highest probability" is a simple measure that indicates which words are the most likely to belong to the topic. Extremely important are also "exclusive" words – namely, those that are highly likely in one topic and unlikely in other topics based on the FREX metric (Bischof and Airoldi 2012; Airoldi and Bischof 2016). As shown by Table A3, all topics can be easily labelled and ascribed to themes of discussion in central bank communication about fiscal policy and sovereign debt.

Figure A2 shows the 150 words with greatest probability of belonging to two estimated topics that can be ascribed to the systemic risk perspective and the fiscal discipline view. The first topic is characterized by words that point to issues of systemic risk and financial fragmentation, like "bank", "financi[al]", "risk", "system", "credit", "support", "supervision", "mechanism", "contagion", "cross-bord[er]" and "fragment[ation]". Instead, the second topic is focused on words that indicate discussions about fiscal imbalances and surveillance, like "fiscal", "stabil[ity]", "rule", "budgetari", "procedur[e]", "excess", "deficit", "credibl[e]", "disciplin[e]","surveil[lance]", "sustain[able]".

Figure A3 presents time series estimates showing the evolution of the topics discussed above between 2002 and 2017. The graph shows that the systemic risk topic played a negligible role in ECB Executive Board members' fiscal communication before 2008. In contrast, the estimated proportion for the fiscal discipline topic is relatively prominent already in the pre-crisis period. The outset of the global financial crisis partly changed the nature of fiscal communication. Discussions about systemic risk gained some importance in 2008 and 2009, with their estimated proportion being around the levels of the fiscal discipline topic in this period.

However, consistent with the Wordfish estimates of Figure 2, it is interesting to observe that the amount of communication informed by the fiscal discipline view picked up at the beginning of the euro crisis, reaching its highest level in 2010. Instead, the estimated amount for the systemic risk perspective remains relatively low until the second half of 2011. Since the end of 2011, a reverse trend has taken place: communication related to systemic risk has gained traction over 2012 and reached its pick in 2013, while communication about fiscal discipline lost importance. Since mid-2013, the estimated mean for the systemic topic risk is higher than the one for the fiscal discipline word cluster.

Despite the similar trends presented by Figure 2 and Figure A3, the comparison between

Table A3: Top Words for 6 Topic STM

Fiscal Discipline	
Highest Probability:	fiscal, govern, rule, stabil, pact, framework, area
Exclusivity (FREX):	procedur, surveil, enforc, pact, rule, council, compact

Systemic Risk	
Highest Probability:	bank, financi, crisi, market, fiscal, govern, risk
Exclusivity (FREX):	supervisori, backstop, omt, supervis, resolut, fund, deposit

Fiscal Outlook	
Highest Probability:	countri, fiscal, euro, debt, area, deficit, gdp
Exclusivity (FREX):	percentag, spain, spread, gdp, recess, greec, ratio

Fiscal Integration	
Highest Probability:	fiscal, union, econom, polici, area, monetari, euro
Exclusivity (FREX):	pp, paper, m, union, feder, polit, presid

Macroeconomic Convergence	
Highest Probability:	polici, monetari, stabil, price, fiscal, central, rate
Exclusivity (FREX):	ii, converg, erm, inflat, price, particip, exchang

Structural Reforms	
Highest Probability:	fiscal, growth, reform, structur, polici, sustain, public
Exclusivity (FREX):	expenditur, product, invest, labour, tax, employ, reform

NOTES: This table presents the top words of the topics produced by a structural topic model with 6 topics, run on the corpus of fiscal communication of ECB Executive Board members' from 2002 to 2017. The words with highest probability of occurrence and highest FREX score are showed for each topic.

the two charts indicates a quantitative difference in the degree to which the ECB turned toward systemic risk. In particular, STM results suggest that the ECB's ideational shift was less prominent than estimated by Wordfish. This difference can be attributed to different features of the two empirical strategies, as there is a noise-comprehensiveness trade-off in the choice between STM and Wordfish[2]. Overall, it seems fair to say that STM estimates can be interpreted as a lower bound proxy of the ECB's ideational turn, while Wordfish ones constitute its upper bound.

