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Inferring Mechanisms for Global Constitutional Progress

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Abstract

Constitutions help define domestic political orders, but are known to be influenced by two international mechanisms: one that reflects global temporal trends in legal development, and another that reflects international network dynamics such as shared colonial history. We introduce the provision space; the growing set of all legal provisions existing in the world’s constitutions over time. Through this we uncover a third mechanism influencing constitutional change: hierarchical dependencies between legal provisions, under which the adoption of essential, fundamental provisions precedes more advanced provisions. This third mechanism appears to play an especially important role in the emergence of new political rights, and may therefore provide a useful roadmap for advocates of those rights. We further characterise each legal provision in terms of the strength of these mechanisms.

1 Introduction

Constitutions detail literally what constitutes an entity. In the case of nation-states, formal constitutions describe the fundamental principles by which the state will be governed, the political and legal state institutions, the powers, procedures, and duties of those institutions, and the rights and responsibilities of individuals. The roles of the constitution are several; as a ‘rule book’ for how the country should operate, as a reflection of the values and character of that country as observed by the rest of the world as well as a means for accountability through international law [1].

There is great diversity in the processes used to create and amend these documents [2]. In some cases, the same document is slowly refined over many decades or even centuries. In others, constitutions are dissolved and replaced with new documents as part of a broader political transition. This may coincide with the installation of a new political regime, particularly when the constitution itself declares amendment to be unconstitutional. The processes for constitutional creation and evolution take many forms, including executive action, constituent assembly, referendum, or some combination of these [3]. The constitution writing process generally involves some degree of compromise and coordination between elected representatives, institutions, and/or citizens, such as the case of Iceland’s 2008 constitutional reform [4]. This diversity in origin persists in present day constitutional documents; in a small number of countries the constitution is partially unwritten, and legal rules and principles are derived in part from judicial precedent.

In addition to the influence of these domestic processes, the present-day versions of formal constitutions also represent the result of long-term and complex international interdependencies. Affiliation or potential affiliation with a formal bloc, union, international organization, or informal community of states – such as the European Union or United Nations – can influence constitution writing. Likewise, wartime turbulence and post-war occupation and reconstruction can result in dramatic changes to formal constitutions [5]. Ongoing international events, trends, and processes can influence the content and style of constitutions being drafted or modified at a given time. Changing social and legal norms, cultural trends, and new empirical evidence bases likely yield profound and enduring influences on constitution drafting, whereas coordinated political movements – such as decolonisation – may give rise to a less sustained influence. Seven distinct “waves” of constitutional activity have been identified [2], including, during the 20th century, in the aftermath of the First World War, the Second World War, decolonisation beginning with the Indian subcontinent and culminating in the 1960s, the fall of Southern European dictatorships

in the 1970s, and finally the fall of the Soviet Union. Throughout this period and into the future, globalization is also likely to provide pressure on countries to adopt the legal norms of influential and powerful neighbors.

Ongoing pressures for constitutions to evolve are nonetheless tempered by historical legacy and the often cumbersome processes for constitutional amendment. Many constitutions belonging to former colonies were based on or were influenced by the laws and constitutions of former Imperial powers [6, 7]. The colonial relationship may also continue to exert influence after independence [8]. Extant constitutions also influence new constitutions by forming a baseline relative to which changes are made or new provisions added. It is an open question as to whether concerted global policy efforts by international bodies such as the UN e.g. the Convention on the Rights of the Child [9], can affect these processes in a durable way. This combination of interacting influences between a large set of actors with a series of abrupt perturbations and trends acting at different time-scales are typical of a complex system [10].

Comparative law is the study of differing national legal systems. This vast literature has yielded several classifications of legal systems such as Arminjon et al [11], La Porta et al. [12] and Zweigert et al [13], and adjudicating between those categorizations is beyond the scope of this work. These classifications are based largely on qualitative assessments focusing on religion, national history, and differing applications of common law and civil law. The application of computational techniques to constitutional documents and the historical records of their changes provide an attractive alternative toolset with which to systematically analyze and measure the dynamics of global constitutionalism.

Our work uses a range of quantitative techniques from the field of computational social science to analyse the content and structure of national constitutions. Our focus is on public law, which governs relations between persons and the state, and not on private law (such as contract law), which governs relations between persons. Computational social science is now a well-developed field in which computational methods (and particularly those of network science [14]) are applied to analyze social systems with numerable and diverse applications [15].

The contributions of this work are as follows. Firstly we introduce a new mechanism by which provisions are introduced into a growing provision space of legal rights that are included in constitutional documents. We identify hierarchical dependencies between provisions, under which related provisions are adopted in a natural sequential order. Secondly, we empirically quantify the well understood phenomena of horizontal influence between countries (particularly along former Imperial relations) as well as temporal trends in constitutional development. We are able to confirm, using computational techniques, theoretical results from comparative law concerning families of legal systems and also a novel classification of provisions in terms of the relative strengths of competing these effects.

Although the use of computational tools is relatively new in this literature, it is not without precedent. In [16], the authors analysed the presence or absence of social rights provisions over a 60-year period. They used this to classify countries on an ideological scale with a libertarian, common law nature at one extreme and a more statist nature at the other. Later work [17] found evidence that the adoption of social rights is influenced by former colonizers, other countries with the same legal system and the same dominant foreign aid donor. Melton et al. [18] investigated the interpretability of national constitutions and found that textual features such as sentence length and the Flesch index measure of complexity were more important than contextual factors such as the geographical region and applicability of common law. More recent work has used automatic content analysis and topic modeling [19, 20] to classify and assess formal constitutions, although this work has examined only the preambles (or introductions) to these documents rather than the full texts. Rockmore et al analysed the diffusion of legal concepts between constitutions over time using a biological framework in which some countries' constitutions inherit from one another [21]. It was found that several distinct epochs of cultural evolution exist and while most constitutions are only influential for a short period, several have a sustained influence.

Henceforth, we consider two different data sets: the current text of the constitutions of 194 nation-states and expert labeled provisions within them (**dataset I**); the historical timeline of amendments and new writing events to such texts along with the presence or absence of 234 constitutional provisions that address specific issues or rights in these historical documents (**dataset II**).

2 Methods

2.1 Temporal Dynamics

Methods: Temporal Dynamics We seek to characterise the temporal dynamics of constitutional development with a view to uncovering the influence of time on which provisions are included in a constitution. We begin by introducing the concept of a provision space in analogy with the product space [22], by which a country may only produce complex goods by first producing other related goods of incrementally increasing complexity. We define the provision space as the set of provisions included across all national constitutions in a given year. Formally the provision space at time t , $\rho(t)$ depends on the provisions of each of the $n^c(t)$ countries in existence in year t , each of which is given by $n^c(t)$ as

$$\rho(t) = \{\rho(t)^1 \cup \rho(t)^2 \dots \cup \rho(t)^{n^c(t)}\} \quad (1)$$

Henceforth we consider only 234 provisions from the survey undertaken in [23] with a binary yes/no answer (see SI Table 10 for a full list) (dataset II). In figure (1) we plot the growth of the provision space over time as new provisions, representing legal concepts and rights, are introduced and first adopted. We see a clear increasing, although not strictly monotonic, trend. We also note the trend for increasing numbers of new countries over time. Periods of particularly rapid growth arise in the provision space, often coinciding with significant events of constitutional history such as World War I/II. However we also note the opposite situation: rapid growth in the number of constitutions during periods of geo-political change but without any growth in the provision space e.g. African decolonisation in the period 1960-70.

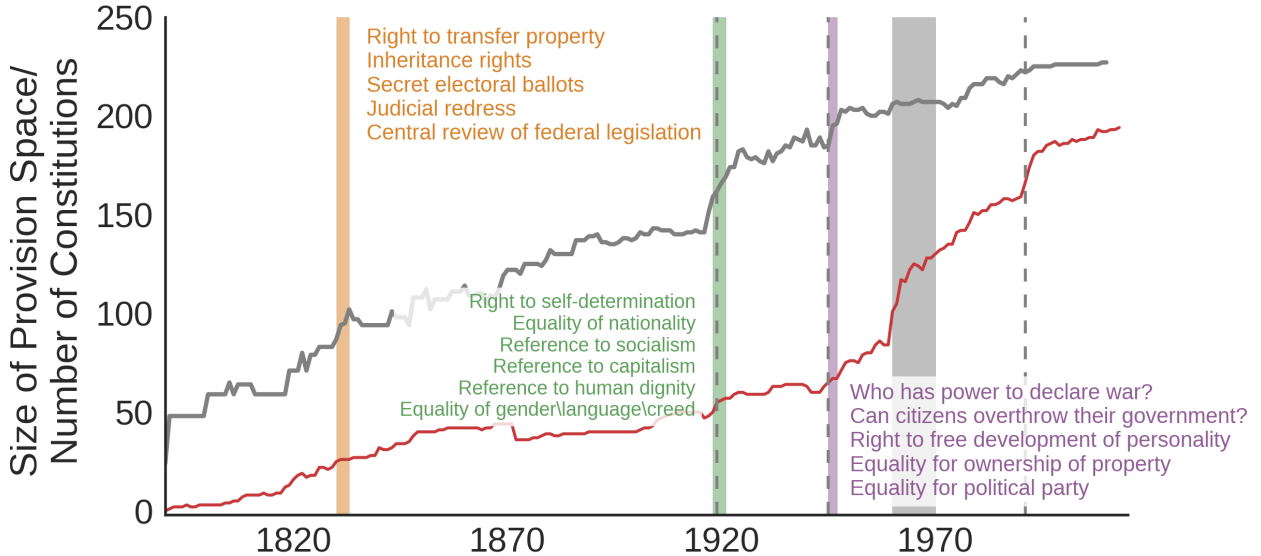


Figure 1: The size of the provision space over time (red line) compared to the growth in the number of countries (grey line). The introduction of specific provisions are highlighted.

2.2 Provision Co-Occurrence and Hierarchy

Next we consider dependencies between provisions to see if the adoption of one co-occurs or is more likely to be adopted with respect to another. We begin by focusing on constitutional provisions relating to young people and children. We identify the 9 provisions most clearly affecting children and young people; Access to higher education, Guarantee of rights of children, Limits on child employment, Free education, General mention of education, Freedom from parentage discrimination, Freedom from age discrimination, Financial support for children/orphans and Special status to juveniles in court. We consider the provision that is most frequently co-occurring with each of these child specific provisions within the set of current constitutions (Table 1). Most of these relations are intuitive; for example limiting the employment of children is associated with the right to join a trade union. Intuitively, it follows that to consider the protection of children from work, adults should also be protected from exploitative employment.

Child Provision	Top Co-occurring Provision
Access to higher education	Right to join trade unions
Privileges for juveniles in criminal process	Protection from ex post facto laws
Compulsory education	Free education
Free education	Protection of environment
Limits in the employment of children	Right to join trade unions
Equality regardless of parentage	General guarantee of equality
Right to found a family	General guarantee of equality
State support for children	State support for the disabled
Rights of children guaranteed	General guarantee of equality

The relationship between employment protection laws for adults and children hints at the presence of hierarchical dependencies within the provisions. Such a hierarchy is intuitively appealing; a fledgling state will set out rules for the basic functioning of the state through structural provisions before addressing other issues as the state matures. In addition, legal activists often use the strategy of “norm grafting” to advocate for the adopting of new rights by associating them with existing rights [24].

We explore possible hierarchical structure by constructing a directed network between provisions, such that an edge from i to j is weighted by the number of countries for which i has been adopted before j . From this we find the Minimal Violation Ranking; the ranking most consistent with this network as in [25]. We find strong evidence that the provisions represent a hierarchical structure with 24% of edges being violated (50% represents ‘no better than random’, see SI). This is consistent with a ‘rights-creep’ [16] under which rights are increasingly likely to be adopted, and in the case of younger states, increasingly likely to be adopted at their inception. This is supported by the increasing mutual similarity over time in provisions adopted (see S27 in SI and the fact that provisions are nearly 3 times more likely to be adopted when a country’s constitution is first written than to be inserted by amendment. The imitation evident in the text of Imperial powers and colonies along with the affect of global policy efforts support this (see next section).

The provision space is, by definition, a fluid set of rights and concepts that grows as the result of many societal and global level processes. These include new evidence bases, technological advances and continued advocacy on behalf of marginalised groups which can account for provisions such as protection of the environment, the right to privacy and protection of children respectively. Therefore, by definition the provision space contains both very mature provisions that are accepted as building blocks of a constitution as well as very young and potentially controversial concepts. Thus the position of a provision in the hierarchy is somewhat determined by the year in which the provision first entered the provision space (Spearman $(r,p)=(0.69, < 10^{-32})$).

Specific examples of provisions related to work and education are visualised in Fig 2. We see that while a general reference to education is fundamental to constitutions (appearing at 8th position in the ranking), explicit mention of equal access to education is adopted much later (193rd). Likewise, the right to form trade unions is a foundational provision that precedes more specific labor rights such as equal pay for equal work and the right to a safe working environment. This latent structure suggests that efforts to impose emerging rights on young states will be more fruitful if an incremental approach is used.

2.3 Constitutional Similarity Network

It is well understood that constitutions of newly independent states typically inherit from extant constitutions and particularly from those of former colonial powers. In order to illuminate the effect of this mechanism we construct a document similarity network in which countries are nodes that are linked by edges determined by the similarity of their text as measured by the Jaccard similarity. Here we consider the entire constitutional text, including text which may not be attributable to a specific subject e.g. a preamble. We find strong text similarity values between the constitutions of countries with shared Imperial histories despite considerable diversity in terms of word length, time of writing and other characteristics. There are several possible explanations for this similarity, it could be attributed to wholesale inheritance of text at the moment of independence or an influence that persists after independence due to academic and immigrant links between countries and their former Imperial powers. More simply, it may be a byproduct of the decision to include the same provisions, with the exact wording being largely a function of this choice. However, we find low similarity values between the language dedicated to the same provision in different constitutions. Further, we find only an intermediate correlation between the similarity matrices based on full constitutional text on one hand and the concatenation of the all provisions on the other (Pearson $r=0.39, p < 10^{-12}$). This suggests that the word choice similarity is driven by both similarity within non-

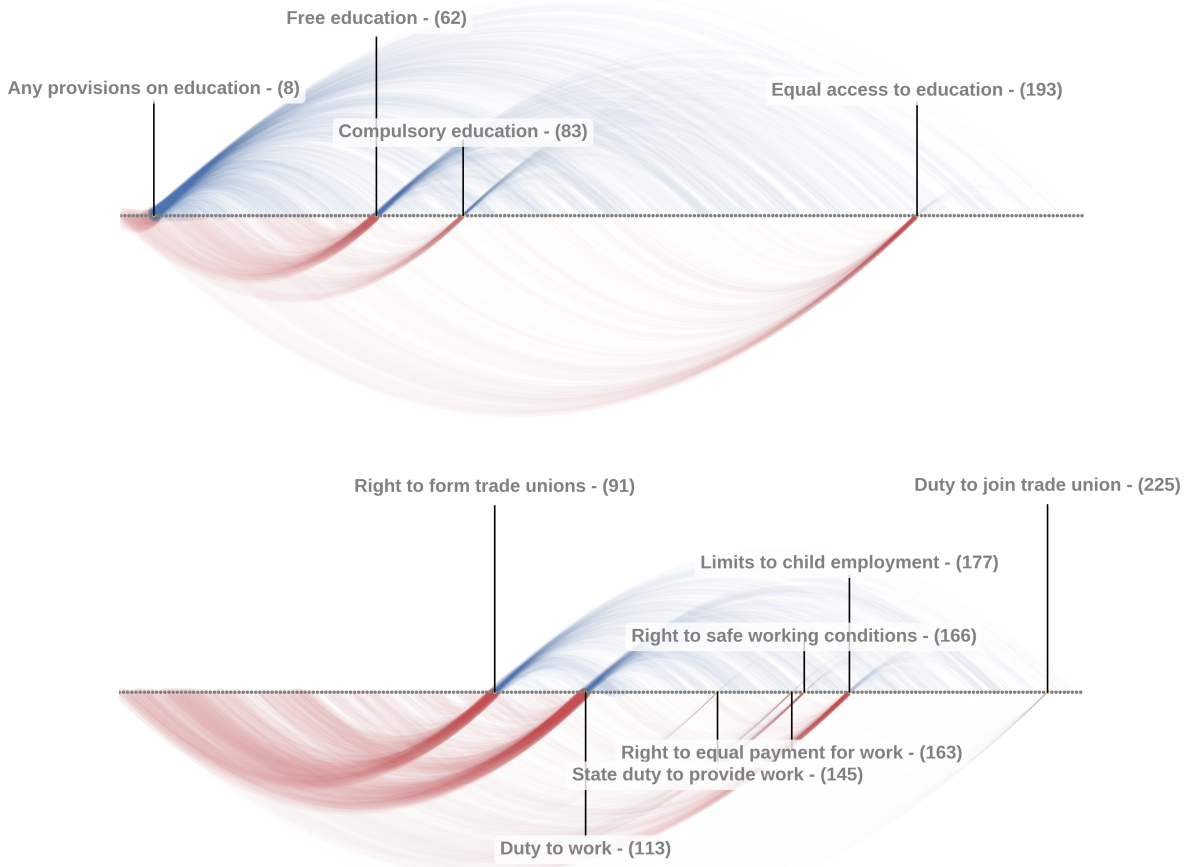


Figure 2: A representation of the hierarchical dependencies of provisions based on the sequential adoption by all countries over time. Provisions on the left are adopted before provisions to the right. Provisions related to (a) education and (b) work are labeled with their numerical position in the hierarchy (out of 234) and their connections to provisions below them (blue) and above them (red) in the hierarchy. Provisions at the top of the hierarchy will have more blue edges than red and vice versa for those at the bottom of the hierarchy.

provisional content and similar wording between different provisions. Upon the application of network community detection, the network partitions into clusters of mutually similar countries. 4 clusters emerge, the membership of which is listed in full in the SI.

