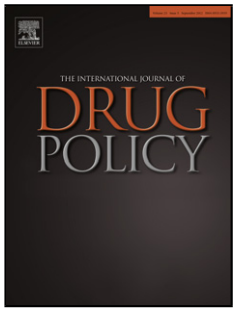

Title: Mixing politics and crime–the prevalence and decline of political discourse on the cryptomarket

Author: Rasmus Munksgaard Jakob Demant

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Title: Mixing politics and crime – the prevalence and decline of political discourse on the cryptomarket

Authors: Munksgaard, Rasmus & Demant, Jakob

Affiliations: Department of Sociology, University og Copenhagen

Email: jd@soc.ku.dk

Corresponding author: Jakob Demant

Address:

Øster Farimagsgade 5, Bld. 16

DK-1014 Copenhagen K

TEL +45 35321584

MOB +45 81742074

Abstract:

Background: Dread Pirate Roberts, founder of the first cryptomarket for illicit drugs named Silk Road, articulated libertarian political motives for his ventures. Previous research argues that there is a significant political component present or involved in cryptomarket drug dealing which is specifically libertarian. The aim of the paper is to investigate the prevalence of political discourses within discussions of cryptomarket drug dealing, and further to research the potential changes of these over the timespan of the study.

Methods: We develop a novel operationalization of discourse analytic concepts which we combine with topic modelling enabling us to study how politics are articulated on cryptomarket forums. We apply the Structural Topic Model on a corpus extracted from crawls of cryptomarket forums encompassing posts dating from 2011 to 2015.

Results: The topics discussed on cryptomarket forums are primarily centered around the distribution of drugs including discussions of shipping and receiving, product advertisements, and reviews as well as aspects of drug consumption such as testing and consumption. However, on forums whose primary function is aiding operations on a black market, we still observe political matter. We identified one topic which expresses a libertarian discourse that emphasizes the individual's right to non-interference. Over time we observe an increasing prevalence of the libertarian discourse from 2011 to the end of 2013. In the end of 2013 - when Silk Road was seized - we observe an abrupt change in the prevalence of the libertarian discourse.

Conclusions: The libertarian political discourse has historically been prevalent on cryptomarket forums. The closure of Silk Road has affected the prevalence of libertarian discourse suggesting that while the closure did not succeed in curtailing the cryptomarket economy, it dampened political sentiments.

Title: Mixing politics and crime – the prevalence and decline of political discourse on the cryptomarket

Introduction

In media representations, public discourse and in academic contexts the political dimensions of cryptomarket drug dealing, in particular those of the original Silk Road, have been articulated in a variety of ways and from differing perspectives. We expand upon this discussion based on a review of perspectives of cryptomarket politics, an empirical study and a discussion of the implications of the politicized context within which cryptomarket drug dealing is situated. We first review perspectives on cryptomarket politics, which we categorize as either oriented towards community, structure, or individuals, specifically the "Dread Pirate Roberts", founder of the Silk Road. From these we move onto an empirical study of the articulations of the cryptomarket. We develop a novel operationalization of central concepts within Fairclough's (1985) discourse analysis in combination with topic modelling to study how politics are articulated on cryptomarket forums. The Structural Topic Model developed by Roberts, Stewart, Tingley and Airoldi (2013) is applied using discourse analytical concepts to identify political discourses on cryptomarket forums. We then measure the prevalence of these over time to study how the politics of the cryptomarket have changed. We finally discuss the findings suggesting explanations for the presence and changing prevalence of political discourse on cryptomarkets.

Background

Martin (2014a, p. 356) defines the cryptomarket as an *online forum where goods and services are exchanged between parties who use digital encryption to conceal their identities*, which may further rely on the Tor network, decentralized exchange networks and electronic currencies such as bitcoin. Currently, the majority of cryptomarkets are located on the Tor network operating as hidden services (DeepDotWeb, 2016) that use the Tor network to anonymize traffic to and from the site. Therefore, while the site is accessible using the Tor browser, its IP address or physical location cannot be determined. Effectively this makes cryptomarkets highly difficult to shut down while relatively easy to access for an individual with some digital literacy. Cryptomarkets utilize cryptocurrencies, most often bitcoin, for transactions. Bitcoin is a decentralized peer-to-peer currency that operates without the involvement of central banks or governments (Bjerg, 2016; Nakamoto, 2008; Karlstrøm, 2014). It further provides a layer of obfuscation in terms of transactional anonymity as when properly used it should be impossible, or at least highly difficult, to connect an illegal purchase to an individual (see Möser 2013 for a discussion of transactional obfuscation). Organizationally cryptomarkets distinguish themselves by operating as eBay-like sites where operators provide services that facilitate the distribution of illicit substances rather than participate in distribution themselves (Barratt, 2012). Since the launch of Silk Road in 2011, the cryptomarket economy has grown at a rapid pace. In 2013, Christin (2013) estimated a lower bound for the revenue generated on Silk Road of 1,2 million USD in monthly sales. Subsequently, Aldridge and Décary-Hétu (2014) found that revenue had increased by more than 600% in the course of the 15 months since Christin's study and argued that cryptomarkets should be considered as a *transformative criminal innovation* in drug distribution (2014, p. 16). In the most extensive study of the cryptomarket economy, a daily sales volume upwards of 600.000 USD was found on the largest cryptomarkets in 2014 (Soska and Christin, 2015, p. 24). In spite of the efforts of law enforcement to disrupt this rapidly growing economy, cryptomarkets are still easily accessible. The situation today is one in which several websites built similarly to eBay allow vendors and buyers to sell and buy illicit substances with a high degree of security.

The aim of this study is to identify the political discourses present on cryptomarket forums and the historical prevalence of these. We identify political discourses on cryptomarket forums by applying topic modelling in combination with discourse analytical concepts. The historical trajectory of political discourse is traced by measuring the prevalence of political discourse over time.

Politics of the Silk Road - crypto-anarchism, libertarianism and constructive activism

We suggest that theoretical perspectives and empirical findings on cryptomarket politics may be conceived of as oriented towards community, structure, or individuals. These are by no means exclusive but the categories serve to group these perspectives. Both empirical findings and theory argue that there is a significant political component, either present or involved in cryptomarket drug dealing, which is specifically libertarian. Though the emphasis in the literature is on Silk Road, which has been gone for more than two years now, it provides a framework for further study and understanding of cryptomarket politics.

