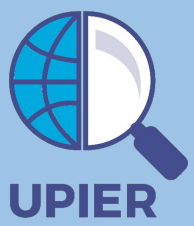
USES OF THE PAST IN INTERNATIONAL ECONOMIC RELATIONS



APPLYING LESSONS OF THE PAST? EXPLORING ECB SPEECHES DURING THE GREAT RECESSION

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Foreword

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Abstract

In his book *Hall of Mirrors* (2015), Barry Eichengreen argues that during the Great Recession policy makers used lessons from the interwar period as guidance in their decision making. To test this hypothesis, this paper employs Text Mining methods to explore all 1009 speeches given by ECB Executive Board members between 2007 and 2015. Three main findings arise from this analysis. Firstly, ECB speeches referred predominantly to lessons about price stability, liquidity, and cooperation. The temporal dimension of this evidence, as measured by a Structural Topic Model, corresponds to Eichengreen's narrative and confirms a shift in policy priorities from 2010 onwards. Secondly, the speeches that actually contained references to these historical lessons constituted only 5% of the overall corpus. While this reflects an interesting and persistent rhetorical pattern, its marginal quantitative size qualifies Eichengreen's claim about a dominant, all-encompassing influence of historical lessons during the Great Recession. Thirdly, the application of a Structural Topic Model to the rhetoric of several Board members indicate an influence of Ordoliberalism, a German school of economic thought that regained prominence during the Eurozone crisis. Nevertheless, Freiburg School references also had a legitimising function especially when ECB members faced German audiences. In sum, ECB Executive Board members paid tribute to a cultural preference for price stability and balanced budgets that was grounded in specific German lessons from the interwar period. The new quantitative evidence presented in this paper therefore helps to explain the divergent monetary crisis reactions in Europe and the US.

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Introduction: Applying Lessons from the Past?

When the financial crisis of 2007 erupted, the limitations of mainstream economic models soon became apparent. Jean-Claude Trichet, then President of the European Central Bank, found the available models of limited help: 'in the face of the crisis,' he reported during an opening address in November 2010, 'we felt abandoned by conventional tools.' In the absence of clear guidance from existing analytical frameworks, one area of literature promised help: historical analysis. 'Historical studies of specific crisis episodes highlighted potential problems which could be expected. And they pointed to possible solutions. Most importantly, the historical record told us what mistakes to avoid' (Trichet, 18.11.2010).[1]

Trichet's reflections were by no means an outlier. Following the crisis' outbreak, numerous observers used references to the Great Depression and the lessons that might be learned. In his book *Hall of Mirrors: The Great Depression, the Great Recession, and the Uses – And Misuses – Of History* (2015), Barry Eichengreen, an American 'saltwater' macroeconomist at the University of California, Berkeley, describes and analyses these historical analogies. He argues that a repeat of the 1930s was avoided because central bankers and politicians recognised the Great Depression's lessons regarding monetary and fiscal policy. This argument gains its attraction through the fact that important protagonists of Eichengreen's story, such as Federal Reserve Chair Ben Bernanke and Chair of the Council of Economic Advisors Christina Romer, had studied the Great Depression in their previous academic life. While applying historical lessons prevented the worst in 2008, Eichengreen argues, this ironically increased the duration of the Great Recession by reducing the perceived need of large fiscal stimuli and substantial banking reforms.[2]

However, *Hall of Mirrors* is largely based on sparse and anecdotal evidence. In this paper, I propose a structured and empirical assessment of its main hypothesis, namely that economic and political elites actually used 'lessons from the past' in their decision making. To provide a more nuanced, dynamic analysis of the extent to which policy makers applied historical analogies, this paper employs

[1] References to ECB speeches within the corpus are displayed in the main text and abbreviated with name of speaker and date of speech.

[2] Eichengreen, B.J., *Hall of Mirrors: The Great Depression, the Great Recession, and the Uses - and Misuses - of History* (New York, 2015).

Text Mining methods to investigate all 1009 speeches given by ECB Executive Board members during the Great Recession (2007-15). It thereby connects three strands of literature. Firstly, academics have studied how, in a globalising world, references to the past are increasingly used to form and legitimise corporate identities.[3] Despite the fact that academic historiography is responsible for the production of historical knowledge, the past is addressed in many popular contexts that promise the delivery of useful and easily communicable knowledge. While most literature criticises the various forms of simplifying and 'marketing' the past,[4] Eichengreen's book shifts the focus to policy makers and their relationship to 'useful' historical lessons.

Secondly, a growing literature analyses central bank communication, which has become an important monetary policy tool since the 1990s. Scholars have found that central banks' communication can move financial markets, enhance the predictability of monetary policy, and help achieve the banks' stabilisation objectives.[5] However, since the publication of Morris and Shin's influential paper, central bankers are well aware that increases in the precision of the published information can also have welfare-reducing effects by attenuating the weight that each market participant puts on her private information in choosing her action.[6] In practice, therefore, communication strategies usually improve through a trial-and-error process, which teaches market participants how to interpret the central bank's message and the central bank how to anticipate its statement's interpretation.[7] This paper contributes to our understanding of the ECB's communication process during the Great Recession.

Thirdly, social scientists are increasingly interested in new Text Mining methods that can analyse large numbers of primary sources.[8] This growing set of computational tools and statistical methods allows to quantify text and has two crucial advantages. First, computer-enabled approaches can investigate a large collection of documents ('corpus') at a scale that would be impossible by human close reading. Second, such approaches can extract meaning that would be overlooked by humans due to prior beliefs or expectations. Recently, these quantification techniques have been applied to central banks'

[3] Tomann, J., 'Commodification of History: The Past as Source of Entertainment and Commerce', *H-Soz-Kult* (23.02.2018), www.hsozkult.de/event/id/termine-36535 (12.06.2018).
[4] Odermatt, P., 'Built heritage and the politics of (re) presentation', *Archaeological Dialogues*, 3/2 (1996), pp.95-119, and subsequent discussion.
[5] Blinder A.S. et al., 'Central Bank Communication and Monetary Policy: A Survey of Theory and Evidence', *Journal of Economic Literature*, 46/4 (2008), pp.910-45.
[6] Morris, S., and Shin, H.S., 'The Social Value of Public Information', *American Economic Review*, 92 (2002), pp.1521-34.
[7] Woodford, M., 'Central Bank Communication and Policy Effectiveness', *NBER Working Papers*, 11898 (2005), p.21.
[8] Overview: Bholat, D., et al., 'Text mining for central banks: handbook', *Centre for Central Banking Studies*, 33 (2015).

communication. This approach has been pioneered by Hansen and McMahon, who use computational linguistics to measure the information released by the Federal Open Market Committee on the state of economic conditions[9] as well as the effects of transparency on monetary policy makers' deliberations.[10] Similarly, Masawi et al. use the commercial Leximancer software to perform content and relational analysis of central banks' speeches[11] and Takeda and Keida offer a computer-based analysis that shows how the Bank of Japan followed a 'cheap talk' strategy to manipulate expectations.[12] Despite Text Mining's advantages, quantitative and qualitative approaches should not be seen as substitutes, but as necessary complements in historical research. This paper therefore includes a more conventional qualitative case study that investigates one of the anomalies discovered in the previous quantitative analysis.

The remainder of the paper is structured as follows. First, the necessary background with respect to historical dynamics and Eichengreen's specific lessons is provided. The subsequent sections presents the main quantitative analysis, including an investigation of descriptive statistics, the estimation of a Structural Topic Model and the analysis of a subset of speeches that contain key dates related to historic crises. Based on the quantitative finding that German experiences played a prominent role in the ECB's reasoning, a final case study investigates whether ECB speeches were influenced by a German school of thought called Ordoliberalism.

Chronology: The 'Great Recession'

It has been argued that different economic crises require different reactions and tools.[13] In this sense, different crises also invoke different lessons from the past. When analysing ECB speeches during the Great Recession it is therefore crucial to recognise that the euro-area faced three interlocking crises,

[9] Hansen, S. and Mcmahon, M., 'Shocking Language: Understanding the Macroeconomic Effects of Central Bank Communication', *Journal of International Economics*, 99 (2016), pp.114-33.
[10] Hansen, S. et al., 'Transparency and Deliberation Within the FOMC: A Computational Linguistics Approach', *The Quarterly Journal of Economics*, 133/2 (2018), pp.801-70.
[11] Masawi, B. et al., 'The power of words: A content analytical approach examining whether central bank speeches become financial news', *Journal of Information Science*, 40/2 (2014), pp.198-210.
[12] Takeda, Y. and Keida, M., 'Central bank communication strategies: A computer based narrative analysis of the Bank of Japan's Governor Kuroda' in S. Eijffinger and D. Masciandaro (eds), *Hawks and Doves: Deeds and Words Economics and Politics of Monetary Policymaking* (VoxEU.org eBook, London, 2018), pp.137-42.
[13] Gros, D. et al., 'Central Banks in Times of Crisis: The FED vs. the ECB', *IDEAS Working Paper Series from RePEc* (2012).

which fed into each other in a vicious circle: a banking crisis, a sovereign debt crisis, and a growth crisis.[14] This interdependent nature of the recession implies a conflict between the "austerity" measures meant to address the debt crisis and their aggravating impact on growth performance. The dynamics within and between these different phases of the crisis are essential for understanding the shifting focus of ECB speeches, they play a key role in Eichengreen's narrative and they can be captured by the Structural Topic Model.

As a result of the macroeconomic stability following the 2001 high-tech bubble, policy makers became less sensitive to risk at a time when US bankers offered increasingly risky subprime loans. When US housing prices started to collapse, the linkages between financial institutions led to a global panic and a sudden "freezing" of inter-bank borrowing and lending. The first signs of reduced liquidity appeared in 2007, when New Century Financial Corporation, a US mortgage lender, declared bankruptcy (April 2007), followed by the decisions of Bearn Stearns (July 2007) and BNP Paribas (August 2007) to suspend the redemption of shares in those of their funds that had invested in subprime mortgages. After a few months of deceptive calm, the failure of Lehman Brothers on 15 September 2008 finally triggered the outbreak of a global financial crisis.

Given the subsequent sharp contraction in world output and trade, the ECB cut its minimum bid rate gradually from 4.25% to 1%. In addition, 'non-standard' monetary policy measures were implemented, including the decision to narrow the interest rate corridor of standing facilities, the temporarily extension of the eligibility criteria for collateral, and the launch of the Covered Bond Purchase Programme (July 2009). Following the G20 Summit in London (April 2009), governments experienced with expansionary fiscal policies to support the recovery. Between December 2009 and April 2010, the ECB already initiated the 'phasing-out' from its non-standard policy measures.

Meanwhile, the dramatic increase in budget deficits had prepared the ground for the next phase of the crisis. Financial markets increasingly worried about the sustainability of euro-area countries' public finances, as indicated by diverging sovereign bond yields in early 2010. After the bailout of Greece (May 2010), contagion spread to other euro-area bond markets, resulting in the bail-out of four other countries: Ireland (November 2010), Portugal (May 2011), Spain (July 2012), and Cyprus (April 2013).

[14] Chronology based on: Shambaugh, J., 'The Euro's Three Crises', *Brookings Papers on Economic Activity*, 43/1 (2012), pp.157-231; Baldwin, R.E. and Wyplosz, C., *The economics of European integration*, 5th edn (London, 2015), ch.19; and González-Páramo, J.M., 'The conduct of monetary policy: lessons from the crisis and challenges for the coming years', *Speech by at the SEACEN-CEMLA Conference* (Kuala Lumpur, 13.10.2011), https://www.ecb.europa.eu/press/key/date/2011/html/sp111013.en.html (06.06.2018).

Additionally, Greece needed two further rescue packages (March 2012, August 2015). The newly created European Financial Stability Facility (EFSF) provided governments with resources to counter this contagion (June 2010), until it was replaced by the European Stability Mechanism (ESM), an intergovernmental organisation with a lending capacity of 500 billion euros (July 2013). Given this intensification of the sovereign debt crisis, the ECB reassessed its phasing-out process and subsequently launched the Securities Market Programme (SMP) under which it conducted outright purchases of debt securities in the secondary market (May 2010).

However, these policy responses were slow and only half-hearted, reflecting the growing political tensions between surplus and deficit countries.[15] Analysts and international academics criticised the implementation of austerity measures during a severe recession, which tended to generate contractions in the affected countries' GDP.[16] Likewise, the ECB's monetary policy was accused of being constantly 'behind the curve' because the reductions of its policy rate were implemented too slowly.[17] Indeed, if we take an aggregate look at the common effect of the central banks' operations, the 170% increase in the

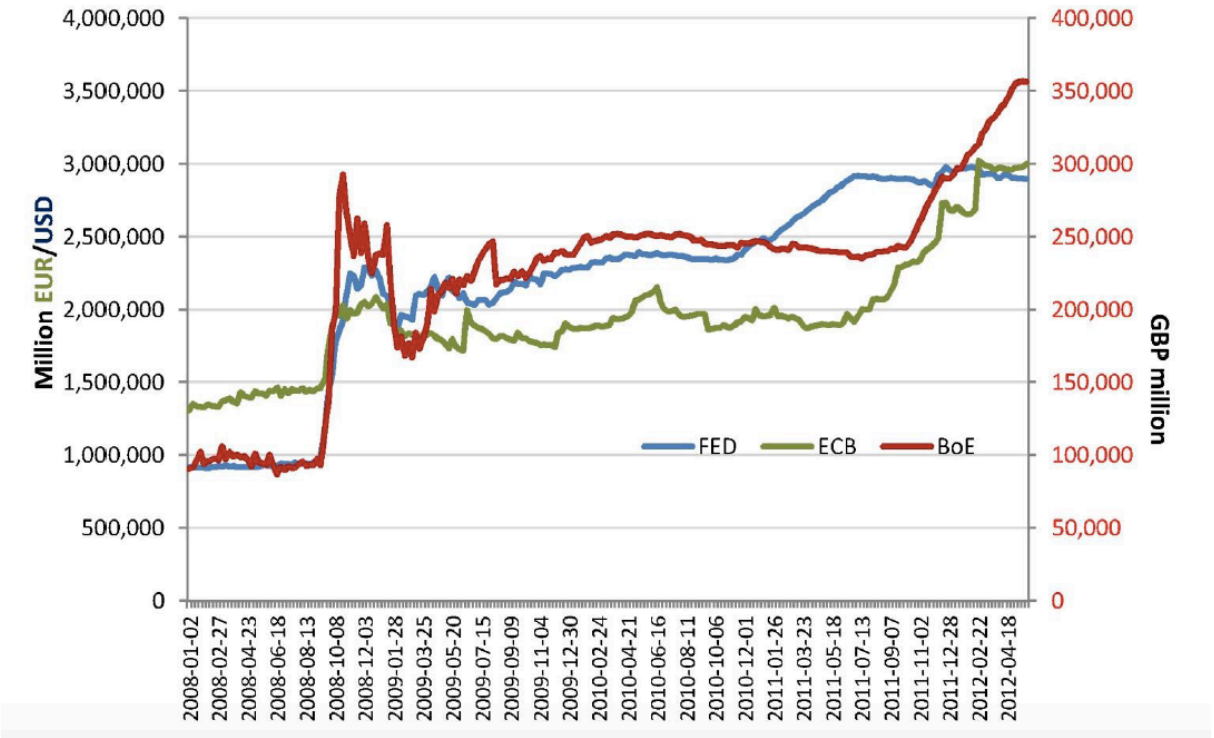

FIGURE 1: TOTAL ASSETS/LIABILITIES: ECB, FED, BOE
SOURCE: GROS ET AL, 'CENTRAL BANKS', P. 3.

[15] This conflict is analysed by: Brunnermeier, M.K. et al., *The Euro and the Battle of Ideas* (Princeton, 2016).
[16] Evidence summarised by: Shambaugh, 'Three Crises', pp.192-6.
[17] Mody, A., *Eurotragedy: A drama in nine acts* (New York, 2018), p.225.

ECB's balance sheet between January 2008 and May 2012 looks relatively 'small' when compared with the BoE's 300% increase and the Fed's 230% expansion (Figure 1).[18]

The increasing uncertainty was stopped when ECB president Draghi announced that 'the ECB is ready to do whatever it takes to preserve the euro' (July 2012), a statement that was interpreted as the promise to buy, if needed, an indefinite amount of distressed public bonds. When this intention was formalised as the Open Market Transactions (OMT) programme (September 2012), sovereign bond yield spreads declined dramatically. In short, the ECB's announcement to act as lender of last resort ended the acute phase of the Eurozone crisis.