We note that the clusters reveal consistency with historical trends and some qualitative characterizations of legal system type. One cluster contains the majority of former French colonial countries along with France itself. The former British and Spanish empires along with the UK and Spain themselves separate into distinct clusters. The final cluster does not reveal the same clear historical relation; however, we note that these countries include the majority of former members of the Soviet Union along with Russia itself. Another clear component of this cluster is Middle Eastern, especially Persian Gulf countries. The final component are Scandinavian countries. We note that this measure produces some cluster memberships that are not immediately intuitive e.g. Greece and Germany associated in the Iberian cluster, however there is remarkable explanatory power for a simple text similarity measure. We emphasise that the purpose is to uncover macroscopic structure in a robust manner, rather than derive a fully consistent set of individual dyadic relations between countries.

We also find consistencies in the timeline of constitutional amendment activity broken down by cluster using historical data from dataset II based on clusters described above (Fig 4). Some common features are shared between each cluster; such as a spike in activity following World Wars and the collapse of the Soviet Union. Remarkably, significant coordination is observed between clusters despite limited geographic proximity or obvious political similarity. A simple pairwise correlation over time confirms this; with statistically significant correlation values in the range (0.45-0.68), more details in the SI.

In order to quantify the correspondence between this empirical structure and theoretical classifications of legal

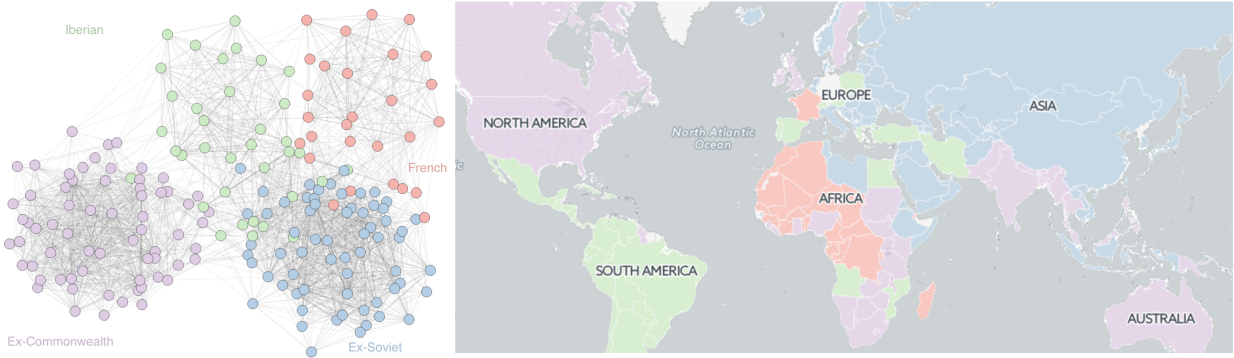


Figure 3: Clusters derived from constitutional similarity network (a) as a geographical map (b) as a network

systems, we analyze the clusters using a series of multinomial logit models in which the cluster ID is the dependent variable. The clusters appear to correlate well with the legal system types identified by [12]. They divide legal system into 5 categories: UK (which is correlated with our Commonwealth cluster), French (our Francophone cluster), Spanish (our Iberian cluster), former Socialist (our Soviet Cluster), and Scandinavian (our Soviet Cluster). A model that includes only the La Porta classifications yields an expected percent correctly predicted (ePCP) of 58.48%, so these data incorrectly predict many of our results. Likewise, a model that includes only indicators of former colonial powers, using data from [26], has an ePCP of 65.01%. A model that includes both sets of variables yields an ePCP of 76.24%, which suggests that colonial history and legal system type correctly predict the word choice of constitutional texts, but nonetheless also suggests that other factors may play important roles in influencing such texts.

We now address the question of whether this inheritance of constitutional language generally implies inheritance of the same individual provisions as are present in a parent constitution. We compare text similarity and provisional similarity as follows; for each constitution we define a constitutional provisional fingerprint, a binary valued vector of length $n_{provisions}$ indicating the presence or absence of a provision based on human coding. The provisional similarity between two countries is computed as the cosine distance between their provisional fingerprints, the text similarity is defined as before. For each country we measure the textual and provisional similarity of the remaining $n_{countries}-1=193$. That is for each country i we have a set of textual similarities and provisional similarities. From these two measures of similarity, we construct two country rankings; from most similar to least similar. Using the Spearman rank correlation coefficient we derive a value in the range $[-1,1]$ that describes how these rankings compare. Values close to one suggest that the constitutions that have the most similar text content also have similar provisions (and vice versa) as would be expected if constitutions were perfectly inherited with no new provisions inserted or deleted. Surprisingly, we find low correlations between these two rankings; $\langle \rho \rangle = 0.227$ ($\sigma = 0.146$). Correlating the raw numerical values rather than ranks using a Pearson correlation yields similar results with $\langle \rho \rangle = 0.257$ ($\sigma = 0.149$). A final examination of provision clusters finds little correspondence between similar provisions and country clusters (see SI S14-16).

These findings suggest that constitutions do not inherit perfectly; preserving both wording and substantive content. While the similarities in wording are consistent in terms of colonial history and geography, these findings suggest changes to the individual provisions despite imitation of wording. In addition we note that when countries first create a constitution there is a strong tendency to add provisions across all colonial based clusters (see SI S20). This suggests that other contextual factors, exogenous to the precedent or influence of other countries with shared history or legal system, encourage the adoption of provisions in new constitutions.

2.4 Disentangling Global and Network Effects

The results above have shown that strong coordination occurs between countries with shared colonial history and legal systems, which we refer to as ‘network effects’, which manifest in word choice and provisional topics. On the other hand we see strong temporal trends driven by significant historical events and policy efforts leading to correlated global behaviour independent from network structure.

Having found coordination between clusters, we investigate correlated temporal behaviours within provisions (Fig 5b). Our dataset of provisional adoption of countries suffers from a changing denominator; new constitutions

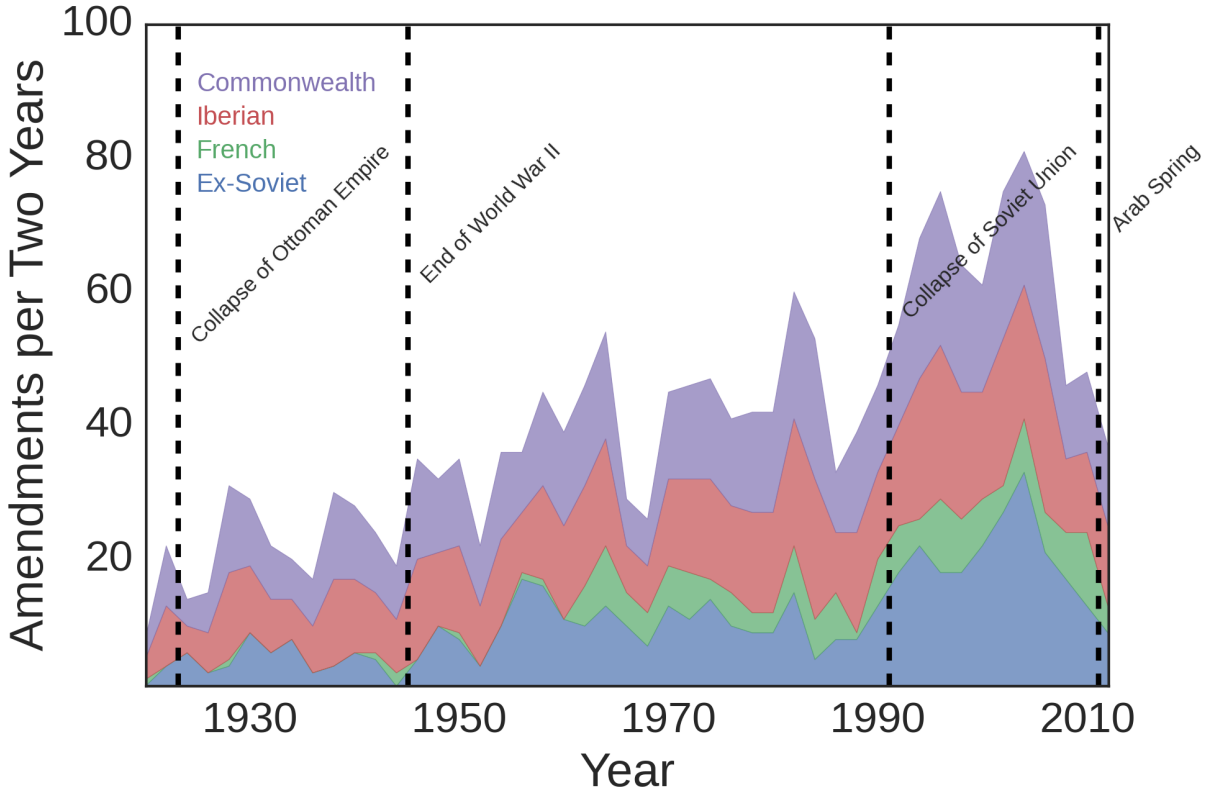


Figure 4: Timeline of constitutional amendment activity over time broken down by language based cluster

enter when a country achieves independence and may leave for several reasons; the country may simply no longer exist due to annexation or unification or the constitution may be suspended for example during a temporary period of military rule. With this variability in mind, henceforth we consider the proportion of constitutions in existence which include each provision over time. We perform a clustering of provisions based on a dimensionality reduction on the yearly time series of proportional adoption of each provision (see S21-26 in SI for more details).

Although these provisions are not arranged in topics or a hierarchy, we can extract some themes by inspection of the provision labels (Fig 5b). Cluster 1 mostly describes social rights of citizens and increases steadily over time. Cluster 2 also describes social rights as well as religion and privacy and is distinguished from the other clusters by a relatively high and constant adoption from the early 20th century. Cluster 3 describes legal obligations of the state and enjoys a peak around 1945. All clusters are characterized by an increase and convergence over time with the exception of cluster 4 which contains a few obscure and sparsely adopted provisions including the right to bear arms and same-sex marriage (the full list is found in SI. Each component is distinguished by behaviour in specific periods corresponding to World War II and the collapse of the Soviet Union. The trend for convergence and increasing adoption is observed not only across the components found above, but across the set of constitutions as a whole (see SI S17).

Having demonstrated that both network and temporal effects are significant, we next quantify the effects of each on the adoption of individual provisions. We consider each provision in dataset II and compare the probability of two countries co-adopting each provision, under the condition that they belong to the same cluster based on word choice identified above (manifesting network effects) and the probability of coadoption in the same year (manifesting global temporal effects).

If the adoption of a provision is largely determined by colonial history and legal system, the probability of coadoption conditioned on cluster would be relatively high. Conversely, if the adoption of a provision is influenced by time-varying trends and social norms, then the probability of coadoption by year would be higher. These two effects are intuitively far from independent; countries sharing colonial history may well undergo constitutional

amendment at the same time e.g. a coordinated period of decolonisation. This dependence is confirmed by the scatter plot of these quantities per provision (Fig 5a) and a linear fit $((r,p)=(0.936,10^{-12}))$ showing that the probability of temporal coadoption and network coadoption increase together.

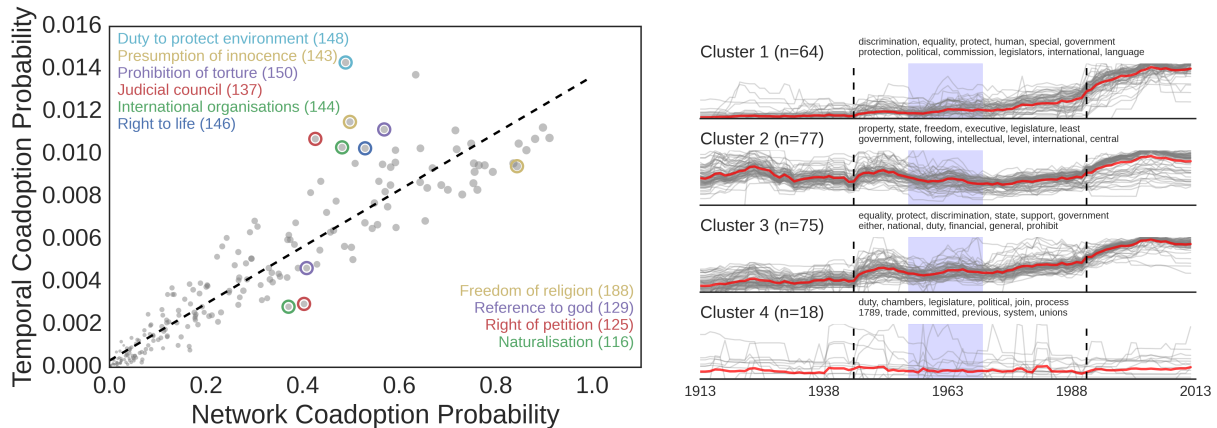


Figure 5: Scatter plot of conditional probability of coadoption of a provision given a common year of writing and a common network cluster. Dashed line indicates a linear regression; the adoption of provisions above this line is driven by time, and those below by network effects. The size of the points indicates the number of countries adopting in the final year of the dataset (also indicated by the number in brackets) (b) Clustering of time series of adoption of provisions. The number of provisions in each cluster is labeled along with the most common terms in the labels of the cluster members. The mean of each cluster is marked in red

However we note several outlying provisions, which may now be classified by the residual difference from the regression line and associated z-score. For example, reference to god ($z=-0.89$) is more strongly coadopted within clusters compared to the average since the role of religion in the state varies significantly with differing legal systems. Whereas coadoption of a duty to protect the environment ($z=6.00$), a provision intuitively linked to changing norms over time, is favourably coadopted in the same year.

We isolate provisions relevant to children in the context of the 1991 Convention on the Rights of the Child (the underlying adoption of these 9 provisions is shown in S27 in (22)). We note that a general guarantee of the rights of the child ($z=1.1$) and financial support for orphans ($z=0.69$) is coadopted significantly more in time than within clusters suggesting a strong temporal dependence. However, a general mention of education ($z=-1.73$) and special status for juveniles in court ($z=-0.45$) are dominated by network effects determined by legal system and history. A full list of provisions and associated z-scores is provided in SI.

3 Discussion

In this work we have demonstrated that computational techniques can help to understand and quantify mechanisms of constitutional change. To understand the emergence of new legal provisions, we introduce the provision space as the set of provisions that are included among all constitutions at a given time. The provision space grows almost monotonically over two centuries as new constitutional legal rights and concepts are introduced, with three main temporal patterns of adoption emerging.

We uncover strong hierarchical dependencies among provisions such that adoption of one provision is statistically more likely to be adopted following the adoption of other related and foundational rights. For example we find that limits on employment of children is preceded by the right to safe working conditions which is in turn preceded by the right to form trade unions. This allows us to articulate a roadmap to advocating for social rights; introduction of new concepts into provision space that are incremental advances on previously adopted provisions.

We have used a computational linguistic measure to quantify the similarity between pairs of constitutions from which clusters of mutually similar constitutions emerge. While these findings largely align with accepted and theoretically derived legal families, we also show that this similarity is not only due to perfect replication of the

provisions of the parent constitution. Rather there is a tendency for different wording of existing provisions and insertion of new provisions at independence that are not present in parent constitutions. While both network based and temporal trends determine the nature of constitutions, the relative importance of these mechanisms varies between provisions. We identify provisions such as environmental protection that are strongly time dependent and conversely others such as reference to god that are strongly network dependent.

We acknowledge that this study is constrained by the nature of constitutional law. Laws which are conferred by precedent or legislature are not included here. Compelling future work would consider the texts of other appropriate legal documents. We are further limited by the lack of availability of historical versions of constitutions. This is on account of copyright issues. Such an historical corpus containing each version of a constitution would provide time varying snapshot of the structure of constitutional similarities allowing for a rich dynamical study of contagion and influence. Since constitutional and other legal documents tend to use more formal and strict language, these texts will likely be amenable to more complex semantic level NLP approaches. This will allow us to measure similarity between the content and meaning of different countries' specific provisions, beyond noting only that a pair of countries both refer to the same topic.