Additional insights are provided by Figure A4 , which shows the estimated topic proportions by ECB Executive Board member than can be compared with the estimates of Figure 3. Old members of the Board, as Papademos, Stark, Trichet, Tumpel-Gugerell, and González-Páramo, are associated with high levels for the fiscal discipline topic and low levels for the systemic risk one. Instead, new members, as Praet, Mersch, Cœuré and Lautenschläger, display a much higher degree of communication informed by the systemic risk perspective, and higher than the amount of communication related to fiscal discipline. Draghi, Constâncio, and Asmussen are associated with more balanced estimated: they are estimated to talk slightly more about systemic risk than fiscal discipline. The only significant exception vis-à-vis Figure 3 is given by Bini-Smaghi, who, different from the other old Board members, is estimated to talk more about systemic risk than fiscal discipline. Overall, these results confirm the general picture provided in the previous section.

As a robustness check, I also produce results from a STM with 8 (instead of 6) topics, which are available upon request. The systemic risk and fiscal discipline topics are easily identifiable also with a different number of estimated topics. Also, the results confirm the time series patterns shown in the paper. Interestingly, with a 8 topic STM the relative strength of the systemic risk perspective appears to be even higher than in Figure A3, as the conditional mean for the systemic risk topic is consistently above the one of the fiscal discipline view starting from 2011. Finally, no major difference can be noticed between the findings of Figure A4 and the ones obtained with a 8 topic STM, apart from the lower amounts of absolute estimated topic proportions – something natural given the presence of two additional topics in the estimated model.

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[2]Focusing on two theoretically meaningful word clusters obtained from STM presents that advantage that it minimises the amount of noise deriving from other issues included in the ECB's fiscal communication. However, it suffers from the drawback that such a focus might be too narrow, and might neglect content than is easily ascribable to either the fiscal discipline view or the systemic risk perspective, such as words about structural reforms or fiscal integration. The estimation strategy based on Wordfish presents the opposite problem. Wordfish is a more comprehensive method, inasmuch as also words that pertain, for instance, to structural reforms and fiscal integration more directly contribute to the final estimates. Yet, Wordfish estimates are potentially more sensitive to noise deriving from non-relevant content.

