What's the Talk in Brussels? Leveraging Daily News Coverage to Measure Issue Attention in the European Union

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Abstract

Research on issue attention in the European Union has focused on the prominence of EU integration in domestic politics and media and, at EU level, on the salience of individual issues and legislative files, often in relation to lobbying. Existing EU-level measures of issue saliency, though, are limited in scope and periodicity and tend to reflect the policy priorities of a single institutional actor rather than that of the broader EU elite sphere. We present an alternative measure of issue attention leveraging the quasi-institutional nature of the Agence Europe daily bulletin which provides comprehensive but independent news coverage of EU affairs. We use text-mining techniques, including dynamic topic modelling, in combination with manual classification to map issue prevalence between 1979 and 2018. In addition to reporting validation results, we illustrate how our measure relates to other indicators of EU agenda formation and explain how researchers can make use of our new dataset.

Keywords: Issue attention, Media, Dynamic topic model, Validation

JEL Classification: C19, C59, H79, K10

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1 Introduction

What issues receive political attention, or not, is a crucial aspect of politics. Political attention is a scarce and precious good, for which aspiring agenda influencers must compete along with institutionalized agenda-setters. So, since agenda formation affects, either directly or indirectly, virtually all facets of politics, it is not surprising that political scientists have expended considerable efforts on mapping and explaining how policy agendas change (Baumgartner et al., 2006; Baumgartner and Jones, 1993; Princen and Rhinard, 2006), issues and their frames evolve (Carmines and Stimson, 1989; Diez-Medrano, 2004) and how democratic institutions respond to public demands and concerns (Alexandrova et al., 2016; Sorace, 2018).

European Union (EU) studies are no exception to the quest for reliable and comprehensive indicators of issue attention. Much of the literature on agenda formation in the context of EU affairs has concerned itself with the salience of EU integration in domestic politics and media (Rauh, 2014; Wonka, 2016; Veen, 2011; Netjes and Binnema, 2007; Adam and Eschner, 2008; Peter and De Vreese, 2004; Koopmans and Pfetsch, 2006; Diez-Medrano, 2004). Owing to the absence of “a genuinely supranational public sphere on the European level” (Koopmans, 2007; Risse, 2010, 185), measuring the degree of “Europeanization” of domestic politics has been the principal preoccupation of this strand of research. At EU level, meanwhile, researchers have concentrated on the salience of individual issues and legislative files, often in connection with lobbying efforts (Beyers et al., 2018; De Bruycker and Beyers, 2015; Klüver, 2011; Dür and Matteo, 2014). As with agenda research in other contexts, the development of a general measure of issue attention has had to grapple with the difficulty of measuring salience in a comprehensive manner (Wlezien, 2005), either due to prohibitive cost of measurement techniques (surveys, expert interviews, human coding) or the lack of sufficiently comprehensive data (Warntjen, 2012). Using European Council and European Commission documents, though, researchers have evolved actor-based indicators of agenda formation. Among these is the European Union Policy Agendas Project (Alexandrova et al., 2014), which represents, to date, the most comprehensive attempt to measure issue attention at EU level. The dataset covers a wide range of policies across four decades and constitutes, without any doubt, a major contribution to the study of agenda-setting in the EU context. Still, it exhibits important limitations. First, it is exclusively based on the items appearing in European Council conclusions. Yet what matters to the European Council may not matter for other EU actors, and vice-versa. Researchers should therefore be wary of using it as more than a measure of Council agenda priority. Second, European Council conclusions emphasize high politics where national governments wish to set general guidelines and objectives for the bloc. Yet for

many research questions, such as the influence of lobby groups on particular policies or the comparative policy responsiveness of EU institutions on specific issues, researchers need a measure that captures both high and low politics and is independent of EU institutions. More broadly, what they need is a measure that captures issue attention in the Brussels-bound, EU elite sphere that encompasses Commissioners, MEPs, EU civil servants, diplomats, policy experts, EU contractors, consultants, pressure groups and NGOs, as well as national government representatives.

In this paper, we undertake to construct such a measure by leveraging text data from the Agence Europe bulletin (AEB). AEB, we argue, is a “quasi-institutional” news outlet which caters to EU policy wonks, civil servants and lobbyists. Published daily, it covers all policy areas within the remit of EU competences along with broader foreign policy and business news. The broad scope of AEB ensures that it captures low as well as high politics. Analysing the entire universe of English-language AEB from 1979 to 2018, we apply text-mining techniques, including dynamic topic modelling, to construct a detailed classification of the bulletins’ contents. The resulting dataset provides a measure of the proportion of 75 machine-generated topics organized into 19 manually defined meta-categories.¹ We validate our indicator using a random sample of human-coded bulletins. Besides showing how our measure of issue attention relates to other measures of EU agenda formation, we provide illustrations of how particular agenda items track international developments and critical junctures in the European integration process.

The paper proceeds as follows. Section 2 discusses the literature on issue attention. Section 3 provides some context regarding the documents forming our corpus and serving as basis for the construction of our indicator, while Section 4 explains our methodology. Section 5 presents the resulting measure, which we name “EUSSUE”. Section 6 reports the results of our validation and Section 7 examines how EUSSUE compares to the Agendas Project. Finally, Section 8 links our measure to indicators concerning climate change, the Eurozone crisis, the European migrant crisis and the Syria conflict.

2 Issue Attention in the EU

Issue attention, agenda formation or issue saliency – we use these terms interchangeably² – can be measured in a variety of ways. A useful distinction is between generic and actor-centred measures (Beyers et al., 2018). Actor-centred indicators approach

¹The textual corpora (.txt and .RData) and time-series data (.dta, .csv and RData file) of the EUSSUE measure can be downloaded from the *masked for review* repository.

²For a conceptual elaboration of these notions see Beyers et al. (2018) and Netjes and Binnema (2007).

issue saliency from the viewpoint of aspiring agenda influencers or institutionalized agenda setters. This is the approach adopted by researchers who have constructed measures of issue prevalence from European Council, Council of the European Union and European Commission files (Alexandrova, 2017; Alexandrova et al., 2016, 2014; Carammia et al., 2016; Osnabrügge, 2015; Häge, 2016), European Parliament speeches (Greene and Cross, 2017) or, at the domestic level, from debates in the legislature (Rauh, 2014; Wonka, 2016) or items in party manifestos (Veen, 2011). This approach has the advantage of being both analytically and empirically tractable, in addition to having relevance for various strands of research on EU politics. Each EU institution produces its own line of policy documents and communications which scholars have been able to dissect and interpret as issue attention (Alexandrova et al., 2014; Greene and Cross, 2017; Osnabrügge, 2015; Häge, 2016).³ The same holds for electoral manifestos and legislative debates (Rauh, 2014; Wonka, 2016; Veen, 2011). In contrast to actor-centred measures, generic measures seek to capture issue attention in the broader mediatized public sphere, assuming that this sphere is imperfectly controlled and transcends the priorities of individual agenda-setters. “Europeanization” studies that aim to assess the attention paid to the EU in domestic media (Adam and Eschner, 2008; Peter and De Vreese, 2004; Koopmans and Pfetsch, 2006; Diez-Medrano, 2004) typically follow this line of inquiry.

A comparison of the domestic and EU-level literatures on issue attention reveals an interesting disparity. Whereas research on issue attention at the domestic level features both generic and actor-centred approaches, the EU-level literature has considered only the latter. The underlying reason for this asymmetry may seem obvious. The EU lacks an autonomous public sphere (Koopmans, 2007; Risse, 2010, 185). So actor-based indicators may seem to adequately capture the items that define the agenda in Brussels. The EU Policy Agendas Project is predicated on the notion that the European Council is the most powerful agenda-setter in the EU context (Alexandrova et al., 2014). Thus, what the EU pays attention to should somehow find its way into European Council conclusions, or alternatively into Commission documents or European Parliament speeches.

We believe, however, that actor-centred measures of agenda formation miss important aspects of the EU-level policy debate. While the EU lacks an autonomous public sphere, Commissioners, MEPs, EU civil servants, diplomats, policy experts, EU contractors, consultants, pressure groups, NGOs, and national government representatives operating in the Brussels-bound “EU bubble”(Busby, 2013) form what we may call an “elite sphere”. What participants in this sphere debate and discuss goes be-

³The variance in issue attention among different institutions is itself an object of research (Alexandrova, 2017).

yond what a particular EU institution formally puts on its agenda. EU institutions are typically self-focused when articulating their policy priorities, as research comparing the Commission and the European Council has shown (Alexandrova, 2017). Moreover, what they choose to prioritize partly reflects their position in the policy-making process. European Council conclusions set broad goals and articulate general guidelines, which the Commission, the European Parliament and the Council of the European Union then work to implement (Alexandrova et al., 2012). By contrast, while issues debated in the EU elite sphere should be expected to include the items of high politics placed on the European Council’s agenda in the ongoing policy cycle, they should also encompass many low-politics topics and sub-topics.