A natural extension to the question of which constitutional provisions are adopted and how, is to the question of their efficacy. Evidence exists /citehilton that rights that are supported with organisations i.e. the right to join a political party or the right to join a trade union, do lead to increased protection of social rights when compared to intrinsically individual rights e.g. freedom of movement or freedom of expression. Further evidence exists of a 'rights creep' by which signature of the UN International Convention on Human Rights becomes de rigeur for UN member states, yet does not necessarily lead to statistically significant improvements in treatment of human rights [27]. The validity of such a 'top-down' approach to development is part of a larger discussion on the efficacy and causality of international development processes and metrics of evaluation [28].

Nevertheless, this work sets forth a precedent that inter-disciplinary quantitative techniques can provide rich insight into constitution making in young states and global policy making procedures. The findings presented here can be particularly informative in light of discussions of self-determination through partition of extant states into new states.

4 Data Availability

All data is freely available at <https://www.constituteproject.org/> and <http://comparativeconstitutionsproject.org/>

5 Acknowledgements

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1 Description of Datasets

Current Constitutions We make use of the English translations of 194 national constitutions [3] along with the year of writing and last amendment. In the case where a single constitutional document does not exist and are instead distributed among many statutes and laws, satisfaction of at least one of the following three requirements must be met (a) *The document is identified explicitly as the Constitution, Fundamental Law, or Basic Law of a country.* (b) *The document contains explicit provisions that establish it as the highest law, either through entrenchment or limits on future law.* (c) *The document contains provisions which define the basic pattern of authority, either by establishing or suspending an executive, legislative or judicial branch of government, or by protecting the rights and freedoms of individuals.*

- **Current Constitutional Provisions** Content in these constitutional documents pertaining to 330 specific topics have been labeled by domain experts in a redundant manner [3]. Thus we have both a binary label for each of 330 provisions for each of 194 countries as well as the text content for each provision.
- **Historical Constitutional Provisions** A similar coding procedure has been repeated for historical constitutional texts [2]. The provisions labeled in this case are not identical to those in the previous dataset and include a number of non-binary indicators e.g. *What is the minimum age for becoming ahead of state?* In this analysis only binary valued indicators of the form *Does the constitution contain a provisions for X?* The dataset considers all historical versions of constitutions of independent nation states; therefore not all of the countries in the first dataset are present throughout. In fact the number of countries changes dramatically. The basic unit of analysis is the ‘constitution-year’ describing the characteristics of each nation’s constitution in each year. However, owing to copyright restrictions, the full text of these historical documents is not publicly available. The states included conform to a reconciled list of independent states that satisfy consistent criteria [8]. On account of apparent missing values in the more recent years of the data, we restrict our analysis to years before 2010.

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2 Summary Statistics

2.1 Document Length

The UK has the longest constitution (over 145,000 words) with the shortest belonging to Libya with just over 2,000 words.

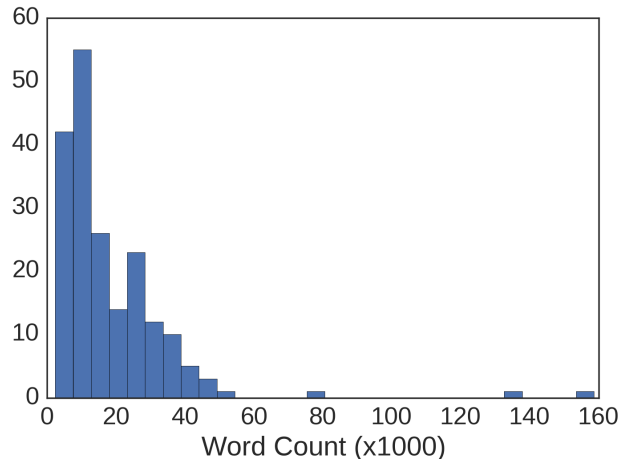


Figure 1: Word Count Histogram

2.2 Time of Writing Constitutions

The oldest constitution in dataset 1 is the United Kingdom's Magna Carta (1215) followed by the United States (1789). The year of writing of current constitutions are seen to follow geo-political events (fig 2)

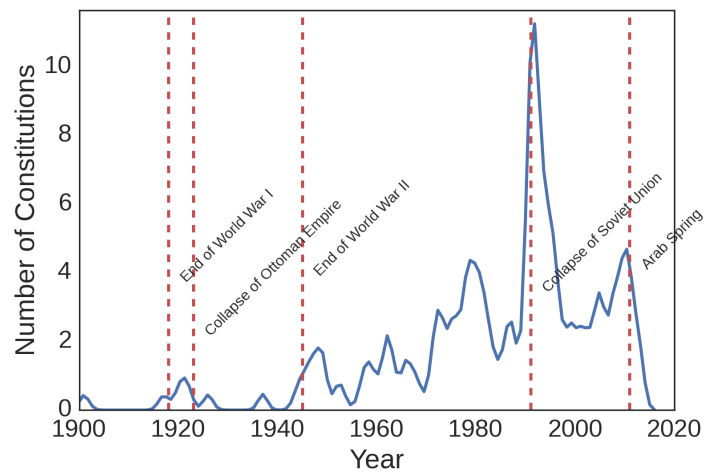


Figure 2: Kernel Density Plot of the Year of Writing of Constitutions Currently in Effect (truncated at 1900 to highlight 20th century political events)

Table 1: Table of pairwise correlations between cluster amendment time series

Cluster 1	Cluster 2	r	p
ex-Soviet	Iberian	0.683	$<10^{-5}$
ex-Soviet	Commonwealth	0.456	0.001
ex-Soviet	French	0.477	0.001
Iberian	Commonwealth	0.683	$<10^{-5}$
Iberian	French	0.578	$<10^{-5}$
Commonwealth	French	0.606	$<10^{-5}$

2.3 Temporal Activity

We consider constitution writing activity, both new constitutions and amendments, over time from dataset III (fig 9)

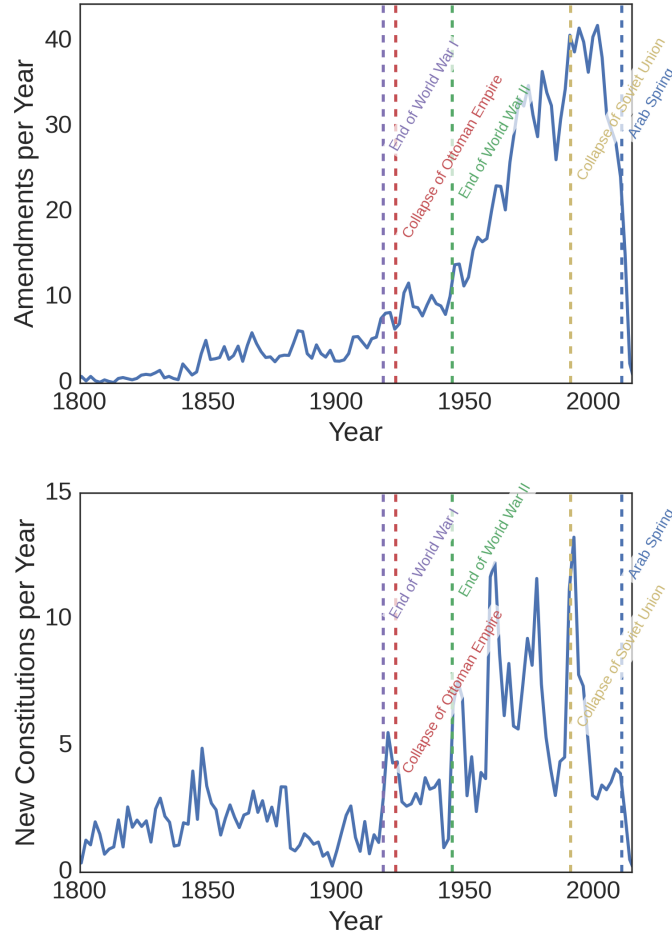


Figure 3: Historical Constitution Amendment Events

We consider the time series of constitutional amendment activity with 2 year resolution presented in the main paper. The pairwise Pearson correlation coefficient and corresponding p value between the time series describing each cluster is listed in table 1

Here we plot the number of constitutions present in the longitudinal dataset, we see distinct increases during periods of decolonisation or independence.

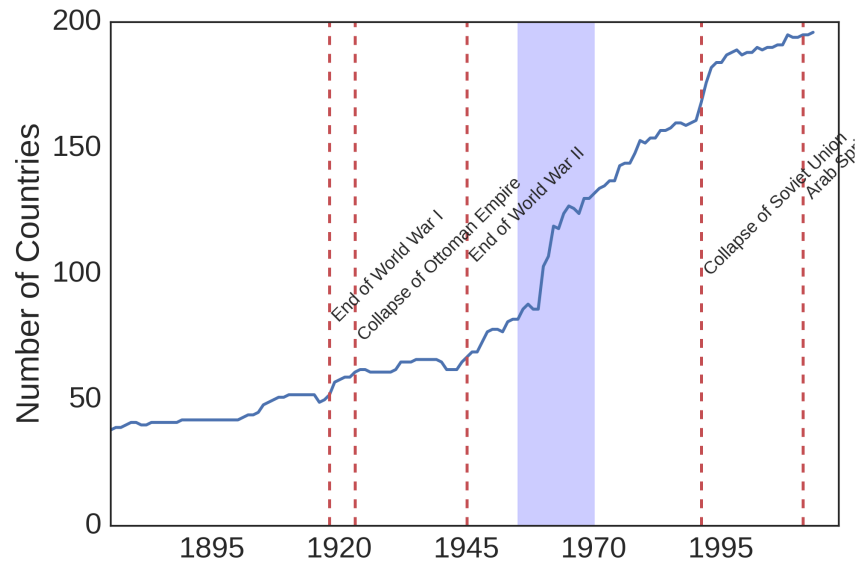


Figure 4: Yearly time series of the number of constitutions in our dataset. The blue shaded area corresponds to the period of 1960-1970 during which many countries achieved independence also known as ‘decolonisation’

2.4 Comparison of Clusters

We now compare summary statistics between the country clusters derived from the network of constitutional document similarity. Fig (5) demonstrates that the Commonwealth cluster contains vastly longer constitutional documents than the other clusters.

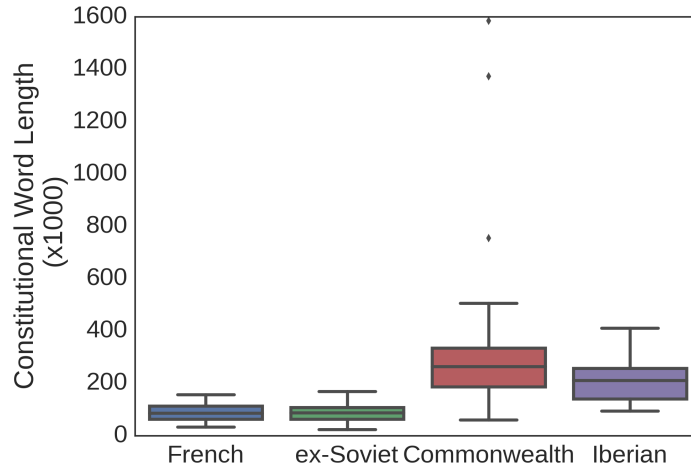


Figure 5: Word Count by Cluster

Next we ask how the number of amendments differ between clusters (figure 6).

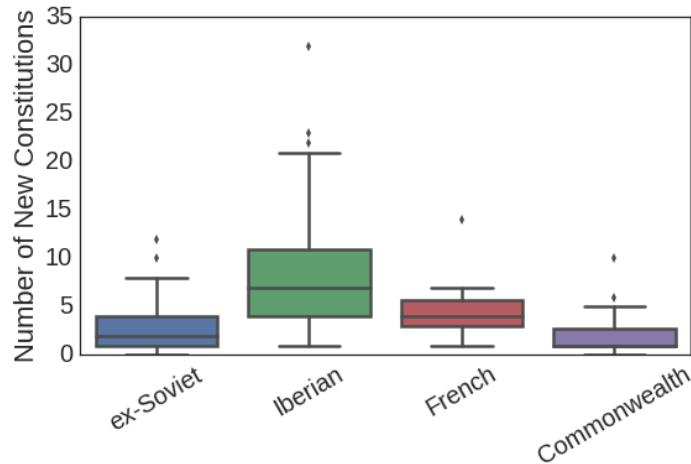


Figure 6: Distribution of number of new constitutions by cluster

The Iberian cluster not only dominates in the number of new constitutions, but also the number of provisions contained within those constitutions (see Fig. (7))

We consider the individual countries that have had the greatest number of constitutions and amendments (8a and 8b).

In order to further examine the differences between clusters, we consider the chronology of new constitutions among members of each cluster. We compare the yearly distribution of new constitution events within these clusters. We observe distinct historical patterns within each. The Iberian cluster also shows an interesting pattern of activity prompted by relatively early colonial independence. However, these early declarations of independence were followed by indigenous led independence movements in the 20th century [7] as more constitutional events were recorded.

Out of the set of labeled provisions, we consider the most commonly and least commonly adopted

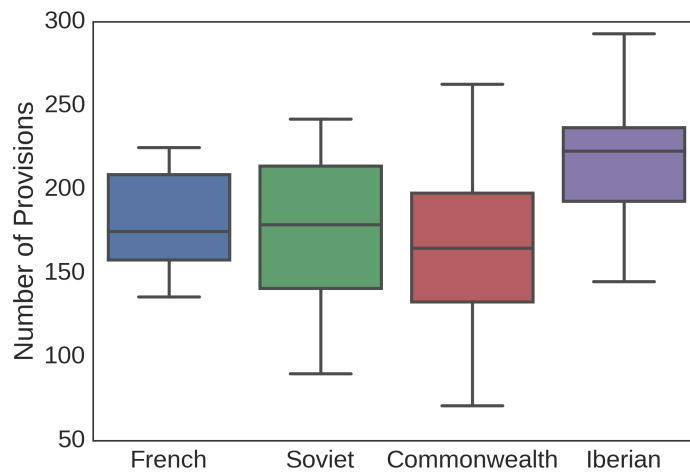
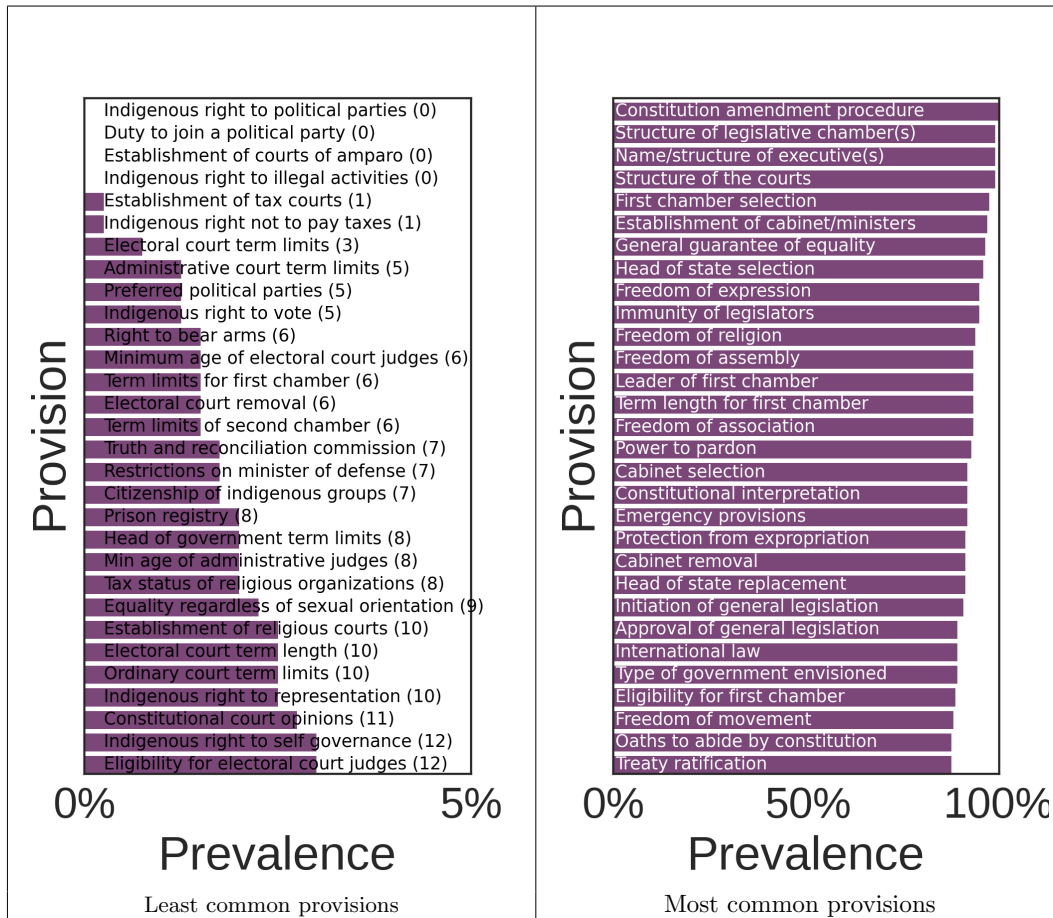
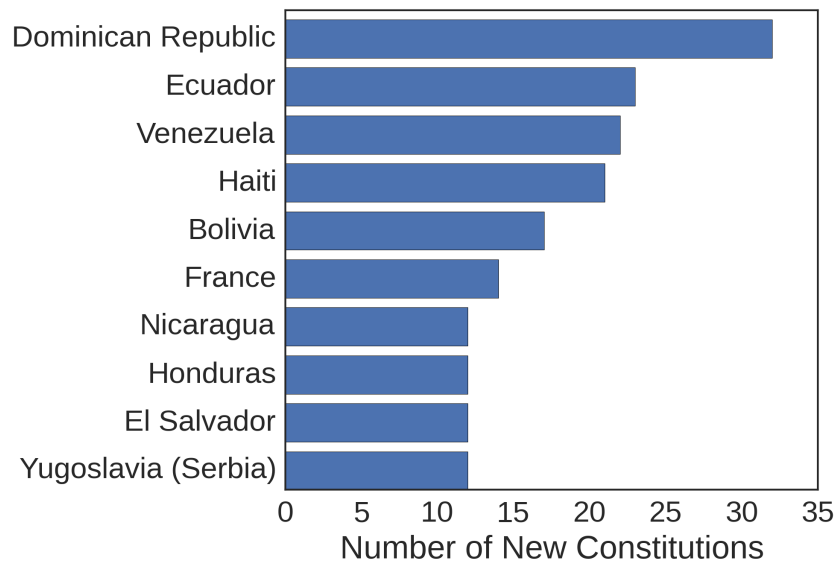
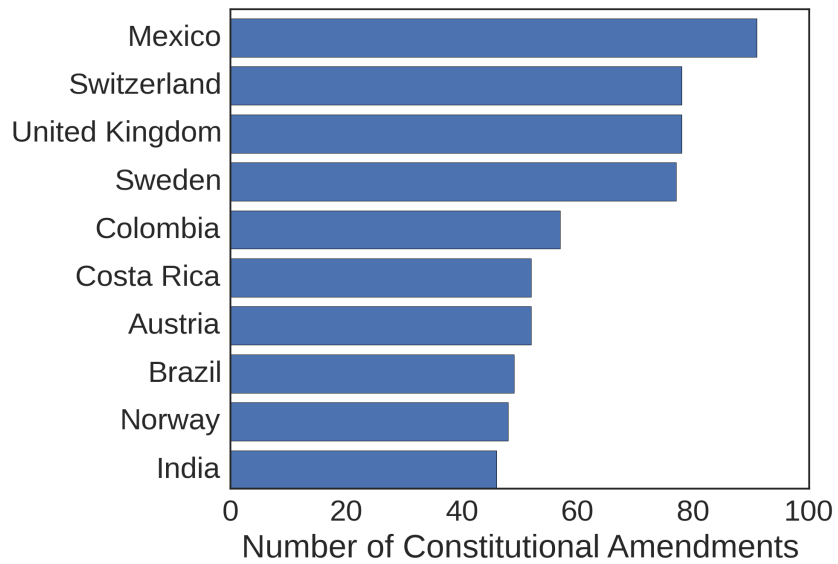