Figure A2: Word Clouds of Fiscal Discipline and Systemic Risk Topics
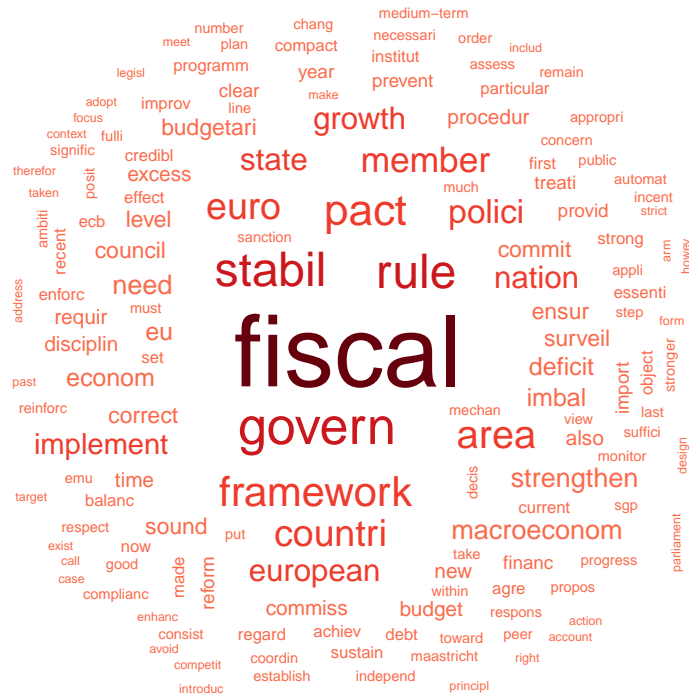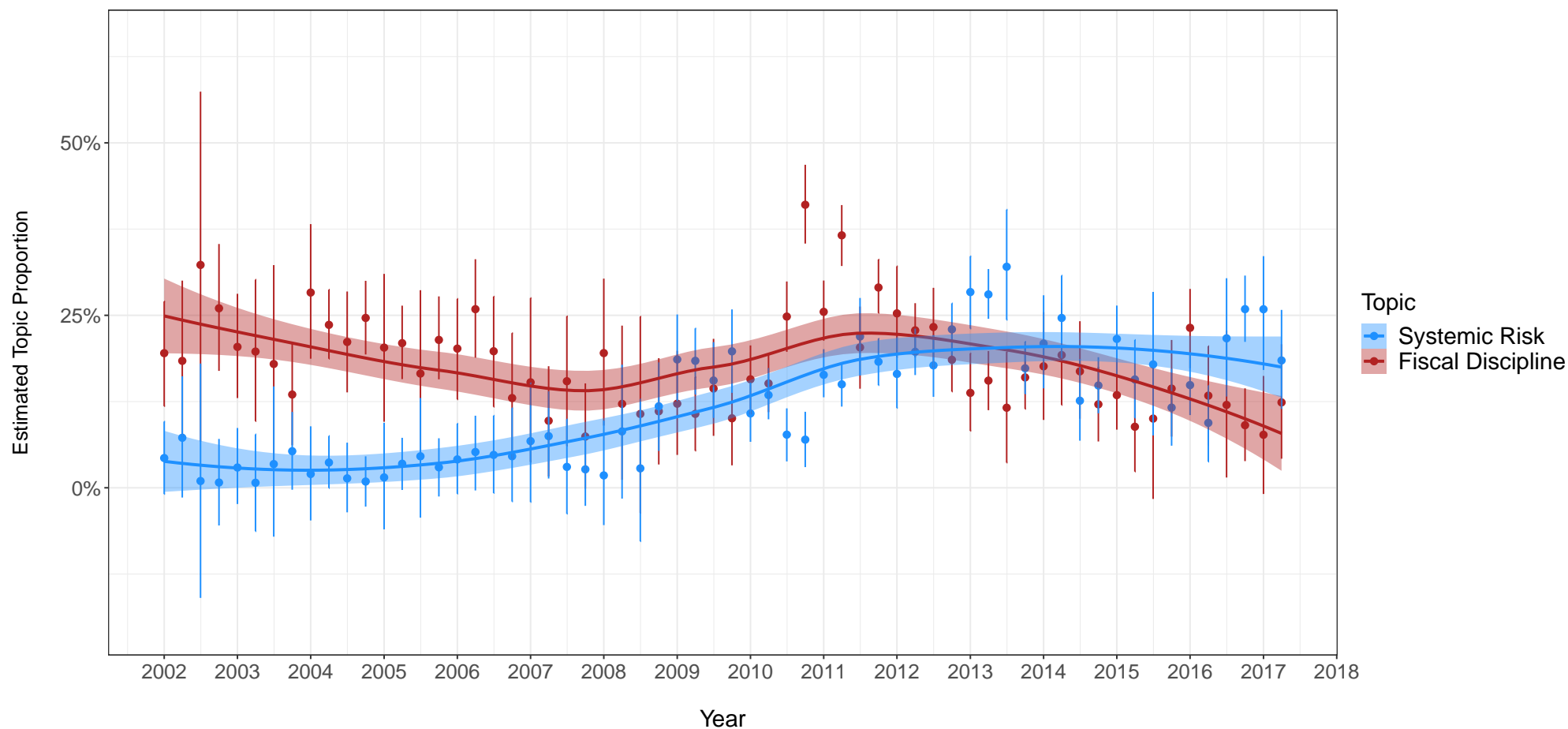