We would like a generic, EU-level measure of issue attention to cover all these items while minimizing the institutional biases associated with actor-centred measures. In the following sections, we undertake to construct and validate such a measure.

3 The Agence Europe Bulletin

We propose to construct a generic indicator of issue attention from the AEB. Founded in 1953, originally published in French and from 1979 onward also in English, the AEB specializes in news relating to EU activities and institutions. The AEB sees itself as the leading source of information on European integration:

“For 66 years now, Agence Europe has been widely considered THE source (some might say the ‘Bible’) of information on European economic and political integration.”⁴

Stressing its prominence in the EU elite sphere, some scholars have described the AEB as a “quasi-institution” (Fougier, 2010; Bastin, 2002; Marthoz, 2008). The bulletin is an elite-sphere publication both *for* and *about* EU decision makers. AEB journalists and correspondents are policy specialists while EU civil servants, Brussels-bound diplomats and EU policy experts constitute the bulk of AEB’s readership (Fougier, 2010). This specialized, policy orientation is reflected in the breadth and dry descriptiveness of the bulletins. Aside from institutional and policy developments – which capture change in policy agendas (Princen and Rhinard, 2006; Princen, 2007, 2011; Peters, 1994) – bulletins also carry industry and economic news, in particular those tied to EU affairs. While the AEB along with its leading journalists are associated with a soft-federalist editorial line and EU officials are often their main source of information (Fougier, 2010), AEB is financially and organisationally independent of

⁴See website <https://agenceurope.eu/en/about.html>

EU institutions. In early decades, the AEB sometimes re-printed institutional reports which could skew an individual issue towards the frames favoured by its institutional author. Nonetheless, the vast majority of bulletins consist of news items reporting on EU developments without using emotionally charged language and this largely descriptive tone is consistent over time.⁵ Opinion pieces (including editorials) represent a very small fraction of the contents of the bulletins.

While political and media attention are, arguably, co-constitutive (Boydston, 2013), we believe that the AEB provides a comprehensive and relatively objective measure of issue attention. This presumption rests on the small and specialized nature of the AEB’s readership. First, the AEB reports on issues which are not sufficiently newsworthy for mass media but of interests to EU civil servants and policy experts. The resulting breadth of coverage makes the AEB suitable for serving as a basis for a general survey of topic attention. Second, its small, specialized audience makes the AEB unable to shape public opinion. Obviously, the AEB is not a publication for the masses. The AEB’s journalistic style is descriptive rather than investigative (Fougier, 2010). So political actors at the EU level are relatively safe to ignore its reporting.⁶ In consequence, it seems reasonable to assume that AEB comprehensive coverage of EU affairs is comparatively less distorted by the pressures of electoral and political cycles and the desire to influence voters than transnational mass outlets – such as the Financial Times, the Guardian and the Economist – or, for that matter, national newspapers and TV broadcasters.

While the EU’s elite sphere has seen the emergence of other news outlets – most notably euobserver, Euractiv and Politico – and their degree of overlap with the AEB is a question that future research might deem worth investigating, these outlets do not offer the temporal coverage of the AEB. The English version of the AEB employed in the construction of our measure of issue attention goes back to 1979. By comparison, the olded rivals of the AEB, Euractiv and Euractiv, were launched in respectively 1999 and 2000.

4 Data and Methodology

This Section explains how digitized versions of the bulletins were obtained; how these texts were pre-processed to facilitate computer-aided analysis and how we combine probabilistic topic modelling and human classification to construct our indicator.

⁵We report a minor sentiment analysis exercise in the Appendix.

⁶Even the increased politicization of EU affairs and the emergence of rival outlets, such as Politico, Euractiv and eubserver has made little difference to AEB’s descriptive style of reporting (Fougier, 2010).

4.1 Data: AEB, 1979-2018

Our issue attention measure is derived from the entire universe of bulletins (N=9546) published in English during the period 1979-2018. By relying on a single type of publication from a single media source we strive to minimize unwanted heterogeneity and maximize temporal consistency in the underlying text data. Between 1979 and 2000 the textual data is available in scanned form courtesy of a digitization project conducted by the European University Institute Library. From 2000 onward the data was sourced in digital form from the website of Agence Europe.⁷

The fact that the data prior to 2000 comes from scans of printed publications, as opposed to HTML websites, could introduce unwanted distortion to our measure, as our topic modelling could pick up on technical differences between the two sets of documents. While we acknowledge that the pre-2000 data does not have the perfect quality of the electronically published documents, we strived to apply the best available optical character recognition (OCR) and image conversion techniques to minimize data loss. We point out that 19 bulletins from the early period are missing entirely. Depicting the number of words of each document, Figure 1 suggests the data retrieval process has not resulted in a systematically biased corpus.

⁷<https://agenceurope.eu>

Figure 1: Number of words per document in the raw corpus.

Whereas document length is relatively consistent around the period corresponding to the transition from the scanned to the HTML format (1999/2000), we can see a gradual decline since 2006. We speculate that this reflects editorial decisions driven by readership preferences as a consequence of the changing competitive landscape in the EU-level news market. That said, document length is on the whole remarkably stable, with outliers few and far between.⁸ Systematic variation can be observed when comparing summer issues (in particular August) with the rest of the year, which mirrors the lighter workload of EU institutions and the less intense news cycle in this period (see also Figure 9 in Appendix).

4.2 Pre-processing

As is customary for text-mining applications, our pre-processing steps involve removing white-spaces, punctuation, numbers and stop-words together with stemming, while

⁸Sentence and character-level measures produce results very similar to the word-level measure. We report the latter because words constitute the unit of analysis in the topic model.

converting all characters to lower case. The goal of pre-processing is to strike the right balance between reducing the inherent complexity of textual data and preventing the loss of relevant information (Denny and Spirling, 2018; Grimmer, 2010; Lucas et al., 2015). More specifically, Figure 2 illustrates our pre-processing strategy, which breaks down into three main steps: data collection, cleaning and reduction. As half of our data consists of scanned documents, we attempted to minimize unwanted distortions in the data collection phase by applying a state-of-the-art optical character recognition (OCR) technique which improves the likelihood of successful text extraction (Smith, 2007). Using recognized words as training data, the OCR algorithm detects the individual component features from which a character is made.

Figure 2: Data pre-processing steps.

The second stage of pre-processing involves the removal of undesirable document-specific (quasi-)words. A substantial number of bulletins feature sentences or paragraphs written in a language other than English (often French). In order to avoid misclassification problems in the topic model, we tokenize all documents at the sentence

level and apply a language detection tool to identify non-English sentences, which we then remove from the corpus. Owing to frequent misspelling, typos and similar errors resulting from either incorrect character recognition or the original texts, we employ a dictionary-based spell-checker after tokenizing the sentences at the word level (Ooms, 2017). Erroneous terms are replaced by most likely suggested words or dropped if no suggestion is available, as is the case for garbage tokens. In the last step we apply four common pre-processing techniques⁹ aiming at reducing the number of features in the final document-term matrix: removal of uninformative words¹⁰ and terms shorter than three or longer than fifteen characters, reducing words to their stem (stemming), and dropping words appearing in more than 95% and fewer than 5% of all documents. During this stage we also convert frequent – appearing at least 1000 times in the corpus – two-word collocations (bi-grams) into single expressions (for example, “cohesion” followed by “policy” becomes “cohesion_policy”).

While the present paper emphasizes our own indicator, which, we are confident, should meet the needs of many researchers in search of generic EU-level measure of issue attention, the textual corpus enables the construction of alternative indicators, a different set of techniques (e.g. supervised classification, vector embeddings) and/or choosing distinct units of time (week, month) or level of generality. All the data we collected and generated – whether the raw and pre-processed corpus or the final EUSSUE indicator – are available on *masked for review* for researchers to use.

4.3 Dynamic Topic Modelling and Human Classification

With individual bulletins spanning around 13,000 words on average, coding our corpus manually would require an impossibly large amount of resources. For that reason, we rely on automated content analysis techniques to estimate the latent topical structure of our corpus (Quinn et al., 2010; Grimmer and Stewart, 2013; Grimmer, 2010; Kim, 2018; Dybowski and Adämmer, 2018; Rothschild et al., 2019; Catalinac, 2016). Developments in machine learning and natural language processing have led to the emergence of probabilistic topic modelling as a powerful technique to classify large collections of documents (Blei et al., 2003; Blei and Lafferty, 2006). Originally developed by (Blei et al., 2003), Latent Dirichlet Allocation (LDA) remains the most popular topic modelling approach. Yet increasingly sophisticated or specialized topic modelling algorithms have appeared in recent years ranging from non-negative matrix factorization to hierarchical topic models (Greene and Cross, 2017; Blei, 2012; Grimmer, 2010; Rosen-Zvi et al., 2004). All topic models, though, share the same basic assumptions. While reducing texts to bags of words, they model topics as latent prob-

⁹See the Appendix for a comparison with an alternative pre-processing strategy.