In October 2013 Ross Ulbricht was apprehended for operating Silk Road under the pseudonym Dread Pirate Roberts, at the time the biggest cryptomarket, and the site was shut down. Though Ulbricht was sentenced for facilitating drug trafficking and money laundering, among other crimes, according to Judge Forrest he created, in Silk Road, *a world in which democracy did not exist* (Greenberg, 2015). Silk Road was articulated by Dread Pirate Roberts as more than the means for harm-reduction or a non-democratic space. Reflecting upon his own motivations for starting the project, Roberts argued that *every single transaction that takes place outside the nexus of state control is a victory for those individuals taking part in the transaction. So there are thousands of victories here each week and each one makes a difference, strengthens the agora, and weakens the state*. Referencing the science fiction novel Alongside Night (Schulman, 1999), in which the main character finds himself in a dystopian future where free market trade is a means to the liberation of mankind, Roberts articulated his vision of the Silk Road as a means to dismantle the state. A more radical position than that which has been expressed in the community around Silk Road (discussed below), but still a libertarian political position. This particular political position, agorism, is a radical anarchist philosophy advocating the establishment of freed markets, grey and black markets, as the means to sabotage the state (Konkin III, 1995). Thus, when focusing on the individual who introduced cryptomarkets, Dread Pirate Roberts, we find that Silk Road was presented as a means to dismantle the state.

As an online community the Silk Road forums did not only cater to the practicalities of online drug distribution. On the associated forums Dread Pirate Roberts hosted a libertarian book club (Ormsby, 2014). Furthermore, a libertarian ethos and dedication to harm-reduction (Van Hout and Bingham, 2014; Phelps and Watt, 2014; Van Hout and Bingham, 2013) was conspicuously present on the Silk Road forums. In extension of this, Martin (2014b, p. 19) observes that cryptomarket rules of conduct were *developed and discussed by informed users in the context of broader philosophical, political and economic debates* and acknowledges the *diverse range of views across cryptomarkets about the political and ethical dimensions of online drug trading* (Martin, 2014b, p. 15). Maddox, Barratt, Allen, and Lenton (2016) argue that the users of Silk Road engaged in constructive activism as *they sought to transform their values into built environments that were designed to socially engineer a more permissive digital reality* (Maddox et al., 2016, p. 111). These observations stress the cryptomarket forums as expressing political allegiances to libertarian politics consequently shaping the cryptomarket's institutions and communities.

Recently, discussions of encryption and regulations thereof similar to those of the 1990's Crypto-Wars (Electronic Frontier Foundation, 2015; Guarino, 2013) have resurfaced in public discourse, and cryptomarkets have been used as an example of the unintended consequences of the proliferation of

technologies for anonymity and security. Law enforcement agencies have expressed concerns about 'going dark' and allowing 'dark, ungoverned space' as the unintended consequence of the availability of tools for encryption and privacy (Comey, 2014; Whitehead, 2014). The use and preoccupation with technologies for encryption and anonymity on cryptomarkets echo a cipherpunk ethos of either sabotaging or limiting state power through technology (Martin, 2014b; Maddox et al., 2016; May, 2001, 1994). Thus, there is also a political dimension that is oriented towards structure, state, and state power. In terms of consequences, Martin (2014a) argue that cryptomarkets operate as informal governing nodes similar to insurgent groups, a situation that would hardly be possible without technologies for encryption and anonymity. The structural-political dimension of cryptomarkets is intertwined with both the cipherpunk ethos and the use of technologies for anonymity and encryption, which have consequences upon state and law enforcement capabilities. This dimension is, for example, observed in the use and reliance on the cryptocurrency bitcoin, a currency that both challenges state power and which reflects political ideals (Bjerg, 2016; Karlstrøm, 2014).

Methodology

We apply the statistical technique topic modelling as a method to identify political discourses. Topic models excel in the analysis of large amounts of textual data by providing *an automated procedure for coding the content of a corpus of texts (including very large corpora) into a set of substantively meaningful coding categories called 'topic*' (Mohr and Bogdanov, 2013, p. 546). Described as *a statistical model of language* (DiMaggio, Nag, and Blei, 2013, p. 577), topic models have been used for a variety of purposes in the context of social sciences (Grimmer and Stewart, 2013, for an extensive discussion of applications), cultural sociology (DiMaggio et al., 2013) and literature history (Jockers, 2013; Jockers and Mimno, 2013). Within the context of the dark web, Spitters, Verbruggen, and Van Staalduinen (2014) used topic modelling to study the thematic structure of the dark web using latent Dirichlet allocation and interlinking between sites. DiMaggio et al. (2013) argue that topic models renders central concepts within cultural sociology operational. Conversely, we agree with these scholars and suggest that topic modelling further makes concepts from Fairclough's (2008) discourse analysis operational on large sets of textual data.

The key result produced by the topic model is a number of topics, or themes (Blei, 2012). Within topic modelling a topic is formally defined as a distribution over a vocabulary (DiMaggio et al., 2013, p. 578; Roberts et al. 2014, p. 1067). That is, in one topic, 'cannabis' for example, it is likely that there is a higher probability of the terms 'weed' and 'smoke' occurring than the terms 'capital' and 'investment'. 'Weed', for example, may appear in the topic 'gardening' as well as in the topic 'cannabis', having entirely different contextual meanings. As the topic is a distribution, 'weed' appears with other high-probability terms such as 'garden', 'nature' and 'flower', in the 'gardening' topic, and with other terms in the 'cannabis' topic such as 'smoke', 'bong' and 'high'. The distribution of terms can be considered as a *preferential topical vocabulary*. Conceptually, we suggest that the topics can be understood as if one was to talk about a topic, and when doing so, one is more likely to use some words than others when the topic is 'gardening' as opposed to 'cannabis'. Thus, the preferential vocabularies of individuals can be interpreted as a measure of their meaning-making. Put more simply, if the probability of 'fun' appearing in the same sentence as 'cannabis' is higher than that of 'abuse', this is the ascribing of meaning to cannabis expressed as probabilities.