Overview: Eichengreen's 'Lessons from the Past'

Throughout *Hall of Mirrors*, Eichengreen emphasises 'how conventional wisdom about the [1929 crisis], what is referred to as "the lessons of the Great Depression", shaped the response to the events of 2008-09' (p.1).[19] Note that these historical lessons come in a narrative, not technical, form. Their narrative structure evolves around some historical experiences but marginalises others. This is crucial because 'what is not told is not remembered, and what is not remembered cannot be taken into account in decision making.'[20] This perspective reflects the audience that Eichengreen addresses with his book. *Hall of Mirrors* is a book intended to be read by policy makers and advisers and therefore necessarily 'less a history of crisis than a handbook,' whose purpose 'is to learn lessons, indeed to learn lessons about learning lessons.'[21]

A careful reading of *Hall of Mirrors* enables us to identify seven distinctive lessons from the past that can be grouped around the two phases of the crisis: lessons that inspired the immediate monetary and fiscal reactions when the crisis erupted and spread from the US to Europe (2007 – 2009); and lessons that shaped the later handling of the sovereign debt crisis in Europe (2010 – 2015). These seven lessons (L1-L7) provide the analytical benchmark for the subsequent analysis of ECB speeches and are described in the following (summary: Table 1).

[18] Gros et al., 'Central Banks', p.3.
[19] Page references in the main text always refer to Eichengreen, *Hall of Mirrors*.
[20] Hansen, P., 'Hall of Mirrors: The Great Depression, the Great Recession, and the Uses - and Misuses - of History', *Business History Review*, 89/3 (2015), p.559.
[21] Tooze, A., 'How to Mishandle a Crisis', *New Left Review*, 92 (2015), p.140.

The narrative constructed by Milton Friedman and Anna Schwartz in their *Monetary History of the United States* is probably the best known lesson from the past.[22] They associated the Great Depression with the Fed's failure to act as a lender of last resort and to provide liquidity to financial markets during the early 1930s banking crises. According to Eichengreen, central banks both in the US and in Europe acted in line with this lesson by quickly *flooding the market with liquidity* (L1). When interbank rates rose above the ECB's target following the BNP Paribas announcement, the ECB reported quickly that it was ready to act and offered to provide unlimited amounts of liquidity: 'Even in Frankfurt they had evidently read Friedman and Schwartz' (p.177). Similarly, the Fed injected $24 billion into financial markets and affirmed to supply 'as many dollars as the markets required,' which, as Eichengreen notes again, 'was exactly the response recommended by Friedman and Schwartz' (p.177).

However, unlike the Great Depression, the 2007 crisis did not centre on commercial banks, but on the shadow banking system of hedge funds, money market mutual funds, and commercial paper issuers. Accordingly, standard central bank interventions were less effective. According to Eichengreen, the central banks' erroneous *targeting of the banking sector* (L2) can similarly be traced back to historical experiences: 'The 1930s crisis centred on the banking system. Influenced by that history, it was to the banking system that the Fed now looked. Lending to banks was the Fed's bread and butter' (pp.190f.).

Besides central banks' reactions, active fiscal policy was needed to counter the crisis. For instance, the Obama administration designed a $787 billion *fiscal stimulus bill* (L3) that, according to Eichengreen, was informed by the impression that both the Hoover and Roosevelt administrations had done too little to offset the decline in private spending during the 1930s. Christina Romer, Obama's economic advisor, had argued that during the Great Depression, fiscal policy had been of little consequence because fiscal stimuli were too small.[23] Now, politicians aimed to 'prevent the repetition of this mistake' (p.297).

During the Great Depression, central banks had been slow to coordinate their actions to enable the functioning of the gold standard. Eichengreen argues that this historic lesson inspired *international cooperation* in 2008-09 (L4). Major central banks coordinated interest rate cuts in October 2008 and set up foreign exchange swap lines, while several governments coordinated financial bailouts and fiscal stimulus packages.[24] This spirit of cooperation went beyond mere technical coordination: Eichengreen

[22] Friedman, M., and Schwartz, A., *A monetary history of the United States, 1867-1960* (Princeton, 1963).
[23] Romer, C., 'What Ended the Great Depression?', *The Journal of Economic History*, 52/4 (1992), pp.757-84.
[24] Duca, J., 'The Great Depression versus the Great Recession in the U.S.: How fiscal, monetary, and financial polices compare', *Journal of Economic Dynamics and Control*, 81 (2017), p.59.

argues that the 'ritual invocation' of the Smoot-Hawley tariff helped policy makers to resist protectionism (p.122) and that British prime minister Gordon Brown reminded G20 leaders how the failure of the 1933 World Economic Conference 'had foreshadowed all the other terrible events of that decade and the one to follow' (p.340).

According to Eichengreen, policy makers' emphasis shifted after this first phase of the crisis. From 2010 onwards, new lessons about the danger of inflation and the necessity of balanced budgets prevailed, especially in Europe, while banking reforms came too late: 'This shift occurred despite the fact that the recovery continued to disappoint,' Eichengreen complains. 'Rather than avoiding the mistakes of the 1930s, policy makers almost seemed intent on repeating them' (p.284). If Eichengreen's hypothesis is true, we should therefore observe a change in argumentation over time, with lessons L1 to L4 becoming less prominent and lessons L5 to L7 increasing their respective proportions in ECB speeches.

Germany's *fear of inflation* (L5), based on memories of the 1923 hyperinflation, translated into European policy because of the ECB's *Bundesbank*-like structure and 'the desire of its French president, Jean-Claude Trichet, to demonstrate that he was as dedicated an inflation fighter as any German' (p.8). According to Eichengreen, the German public was 'traumatised by inflation' and those fears of inflation 'informed and inhibited policy in other countries, like the UK, that had experienced the phenomenon only at second hand' (p.254). Consequently, monetary policy was not supportive enough.

Similarly, the idea that fiscal stimuli could facilitate the recovery was dismissed by the German public, who associated deficit spending with historical episodes of out-of-control budgets of Weimar and Hitler's rearmament, as well as with more recent experiences of fiscal profligacy and high inflation in Southern European countries in the 1970s and 80s. Keynesian theory had never gained traction in Germany.[25] German economists therefore argued that government should focus on strengthening contract enforcement and fostering competition. Overall, this mix of peculiar German experiences encouraged an *early (and Europe-wide) shift to austerity* (L6).

Finally, policy makers were aware that the flawed policies and institutional structures that had enabled the crisis needed to be fixed through *comprehensive reforms* (L7). Banks are now subject to higher capital and liquidity requirements. However, historical experience suggests that to be effective, such reforms have to be put in place 'before the sense of urgency has passed' (p.378). According to

[25] Allen, C., 'The Underdevelopment of Keynesianism in the Federal Republic of Germany', in P. Hall (ed), *The Political Power of Economic Ideas* (Princeton, 1989), pp.263-90.

Eichengreen, the fact that 'another Great Depression was avoided weakened the argument for more radical changes' (p.386). He argues that policy makers prioritised recovery over reform during the first phase, implying that efforts to develop banking reforms came too late.

No	Label	Description	Key words	Protagonist	Pages
First Phase: Global financial crisis (2007-2009)					
L1	Liquidity	Pointing to the Fed's unsuccessful attempt to prick a bubble in 1929, policy makers concluded that the central bank should not to attempt to lean against a bubble but rather to flood the markets with liquidity if its bursts.	bubble, liquidity, macroprudential policy, accommodative stance, lender of last resort	Fed, ECB (slower)	63, 119, 176f., 186, 265, 269f., 282, 286f., 305
L2	Pre-occupation with banks	The 1930s crisis centred on the banking system. Influenced by that history, central bankers now looked to the banking system, while many of the most treacherous problems were in the shadow banking system.	(shadow) banking system, securitized mortgages, asset-backed commercial paper	Fed, ECB	190f., 381
L3	Fiscal stimulus	Fiscal policy during the Great Depression made only a limited contribution to recovery because the fiscal initiatives were too small. Obama's$787 billion fiscal stimulus was designed to avoid this mistake. Similarly, the G20 arranged for expansionary policies.	fiscal stimulus, Obama, private spending, New Deal	US government, G20	297, 330f.
L4	Internat. cooperation	Another lesson referred to the destruction that could be wrought by inadequate international cooperation. This inspired the effort in 2008-09 to coordinate monetary and fiscal policies and to shun protectionist measures.	protectionism, coordination, cooperation, World Economic Conference, Smoot-Hawley	Fed, ECB, IBS, politicians	122, 186, 236, 340f., 384
Second Phase: Eurozone-Crisis (2010-2015)					
L5	Fear of inflation	Based on memories of the 1923 hyperinflation, Germany's fear of inflation translated into European policy. This meant that monetary policy was inadequately supportive of the economy.	hyperinflation, 1929, 1970s, headline inflation, price stability	Fed, ECB, Bundesbank	8, 40, 59f., 190, 254, 283, 303f., 338f., 383
L6	Austerity	The out-of-control budgets of Weimar, associations with Hitler's rearmament and lack of Keynesian thought left German economists sceptical of deficit spending. This initiated a pre-mature shift to austerity throughout Europe.	deficit spending, austerity, contract, competition	German government, ECB, Bundesbank	9f., 342, 352
L7	Regulatory reforms	From historical experience, policy makers should have known that the flawed policies that allowed the crisis to develop in the first place should be fixed through comprehensive reforms put in place before the sense of urgency has passed. However, reform attempts came too late and were therefore insufficient.	regulation, reform, Dodd-Frank Act, too-big-to-fail, Volcker Rule, systemically important	policy makers	247, 378, 386

TABLE 1: EICHENGREEN'S SEVEN LESSONS FROM THE PAST

Eichengreen's narrative provides anecdotal evidence but no systematic evaluation of how exactly these historical lessons have been applied in decision making. A typical example for the type of evidence given by Eichengreen is a remark addressed by Bernanke to Professor Friedman in 2002: 'Regarding the Great Depression. You're right, we did it. We're very sorry. But thanks to you, we won't do it again' (p.170). In his book review, Hansen critically notes that 'this case is the only explicit example where Eichengreen substantiates empirically how decision makers understood the crisis through the lens or frame of the 1930s.'[26] Consequently, the goal of this paper is to empirically test Eichengreen's hypothesis about the influence of historical lessons as defined above (L1-7). To do so, the following section first introduces the corpus consisting of all speeches held by ECB Executive Board members during the Great Recession and then employs Text Mining methods to quantitatively explore these speeches.

[26] Hansen, 'Hall', p.562.

Corpus: Institutional Context and Descriptive Statistics

ECB monetary policy is implemented in two steps. First, following an assessment of the medium-term inflation outlook (economic analysis) and an identification of monetary impulses from current and past monetary policy decisions (monetary analysis), the Governing Council decides on the level of the key ECB interest rates. Then, the Executive Board organises the refinancing operations necessary to implement these decisions. The Governing Council consists of the governors of the national central banks of the 19 euro-area countries plus the Executive Board. The latter is composed of the President of the Bank, the Vice-President and four other members. Board members are nominated by the Heads of Government of the euro-area countries for an eight-year term.

All speeches that were given by members of the ECB's Executive Board between 1 January 2007 and 31 December 2015 were downloaded from the bank's digital archive and stored in a single file, together with their respective date, title, speaker and type.[27] Presentation slides and the preliminary material that comes before each speech starts were manually removed. Within our period of analysis, thirteen persons have held positions on the Executive Board, including two presidents (Jean-Claude Trichet, Mario Draghi), two vice-presidents (Lucas Papademos, Vítor Constâncio), and nine additional Board members. The resulting database contains 1,009 speeches, most of which (694) are not further classified (Figure 2).

[27] https://www.ecb.europa.eu/press/key/date/2018/html/index.en.html (03.06.2018).

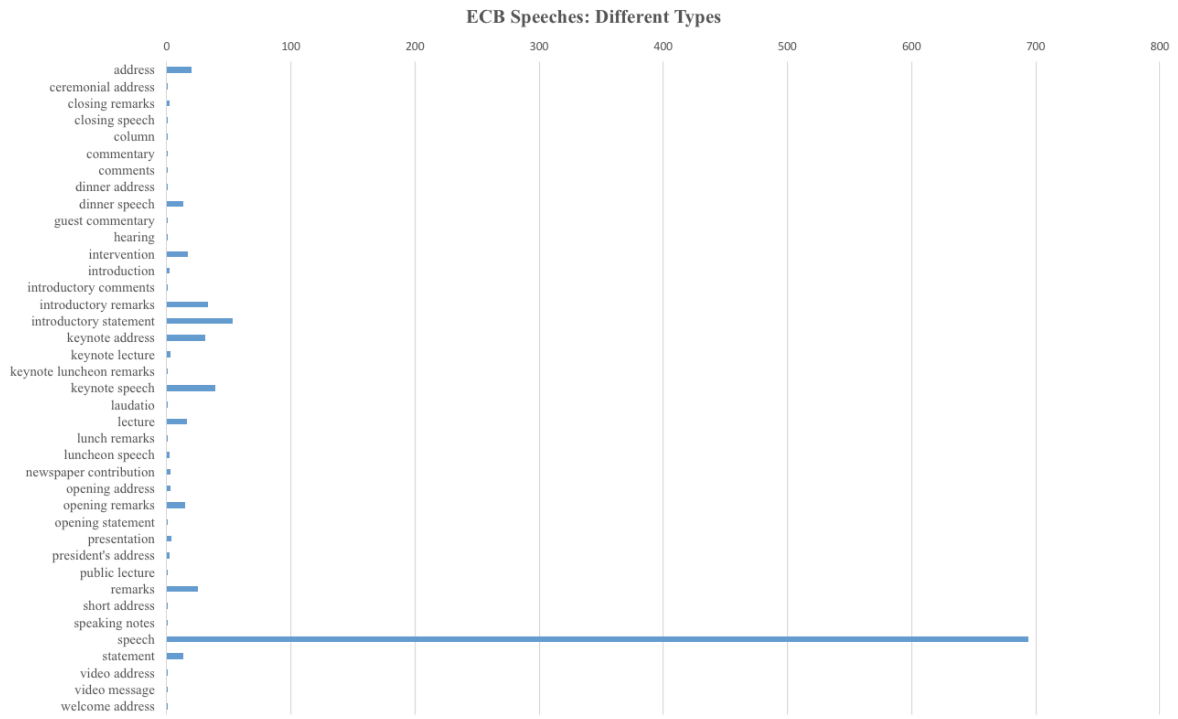

FIGURE 2: ECB SPEECHES: DIFFERENT TYPES

Speeches provide a rich source of information.[28] Firstly, a speech represents the concerted effort of a writer (or communication department) aiming to deliver a meaningful statement. Secondly, a speech usually fulfils more than a ceremonial function since it formally addresses an issue deemed important enough to consume time and energy of an ECB Executive Board member. Thirdly, it is reasonable to assume that digitally available speeches are formally sanctioned by the ECB, meaning that they convey the institution's official position in an attempt to inform, persuade or reinforce the beliefs of a given audience. Although devoted to a particular audience and occasion, speeches are, fourthly, indirectly addressed to a mass audience and Board members are undoubtedly aware of this potential.

However, one has to keep in mind that central bankers follow certain communication rules that can be limiting.[29] Most importantly, they have strong incentives to avoid dramatizing communication with the public. Central bankers try to manage expectations in an attempt to ensure the effectiveness of monetary policy and their speeches are consciously developed to substantiate a given position. Additionally, the oral delivery restricts these texts' length, size, and language.[30] Still, previous research has shown that ECB speeches constitute a 'special category' within the ECB's regular communication because they sometimes contain elements of meta-communication, for instance when Board members

[28] Sussman, L. et al., 'Corporate speeches as a source of corporate values: An analysis across years, themes, and industries', *Strategic Management Journal*, 4/2 (1983), p.188.
[29] E.g. not commenting on authorities and pre-commitments.
[30] Volkens, A. et al., *Mapping policy preferences from texts III: Statistical solutions for manifesto analysts* (Oxford, 2013), p.153.

use the opportunity to reflect on their own approaches to communication or monetary analysis.[31] The existence of such elements of meta-communication means that we would expect to find references to 'historical lessons' if Eichengreen's hypothesis is true. The corpus' large size ensures that these meta-speeches have been included. Besides, even if results derived from publically available sources like speeches are biased by the central bank's communication strategy, it is important to know whether this strategy presents the past as a foundation of central bankers' decisions and, if so, how it discriminates among different historical experiences of member states. Finally, the internal memos and other declassified statements that have been shown by Neustadt and May to be helpful in tracing the uses and misuses of the past[32] are often not accessible to historians analysing contemporary events, in particular when many of the actors involved are still pursuing their political careers. However, today's public sources are available in an electronic machine-readable format that allows historians to analyse them quantitatively in the hope that this aggregate approach can shed light on underlying preferences of these actors.

The following Text Mining methods are applied via the programming language R.[33] They share the assumption that a speech's content can be quantified by looking at the underlying words. Typically, researchers start by calculating each term's tf-idf (term frequency–inverse document frequency) score, the frequency of a term adjusted for how rarely it is used. This score measures how important a word is to a document in a corpus of documents.[34] We get a good impression of the most important topics in ECB speeches by determining the highest tf-idf words that were most specific to each speaker (Figure 3).

