

# Delegating Regulation: European Union and Financial Markets

By Sharyn O'HALLORAN

*Columbia University*

Karen CHEN,

Rudra M Guha BISWAS,

Hoon KIM, Pu LIU,

YouFei ZHANG

and

YunPeng ZHOU

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## **Abstract :**

This paper analyzes the design of financial regulatory structure in the European Union. We develop a two-pronged approach to track changes in decision-making authority in EU financial market regulations and directives enacted from 1964 to the present. Traditional observational data collection methods manually code laws to identify the amount of discretionary authority delegated to regulatory bodies that oversee segments of financial markets. The lack of robustness and scalability of this approach, however, may limit the generalizability of observational studies. To remedy these potential shortcomings, we match observational methods with data science techniques, in particular natural language processing, to visualize complex patterns in the text of laws and temporal movements. The combination of both observational and computational approaches provides more detailed insights of the various elements of financial regulatory structure and the temporal allocation of decision-making authority among the European Commission, regulatory agencies and the Member States. Our analysis indicates that both the scope and location of decision-making authority shifted over time, moving from Member States to EU regulatory agencies. The amount of discretionary authority delegated to EU agencies to implement regulations, on the other hand, has remained largely unchanged.

## Introduction

After the 2007-09 global financial crisis government-led assessments on both sides of the Atlantic concluded that financial institutions took inordinate risks leading up to the crisis, at least in part, caused by lax oversight, or what the British referred to as “light touch” regulation<sup>1</sup>. Without a doubt, many played a role in the economic collapse, including hedge funds, traditional banks, mortgage lenders, ratings agencies, and borrowers themselves. Ultimately, excessive bank risk-taking and regulatory agencies’ failure to curb them brought down the global economy.

Predictably, governments responded with a number of reforms to strengthen financial regulation. In the United States, the Dodd Frank Wall Street Reform and Consumer Protection Act increased capital reserve requirements for Significant Important Financial Institutions (SIFIs), annual stress tests to ensure that banks hold sufficient shock-absorbing capital to withstand market downturns, and living wills for the orderly resolution of insolvent banks. Legislation also introduced corporate governance reforms that regulated executive compensation and board oversight, with the aim to aligning risk and reward incentive structures. These included claw backs, shareholder “Say on Pay”, majority voting on director elections, disclosure on pay ratios, and independent compensation committees, to name a few. A comparison of EU and US post-crisis reforms shows that similar reforms were adopted in Europe, although at a somewhat later date<sup>2</sup>.

But with the introduction of these reforms has financial regulation strengthened in the decade following the financial crisis? This poses a necessary question: what does good financial regulation entail? Once good regulation can be defined, how is it implemented? And how can such regulation be enforced and monitored?

This paper analyzes financial regulatory structure in the European Union. We focus on one aspect of regulatory design: the amount of discretionary authority delegated to regulatory authorities to set policy. Over time, and especially since the crisis, the EU as a governing body has taken on an increasingly central role in setting regulatory standards, especially in financial and commercial policy. Yet EU governance is not monolithic: the European Commission, the Parliament, regulatory agencies, and Member States all play important, albeit changing, roles.

We examine changes in the location and scope of EU financial regulatory authority overtime. Most of the related work developed in the American context<sup>3</sup>, and therefore we present data on U.S. financial regulation trends since 1950 as a benchmark. We adopt a dual approach to analyze the sixty-nine European Union financial regulation laws enacted since 1964 to the present day. First, we detail the rubric used to manually code legal texts (regulations and directives) and present the resulting descriptive summaries of the observational data. Second, we introduce the

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<sup>1</sup> WALKER (2009) and Financial Crisis Inquiry Commission (2011).

<sup>2</sup> Indeed, a comparison shows that of the recommendations suggested by various post-crisis commissions, the US has adopted only five out sixteen while the EU has adopted fifteen out of sixteen.

<sup>3</sup> Recent applications of this approach have been applied to comparative analysis of US antitrust laws.

computational techniques employed to analyze the documents. In particular, natural language processing provides a method to analyze text, words and phrases to display trends in the scope of issues and the allocation of decision-making authority overtime. The last section concludes with suggestions for interpretation of our findings for effective regulatory structure and the changing nature of EU decision-making.

## **Delegation and Discretion in Financial Market Regulation**

What explains the structure of financial regulation? Where, how, and by whom policy is made significantly impacts market outcomes. When designing financial regulation laws, Congress specifies the rules and procedures that govern executive actions. The key is how much discretionary decision-making authority Congress delegates to regulatory agencies. In some cases, Congress delegates broad authority, such as mandating the Federal Reserve to ensure the “safety and soundness” of the financial system. Other times, Congress delegates limited authority, such as specifying interest rate caps on bank deposits.

A recurring theme in the political economy literature of regulatory design is that the structure of policy making is endogenous to the political environment in which it operates<sup>4</sup>. Epstein and O’Halloran (1999) show that Congress delegates policymaking authority to regulatory agencies when the policy preferences of Congress and the executive are closely aligned, policy uncertainty is low, and the cost (political and otherwise) of Congress setting policy itself is high<sup>5</sup>. Conflict arises because of a downstream moral hazard problem<sup>6</sup>.

Application of these theoretical insights to financial regulation is well-motivated. Banking is a complex policy area in which bureaucratic expertise is valuable, and market innovation makes outcomes uncertain. Morgan (2002), for instance, shows that rating agencies disagree significantly more over banks and insurance companies than over other types of firms. Furthermore, continual innovation in the financial sector means that older regulations become less effective, or “decay”, over time. If it did not delegate authority in this area, Congress would have to continually pass new legislation to deal with new forms of financial firms and products, which it has shown neither the ability nor inclination to do. Overall, then, the literature leads the following testable hypotheses: Congress delegates more discretion when: 1) The preferences of the president and Congress are more similar; and 2) Uncertainty over market outcomes (moral hazard) is higher.

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<sup>4</sup> For early work in this area, see, for example, McCUBBINS and SCHWARTZ (1984, 165-179); McCUBBINS, NOLL and WEINGAST (1987, 243-277); McCUBBINS, NOLL and WEINGAST (1989, 431-482); and EPSTEIN and O’HALLORAN (1994, 697-722).

<sup>5</sup> EPSTEIN and O’HALLORAN (1999).

<sup>6</sup> Excellent technical work on the optimal type of discretion to offer agencies is provided by Melumad and Shibano (1991, 173-198); Alonso and Matouschek (2008, 259-293), and Gailmard (2009, 161-186). A series of studies examines the politics of delegation with an executive veto (VOLDEN (2002, 111-133)); civil service protections for bureaucrats (GAILMARD and PATTY (2007, 873-889); GAILMARD and PATTY (2012, 353-377)), and executive review of proposed regulations (WISEMAN (2009, 998-1014)), among others. See also BENDOR and MEIROWITZ (2004, 293-310), for contributions to the spatial model of delegation, and VOLDEN and WISEMAN (2009). SCHICKLER and LEE (2011, 36-65), for an overview of the development of this literature.

## Regulatory Design and Financial Markets

O'Halloran (1999) and O'Halloran *et al.* (2015; 2016, 2017) details the overall architecture of regulation in the US. The current paper extends this approach to EU financial regulation, where additional challenges await: 1) EU Member States do have a pre-EU history which must be taken into account in the long run, and 2) Translation of EU directives into national regulatory frameworks is not straightforward, as Member States could either strengthen EU provisions ('gold plating') or downplay them.

One of the keys to effective regulatory design is the amount of discretionary authority delegated to agencies to oversee and shape public policy. Over the last two decades, and especially since the crisis, there has been a growing perception that the European Union as a governing body has taken an increasingly centralized role in setting regulatory standards, especially in financial and commercial policy. Yet has the move toward centralized decision-making lodged authority within the European Commission or, as others suggests, emerging regulatory agencies or, as even further suggested, EU governance is irrelevant as the Member States still implement laws?

## Delegation in the European Union and United States

Delegation of powers in the European Union differs from how authority is delegated in the United States. In the United States, Congress enacts laws and then delegates varying levels of discretionary powers directly to financial regulatory agencies, which are divided along functional lines. For example, in 1929 in the wake of the Stock Market crash and, Congress created the Securities and Exchange Commission (SEC) and delegated to the new agency the authority to regulate the securities markets, including securities markets and products. Congress created the Commodity Futures Trading Commission (CFTC) in 1974 to regulate commodities and options markets, areas that fell outside of the SEC jurisdiction. In the Dodd-Frank Act that Congress passed in the wake of the 2007-09 mortgage meltdown, expanded the powers of the CFTC to regulate over-the-counter derivatives and Credit Default Swaps (CDS) and other complex financial instruments largely blamed for the collapse of the global markets (LABONTE, 2017).

The European Union, on the other hand, has multiple institutions responsible for decision-making. The European Parliament represents the EU's citizens and is directly elected by them; the Council, which represents the governments of the EU Member States; and the European Commission, which represents the interests of the EU as a whole. In general, it is the European Commission that proposes new laws and it is the European Parliament and Council that adopt them. The Member States, the Commission and regulatory agencies then implement these laws (EUROPEAN COMMISSION, 2012).

The European Commission has a leading role in legislation in the financial sector at the EU level specifically. It organizes the EU wide operation of the financial sector and has the right to initiate financial regulation in many financial service areas. It shares competence with Member States to enact legislation in this area with the primary goal of creating a single market in the EU as a method to increase efficiency and create jobs.

EU agencies are governed by EU public law, but are distinct from other EU institutions and have their own legal personality. There are three supervisory bodies that help to enforce rules for financial institutions and ultimately preserve the stability of Europe's financial system today: the European Banking Authority (EBA), the European Insurance and Occupational Pensions Authority (EIOPA), and the European Securities and Markets Authority (ESMA) (EUROPEAN COMMISSION, 2012).

## **EU Financial Market Regulation**

To track changes in the scope and location of EU decision-making, we identify, encode and characterize EU financial legislation from 1964 to present day. These data provide a means to assess EU convergence and to compare EU and US in a long-term perspective. We employ a two-pronged methodological approach to identify patterns of how decision-making is conducted in the EU. Traditional coding methods of these laws provide an understanding of the changes in discretionary authority across segments of financial markets and over time. We adopt data science techniques, in particular natural language processing, to visualize complex patterns in the text and its temporal movements. The combination of these two approaches provides more detailed insights of the various elements of financial regulatory structure and the allocation of decision-making authority amongst the European Commission, regulatory agencies and the Members States.