Fairclough distinguishes between two types of discourse: genre and discourse. Genre is a particular way of talking, a set of conventions, such as informal talk or the advertising genre. Conversely, discourse *correspond roughly to dimensions of texts that have traditionally been discussed in terms of content, ideational meanings, topic, subject matter, and so forth* (Fairclough, 1992, p. 286). The topics inferred by

the topic model are often similar to these (as we show below), as genres and discourses emerge. For example, we find a topic that has as its high probability terms ‘fuck’, ‘shit’ and ‘man’. When reviewing documents that contain a high proportion of this topic, we find that these contain the genre that we call "swearing". Swearing and cursing are important components in many forum posts and may, among other situations, be used when reviewing a vendor negatively or during heated discussion. Thus, the topic model identifies genres such as swearing.

[FIGURE 1 ABOUT HERE]

Figure 1: “Genre of swearing”, wordcloud based on probabilities of word occurrence in topic.

Mixed-membership topic models consider a document as a distribution over topics (DiMaggio et al., 2013; Blei, 2012). That is, a document contains a bit of each topic. Within discourse analysis the concept of interdiscursivity refers to the fact that texts are constituted by different discourses. For example, an advertisement for herbal medicine may contain the genre-discourse ‘advertisement’ as well as an ‘herbal medicine’ discourse. Conceptually, the topic model therefore recognizes that documents are constituted by different discourses and genres. The coding of documents, which is the result of the model, will assign topical proportions to documents, and a document may therefore contain topics such as ‘swearing’, ‘product reviews’ and ‘vendor discussion’. This acknowledgment of the interdiscursive nature of documents is, in particular, a key feature of the correlated topic model, CTM (Blei and Lafferty, 2007), and the structural topic model, STM (Roberts et al., 2013), both of which allow topics to correlate when estimating the model. Though Fairclough's discourse analysis is more nuanced than is possible to thoroughly review within the scope of this paper, we apply some concepts, along with other insights, for our analysis. When we deem it analytically feasible, and in agreement with the above definition of discourse as either genre or discourse, we use Fairclough's terminology, specifically discourse and genre.

Data

The analysis is based on crawls of cryptomarket forums conducted between October 2013 and March 2015 which contains posts dating back to 2011. 2.6 million forum posts were extracted from five cryptomarket forums: Silk Road, Silk Road 2.0, Evolution Marketplace, Agora Marketplace, and Black Market Reloaded. The omni-forum, a forum where users can discuss multiple marketplaces, The Hub was further included. The five market forums were chosen as they represent some of the largest platforms for discussions of cryptomarkets and have operated for extended periods of time. We included The Hub as it is the only omni-forum located on the dark web. These crawls contain a large proportion of what has been written on cryptomarket forums from 2011 to 2015 as the economy generally has centered on these markets (see Soska and Christin, 2015) and should therefore be considered as representative of the cryptomarket discursive order. March 17th was chosen as a cut-off point being the last date where more than 2 of the studied sites were operational as Evolution Marketplace absconded with user funds.

The crawls we use were conducted by independent researcher Gwern Branwen, and are part of a larger collection with many contributors, which is publicly available (Branwen et al. 2015). Forum posts and associated metadata (date, user, subforum, market) were extracted from Branwen's crawls using XPath-expressions. When extracting forum posts, we further discard quotations of other posts in these, so as to isolate what the individual poster is writing. Posts in subforums dedicated to non-English languages were discarded. Figure 1 shows the distribution of posts over time from the dataset used for the analysis.

Processing and manipulation of data was conducted in the statistical programming language R utilizing packages plyr, XML, doSNOW, stringr and tm (Wickham, 2011; Lang and the CRAN Team, 2015; Revolution Analytics and Weston, 2014; Wickham, 2015; R Core Team, 2015; Feinerer, Hornik, and Meyer, 2015). Differing levels of activity can be attributed to changes in the ecosystem such as markets absconding with user funds, hacks, or uptime, which spur migratory movements across markets.

[FIGURE 2 ABOUT HERE]

Figure 2: Collected forum posts by date.

To prepare the data for topic modelling we reduce forum posts to bags of words from which the co-occurrence of words is analyzed to produce the results. When performing discourse analysis, there are different aspects of the text that may be emphasized in the analysis such as interdiscursivity, cohesion and grammar (Fairclough, 2008). However, topic models that approach documents as bags of words are vocabulary-centric, disregarding grammar and other features of the individual document. Focusing on politics and ideology, the emphasis on vocabulary is preferable. Specifically, our interest is in the ways in which cryptomarket users ascribe meaning to political matter using a variety of terms. Consequently, we seek to analyze bags of words in which the terms retain contextual meanings in relation to each other. English, French and German stop words (some posts in non-English languages will appear in subforums not dedicated to the language), excluding relevant English terms, were removed and terms were stemmed using Porter's stemming algorithm using the R package tm (Feinerer et al., 2015). These manipulations are vocabulary-centric, reducing terms to their stem and discarding stop words such as *I*, *we* and *you*. A small number of terms were manipulated (e.g. 'BTC' to 'bitcoin') and abbreviations were further removed. Empirically, topic modelling has successfully been applied to documents as small in size as tweets (140 characters at the most) (Hong and Davison, 2010) and open-ended survey responses (Roberts et al., 2014), and as large as novels (Jockers, 2013; Jockers and Mimno, 2013). Many forum posts are very short in length, sometimes only expressing agreement with a *+1* or simply quoting another post. Posts with less than 40 terms (after stop word removal) were therefore discarded setting a lower boundary in terms of an empirically viable length.