[31] Noordegraaf-Eelens, L.H.J., *Contested Communication: A Critical Analysis of Central Bank Speech* (Rotterdam, 2010), pp.52f.
[32] Neustadt, R.E. and May, *E.R., Thinking in Time: The Uses of History for Decision-Makers* (New York, 1986).
[33] Mainly: Silge, J., and Robinson, D., *Text mining with R: A tidy approach* (Sebastopol, 2017). Also: Wickham, H., and Grolemund, G., *R for data science: Import, tidy, transform, visualize, and model data* (Beijing, 2017).
[34] Silge and Robinson, *Text mining*, ch.3.

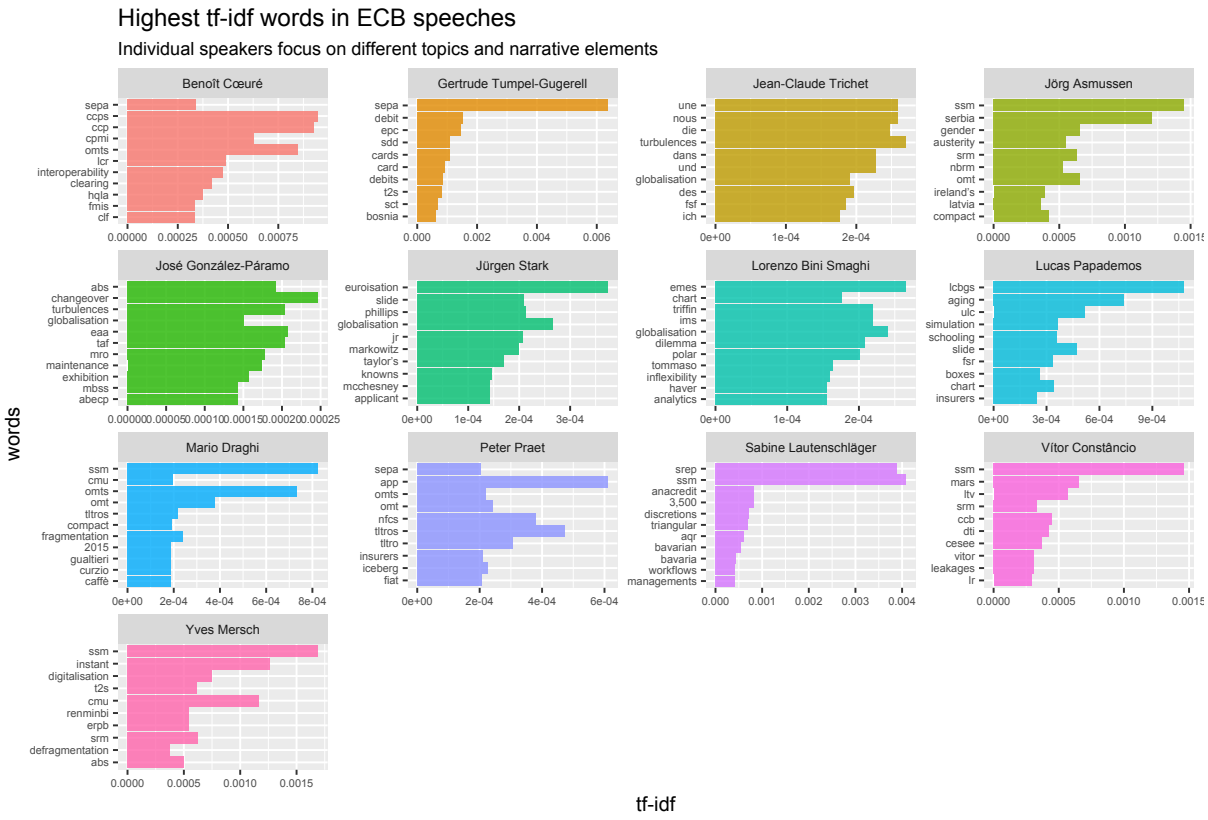

FIGURE 3: HIGHEST TF-IDF WORDS IN ECB SPEECHES

Figure 3 is characterised by numerous abbreviations related to finance and banking such as SSM (Single Supervisory Mechanism), CCP (central counterparty clearing house) or ABS (asset-backed security). Together with abstract terms like 'globalisation,' they belong to the large group of high tf-idf words that are used by several speakers alike. This indicates that most speeches refer to the same underlying discourses or deliver the same official message. Nevertheless, there are also a few specialised terms that can be linked to individual speakers, such as 'schooling' (Papademos), 'digitalisation' (Mersch) and 'euroisation' (Stark). This suggests a certain division of labour among Board members. For instance, Tumpel-Gugerell was responsible for market operations, payment systems and market infrastructure and this is well reflected by terms like 'debit,' 'card,' and 'SEPA' in her word profile. Trichet's inclination to integrate German or French sentences into his speeches whenever he visited one of these countries is similarly captured by his word profile.

At this point, it is worth emphasising that this database does not constitute a *sample* of ECB speeches, but rather the whole *population* of ECB speeches given between 2007-15. This means that the corpus does not suffer from any form of sample selection bias. Differentiating according to the speaker reveals that Board members give approximately 13 speeches per year, with Trichet being the most active speaker. Each member, except Lautenschläger, who is the latest addition to the Board, is represented by several dozen speeches, meaning that the results will not be driven by a single dominant speaker (Table 2).

This impression is strengthened by the correlation network displayed in Figure 4, which quantifies how similar speakers tend to be to each other with respect to speech content.[35] Rather than a high number of

Speaker	Position	Nationality	Term	Speeches	Speeches/Year
Jean-Claude Trichet	President	French	2003-2011	210	26
Mario Draghi	President	Italian	2011-2018	103	15
Lucas Papademos	Vice-President	Greek	2002-2009	45	6
Vítor Constâncio	Vice-President	Portuguese	2010-2018	83	10
Gertrude Tumpel-Gugerell	Board Member	Austrian	2003-2010	86	12
Peter Praet	Board Member	half-Belgian, half-German	2011-2018	51	7
José Manuel González Paramo	Board Member	Spanish	2004-2012	67	8
Yves Mersch	Board Member	Luxembourgian	2013-2018	61	12
Lorenzo Bini Smaghi	Board Member	Italian	2005-2011	96	16
Benoît Cœuré	Board Member	French	2012-2018	93	16
Jürgen Stark	Board Member	German	2006-2011	60	12
Jörg Asmussen	Board Member	German	2012-2013	37	19
Sabine Lautenschläger	Board Member	German	2014-2018	17	4

TABLE 2: ECB EXECUTIVE BOARD MEMBERS (2007-15)

small clusters of speakers, we observe one large network with strong correlations between almost all of the speakers, indicating a strong semantic similarity between their speeches. Even the speeches of Tumpel-Gugerell and Lautenschläger, the only visible outliers, have a correlation of 0.80 with most other speakers. This reflects the speakers' belonging to a close epistemic community of global monetary policy experts with a shared vocabulary as well as the presence of an underlying overall ECB communication strategy.

[35] Ibid., ch.4.

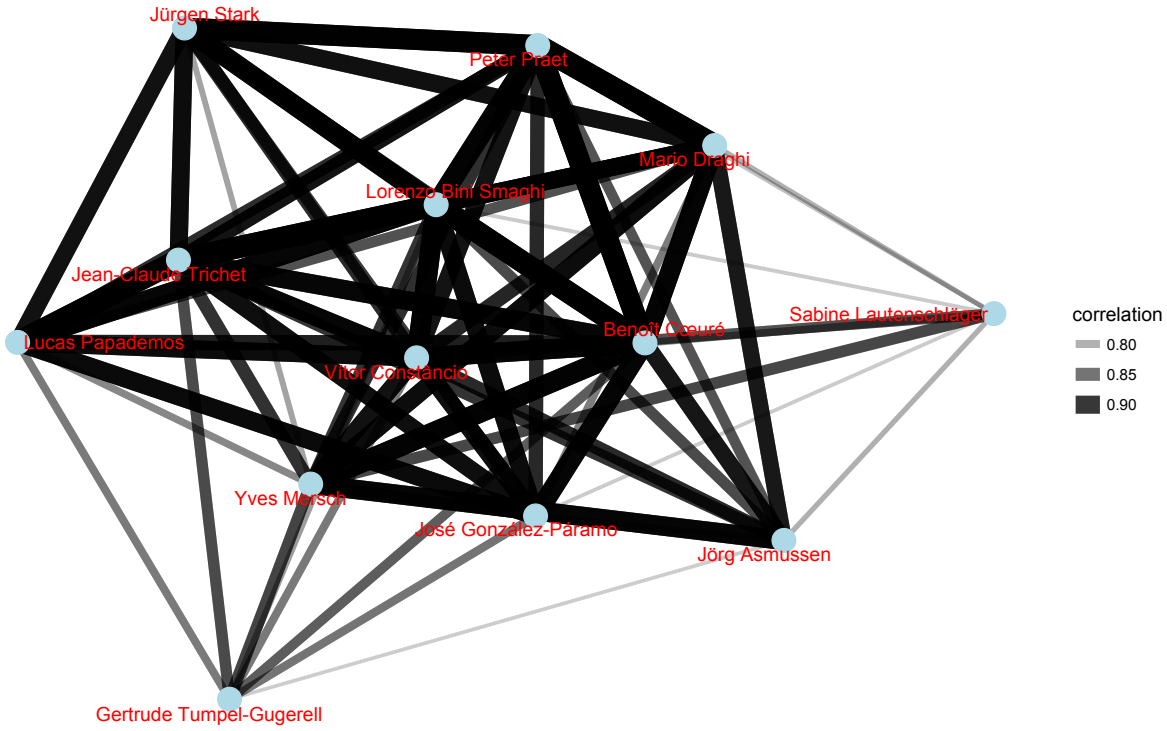

FIGURE 4: SPEAKER-CORRELATION-NETWORK

Plotting all speeches over time shows comparable yearly patterns (Figure 5). The ECB President's speech at the influential Jackson Hole conference in Wyoming is usually the only speech given in August. On average, 112 speeches were held by Board members every year, and minimum (2012: 89) and maximum (2008: 131) years do not deviate significantly.

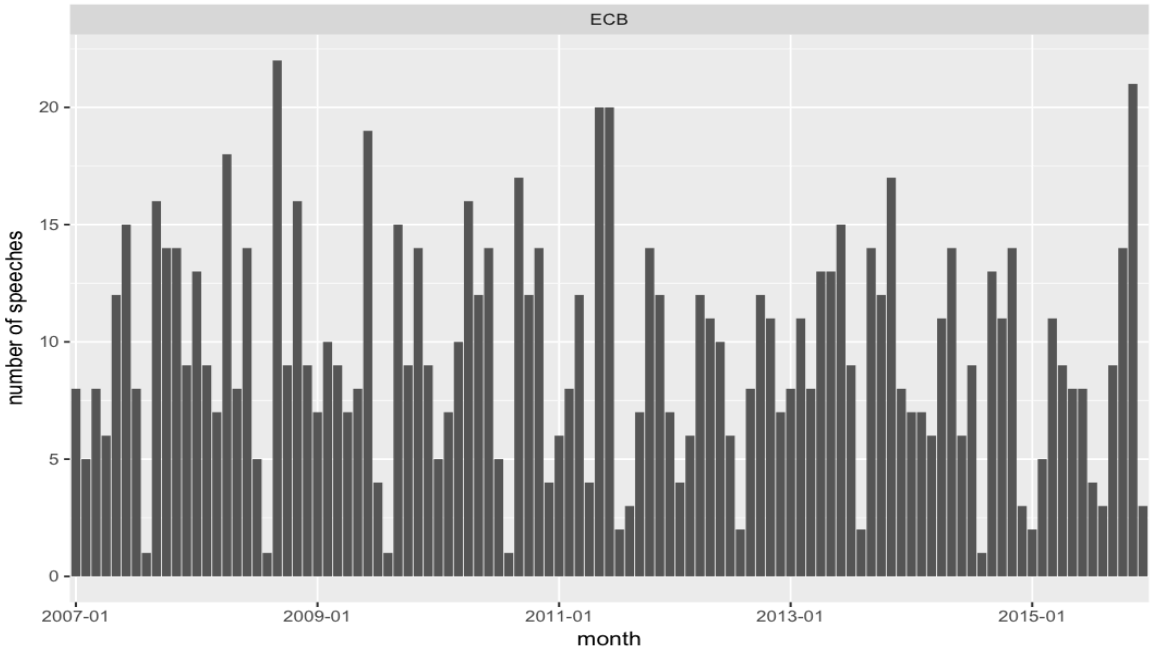

FIGURE 5: NUMBER OF ECB SPEECHES OVER TIME

Eichengreen postulates that historical analogies are 'especially influential in crises, when there is no time for reflection' and 'they resonate most powerfully when an episode is a defining moment for a country and society' (p.377). We can control whether Eichengreen's two psychological prerequisites for the appearance of historical lessons – sense of urgency and perceived turning-point – are fulfilled in our empirical material by applying *sentiment analysis*, a method that detects emotional content of text programmatically.[36] This method is based on sentiment dictionaries, i.e. lists of words that allocate sentiment scores to individual words within the text. I apply a sentiment lexicon that takes into account that ECB speeches contain numerous financial terms, the Loughran/McDonald dictionary of financial sentiment terms.[37]

Examining the most common words belonging to each sentiment within the ECB corpus confirms that this dictionary can approximate the speeches' sentiments (Appendix Figure 12). After counting the number of uses of each sentiment-associated word, each speech's net sentiment (positive – negative) is calculated. Plotting these sentiment scores over time (Figure 6) shows that throughout the Great Recession, ECB speeches were strongly negative and are therefore likely to reflect Eichengreen's notions of urgency and perceived turning point. As expected, speeches from 2007 are relatively neutral in their emotional content, but starting with Lehman Brothers' bankruptcy, net sentiment declines rapidly, achieving its lowest point during 2009. The index slowly recovers, but stays negative up until 2015. If Eichengreen's hypothesis is true, we should therefore find historical lessons in ECB speeches during both crisis phases.

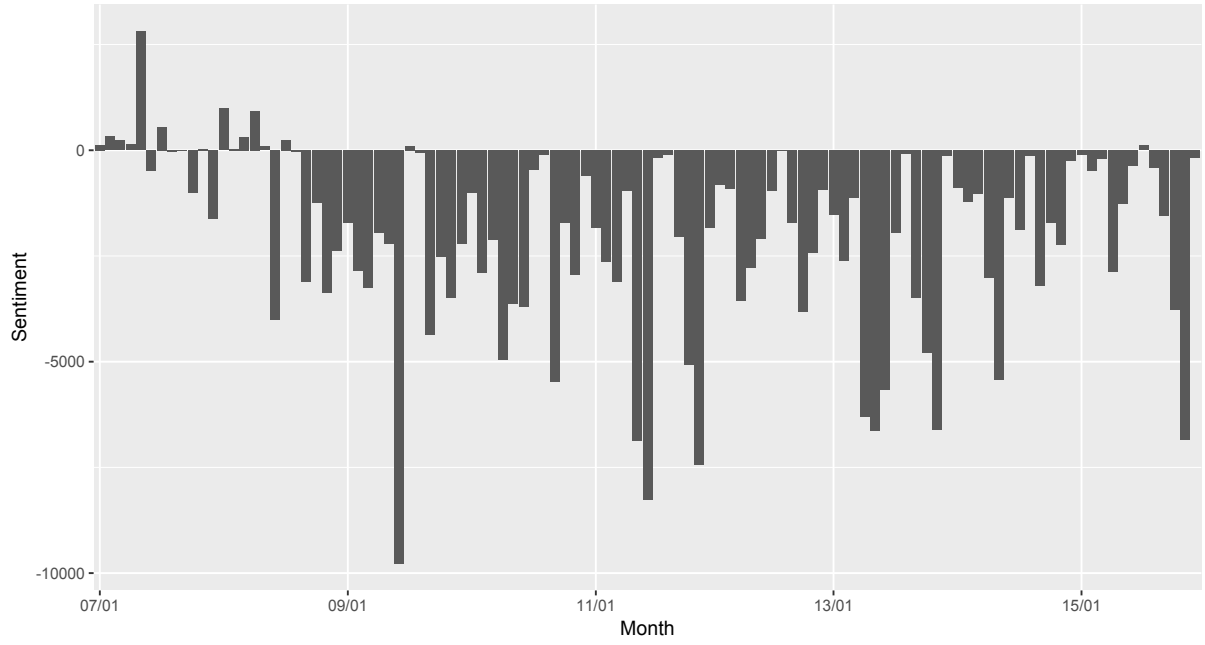

FIGURE 6: SENTIMENT OVER TIME

[36] Bholat et al., 'Handbook', p.8.

[37] With six sentiment groups: positive, negative, litigious, uncertain, constraining, superfluous. Loughran, T., and McDonald, B., 'When Is a Liability Not a Liability? Textual Analysis, Dictionaries, and 10-Ks', *The Journal of Finance*, 66/1 (2011), pp.35-65.