### Regulations and Directives

We analyze all EU directives and regulations related to financial regulation starting from 1964 to 2017. The analysis focuses on a detailed study of EU policies initiatives that concentrate 90% or more of the activity or content of the legislation on the financial sector. In total, there are 69 total such legislation and are accessible from the Official Website of the European Union in both PDF and HTML formats for manual coding and Natural Language Process analysis respectively. The full list of regulations and directives analyzed is stated in *Appendix B*.

The primary types of legislation analyzed in this paper are regulations and directives. Regulations are laws that are applicable and binding to all Member States. They do not need to be passed into national law by the Member States to ensure uniform application of Union law to all Member States. Regulations take precedence over national law where there are conflicts. Directives, on the other hand, have goals that are to be achieved separately by any or all the

Member States to whom they are addressed. It is the responsibility of the national authorities to specify the form and method of how the goal is achieved. Legislators from each Member State must adopt a transposing act to transpose directives and bring national law into line (BUX, 2018).

## Trends in Financial Regulation Legislation Enacted

We initiated our analysis by identifying the number of financial market legislation enacted annually from 1964 to 2017. *Figure 1* shows the progression of legislative enactments.

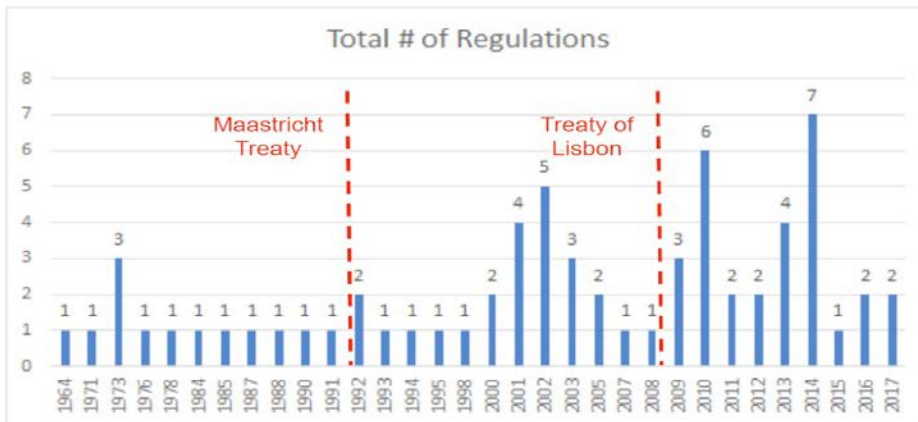


Figure 1: Total Number of Financial Regulation Legislation Enacted, 1964-2017.

We delineate the data into three periods, prior to 1992 and after 2009. Both the Maastricht Treaty, signed in 1992, and The Treaty of Lisbon, entered into force in 2009, act as gateways towards the enactment of major changes in EU governance. The exact years in each period, the number of regulations in each period and the description is indicated in *Table 1*. Legislation is not separated in this analysis by financial crises but they were evaluated for impacts and trends.

*Figure 1* shows that significantly more legislative acts passed following each Treaty, as compared to the previous time period. The greatest amount of legislation was enacted in 2014, when seven pieces of financial market regulation laws passed, followed by 2010, when six were enacted.

Years	# of Regulations	Description
1964 - 2017	69	Entire Period
1964 - 1991	15	Pre-Maastricht Treaty
1992 - 2008	24	Post-Maastricht Treaty
2009 - 2017	30	Post-Treaty of Lisbon

Table 1: The Number of Financial Regulations and Directives Enacted, by Time Period.

## **Observational Data: Manual Coding Delegation and Discretion**

One of the goals of the project is to develop protocols for coding financial legislation (or any legislation) across legal jurisdictions. The robustness of the instrument will be tested using Natural Language Processing (NLP) that produce best results on automatically classifying laws/directives into various codes/labels and inducing best structured representation of sentences for various types of computational analysis. Besides developing best-case algorithms, the research will provide standardized coding labels for comparative financial regulatory policy, setting the basis for testing the impact of alternative regulatory regimes on competition policy and financial inclusion.

The paper refines a scalable methodology and algorithms first used to analyze U.S. financial regulatory policy to code other European financial laws, based on similarly structured materials. The research employs both an observational study similar to those in Epstein and O'Halloran (1999) as well as data science techniques akin to those employed in O'Halloran *et al.* (2016). This research illustrates that while manual coding more accurately predicts agency structure than unstructured text analysis alone, combining both predefined rule-based methods with computational data science techniques offers a more precise interpretation of the determinants of financial regulatory structure.

### **Coding Rules**

A set of coding rules was constructed with reference to O'Halloran *et al.*'s (2016) previous studies, adjusting to specific characteristics of European Union financial institutions. These rules allow for the standardization of what constitutes delegation as well as provide the ability to sort various types of procedural constraints into categories for further analysis.

Detailed data was recorded in a database that stored the results of the manual coding exercise and to help carry out further descriptive analysis. Additional data collected include the specific financial areas that each law targeted, and the EU agencies receiving delegated authority. In following the methodology developed in O'Halloran *et al.* (2016), each Regulation or Directive was manually reviewed to identify the total number of provisions in the text. A key rule in this process is that each article counts as one provision, unless it contained subsections, in which case each subsection counts as one provision. For the specific methodology and related examples, please refer to *Appendix A*. The total number of provisions in the financial laws ranges from two to 1641.

## Delegation

Delegation as defined by O'Halloran *et al.* (2016) is authority granted to an executive branch to move policy away from the status quo. Typical examples of delegation include: The authorization of a new program, discretion to modify decision-making criteria, and the right to issue waivers. In specific, the Federal Deposit Insurance Act of 1950 in the United States, for example, authorized the Federal Deposit Insurance Corporation to insure individual bank deposits up to \$10,000, increased from \$5,000 previously. Under our definition, this is considered as increased delegation of authority.

Based on the methodology detailed previously, *Figure 2* maps the total number of provisions in the financial regulations that delegate authority to a given body per year. In general, prior to the Maastricht Treaty, EU legislation delegated little authority: Regulations and directives tended to be specific and details, narrowly tailored to a given sector, product or participant of financial markets. After 1992, the volume of EU legislation increased, coinciding with an increase in the amount of authority delegated. The most significant increase occurs after 2009. While some of this increase is attributed to the increased number of legislation enacted, it is evident the total number of provisions that delegate authority have increased per number of legislation as well and this is true even when the total number of provisions are taken into account.

The year 2014 had the largest amount of financial regulation legislation passed, but it is also the year with the most number of delegations. This year in particular is the establishment of European supranational agencies. Of note, regulations with the most authority delegated in each subperiod are generally on the subject of regulating capital market institutions.

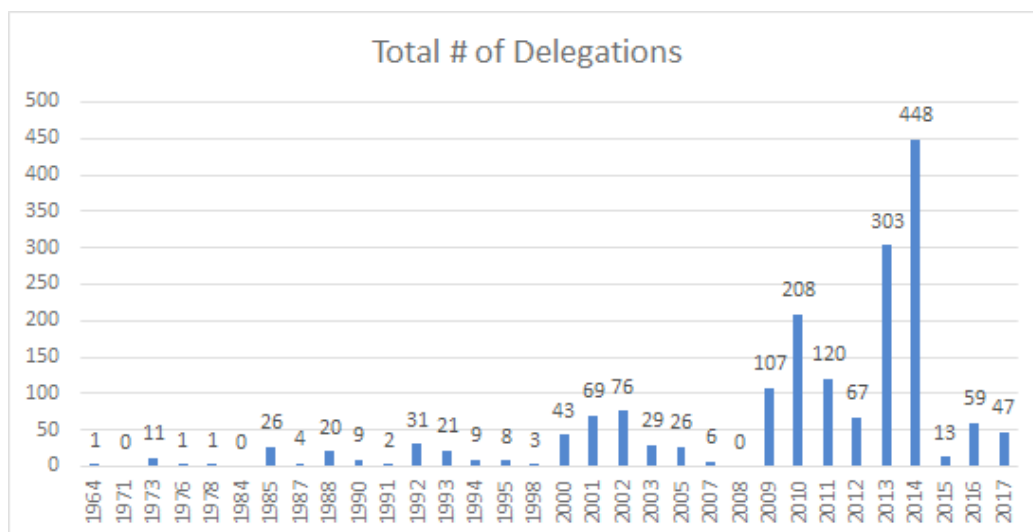


Figure 2: The Number of Delegations by Year, 1964 to 2017.



As previously defined, delegation in the EU is given to: Member States, agencies, and the Commission on an annual basis. Through our database, we analyze changes in delegation in the time periods indicated earlier. The year 2008 is found to be the inflection point in the number and type of delegation given in EU legislation. *Figure 3* shows that in the pre-2008 period, delegated authority mainly resided with Member States while only a relatively small amount of authority was granted to the Commission and agencies.

This trend is in stark contrast to post-2008. Starting in 2009, EU regulations and directives delegated decision-making authority primarily to the Commission and the various agencies. In fact, the ratio of financial regulation laws that ceded authority to the Commission and agencies almost doubled that given to Member States, thus indicating a dramatic shift in the location delegated authority. The pursuant distribution of decision-making authority suggests a deeper collaboration among the three competent bodies regarding the oversight and regulation of financial markets. The change in governance structure also suggests that greater authority and flexibility to set policy shifted to the EU as a whole. On an absolute basis and over the entire time period, however, Member States still retained the majority of delegated authority.



Figure 3: Provisions that Delegated Authority to the Commission, Agencies, and Member States by Year, 1964 to 2017.

## Procedural Constraints

On the other hand, constraints, the procedural and administrative restrictions circumscribing these delegated actions, also increased. When an agency is required to report its decisions or rulemaking the Congress before the actions could be taken, exemplifies a procedural constraint. For example, the International Money Laundering Abatement and Financial Anti-Terrorism Act requires the Treasury Secretary to report to Congress on the most effective way to verify the identities of foreigners opening accounts in US financial institutions and assign them ID numbers that work like tax ID numbers given to citizens. This is an instance of reporting constraints on delegated authority.