The data we analyze has some limitations. First, a crude approach has been taken to remove duplicated posts (identical text, author and date of posting) appearing in the dataset. This is done to minimize the amount of spam included in the corpora. However, it is likely a small number of relevant posts have been removed if they fulfill these criteria. Second, in order to minimize the time spent extracting data, only the most recent version of a downloaded page is used for data extraction. Deleted posts may therefore not be available and posts may have been edited. Third, crawls are not complete. Forums go offline for reasons such as maintenance and DDoS attacks. In spite of these limitations, we have a corpus that is deemed representative of the cryptomarket discursive order. Fourth, on cryptomarket forums a user may cite another user in her post; a manifestation of the intertextual nature of utterances that are always *populated, and indeed constituted, by snatches of others' utterances, more or less explicit or complete* (Fairclough, 1992, p. 270). As quotations of other posts are removed in the data extraction process, we disregard a central property of the analyzed documents. This is a pragmatic choice, as quotations are abundant and we fear that the utterances of the individual would be lost.

Method

Unsupervised topic models require that the researcher specify the number of topics. To find the appropriate number of topics (*k*) we estimated three models with 100, 150 and 200 topics. As suggested by the literature (Grimmer and Stewart, 2013, p. 270; Roberts, Stewart, and Airoldi, 2015, p. 19), these were then subsequently evaluated qualitatively by their ability to produce coherent topics and capture topics discussed in the literature on cryptomarkets (e.g. harm-reduction, libertarian politics) and obvious topics such as smuggling, dealing, and discussion of substances. We settled on the model with 100 topics but found that the models reflected the same thematic structure differing only in granularity or level of detail. The Structural Topic Model, hereafter STM, developed by Roberts et al. (2015) was applied to the corpus using LDA initialization. After processing, our dataset consisted of a vocabulary of 16,133 terms represented in 417,491 documents, each containing at least 10 unique terms from the vocabulary. The key innovation of the STM is its ability to incorporate metadata and we therefore allow topical prevalence to vary by forum (e.g. Agora Marketplace, Silk Road) and date of posting. The date on which a post is submitted is allowed to have a non-linear relationship in the topic estimation by using a B-spline with 10 degrees of freedom.

Validity test

Previous research suggests that a libertarian discourse would be prevalent on cryptomarkets and three of the studied sites offered subforums dedicated to politics, *Philosophy, Economics and Justice*, which constitutes a simple measure of political content that is uninvolved in the measurement process. At our disposal is a pre-existing user- and moderator defined categorization of content as political, the placement of a post in a subforum, and under the hypothesis that subforums dedicated to politics will exhibit a greater amount of political discourse we can therefore test whether the topic we classify as libertarian politics represents political content as categorized by users and moderators. We situate this test between the notion of construct validity and predictive validity (see Grimmer and Stewart, 2013; Quinn, Monroe, Colaresi, Crespin, and Radev, 2010, for a discussion of validity in topic modelling), as the subforum categorization of political content is both exogenous and a pre-existing measure.

[FIGURE 3 ABOUT HERE]

Figure 3: Distribution of libertarian discourse in subforums dedicated to political discussion versus other subforums.

Applying a Welch's t-test to the estimated document-topic proportions we find that there is a significantly ($p < 2.2e-16$) higher prevalence of the topic we deem to express libertarian discourse in the *Philosophy, Economics and Justice* forums compared to all other subforums. In the first group the average post will contain 8% libertarian discourse while in the latter less than 1%. Figure 3 shows the distributions as a boxplot wherein the middle line represents the median prevalence of libertarian discourse, the charted area represents the first and third quartile and the whiskers represent outliers within 1,5 times the interquartile range. As is evident, posts in political subforums do not only contain the libertarian discourse. Averaging at about 8% libertarian discourse per post, posts will contain other topics because the topic model considers documents to be distributions of topics. However, the topic we deem expressive of a libertarian discourse is more prevalent in subforums dedicated to politics constituting a larger proportion of the average post.

Findings

From the STM model, we are presented with 100 topics of which we are primarily interested in those on the subject of politics. To identify political discourses, we qualitatively code each topic by investigating word clouds based on the topic and reviewing exemplar documents (Roberts et al., 2014, p. 1069) that contain high proportions of the topic. Throughout the qualitative coding process, we only found one topic that we deemed to represent political discourse whereas the 99 other topics covered a range of other topics that are of interest to buyers and vendors on the markets. In broad terms these are topics on the shipping, waiting for and receiving illicit substances in the mail, technology with a focus on privacy and anonymity, law enforcement capabilities, testing of substances (e.g. both professional and home-kit tests) and genres we classify as storytelling and swearing. The subject of debate on cryptomarket forums is primarily the distribution of drugs using these, expressed in topics such as shipping and receiving, product advertisements, reviews and so forth as well as aspects of drug consumption such as testing and consumption. However, on forums whose primary function is aiding a black market, we still observe political matter.

The topic we classify as political discourse has as its most probable terms '*govern'*, '*countri'*, '*peopl'*, '*world'*, '*gun'*, '*state'*, '*war'* and '*right'* and exemplar documents that exhibit high proportions of the topic show a preoccupation with these concepts. This expresses a conceptual preoccupation with governing institutions (specifically the state) and their ability to regulate individuals. The preoccupation with rights and state power is most explicitly expressed in documents that explicitly treat this subject in the language of law: constitutional documents. We find copy-pasted excerpts from the USSR Constitution and Articles of Confederation, a document pre-dating the US Constitution and written in 1777 (Legal Information Institute, 2015).

> *"[…] the free inhabitants of each of these States, paupers, vagabonds, and fugitives from justice excepted, shall be entitled to all privileges and immunities of free citizens in the several States; and the people of each State shall free ingress and regress to and from any other State, and shall enjoy therein all the privileges of trade and commerce […]"* - Agora Marketplace Forums, November 7th 2014.

The term gun has a high probability of being deployed as a term in posts containing the topic and will often figure in discussions of the right to bear arms:

> *"Hey I dun judge. Big fat gun is coooooool. I love going to the range pew pew pow. But please, none of that freedom protect rights, keep the government in check crap because it is tremendous BULLSHIT. Or have you seen any minutemen walking at the supreme court in 2000?"* - Silk Road Forums, October 2nd 2012.

While users have a variety of positions or opinions, the documents which match the topic will be on some aspect of relations between citizen and state (e.g. gun control) often with an emphasis on *rights* and *laws*. The preoccupation with rights granted to the individual by the state, expressed in constitutions denoting the limits of state power, expresses a preoccupation with negative liberty, the freedom from outside interference; a defining feature of libertarian philosophy (Berlin, 1958).