Figure 7: Number of Provisions by Cluster





(a) Most New Constitutions



(b) Most Constitutional Amendments

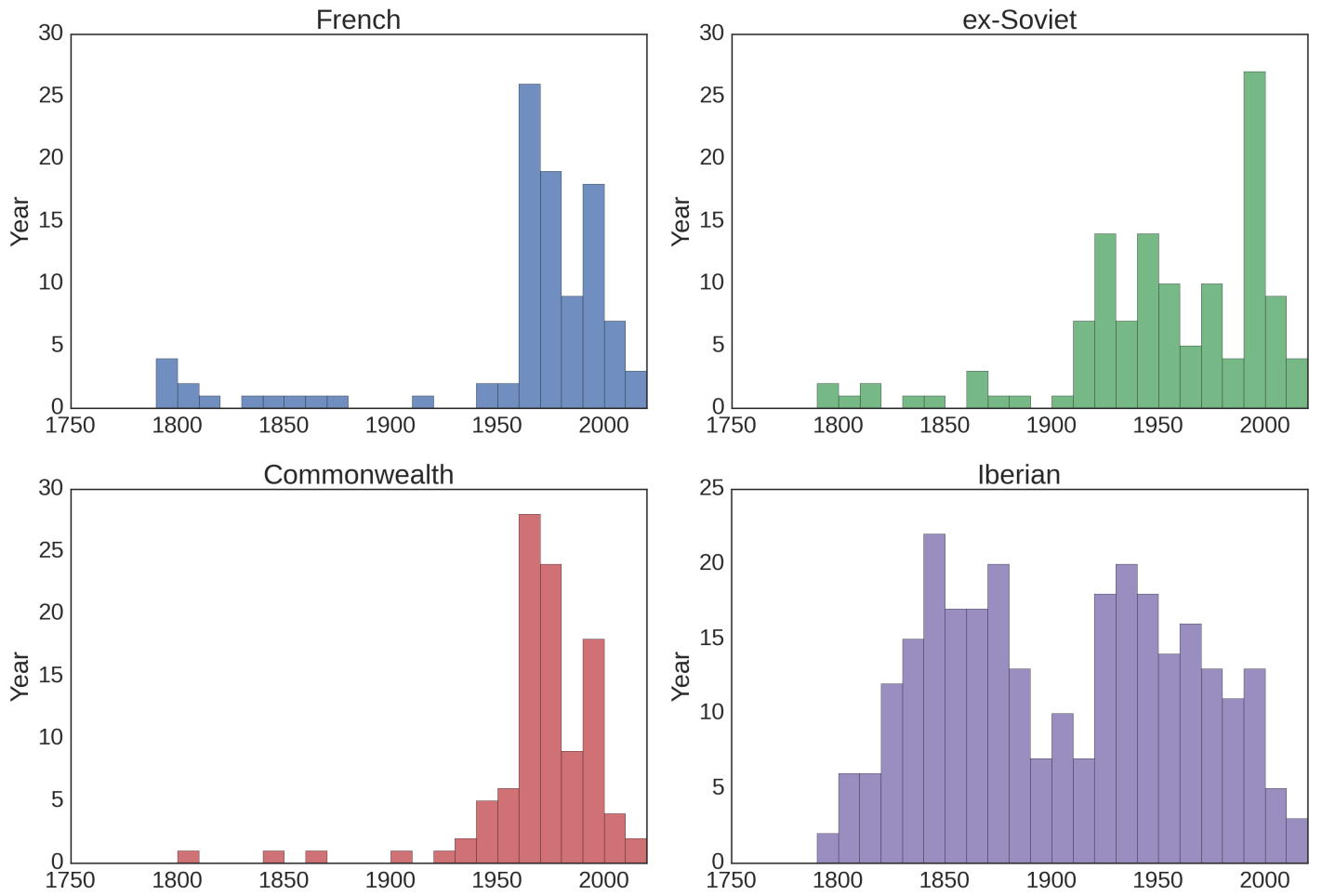


Figure 9: Time distribution of new constitution writing events

3 Constitutional Similarity

In the following section we consider the Jaccard similarity after removal of stopwords. The pairwise Jaccard index is calculated between each constitutional document after tokenisation and removal of stopwords give in the Python NLTK library [?] augmented by the following domain specific terms ('shall','article','may','must','page') as well as country names to avoid, for example, trivial clustering based on a long list of other Commonwealth countries. We construct a semantic network where constitutions represent nodes and edges are directed links determined by Jaccard similarity. Clusters of similar documents, representing national constitutions with similar wordings are formed by taking network communities using the spinglass algorithm [10].

3.1 Provisional Text Similarity

We consider the similarity of each individual provision across all constitutions including that provision. The distribution of similarities is shown below

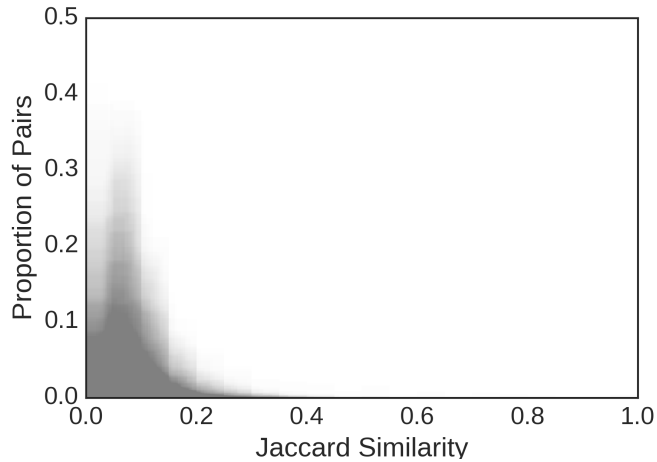


Figure 10: Distribution of Jaccard similarities for all provisions

The highest similarity is observed with 'Examination of witnesses' with a mean similarity of 0.265. The distribution of pairwise similarities for this provision is shown below

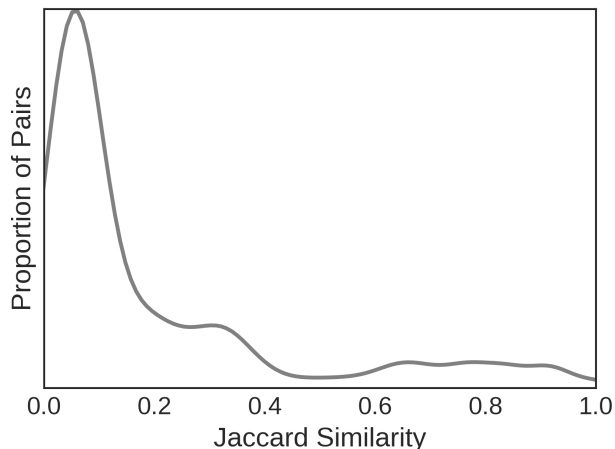


Figure 11: Distribution of Jaccard similarities among all pairs for the provision 'Examination of Witnesses'

3.2 Full Constitutional Text Similarity

We may explore the intrinsic structure of the full text correlation matrix through a hierarchically clustered heatmap. This reveals a clear structure with clusters emerging along several historical and geographical themes moving down the diagonal from top-left to bottom-right; Commonwealth countries, Francophone countries and former Iberian colonies.

The labeled clusters along the diagonal include the following

Cluster 1:

Sierra Leone Guyana Zambia Trinidad & Tobago Malta Jamaica Barbados Bahamas Belize Kiribati Botswana Solomon Islands Mauritius Lesotho St Lucia Dominica St Vincent & Grenadines Grenada St Kitts Antigua & Barbuda

Cluster 2:

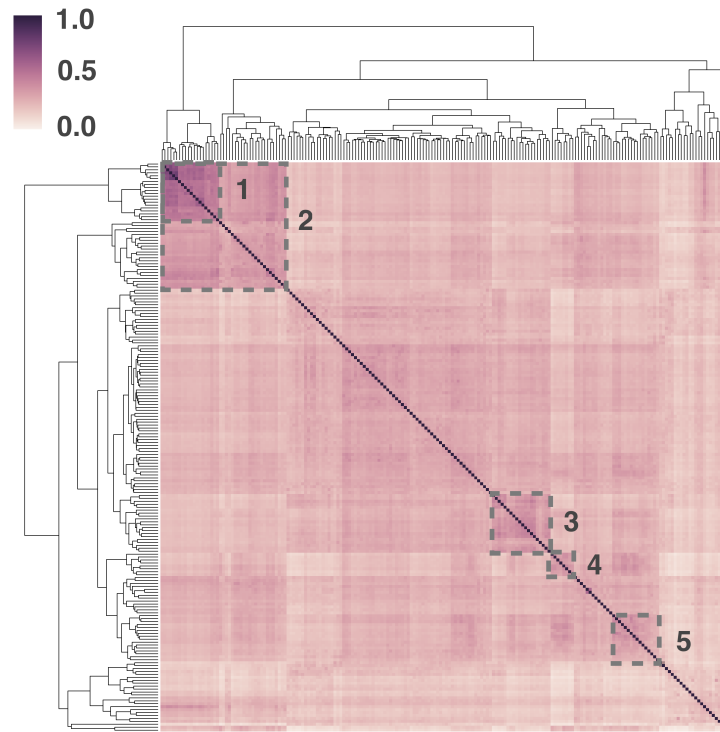


Figure 12: Dendrogram of constitutional similarities.

Singapore Seychelles Malaysia Tuvalu Swaziland Gambia Ghana Fiji Bangladesh Tanzania Malawi Namibia Cyprus Sri Lanka
Pakistan Papua New Guinea Zimbabwe Kenya Uganda Samoa Marshall Islands Nigeria

Cluster 3:

Djibouti Mauritania Gabon Benin Algeria Sao Tome and Principe Central African Republic Togo Burkina Faso Congo Chad Niger
Madagascar Guinea DRC Burundi Morocco Senegal Mali Cote d'Ivoire

Cluster 4:

Ecuador Bolivia Guatemala Paraguay Colombia Venezuela Brazil Mexico

Cluster 5

Cape Verde Angola Mozambique Dominican Republic Honduras El Salvador Portugal Panama Uruguay Chile Costa Rica Haiti
Egypt Switzerland Cuba Iran

When creating a network from an $N \times N$ matrix of similarities, inverse distances or other weights, there are many ways to define an edge. The most obvious is to consider *weighted* edges with a continuous value given by the degree of similarity defining the strength between i and j . Commonly, a threshold is applied to this set of edges, such that links with a weight below a cut-off value are considered sufficiently insignificant to be excluded and those above are retained. The threshold quantifies a trade-off between a resultant network that is too dense for distinct clusters to emerge and one which is so sparse that the network becomes disconnected.

When considering the set of Jacard similarities between constitutional documents as described in the main paper, a difficulty arises since the set of values of pairwise similarities is extremely heterogeneous. This behaviour may be due to a bias based on the highly variable length of the constitutional documents under consideration as noted previously. In addition, applying a minimum threshold will quickly lead to disconnected clusters in the network since the row wise minimum value occurs at the 26th percentile of the entire distribution. In other words, applying a threshold at the largest possible value to retain a connected graph, necessarily retains 74% of all edges. This density in turn precludes fine grained partition of the network into consistent clusters using most community detection algorithms.

Applying the spin-glass algorithm with a threshold of 0.2 yields two clusters

[0] Angola, Antigua and Barbuda, Argentina, Austria, Bahamas, Bangladesh, Barbados, Belgium, Belize, Bolivia, Botswana, Brazil, Burundi, Canada, Cape Verde, Chile, China, Colombia, Democratic Republic of the Congo, Congo, Costa Rica, Cuba, Cyprus, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Fiji, Gambia, German Federal Republic, Ghana, Greece, Grenada, Guatemala, Guinea, Guyana, Haiti, Honduras, India, Iran, Jamaica, Kenya, Kiribati, Lesotho, Malawi, Malaysia, Malta, Marshall Islands, Mauritius, Mexico, Morocco, Mozambique, Myanmar, Namibia, Nepal, New Zealand, Nicaragua, Niger, Nigeria, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Portugal, Romania, St Kitts and Nevis, St Lucia, St Vincent and the

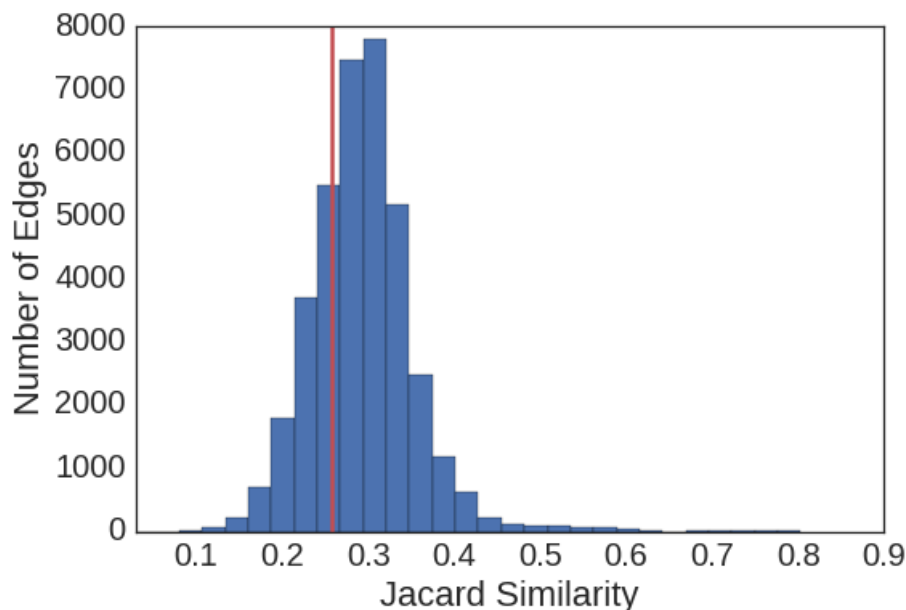


Figure 13: Histogram of all edge weights in $N \times N$.