¹⁰Custom words removed are listed in the Appendix.

ability distributions over words and documents as latent probability distributions over topics.

Although LDA – the plain vanilla approach to topic modelling – is a powerful algorithm for analysing large corpora, it is not well-suited for dynamic corpora, where topics may change over time. Dynamic topic modelling addresses this problem by extending the idea of LDA to allow topic representation to evolve over fixed time intervals (Blei and Lafferty, 2006). The multi-purpose structural topic model developed by Roberts et al. (2014) and implemented in the *stm* package for R allows the estimation of a topic model where each topic is represented not by a single distribution over words but, instead, by a sequence of distributions over the time intervals. Building on the Correlated Topic Model (Blei et al., 2007), the *stm* implementation assumes a logistic normal generalized linear model instead of a latent dirichlet process for topic proportion (Roberts et al., 2014). Here we choose the year as time interval, as it is a common unit of time to track agenda formation dynamics.

Formally, our time interval enters the document-generating process as a covariate interacting with topic prevalence:

$$\theta_{1:D}|t_{1:D}\gamma, \Sigma \sim \text{LogisticNormal}(\mu = t_{1:D}\gamma, \Sigma). \quad (1)$$

where t_d is the year in which document d was published; γ is a $p \times (K - 1)$ matrix of coefficients for topic proportion and Σ is a $(K - 1) \times (K - 1)$ covariance matrix. A topic z is drawn from the document specific distribution, conditional on that topic k , a word is chosen from the multinomial distribution over words denoted by $\beta_{d,k}$:

$$\beta_{d,k} \propto \exp(m + \kappa_k) \quad (2)$$

where m represents the baseline word frequencies and κ_k the topic deviation per topic k . Conditional on the topic selected and token-level distribution $z_{d,n}$ where $n \in [1, \dots, N - d]$ for each word in the document, the observed word $w_{d,n}$ is drawn from a multinomial distribution:

$$w_{d,n}|z_{d,n}, \beta_{d,k=z_{d,k}} \sim \text{Multinomial}(\beta_{d,k=z_{d,k}}) \quad (3)$$

As implemented in the **stm** package, the posterior distribution for this dynamic topic model is computed via variational expectation maximization (Roberts et al., 2019). The number of topics k in a topic model is set by the researcher and determines the dimension of the topic space. A larger k provides a more detailed picture of the corpus, while a smaller k results in a simpler, more general picture. A variety of metrics, such as harmonic mean, perplexity, log-likelihood, semantic exclusivity and coherence, have been proposed to evaluate the quality of the model and to choose

the number of topics (Wallach et al., 2009; Chang et al., 2009; Mimno et al., 2011). However, there is no “right” k and the validity of these formal criteria is not well established; perplexity, for one, has been shown to be inversely correlated with human interpretability (Chang et al., 2009). For our main analysis, we ignore these formal metrics. Instead, we set the number of topics on the basis of two criteria. The first is interpretability. There is little point in using topic modelling if the resulting topics, or at least a large number of them, eschew human interpretation. The second criterion is motivated by the aim of our classification exercise: we want a sufficiently large number of topics to provide a relatively fine-grained picture of agenda variation. After iterating several topic models, we settled on $k = 88$ as providing a sufficiently large number of interpretable topics. We found that a higher k produces few additional meaningful topics, whereas a lower k , though producing interpretable topics, offers a less detailed picture.¹¹

Using unsupervised document classification to construct a measure of issue attention has advantages as well as drawbacks. Topic modelling is an inductive, data-driven approach. Whereas supervised classification and manual coding schemes presuppose that the researcher knows the relevant categorizations a priori (Alexandrova et al., 2014), topic modelling lets the data speak first. The topics do not come from the researcher’s a priori definition but emerge from the data. Thus a topic model may reveal issues the researcher had not thought of. However, to the extent that one has a priori knowledge of the items that a measure of issue salience should include or wishes to relate the results to other, human-coded indicators, the topic model may fail to capture the categories of interest to the researcher. Our approach mitigates this problem by adding a layer of human coding to the topic model. We organize the machine-generated topics into more general themes. For this, we follow the coding scheme of the EU Policy Agendas Project (Alexandrova et al., 2014), from which we only deviate with respect to the European Parliament, the Eurozone and EU Treaties.¹² This makes our measure easier to relate to existing EU-level indicators.

¹¹Figure 15 in the Appendix evaluates the model performance at varying number of topics.

¹²The deviation rests in the fact that we code these three issues at the theme level rather than as part of the “EU Governance” theme. The issues receive sufficient attention in the AEB to warrant this more granular approach compared to the EU Policy Agendas project. If complete comparability is desired, these additional themes can be collapsed by researchers into the “EU Governance” theme.

5 EUSSUE: A Generic, EU-Level Measure of Issue Attention

Similarly to Quinn et al. (2010), we aim to construct a classification scheme with items that sustain attention over time. We take this to imply that topics must transcend mere events. Nevertheless, as will be seen below, our classification method identifies considerable temporal variation in topic proportion.

The most important output of our dynamic topic model is the topic proportion per document θ . We interpret this value as a measure of issue attention in the k -dimensional topic space. For topic i at time t , a larger θ_{it} indicates greater topic prevalence. Ignoring the temporal dimension for the moment, Table 1 shows the topic proportions for all 88 topics in our model. The table includes also the words most distinctive of each topic, as determined by the word-level parameter β .