[FIGURE 4 ABOUT HERE]

Figure 4: "Libertarian discourse", wordcloud based on probabilities of word occurrence in topic.

We previously suggested that the topic can be thought of as a preferential topical vocabulary. When a user writes and submits a post on a cryptomarket forum containing this topic, which, as shown previously, is significantly more prevalent in discussions categorized as political by users and moderators, it is highly likely that concepts of govern(ance), state, and right(s) will be employed. Thus, when an individual on cryptomarkets assigns meaning to the issue of politics, probabilistically they will deploy a vocabulary stressing rights and state. Conversely, terms such as *democracy*, *class*, or *solidarity* are less probable (140th, 85th and 43rd) as opposed to libertarian (32nd). A fruitful discourse analytic procedure is to imagine alternative lexicalizations of a phenomena or 'anti-languages' (Fairclough, 1985, p. 745), and the absence, or less probable presence, of terms such as *democracy*, *solidarity* or *conservative* indicates that the political discourse we find is libertarian. Political matter can be ascribed meanings in a myriad of ways and with very different vocabularies. However, preferentially the cryptomarket user will deploy a libertarian conceptual framework when discussing politics.

[FIGURE 5 ABOUT HERE]

Figure 5: "Libertarian discourse" as a function of time with confidence level 95%. The dotted line marks the closure of Silk Road.

Language and social structure are mutually constitutive and in a dialectical relationship (Fairclough, 2008). For example, whether a person is ascribed meaning to as a freedom fighter or terrorist will results in entirely different consequences. In the context of cryptomarkets several, possibly transformative, events have taken place since their beginning in 2011. These events may change the political discourses on the cryptomarket and we therefore measure the prevalence of libertarian discourse over time. Because the interest is in broader shifts in the prevalence of discourse we estimate a regression wherein we fit libertarian discourse to the date on which a post was written using a B-spline, as recommended by Roberts et al. (2015), with 10 degrees of freedom to the estimated document-topic proportions provided by the STM calculating uncertainty using the "Global" option (see Roberts et al., 2015, for further details). The results are shown in Figure 4 wherein we observe a trend towards a higher prevalence of libertarian discourse from 2011 to the end of 2013. In the end of 2013, when Silk Road was seized, we observe an abrupt downward change in the prevalence of libertarian discourse.

Discussion

One political discourse, libertarianism, was found using the STM. We did not identify other political discourses and therefore suggest that the libertarian discourse has achieved a hegemonic, dominant position. However, this does not mean that alternate political opinions are absent. We observe a variety of such opinions, but our findings suggest libertarianism as the dominant discourse.

Martin (2014b) conceptualizes the cryptomarket as an informal governing node similar to insurgent groups governing territory. This notion may serve to explain why we find radical political discourses in a locality designed, intended, and used for the distribution of illicit substances. Free spaces and locations outside the direct control of dominant groups provide avenues for the envisioning of alternative futures and plotting of

strategies to realize them (Polletta, 1999, p. 3). Silk Road existed as such, constituting a *digital demimonde, a marginalized world that is an isolated part of everyday lives* on the fringes of social mores and the internet (Maddox et al., 2016, p. 111) which serves as explanation of the presence of the political discourse.

We observe that the prevalence of the libertarian discourse was increasing until the seizure of Silk Road after which is decreased. Maddox et al. (2016) found that respondents after the fall of Silk Road experienced a *sense of loss for the political vision of a different future* (Maddox et al., 2016, p. 122). Empirically, we see this loss expressed in a declining prevalence of libertarian discourse indicating that after the fall of Silk Road, participants stopped discussing libertarian politics. Though some expressed a desire to recreate what was lost with Silk Road (Maddox et al., 2016, p. 123), our findings suggest that the libertarian discourse on cryptomarket has never been as prevalent as before the fall of Silk Road.

After the fall of Silk Road, new markets emerged to take its place (Van Buskirk, Roxburgh, Farrell, and Burns, 2014) along with Silk Road 2.0 and a new Dread Pirate Roberts. However, in spite of this, the libertarian discourse did not reemerge. The territorial and structural qualities of the cryptomarket, whether demimonde or informal governing node, did not change as new cryptomarkets operated similarly. Polletta (1999) argues that long-standing community institutions, which Silk Road can be considered as being, and networks are crucial to the generation of cultural challenges within free spaces. With the fall of Silk Road, the change consisted in the longest-standing community institution being seized, and the unmasking of a charismatic leader, one who had articulated drug dealing as a means to liberation. While interventions against cryptomarkets have not stopped the growth of the economy (Soska and Christin 2015; Van Buskirk et al. 2014), the closure of Silk Road seems to have put an end to the expressions of libertarian politics by cryptomarket participants.

Conclusion

Within the paper we have developed a methodology combining the structural topic model with concepts from discourse analysis which was used to analyze 417,495 forums posts from five cryptomarket forums and one omni-forum. In line with earlier research, it is found that libertarianism has a significant position within the discussion forums. One out of 100 topics expressed a libertarian discourse. The absence of alternate lexicalizations of politics (e.g. conservative, socialist) leads us to suggest that the discourse can be considered hegemonic.

We find that the prevalence of the libertarian discourse was increasing from 2011 to the closure of Silk Road in October 2013 after which a steep decline in the prevalence of libertarian discourse is observed. The closure of Silk Road coincides with a steep decline in the prevalence of the libertarian discourse suggesting that while the closure did not succeed in curtailing the cryptomarket economy, it dampened political sentiments. The findings indicate a tendency towards a more rational motivation - or at least less political participation - on cryptomarkets. The use of structural topic models and discourse analyses on sizeable discussion material has established the finding of the trend in the cultural meanings of the cryptomarkets. Further research ought to follow the trends in cultural meanings of the markets which may also be relevant in understanding the developments within the patterns of dealings. Will a more rational orientation within the markets change the market further towards a gross market, and will it significantly change the crime scripts of both vendors and buyers?