In sum, the corpus is rather homogenous and well balanced: it contains a variety of speeches, it gives room to each individual speaker and it captures all observations during the period of analysis, with each year having roughly the same number of observations. Given the corpus's negative net sentiment, references to historical lessons should be observable if Eichengreen's hypothesis is true.

Topic Modelling: Capturing Content and Dynamics

This section estimates a specific type of probabilistic topic model known as Structural Topic Model (STM). Generally, topic models are algorithms for discovering the main themes that pervade a large collection of texts.[38] Without any prior categorisation, topics emerge from the analysis of the primary sources and the model then organises the corpus according to the discovered themes. These models are generative models of word counts, with a topic being defined as a mixture over words with each word having a probability of belonging to a topic. Analogously, a document is understood as a mixture over topics. This allows the content of documents to 'overlap,' thereby mirroring typical use of natural language.[39]

The key innovation of STM is that it allows document-related information to be incorporated into the topic model. I focus on the metadata's effect on topical prevalence, i.e. the frequency with which a topic is discussed. STMs have been applied to international newspapers,[40] online class forums,[41] and religious texts.[42] They are used to conduct hypothesis testing about topic-metadata relationships. Here, we are testing Eichengreen's hypothesis by comparing the main topics in ECB speeches, as estimated by the STM, with the historical lessons L1-7 regarding both content and dynamics. I implement STM via the *stm* R package.[43]

To begin with, I import all speeches and associated meta-data and convert the speeches into a document-term matrix. The usual pre-processing steps are performed, including removal of stop words (uninformative words like 'the'), stemming (reducing words to their root form) and dropping punctuation. Next, a threshold needs to be defined, which corresponds to the minimum number of documents a word needs to appear in order for the word to be kept within the vocabulary. Figure 7 evaluates how many words and documents would be removed according to different thresholds. I **select**

[38] Blei, D., 'Probabilistic Topic Models', *Communications of the ACM*, 55/4 (2012), pp.77-84.
[39] Silge and Robinson, *Text mining*, ch.6.
[40] Roberts, M.E. et al., 'A model of text for experimentation in the social sciences', *Journal of the American Statistical Association*, 111/515 (2016), pp.988-1003.
[41] Reich, J. et al., 'Computer Assisted Reading and Discovery for Student Generated Text in Massive Open Online Courses', *Journal of Learning Analytics*, 2/1 (2015), pp.156-184.
[42] Lucas, C. et al., 'Computer Assisted Text Analysis for Comparative Politics', *Political Analysis*, 23/2 (2015), pp.254-277.
[43] http://www.structuraltopicmodel.com (04.06.2018).

a threshold of 5, meaning that 21768 of 31149 terms (36989 of 754524 tokens) are removed.[44] The final corpus consists of 1009 documents, 9381 terms and 717535 tokens.

Topical prevalence is modelled as a formula consisting of relevant 'covariates.' Since the ECB

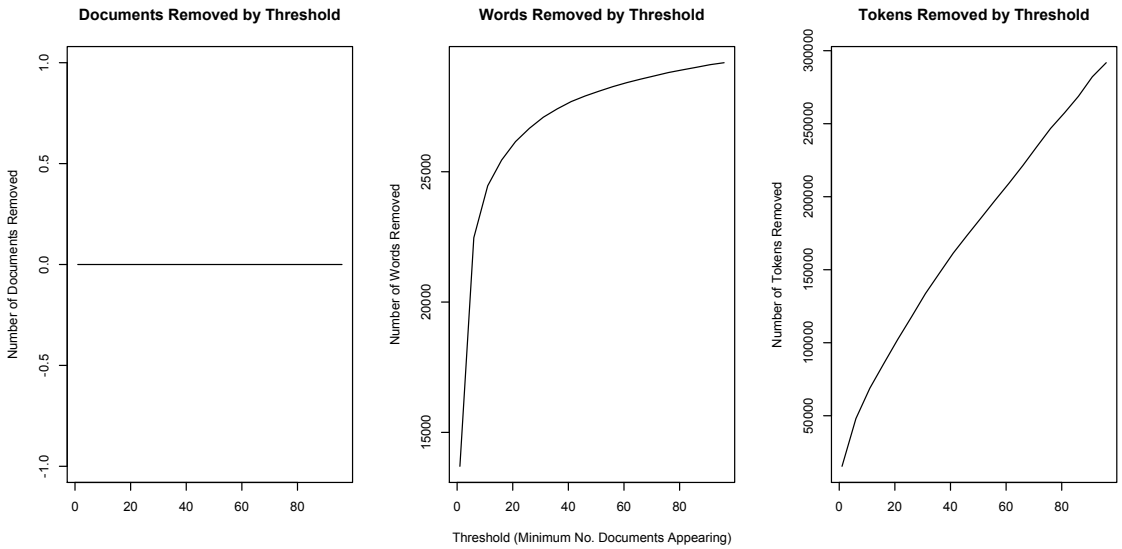

FIGURE 7: SELECTING A THRESHOLD

speeches' content varies according to speaker and phase of the crisis, it is intuitive to allow topic prevalence to vary with these metadata. Consequently, the frequency with which a topic is discussed (*prevalence*) is defined as a function of the *speaker* variable, indicating the speaker's name, and the variable *date*, which is an integer measure of days running from 2007 to 2015.[45]

I estimate a 5 topic model.[46] Figure 8 plots semantic coherence and exclusivity for each resulting topic.[47] In general, the estimated model has desirable properties in both dimensions, as indicated by the topic scores towards the plot's upper right side. Topic 4's relatively weaker scores are acceptable since this topic is not important for the following argumentation. The document-topic distributions are strongly skewed to the right (Appendix Figure 13), signalling that the STM successfully distinguished five recognisable topics, with a single speech being mostly generated from one corresponding topic.

[44] Whereas 'terms' refers to the number of different words, 'tokens' designates the total number of words.

[45] The variables are entered additively and the date variable is allowed to have a non-linear relationship in the estimation stage.

[46] Using *spectral initialization*, which means that independent of the seed that is set, the same results will be generated.

[47] Semantic coherence measures if the most probable words in a given topic frequently co-occur together. Mimno, D. et al., 'Optimizing Semantic Coherence in Topic Models', *Proceedings of the Conference on Empirical Methods in Natural Language Processing* (2011), pp.262-72.

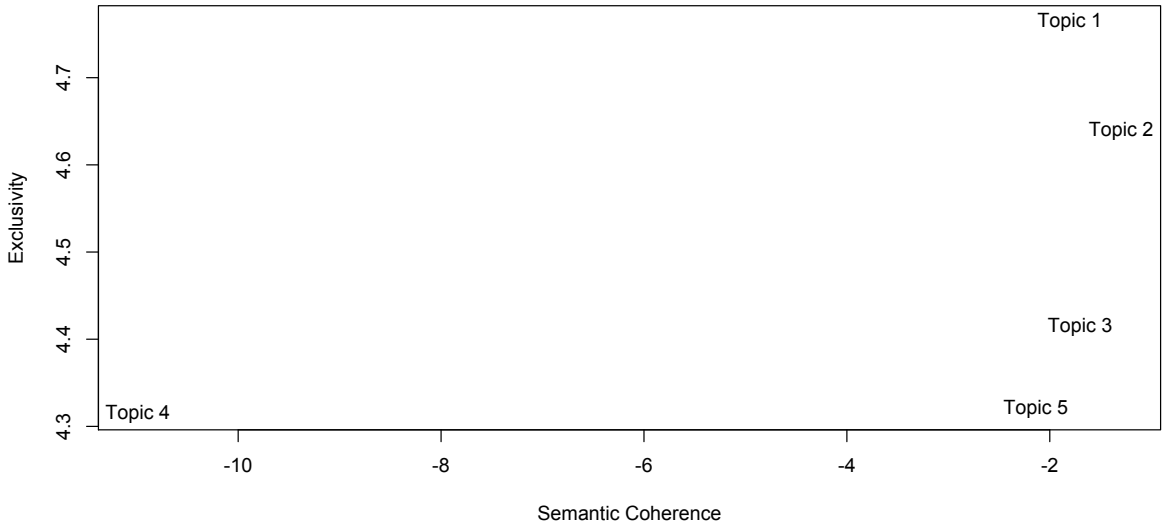

FIGURE 8: MODEL EVALUATION

To interpret the output, researchers look at the words associated with each topic. Table 3 gives four different types of word profiles, including the standard output of a topic model, i.e. the highest probability words based on the probabilities that each word is generated from each topic. Three additional metrics are included. FREX indicates words that are frequent *and* exclusive to each topic.[48] 'Lift' weights words by dividing by their frequency in other topics, thereby prioritising words that appear less frequently in other topics.[49] Similar to lift, 'score' divides the log frequency of the word in the topic by the log frequency of the word in other topics.[50]

[48] For FREX: Airoldi, E.M. and Bischof, J.M., 'Improving and Evaluating Topic Models and Other Models of Text', *Journal of the American Statistical Association*, 111/516 (2016), pp.1381-1403.

[49] For 'Lift': Taddy, M., 'Multinomial Inverse Regression for Text Analysis', *Journal of the American Statistical Association*, 108/503 (2013), pp.755-70.

[50] For 'score': https://cran.r-project.org/package=lda (12.06.2018).

Topic	Label	Metric	Word profile
Topic 1	**Price Stability**	Highest Prob	policy, monetary, inflation, price, central, stability, rates
		FREX	inflation, curve, phillips, expectations, price, bound, deflation
		Lift	gürkaynak, mankiw, memorial, phillips, williams, low-frequency, inflation-targeting
		Score	inflation, policy, monetary, memorial, phillips, price, rates
Topic 2	**Structural Reforms**	Highest Prob	euro, area, countries, economic, growth, fiscal, european
		FREX	labour, productivity, emu, competitiveness, reforms, fiscal, greece
		Lift	"insider-outsider", "knowledge-intensive", arizona, austerity, liberalise, nation-state, prime-age
		Score	fiscal, labour, euro, area, productivity, countries, growth
Topic 3	**Banking regulation**	Highest Prob	financial, will, banks, risk, banking, crisis, system
		FREX	esrb, ssm, supervisory, supervision, macro-prudential, systemic, resolution
		Lift	macro-prudential, addressees, depositor, egypt, esrb's, fsb's, inspections
		Score	macro-prudential, esrb, egypt, ccps, ssm, financial, ccp
Topic 4	**Introduction SEPA**	Highest Prob	will, european, euro, market, sepa, payments, integration
		FREX	sepa, payments, payment, card, settlement, banknotes, retail
		Lift	exhibition, online, user, "sepa, advertising, authenticity, borderless
		Score	sepa, debit, payment, sdd, interoperability, settlement, debits
Topic 5	**Liquidity measures**	Highest Prob	financial, market, liquidity, banks, euro, credit, area
		FREX	refinancing, loans, operations, bonds, liquidity, spreads, lending
		Lift	bidders, corporations', delinquency, allotted, ambitiously, boxes, lcbgs
		Score	liquidity, refinancing, rates, collateral, credit, banks, operations

TABLE 3: FIVE TOPICS IN ECB SPEECHES

These word profiles allow us to identify five distinctive topics: Topic 1, labelled 'price stability' (T1), describes the central bank's task to pursue price stability, including technical terms like 'Philipps curve' and 'inflation-targeting.' Topic 2 deals with enhancing growth in the post-crisis euro-area, particularly via 'austerity' measures, 'liberalisation' of markets, and 'reforms' that increase the individual country's 'productivity' and 'competitiveness,' hence the label 'structural reforms' (T2). The references to regulatory concepts such as macro-prudential policy, the proposed 'living will' for banks,[51] and new resolution and supervision institutions link topic 3 to the area of 'banking regulation' (T3). Topic 4 refers to the SEPA payment-integration initiative (T4). Finally, topic 5 encompasses the ECB's 'liquidity measures' (T5) intended to sustain liquidity among banks and credit to the real economy.

We can compare these topics with Eichengreen's historical lessons. In cases where we find that one (or several) historical lessons are represented by an estimated topic, we receive an upper-bound estimate for the prevalence of the respective lesson in the ECB's communication. Although these proportions are clearly upward-biased estimates, they still give valuable indications of the lessons' potential occurrence and their significance relative to each other. We can relate discussions about price stability (T1) with the historic fear of (hyper)inflation (L5), the demands for structural reforms (T2) with German economists' preference for austerity measures (L6), the banking regulation topic (T3) with history-driven focus on banks (L2) and the need to regulate them quickly (L7), and the ECB's liquidity measures (T5) with the Friedman and Schwartz story (L1). Note that the estimated topics do not refer to the need for fiscal stimulus packages (L3) and international cooperation (L4). While the absence of L3 supports the hypothesis that the prevailing discourse on "austerity" as a solution for the sovereign debt crisis excluded the issue of fiscal stimulus, the latter finding could be partly explained by the fact that

[51] 'Living will' designates mandatory pre-crisis plans of banks that should ensure that banks can be resolved.

cooperation between euro-area countries had been already institutionalised under the Stability and Growth Pact. Plotting the expected proportion of the corpus that belongs to each topic (Figure 9) shows that growth through structural reforms (T2) is the most common topic, while the SEPA initiative (T4) requires relatively little space in the corpus.

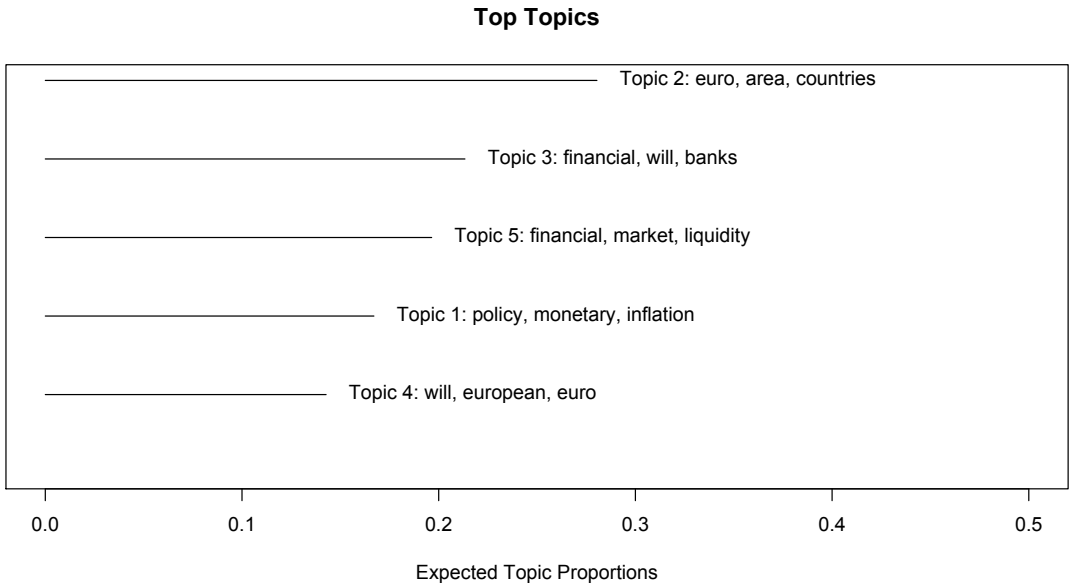

FIGURE 9: TOPIC PROPORTIONS IN THE CORPUS

The STM output allows us to investigate the temporal dimension of these topics by plotting topic prevalence as a function of *date* (Figure 10). Appendix Figures 15-19 provide this visualisation for each topic separately. As argued below, the estimated topics' dynamics are in line with Eichengreen's narrative in particular and the historical context in general.