Table 1: Topic Proportions and Top Words for 88-Topic Model

Topic number	Topic portion (%)	Pro-portion (θ) in	Words (β)	Topic label
29	2.175		court justic law reason legis wast infrng water fail judg	european_court_of_justice
39	2.157		treati articl provis power common legal legis charter compet draft	treaty_reform
80	2.140		law power histori citizen research social cultur legal describ integr	garbage: political_principles
77	1.878		summit strategi conchus commit prioriti reform framework integr full invit	summits_organisation
40	1.827		growth deficit rate forecast fall rise economi inflat budgetari figur	economic_outlook_european_economies
5	1.812		brexit vote sourc draft articl law compromis citizen invest mogherini	brexit
17	1.784		price agricultur produc wine farmer milk sugar farm cereal cap	common_agricultural_policy
7	1.782		maastricht treati summit round debat uruguay republ danish yugoslavia packag	maastricht_treaty
48	1.757		vote amend resolut plenari rapporteur debat socialist abstent reject green	EP_debates
9	1.695		oil price import unit dollar energi convent neuron jenkin start	oil_price
68	1.689		price export commod import oil deleg start produc energi get	commodity_prices_2
22	1.568		organ summit treati network debat prepar single_curr social spanish access	procedural_summits
36	1.564		budget fund budgetari expenditur spend resourc payment commit amount appropri	EU_budget
61	1.553		turnov debat summit american nice aim stake usd enlarg british	garbage: summit
1	1.547		price import export rate demand agricultur united_st dollar american firm	commodity_prices
12	1.526		bank subsidiari share capit firm invest american acquir british turnov	business_activity
21	1.514		technolog enlarg dollar deleg head united_st treati summit lead esprit	garbage: trade_dollar_mid_1980s
24	1.458		convent co-oper enlarg candidate_countri debat summit reform access organis united_st	convention_future_of_europe_and_enlargement
27	1.447		resourc special deleg financ reduct athen stuttgart summit agricultur german	community_budget_summit
20	1.422		constitut lisbon_strategi debat research citizen solana financial_perspect get communic prioriti	constitutional_treaty
62	1.415		transport road rail infrastruclur railway traffic network port air passeng	transport_pan-european_networks_and_market_liberalisation
11	1.415		gorbachev environ framework single_market deleg social ask debat control creation	single_market_creation
3	1.411		elect parti vote candid democrat seat elector list liber leader	EP_elections
71	1.407		loan financ invest fund bank credit small infrastruclur investment_bank water	european_investment_bank
46	1.403		summit internal_market lord pro debat singl complet environ larg accord	internal_market_SEA
44	1.401		human_right humanitarian peac conflict condemm mission humanitarian_aid violenc resolut united_n	humanitarian_crises
28	1.358		aid state_aid restructur grant invest cost scheme authoris amount subsidi	state_aid
13	1.333		dollar united_st agricultur japan american export ton singl price import	trade_japan_united_states
57	1.325		import export textil duti price origin quota tariff produc dump	tariffs_and_barriers_to_international_trade
23	1.325		debat socialist british communist democrat resolut vote italian budget speak	EP_debates_socialists
58	1.323		employ worker social job unemploy labour social_partu social_secur trade_union labour_market	employment
75	1.303		migrant refuge migrat organis mogherini greek sourc crisi lamer mechan	migrant_crisis
72	1.244		acquisit investig merger network activ fund mobil control busi retail	merger_and_acquisition
37	1.231		fish fisheri vessel quota stock catch water sea fleet speci	fisheries
81	1.212		gulf yugoslavia soviet crisi aid deleg kuwait dutch agricultur context	yugoslavian_and_gulf_crisis
69	1.158		crime asylum immigr justic drug fight polic terror legal crimin	criminality_and_immigration
47	1.147		enlarg summit amsterdam treati british debat employ reform organ agenda	amsterdam_treaty
54	1.133		energi electr gas oil suppli nuclear price coal fuel natural_ga	energy
32	1.131		tax taxat vat rate exempt save incom appli harmonis fiscal	taxation
38	1.127		german east unif eastern summit debat monetari emu central dublin	german_reunification
18	1.114		russia german law central offici eastern russian firm secretari feder	garbage: russia
8	1.099		ashton roma fund hungarian access manag debat strategi citizen schengen	garbage: roma_foreign_policy
15	1.097		czech eu27 amend lisbon_treati fund access case_comp tran irish slovenian	lisbon_treaty_ratification
25	1.093		israel palestinian isra middle_east peac lebanon united_st prime_minist jerusalem american	israel_palestine_conflict
87	1.080		consum price communiti comm geneva environ technolog contain cultur edit	garbage: price_consumer
2	1.072		greec eurozon greek eurogroup debt ecb inf crisi finance_minist gdp	eurozone_crisis
52	1.072		organ framework consum taxi environ united_st irish debat deleg dublin	garbage: consumer_irish
59	1.041		german epp- pes fund debat trichet finnish citizen germani ecb	garbage: german_presidency
45	1.039		energi climat target renewable_energi energy_effici environment environ technolog sustain invest	renewable_energy
56	1.036		digit invest reform latvian mogherini foreign economi onlin data consum	EU_agenda_for_digital_economy
67	1.031		bank fund esm eurozon budget reform invest cohesion_polic growth 2014-2020	eurozone_bailout_ESM
4	1.029		constitut igc convent draft enlarg italian insist iraq berlusconi commission	constitutional_treaty_IGC
19	1.021		epp aid leader greens_cfa vote gve_ngl citizen prime_minist cer itali	EP_factions
55	1.020		bank ashton reform foreign file mail troika high_repres aid vote	EU_foreign_policy_banking_crisis
26	1.019		educ train cultur youth school young_peopl student young mobil learn	education_culture_european_youth
82	1.012		monetari rate currenc em bank exchange_r central_bank governor exchang mechan	currency_fluctuations
35	0.999		secur defenc militari nato capabl mission common agenc defenc_minist alliance	defence_and_NATO
86	0.997		wto agricultur developing_countri british united_st farm landi doha compromis india	doha_negotiations
76	0.971		greet germani german contract merger greek sweden complaint spokesman austria	garbage
49	0.963		bank g20 crisi fund climat global summit strategi united_st economi	financial_crisis
73	0.944		steel steel_industri quota iron roll steel_product restructur export capac produc	steel_production
70	0.878		car vehicl japan manufactur japanes emiss pollut motor standard environ	japanese_car_imports
10	0.875		russia ukraine russian gas ukrainian energi moscow suppli gazprom putin	russia_ukraine_crisis_incl_gas
84	0.856		emiss climat airlin airport aviat air reduct carbon flight passeng	CO2_emissions
78	0.847		women men equal fanili children discrimin age social life poverti	gender_equality
85	0.838		health medicin tobaco medic diseas research patient pharmaceut prevent cancer	health
65	0.825		south africa african assembl convent sanction southern angola resolut mozambiqu	south_africa_apartheid
53	0.812		research canada nuclear scientif canadian greenland technolog fusion seal euratom	nuclear_energy
16	0.800		turkey cyprus turkish cypriot access ankara island membership custom greek	turkey_accession_to_EU
51	0.792		euro german reform cologn employ agenda united_st vienna summit turnov	garbage: germany_euro
74	0.766		romania bulgaria access hungari poland bulgarian reform romanian administr legis	eastern_member_states
42	0.760		food label authoris organ esa scientif risk gmos consum crop	food_labelling
14	0.726		euro bank currenc central_bank single_curr monetari coin introduct consum prepar	euro_introduction
66	0.716		mediterranean partnership algeria arab dialogu libya tunisia partner egypt eib	EU_mediterranean_cooperation_incl_MENA
31	0.716		morocco moroccan tunisia deleg protocol access compromis net environ conchus	cooperation_with_morocco_and_tunisia
64	0.702		anim meat beef ban diseas veterinari poulti pig control cattl	veterinary_regulations
43	0.689		mexico latin_america brazil central american america argentina latin_american chile banana	EU_latina_merica_cooperation
83	0.668		kosovo serbia albania croatia montenegro belgrad balkan macedonia albanian foreign_minist	balkans
6	0.626		prod euro finnish helsinki summit british enlarg round chair reform	garbage
41	0.613		patent research counterfeite languag legal inov court trademark translat internal_market	intellectual_property
33	0.601		acp africa acp_countri african wto fund edf partnership caribbean pacif	Cotonou (ACP) agreement
60	0.593		china chines beij anti-dump space duti investig invest export import	trade_relations_with_china
79	0.548		syria syrian holland bank regim weapon attack foreign chemic crisi	syrian_crisis
34	0.535		televis broadcast audiovisu media film advertis channel cinema satellit aluminium	audiovisual_media_contents
63	0.446		asean indonesia human_right thailand vietnam asian singapor burma philippin malaysia	EU_ASEAN_cooperation
88	0.428		safeti consum accid standard toy danger cocoa children fat coffe	consumer_protection
30	0.346		sport game club football player olymp organis transfer match profession	sport
50	0.153		glass bottl float flat european plastic share price agricultur individu	garbage: industrial_glass

In the next step we proceeded to label all topics and identify those which are not useful for our measurement objectives. The topics were labelled independently by two of the authors with the third one reconciling discrepancies.¹³ The labels were assigned

¹³We use the average cosine similarity to measure inter-coder reliability for topic labelling yielding 0.761. The correlation of assigning the themes of the Policy Agenda project is 0.878.

on the basis of the topic’s most distinctive words (based on β value), most distinctive documents (based on θ value) and varying proportion over time. As is common in unsupervised document classification, some topics proved, despite the care we put in selecting the model, impossible to interpret. While “garbage” topics may take up a significant proportion of the topic space (Quinn et al., 2010), in our case this amounts to a tolerable 13.2% of the total. We discarded these topics, thereby bringing the number of topics down to 75.¹⁴

As can be readily seen in Table 1, several topics relate to a similar overarching theme such as agriculture or the euro. As explained above, we organized the topics into 19 themes following a coding scheme largely inspired by the EU Policy Agendas Project.

¹⁴This step also involved merging two topics dealing with commodity prices into one after adjudging that they captured the same issue.

Table 2: EUSSUE Topics Clustered into Themes

Theme labels	Theme proportion (δ) in [%]	Topic number	Topic labels	Topic proportion (θ) in [%]
international affairs and foreign aid	17.109	22	procedural_summits	1.743
		44	humanitarian_crises	1.576
		81	yugoslavian_and_gulf_crisis	1.387
		38	german_reunification	1.303
		25	israel_palestine_conflict	1.268
		55	EU_foreign_policy_banking_crisis	1.195
		10	ukraine_crisis_incl_gas	1.05
		65	south_africa_apartheid	1.000
		16	turkey_accession_to_EU	0.975
		66	EU_mediterranean_cooperation_incl_MENA	0.892
		31	cooperation_with_morocco_and_tunisia	0.891
		43	EU_latam_cooperation	0.865
		83	balkans	0.843
		33	Cotonou (ACP) agreement	0.776
		79	syrian_crisis	0.723
EU governance	12.328	63	EU_ASEAN_cooperation	0.622
		29	european_court_of_justice	2.351
		77	summits_organization	2.053
		5	brexit	1.987
		36	EU_budget	1.74
		24	convention_future_of_europe_and_enlargement	1.633
banking, finance and internal trade	10.856	27	community_budget_summit	1.622
		74	eastern_member_states	0.942
		12	business_activity	1.701
		11	single_market_creation	1.590
		46	internal_market_SEA	1.579
		28	state_aid	1.533
		72	merger_and_acquisition	1.419
		73	steel_production	1.12
treaties	9.686	41	intellectual_property	0.788
		88	consumer_protection	0.604
		30	sport	0.522
		39	treaty_reform	2.332
		7	maastricht_treaty	1.957
foreign trade	9.413	20	constitutional_treaty	1.598
		47	amsterdam_treaty	1.323
		15	lisbon_treaty_ratification	1.272
		4	constitutional_treaty_IGC	1.204
european parliament	6.216	1	commodity_prices	3.411
		13	trade_japan_united_states	1.507
		57	tariffs_and_barriers_to_international_trade	1.501
		86	doha_negotiations	1.172
		70	japanese_car_imports	1.053
macroeconomics	6.079	60	trade_relations_with_china	0.769
		48	EP_debates	1.932
		3	EP_elections	1.586
		23	EP_debates_socialists	1.501
energy	5.381	19	EP_factions	1.197
		40	economic_outlook_european_economies	2.003
		71	european_investment_bank	1.582
		32	taxation	1.306
agriculture and fisheries	5.178	82	currency_fluctuations	1.188
		9	oil_price	1.870
		54	energy	1.309
		45	renewable_energy	1.214
eurozone	4.496	53	nuclear_energy	0.988
		17	common_agricultural_policy	1.959
		37	fisheries	1.406
		42	food_labelling	0.936
immigration	2.812	64	veterinary_regulations	0.877
		2	eurozone_crisis	1.248
		67	eurozone_bailout_ESM	1.207
		49	financial_crisis	1.139
space, science, technology and communication	1.922	14	euro_introduction	0.902
		75	migrant_crisis	1.479
transportation	1.590	69	criminality_and_immigration	1.333
		56	EU_agenda_for_digital_economy	1.212
labour and employment	1.499	34	audiovisual_media_contents	0.710
		62	transport_pan-european_networks_and_market_liberalization	1.590
education	1.194	58	employment	1.499
		26	education_culture_european_youth	1.194
defence	1.174	35	defence_and_NATO	1.174
environment	1.032	84	CO2_emissions	1.032
civil rights, minority issues and civil liberties	1.022	78	gender_equality	1.022
health	1.013	85	health	1.013