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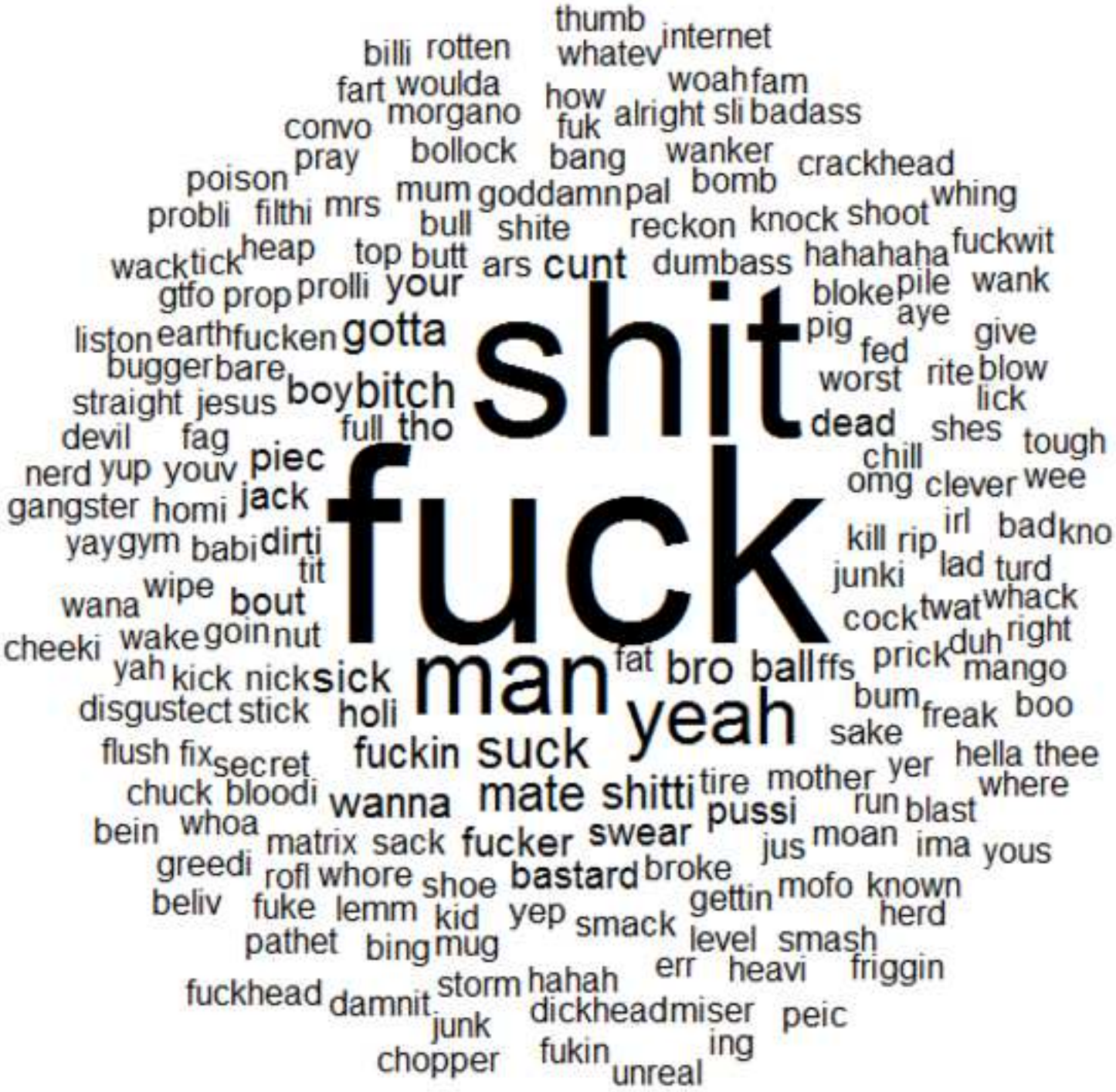
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