The data indicates that the number of constraints per year mirrors the trend of delegations; the analysis show a slight increase in the 1992-2008 period and a sharp rise following 2009. Similar to the data on delegated authority, the year 2014 saw the highest number of constraints prescribed to limit authority. The raw number of constraints given in each year is generally lower than the level of delegation for the same year.

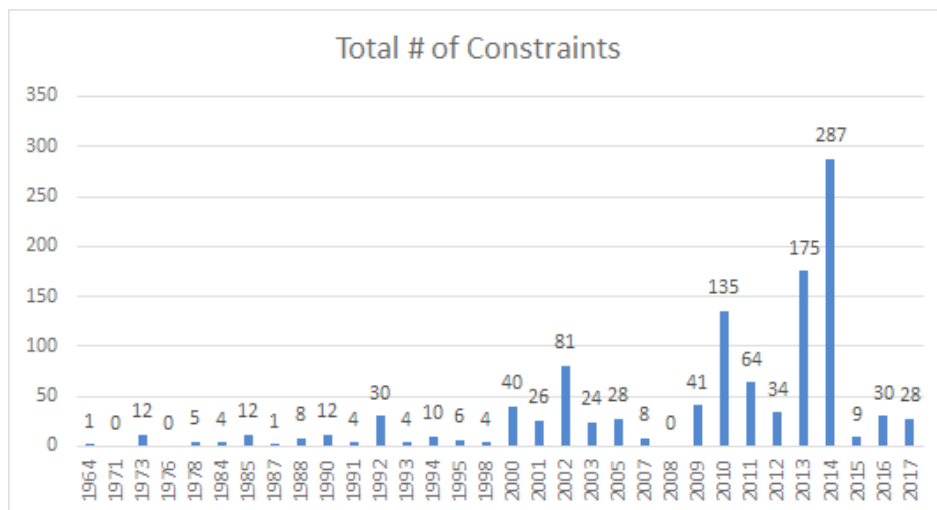


Figure 4: The Number of Constraints by Year, 1964 to 2017.

Unlike delegations, however, the distribution pattern of constraints to Member States, the Commission, and Agencies is the relatively constant over the entire period, with the vast majority of constraints imposed on Member States, who also receive the lion share of delegated authority. The data does not show a major shift in constraints from Member States to Agencies or the Commission during the three periods defined. The data does indicate, however, that there has been a shift in regulatory authority from Member States to the EU by way of the Commission and the various agencies.

## Regulatory Discretion

Agency discretion depends on both delegation and the associated limits on authority. That is, discretion depends not only on the amount of authority delegated but also on the procedural constraints prescribed to the use of that authority. The effects of delegation and constraints on the discretion differ; delegation positively affects discretion whereas constraints are negatively linked with the discretion. The more discretion an agency has to set policy, the greater the leeway it has to regulate market participants. Therefore, total discretion is defined as delegation minus constraint, the amount of unconstrained authority delegated to agents (O'HALLORAN *et al.*, 2016)<sup>7</sup>.

<sup>7</sup> A number of different ways have been explored to calculate discretion, including factor analysis. For the most part, each variation yields similar results.

With the number of delegations and constraints available, a discretion index was calculated. This index is based on the methodology of O’Halloran *et al.* (2016). We posited that the amount of delegation provided to the Member States, Agencies and the Commission is tempered by the number of constraints enforced upon them by year. Hence, we created a discretion index using the following calculation:

$$\text{Discretion} = \left\{ \frac{\text{The Number of Delegations}}{\text{The Number of Provisions}} \right\} \times \left\{ 1 - \frac{\text{The Number of constraints}}{\text{The Number of provisions}} \right\}$$

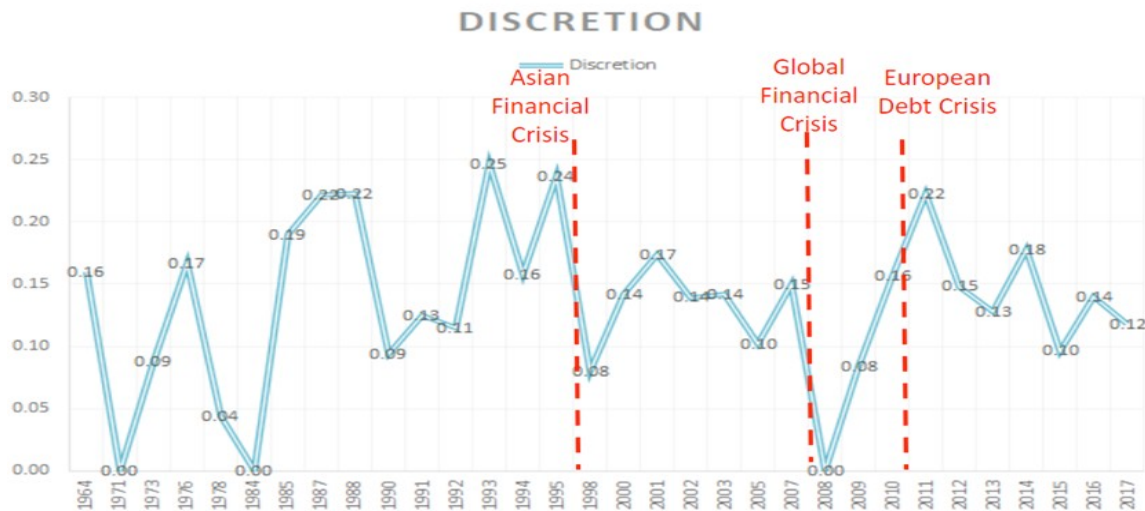


Figure 5: EU Financial Regulation Laws Discretion Index, 1964-2017.

Figure 5 shows the discretion index results and affords us the opportunity to gain a clearer picture of the evolution in discretion. Of note, the index calculates total discretion from the number of provisions that delegated authority to competent bodies and the constraints imposed on the use of this authority. The analysis does not separate delegation and constraints given to an Agency, Commission or Member States separately to maintain robustness of the data. Through our calculations, the highest amount of discretion occurs in 1993, with a discretion index of 0.25. There are periods where no discretion is given in the legislation. Most discretion levels vary, ranging from 0.08 to 0.22.

Several major financial crises were included to see if legislative discretion changed following these events, as was the class with treaties. The trend did not indicate a singular type of discretion response to financial crises nor a trend of discretion levels preceding a crisis. The magnitude of change in discretion is also not uniform.

From this total index, it is evident that there was a sharp increase in the total amount of authority delegated in the post-Treaty of Lisbon period, in particular the year 2014. Yet this delegation has been accompanied by a corresponding increase in the level of constraints imposed on decision-making, and thus tempered the total level of discretion granted in each year. As a result, discretion in the later period has not expanded to significant levels, as many initially believed, simply from the length and complexity of legislation enacted alone.

## **Computational Data Methods**

Manually coding banking and financial service laws requires aggregating measures from thousands of pages of text-based data sources with tens of thousands of provisions, containing millions of words. Such a large-scale manual data-tagging project is time consuming, expensive and subject to potential measurement error. To overcome these limitations, we refine a scalable methodology first used to analyze U.S. financial regulatory policy to code other European financial laws, based on similarly structured materials. The data science technique employed is akin to those developed in O'Halloran *et al.* (2016).

As an illustration, let us consider the example of the U.S. Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010, which covers the activities financial institutions can undertake, how these institutions will be regulated, and the regulatory architecture itself. The law contains 686 major provisions, of which 322 laws delegated authority to some 46 federal agencies. In addition, the Act has a total of 341 administrative procedural constraints across 11 different categories, with 22 new agencies created. If we manually process the text of this law, data annotators, trained in political economy theories, would read and code the provisions based on the rulebook provided. In effect, coders would have to read 30,000 words, the length of many English novels. In addition, we cannot ensure that the coding rules identify all significant policy features in the laws or that annotators identify all relevant combinations of policy instruments that impact financial markets under various scenarios. To mitigate these limitations of observation studies, we adopt data science techniques to automatically classify and rank laws, thereby providing robustness check on manual coding.

## **Natural Language Processing**

Natural Language Processing (NLP) is a prominent research area in artificial intelligence. It allows computers to analyze, understand and derive meaning from human text in an unbiased and useful way. NLP can check the robustness of the manual coding tools developed above and can provide additional insights to the regulatory structure that are limited by manual coding (O'Halloran *et al.*, 2016). NLP summarizes blocks of text, reveals clusters of related terms and provides network mapping of terms and concepts, identify word frequency, extract terms by grammar, identify the type of entity extracted, reduce words to their roots via a tokenizer, among many other functions (KISER, 2016).

To check the robustness of the manual coding tools can provide insights to the regulatory structure that are limited by manual coding (O'HALLORAN *et al.*, 2016). Natural Language Processing (NLP) analysis was conducted on the same set of financial regulations to illustrate how these more robust tools can provide insights to the regulatory structure that are limited by manual coding (O'HALLORAN *et al.*, 2016). NLP provides us with the opportunity to quantitatively, and from an unbiased perspective, analyze how these regulations have transformed over time. We also seek to view various connections of these legislations unavailable to us manually. The combined examination of these financial regulations will offer more avenues to explore how changes in regulatory structure has changed. The two main analysis conducted is frequency distribution over time, and networking mapping.

To visualize and analyze the compiled text files, we used *Cortext* Manager, a digital platform powered by INRA (French National Institute for Agricultural Research) with support by LabEx in France. This platform allows us to upload the text corpus of the financial regulations and then perform scripted analysis<sup>8</sup>. To see the progression of the financial regulations through this manner, we decided to review the regulations in the four periods divided in the manual coding section of the paper.

There are several key components to preparing text that *Cortext* inherently is able to perform for the end user. These include *Parts-of-Speech* tagging, which first identifies each word by part of speech such as noun, verb, adjective, etc., and *Chunking*, which helps to identify phrases. Following is *Normalization*, which corrects small differences in words with hyphens. Last is *Stemming* which gathers the words together if they share the same stem. For example, 'credit rating agency' and 'ratings agencies or credit' are normalized to the same main form (*Cortext* Documentation Manager, 2018).