This task was completed following the same procedure as topic labelling, with two researchers annotating topics independently and a third one reconciling the discrepan-

cies.¹⁵ We call the resulting generic, EU-level measure of issue attention “EUSSUE”. Table 2 shows the labelled topics and themes with the attached (overall) proportions.

Figure 3 illustrates how issue attention varies over time using the theme level of analysis. Among other things, the plot suggests a decline in the salience of foreign trade but a surge in the salience of immigration around 2015, while agriculture exhibits remarkable stability.¹⁶

Figure 3: EUSSUE theme-proportion over time

Note. The theme “Other” comprises the seven smallest themes in terms of proportion for the sake of visualization. With the exception of themes “European Parliament”, “Eurozone” and “EU Treaties”, thematic clustering is aligned with the codebook of the Agendas Project (Alexandrova et al., 2014).

¹⁵Results based on more formal clustering metrics are reported in the Appendix.

¹⁶The data can be explored online at https://eussue.shinyapps.io/eussue_shiny/.

6 Validation

Because our classification scheme is, for the largest part, machine-generated, it requires validation (Grimmer and Stewart, 2013). Both the nature of the documents and the relative complexity of our classification scheme presented a validation challenge. The bulletins are lengthy and varied documents, issued in changing economic and geopolitical contexts. Also, because our unsupervised content analysis method models documents as mixtures of topics, a document is assumed to feature all topics, although in proportion varying from large to infinitesimally small. As a consequence, we had reasons to expect that human coders would, at times, lack the historical knowledge or expertise to situate the events described in the bulletins and relate them to the correct topic in our classification scheme. Still, we opted for a simple, conservative validation procedure. We took a random sample of bulletins and then independently asked untrained coders to determine which of the 75 EUSSUE topics they believed to be instantiated in these documents. Each coder had first to read the document and then tick a box in a form listing the 75 topics. The exercise spanned 20 unique documents, for a total of 49 coder-document observations.

Inter-coder reliability was 56 per cent, which is reasonably high for a validation task of such complexity (Hruschka et al., 2004). It bears emphasis, in particular, that, owing to the high number of topics, the probability that coders would agree simply by chance was very small. Cohen’s κ , which takes this probability into account, averages 0.53 across pairwise coder comparisons.

To evaluate how our computer-based measure of topic proportion compares to human coding, we related the documents’ θ values from the topic model to the coders’ determination regarding the presence of the corresponding topics. Whether we regress human coding on θ (using logistic regression) or θ on the coders’ choice (using OLS regression), we find a positive and strongly significant association, as shown in Table 3.

Table 3: Relationship between EUSSUE θ and manual coding of a random sample of Agence Europe bulletins.

	<i>Dependent variable:</i>			
	Coders' Choice	θ	Coders' Choice	θ
Constant	0.259*** (0.053)	0.010** (0.005)	0.221*** (0.007)	0.011*** (0.0005)
θ	1.856*** (0.221)		1.856*** (0.219)	
Coder's Choice		0.012*** (0.002)		0.011*** (0.002)
FE Author	Yes	Yes	No	No
FE Bulletin	Yes	Yes	No	No
Observations	3,825	3,825	3,825	3,825
R ²		0.021		0.021
Adjusted R ²		0.014		0.021
McFadden Pseudo R ²	0.038		0.018	
Log Likelihood	-2,123.067		-2,165.995	
Akaike Inf. Crit.	4,308.134		4,335.991	
Residual Std. Error		0.033 (df = 3794)		0.033 (df = 3823)
F Statistic		2.758*** (df = 30; 3794)		81.532*** (df = 1; 3823)

Note. *p<0.1; **p<0.05; ***p<0.01

Robust standard errors are given in parentheses.

Table 4 further reports the degree of agreement between human coders and our 19 theme-level categories. Correlation coefficients are mostly positive and often significant. Moreover, even if we group the data at the theme level, we observe consistently high correlation across all themes (see 7 in the Appendix). These results, we believe, support the validity of our measurement method.

Table 4: Correlation between EUSSUE theme proportions and human coding at bulletin level

	Pearson	Spearman	Number of coders
BNo_04921	0.849*** (0.849; 0.849)	0.738*** (0.738; 0.738)	5
BNo_10929	0.837*** (0.837; 0.837)	0.586*** (0.153; 1.019)	5
BNo_11656	0.641*** (0.218; 1.064)	0.338 (-0.13; 0.806)	5
BNo_02687	0.562** (0.123; 1.001)	0.441* (-0.018; 0.900)	2
BNo_02720	0.501** (0.051; 0.951)	0.820*** (0.820; 0.820)	2
BNo_03257	0.546** (0.101; 0.991)	0.818*** (0.818; 0.818)	2
BNo_04900	0.815*** (0.815; 0.815)	0.416* (-0.046; 0.878)	2
BNo_05078	0.592*** (0.155; 1.029)	0.468** (0.014; 0.922)	2
BNo_05151	0.577*** (0.138; 1.016)	0.625*** (0.200; 1.050)	2
BNo_05231	0.641*** (0.218; 1.064)	0.320 (-0.148; 0.788)	2
BNo_05361	0.452* (-0.005; 0.909)	0.273 (-0.198; 0.744)	2
BNo_05541	0.664*** (0.244; 1.084)	0.576*** (0.138; 1.014)	2
BNo_06710	0.625*** (0.200; 1.050)	0.690*** (0.281; 1.099)	2
BNo_07664	0.643*** (0.219; 1.067)	0.362 (-0.104; 0.828)	2
BNo_09499	0.371 (-0.094; 0.836)	0.609*** (0.175; 1.043)	2
BNo_10072	0.297 (-0.174; 0.768)	0.343 (-0.124; 0.810)	2
BNo_10185	0.282 (-0.189; 0.753)	0.403 (-0.059; 0.865)	2
BNo_10331	0.180 (-0.289; 0.649)	0.125 (-0.338; 0.588)	2
BNo_10858	0.330 (-0.137; 0.797)	0.448* (-0.01; 0.906)	2
BNo_11713	0.328 (-0.14; 0.796)	0.187 (-0.283; 0.657)	2

Note. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$; 95%
95% confidence intervals are given in parentheses.

Note. A random sample of Agence Europe bulletins has been selected for the validation.

7 Relation to European Council Agenda Items

While manual topic validation demonstrates that our method is effective at extracting agenda items from the AEB documents, comparing EUSSUE with an existing measure of EU agenda formation is useful to understand how a generic indicator differs from actor-centred ones. The European Union Policy Agendas Project offers the only quantitative measure comparable to the EUSSUE measure proposed here (Alexandrova et al., 2014). As highlighted above, EUSSUE and the Agendas Project differ in two important respects. First, one is based on European Council conclusions, which are essentially outcomes of political negotiations, whereas the other is built on journalistic

reporting. Second, the two measures also diverge in the way they capture the time dimension. AEB is published on average five times a week, while European Council summits have traditionally had biannual recurrence. In sum, the two indicators are designed to measure different things. So, while a degree of overlap is to be expected – European Council conclusions are normally reported in the AEB – they should also exhibit a fair amount of divergence.