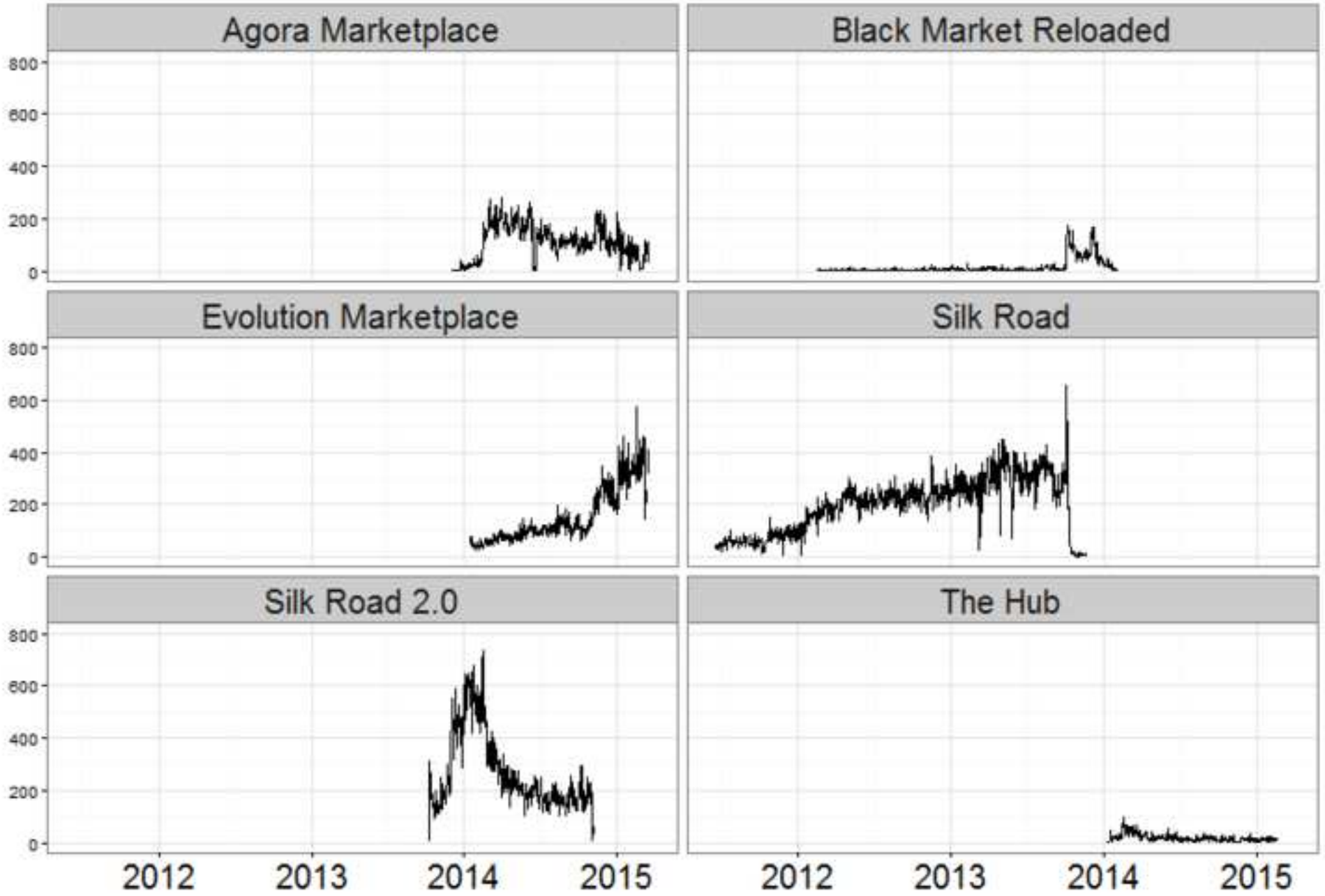
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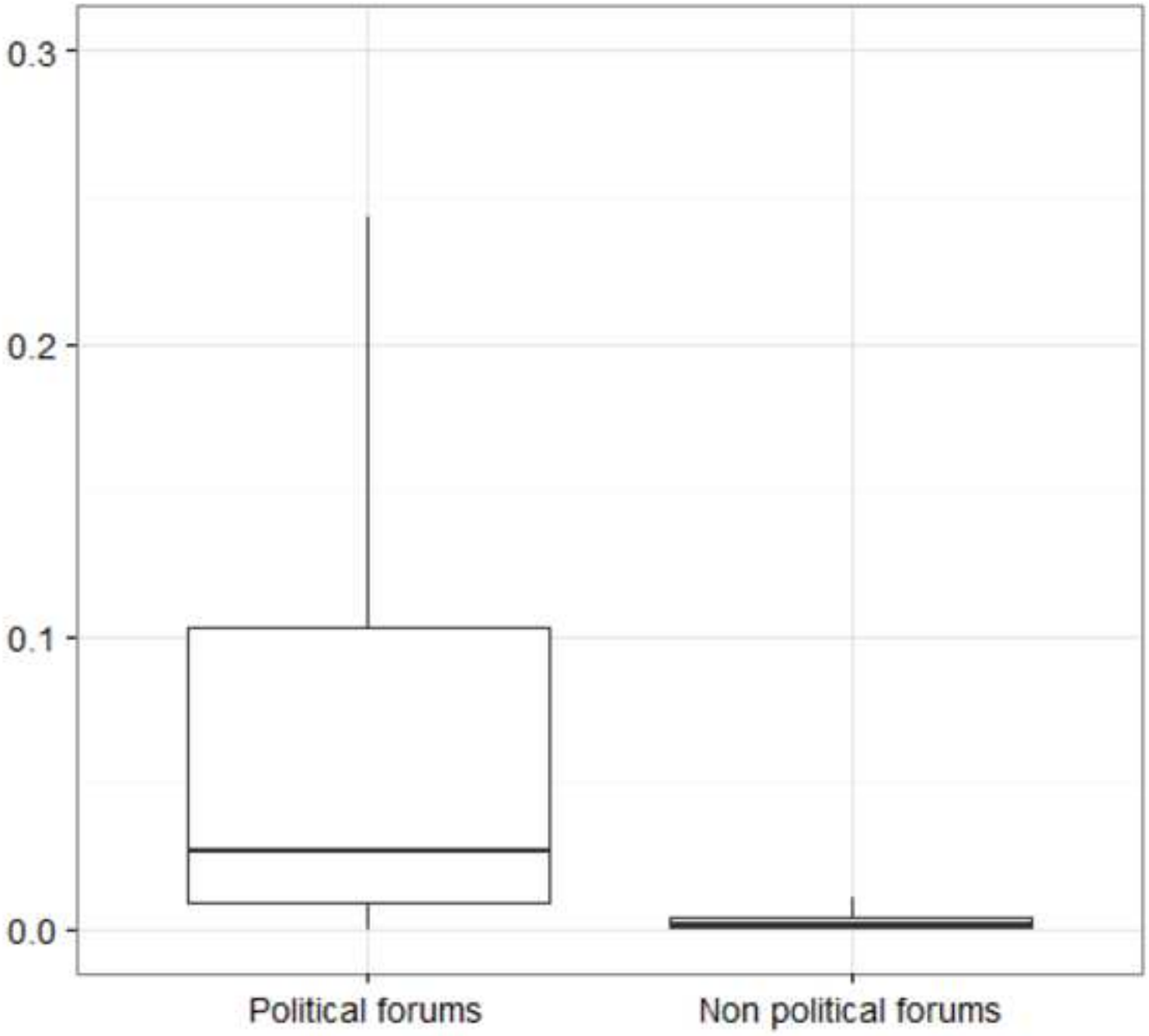