The text data was further cleaned of footnotes without substantial substance. For example, footnotes that refer to Official Journal locations such as (OJ L 322, 17.12.1977, p. 30) were removed. Annexes that were primarily tables with significant whitespace was removed to maintain the structure of the text. Numbers and dates remained untouched in the text. For this analysis, we viewed only "noun phrase" terms with maximum words per phrase as three, the basic settings in *Cortext*.

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<sup>8</sup> A detailed description of the methodology is provided in the *Appendix A*.

## Distribution of Scope and Location of Authority

To understand the words most prevalent in these financial regulations, we reviewed the distribution of the top 20 most frequently appeared noun phrases in the sixty-nine legal documents reviewed over the three time periods previously identified.

Figure 6 provides a snapshot of the distribution over the entire time period. We have included separated time breaks, which indicate the Maastricht Treaty and the Treaty of Lisbon. The X-axis of Figure 6 denotes time, while the Y-axis denotes total frequency. The legend provides the word with its color reference. The most frequently occurring word is shown at the bottom of the graph.

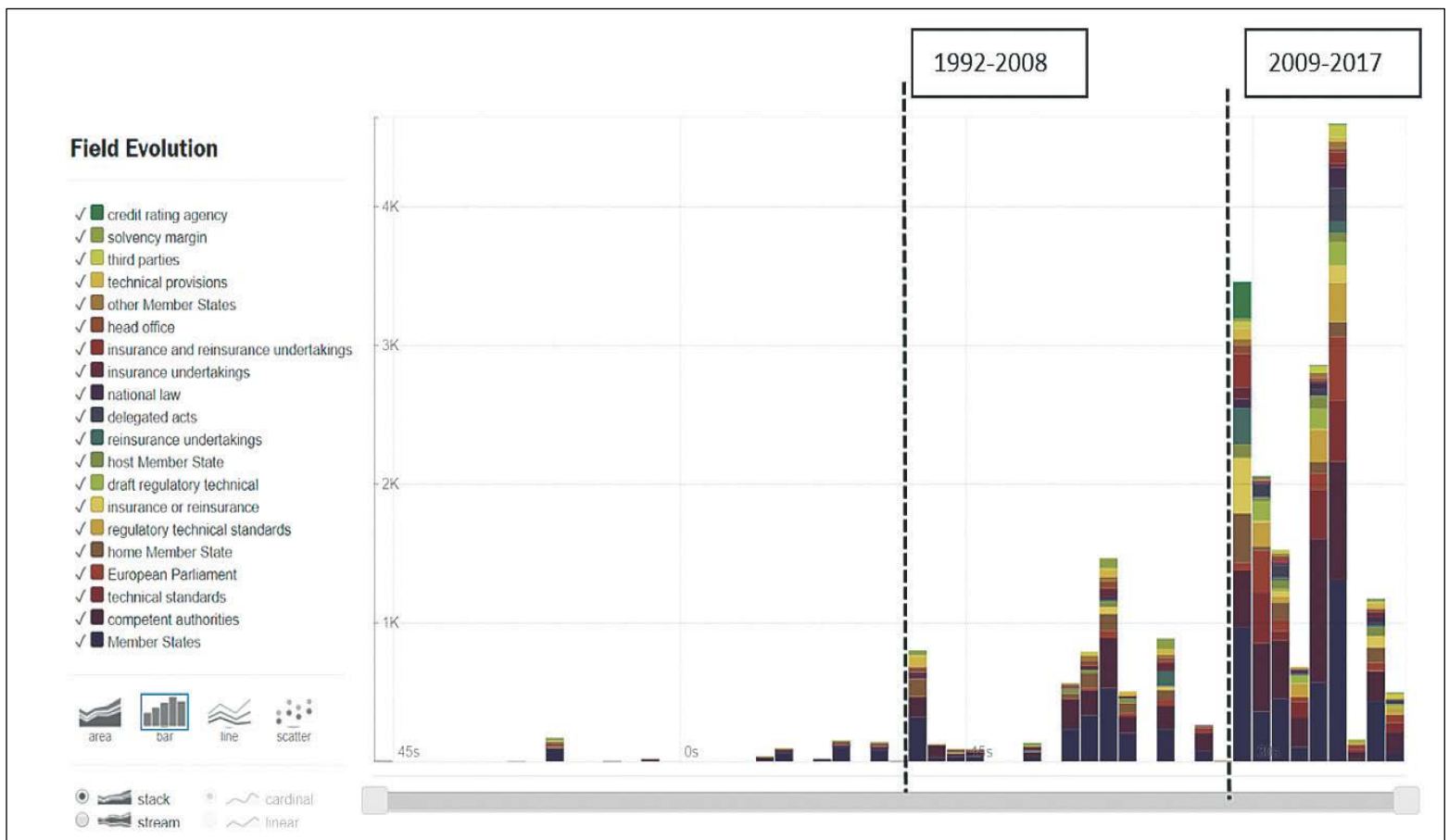


Figure 6: Frequency Distribution of Top Twenty Terms, 1964-2017.

The shape of this graph mirrors the observational data collected by manual coding. The pre-1992 time period exhibits a lower word count than the later periods, reflecting the degree of complexity of the legislation. This corresponds to the lower word count in general of these regulations. The peak comes from 2014 regulations with the combined word count reaching upwards of 4,000. This mirrors the large number of regulations passed in that period as well as the greater degree of delegation and procedural constraints seen in the manual coding section of this paper and the high total word count. From this data, the most populous words are ‘competent authorities’ and ‘Member States’.

To further understand this change, we analyzed how these top words have changed in significance over time through these 3 periods: 1964-1991, 1992-2008 and 2009-2017. The X-axis of *Figure 7* denotes the different time periods with 0 being 1964-1991 and 2 being 2009-2017. The Y-axis are the various word phrases. ‘Member States’ remains the most prominent word phrase in this period, followed closely by ‘competent authorities’. The introduction of “regulatory technical standards” has ballooned the frequency of this phrase in the post-Treaty of Lisbon period indicating a focus on these standards.

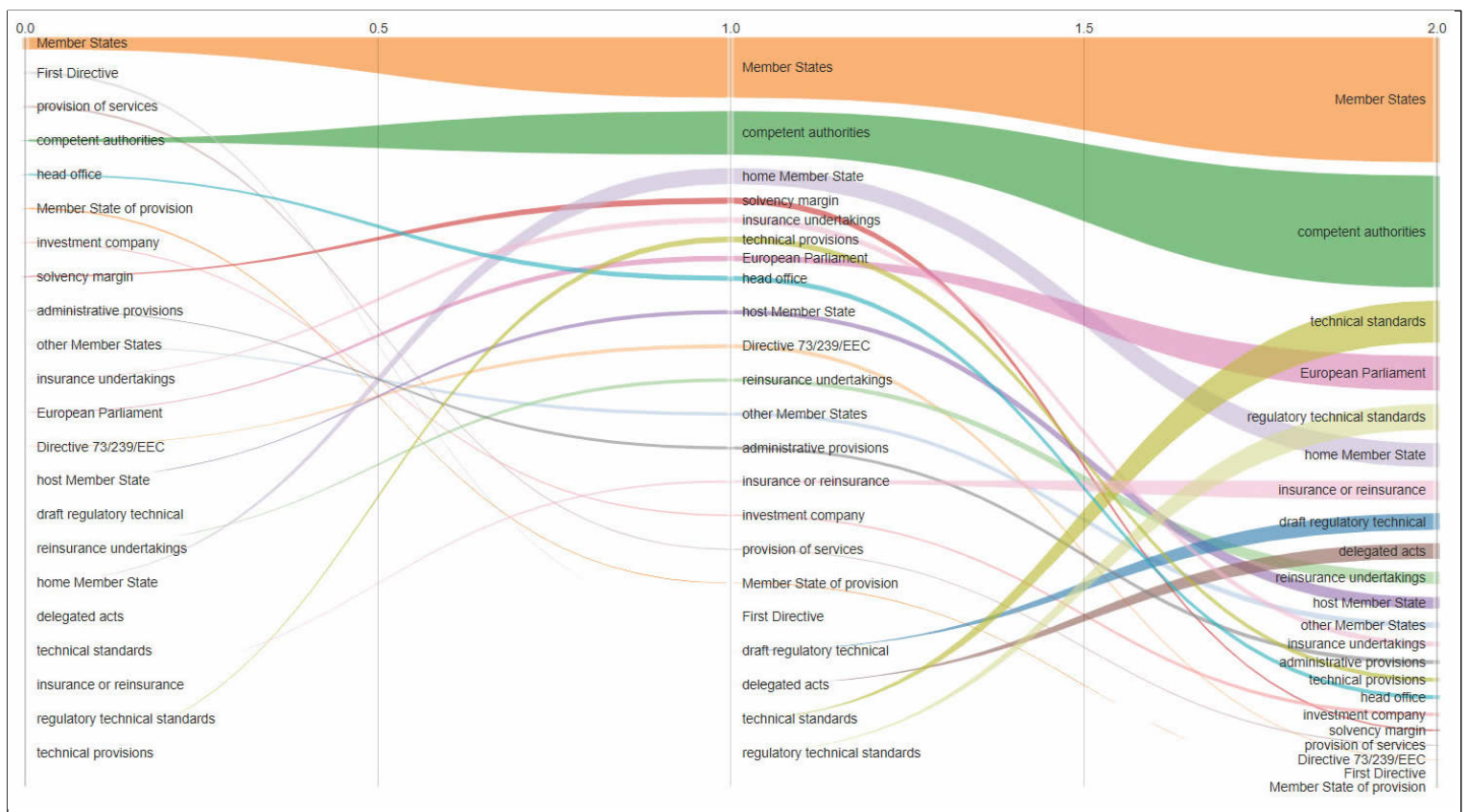


Figure 7: Changes of Top Ten Terms Over Time, 1964-2017.

## Network Mapping

To understand how words in these regulations relate to each other, we turn to Network Mapping. The top 100 noun terms that were previously extracted in each period are mapped to see the structure and dynamics of the corpus. The nodes, or word phrases, are defined by its co-occurrence or frequency. Larger nodes represent higher frequency in the text. The *Cortex* script is able to link various phrases accordingly. Below are the graphs for each time period. The map legend shows the main themes of the nodes and cluster (*Cortex* Documentation Manager, 2018).