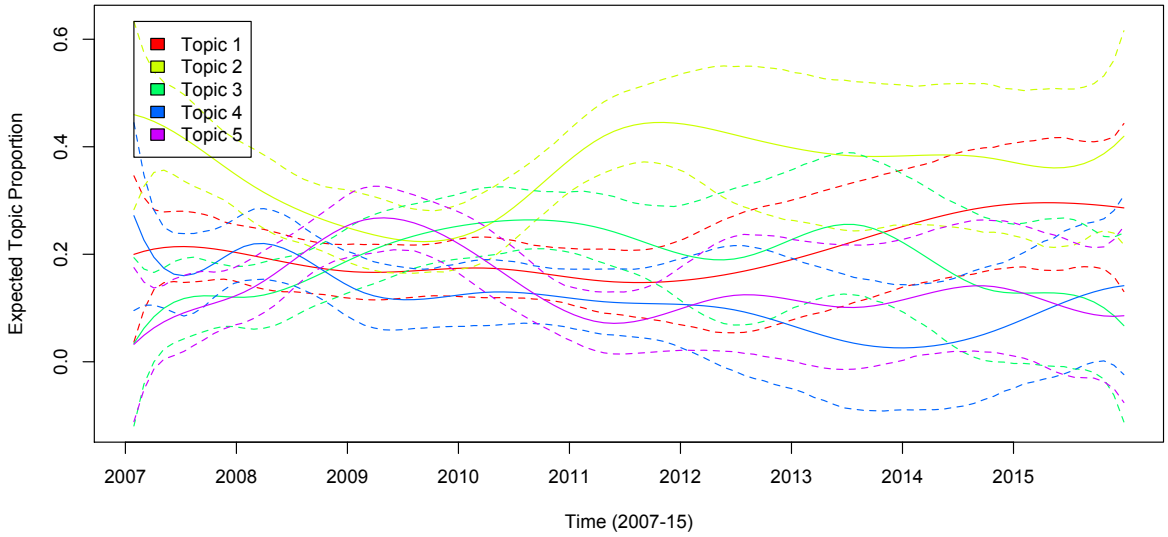

FIGURE 10: ESTIMATED TOPICS OVER TIME; HOLDING *SPEAKER* AT SAMPLE MEDIAN AND WITH

To begin with, European central bankers' sensitivity to inflation (L5) is captured by the continued presence of the price stability topic even in the most dramatic months (T1). To a certain extent, this simply reflects the fact that price stability is the explicit mandate of the ECB. Particularly from 2012 onwards, however, discussions about price stability assumed ever larger proportions in ECB speeches, supporting the notion that the 'mandate to pursue low inflation […] continued to guide and constrain policy' (p.304). According to Eichengreen, the analogy with the Great Depression 'was foremost in the minds of policy makers' during 'a brief period in 2008-09,' but afterwards, 'the emphasis shifted' towards balanced budgets (p.284). His timing of this pre-mature shift to austerity (L6) is confirmed by the STM, which records a significant increase of discussions about austerity and structural reforms from 2010 onwards (T2). Eichengreen also notes that central banks' policies were targeted at banks (L2) due to a 'historically informed vision of the risks' (p.381) and given T3's continued presence, this pre-occupation with banks is visible in ECB speeches. Given that the shadow banking system is significantly smaller and less relevant in Europe than in the US,[52] this historical lesson of focusing on the banking system suits well the structural characteristics of the European financial system. Additionally, the evolution of T3, which contains proposals for banking reforms, supports Eichengreen's notion that banking reforms were initiated too late (L7), as T3's proportion is especially large in the second phase of the crisis (between 2010-14), but rather small when the financial crisis erupted. Still, it should be noted that the characteristics of EU legislation process make agreements on reforms of banking regulations complex and time-consuming.[53] Although not related to Eichengreen's lessons, the SEPA topic (T4) closely follows the initiative's actual development, peaking in 2008 when SEPA pan-European payment instruments became operational and declining after SEPA payments had successfully replaced national payments in 2011. Lastly, the central banks' 'readiness to provide not just liquidity but unlimited amounts of **liquidity'**

[52] Shambaugh, 'Three Crisis', p.162.

[53] For a good summary of regulatory changes in the EU, see: Sum, K., *Post-Crisis Banking Regulation in the European Union: Opportunities and Threats* (Berlin, 2016).

(pp.176f.), much acclaimed by Eichengreen (L1), is mirrored by the liquidity topic (T5), which rises rapidly between 2007-09. Thereafter, T5 declines in line with the ECB's first 'phasing-out' between December 2009 and April 2010, only to rise again first in 2012 with the OMT programme and then in 2015 with Quantitative Easing.

Taken together, the five topics mirror also more generally the evolution of the crisis.[54] The co-occurrence of price stability (T1) and economic growth (T2) discussions in the central bank speeches and the simultaneous disinterest in any types of liquidity provisions (T5) in the early months of 2007 reflect the then prevailing narrative of great moderation, which in the Eurozone took the form of a strong belief in the ECB's ability to maintain stability and growth. Following first signs of reduced liquidity in 2007 and the Lehman bankruptcy in 2008, the shares of speeches discussing liquidity measures (T5) or banking reforms (T3) began to rise, albeit rather gradually. Ultimately, liquidity speeches (T5) peaked in 2009, in line with the ECB's implementation of 'non-standard' monetary policy measures during this year's summer, but declined already in the subsequent year, while contagion started to spread from Greece to other euro-area bond markets. Price stability (T1) considerations never faded away and, accompanied by belated proposals for banking regulation (T4) and calls for structural reforms (T2) from 2010 onwards, formed the intellectual background for the bail-out negotiations with indebted Eurozone states during the second phase of the crisis. As part of the so-called Troika, the ECB participated in these negotiations.

In particular, the degree to which structural reforms (T2) were emphasised by ECB Board members in their speeches resembles the chronology of the Greek debt crisis.[55] To avoid default, the Troika provided Greece with €110 billion in May 2010, but in return demanded cuts in public spending, higher taxes, and privatisation. Since austerity proved to be contractionary rather than expansionary, Greece soon missed its growth targets. A second bailout package was necessary in early 2012, adding €130 billion, but also containing harsher austerity measures. In late January 2015, the left-wing party Syriza achieved an electoral triumph in Greece by promising to end this crisis (mis)management. In line with these developments, the share of T2 rose from mid-2010 onwards and stayed on a high plateau between 2011-12, gradually sank afterwards, and finally resurfaced sharply in the summer of 2015, when the Troika clashed with Greece's then-Finance Minister Yanis Varoufakis.

Two local peaks of the liquidity measures' share (T5) in 2012 and 2015 are in line with the fact that, eventually, unconventional monetary policy measures were implemented following Draghi's 'whatever it takes' remarks. However, at the same time the share of price stability (T1) elements in Board members' speeches increased by even more. This polarity reflects both the internal disagreements between German 'hawks' and Southern 'doves' within the Board as well as the ECB's statute with its single priority of price stability. In short, the STM is able to quantitatively substantiate the criticism of ECB policy being 'behind the curve' for too long.[56]

[54] Overview: Mody, *Eurotragedy*, ch.5, 6, 8, and 10.

[55] Overview: Bistis, G., 'From Karamanlis to Tsipras: The Greek Debt Crisis through Historical and Political Perspectives', *Mediterranean Quarterly*, 27/1 (2016), pp. 30-54.

[56] Baldwin and Wyplosz, *Integration*, p.510; Mody, *Eurotragedy*, p.225; Eichengreen, *Hall of Mirrors*.

Tracing 'Lessons from the Past'

An intuitive starting point for identifying lessons from the past is to search the corpus for key terms such as 'history' or 'lessons.' However, it is impossible to link these words to specific lessons because they have several meanings, as underlined by the wide range of words that are most highly correlated with them (Appendix Figures 20-21). For instance, ECB speeches that include the term 'history' could also refer to 'history dependence' (Stark, 26.11.2007), a technical term labelling central banks' concern for their past track records, simply mention the host country's history by way of introduction (Tumpel-Gugerell, 26.11.2007), or note the ECB's staff 'awareness of, and pride in, making history' (Trichet, 15.09.2008).

Dates are a more precise proxy for tracing historical lessons than multifunctional words. A good example is a 2008 speech given by Smaghi, who reflected on 'what the errors of the past could teach us,' asking particularly 'what was done in earlier crises, in 1929, 1974-75, 1992-93 and in 2001-2002?' (Smaghi, 15.05.2008). Smaghi identified four distinctive lessons from the past. First, he emphasised the importance of price stability (L5) and demanded that any 'rise in headline inflation must remain temporary.' This supports Eichengreen's accusation that the ECB's 'extraordinarily destructive' decision to raise its main policy rate by 25 basis points to 4.25% in July 2008 (two months after Smaghi's speech!) was grounded in a mistaken focus on headline inflation, which in turn resulted from inflation aversion in Germany, where 'the distinction between headline and core inflation was dismissed out of hand' (p.339). Secondly, Smaghi referred to the 'experience of Germany' to denounce potential Keynesian counter-measures to the crisis as 'illusions,' echoing German economists' scepticism regarding deficit spending (L6). Thirdly, he argued that the 1929 crisis showed that policy makers should not 'put up protectionist barriers' in response to a financial crisis, and, as predicted by Eichengreen (p.122), invoked Smoot-Hawley as a negative example (L4). Finally, Smaghi noted that all support measures for distressed financial institutions should support 'market liquidity' but not relieve investors from 'solvency risks.' This peculiar combination of the classic Friedman-Schwartz-liquidity lesson (L1) with moral hazard concerns could again signal the influence of German economists, who stressed the importance of liability and disciplining behaviour throughout the crisis.[57]

Smaghi's remarks suggest that searching the corpus for the dates of 20th century's main economic crises and visualising how their occurrence changed in frequency over time is an efficient strategy for capturing historical lessons within ECB speeches (Figure 11). The resulting figure shows that Board members referred to various crises throughout the period, with a potential peak towards the end of the first phase of the crisis. Such bell-shaped patterns are typical phenomena in the field of Narrative Economics and have been found for the spread of intellectual innovations such as the IS-LM model, the multiplier-accelerator model, and the real business cycle model.[58] This implies that during a crisis, the narrative recourse to historical lessons follows the typical innovation cycle of adoption, peak, and decline.

[57] Guiso, L. et al., 'Cultural Differences and Institutional Integration', *Journal of International Economics*, 99 (2016), p.111.
[58] Shiller, R., 'Narrative Economics', *The American Economic Review*, 107/4 (2017), p.982.

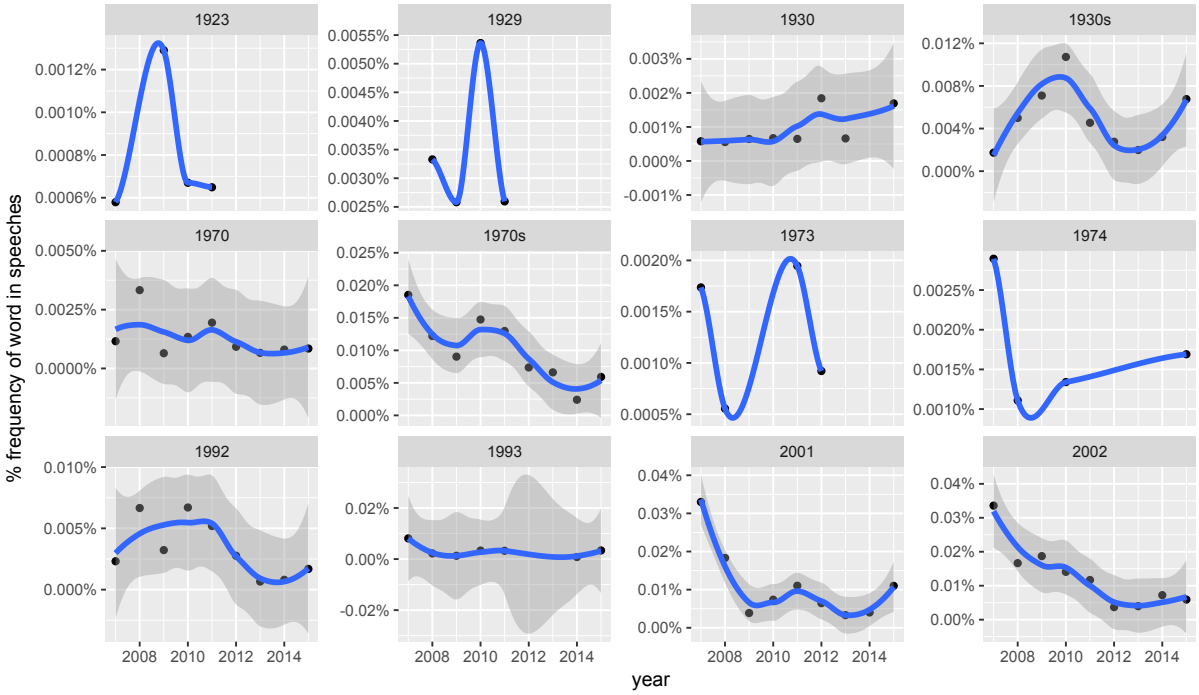

FIGURE 11: WORD FREQUENCIES: MAIN ECONOMIC CRISES

Given that Eichengreen's narrative deals with the interwar period, I focus on references to the German hyperinflation and the Great Depression ('1923,' '1929,' '1930,' '1930s').[59] Additionally, I search for the term 'hyperinflation,' which is used almost exclusively with respect to the German hyperinflation of **the**

Lesson	1923	1929	1930	1930s	hyperinflation	SUM
price stability (L5)	1	0	0	5	7	**13**
cooperation (L4)	0	1	2	8	0	**11**
liquidity (L1)	0	5	0	5	0	**10**
austerity (L6)	0	0	0	5	1	**6**
regulation (L7)	0	2	0	4	0	**6**
bank focus (L2)	0	0	0	4	0	**4**
fiscal stimulus (L3)	0	0	0	0	0	**0**
NO LESSON	3	6	2	25	4	40
SUM	4	14	4	56	12	90

TABLE 4: MANUAL CLASSIFICATION: ECB'S LESSONS FROM THE PAST

[59] While counting references to specific dates in the interwar period is likely to miss on other obvious references such as 'between the wars' or 'Great Depression,' the latter expressions in most cases were found to be used only in a loose, general way that did not suggest the intentional utilisation of an 'historical lesson.'

interwar period. In total, these five search terms can be found in 90 speeches (8.92%). I manually classify each speech to determine if they use the respective term only in a loose, comparative way (like 'The world is hit by a severe economic and financial downturn, the deepest since the beginning of the Great Depression in 1929,' Tumpel-Gugerell, 15.06.2009) or if they refer to a specific historical lesson (Table 4).

Three findings emerge from this exercise. First, almost half of the identified references are unrelated to actual historical lessons, shrinking the latter's proportion in the corpus to roughly 5%. It is therefore questionable if historical lessons constituted a significant pattern given their quantitatively minor role. Secondly, we can identify a division of labour with respect to the way that specific historic experiences are remembered. The German experience of a 'hyperinflation' in '1923' is typically mentioned when the speaker aims to emphasise the economic and social importance of rigorous price stability, while '1929' immediately leads to associations of insufficient liquidity. By contrast, references to the '1930s' period in general can form the background to various, even conflicting, lessons, but their most frequent purpose is to illustrate the need for cooperation.

Thirdly, if we understand Eichengreen's seven lessons as a pool of readily available lessons, the aggregate ranking of lessons as actually used reveals the Board members' preferences. Price stability, cooperation and liquidity seem to have been their main priorities and the respective lessons invoked in their favour recall Eichengreen's narrative. Speaking in Munich, Trichet recalled the German hyperinflation, which 'has left deep scars in the collective memory of both Germany and Europe' and demonstrated 'how painful deviations from price stability can be.' According to Trichet, 'these lessons of history were shared all over Europe' and with the creation of the ECB, Germany's stability culture had been fully 'europeanised' (Trichet, 13.07.2009). ECB board members regarded the post-WWI hyperinflations as one of the few 'natural experiments' offered by economic history whose lessons were 'deeply entrenched into the collective psyche of many European peoples' (Stark, 11.06.2008). Lessons about liquidity were likewise in line with Eichengreen's analysis in that they frequently mentioned Friedman and Schwartz. How to conduct monetary policy during a downturn had been 'shown by Milton Friedman and Anna Schwartz already long ago' (Smaghi, 25.11.2008). Their 'seminal analysis' had 'taught' the central bankers that the Fed's failure to 'provide enough liquidity to the financial system' had amplified the Great Depression: 'This time we made sure we avoided a similar scenario' (Tumpel-Gugerell, 03.05.2011). Interestingly, Praet acknowledges that while Friedman and Schwartz's analysis provided 'inspiration,' it did not offer an 'off-the-shelf recipe' since it only stated a 'general rule without a detailed prescription' (Praet, 26.11.2012). This suggests that historical lessons provide a convenient analytical starting point in a crisis situation, but are not sufficient to design the technical implementation of the necessary policies. Finally, it is remarkable that even in a non-US context, lessons about cooperation included hortatory reminders of Smoot-Hawley (Smaghi, 15.05.2008), thereby giving credibility to Eichengreen's claim that its 'ritual invocation' helped policy makers resist protectionism (p.122).

Next, lessons about austerity, regulation and the role of banks form a second group of lessons that were occasionally mentioned. The moral hazard concerns expounded in favour of early austerity measures signal again a proximity to German priorities. While Stark admitted that 'discretionary government intervention has been key in forestalling a repeat of a 1930s-style depression,' he criticised the 'policy hyper-activism' of some countries and demanded a stability-oriented policy framework to ensure that fiscal authorities 'withdraw stimulus to safeguard public solvency' (25.02.2010). The fact that several speeches referred to lessons about the banking sector and its potential regulation supports

Eichengreen's lessons L2 and L7, but it should be noted that the ECB was nevertheless aware of the systemic risk arising from the shadow banking sector (Constâncio, 13.02.2015).

Finally, just as the STM output, the identified historical lessons omit the positive role played by fiscal stimuli during times of recession (L3). The observation that price stability has been the lesson most evoked by ECB Board members even aggregates this apparent contrast with the developments in the US. An institutional explanation would highlight that unlike the Fed with its dual mandate, the ECB's statute defined the responsibility for price level stability as single priority. Alternatively, an idea-historical explanation is possible that links this prominence of German experiences in the ECB's reasoning with recent academic discussions that identify an increasing 'Ordoliberalization of Europe.'[60] This explanation will be investigated in the following case study.[61]

Case Study: The Influence of Ordoliberalism

This section starts by evaluating the individual speaker's influence on speech content. Table 5 expresses the effect of the variable that codes the speaker's name on the prevalence of T1 ('price stability') and marks the respective levels of statistical significance. Similar regression tables have been produced for the four other topics (Appendix Tables 15-19). In all five regressions, Jürgen Stark, the German Board member, has a highly significant influence, unparalleled by any of the other speakers.