Grenadines, Samoa, Serbia, Seychelles, Sierra Leone, Singapore, Solomon Islands, Somalia, South Africa, South Sudan, Spain, Sri Lanka, Sudan, Swaziland, Sweden, Switzerland, East Timor, Trinidad and Tobago, Turkey, Tuvalu, Uganda, United Kingdom, Tanzania, Uruguay, Venezuela, Socialist Republic of Vietnam, Zambia, Zimbabwe

[1] Afghanistan, Albania, Algeria, Andorra, Armenia, Australia, Azerbaijan, Bahrain, Belarus, Benin, Bhutan, Bosnia Herzegovina, Brunei, Bulgaria, Burkina Faso, Cambodia, Cameroon, Central African Republic, Chad, Comoros, Cote D'Ivoire, Croatia, Czech Republic, Denmark, Djibouti, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Finland, France, Gabon, Georgia, Guinea Bissau, Hungary, Iceland, Indonesia, Iraq, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Peoples Republic of Korea, Republic of Korea, Kosovo, Kuwait, Kyrgyz Republic, Laos, Latvia, Lebanon, Liberia, Libya, Liechtenstein, Lithuania, Luxembourg, Macedonia, Madagascar, Maldives, Mali, Mauritania, Micronesia, Moldova, Monaco, Mongolia, Montenegro, Nauru, Netherlands, Norway, Oman, Palau, Poland, Qatar, Russia, Rwanda, Sao Tome and Principe, Saudi Arabia, Senegal, Slovakia, Slovenia, Surinam, Syria, Taiwan, Tajikistan, Thailand, Togo, Tonga, Tunisia, Turkmenistan, Ukraine, United Arab Emirates, United States of America, Uzbekistan, Vanuatu, Yemen

These broadly describe the former British, Spanish and Portuguese Empires on one hand and French, Soviet, Middle Eastern, Scandinavian and Asian spheres of influence on the other.

Using the same threshold and the leading Eigenvector method yields a similar decomposition

[0] Afghanistan, Albania, Algeria, Andorra, Armenia, Australia, Azerbaijan, Bahrain, Belarus, Benin, Bhutan, Bosnia Herzegovina, Brunei, Bulgaria, Burkina Faso, Cambodia, Cameroon, Central African Republic, Chad, Comoros, Cote D'Ivoire, Croatia, Czech Republic, Denmark, Djibouti, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Finland, France, Gabon, Georgia, Guinea Bissau, Hungary, Iceland, Indonesia, Iraq, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Republic of Korea, Kosovo, Kuwait, Kyrgyz Republic, Laos, Latvia, Lebanon, Liberia, Libya, Liechtenstein, Lithuania, Luxembourg, Macedonia, Madagascar, Maldives, Mali, Mauritania, Micronesia, Moldova, Monaco, Mongolia, Montenegro, Nauru, Netherlands, Norway, Oman, Palau, Poland, Qatar, Romania, Russia, Rwanda, Sao Tome and Principe, Saudi Arabia, Senegal, Slovakia, Slovenia, Surinam, Syria, Taiwan, Tajikistan, Thailand, Togo, Tonga, Tunisia, Turkmenistan, Ukraine, United Arab Emirates, United States of America, Uzbekistan, Vanuatu, Yemen

[1] Angola, Antigua and Barbuda, Argentina, Austria, Bahamas, Bangladesh, Barbados, Belgium, Belize, Bolivia, Botswana, Brazil, Burundi, Canada, Cape Verde, Chile, China, Colombia, Democratic Republic of the Congo, Congo, Costa Rica, Cuba, Cyprus, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Fiji, Gambia, German Federal Republic, Ghana, Greece, Grenada, Guatemala, Guinea, Guyana, Haiti, Honduras, India, Iran, Jamaica, Kenya, Kiribati, Peoples Republic of Korea, Lesotho, Malawi, Malaysia, Malta, Marshall Islands, Mauritius, Mexico, Morocco, Mozambique, Myanmar, Namibia, Nepal, New Zealand, Nicaragua, Niger, Nigeria, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Portugal, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Samoa, Serbia, Seychelles, Sierra Leone, Singapore, Solomon Islands, Somalia, South Africa, South Sudan, Spain, Sri Lanka, Sudan, Swaziland, Sweden, Switzerland, East Timor, Trinidad and Tobago, Turkey, Tuvalu, Uganda, United Kingdom, Tanzania, Uruguay, Venezuela, Socialist Republic of Vietnam, Zambia, Zimbabwe

Likewise the multilevel community detection algorithm returns two clusters

[0] Afghanistan, Albania, Algeria, Andorra, Armenia, Australia, Azerbaijan, Bahrain, Belarus, Benin, Bhutan, Bosnia Herzegovina, Brunei, Bulgaria, Burkina Faso, Cambodia, Cameroon, Central African Republic, Chad, Comoros, Cote D'Ivoire, Croatia, Czech Republic, Denmark, Djibouti, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Finland, France, Gabon, Georgia, Guinea

Bissau, Hungary, Iceland, Indonesia, Iraq, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Peoples Republic of Korea, Republic of Korea, Kosovo, Kuwait, Kyrgyz Republic, Laos, Latvia, Lebanon, Liberia, Libya, Liechtenstein, Lithuania, Luxembourg, Macedonia, Madagascar, Maldives, Mali, Mauritania, Micronesia, Moldova, Monaco, Mongolia, Montenegro, Nauru, Netherlands, Norway, Oman, Palau, Poland, Qatar, Romania, Russia, Rwanda, Sao Tome and Principe, Saudi Arabia, Senegal, Slovakia, Slovenia, Surinam, Syria, Taiwan, Tajikistan, Thailand, Togo, Tonga, Tunisia, Turkmenistan, Ukraine, United Arab Emirates, United States of America, Uzbekistan, Vanuatu, Yemen

[1] Angola, Antigua and Barbuda, Argentina, Austria, Bahamas, Bangladesh, Barbados, Belgium, Belize, Bolivia, Botswana, Brazil, Burundi, Canada, Cape Verde, Chile, China, Colombia, Democratic Republic of the Congo, Congo, Costa Rica, Cuba, Cyprus, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Fiji, Gambia, German Federal Republic, Ghana, Greece, Grenada, Guatemala, Guinea, Guyana, Haiti, Honduras, India, Iran, Jamaica, Kenya, Kiribati, Lesotho, Malawi, Malaysia, Malta, Marshall Islands, Mauritius, Mexico, Morocco, Mozambique, Myanmar, Namibia, Nepal, New Zealand, Nicaragua, Niger, Nigeria, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Portugal, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Samoa, Serbia, Seychelles, Sierra Leone, Singapore, Solomon Islands, Somalia, South Africa, South Sudan, Spain, Sri Lanka, Sudan, Swaziland, Sweden, Switzerland, East Timor, Trinidad and Tobago, Turkey, Tuvalu, Uganda, United Kingdom, Tanzania, Uruguay, Venezuela, Socialist Republic of Vietnam, Zambia, Zimbabwe

However the infomap algorithm returns 96 clusters with little consistency. This may be due to the nature of the network which is necessarily built around a set of pairwise relationships rather than networks upon which dynamical processes such as information flow occur.

Since it is apparent that the distribution of similarities with all N-1 other countries differs significantly between all countries, we consider the $N_{closest}$ other countries to each individual country. This effectively controls for the skew present in each countries similarity to all other countries. Ideally we expect ties between node i and j to be most significant when the edge $e_{i,j}$ is both among i's $N_{closest}$ strongest links and j's $N_{closest}$ links. However we require $N_{closest} = 67$ before we arrive at a fully connected graph.

In addition, when we consider the sum of the N-1(=193) Jaccard similarities for each country (out degree using weighted edges), we would expect to see an indication of the most significant or important country constitutions.

Country	Sum of Jaccard similarities
Zambia	65.075643
Sudan	64.642549
Dominica	64.236225
Republic of Korea	64.131567
Russia	63.698398
Serbia	63.641952
Albania	63.619232
Singapore	62.970728
Antigua and Barbuda	62.844347
Guatemala	62.759447

And the lowest

Country	Sum of Jaccard similarities
Liberia	38.125831
United States of America	39.831019
Denmark	39.902812
Tonga	40.771953
Mexico	42.124157
Tunisia	42.352826
Bosnia Herzegovina	43.116865
Iraq	43.998425
Uruguay	44.071001
Netherlands	44.189905

Even normalising the vector of Jaccard indices for all N-1 neighbours i.e. each row in the similarity matrix, we require a threshold no greater than 0.025 to recover a connected graph. At this point the network is sufficiently dense that only one cluster may be recovered.

Considering all of these facts, we therefore relax the condition for preserving an edge and for all of i's $N_{closest}$ neighbours create a directed edge of weight 1. This allows a more fine grained disaggregation of the intuitive clusters found when weighting edges by similarity as described above. Results from this network are reported in the main paper.

Former Socialist (Cluster 1): Afghanistan Albania Andorra Armenia Azerbaijan Bahrain Belarus Belgium Bosnia Herzegovina Bulgaria Cambodia China Croatia Czech Republic Denmark Eritrea Estonia Ethiopia Finland Georgia Guinea Bissau Hungary Iceland Indonesia Iraq Japan Jordan Kazakhstan Peoples Republic of Korea Republic of Korea Kosovo Kuwait Kyrgyz Republic Laos Latvia Lebanon Libya Liechtenstein Lithuania Macedonia Micronesia Moldova Monaco Mongolia Montenegro Netherlands Norway Oman Qatar Romania Russia Saudi Arabia Serbia Slovakia Slovenia Syria Taiwan Tajikistan Tunisia Turkmenistan Ukraine United Arab Emirates Uzbekistan Socialist Republic of Vietnam Yemen

Commonwealth (Cluster 2): Antigua and Barbuda Australia Bahamas Bangladesh Barbados Belize Bhutan Botswana Brunei Canada Cyprus Dominica Fiji Gambia Ghana Grenada Guyana India Ireland Israel Jamaica Kenya Kiribati Lesotho Liberia Malawi

Malaysia Maldives Malta Marshall Islands Mauritius Myanmar Namibia Nauru Nepal New Zealand Nigeria Pakistan Palau Papua New Guinea Philippines St Kitts and Nevis St Lucia St Vincent and the Grenadines Samoa Seychelles Sierra Leone Singapore Solomon Islands South Africa South Sudan Sri Lanka Sudan Swaziland Sweden Thailand Tonga Trinidad and Tobago Tuvalu Uganda United Kingdom Tanzania United States of America Vanuatu Zambia Zimbabwe

Iberian(Cluster 3): Angola Argentina Austria Bolivia Brazil Cape Verde Chile Colombia Costa Rica Cuba Dominican Republic Ecuador Egypt El Salvador German Federal Republic Greece Guatemala Haiti Honduras Iran Italy Mexico Mozambique Nicaragua Panama Paraguay Peru Poland Portugal Somalia Spain Surinam Switzerland East Timor Turkey Uruguay Venezuela

French (Cluster 4): Algeria Benin Burkina Faso Burundi Cameroon Central African Republic Chad Comoros Democratic Republic of the Congo Congo Cote D'Ivoire Djibouti Equatorial Guinea France Gabon Guinea Luxembourg Madagascar Mali Mauritania Morocco Niger Rwanda Sao Tome and Principe Senegal Togo

Decreasing $N_{closest} = 10$ lowers the density of edges allowing an additional cluster to emerge.

Ex-Soviet (Cluster 1):Afghanistan Albania Andorra Argentina Armenia Azerbaijan Belarus Belgium Bosnia Herzegovina Bulgaria Cambodia China Croatia Cuba Czech Republic Denmark Eritrea Estonia Ethiopia Finland Georgia Guinea Bissau Hungary Iceland Indonesia Italy Japan Kazakhstan Peoples Republic of Korea Republic of Korea Kosovo Kyrgyz Republic Laos Latvia Libya Liechtenstein Lithuania Macedonia Moldova Mongolia Montenegro Netherlands Norway Romania Russia Serbia Slovakia Slovenia Somalia Surinam Taiwan Tajikistan Thailand Turkmenistan Ukraine Uzbekistan Socialist Republic of Vietnam

Middle Eastern (Cluster 2):Bahrain Iraq Jordan Kuwait Lebanon Oman Qatar Saudi Arabia Syria Tunisia United Arab Emirates Yemen

Ex-French (Cluster 3):Algeria Benin Burkina Faso Burundi Cameroon Central African Republic Chad Comoros Democratic Republic of the Congo Congo Cote D'Ivoire Djibouti Equatorial Guinea France Gabon Guinea Luxembourg Madagascar Mali Mauritania Monaco Morocco Niger Sao Tome and Principe Senegal Togo

Ex-Iberian (Cluster 4): Angola Austria Bolivia Brazil Cape Verde Chile Colombia Costa Rica Dominican Republic Ecuador Egypt El Salvador German Federal Republic Greece Guatemala Haiti Honduras Iran Mexico Mozambique Nicaragua Panama Paraguay Peru Poland Portugal Rwanda Spain Switzerland East Timor Turkey Uruguay Venezuela

Commonwealth (Cluster 5):Antigua and Barbuda Australia Bahamas Bangladesh Barbados Belize Bhutan Botswana Brunei Canada Cyprus Dominica Fiji Gambia Ghana Grenada Guyana India Ireland Israel Jamaica Kenya Kiribati Lesotho Liberia Malawi Malaysia Maldives Malta Marshall Islands Mauritius Micronesia Myanmar Namibia Nauru Nepal New Zealand Nigeria Pakistan Palau Papua New Guinea Philippines St Kitts and Nevis St Lucia St Vincent and the Grenadines Samoa Seychelles Sierra Leone Singapore Solomon Islands South Africa South Sudan Sri Lanka Sudan Swaziland Sweden Tonga Trinidad and Tobago Tuvalu Uganda United Kingdom Tanzania United States of America Vanuatu Zambia Zimbabwe

4 Provisional Topics

4.1 Provision Decomposition

We now examine the high level structure of the set of current constitutions. Using dimensionality reduction, we recover sets of provisions that commonly co-occur and best represent the set of constitutions. Henceforth we refer to these sets of co-occurring provisions as ‘provisional topics’ in analogy with topics (sets of co-occurring words) found in the text of documents. These provisional topics are illustrated below (fig ??).

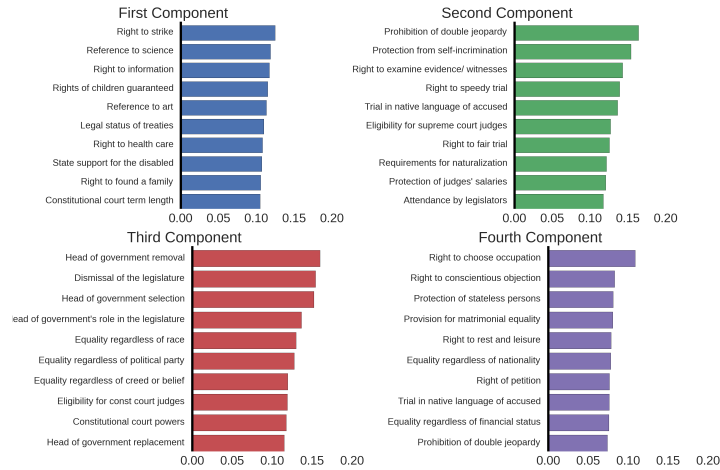


Figure 14: Graphical representation of provisions with largest projections on first 4 components

We find that the first two singular vectors are characterised by provisions concerning social rights and duties, and legislative process respectively. The third and fourth components are characterised by provisions related to oversight and limits to positions of powers and the structure of the second chamber respectively. In addition we find the first and second vectors allow for clear separation of the Commonwealth and Iberian clusters. However the third and fourth singular vectors do not allow for such a clear separation (see fig (14)).

In order to resolve the apparent disparity between similarities based on word choice and on provisional fingerprint, we investigate the relationship between the provisional topics and the network clusters discovered based on word choice in the text. We return to the multinomial logit models from the main paper using the network cluster IDs as dependent variables. From the PCA analysis, we derive a score for each country on each of the 4 components. A model that includes only these scores has an ePCP of 75.13%, meaning that it performs better than models that include only colonial history (65.01%) or legal system type (58.48%) and almost as well as a model that includes both of the latter (76.24%). This indicates that the choice to include or exclude provisions from a constitution can statistically explain most of the similarity in word choice across constitutions. Finally, a model that includes all three of these variables has an ePCP of 93.14%, which means that legal system type, colonial history, and provision inclusion/exclusion choices of constitutions perform very well in predicting word choice similarity. Thus, while a given constitution is likely to adopt some new provisions not present within it's peer constitutions, structure exists within provisions that co-occur within constitutions and this high level structure corresponds to similarities based on word choice. Figure (15) plots the variance explained by each component of the country-provision matrix decomposition. The shape of this plot demonstrates that significant structure exists within this matrix. This is followed by visualisation of the projection onto these components by each country as well as tabulation of the composition of these components.