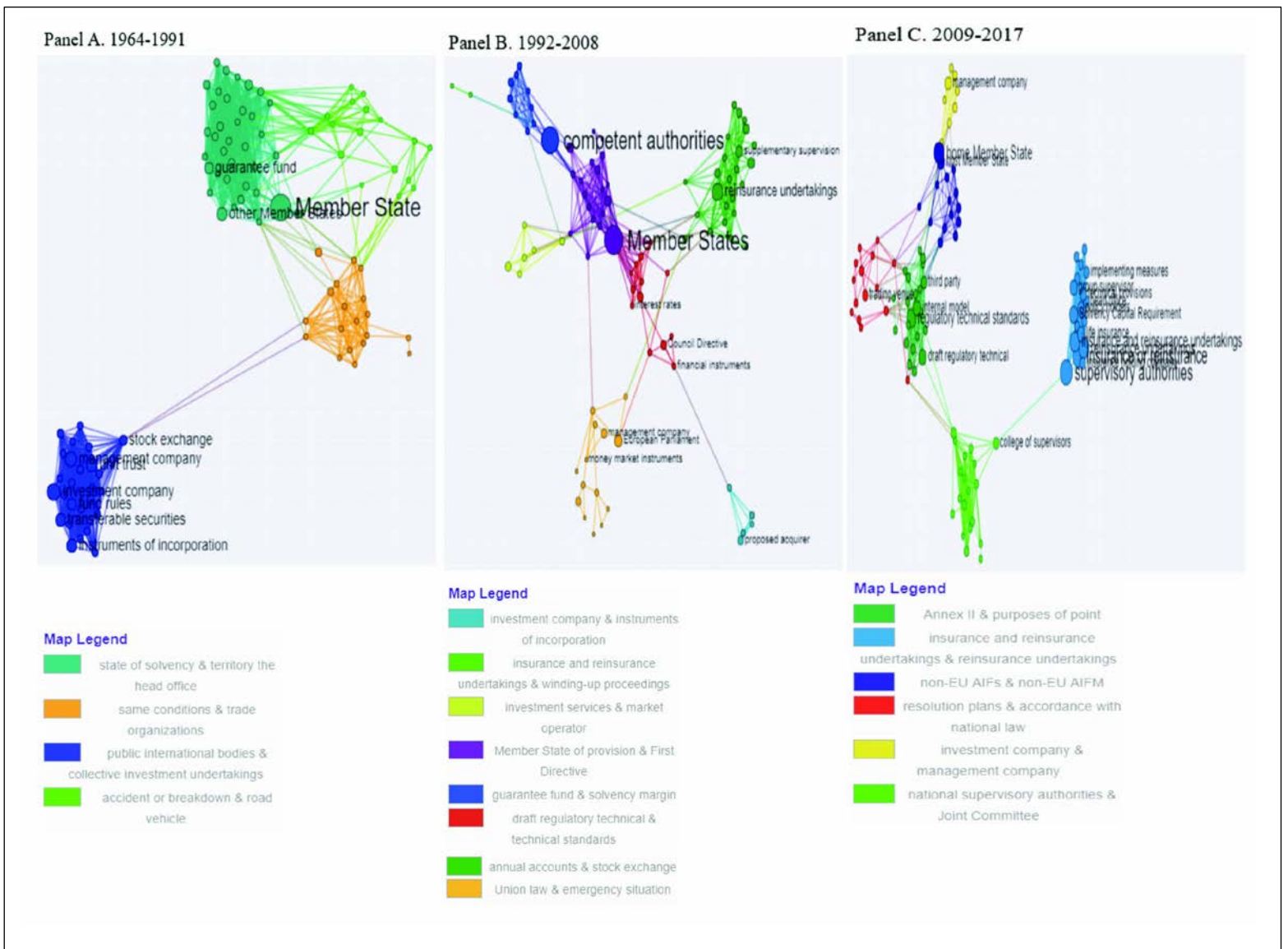


Figure 8: Network Mapping of Related Terms, 1964-2017.



Reviewing these maps over time provides another picture of the change in complexity and focus of financial regulations as is evident by the three panels. In Panel A, the pre-1992 period, the clusters are relatively distinct and the number of distinct clusters minimal at only four. Phrases relate closely to their cluster which suggests that the topics are not interrelated to one another. The limited number of clusters suggests the topics encompassed in financial regulation at that time were similarly limited in scope.

In Panel B, 1992-2008, the network map dramatically changes. Here, the map moves from four to eight distinct clusters and the phrases are much more interconnected. This suggests the topics of these legislations have become more complex and not as focused to singular topics as they once were. This reflects the growing range of topics of financial regulation.

After 2009, the map simplifies slightly. The clusters reduce to seven and there are more distinct clusters akin to the pre-1992 network map. Seemingly, the legislation is now more focused. As seen in the frequency analysis, 'regulatory technical standards' becomes an increasingly important node in this period as does 'supervisory authority' which constitutes a major cluster on this map indicating a shift in focus on these topics.

The shape of these maps could have significant implications on optimal regulatory design moving forward. Further analysis could provide insights to which map shape is the most successful in regulating its subjects, whether more interrelated, or more focused is optimal.

The last portion of the NLP analysis was to analyze how agencies changed in these regulations over time. This initial analysis was done by extracting organizational terms from the text and plotting its changes in frequency over time.

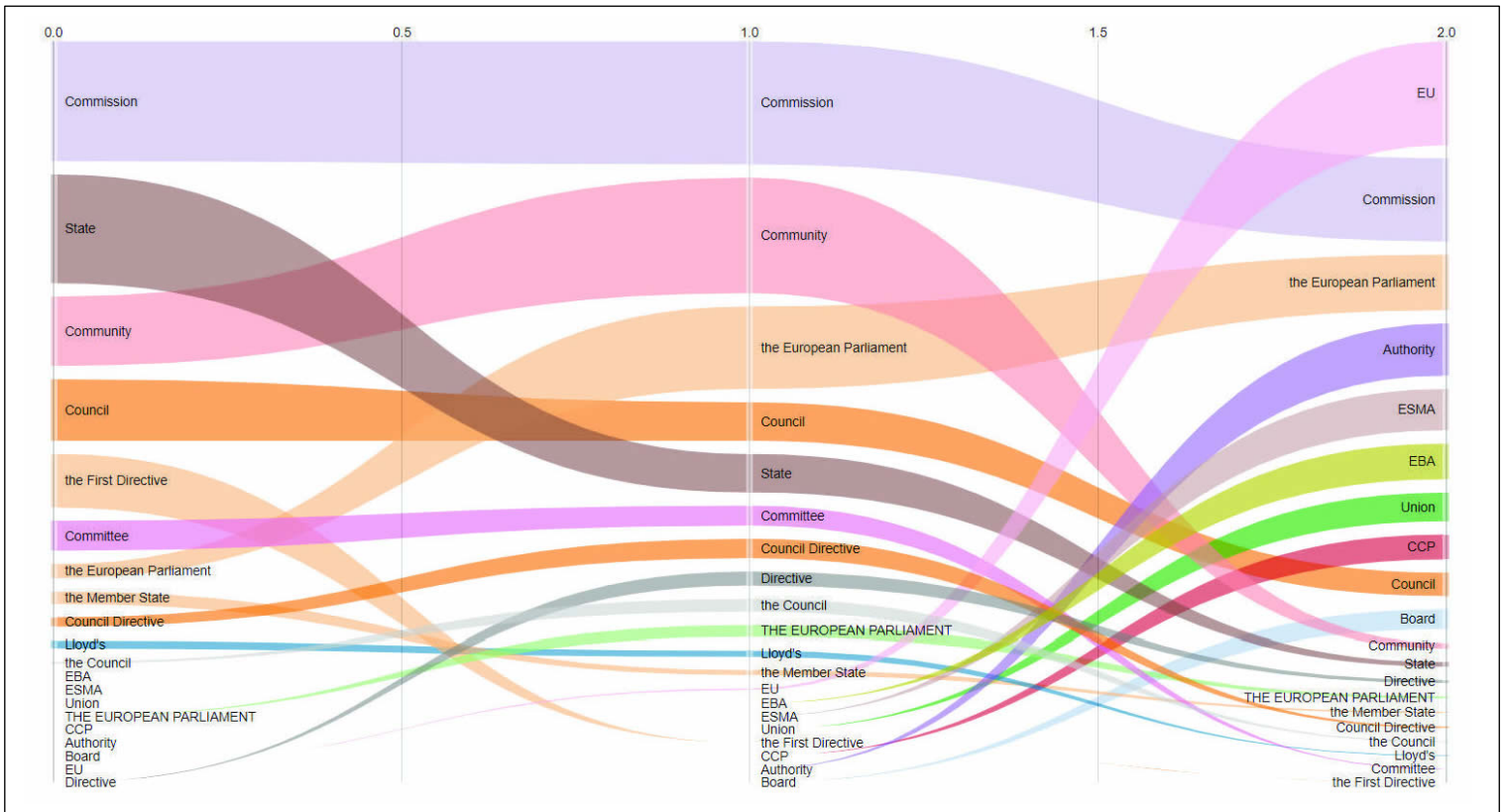


Figure 9: Organizations Mentioned Over Time (1964-2017).

On a normalized basis, 'Commission' was the primary organization mentioned over the first 2 periods. This changed in the third period as the top position was supplanted by 'EU'. From this analysis alone, we see that the 'EU' as an organization did not hold much weight compared to the 'Commission', the 'Community' or the 'European Parliament' in the previous periods. The sudden emergence of 'EU' supports the notion of more cohesion in the EU with regards to financial regulation and potentially an increasingly centralized focus at the EU level in setting regulatory standards. With legislation enacting various authorities and agencies, words such as 'Authority', 'ESMA', and 'EBA' are also now more prominent. However, these agencies do not supersede the overarching European legislative bodies.

## **Conclusion**

This paper provides a first cut into the impact that alternative regulatory structures have on financial market stability, economic growth, and financial inclusion. The research employs both an observational study similar to those in Epstein and O'Halloran (1999) as well as data science techniques akin to those employed in O'Halloran *et al.* (2016). We augment the previous research design and analytical tools to study the case of European financial institutions to examine the changes in the location and scope of regulatory authority overtime among the competent authorities.