[60] Biebricher, T., 'The Return of Ordoliberalism in Europe - Notes on a Research Agenda', i-*lex*, 21 (2014), p.10.
[61] The two explanations are not mutually exclusive. The principles of Ordoliberalism informed the institutional characteristics and policy priorities of the German *Bundesbank*, which in turn provided the model for the design of the ECB.

```
Call:
estimateEffect(formula = 1:5 ~ speaker + s(date), stmobj = stm_model,
    metadata = out$meta)


Topic 1:

Coefficients:
                               Estimate Std. Error t value Pr(>|t|)
(Intercept)                    0.115268   0.094968   1.214  0.22513
speakerGertrude Tumpel-Gugerell -0.052114   0.060902  -0.856  0.39237
speakerJean-Claude Trichet      0.081914   0.057685   1.420  0.15591
speakerJörg Asmussen           -0.047097   0.046442  -1.014  0.31078
speakerJosé González-Páramo     0.048364   0.059767   0.809  0.41859
speakerJürgen Stark             0.257312   0.060562   4.249 2.35e-05 ***
speakerLorenzo Bini Smaghi      0.133920   0.059722   2.242  0.02516 *
speakerLucas Papademos          0.079489   0.067643   1.175  0.24023
speakerMario Draghi             0.036175   0.033942   1.066  0.28678
speakerPeter Praet              0.126586   0.046914   2.698  0.00709 **
speakerSabine Lautenschläger   -0.093763   0.066154  -1.417  0.15670
speakerVítor Constâncio         0.021136   0.039899   0.530  0.59642
speakerYves Mersch             -0.092461   0.040166  -2.302  0.02154 *
s(date)1                        0.028770   0.132654   0.217  0.82835
s(date)2                        0.002192   0.083807   0.026  0.97914
s(date)3                       -0.044040   0.099036  -0.445  0.65664
s(date)4                       -0.009836   0.086260  -0.114  0.90924
s(date)5                       -0.060170   0.095663  -0.629  0.52951
s(date)6                       -0.039603   0.108863  -0.364  0.71610
s(date)7                        0.027511   0.105400   0.261  0.79414
s(date)8                        0.109675   0.117177   0.936  0.34952
s(date)9                        0.100476   0.120316   0.835  0.40387
s(date)10                       0.091261   0.109633   0.832  0.40537
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

TABLE 5: STM REGRESSION TABLE: TOPIC PREVALENCE T1

On a biographical level, this ties in with Stark’s growing dissatisfaction with the development of the EMU, which eventually led to his resignation. In his January 2012 farewell letter to ECB employees, he criticised his ex-colleagues in the Governing Council of having taken decisions ‘that have stretched the mandate of the ECB to extremes,’ adding that it is an ‘illusion to believe that monetary policy can solve major structural and fiscal problems in the euro area.’ To him, this was an important lesson from the

past: whenever in history a central bank had subordinated itself to budgetary policy, Stark argued in his letter, it had to make concessions in its actual task of keeping the monetary value stable.[62]

On a broader level, Stark's aversion regarding expansionary monetary and fiscal policies and his insistence on absolute price stability resemble the arguments of Ordoliberalism, a German school of thought that had been developed by a group of economists and lawyers in Freiburg during the 1930s.[63] Strongly impressed by hyperinflation and subsequent Nazi interventionism, the Ordoliberals, headed by Walter Eucken, attributed the interwar period's mass unemployment to unwise monetary expansions, monopolies and market interventions.[64] To avoid another Great Depression, they argued, flexible prices and wages and an adequate and stable monetary order were needed – in Eucken's words, the perfect 'economic constitution.' Ordoliberal thought strongly influenced the design of Germany's post-war economic order.[65] In the aftermath of the Eurozone-crisis, critics linked Eucken's dismissal of macroeconomic policy with the German focus on balanced budgets, price stability and structural reforms and the neglect of aggregate demand.[66] To determine whether ECB policy too has been influenced by Ordoliberalism, the remainder of this section analyses the subset of speeches that contain explicit references to the Freiburg School.

In total, ten ECB speeches refer to 'Eucken' and/or 'Ordoliberalism.' It is probably no coincidence that it was Stark who mentioned the Freiburg School for the first time during the period of analysis. In 2008, he demanded that all post-crisis policies should remain committed to 'price stability and sound public finances' and he explicitly derived these suggestions from Eucken's 'famous book' *Principles of Economic Policy*, which, he acknowledged, had been 'a constant source of inspiration' throughout his career (Stark, 18.11.2008). He listed all of Eucken's seven constitutive principles, including 'the primacy of price stability' and complained that they had not been adhered to in the run up to the crisis. This has been a popular crisis explanation in the Ordoliberal community.[67] Expansionary fiscal and monetary counter-measures, Stark continued, were not appropriate because 'stability orientation of macroeconomic policies is as crucial today as it was sixty years ago when Walter Eucken worked on his landmark study.' He also emphasised that new banking regulations should be 'in the spirit of Eucken.' With his closing remarks, Stark assured the audience that 'we at the ECB will continue boring you with these lessons on numerous occasions in the future,' thereby equating Eucken's principles with historical lessons that, according to him, should inform ECB policies nowadays.

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[62] Anonymous, 'Ex-Währungshüter Stark attackiert EZB-Kurs', *Der Spiegel*, 3 (2012), http://www.spiegel.de/wirtschaft/soziales/brandbrief-ex-waehrungshueter-stark-attackiert-ezb-kurs-a-809199.html (03.06.2018).

[63] Overviews: Oliver, H., 'German Neoliberalism', *The Quarterly Journal of Economics*, 74/1 (1960), pp.117-49; Vanberg, V., 'The Freiburg School: Walter Eucken and Ordoliberalism', *Freiburg Discussion Papers on Constitutional Economics*, 04/11 (2011).

[64] Oliver, 'Neoliberalism', p.129.

[65] Giersch, H. et al., *The fading miracle: Four decades of market economy in Germany* (Cambridge, 1992).

[66] Bofinger, P., 'German macroeconomics: the long shadow of Walter Eucken', in G. Bratsiotis and D. Cobham (eds), *German Macro: How It's Different and Why That Matters* (Policy File, 2016), pp.8-19; Dullien, S. and Guérot, U., 'The Long Shadow of Ordoliberalism: Germany's Approach to the Euro-Crisis', *European Council on Foreign Affairs Policy Brief*, 49 (2012), pp.1-16.

[67] Winkler, A., 'Ordoliberalism, post-crisis monetary policy and the German "Angst"', in T. Beck and H.-H. Kotz (eds), *Ordoliberalism: A German oddity?* (London, 2017), pp.91-106.

Stark's message was adopted by other, non-German board members as well. When Bini Smaghi visited the University of Freiburg in the following year, he acknowledged that Eucken's commitment to price stability still 'exerted a strong influence' (Smaghi, 14.10.2009). Praet connected the 'historical episodes of hyperinflation' with Eucken's lessons about 'strong independent institutions' that enable to 'preserve the value of money' (Praet, 10.10.2012) and argued that the 'traumatic' financial crisis could serve as a 'catalytic event' for the emergence of a 'European culture of stability' along the lines of *Ordnungspolitik* (Praet, 27.02.2012). Mersch noted that 'the spirit of the Freiburg School' had underlain the legal foundations of the EMU, which in turn had served as 'crucial guideposts for the ECB's monetary policy also during the course of the crisis' (Mersch, 26.11.2013). He even quoted Eucken's *Principles*, as Stark had done, to emphasise that the Ordoliberal principles 'restrict discretionary policy intervention.' Since monetary policy should be 'fully focused on the delivery of price stability,' this implied that 'structural reforms' and 'sound public policies' were unavoidable. With this Ordoliberal argumentation, Mersch implicitly connected L5 (price stability) with L6 (austerity).

The methodology employed by Mersch in his later speech 'Law, money and market' is probably the best evidence available in favour of an interrelationship between historical lessons, Ordoliberalism and the ECB's reasoning (Mersch, 31.05.2014). In an attempt to develop remedies for the governance of the euro-area, Mersch proposed 'to go back to the first principles of what makes a market economy function, and then to look at the situation in the euro area from there.' He identified the 'ordoliberal school' as the 'clearest expression' of these free market principles and used the Freiburg school's reasoning and terminology to advocate for a banking union, the Fiscal Compact, and structural reforms – all of these goals are shared by modern Ordoliberals.[68] His portrayal of euro-area governance as a 'set of interlocking cogs wheels,' whose pre-crisis arrangements had pulled in different directions, resembles Eucken's 'interdependence of orders' approach.