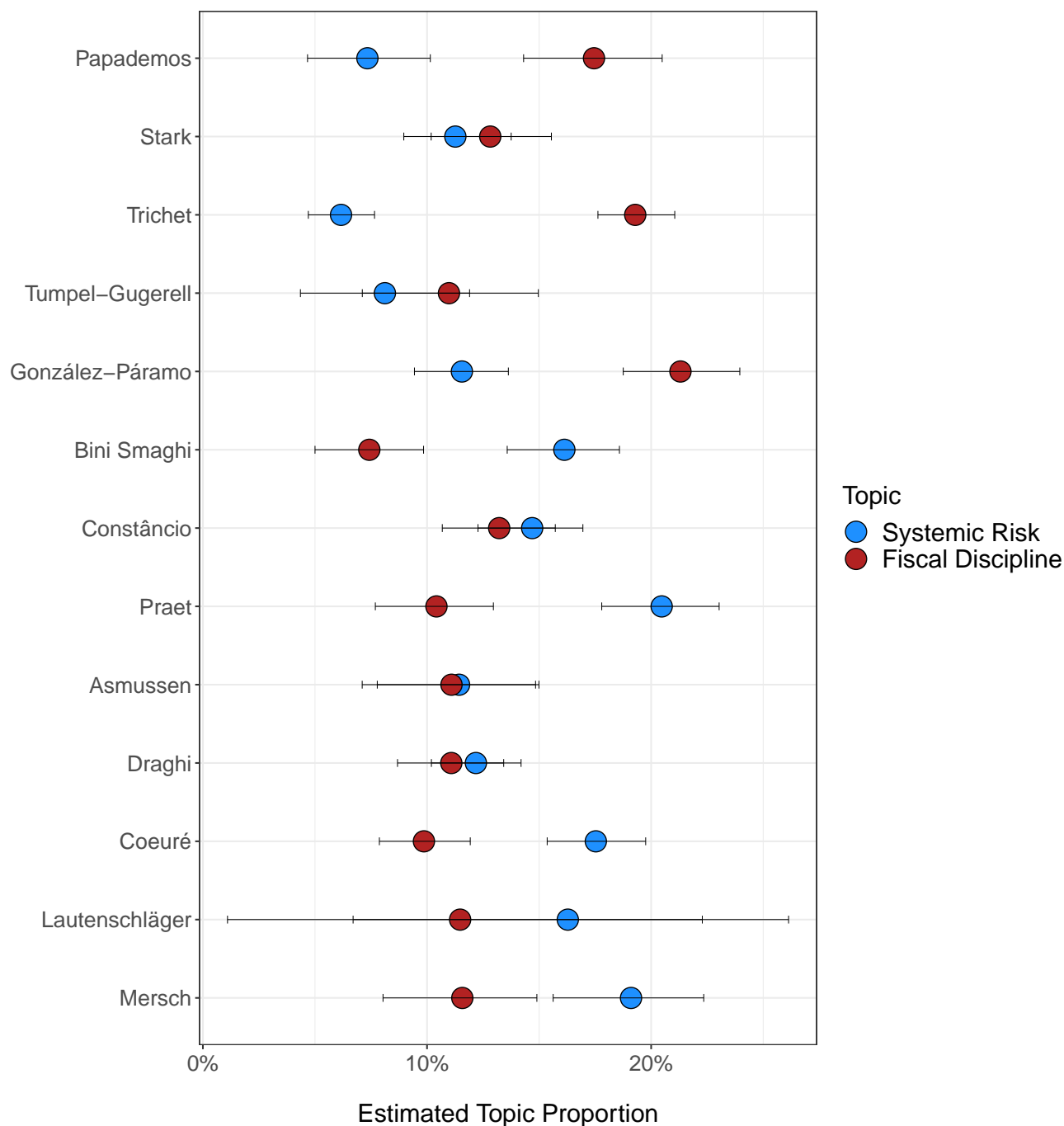
(a) Systemic Risk Topic
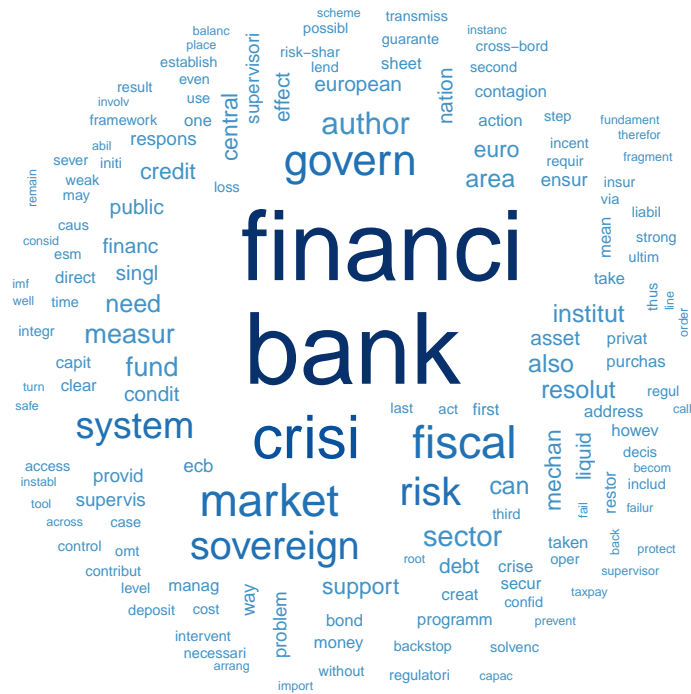
(b) Fiscal Discipline Topic