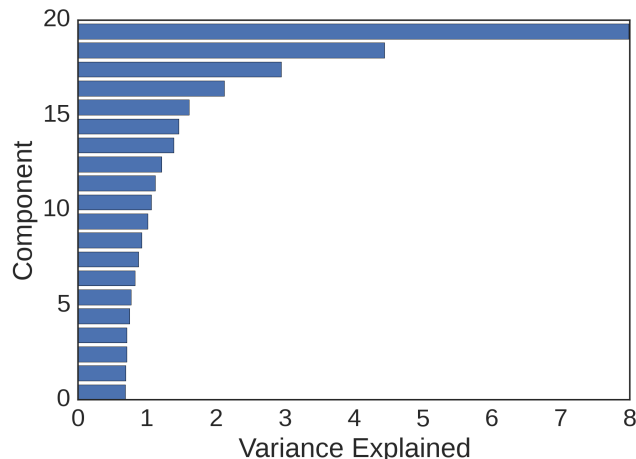


Figure 15: Scree plot of decomposition of country-provision matrix

Provision	Weight
Spending Bills	0.0458
Tax bills	0.0396
Right to examine evidence/ witnesses	0.0379
Electoral districts	0.0376
Finance Bills	0.0361
Reference to art	-0.1129
Right to information	-0.1181
Reference to science	-0.1182
Rights of children guaranteed	-0.1182
Right to strike	-0.1250

Table 2: Top Components of First Singular Vector

Provision	Weight
Establishment of constitutional court	0.0975
Head of government powers	0.0968
Constitutional court selection	0.0925
Constitutional court powers	0.0889
Head of government selection	0.0843
Trial in native language of accused	-0.1352
Right to speedy trial	-0.1383
Right to examine evidence/ witnesses	-0.1428
Protection from self-incrimination	-0.1532
Prohibition of double jeopardy	-0.1636

Table 3: Top Components of Second Singular Vector

Provision	Weight
Head of government removal	0.1576
Dismissal of the legislature	0.1540
Head of government selection	0.1501
Head of government's role in the legislature	0.1348
Equality regardless of race	0.1309
Electoral court selection	-0.0808
Right to amparo	-0.0818
Electoral court powers	-0.0865
State support for the elderly	-0.0870
Minimum age of supreme court judges	-0.0901

Table 4: Top Components of Third Singular Vector

Provision	Weight
Eligibility for second chamber	0.2536
Division of labor between chambers	0.2507
Leader of second chamber	0.2499
Second chamber selection	0.2471
Minimum age for second chamber	0.2354
Right to rest and leisure	-0.0793
Provision for matrimonial equality	-0.0815
Protection of stateless persons	-0.0818
Right to conscientious objection	-0.0826
Right to choose occupation	-0.1095

Table 5: Top Components of Fourth Singular Vector

Provision	Weight
Right to strike(-)	0.1250
Rights of children guaranteed(-)	0.1182
Reference to science(-)	0.1182
Right to information(-)	0.1181
Reference to art(-)	0.1129
Legal status of treaties(-)	0.1094
Right to health care(-)	0.1075
State support for the disabled(-)	0.1065
Right to found a family(-)	0.1060
Constitutional court term length(-)	0.1050
Compulsory education(-)	0.1039
Free education(-)	0.1036
Constitutional court selection(-)	0.1026
National anthem(-)	0.1022
Right to culture(-)	0.1008

Table 6: Top Absolute Components of First Singular Vector

Provision	Weight
Prohibition of double jeopardy(-)	0.1636
Protection from self-incrimination(-)	0.1532
Right to examine evidence/ witnesses(-)	0.1428
Right to speedy trial(-)	0.1383
Trial in native language of accused(-)	0.1352
Eligibility for supreme court judges(-)	0.1266
Right to fair trial(-)	0.1250
Requirements for naturalization(-)	0.1215
Protection of judges' salaries(-)	0.1208
Electoral commission(-)	0.1201
Attendance by legislators(-)	0.1177
Equality regardless of skin color(-)	0.1106
Right to renounce citizenship(-)	0.1085
Right to appeal judicial decisions(-)	0.1085
Tax bills(-)	0.1061

Table 7: Top Absolute Components of Second Singular Vector

Provision	Weight
Head of government removal(+)	0.1576
Dismissal of the legislature(+)	0.1540
Head of government selection(+)	0.1501
Head of government's role in the legislature(+)	0.1348
Equality regardless of race(+)	0.1309
Equality regardless of political party(+)	0.1277
Equality regardless of creed or belief(+)	0.1235
Eligibility for const court judges(+)	0.1165
Head of government replacement(+)	0.1155
Constitutional court powers(+)	0.1150
Equality regardless of origin(+)	0.1120
Establishment of constitutional court(+)	0.1097
Establishment of judicial council(+)	0.1082
Constitutional court term length(+)	0.1075
Head of government powers(+)	0.1064

Table 8: Top Absolute Components of Third Singular Vector

Provision	Weight
Eligibility for second chamber(+)	0.2536
Division of labor between chambers(+)	0.2507
Leader of second chamber(+)	0.2499
Second chamber selection(+)	0.2471
Minimum age for second chamber(+)	0.2354
Term length of second chamber(+)	0.2236
Joint meetings of legislative chambers(+)	0.1982
Replacement of legislators(+)	0.1679
Size of second chamber(+)	0.1623
First chamber reserved policy areas(+)	0.1382
Compensation of legislators(+)	0.1161
Second chamber reserved policy areas(+)	0.1097
Right to choose occupation(-)	0.1095
Finance bills(+)	0.1067

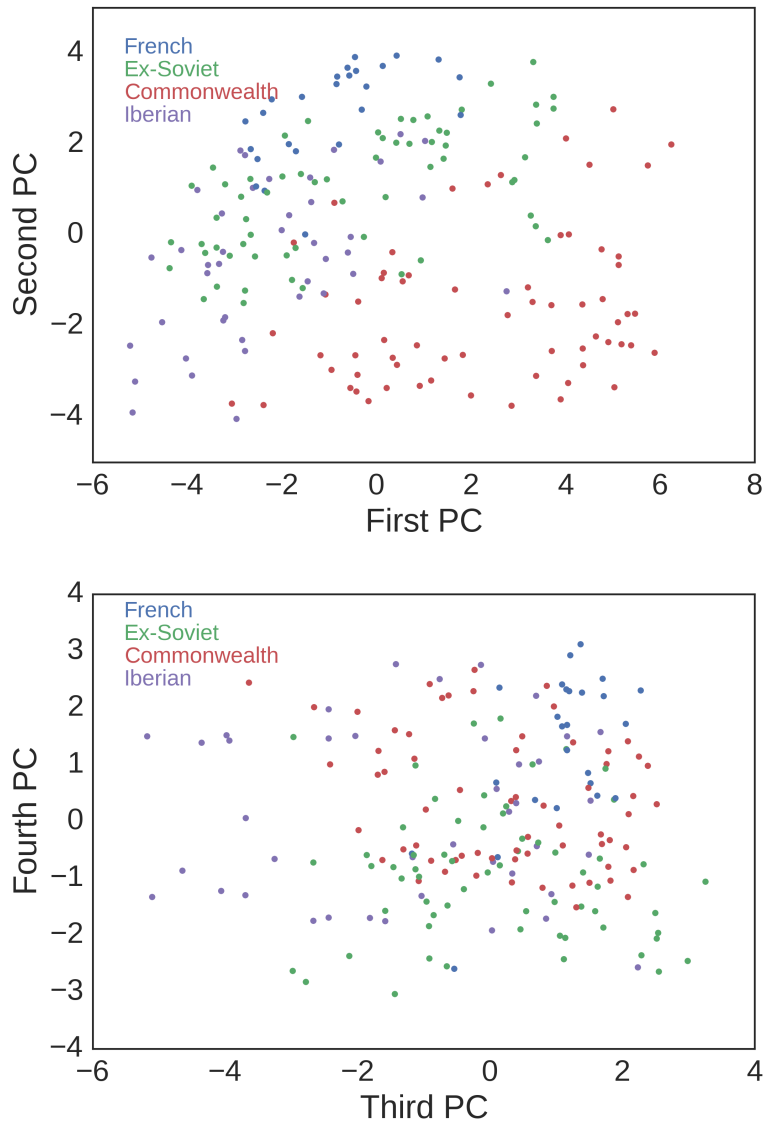


Figure 16: Projection of constitutional traces onto first and second and third and fourth principal components

4.2 Convergence of Constitutional Traces

Figure 17 shows both (i) the mean proportion of provisions that are adopted (in green) and (ii) the provisional similarity (measured by the cosine similarity, shown in green) between countries increases over time.

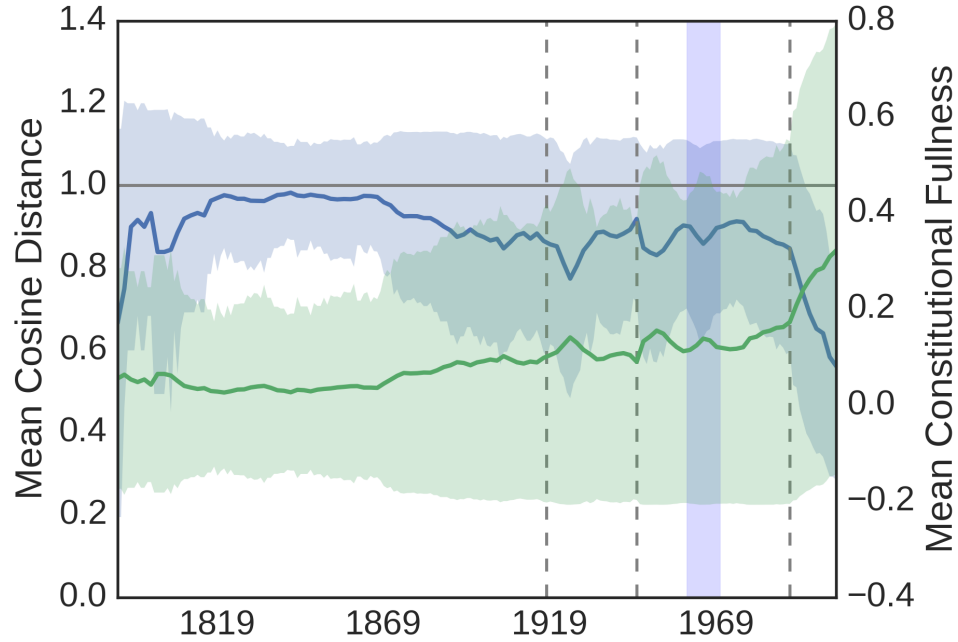


Figure 17: Convergence of constitutional provisional similarity over time. Blue line shows mean cosine distance between pairs of countries with one standard deviation marked on. The green line shows mean ‘density’ of constitutions i.e. proportion of provisions adopted. The years 1919, 1945 and 1991 are marked.

5 Correlations of Text and Provisional Similarities

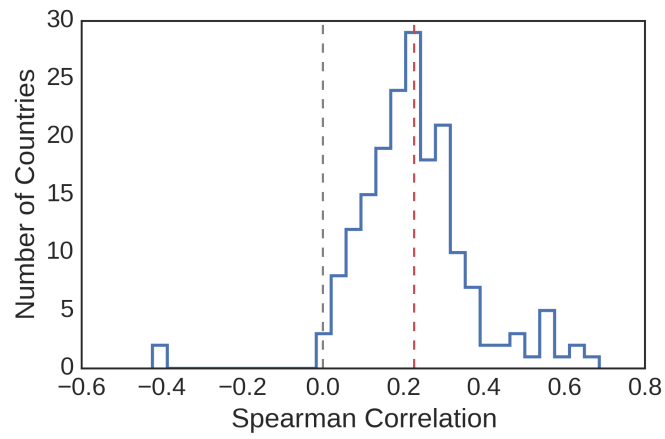


Figure 18: Distribution over countries of Spearman rank correlation coefficients based on text and provisions similarity

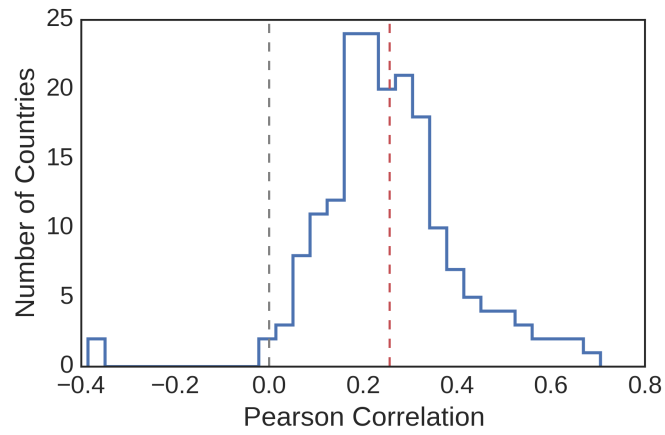


Figure 19: Distribution over countries of Pearson rank correlation coefficients based on text and provisions similarity

6 Insertion/Removal of Provisions upon Independence

Here we consider the number of provisions present in countries when independence is first achieved i.e. in the first constitution that appears in the CCPNC dataset[9]. We compare this number to the number of provisions present in the former Imperial power in that cluster (e.g. Russia, UK, Spain or France) in that same year. Due to shortcomings in this dataset, often no information is available on the presence of these provisions, therefore we consider the first year after independence for which this information is available. Where no future year has this information we look to the first available *past* year for comparison. The boxplot of differences in provisions is plotted below with the Iberian cluster (Spain) omitted due to the sparsity of information available on Spanish provisions before the year 1932.

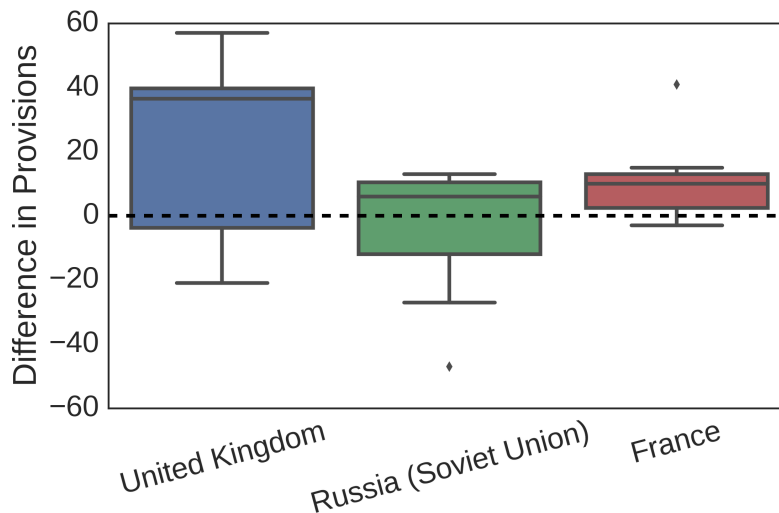


Figure 20: Boxplot of number of provisions added to each constitution relative to parent constitution by cluster.

7 Provisional Time Series

7.1 Time Series Dimensionality Reduction

In order to find structure within the historical adoption of each provision, we consider the time series of the proportion of constitutions adopting each provision. On account of the large peaks around 1990 which occur for all provisions, a simple linear measure of similarity such as Pearson correlation coefficient returns artificially large correlations which precludes meaningful clustering. Therefore we perform a dimensionality reduction using a probabilistic PCA [4] as implemented in the Python scikit-learn package [5]. This allows for the provisions to be reduced to a linear combination of a smaller number of representative time series. For this purpose we consider the provisional activity over the 100 year period from 1913 to 2013 in order to mitigate the effect of noise arising from a relatively small number of countries having national constitutions at this time.

The dimensionality reduction therefore reduces the matrix of observations from $(n\text{Years} \times n\text{Provisions}) = (100 \times 234)$ to $(n\text{Principal} \times n\text{Provisions})$ where $n\text{Principal}$ is chosen arbitrarily. However we can see from the scree plot [6] below that the vast majority of the variance of the provisions is captured by the first 4 principal components. The evolution of the principal components are visualised below, along with their respective proportion of the of explained variance.

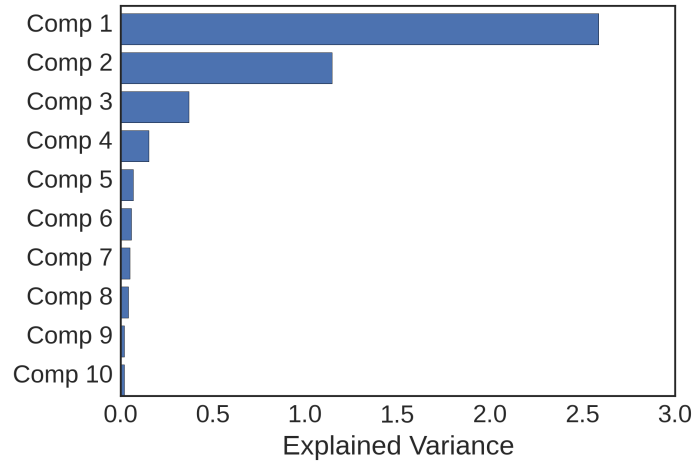


Figure 21: The variance explained by each principal component.