The Ordoliberal inflation aversion also influenced the first French president of the ECB. According to Eichengreen, Trichet tried to establish that he was 'as Teutonic monetarily as any German,' with his commitments even extending to taking German language lessons.[69] Indeed, Trichet presented the ECB as 'an anchor of stability and confidence' in a contribution to the *Frankfurter Allgemeine Zeitung*, one of Germany's largest newspapers (Trichet, 26.03.2010). He described that the 'primary objective of maintaining price stability' acted as a 'compass' in all his decisions and attributed this idea to a 'strong tradition within German economic science,' namely 'Ordnungspolitik,' and acknowledged Eucken as one of the 'spiritual fathers' of this tradition.

However, three observations qualify this apparent usage of Ordoliberal lessons. First, the proportion of speeches explicitly mentioning the Freiburg School is minimal (0.99%). Secondly, apart from Stark, the two other German Board members Asmussen and Lautenschläger have no statistically significant influence on the price stability topic (Table 5). Asmussen, who is connected with the left-Keynesian economist Heiner Flassbeck,[70] clearly deviated from Ordoliberal thought in August 2012, when he publicly opposed the position of *Bundesbank* President Jens Weidmann, a convinced Ordoliberal, by arguing that the new programme for the purchase of government bonds was compatible with the **ECB's**

[68] Summary: Winkler, A., 'Ordnung Und Vertrauen – Zentralbank Und Staat in Der Eurokrise', *Perspektiven Der Wirtschaftspolitik*, 14/3-4 (2013), pp.198-218.
[69] Eichengreen, *Hall of Mirrors*, p.339.
[70] In 1998, Asmussen became personal advisor to State Secretary Heiner Flassbeck in the Ministry of Finance.

mandate.[71] The reason for Lautenschläger's statistical insignificance may simply stem from the fact that she only gave 17 speeches in total (on average 4 per year). Thirdly, given that eight out of the ten speeches with Freiburg school references were held at locations in Germany, these references can also be interpreted as public relations measures intended to reassure angry German savers, who increasingly understood the crisis as a moral story consisting of 'Northern saints' and 'Southern sinners.'[72]

Seeking legitimation through references to Ordoliberal principles became especially important for Draghi, whose candidacy had been supported by the influential German tabloid *Bild*. *Bild* had argued that he was the 'most German of all remaining candidates' and had given him a Prussian military helmet to remind him of his 'Prussian virtues.' In an accompanying interview, Draghi associated these 'German virtues' with fighting inflation, developing a strong currency, and favouring independence of politics, noting that these were virtues that 'every European central banker should strive towards.'[73]

However, Draghi's two explicit Freiburg School references in the corpus only occurred after German commentators started to criticise his OMT programme in September 2012.[74] The references' timing suggests that their main function was rhetorical, not analytical. When visiting Munich in early 2013, Draghi linked the ECB's 'special responsibility' to ensure price stability to 'Walter Eucken, the philosophical father of ordoliberalism' (Draghi, 27.02.2013). Draghi assured the German audience that given Germany's history, their 'deep-seated fear of inflation' was 'more than understandable' and he promised that their country's 'national experience' would continue to serve as 'a powerful reminder and steadfast obligation for the central bank.' When the German constitutional court started to debate the legality of the ESM and the OMT programme in June 2013, Draghi was quick to emphasise that the ECB's constitution was 'firmly grounded in the principles of "Ordoliberalism",' and that the OMT programme did not imply a 'violation' of these 'ordoliberal principles' (Draghi, 18.06.2013).

In sum, we face a mixed picture. While Stark and Trichet identified themselves with Ordoliberal thought to such an extent that it even shaped their personal development (Stark's resignation, Trichet's German lessons), other ECB representatives like Draghi utilised Freiburg School references simply as publicity measures when facing a German audience. Still, the fact that both Stark and Trichet held influential positions during the first phase of the crisis suggests that their Ordoliberal preferences could have had an influence on ECB monetary policy. Although they could not determine the central bank's policy on their own, their resistance to stronger and quicker expansionary measures might explain why the ECB remained 'behind the curve' for an extended period of time.[75]

Conclusions

[71] von Heusinger, R. and Sievers, M., 'Krisen-Länder müssen Probleme angehen' (Interview), *Frankfurter Rundschau* (20.08.2012), http://www.fr.de/wirtschaft/ezb-direktor-asmussen-krisen-laender-muessen-probleme-angehen-a-813815 (03.06.2018).
[72] Fourcade, M. et al., 'Moral Categories in the Financial Crisis', *Socio-Economic Review*, 11/3 (2013), pp.601-27.
[73] Mee, S., 'Monetary mythology: the West German central bank and historical narratives, 1948-78' (D.Phil. thesis, University of Oxford, 2016), pp.1-8.
[74] Wolff, G., 'The ECB's OMT Programme and German Constitutional Concerns', *Policy File* (2013).
[75] Baldwin and Wyplosz, *Integration*, p.510.

To test Eichengreen's hypothesis that during the Great Recession policy makers used lessons from the interwar period as guidance in their decision making, this paper employed Text Mining methods to explore all 1009 speeches given by ECB Executive Board members between 2007 and 2015. Three main findings arise from this analysis. Firstly, there is empirical evidence for some of Eichengreen's lessons that go beyond the occasional anecdote à la Bernanke. In particular, ECB speeches referred predominantly to lessons about price stability (L5), liquidity (L1), and cooperation (L4). The temporal dimension of this evidence, as measured by the STM, corresponds to Eichengreen's narrative and confirms a shift in policy priorities from 2010 onwards. Secondly, the speeches that actually contained these historical lessons constituted only 5% of the overall corpus. While this still reflects an interesting and persistent rhetorical pattern, its marginal quantitative size qualifies Eichengreen's claim about a dominant, all-encompassing influence of historical lessons during the Great Recession. Thirdly, Stark's statistical significance in the STM and the Ordoliberal rhetoric of several Board members indicate an influence of Ordoliberalism, although Freiburg School references also had a legitimising function when ECB members faced German audiences.

Two caveats have to be acknowledged. First, there is no objective or standardised method to balance conflicting qualitative and quantitative evidence. This means that despite the fact that most of Eichengreen's lessons could be substantiated with content from ECB speeches, it remains open to debate if this finding is qualified by the small proportion of speeches that actually contain these lessons. Secondly, this analysis has focused solely on speeches. However, ECB speeches are no objective display of the speaker's underlying thoughts, but aim to influence the public's expectations. Therefore, these sources provide a very specific lens through which we see a certain interpretation of the crisis, namely the interpretation that the central bank wants us to see. Still, it is important to understand the ECB's framing of the crisis. Following in the tradition of Neustadt and May, it remains to be investigated by future research with access to non-public sources if and how this public framing of historical lessons differed from the central bankers' internal assessments.

While Trichet repeatedly emphasised his staff's awareness of *making* history, this paper has shown that to a certain extent, they were also *re*-making history. Early on, ECB Executive Board members paid tribute to a cultural preference for price stability and balanced budgets that was grounded in specific German lessons from the interwar period. By focusing on these historical experiences, other potentially available lessons were marginalised. The new quantitative evidence presented in this paper therefore helps to explain the divergent monetary crisis reactions in Europe and the US.

Appendix

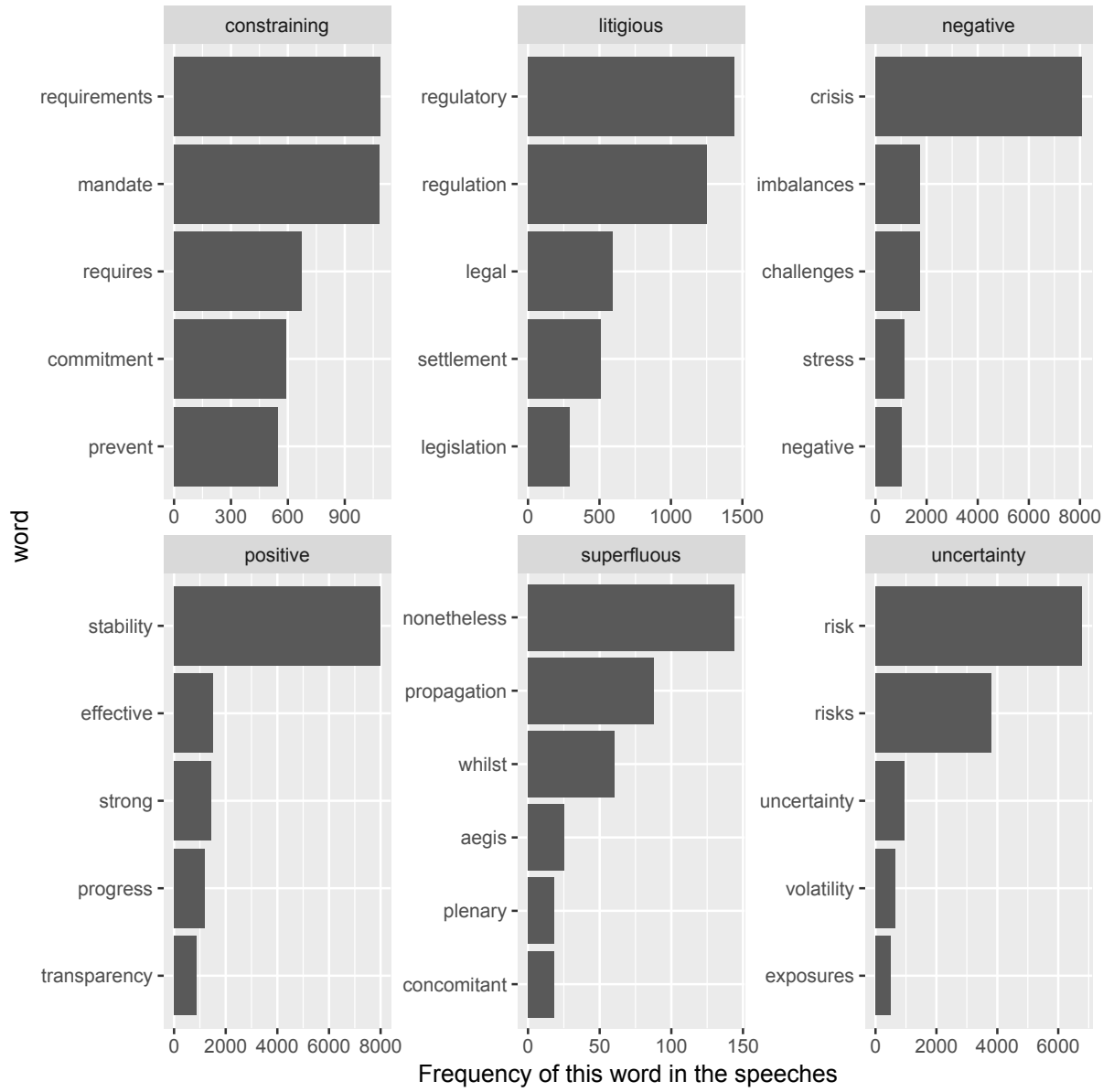

FIGURE 12: SENTIMENT CATEGORIES

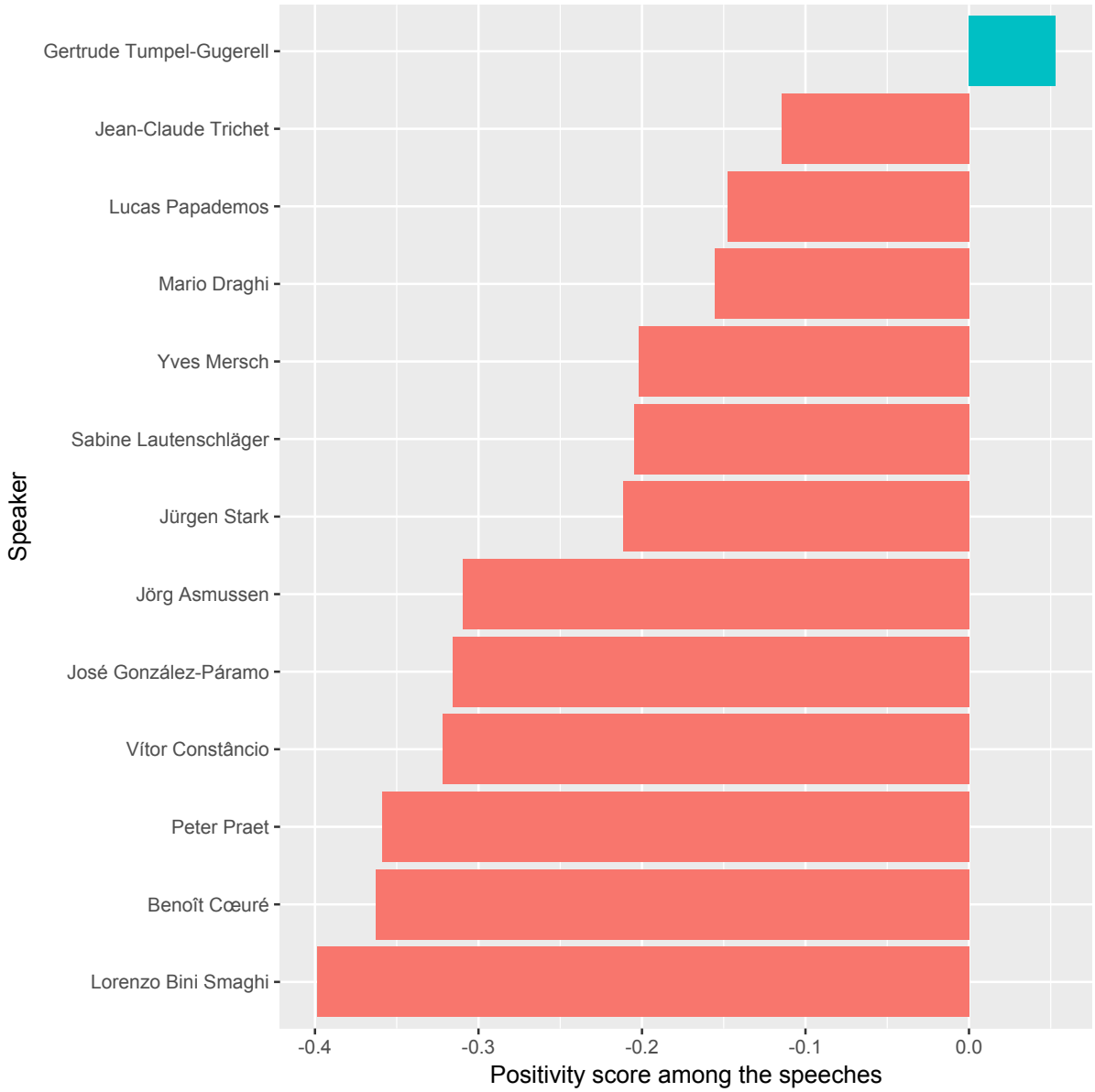

FIGURE 14: POSITIVITY SCORE ACCORDING TO SPEAKER

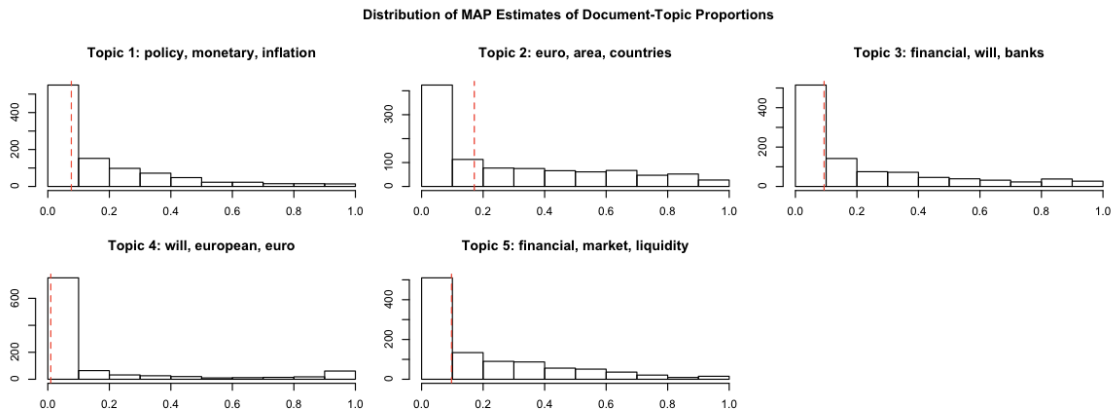

FIGURE 13: DISTRIBUTION OF DOCUMENT-TOPIC-PROPORTIONS

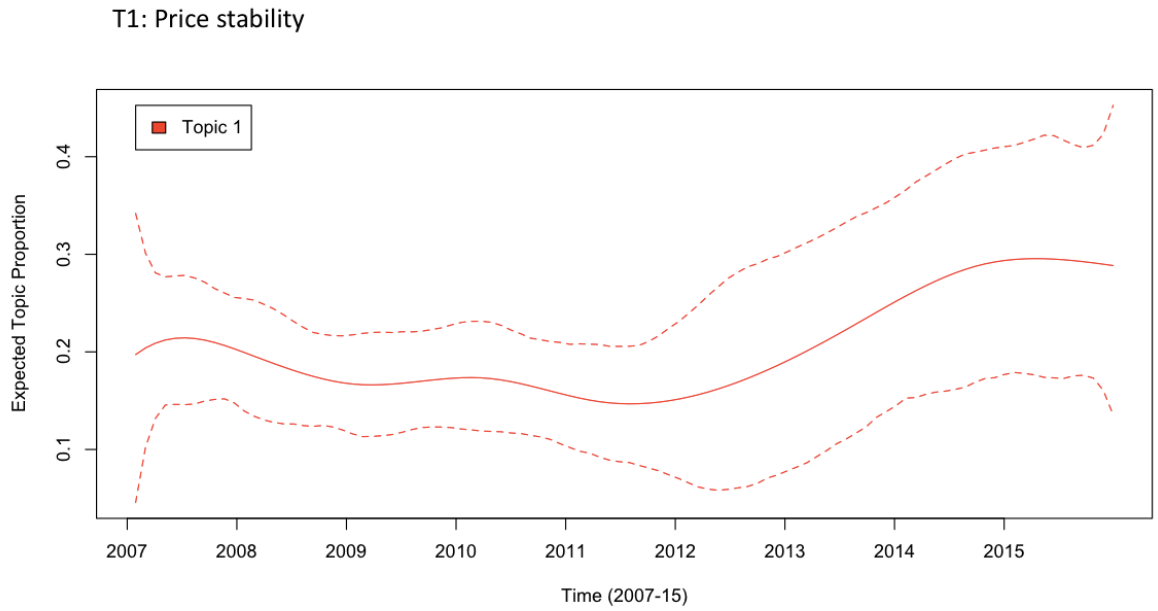

FIGURE 15: TOPIC 1 OVER TIME

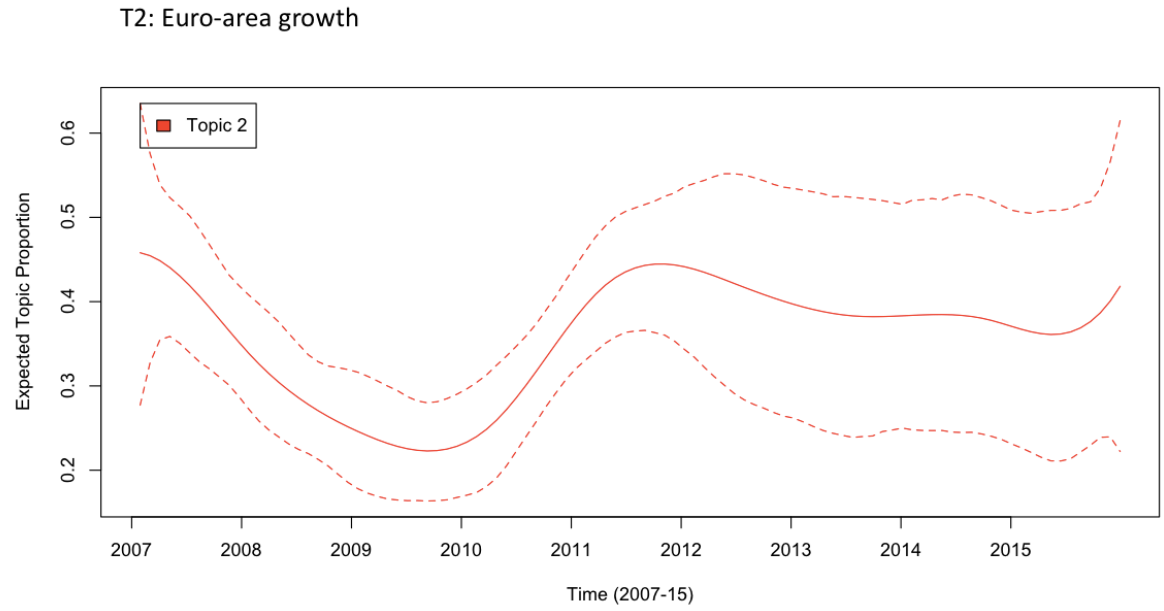

FIGURE 16: TOPIC 2 OVER TIME

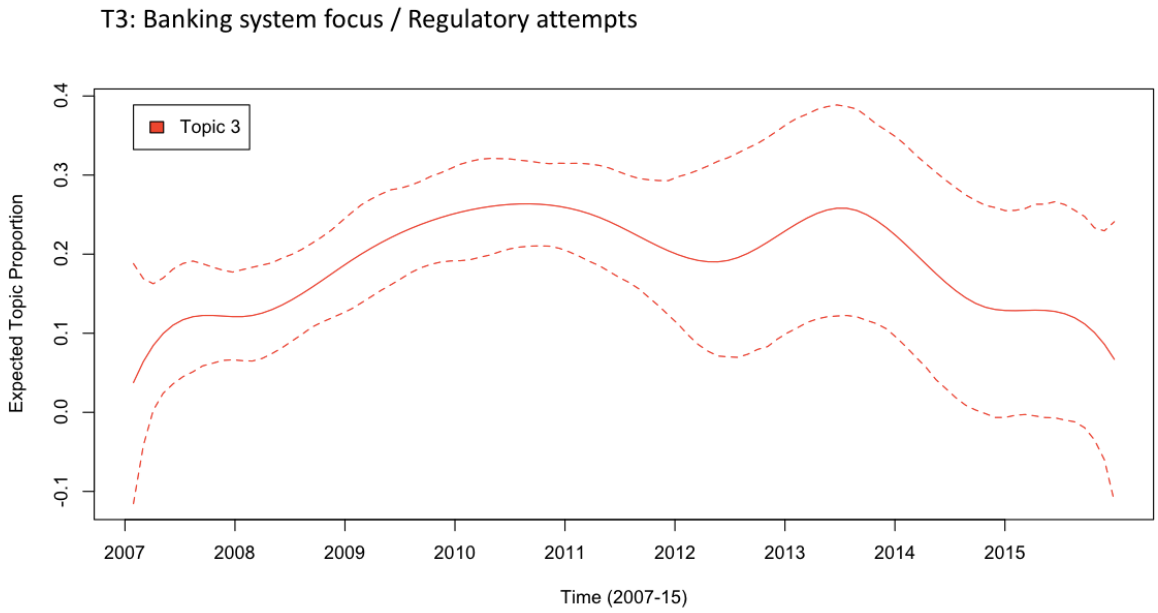

FIGURE 18: TOPIC 3 OVER TIME

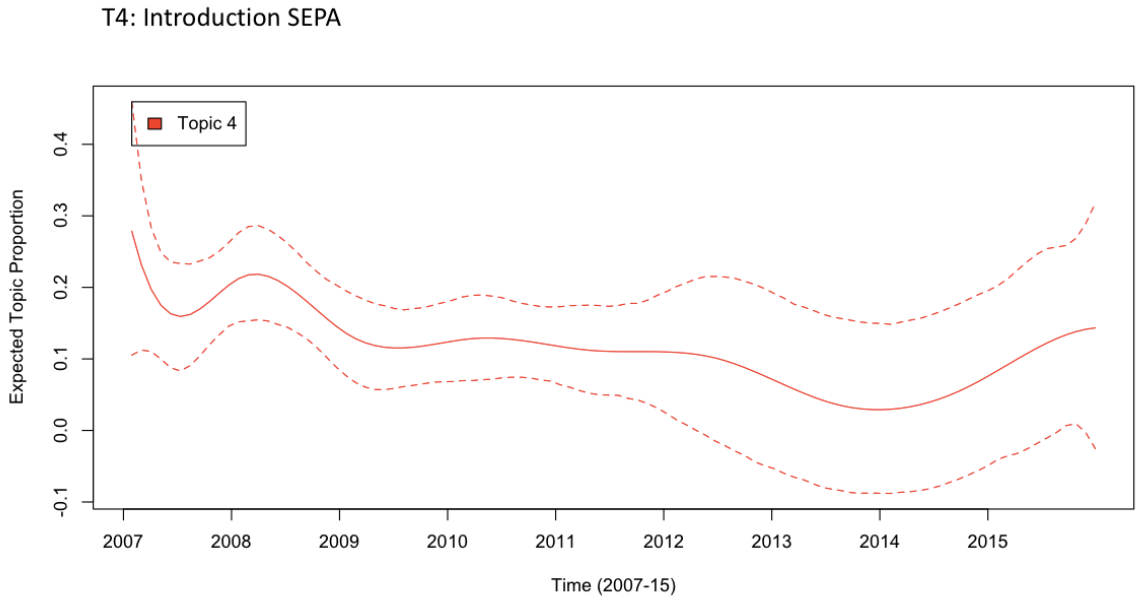

FIGURE 17: TOPIC 4 OVER TIME

T5: Liquidity measures

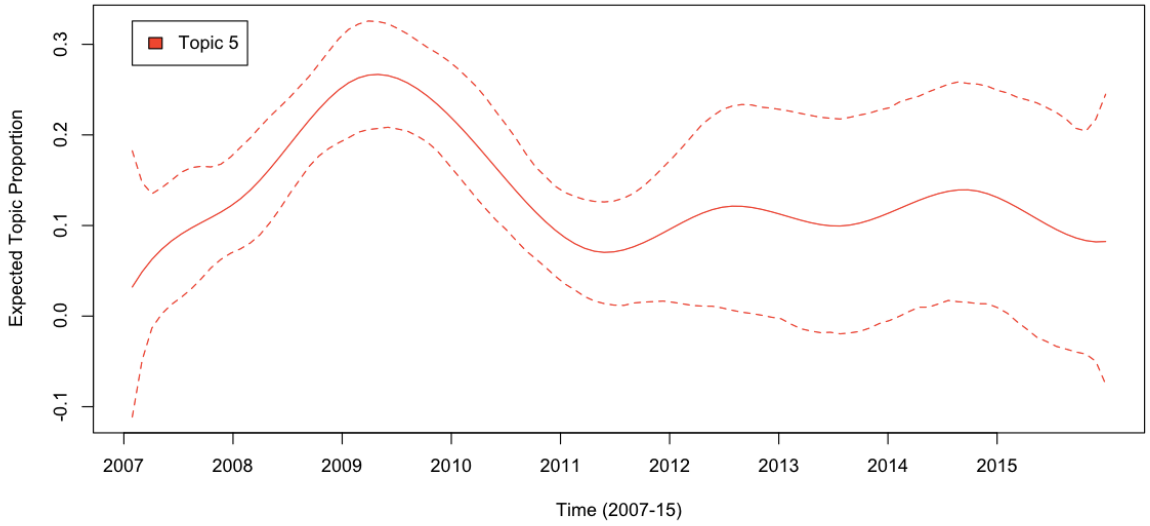

FIGURE 19: TOPIC 5 OVER TIME

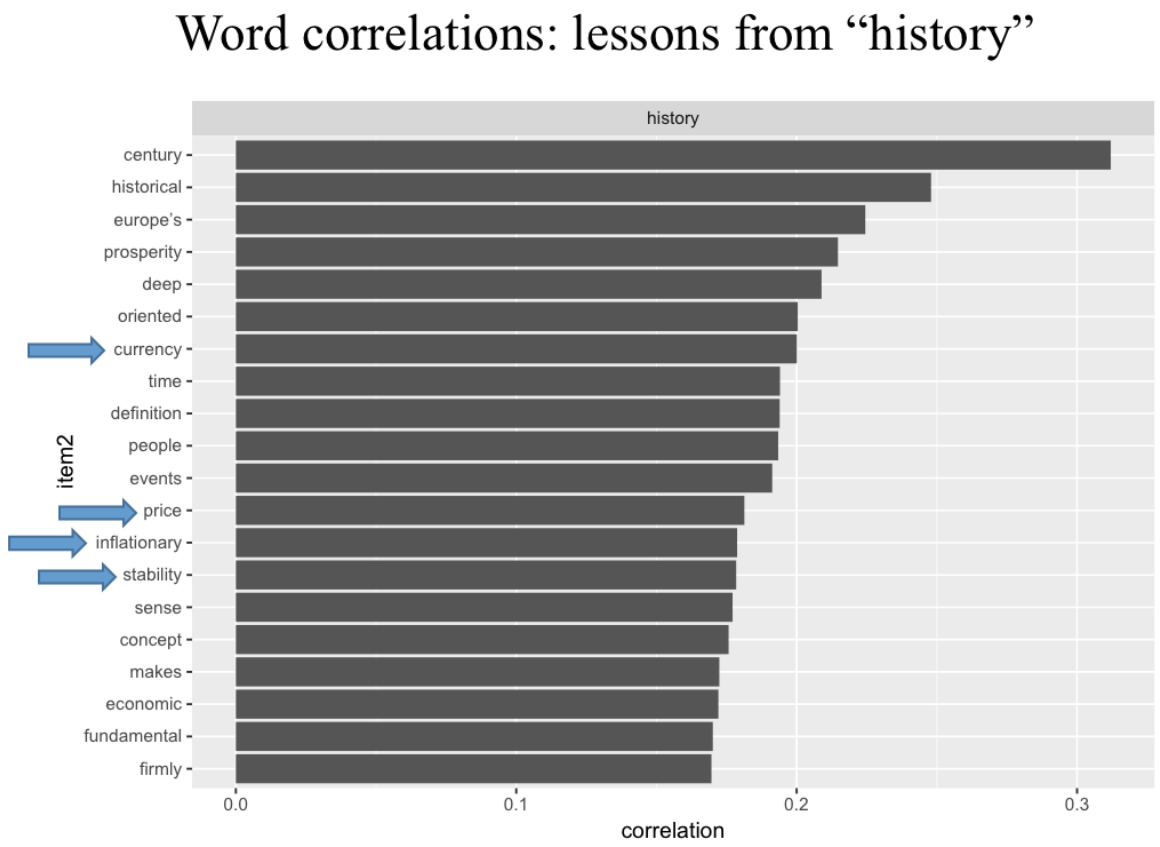

FIGURE 20: WORD CORRELATIONS ‘HISTORY’

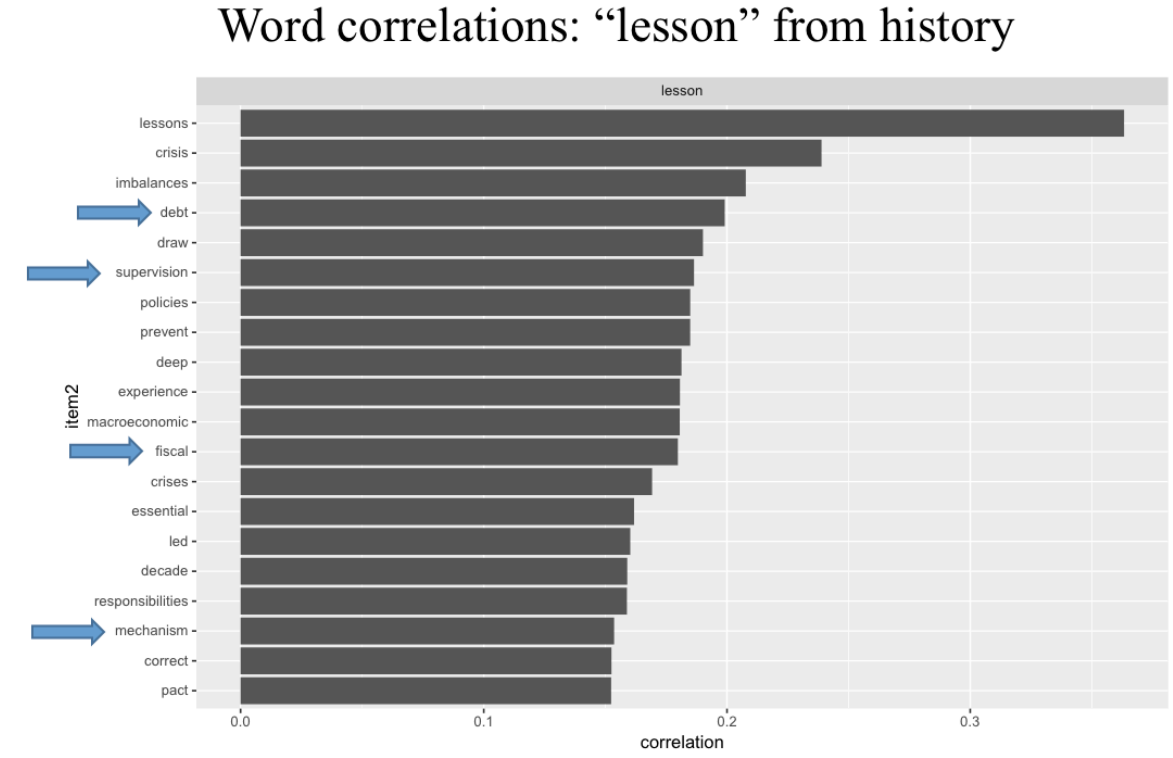

FIGURE 21: WORD CORRELATIONS ‘LESSON’