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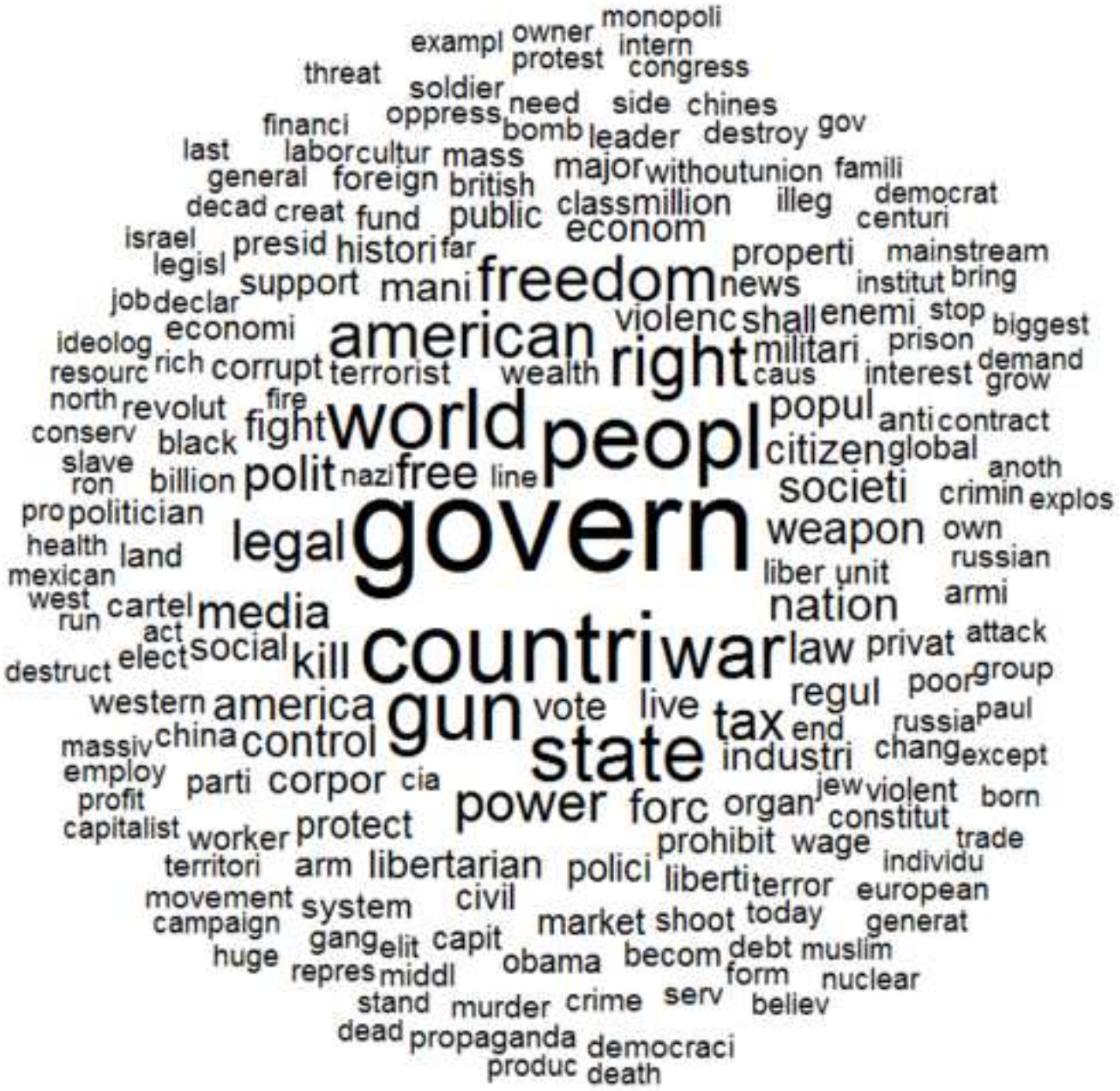
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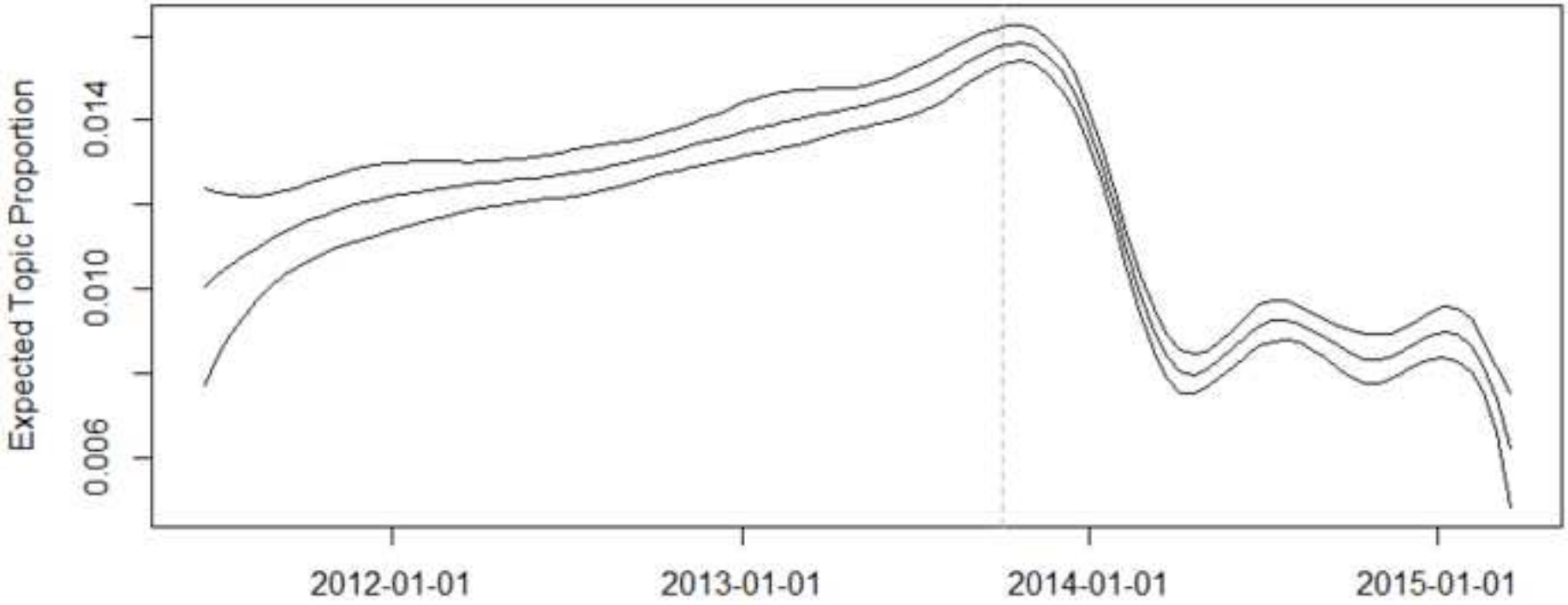
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