Figure A3: ECB Executive Board Members' Communication: Systemic Risk and Fiscal Discipline Topics by Quarter (STM Estimates)

Figure A4: ECB Executive Board Members' Communication: Systemic Risk and Fiscal Discipline Topics by Member (STM Estimates)

D An Extended Reading of ECB Inter-Meeting Speeches

This section extends the discussion of Section 4 of the paper, by providing additional examples of key passages from ECB Executive Board members showing the shift from the fiscal discipline view to the systemic risk perspective.

Similar to Jean-Claude Trichet, older members of the ECB Executive Board focused on the negative consequences of deterioration in fiscal fundamentals, arguing that the "main reason for the severe deterioration of public finances was the activation of automatic stabilisers as a result of the marked contraction of economic activity which followed the collapse of Lehman Brothers" (Papademos 2010) and claiming that "timely and credible exit strategies for withdrawing the existing fiscal stimuli must be developed and communicated as soon as possible" (Stark 2009).

The narrative of the crisis progressively changed starting from 2011. Great attention to fiscal discipline kept on being paid, but alternative views on the causes of the crisis started emerging. While maintaining a tough stance on fiscal discipline, Lorenzo Bini Smaghi was one of the first who highlighted the risks stemming from financial sector fragilities and contagion (Bini Smaghi 2011): "Even when fiscal policy is sound, as it was in Ireland's case, a country's public finances can be derailed if its banking system is overextended, poorly regulated and insufficiently diversified. Furthermore, given the integration of Europe's financial system, contagion cannot be avoided."

In a similar vein, José M. González-Páramo publicly acknowledge the literature "calling for euro-area wide bank supervisory bodies in order to bypass dangerous incentives at the national level to tolerate imbalances in the domestic banking sector, with associated risks of contagion and systemic crises" (González-Páramo 2011b) and talked about evidence of sovereign contagion in the euro area (González-Páramo 2011a).