Through the combination of traditional observational methods and computational data science techniques, the analysis uncovered changes in the location and scope of regulatory authority over time. Observational methods reflect a shift in delegation from Member States to the European Commission and to regulatory agencies in recent years. This supports the idea that regulatory authority is moving away from Member States to more centralized sources of decision-making. New machine learning and NLP techniques suggest that while various regulatory agencies have increased its position in financial regulation in recent years, the EU as a whole is more prominent in regulatory authority. Lastly, despite an influx of new financial regulation passed in recent years with a significant increase in delegation, the overall level of discretion provided in these regulations is tempered by the total number of constraints which have increased proportionally.

The data and computational techniques developed will have significant implications for policy makers and market participants alike. One of the challenges faced by both government and business is the lack of precise indicators to systematically measure regulatory policy across countries and over time. The methodology developed will offer the potential to predict the impact of alternative policy instruments and institutional arrangements on regulatory stringency, enforcement and compliance. The analysis will thereby help governments to better evaluate the effect of the policy choices they confront, as well as assist business communities to better understand the impact of those choices on the competitive environment they face.

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## Appendix A: Coding Rules for Discretion

### Introduction

This appendix details the coding rules used to compile the data sets in our study. As a general rule, each of the data sets was coded independently by two different researchers, and then checked over by a third. Upon final entry, each law was then checked a fourth and final time by the authors. In the field of financial regulation, particularly given that we examined regulation from 20xx to the present day, a number of initial pieces of regulation were revised and amended over this period. It is important to note, therefore, that each bill was coded as a stand-alone bill, where any provision that shifted policy away from the status quo was coded as delegation.

### *Major Provisions*

For the most part, when counting the number of major provisions in a particular piece of legislation, we followed these rules:

Bullets and paragraphs with an ordinal number (1, 2, 3, etc.) count as separate provisions.

--Sub-bullets do not count if they merely elaborate on the previous paragraph.

- Unbulleted paragraphs count as a separate provision if they are substantively distinct from the previous, bulleted paragraph.

- If a paragraph is followed by a colon and a list of elements, and if the elements of the list merely elaborate on the main point of the paragraph, then we count the paragraph and accompanying list as one provision.

- If a directive/regulation only contains amendments to former legislations, subsections numbered with 1), 2), 3), etc., count as separate provisions.

Here, each section (Article 1, Article 2, etc.) counts as one provision, unless it contained subsections (1, 2, 3, etc.), in which case each subsection counts as one provision.

EU Regulation/Directive	Provision numbering
Article 1:	
1.	1
2.	2
Article 2: (no subsections)	3
Article 3: (no subsections)	4 <b>Delegation</b>

Our definition of delegation is any major provision that gives a 1) member state, 2) agency or the 3) European Commission the authority to move policy away from the status quo. To maintain consistency across laws, we developed the following guidelines.

Examples of Delegation:

- The ability to permit valuation of assets or liabilities.
- The ability to place restrictions on specific instruments.
- The ability to draft standards.
- The ability to adopt standards.
- Supervisory Authority.
- The right to conclude cooperation agreements.
- The right to authorize an exchange or disclosure of information.
- The authority to waive certain provisions.
- The right to prohibit disbursement of assets.
- The right to exclude entities from the scope of provisions.
- The right to authorize derogations from conditions/obligations.
- The right to refuse cross-listing of securities in multiple jurisdictions.
- The right to suspend the listing of certain securities.

Some examples of what is not delegation:

- Authorizing appropriations or funds for a program (including the creation of a revolving fund: the revolving fund is simply the vehicle and does not constitute a new program).
- Requiring reports or publication of information.
- The hiring of staff or personnel.
- Asking competent authorities to consult across jurisdictions.
- Evaluations, recommendations, and assessments that do not directly alter policy.

### *Constraints*

The next step is to define how we coded constraints of administrative procedures associated with each law.

#### 1. Reporting Requirements

One of the central ways in which Parliament is able to keep tabs on what the bureaucracy is doing is through reporting requirements. Usually after – or even in some cases prior – to the agency's promulgating a rule or making a decision, they are to report to Parliament or the oversight committees as to the actions taken, or those that will be taken, and their proposed economic impact. Reporting requirements can be very detailed – often Parliament specifies exactly the type of information it wishes to consider – or can just require that the agency report to Parliament annually about its general activity.

## Examples

Directive 2014/91/EU of the European Parliament and of the Council of 23 July 2014 amending Directive 2009/65/EC on the coordination of laws, regulations and administrative provisions relating to undertakings for collective investment in transferable securities (UCITS) as regards depositary functions, remuneration policies and sanctions c):

- Provision 16: "By 18 March 2016, Member States shall notify the laws, regulations and administrative provisions transposing this Article, including any relevant criminal law provisions, to the Commission and ESMA".
- Provision 17: "Competent authorities shall inform ESMA of all administrative sanctions imposed but not published in accordance with point (c)..."

Directive 2005/68/EC of the European Parliament and of the Council of 16 November 2005 on reinsurance (OJ L 323, 9.12.2005, p. 1):

- Provision 111: "The Commission shall submit those reports to the Council, together with any appropriate proposals or recommendations."

## 2. Consultation Requirements

Sometimes Parliament requires that before an Commission, agency, or Member states promulgate any regulations it must consult with other agencies or Member states as well. In this case, the Commission, agency or Member States simply have to consult with a specified actor prior to making its final ruling. Other instances of this category arise when agencies must consult with affected private interests or with Parliament, cooperate with each other, or be assisted by other agencies before promulgating regulations.

## Examples

Directive 2007/44/EC of the European Parliament and of the Council of 5 September 2007 amending Council Directive 92/49/EEC and Directives 2002/83/EC, 2004/39/EC, 2005/68/EC and 2006/48/EC as regards procedural rules and evaluation criteria for the prudential assessment of acquisitions and increase of holdings in the financial sector:

- Provision 3: "The relevant competent authorities shall work in full consultations with each other when carrying out the assessment..."

Directive 2005/68/EC of the European Parliament and of the Council of 16 November 2005 on reinsurance (OJ L 323, 9.12.2005, p. 1):

- Provision 23: "The competent authorities of the other Member State involved shall be consulted prior to the granting of an authorisation to a reinsurance undertaking."



### 3. Rule-Making Requirements

The most common way for Parliament to limit the discretionary authority that an agency has in implementing policy is to specify detailed rules and procedures in the form of standards and criteria by which an agency must make a decision. Sometimes the agency is merely directed to regulate in the public interest. But more often than not, Parliament specifies in intricate detail what the agency can and cannot do, and how an agency can do what it does.

#### Example

Directive 2005/68/EC of the European Parliament and of the Council of 16 November 2005 on reinsurance:

- Provision 64: "Furthermore, the home Member State shall lay down more detailed rules setting the conditions for the use of amounts outstanding from a special purpose vehicle as assets covering technical provisions pursuant to this Article."

### 4. Exemptions

Here we coded whether a specific group or class of interests was exempted from the effects of a regulation, either permanently or for a given period of time. Usually, the content of the provision made it clear that an exemption was being offered.

#### Example

Council Directive 90/619/EEC of 8 November 1990 on the coordination of laws, regulations and administrative provisions relating to direct life assurance, laying down provisions to facilitate the effective exercise of freedom to provide services and amending Directive 79/267/EEC:

- Provision 6: "A Member State in which various territorial units have their own rules of law concerning contractual obligations shall not be bound to apply the provisions of this Directive to conflicts which arise between the laws of those units."

### 5. Legislative Action Required

Another constraint that limits the ability of executive agencies to alter policy is the requirement that Parliament must act prior to the agency's action becoming effective by passing a bill or resolution that approves the policy proposed by the agency. In these cases, the agency's decision does not constitute final policy action, but rather the final action is placed in the hands of Parliament. This category of constraint is more stringent than a legislative veto, which allows an agency's decision to take effect unless Parliament acts to stop it. Here, in order for the agency's decision to take effect at all, Parliament must first take some positive action, usually requiring at least a majority in each chamber.

### Example

Regulation (EU) No 1095/2010 of the European Parliament and of the Council of 24 November 2010 establishing a European Supervisory Authority (European Securities and Markets Authority), amending Decision No 716/2009/EC and repealing Commission Decision 2009/77/EC:

- Provision 37: "If either the European Parliament or the Council objects to a regulatory technical standard within the period referred to in paragraph 1, it shall not enter into force."

### 6. Executive Action Required

Another means of limiting arbitrary actions by agencies is to require that their rulings or decisions be approved by a separate agency or the president himself. This is less restrictive than requiring congressional action, since executive actors appointed by the same president may tend to have similar policy preferences, but it is also less costly from legislators' point of view. This category contained only provisions that required final agency actions to be approved by another executive branch actor to take effect; requirements that one executive branch actor merely consult with another before taking action were coded in the separate category of consultation requirements.

### 7. Legislative Veto

Parliament can always override the decisions taken by an agency by passing a law that makes null and void the agency's action. A legislative veto establishes a process that allows Parliament to overturn specific agency decisions through a resolution.

### Example

Regulation (EU) No 1095/2010 of the European Parliament and of the Council of 24 November 2010 establishing a European Supervisory Authority (European Securities and Markets Authority), amending Decision No 716/2009/EC and repealing Commission Decision 2009/77/EC:

- Provision 32: "The delegation of power referred to in Article 10 may be revoked at any time by the European Parliament or by the Council."

## 8. Appeals Procedures

All agency decisions are subject to judicial review and can be appealed by a person or group who can show that they are adversely affected by the ruling. Here, we coded for whether the act established explicit procedures by which an agency's decision could be appealed. This includes giving a group standing, expediting the review process, or defining in which court's jurisdiction a case will be heard. In case of the U.S., appeals procedures have become an effective way for environmental and civil rights groups to force effective change on a case-by-case basis, and by the 1970s most social policy contained rather detailed appeals procedure provisions.