```
Call:
estimateEffect(formula = 1:5 ~ speaker + s(date), stmobj = stm_model,
    metadata = out$meta)


Topic 2:

Coefficients:
                                Estimate Std. Error t value Pr(>|t|)
(Intercept)                     0.116411   0.094514   1.232  0.21836
speakerGertrude Tumpel-Gugerell -0.052984   0.060588  -0.874  0.38206
speakerJean-Claude Trichet       0.080938   0.057346   1.411  0.15844
speakerJörg Asmussen            -0.046793   0.046535  -1.006  0.31487
speakerJosé González-Páramo      0.047452   0.059435   0.798  0.42484
speakerJürgen Stark              0.255722   0.060691   4.214 2.74e-05 ***
speakerLorenzo Bini Smaghi       0.132893   0.060126   2.210  0.02732 *
speakerLucas Papademos           0.078424   0.067990   1.153  0.24900
speakerMario Draghi              0.036236   0.033878   1.070  0.28507
speakerPeter Praet               0.125866   0.047159   2.669  0.00773 **
speakerSabine Lautenschläger    -0.093290   0.066980  -1.393  0.16400
speakerVítor Constâncio          0.021053   0.039871   0.528  0.59759
speakerYves Mersch              -0.092243   0.039629  -2.328  0.02013 *
s(date)1                         0.029126   0.132279   0.220  0.82577
s(date)2                         0.001808   0.083425   0.022  0.98272
s(date)3                        -0.044160   0.098028  -0.450  0.65246
s(date)4                        -0.009434   0.085938  -0.110  0.91261
s(date)5                        -0.060339   0.095186  -0.634  0.52629
s(date)6                        -0.040691   0.108738  -0.374  0.70833
s(date)7                         0.026900   0.104647   0.257  0.79719
s(date)8                         0.107665   0.116826   0.922  0.35697
s(date)9                         0.099688   0.120376   0.828  0.40779
s(date)10                        0.089781   0.107337   0.836  0.40311
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

TABLE 6: STM REGRESSION TABLE: TOPIC PREVALENCE T2

```
Call:
estimateEffect(formula = 1:5 ~ speaker + s(date), stmobj = stm_model,
    metadata = out$meta)


Topic 3:

Coefficients:
                                Estimate Std. Error t value Pr(>|t|)
(Intercept)                     0.113993   0.095295   1.196  0.23190
speakerGertrude Tumpel-Gugerell -0.051849   0.062304  -0.832  0.40550
speakerJean-Claude Trichet       0.082277   0.057988   1.419  0.15626
speakerJörg Asmussen            -0.045940   0.045951  -1.000  0.31768
speakerJosé González-Páramo      0.049091   0.059647   0.823  0.41070
speakerJürgen Stark              0.256915   0.061143   4.202 2.89e-05 ***
speakerLorenzo Bini Smaghi       0.134424   0.060875   2.208  0.02746 *
speakerLucas Papademos           0.079783   0.068087   1.172  0.24157
speakerMario Draghi              0.036350   0.034103   1.066  0.28674
speakerPeter Praet               0.126917   0.047058   2.697  0.00711 **
speakerSabine Lautenschläger    -0.093331   0.066246  -1.409  0.15919
speakerVítor Constâncio          0.021522   0.040177   0.536  0.59229
speakerYves Mersch              -0.091949   0.040077  -2.294  0.02198 *
s(date)1                         0.030602   0.133577   0.229  0.81884
s(date)2                         0.003013   0.083593   0.036  0.97125
s(date)3                        -0.043572   0.099294  -0.439  0.66089
s(date)4                        -0.007543   0.086644  -0.087  0.93065
s(date)5                        -0.060077   0.096361  -0.623  0.53312
s(date)6                        -0.038145   0.108587  -0.351  0.72545
s(date)7                         0.028601   0.105053   0.272  0.78549
s(date)8                         0.110372   0.117040   0.943  0.34590
s(date)9                         0.100927   0.120353   0.839  0.40190
s(date)10                        0.092495   0.108606   0.852  0.39462
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

TABLE 7: STM REGRESSION TABLE: TOPIC PREVALENCE T3

```
Call:
estimateEffect(formula = 1:5 ~ speaker + s(date), stmobj = stm_model,
    metadata = out$meta)


Topic 4:

Coefficients:
                                Estimate Std. Error t value Pr(>|t|)
(Intercept)                     0.116562   0.094277   1.236  0.21661
speakerGertrude Tumpel-Gugerell -0.052867   0.061120  -0.865  0.38727
speakerJean-Claude Trichet       0.081022   0.057670   1.405  0.16036
speakerJörg Asmussen            -0.046718   0.045436  -1.028  0.30411
speakerJosé González-Páramo      0.047667   0.059180   0.805  0.42075
speakerJürgen Stark              0.256099   0.060846   4.209  2.8e-05 ***
speakerLorenzo Bini Smaghi       0.132974   0.060156   2.210  0.02730 *
speakerLucas Papademos           0.078619   0.068422   1.149  0.25082
speakerMario Draghi              0.036458   0.033794   1.079  0.28094
speakerPeter Praet               0.126440   0.047392   2.668  0.00776 **
speakerSabine Lautenschläger    -0.093161   0.066083  -1.410  0.15893
speakerVítor Constâncio          0.021073   0.040246   0.524  0.60067
speakerYves Mersch              -0.091976   0.040318  -2.281  0.02275 *
s(date)1                         0.028184   0.131797   0.214  0.83071
s(date)2                         0.002653   0.082880   0.032  0.97447
s(date)3                        -0.045684   0.098573  -0.463  0.64314
s(date)4                        -0.009205   0.086289  -0.107  0.91506
s(date)5                        -0.060640   0.094639  -0.641  0.52184
s(date)6                        -0.040912   0.108412  -0.377  0.70598
s(date)7                         0.026202   0.103231   0.254  0.79969
s(date)8                         0.107510   0.116636   0.922  0.35688
s(date)9                         0.098602   0.120598   0.818  0.41378
s(date)10                        0.089721   0.107899   0.832  0.40588
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

TABLE 8: STM REGRESSION TABLE: TOPIC PREVALENCE T4

```
Call:
estimateEffect(formula = 1:5 ~ speaker + s(date), stmobj = stm_model,
    metadata = out$meta)


Topic 5:

Coefficients:
                                Estimate Std. Error t value Pr(>|t|)
(Intercept)                     0.115977   0.094111   1.232  0.21812
speakerGertrude Tumpel-Gugerell -0.052843   0.061632  -0.857  0.39144
speakerJean-Claude Trichet       0.080731   0.057654   1.400  0.16175
speakerJörg Asmussen            -0.047255   0.046249  -1.022  0.30715
speakerJosé González-Páramo      0.047952   0.060173   0.797  0.42570
speakerJürgen Stark              0.255789   0.061020   4.192 3.02e-05 ***
speakerLorenzo Bini Smaghi       0.133099   0.060714   2.192  0.02860 *
speakerLucas Papademos           0.078827   0.067726   1.164  0.24475
speakerMario Draghi              0.036592   0.033883   1.080  0.28042
speakerPeter Praet               0.126323   0.046870   2.695  0.00716 **
speakerSabine Lautenschläger    -0.093769   0.066064  -1.419  0.15611
speakerVítor Constâncio          0.021213   0.040233   0.527  0.59814
speakerYves Mersch              -0.092510   0.039968  -2.315  0.02084 *
s(date)1                         0.029538   0.132413   0.223  0.82352
s(date)2                         0.002928   0.083812   0.035  0.97214
s(date)3                        -0.044652   0.098467  -0.453  0.65031
s(date)4                        -0.008199   0.086441  -0.095  0.92446
s(date)5                        -0.060644   0.094463  -0.642  0.52103
s(date)6                        -0.040211   0.108588  -0.370  0.71123
s(date)7                         0.026806   0.103890   0.258  0.79644
s(date)8                         0.108520   0.116426   0.932  0.35151
s(date)9                         0.098098   0.119107   0.824  0.41036
s(date)10                        0.091192   0.107302   0.850  0.39561
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

TABLE 9: STM REGRESSION TABLE: TOPIC PREVALENCE T5

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