Generally speaking, our measure attributes greater saliency to items relating to EU institutions (notably European Parliament debates), the Eurozone and EU Treaties than the European Council conclusions coded in the Agendas Project. This is the reason why we created specific themes for these items, thereby deviating from the meta-classification employed in the Agendas Project. For the purpose of comparing the EUSSUE with the Agendas Project, we collapse the Eurozone topic under “macroeconomics” and European Parliament and EU Treaties under “EU governance”. For each theme we computed the annual theme proportion for the period 1979-2014 shared by both indicators.¹⁷ Figure 4 shows the correlations between the two measures with data aggregated by theme and year. Because the data is a mixture of normal and skewed distributions, we report three correlation methods. Coefficients are $\bar{r} = 0.28$; $\bar{\rho} = 0.24$; $\bar{\tau} = 0.17$ for, respectively, Pearson, Spearman and Kendall correlation.

Figure 4: Pearson’s, Spearman’s and Kendall’s correlation between paired theme-year observations in the EUSSUE and Agenda Project datasets. Asterisk denotes statistical significance at $p - value < 0.05$.

Given the underlying differences in measurement design and approach, it should not come as a surprise that the correlations oscillate, for the most part, between low and medium. It is also understandable that rank correlation is overall lower than

¹⁷We add zeros to the Agendas Project data for years where no sentence is coded as belonging to a given topic and convert the counts into proportions, taking into account the length of European Council conclusions in each year.

linear correlation, since issue attention frequently surges considerably in response to crises with the scale of such a phenomenon co-occurring in both measures captured to a larger extent by a linear function. The greatest difference between linear and rank correlation can be seen for theme “energy” ($r = 0.75$; $\rho = 0.18$; $\tau = 0.10$). A visual inspection of the data (see Figure 5) demonstrates that both measures share important similarities, in particular for the period of the 1979 oil crisis and in the mid 2000s. Themes which consist of merely one topic – such as health, civil rights, space and science – in the EUSSUE measure tend to be weakly correlated with the corresponding items in the Agendas Projects. Also, whereas agriculture seems to enjoy sustained saliency in AEB, it is much less present in European Council conclusions, which may reflect the fact that this policy has been, in large measure, delegated to the European Commission (Alexandrova, 2017). Overall, these results are consistent with our expectation that while partly overlapping, EUSSUE and the Agendas Project represent distinct measures of issue attention.

Figure 5: Comparison of EUSSUE and Agendas Project data on attention paid to theme “energy” between 1979 and 2014.

8 Events and Temporal Patterns

Finally, we relate the EUSSUE to a selected set of exogenous events. While not strictly equivalent to a validation exercise, this helps shore up our assumption that AEB provides a generic and relatively neutral measure of issue attention. If this assumption is correct, then we should expect topic and theme proportion to correlate with major events, such as armed conflicts and economic crises, where these topics are central. Simultaneously, this exercise helps illustrate how our indicator can be used in research on EU affairs. As a first illustration, we consider the topic “CO2_emissions”. At the most basic level we should expect this topic to reflect the rising political and social salience of climate questions since the 1980s and, more recently, the intense diplomatic efforts to bring countries together to cap and reduce greenhouse gases globally. Because the EU has been a key player in this international political effort, we expect the EUSSUE to reflect this. The sizeable literature on the EU’s role in the international climate change regime highlights the 2009 Copenhagen summit as a salient juncture, exposing the failure of European leadership (Dimitrov, 2010; Haug and Berkhout, 2010; Oberthür, 2011; Groen and Niemann, 2013; Bäckstrand and Elgström, 2013).

Figure 6: EUSSUE topic “CO2_emissions” and notable UN climate change summits.

In Figure 6 we can see that the 2009 Copenhagen summit coincides with one of the peaks of the “CO2_emissions” EUSSUE topic. The θ value for this topic, though, reaches its peak in 2016, which corresponds to the signature of the Paris Agreement. Our measure therefore behaves consistently with basic expectations about climate change issue attention in the EU: we observe decade-on-decade increases while peaks correspond to salient junctures.

The impact of climate change summits on issue attention can also be analysed at a more granular level using days rather than years as unit of time. Summits usually take place at the tail-end of calendar years and might otherwise go undetected when issue attention is aggregated at the year or semester level. Figure 7 reports the document-level θ of the “CO2_emissions” topic around the time of the 2009 Copenhagen summit.¹⁸

¹⁸In order to use document-level values we must remove the effect of the year-covariate present in the EUSSUE measure otherwise. This does not lead, however, to a large discrepancy. For the topic “CO2_emissions” the average effect is 0.00004. Documents were annotated with their date of publication to construct the time-series.

Figure 7: Document-level θ of EUSSUE topic “CO2_emissions” around the time of the 2009 Copenhagen climate change conference. The time-series window spans 1 September 2009 – 1 March 2010.

Figure 7 illustrates how the occurrence of significant events may affect issue coverage outside the strict window when they take place. This makes intuitive sense: in the case of a planned event such as the Copenhagen climate summit, actors prepare and can signal positions in the build-up to the event. The outcome of the event – failure of climate diplomacy and EU leadership – is subsequently discussed in its aftermath. As a result, the period around the Copenhagen summit has a higher $\bar{\theta}$ than the average for 2009, 2010 or overall.

Events and crises whose intensity can be credibly tracked using continuous indicators instead of individual time-moments provide another illustration of how AEB items respond to these events. Assuming again (imperfect) parallelism between issue attention and real-world developments intuitively recognized as economically or politically salient, we first use Greek bond yields as a proxy for the intensity of the Eurozone crisis. Bond yields capture a combination of risk factors which are sensitive to financial

and sovereign debt conditions in a country (Manganelli and Wolswijk, 2009; Arghyrou and Kantonikas, 2012). As the situation in Greece was the most critical to the survival of the Eurozone during the European sovereign debt crisis, the country's bond yields summarize well the evolution of the crisis. Next, we consider the number of asylum applications as a proxy for the "European migrant crisis". While asylum-seekers are only one group of migrants, they were at the centre of the European migrant crisis when Germany opened its borders to Syrian refugees in 2015. Last, the Syria conflict is itself the subject of one of our EUSSUE topics. Here for the comparison with issue attention in the EU we take battle-related deaths as a relatively objective measure of the conflict's intensity. The association between these proxies and topics is depicted in Figure 8.

(a) Eurozone crisis

(b) Migrant crisis

(c) Syria crisis

Figure 8: Temporal patterns of four EUSSUE topics and related external measures. Greek bond yields and the number of asylum application are sourced from Eurostat and battle-related deaths in Syria from the World Bank. On the left vertical axis is the estimated proportion of a given topic $\hat{\theta}_s$ where $s \in [1, 75]$, while the external indicator is measured on the right vertical axis.

The temporal patterns of external measures largely overlap with EUSSUE topics. The trends support the plausible assumption that issue attention varies for the most part in step with crisis intensity. Crises tend to generate and subsequently lose EU-level attention rapidly.

To assess the statistical strength of these relationships, Table 5 presents the results of several linear regressions, taking the EUSSUE topic proportions as the dependent variable and the external indicators as predictors. The Table reports effect sizes and

95% confidence intervals with bootstrap standard errors.¹⁹ The estimates of the external measures are positive and significant at $\alpha = 5\%$.

Table 5: Relationship between three EUSSUE topics and thematically connected real-world quantities.

	<i>Estimated Topic Proportion ($\hat{\theta}_s$)</i>		
	eurozone crisis	migrant crisis	syria crisis
Constant	0.003 (−0.008, 0.013)	−0.030 (−0.058, −0.001)	0.015** (0.011, 0.019)
Greek Long Term Bond Yields	0.297** (0.178, 0.417)		
Asylum Applications		0.135** (0.094, 0.176)	
Battle-related Deaths			0.137* (0.042, 0.232)
Observations	18	11	7
R ²	0.598	0.821	0.613
Adjusted R ²	0.573	0.801	0.536
Residual Std. Error	0.012 (df = 16)	0.026 (df = 9)	0.003 (df = 5)
F Statistic	23.849*** (df = 1; 16)	41.201*** (df = 1; 9)	7.930** (df = 1; 5)

Note. *p<0.05; **p<0.01; Number of bootstrap iterations is 10.000.

9 Conclusion

In this paper we presented a new measure of issue attention at the EU level, EUSSUE. Constructed from Agence Europe daily bulletins using a combination of human and computerized text-classification methods, EUSSUE provides a generic EU-level measure of issue prevalence across 75 topics organized in 19 policy themes. Our validation exercise shows that it constitutes a reliable measure of the issues discussed in the entire universe of Agence Europe bulletins published in English in the period 1979-2018. EUSSUE should be seen as a complement rather than a substitute to existing, actor-based indicators of agenda priority like the Agendas Project.

We believe that our measure of issue attention should be of broad interest to the EU studies research community. How the Brussels bubble reacts to world events and major crises is just one illustration. The generic nature of the EUSSUE dataset opens the possibility for researchers to deploy it – in entirety or in part – in different ways and contexts to investigate items of both low and high politics. Our indicator can be used as a dependent variable to explain variation in issue attention; as an independent variable to explain other phenomena; or as a control variable to remove the effect of

¹⁹The normality assumption in the regression analysis is likely to be violated and bootstrapping permits to relax this assumption by producing robust standard errors.

varying issue saliency on a causal relationship of interest. Alternatively, researchers may also decide to use the underlying textual corpus or the pre-processed data in order to, for example, remodel the topic space in a way tailored to specific research objectives or to apply supervised classification techniques.