### Example

Directive 2001/34/EC of the European Parliament and of the council of 28 May 2001 on the admission of securities to official stock exchange listing and on information to be published on those securities:

- Provision 34: "Failure to give a decision within the time limit specified in paragraph 2 shall be deemed a rejection of the application. Such rejection shall give rise to the right to apply to the courts provided for in paragraph 1."

## 9. Direct Oversight

All bureaucratic agencies are subject to oversight by congressional committees. But in certain cases, we find that Parliament takes the time to specify how agencies' actions will be overseen. These procedures are coded separately from other devices used to oversee agencies, such as reporting requirements or public hearings, because they entail a level of direct involvement by a third-party exterior to the agency's daily functioning and routines.

### Examples

Directive 94/19/EC of the European Parliament and of the Council of 30 May 1994 on deposit-guarantee schemes:

- Provision 25: "The amount referred to in paragraph 1 shall be reviewed periodically by the Commission at least once every five years."

Regulation (EU) No 600/2014 of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Regulation (EU) No 648/2012:

- Provision 18: "Before granting a waiver in accordance with paragraph 1, competent authorities shall notify ESMA and other competent authorities of the intended use of each individual waiver and provide an explanation regarding its functioning, including the details of the trading venue where the reference price is established as referred to in paragraph 1(a)."

## 10. Public Hearings

Public hearing is a normal element of rule making process in any case. But this category of constraints identifies those acts that specifically call for an agency to hold public hearings at certain times or under certain circumstances over and above the requirements of the general rule making process.

### Example

Regulation (EU) No 806/2014 of the European Parliament and of the Council of 15 July 2014 establishing uniform rules and a uniform procedure for the resolution of credit institutions and certain investment firms in the framework of a Single Resolution Mechanism and a Single Resolution Fund and amending Regulation (EU) No 1093/2010:

- Provision 258: "At the request of the European Parliament, the Chair shall participate in a hearing by the competent committee of the European Parliament on the performance of the resolution tasks by the Board. A hearing shall take place at least annually."

## **Appendix B: The List of 69 Regulations**

Below is the list of all financial regulations from 1964 to 2017. The text was sourced from the EUR-Lex website which is a database for texts produced by various institutions in the European Union. The main source of content comes from the Official Journal of the European Union. Texts are updated daily and can be accessed here: <https://eur-lex.europa.eu/homepage.html>. This is the sole source for data for this paper. No alternative forms of text were considered.

1. Council Directive 64/225/EEC of 25 February 1964 on the abolition of restrictions on freedom of establishment and freedom to provide services in respect of reinsurance and retrocession.
2. 64/300/EEC: Council Decision of 8 May 1964 on cooperation between the Central Banks of the Member States of the European Economic Community.
3. 71/142/EEC: Council Decision of 22 March 1971 on the strengthening of cooperation between the central banks of the Member States of the European Economic Community.
4. Council Directive 73/183/EEC of 28 June 1973 on the abolition of restrictions on freedom of establishment and freedom to provide services in respect of self-employed activities of banks and other financial institutions.
5. First Council Directive 73/239/EEC of 24 July 1973 on the coordination of laws, regulations and administrative provisions relating to the taking-up and pursuit of the business of direct insurance other than life assurance.
6. Council Directive 73/240/EEC of 24 July 1973 abolishing restrictions on freedom of establishment in the business of direct insurance other than life assurance.
7. Council Directive 76/580/EEC of 29 June 1976 amending Directive 73/239/EEC.
8. Council Directive 78/473/EEC of 30 May 1978 on the coordination of laws, regulations and administrative provisions relating to Community co-insurance.
9. First Council Directive 79/267/EEC of 5 March 1979 on the coordination of laws, regulations and administrative provisions relating to the taking up and pursuit of the business of direct life assurance.
10. Council Directive 84/641/EEC of 10 December 1984 amending, particularly as regards tourist assistance, the First Directive.

11. Council Directive 85/611/EEC of 20 December 1985 on the coordination of laws, regulations and administrative provisions relating to undertakings for collective investment in transferable securities.

12. Council Directive 87/344/EEC of 22 June 1987 on the coordination of laws, regulations and administrative provisions relating to legal expenses insurance.

13. Second Council Directive 88/357/EEC of 22 June 1988 on the coordination of laws, regulations and administrative provisions relating to direct insurance other than life assurance and laying down provisions to facilitate the effective exercise of freedom to provide services.

14. Council Directive 90/619/EEC of 8 November 1990 on the coordination of laws, regulations and administrative provisions relating to direct life assurance, laying down provisions to facilitate the effective exercise of freedom to provide services and amending Directive 79/267/EEC.

15. Council Directive 91/675/EEC of 19 December 1991 setting up an insurance committee.

16. Council Directive 92/49/EEC of 18 June 1992 on the coordination of laws, regulations and administrative provisions relating to direct insurance other than life assurance (third non-life insurance Directive).

17. Council Directive 92/96/EEC of 10 November 1992 on the coordination of laws, regulations and administrative provisions relating to direct life assurance and amending Directives 79/267/EEC and 90/619/EEC (third life assurance Directive).

18. Council Directive 93/6/EEC of 15 March 1993 on the capital adequacy of investment firms and credit institutions.

19. Directive 94/19/EC of the European Parliament and of the Council of 30 May 1994 on deposit-guarantee schemes.

20. European Parliament and Council Directive 95/26/EC of 29 June 1995 amending Directives 77/780/EEC and 89/646/EEC in the field of credit institutions, Directives 73/239/EEC and 92/49/EEC in the field of non-life insurance, Directives 79/267/EEC and 92/96/EEC in the field of life assurance, Directive 93/22/EEC in the field of investment firms and Directive 85/611/EEC in the field of undertakings for collective investment in transferable securities (Ucits), with a view to reinforcing prudential supervision.

21. Directive 98/78/EC of the European Parliament and of the Council of 27 October 1998 on the supplementary supervision of insurance undertakings in an insurance group.

22. Directive 2000/12/EC of the European Parliament and of the Council of 20 March 2000 relating to the taking up and pursuit of the business of credit institutions.

23. Directive 2000/64/EC of the European Parliament and of the Council of 7 November 2000 amending Council Directives 85/611/EEC, 92/49/EEC, 92/96/EEC and 93/22/EEC as regards exchange of information with third countries.

24. Directive 2001/17/EC of the European Parliament and of the Council of 19 March 2001 on the reorganisation and winding-up of insurance undertakings.

25. Directive 2001/24/EC of the European Parliament and of the Council of 4 April 2001 on the reorganisation and winding up of credit institutions.

26. Directive 2001/34/EC of the European Parliament and of the Council of 28 May 2001 on the admission of securities to official stock exchange listing and on information to be published on those securities.

27. Directive 2001/65/EC of the European Parliament and of the Council of 27 September 2001 amending Directives 78/660/EEC, 83/349/EEC and 86/635/EEC as regards the valuation rules for the annual and consolidated accounts of certain types of companies as well as of banks and other financial institutions.

28. Directive 2001/107/EC of the European Parliament and of the Council of 21 January 2002 amending Council Directive 85/611/EEC on the coordination of laws, regulations and administrative provisions relating to undertakings for collective investment in transferable securities (UCITS) with a view to regulating management companies and simplified prospectuses.

29. Directive 2001/108/EC of the European Parliament and of the Council of 21 January 2002 amending Council Directive 85/611/EEC on the coordination of laws, regulations and administrative provisions relating to undertakings for collective investment in transferable securities (UCITS), with regard to investments of UCITS ( )Directive 2001/108/EC of the European Parliament and of the Council of 21 January 2002 amending Council Directive 85/611/EEC on the coordination of laws, regulations and administrative provisions relating to undertakings for collective investment in transferable securities (UCITS), with regard to investments of UCITS.

30. Directive 2002/83/EC of the European Parliament and of the Council of 5 November 2002 concerning life assurance.

31. Directive 2002/87/EC of the European Parliament and of the Council of 16 December 2002 on the supplementary supervision of credit institutions, insurance undertakings and investment firms in a financial conglomerate and amending Council Directives 73/239/EEC, 79/267/EEC, 92/49/EEC, 92/96/EEC, 93/6/EEC and 93/22/EEC, and Directives 98/78/EC and 2000/12/EC of the European Parliament and of the Council.

32. Directive 2002/92/EC of the European Parliament and of the Council of 9 December 2002 on insurance mediation.

33. Directive 2003/41/EC of the European Parliament and of the Council of 3 June 2003 on the activities and supervision of institutions for occupational retirement provision.

34. Directive 2003/71/EC of the European Parliament and of the Council of 4 November 2003 on the prospectus to be published when securities are offered to the public or admitted to trading and amending Directive 2001/34/EC.

35. 2004/10/EC: Commission Decision of 5 November 2003 establishing the European Banking Committee.

36. Directive 2005/1/EC of the European Parliament and of the Council of 9 March 2005 amending Council Directives 73/239/EEC, 85/611/EEC, 91/675/EEC, 92/49/EEC and 93/6/EEC and Directives 94/19/EC, 98/78/EC, 2000/12/EC, 2001/34/EC, 2002/83/EC and 2002/87/EC in order to establish a new organisational structure for financial services committees.

37. Directive 2005/68/EC of the European Parliament and of the Council of 16 November 2005 on reinsurance.

38. Directive 2007/44/EC of the European Parliament and of the Council of 5 September 2007 amending Council Directive 92/49/EEC and Directives 2002/83/EC, 2004/39/EC, 2005/68/EC and 2006/48/EC as regards procedural rules and evaluation criteria for the prudential assessment of acquisitions and increase of holdings in the financial sector.

39. Directive 2008/36/EC of the European Parliament and of the Council of 11 March 2008 amending Council Directive 92/49/EEC on the coordination of laws, regulations and administrative provisions relating to direct insurance other than life assurance, as regards the implementing powers conferred on the Commission.

40. Directive 2009/65/EC of the European Parliament and of the Council of 13 July 2009 on the coordination of laws, regulations and administrative provisions relating to undertakings for collective investment in transferable securities (UCITS).

41. Directive 2009/138/EC of the European Parliament and of the Council of 25 November 2009 on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II).



42. Regulation (EC) No 1060/2009 of the European Parliament and of the Council of 16 September 2009 on credit rating agencies.