The evolution of the principal components are visualised below, along with their respective proportion of explained variance

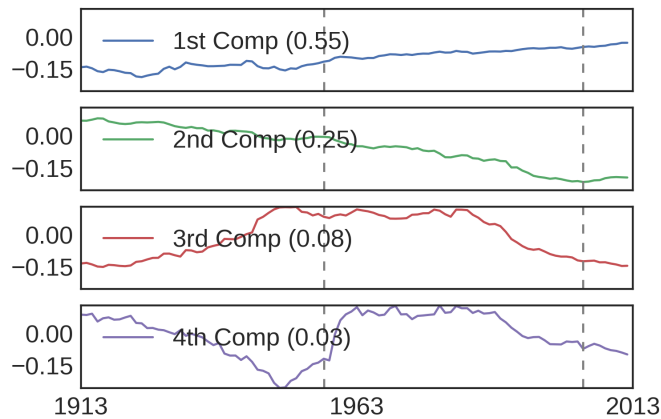


Figure 22: First 4 principal components of provisional time series annotated with their respective explained variance

7.2 Clustering in Reduced Space

Next we consider the clustering of these time series when projected into the reduced 10-dimensional space. We make use of k-means clustering, with $k=3,4,5$ displayed below. The ‘elbow’ plot below shows the reduction in the total intra-cluster distance to justify our use of $k=4$

Below the full list of provisions in each cluster is enumerated.

Cluster 1

Does the constitution provide for matrimonial equality?
Does the constitution refer to political parties?
Does the constitution contain provisions concerning the relationship between the constitution and international law?
Does the constitution provide the right to just remuneration, fair or equal payment for work?
Does the constitution refer to "democracy" or "democratic"?
Does the constitution guarantee the rights of children?
Does the constitution prohibit cruel, inhuman, or degrading treatment?
Does the constitution provide for a right of rest and leisure?
Does the constitution place limits on child employment?
Does the constitution provide for the right to choose ones occupation?
Does the constitution mention the right to safe/healthy working conditions?
Does the constitution contain provisions with regard to any additional central independent regulatory agencies ?
Does the constitution prohibit punishment by laws enacted ex post facto ?
Does the constitution stipulate that some public office holders take an oath to support or abide by the constitution?
Is a supermajority needed for passing any legislation?
Is there a mandatory retirement age for judges?
Does the constitution refer to a duty of the people to take part in building society or to work for the development of the country?
Does the constitution provide for the right of some redress in the case of false imprisonment, arrest, or judicial error?
Does the constitution provide for freedom of movement?
Does the constitution provide for freedom of opinion, thought, and/or conscience?
How does the constitution address the state operation of print or electronic media?
Does the constitution refer to the "free market," "capitalism," or an analogous term?
Does the constitution include provisions for the meritocratic recruitment of civil servants (e.g. exams or credential requirements)?
Are any parts of the constitution unamendable?
Does the constitution contain an explicit declaration regarding the independence of the central judicial organ(s)?
Does the constitution refer to radio?
Does the constitution provide the right to counsel if one is indicted or arrested?
Does the constitution make a claim to universal adult suffrage?
Does the constitution contain provisions concerning the national flag?
Does the constitution provide the right to a free and/or competitive market?
Does the constitution guarantee equal access to higher education?
Does the constitution provide for a right to an adequate or reasonable standard of living?
Do defendants have the right to appeal judicial decisions?
Does the constitution contain a national motto?
Does the constitution provide for the right to form or to join trade unions?
Does the constitution provide for the right of protection of one's reputation from libelous actions?
Does the constitution provide for the extradition of suspected or convicted criminals to other countries?
Does the constitution refer to "customary" international law or the "law of nations"?
Does the constitution provide for the right/possibility of pre-trial release?
Does the constitution contain provisions concerning national integration of ethnic communities?
In what language is the source document written (not the original, but the one used for coding)?
Does the constitution mention a state duty to provide work/employment?
Does the constitution refer to a state duty to protect or promote culture or cultural rights?
Does the constitution refer to the social security of the society or nation?
Does the constitution provide for positive obligations to transfer wealth to, or provide opportunity for, particular groups?
Does the constitution refer to social, political, or economic conditions in the time before the birth of the state or in the time of a former constitution?
Does the constitution refer to "fraternity" or "solidarity"?
Does the constitution provide for inheritance rights?
Does the constitution restrict entry or exit of the states borders?
Does the constitution provide for the prohibition of double jeopardy (i.e., being tried for the same crime twice)?
Does the constitution refer to "socialism" or "socialist"?
Does the constitution contain provisions for the protection of stateless individuals, refugees from other states, or the right to asylum?
Does the constitution stipulate that courts have to take into account decisions of higher courts?
Does the constitution mention a state duty to provide health care?
Does the constitution prohibit torture?
Does the constitution generally require public trials?
Does the constitution mention the adoption of national economic plans?
Does the constitution stipulate a quota for representation of certain groups in the Second Chamber?
Does the constitution prescribe that electoral ballots be secret?
Are there provisions for dismissing the Head of Government?
Does the constitution specify a deputy executive of any kind (e.g., deputy prime minister, vice president)?
Does the constitution provide for either general or financial support by the government for the elderly?
Does the constitution provide for either general or financial support by the government for the unemployed?
Does the constitution provide for either general or financial support by the government for the disabled?
Does the constitution provide for either general or financial support by the government for children, orphans?
Does the constitution protect from discrimination/provide for equality for gender?
Does the constitution protect from discrimination/provide for equality for nationality?
Does the constitution protect from discrimination/provide for equality for race?
Does the constitution protect from discrimination/provide for equality for religion?
Does the constitution protect from discrimination/provide for equality for creed/beliefs?
Does the constitution protect from discrimination/provide for equality for social status?
Does the constitution protect from discrimination/provide for equality for parentage? </pre>

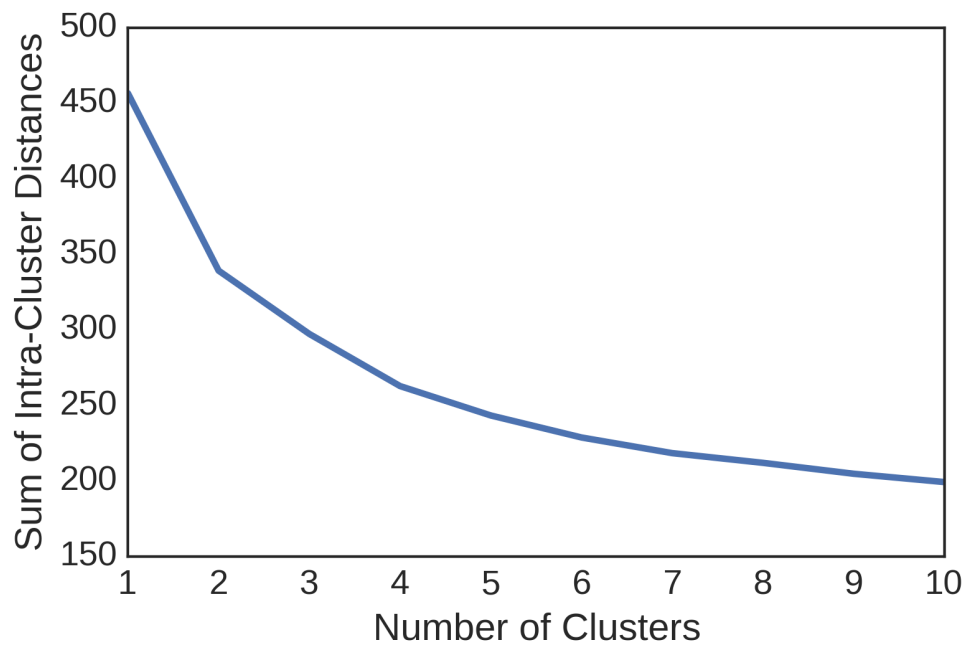


Figure 23: Elbow plot of k-means clustering.

Cluster 2
Does the constitution specify that the chambers should meet jointly for any reason?
Does the constitution refer to a duty to join a political party?
Does the constitution mention a state duty to provide work/employment?
Does the constitution mention anything about crimes committed by the previous regime?
Does the constitution prohibit one or more political parties?
Does the constitution provide for immunity for the members of the Legislature under some conditions?
Does the constitution require that the names of those imprisoned be entered in a public registry?
Does the constitution provide the right for same sex marriages?
Does the constitution provide for the right to bear arms?
Does the constitution explicitly mention due process?
How many chambers or houses does the Legislature contain?
Does the constitution refer to a duty to join trade unions?
Does the constitution specify the electoral system for the Second Chamber?
Does the constitution refer to the French declaration of rights (1789)?
Does the constitution refer to the Helsinki Accords (1966)?
Is there citizen involvement in the indicting process (such as a grand jury)?
Is there a constitutional provision for civil marriage?</pre>

Cluster 3

Does the constitution provide for an individual right to view government files or documents under at least some conditions?
Does the constitution provide for the right to examine evidence or confront all witnesses?
Does the constitution specify that healthcare should be provided by government free of charge?
Does the constitution require that legislators give up any other profession (i.e. work exclusively as legislators)?
Does the constitution contain provisions for a Judicial Council/Commission?
Is one of the executives explicitly referred to as the "Head of Government"?
Does the constitution mention judicial opinions of the Constitutional Court?
Does the constitution provide for a right to form political parties?
Is there special mention of terrorism and public security provisions regarding terrorism?
Is there a right to exemption from military service for conscientious objectors to war or other groups?
Does the constitution use the words (socio-) economic rights or similar?
Does the constitution require that legislators disclose their earnings and/or assets?
Does the constitution provide for an Ombudsman?
Does the constitution suggest that citizens should have the right to overthrow their government under certain circumstances?
Does the constitution provide for an individual's right to self determination or the right to free development of personality?
Does the constitution provide for the ability of individuals to propose legislative initiatives (referenda from below)?
Do citizens have the right to renounce their citizenship?
Does the constitution provide for a commission for truth and reconciliation?
Does the constitution mention a special regulatory body/institution to oversee the media market?
Does the constitution express a preference for one or more political parties?
Does the constitution provide for the right to a speedy trial?
Does the constitution stipulate a quota for representation of certain groups in the first (or only) chamber?
Does the constitution refer to protection or preservation of the environment?
Does the constitution provide for a people's right of self-determination?
Is one of the executives explicitly referred to as the "Head of State"?
Does the constitution provide the right to found a family?
Does the constitution provide for a right to strike?
Does the constitution specify the trial has to be in a language the accused understands or the right to an interpreter if the accused cannot understand the language?
Does the constitution mention any special procedures for removing members of the constitutional court?
Does the constitution contain a general statement regarding rule of law, legality, or Rechtsstaat (the German equivalent)?
Is there a presumption of innocence in trials?
Does the constitution contain provisions concerning the national anthem?
Does the constitution refer to the "dignity of man" or human "dignity"?
Does the constitution contain provisions concerning international organizations?
Does the constitution provide for the right to shelter or housing?
Does the constitution provide for a right to enjoy the benefits of scientific progress?
Does the constitution provide for an electoral commission or electoral court to oversee the election process?
Does the constitution mention consumer rights or consumer protection?
Does the constitution give juveniles special rights/status in the criminal justice process?
Does the constitution suggest that citizens should have the right to overthrow their government under certain circumstances?
Does the constitution refer to television?
Are rights provisions binding on private parties as well as the state?
Does the constitution mention "foreign investment" or "foreign capital"?
Does the constitution contain provisions for a central bank?
Does the constitution provide the right to a fair trial?
Does the constitution refer to the protection of different languages?
Does the constitution refer to the UN universal Declaration on Human Rights (1948)?
Does the constitution refer to the UN charter Article 45 (1945)?
Does the constitution refer to the European Convention for the Protection of Human Rights and Fundamental Freedoms (1950)?
Does the constitution refer to the International Covenant on Civil and Political Rights (1966)?
Does the constitution refer to the International Covenant on Economic and Social Rights (1966)?
Does the constitution refer to the American Convention on Human Rights (1969)?
Does the constitution refer to the African Charter on Human People's Rights (1981)?
Does the constitution contain provisions for a counter corruption commission?
Is there a special mention of victims rights in the constitution?
If counsel is provided, is it provided at the state's expense?
Does the constitution protect from discrimination/provide for equality for country of origin?
Does the constitution protect from discrimination/provide for equality for language?
Does the constitution protect from discrimination/provide for equality for sexual orientation?
Does the constitution protect from discrimination/provide for equality for age?
Does the constitution protect from discrimination/provide for equality for mental or physical disability?
Does the constitution protect from discrimination/provide for equality for color?
Does the constitution protect from discrimination/provide for equality for financial/propety ownership?
Does the constitution protect from discrimination/provide for equality for tribe/clan?
Does the constitution protect from discrimination/provide for equality for political party? </pre>

Cluster 4
Does the constitution contain an explicit declaration regarding the INDEPENDENCE of the central executive organ(s)?
Does the constitution provide for a right to petition for "amparo"?
Does the constitution mention international treaties?
Does the constitution provide for freedom of religion?
Are there provisions for dismissing judges?
Does the constitution prescribe whether or not the meetings of the Legislature are (generally) held in public?
Is the executive identified explicitly as the Head of State or Head of Government?
Does the constitution give the accused a right to silence or protection from self incrimination?
Are there provisions for removing individual legislators?
Does the constitution provide for the right to protection from unjustified restraint (habeas corpus)?
Does the constitution provide for freedom of assembly?
Does the constitution refer to a duty to pay taxes?
Is the military or armed forces mentioned in the constitution?
Does the constitution provide a right to conduct/establish a business?
Does the legislature have the power to investigate the activities of the executive branch?
Does the constitution contain provisions concerning the relationship between the constitution and international law?
Does the constitution provide for freedom of expression or speech?
Does the constitution refer to ownership or possession of natural resources (such as minerals, oil, etc.)?
Does the constitution forbid the detention of debtors?
Does the constitution stipulate that some public office holders take an oath to support or abide by the constitution?
Does the constitution provide for a right of petition?
Does the constitution require a jury or any form of citizen participation in decision making in criminal trials?
Is the state described as either federal, confederal, or unitary?
Does the constitution explicitly state that judicial salaries are protected from governmental intervention?
Does the constitution contain provisions protecting the individual against illegal or ultra-vires administrative actions?
Do constitutional amendments require more than a simple majority by the legislature to be approved?
Does the constitution provide for a central representative body (a legislature)?
Does the constitution prohibit slavery, servitude, or forced labor?
Does the constitution refer to artists or the arts?
Does the constitution provide for freedom of expression or speech?
Does the constitution contain provisions concerning a national or official religion or a national or official church?
Does the constitution refer to "democracy" or "democratic"?
Does the constitution prohibit censorship?
Does the constitution provide for a right to own property?
Does the constitution place any restrictions on the right to vote?
Does the constitution mention bankruptcy law?
Does the legislature have the power to interpellate members of the executive branch??
Does the constitution provide for freedom of association?
Are there provisions for the secession or withdrawal of parts of the state?
Does the constitution provide for at least one procedure for amending the constitution?
Does the constitution make voting mandatory, at least for some elections?
Are there provisions for dismissing the Head of State?
Does the constitution mention the executive cabinet/ministers?
Does the constitution provide for judicial opinions of the Highest Ordinary Court?
Does the constitution refer to equality before the law, the equal rights of men, or non-discrimination?
Does the constitution specify a census?
Does the constitution provide for naturalized citizens or naturalization?
Does the constitution stipulate that education be free, at least up to some level?
Does the constitution provide for the right to marry?
Does the constitution contain an explicit decree of separation of church and state?
What is the specified level of compensation for expropriation of private property?
Does the constitution stipulate that certain rights are inalienable or inviolable?
Does the constitution contain provisions concerning education?
Does the constitution guarantee academic freedom?
Does the constitution provide for a right of privacy?
Does the constitution regulate the collection of evidence?
Does the constitution provide for a right of testate, or the right to transfer property freely after death?
Does the constitution contain provisions allowing review of the legislation of the constituent units in federations by federal judicial or other central government organs?
Does the constitution mention nulla poena sine lege or the principle that no person should be punished without law?
Does the constitution define the geographic borders/territory of the state?
Does the constitution mention "God" or any other Deities?
Does the constitution refer to artists or the arts?
Can the government expropriate private property under at least some conditions?
Does the constitution refer to a duty of military service?
Are members of the first (or only) chamber elected in the same cohort, or in staggered cohorts?
Does the constitution contain provisions specifying the location of the capital (if so, please specify the location in the comments section)?
Does the constitution mention foreign or international trade?
Does the constitution provide for suspension or restriction of rights during states of emergency?
Is there a mention of telecommunications?
Does the constitution mention the right to transfer property freely?
Are there provisions for the secession or withdrawal of parts of the state?
Does the constitution stipulate that education be compulsory until at least some level?
Does the constitution mention any of the following intellectual property rights: patents?
Does the constitution mention any of the following intellectual property rights: copyrights?
Does the constitution mention any of the following intellectual property rights: trademark?
Does the constitution mention any of the following intellectual property rights: general reference to IP? </pre>