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Appendix

Number of words per document

The news cycle is not uniform during the course of a year. As visible in Figure 9, the summer months (in particular August) see reduced activity reflected also in shorter AEB issues.

Figure 9: AEB issues are systematically shorter during the summer.

List of custom words removed

In the pre-processing stage we created a list of words which were deemed unhelpful for the interpretation of the STM results. The list contains words peculiar to the data source, prepositions, conjunctions verbs and others. These words were removed at the first stage of the data reduction process (see Figure 2).

Table 6: Custom words removed from the textual corpus.

Type	Words
Short	des sur der die das les see will eur ecu une von van aus eec frg mrs rue con fax one two tel six par pas ces cee son ses und s.a nnn den com sir non dont est bei new end year can put e.p eec's e.e.c eu's eee top l.c o.l b.c a.b h.b e.h n.s n.s. due mon tues isbn ten act http www iii etc ing ion tion hue dent
Bulletin	bulletin agence series serie transl.fl transl.jl transl.rt transl.rh gazzo riccardi ferdinando page pages telex book event library transl publish published publishing publishes editor editorial editing edited edit editor's editorials editors mathieu lionel letter e-mail email website volume events pascal korbys bion changeur aminata niang solenn paulec hansens gesant petitjean sophie ferdina ferdinand ricc ricca riccar riccard ric hagry emanuel original version versions french translate translated news new originally subscription subscrip subscribe press release university author authors author's universities university's professor professor's professors language study studies study's info bookshop subscriber subscribers subscribed distribute distributed office distributes internet idea publication publication's publications report
European	europe european europa europe's union union's community community's eu eu's furopean furope session ecus mecus fifteen twelve nine strasbourg brussels meeting luxembourg commission commissioner mep meps spokesperson
French	pour européenne européen européennes européens politique l'europe président société bruxelles banque principe principement communautaire communautaires comme faire mondial mondiale d'information petit petits petite petites uniquement telles telle orienter probablement optionelle internationale pays belgique sans rédacteur quotidien bruxellois que dans nouvel nouvelle nouvelles nouveaux abonnement abonnements thé paris allemand allemande bonito saint
Leaders	romano prodi catherine juncker jean-claude jean barroso miguel thorn delors jacques santer leon brittan javier federica giscard d'estaing verhaegen tindeman julian king herman rompuy decors saner donald tusk
Month	january february march april june july august september october may november december jan feb mar apr jun jul aug sep oct nov dec janvier février mars avril mai juin jullet août aout septembre octobre novembre décembre februari januari maart mei juni juli augustus oktober month year
Days	monday tuesday wednesday thursday friday saturday sunday mon tue wed thu fri sat sun yesterday day today tomorrow week
Other	mainly primarily notably presumably preferably particularly behalf concern other behind upon first last also according part level certain possible well already three now next view within without still number place way necessary role including favour current main period different total towards long issue issues problem problems area areas able point results like months weeks years major among specific far better less more many allow just four former present particular position million billion sector situation time general affairs fact subject opinion conditions plan interest term talks activities text visit programme programmes example importance possibility terms hand currently whole addition moreover form matter another request especially efforts initiative several important announced future report mitre neuron after although as if though because before even lest once unless until since whenever wherever while whatever where both either neither whether however nevertheless nonetheless given therefore thus whereas wherea aspect approach field eureka silly cleric pianism outgoing back forward focus practice subsequent previous tonnes tonne ton
Verbs	shall following called calls recall recalls recalled calling discuss discussed declared declare declares regarding concernement concern concerning concerns concerned reflects reflected look looks looking concerning concerned concerns said say says must made take make use held holds hold decided expected added ensure continue based give used taking taken provide come means stressed stresses help making asked expressed want wants wanted intended intends proposed proposes increase set need support adopted account respect change approve approved approves points pointed launch welcome welcomes welcomed explain explained explains informed informs regards regarded analyse analysed analyses examined examines examine participate participated stated call present presented presents noted compared compare agreed agree agrees regard meet describe announce announced announces announcing allow allows allowed provided reached considered confirmed met granted signed aimed applied received receive prepared established brought takes include including promoted launched sent continued contribute trengthen establish encourage achieve organise organised felt seems requested obtain hopes maintain related affected facilitate ensuring promoting opening feels seeking completed reiterated reaffirmed dealing constitutes constituted constituting repeating identify repeated concluded recording excluding assessing assessed assess analysing changing changed recommend recommended recommending introduced introduces introducing introduce offer involve involved involves involving become becomes becoming became indicate believe believed indicated indicating tackle tackled tackling tackles focusing focused focuses drawing needing needs needed note noting notes

Examples of STM output

The β and θ values output by the STM are the most valuable information about the model topics. We provide several visualizations here with the rest available online.²⁰

Figure 10: Estimated topic proportion over time $\hat{\theta}$ and top 15 words by $\hat{\beta}$ associated with topic.

In addition to these plots, we also used the document with the highest topical proportion to guide our choice of topic labels. The following is an excerpt from a document with the highest θ value for topic “CO2_emissions”:

Mission accomplished for the German presidency of the European Council and the G8, after it made an integrated energy and climate strategy an

²⁰https://eussue.shinyapps.io/eussue_shiny/

absolute priority in the fight against climate change - a global phenomenon which requires an urgent and determined response if we wish to avoid catastrophic consequences. In Brussels on 9 March, the heads of state and government of the 27 EU member states backed a policy, unanimously described as ambitious, to combat climate change post 2012. There was no difficulty in their subscribing to a target of a 30% reduction (compared with 1990 levels) in greenhouse gases for all industrialized countries by 2020 (and 60-80% reductions by 2050), and to agree to a unilateral 20% reduction in EU emissions if the other countries refused to come on board in international negotiations. This undertaking is binding, as the European Commission, with the agreement of the Environment and Energy Council, proposed in its energy and climate package of 10 January.

For the AEB corpus the top documents provide usually only limited guidance, as each AEB issue contains a variety of news items on different topics. The top θ document might be more useful in the interpretation of topic models of other textual corpora.

Figure 11: EUSSUE theme proportion over time

Metric-based topic clustering

Model topics can also be clustered using distance and similarity measures, and visualized as, for example (Quinn et al., 2010), a dendrogram. Clustering still requires that the user chooses the number of clusters, although as in the case of the number of topics, heuristic methods to determine the optimal number of clusters exist. In Figure 12 we show a 9-cluster dendrogram for the 75 topic EUSSUE measure.

Figure 12: 9-cluster dendrogram of 75 EUSSUE topics.

While the proximity of some topics makes intuitive sense (for example consumer protection and food labelling), other associations are more difficult to interpret. In fact we can see the clustering algorithm to pick up on similarities between topics which are salient at roughly the same moment in time (for example Brexit and EU digital agenda). These temporal relationships are not particularly useful from the perspective of our objective to construct a dynamic measure of issue attention.

Inter-coder reliability

In the validation exercise we employed human coders to manually classify randomly sampled documents on the basis of our machine-generated classification. We had three documents coded by five persons in order to get a more robust sense of inter-coder reliability. Figure 13 shows the correlation among five coders' determination of presence of topics in the sample documents. The average level of agreement among these five coders was similar to the values obtained for the rest of the documents, which were coded by two persons.

Figure 13: Correlation matrix showing inter-coder reliability for three randomly sampled AEB documents.

Table 7: Correlation between EUSSUE theme proportions and human coding at theme level for a random sample of Agence Europe bulletins.

	Pearson	Spearman
macroeconomics	0.965*** (0.965; 0.965)	0.74*** (0.185; 1.295)
civil rights, minority issues and civil liberties	0.968*** (0.968; 0.968)	0.667** (0.083; 1.251)
health	0.778*** (0.235; 1.321)	0.357 (-0.287; 1.001)
agriculture and fisheries	0.956*** (0.956; 0.956)	0.641** (0.047; 1.235)
labour and employment	0.955*** (0.955; 0.955)	0.565* (-0.047; 1.177)
education	0.700** (0.13; 1.27)	0.327 (-0.319; 0.973)
environment	0.748*** (0.195; 1.301)	0.381 (-0.261; 1.023)
energy	0.891*** (0.891; 0.891)	0.355 (-0.29; 1)
immigration	0.742*** (0.185; 1.299)	0.744*** (0.186; 1.302)
banking, finance and internal trade	0.979*** (0.979; 0.979)	0.668** (0.083; 1.253)
space, science, technology and communication	0.943*** (0.943; 0.943)	0.576* (-0.034; 1.186)
international affairs and foreign aid	0.970*** (0.97; 0.97)	0.772*** (0.233; 1.311)
defence	0.856*** (0.348; 1.364)	0.465 (-0.167; 1.097)
transportation	0.846*** (0.344; 1.348)	0.201 (-0.445; 0.847)
foreign trade	0.956*** (0.956; 0.956)	0.397 (-0.243; 1.037)
EU governance	0.968*** (0.968; 0.968)	0.809*** (0.276; 1.342)

Note. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$; 95%
95% confidence intervals are given in parentheses.