43. Directive 2010/78/EU of the European Parliament and of the Council of 24 November 2010 amending Directives 98/26/EC, 2002/87/EC, 2003/6/EC, 2003/41/EC, 2003/71/EC, 2004/39/EC, 2004/109/EC, 2005/60/EC, 2006/48/EC, 2006/49/EC and 2009/65/EC in respect of the powers of the European Supervisory Authority (European Banking Authority), the European Supervisory Authority (European Insurance and Occupational Pensions Authority) and the European Supervisory Authority (European Securities and Markets Authority).

44. Corrigendum to Directive 2010/78/EU of the European Parliament and of the Council of 24 November 2010 amending Directives 98/26/EC, 2002/87/EC, 2003/6/EC, 2003/41/EC, 2003/71/EC, 2004/39/EC, 2004/109/EC, 2005/60/EC, 2006/48/EC, 2006/49/EC and 2009/65/EC in respect of the powers of the European Supervisory Authority (European Banking Authority), the European Supervisory Authority (European Insurance and Occupational Pensions Authority) and the European Supervisory Authority (European Securities and Markets Authority).

45. Regulation (EU) No 1092/2010 of the European Parliament and of the Council of 24 November 2010 on European Union macro-prudential oversight of the financial system and establishing a European Systemic Risk Board.

46. Regulation (EU) No 1093/2010 of the European Parliament and of the Council of 24 November 2010 establishing a European Supervisory Authority (European Banking Authority), amending Decision No 716/2009/EC and repealing Commission Decision 2009/78/EC.

47. Regulation (EU) No 1094/2010 of the European Parliament and of the Council of 24 November 2010 establishing a European Supervisory Authority (European Insurance and Occupational Pensions Authority), amending Decision No 716/2009/EC and repealing Commission Decision 2009/79/EC.

48. Regulation (EU) No 1095/2010 of the European Parliament and of the Council of 24 November 2010 establishing a European Supervisory Authority (European Securities and Markets Authority), amending Decision No 716/2009/EC and repealing Commission Decision 2009/77/EC.

49. Council Regulation (EU) No 1096/2010 of 17 November 2010 conferring specific tasks upon the European Central Bank concerning the functioning of the European Systemic Risk Board.

50. Directive 2011/61/EU of the European Parliament and of the Council of 8 June 2011 on Alternative Investment Fund Managers and amending Directives 2003/41/EC and 2009/65/EC and Regulations (EC) No 1060/2009 and (EU) No 1095/2010.

51. Directive 2011/89/EU of the European Parliament and of the Council of 16 November 2011 amending Directives 98/78/EC, 2002/87/EC, 2006/48/EC and 2009/138/EC as regards the supplementary supervision of financial entities in a financial conglomerate.

52. Directive 2012/23/EU of the European Parliament and of the Council of 12 September 2012 amending Directive 2009/138/EC (Solvency II) as regards the date for its transposition and the date of its application, and the date of repeal of certain Directives.

53. Regulation (EU) No 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories.

54. Council Directive 2013/23/EU of 13 May 2013 adapting certain directives in the field of financial services, by reason of the accession of the Republic of Croatia.

55. Directive 2013/36/EU of the European Parliament and of the Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms, amending Directive 2002/87/EC and repealing Directives 2006/48/EC and 2006/49/EC.

56. Directive 2013/58/EU of the European Parliament and of the Council of 11 December 2013 amending Directive 2009/138/EC (Solvency II) as regards the date for its transposition and the date of its application, and the date of repeal of certain Directives (Solvency I).

57. Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012.

58. Directive 2014/49/EU of the European Parliament and of the Council of 16 April 2014 on deposit guarantee schemes.

59. Directive 2014/51/EU of the European Parliament and of the Council of 16 April 2014 amending Directives 2003/71/EC and 2009/138/EC and Regulations (EC) No 1060/2009, (EU) No 1094/2010 and (EU) No 1095/2010 in respect of the powers of the European Supervisory Authority (European Insurance and Occupational Pensions Authority) and the European Supervisory Authority (European Securities and Markets Authority).

60. Directive 2014/59/EU of the European Parliament and of the Council of 15 May 2014 establishing a framework for the recovery and resolution of credit institutions and investment firms and amending Council Directive 82/891/EEC, and Directives 2001/24/EC, 2002/47/EC, 2004/25/EC, 2005/56/EC, 2007/36/EC, 2011/35/EU, 2012/30/EU and 2013/36/EU, and Regulations (EU) No 1093/2010 and (EU) No 648/2012, of the European Parliament and of the Council.

61. Directive 2014/65/EU of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Directive 2002/92/EC and Directive 2011/61/EU.

62. Directive 2014/91/EU of the European Parliament and of the Council of 23 July 2014 amending Directive 2009/65/EC on the coordination of laws, regulations and administrative provisions relating to undertakings for collective investment in transferable securities (UCITS) as regards depositary functions, remuneration policies and sanctions.

63. Regulation (EU) No 600/2014 of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Regulation (EU) No 648/2012.

64. Regulation (EU) No 806/2014 of the European Parliament and of the Council of 15 July 2014 establishing uniform rules and a uniform procedure for the resolution of credit institutions and certain investment firms in the framework of a Single Resolution Mechanism and a Single Resolution Fund and amending Regulation (EU) No 1093/2010.

65. Regulation (EU) 2015/760 of the European Parliament and of the Council of 29 April 2015 on European long-term investment funds.

66. Directive (EU) 2016/2341 of the European Parliament and of the Council of 14 December 2016 on the activities and supervision of institutions for occupational retirement provision (IORPs).

67. Directive (EU) 2016/97 of the European Parliament and of the Council of 20 January 2016 on insurance distribution (recast).

68. Regulation (EU) 2017/1131 of the European Parliament and of the Council of 14 June 2017 on money market funds.

69. Regulation (EU) 2017/2402 of the European Parliament and of the Council of 12 December 2017 laying down a general framework for securitisation and creating a specific framework for simple, transparent and standardised securitisation, and amending Directives 2009/65/EC, 2009/138/EC and 2011/61/EU and Regulations (EC) No 1060/2009 and (EU) No 648/2012.

## **Appendix C: NLP Cortext Steps-by-Step Instructions**

### **Setup: Log into Cortext:**

- 1 - All text files should be saved into a .zip file
- 2 - Create a new project – name the project

### **1. Upload the zip files:**

- a) Select “upload a new corpus”
- b) Add the zip file to drop area, then click “Accept & Upload”
- c) In “Script Parameters”, select the following:
  1. Type of Data: “database”
  2. Corpus Format: “txt”
  3. Should the paragraph structure of your original files be respected: “yes”
  4. Create one separate document per paragraph: “no”
  5. Lexis Nexis data: “no”
  6. Ignore entries with incorrectly formatted time steps: “yes”
- d) Click “start script”.

### **2. Upload the csv file of yearlist:**

- a) Select “upload a new corpus”
- b) Add the csv file to drop area, then click “Accept & Upload”
- c) In “Script Parameters”, select the following:
  1. Type of Data: “term list”
- d) Click “start script”.

### **Attention**

- a. This .csv file must have 2 columns: 1. File name; 2. Year (the year of the legislation)
- b. Save file as UTF8 format
- c. Sample looks like.

### 3. Term Extraction

- a) Select “start a new script” – scroll down to “Terms Extraction”
- b) Select the appropriate “corpus”
- c) In “Script Parameters”, select the following:
  1. Textual Fields: “text”
  2. Minimum Frequency: “3”
  3. List length: “100”
  4. Language: “en”
  5. Monograms are forbidden: “yes”
  6. Maximal length (max number of words): “3”
  7. Lexical extraction advanced settings: “no”
  8. Grammatical criterion: “noun phrase”
  9. Optionally you can name the new indexation that will be generated: “ ”
  10. Number of time slices: “1”
  11. Time slices distribution: “homogeneous”
- d) Click “start script”

### 4. Corpus list indexer:

- a) Select “start a new script” – scroll down to “Corpus list indexer”
- b) Select the appropriate “corpus”
- c) In “Script Parameters”, select the following:
  1. Field: “filename”
  2. Define a custom list of entities: “no”
  3. Add a dictionary of equivalent strings: “yes”
  4. Enter a dictionary with equivalences – select the appropriate file
  5. Add a null label to every article with no matching tag: “no”
  6. Count only one occurrence per article during indexation: “no”
  7. Optionally you can name the new indexation that will be generated: “ISIpupdate”
- d) Click “start script”

### 5. Demography:

- a) Select “start a new script” – scroll down to “Demography”
- b) Select the appropriate “corpus”
- c) In “Script Parameters”, select the following:
  1. Number of items to consider: “20”
  2. Which variable(s): “Terms”
  3. Demography Parameters Advanced Settings: “no”
- d) Click “start script”

## 6. Network mapping:

- a) Select “start a new script” – scroll down to “Network mapping”
- b) Select the appropriate “corpus”
- c) In “Script Parameters”, select the following:
  1. First Field: “Terms”
  2. Second Field: “Terms”
  3. Number of nodes: “100”
  4. Nodes advanced settings: “no”
  5. Automatically define the Proximity Measure: “yes”
  6. Edges filtering advanced settings: “no”
  7. Edges advanced settings: “no”
  8. Number of time slices: “1”
  9. Time slices distribution: “homogeneous”
  10. Overlapping periods: “no”
  11. Sequencing: “snapshot”
  12. Community detection algorithm: “louvain”
  13. Historical map: “no”
  14. Project records onto clusters: “yes”
  15. Modify the name of the projected cluster: “ ”
  16. Assign an unique cluster to each record (best match): “no”
  17. Penalize large clusters when computing projections: “no”
  18. Add information from a 3<sup>rd</sup> variable to tag clusters or produce a heatmap: “no”
  19. Network analysis advanced settings: “no”
- d) Click “start script”

## 7. Epic Epochs:

- a) Select “start a new script” – scroll down to “Epic Epochs”
- b) Select the appropriate “corpus”
- c) In “Script Parameters”, select the following:
  1. Field: Terms
  2. Size of the Hierarchy: “10”
  3. Normalization of frequency count: “no”
  4. Number of time slices: “3”
  5. Time slices distribution: “regular”
  6. Overlapping periods: “no”
- d) Click “start script”