However, it's after 2011 that the framing of the ECB's fiscal communication became mainly focused on systemic risk. In the second half of 2011, major changes in the composition of the ECB Executive Board took place. Mario Draghi replaced Jean-Claude Trichet as ECB President in November 2011. After his resignation, Jürgen Stark was succeeded by Jörg Asmussen in January 2012. Peter Praet and Benoît Cœuré also joined the board in 2011. In February 2012, Peter Praet was the first one who expressly referred to the sovereign-bank vicious circle as a root cause of the euro crisis (Praet 2012): "An adverse feedback loop set in: a vicious circle by which weak sovereign hurt banks and the need for bank recapitalisation and refinancing hurt sovereign. Risk aversion by market participants soared: there was contagion."

In the same spirit, just few days before Draghi's famous "whatever it takes" pledge, Benoît Cœuré described the decision to give the European Stability Mechanism the ability to recapitalise banks directly as a move that was "crucial to break the vicious circle between banks and sovereigns that is at the heart of the crisis" (Cœuré 2012).

A similar line was adopted by Jörg Asmussen. Starting from April 2012, he conceded that "several European countries face a vicious circle where weak domestic banks cause fiscal difficulties for governments, which in turn undermines public debt sustainability and further damages banks' balance sheets" (Asmussen 2012b). Moreover, after a legal challenge against the OMT programme was launched in Germany, Asmussen took a favourable stance on the ECB's decision before the German Federal Constitutional Court with arguments that

entirely resonated with the systemic risk perspective (Asmussen 2013): "[...] the rapid rise in spreads in the first half of 2012 was not accompanied by an equivalent deterioration in those countries' fundamentals. At the same time, there was an acute risk that contagion would affect other euro area countries, pointing to systemic risks that were not limited to specific countries".

Nonetheless, as in the case of Draghi, it would be misleading to consider Asmussen as a carrier of new ideas inside the Board. Indeed, in his first two public speeches as a Board member, Jörg Asmussen appeared to display continuity with Jürgen Stark, as he defended the fiscal adjustment process in Greece and Ireland, and argued that fiscal consolidation based on spending cuts was key to foster economic growth (Asmussen 2012a; Asmussen 2012c).

The content of fiscal communication has been rather stable since 2013. From this year onwards, this type of communication has remained focused on calling for growth-enhancing supply side measures in euro area member states (i.e., "structural reforms"), and advocating greater European integration (i.e., "risk-sharing") to reinforce the euro area governance. This has been especially true for new members of the Executive Board. Former Bundesbank vice-president Sabine Lautenschläger, who succeeded Jörg Asmussen after his resignation in December 2013, is often regarded as a carrier of the doctrinaire view of the Bundesbank, especially since she signalled her opposition to the ECB's interventionism in many occasions (e.g., Wall Street Journal 2014; Reuters 2015). However, when considering her fiscal communication, one can hardly find any similarity with that of Jürgen Stark, another German member of the ECB Executive Board with a long experience in the Bundesbank.

Consistent with her role of Vice-Chair of the ECB Supervisory Board, Lautenschläger has put much greater emphasis on problems of systemic risk in the euro area than Stark. For instance, she argued (Lautenschläger 2016): "It's becoming more likely that systemic problems are emerging or intensifying: a state infects the national banking system, or vice versa, and the problems spread across borders. Such systemic risks can then only be kept in check by way of a fiscal risk-sharing". Furthermore, she has repeatedly called for greater European integration and claimed that a European finance minister with strong powers could serve as an anchor for deeper economic union (Lautenschläger 2017).

Along the same line, Luxembourger ECB Executive Board member Yves Mersch, who joined the board in December 2012 and is often regarded as an anti-inflation "hawk" (Politico 2013), repeatedly referred to the sovereign-bank loop as the key cause of the euro crisis (e.g., Mersch 2013b; Mersch 2016) and called for further steps towards fiscal union and a stronger governance of the economic union (e.g., Mersch 2013a; Mersch 2014).

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