Pre-processing robustness

Although we have striven for maximum transparency in this domain, there are always several ways in which the text corpus can be pre-processed (Denny and Spirling, 2018).

Here we show an alternative pre-processing specification requested by one of the reviewers. This specification differs from the one used in the paper in two respects: we remove the upper character limit (15) on tokens and the minimum document frequency (5%) when constructing the document-term matrix. In order to avoid repeating the entire labelling and clustering exercise, we compare the results from the two specifications using, first, the heuristic approach devised by Denny and Spirling (2018) and, second, the θ distributions from the STM model.

Following Denny and Spirling (2018), we compare the two specifications according to how much they affect pairwise document similarity calculated from an “un-pre-processed” document-term matrix of the corpus. Denote M_1 a matrix of pairwise document similarity values calculated from the pre-processed document-term matrix used in the paper, M_2 the same but on the basis of a document-term matrix pre-processed according to the alternative criteria suggested by a reviewer and M_0 a baseline similarity matrix computed from a document-term matrix in which no data reduction has been carried out (see Figure 2). We find that both the absolute and rank differences between M_1 and M_2 are small, indicating that the two pre-processing specifications yield similar document-term matrices. The absolute mean difference $\frac{1}{I \times J} \sum |M_1 - M_2| = 0.024$ shows by how much pairwise similarity scores (a value between 0 and 1) differ on average if we apply the two pre-processing specifications. The rank difference between the two matrices is similarly low: after differentiating against the baseline $|M_i - M_0|$ and taking the top 10, 50 and 100 pairs (as recommended by Denny and Spirling (2018)) affected by pre-processing, we find that the mean rank difference between M_1 and M_2 is, respectively, 2.2, 9.1 and 14.8. These values are low given that there are more than 45 million degrees of freedom. The implication is that the alternative pre-processing method suggested by a reviewer results in an analysis-ready corpus that is very similar to the one we use in the paper.

We take this robustness check a step further by running the STM model used in the paper on both pre-processing specifications and comparing the theta distributions. Figure 14 shows the empirical cumulative distribution function of the theta values for the two specifications. We can see that the two distributions are very close to each other. This suggests that the theta distribution is not strongly affected by the suggested changes to pre-processing.²¹

²¹A t-test confirms that there is no significant difference between the means of the two distributions.

Figure 14: Empirical cumulative distribution function of theta values for two different pre-processing specifications.

Note. The dotted red line shows the results from the reviewer-suggested specification; the solid line is the distribution based on the pre-processing parameters followed in the paper.

Optimal number of topics

To evaluate the model performance at varying number of topics with $k \in \{28, 48, 68, 88, 108, 128, 148\}$, we compare model selection statistics. Depicted in Figure 15 is the trade-off between semantic coherence and exclusivity for k .²² Ideally, we want to have topics that are both cohesive and exclusive. It can be seen that exclusivity rises and semantic coherence shrinks with a higher number of topics. 68 and 88 topics seem to strike the balance between this trade-off. Moving from $k=88$ to $k=108$ results in a greater loss of semantic coherence with small improvements in

²²Topics are coherence in the sense that high probability words tend to appear within documents and are exclusive when top words for a topic is unlikely to appear in other topics.

exclusivity levels than shifting from $k=68$ to $k=88$. This also indicates that the optimal k lies around 68 and 88.

Figure 15: Optimal number of topics: Semantic Coherence versus Exclusivity

Sentiment analysis

As a measure of the neutral tone of the news reports, Figure 16 shows document-level sentiment using the AFINN lexicon (Årup Nielsen, 2011). Mean valence per (raw) document is computed simply as the sum of valence scores of those words appearing in a document which are found in the AFINN lexicon with a non-zero value weighted by the number of token words (with a non-zero value) in the document. Average valence, though positive on average, is not far from zero – news are not overly loaded with sentiment. Nor does the average sentiment value show much temporal variation. To the extent that individual documents deviate from the general pattern, we are agnostic about the potential causes, which may be both exogenous (higher incidence of crises

or negative news) and endogenous (changes in editorial policy).

Figure 16: Sentiment analysis of documents in the raw corpus.

Our primary interest in carrying out sentiment analysis using the popular Årup Nielsen (2011) dictionary is to show over time variation in valence. Significant temporal fluctuation could indicate the presence of a previously unknown biasing factor. Although we do not observe any such critical breaks in the time-series, we believe this kind of exploratory data analysis to be good practice in preventing unpleasant surprises down the line.

For the sake of completeness, we provide here further information about the valence scores. The overall mean valence is 0.387 which means that the tone of the news is slightly positive, at least according to the Årup Nielsen (2011) dictionary. The most common scored words are, unsurprisingly, “no” ($n = 409525$) which is coded in the

dictionary as having valence of -1 and “agreement” ($n = 3324389$, valence +1). The third most common word is “united” ($n = 1777653$, +1) which in the context of our corpus usually refers to “United States” or “United Kingdom”. The most positively scored document ($\overline{valence} = 1.27$) relates to business and investment news but also commemorates the passing of the Agence Europe’s longtime editor, Emanuele Gazzo. Dated 1 September 1994, the following are representative excerpts:

Electromechanics: The Franco-British group-GEC-ALSTOM is to renovate two units of a hydroelectric power station in Bula (India) in order to bring their power up to 50 MW. This contract of 129 million FF will be financed with a loan from the British Government and will comprise considerable local participation.

Building site equipment: The Japanese group KOMATSU LTD will acquire 100% of its American subsidiary KOMATSU DRESSER CO (Illinois) through the purchase of the 19% share still owned by INDRESCO INC (Texas). The deal, worth \$38 millions will be finalized in late September by the group’s US-based subsidiary, KOMATSU AMERICA CORP, which owns 81% of KOMATSU DRESSER CO.

Faced with the challenges of the end of the century, we do not need less but more solidarity in Europe. Emanuele Gazzo knew this and fought admirably for this, with his heart, his pen and his keen intelligence.

The document with the most negative mean valence largely owes its score to using the word “war” and related vocabulary in multiple contexts:

Mr Woerner knew he had been “gambling his life away” when he ignored medical advice and insisted on chairing the NATO Council in February, when important decisions were taken regarding the war in Bosnia, said Mr Balanzino. He added that Mr Woerner was outraged as he lay in his own hospital bed to see the pictures of the spartan medical facilities in Sarajevo and Gorazde.

Tension rose again on Thursday in the “tuna war” pitting French fishermen against their Spanish counterparts for the past few weeks. The French Minister for Fisheries announced that five Spanish vessels had attacked four French vessels off the coast of Cap Breton and that the Spaniards had used gunfire, wounding a French fisherman.

Mr Kok, the third Socialist Head of Government since the end of World War One, will be seconded by two Deputy Prime Ministers, Hans Dijkstal (VVD), who will serve as Home Affairs Minister, and Hans van Mierlo, leader of Democracy '66, who will become Foreign Minister.

And finally an AEB issue with mean valence zero (signalling complete neutrality), with a lead story on indirect taxation and news concerning legislation on posted workers, Brexit and European External Action Service appointments:

VAT agenda for EU in second half of 2017 The European Union may end up doing more work on matters of indirect taxation - with the European Commission's presentation of a major reform of the value-added tax (VAT) system - than on questions relating to corporate taxation in the second half of 2017.

Despite disagreements among countries of central and Eastern Europe in recent months on the review of the posted worker directive, the leaders of Austria, France, Slovakia and the Czech Republic restated their aim of reaching agreement at the Council by 23 October, the date of the next EPSCO Council (employment and social policy).

London wants data to continue to move freely on both sides of the Channel after Brexit British authorities believe data should continue to move freely between the European Union and United Kingdom after Brexit, and that a high level of personal data protection should be maintained. On the day the UK withdraws from the EU, the country will apply the framework regulation (2016/679) on the data protection of natural persons, as well as the directive (2016/680) on the handling of personal data for the purposes of preventing criminal offences.

On Monday 23 August, the European External Action Service (EEAS) announced in a press release that High Representative of the EU for Foreign Affairs and Security Policy Federica Mogherini has appointed a new deputy managing director and three heads of EU delegations.

The words classified by the AFINN dictionary as having the lowest valence are swear words (-5) and words such as "fraudulent", "catastrophic", "rape" and "tortured" (-4). The most positive words (+5) are "outstanding", "superb", "breathtaking", "hurrah" and "thrilled", each appearing in the corpus only once. The most frequent word with a positive score of 4 is "triumph".