The figure analogous to that in the main paper for $k=3$ and $k=5$ are displayed below

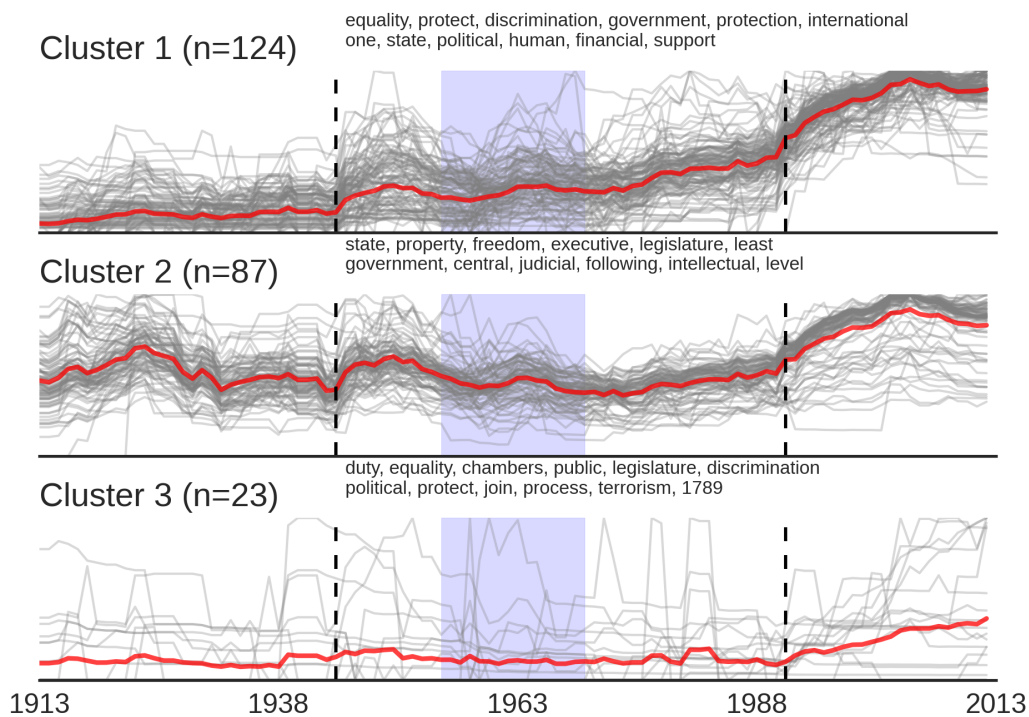


Figure 24: Clusters of provisional time series with child specific provision shown in red. Top terms in descriptions of provisions are included.

We present a heatmap of key terms and their appearance in each of the clusters when $n=4$, this figure accompanies the time series clustering plot in the main paper.

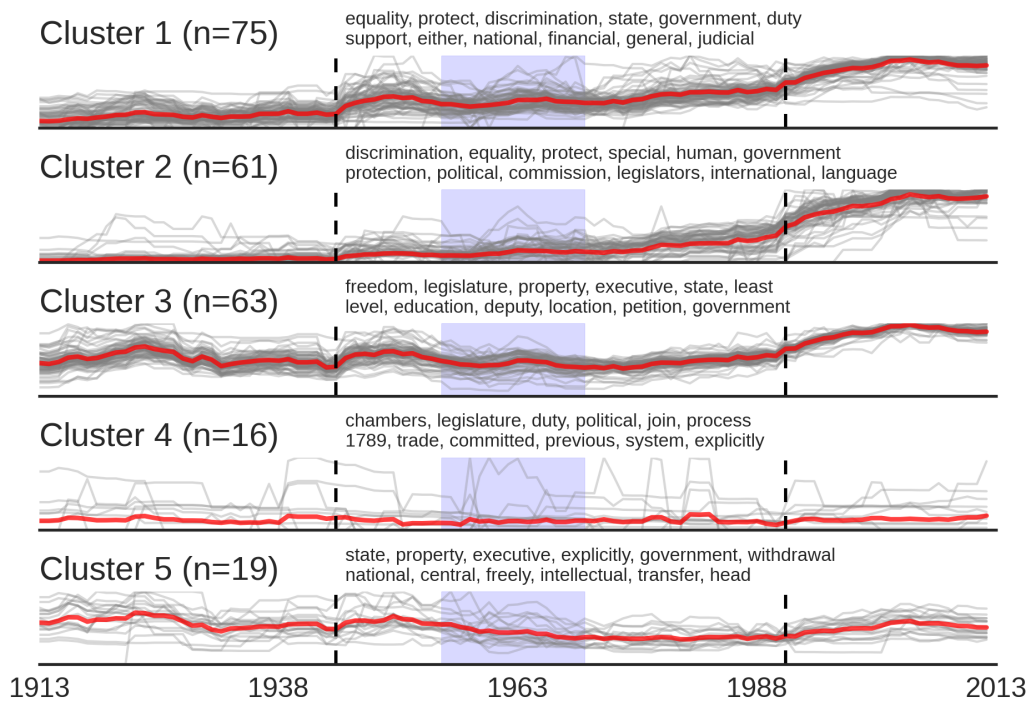


Figure 25: Clusters of provisional time series with child specific provision shown in red. Top terms in descriptions of provisions are included.

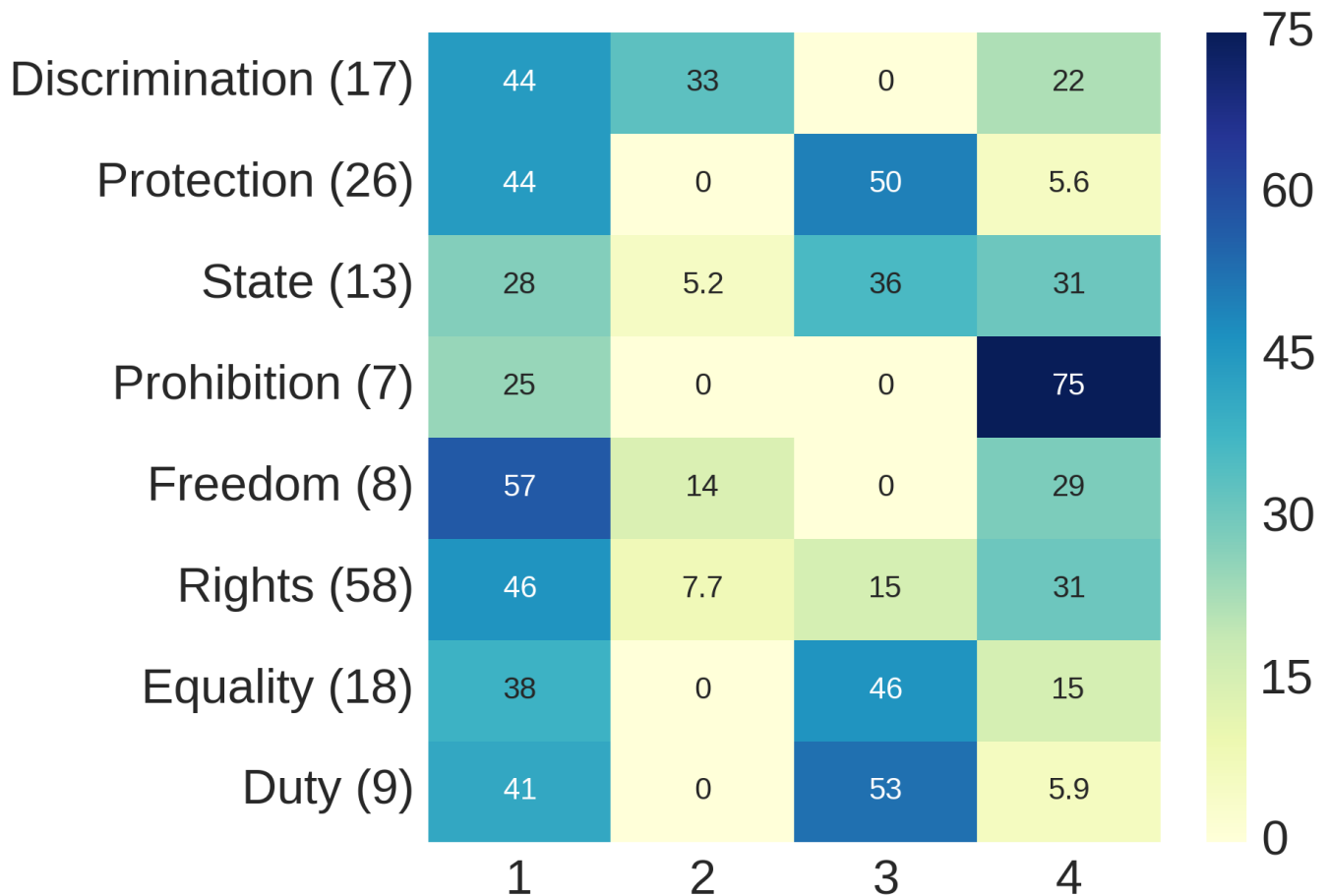


Figure 26: Heatmap showing how frequently key terms such as *discrimination* appear in the provisions in each cluster normalised by how often they appear across all clusters.

Table 10: Questions and Corresponding codes

Code	Description
LIFE	Does the constitution provide for a right to life?
HEALTHR	Does the constitution mention the right to health care?
WARAP	Who has the power to approve declarations of war?
INFOACC	Does the constitution provide for an individual right to view government files or documents under at least some conditions?
MATEQUAL	Does the constitution provide for matrimonial equality?
EXAMWIT	Does the constitution provide for the right to examine evidence or confront all witnesses?
CITDEP	Does the constitution grant the government the right to deport citizens or residents?
EXECINDP	Does the constitution contain an explicit declaration regarding the INDEPENDENCE of the central executive organ(s)?
PART	Does the constitution refer to political parties?
AMPARO	"Does the constitution provide for a right to petition for ""amparo""?"
TREAT	Does the constitution mention international treaties?
NAT	Does the constitution contain provisions concerning the relationship between the constitution and international law?
HEALTHF	Does the constitution specify that healthcare should be provided by government free of charge?
REMUNER	Does the constitution provide the right to just remuneration, fair or equal payment for work?
PROFLEG	Does the constitution require that legislators give up any other profession (i.e. work exclusively as legislators)?
JC	Does the constitution contain provisions for a Judicial Council/Commission?
DEMOC	"Does the constitution refer to ""democracy"" or ""democratic""?"
FREEREL	Does the constitution provide for freedom of religion?
JREM	Are there provisions for dismissing judges?
CHILDPRO	Does the constitution guarantee the rights of children?
HOGID	"Is one of the executives explicitly referred to as the ""Head of Government""?"
CRUELTY	Does the constitution prohibit cruel, inhuman, or degrading treatment?
LEISURE	Does the constitution provide for a right of rest and leisure?
PUBMEET	Does the constitution prescribe whether or not the meetings of the Legislature are (generally) held in public?
CHILDWRK	Does the constitution place limits on child employment?
CONCOP	Does the constitution mention judicial opinions of the Constitutional Court?
HOSHOG	Is the executive identified explicitly as the Head of State or Head of Government?
PARTRGHT	Does the constitution provide for a right to form political parties?
MIRANDA	Does the constitution give the accused a right to silence or protection from self incrimination?
TERROR	Is there special mention of terrorism and public security provisions regarding terrorism?
REMLEG	Are there provisions for removing individual legislators?
LEGJOINT	Does the constitution specify that the chambers should meet jointly for any reason?
HABCORP	Does the constitution provide for the right to protection from unjustified restraint (habeas corpus)?
NOMIL	Is there a right to exemption from military service for conscientious objectors to war or other groups?
OCCUPATE	Does the constitution provide for the right to choose ones occupation?
ASSEM	Does the constitution provide for freedom of assembly?
PRTYDUTY	Does the constitution refer to a duty to join a political party?
TAXES	Does the constitution refer to a duty to pay taxes?
SAFework	Does the constitution mention the right to safe/healthy working conditions?
EXINST	Does the constitution contain provisions with regard to any additional central independent regulatory agencies ?
MILITARY	Is the military or armed forces mentioned in the constitution?
BUSINES	Does the constitution provide a right to conduct/establish a business?
EXPOST	Does the constitution prohibit punishment by laws enacted ex post facto ?
SOCECON	Does the constitution use the words (socio-) economic rights or similar?
INVEXE	Does the legislature have the power to investigate the activities of the executive branch?
INTLAW	Does the constitution contain provisions concerning the relationship between the constitution and international law?
ASSETS	Does the constitution require that legislators disclose their earnings and/or assets?
REFEREN	Does the constitution stipulate that some public office holders take an oath to support or abide by the constitution?
EXPRESS	Does the constitution provide for freedom of expression or speech?
LEGSUPR	Is a supermajority needed for passing any legislation?
RESRCE	Does the constitution refer to ownership or possession of natural resources (such as minerals, oil, etc.)?
JUDRETIR	Is there a mandatory retirement age for judges?
DEBTORS	Does the constitution forbid the detention of debtors?
BUILDSOC	Does the constitution refer to a duty of the people to take part in building society or to work for the development of the country?
OATH	Does the constitution stipulate that some public office holders take an oath to support or abide by the constitution?
PETITION	Does the constitution provide for a right of petition?
FALSEIMP	Does the constitution provide for the right of some redress in the case of false imprisonment, arrest, or judicial error?
OMBUDS	Does the constitution provide for an Ombudsman?

Table 11: Questions and Corresponding codes cont.

Code	Description
JURY	Does the constitution require a jury or any form of citizen participation in decision making in criminal trials?
HR	Does the constitution suggest that citizens should have the right to overthrow their government under certain circumstances?
DEVLPEPERS	Does the constitution provide for an individual's right to self determination or the right to free development of personality?
PROVWORK	Does the constitution mention a state duty to provide work/employment?
FREEMOVE	Does the constitution provide for freedom of movement?
INITIAT	Does the constitution provide for the ability of individuals to propose legislative initiatives (referenda from below)?
FEDUNIT	Is the state described as either federal, confederal, or unitary?
JUDSAL	Does the constitution explicitly state that judicial salaries are protected from governmental intervention?
ILLADMIN	Does the constitution contain provisions protecting the individual against illegal or ultra-vires administrative actions?
OPINION	Does the constitution provide for freedom of opinion, thought, and/or conscience?
AMNDAMAJ	Do constitutional amendments require more than a simple majority by the legislature to be approved?
GOVMED	How does the constitution address the state operation of print or electronic media?
MARKET	"Does the constitution refer to the ""free market,"" ""capitalism,"" or an analogous term?"
LEGISL	Does the constitution provide for a central representative body (a legislature)?
SLAVE	Does the constitution prohibit slavery, servitude, or forced labor?
CITREN	Do citizens have the right to renounce their citizenship?
TRUTHCOM	Does the constitution provide for a commission for truth and reconciliation?
CIVIL	Does the constitution include provisions for the meritocratic recruitment of civil servants (e.g. exams or credential requirements)?
MEDCOM	Does the constitution mention a special regulatory body/institution to oversee the media market?
UNAMEND	Are any parts of the constitution unamendable?
JUDIND	Does the constitution contain an explicit declaration regarding the independence of the central judicial organ(s)?
SCIENCE	Does the constitution refer to artists or the arts?
PRESS	Does the constitution provide for freedom of expression or speech?
RADIO	Does the constitution refer to radio?
OFFREL	Does the constitution contain provisions concerning a national or official religion or a national or official church?
EM	"Does the constitution refer to ""democracy"" or ""democratic""?"
PREVLEAD	Does the constitution mention anything about crimes committed by the previous regime?
PARTPRF	Does the constitution express a preference for one or more political parties?
COUNS	Does the constitution provide the right to counsel if one is indicted or arrested?
PARTPRH	Does the constitution prohibit one or more political parties?
CENSOR	Does the constitution prohibit censorship?
PROPRGHT	Does the constitution provide for a right to own property?
VOTEUN	Does the constitution make a claim to universal adult suffrage?
SPEEDTRI	Does the constitution provide for the right to a speedy trial?
VOTERES	Does the constitution place any restrictions on the right to vote?
FLAG	Does the constitution contain provisions concerning the national flag?
LHQUOTA	Does the constitution stipulate a quota for representation of certain groups in the first (or only) chamber?
ENV	Does the constitution refer to protection or preservation of the environment?
FREECOMP	Does the constitution provide the right to a free and/or competitive market?
SELFDDET	Does the constitution provide for a people's right of self-determination?
HOSID	"Is one of the executives explicitly referred to as the ""Head of State""?"
FNDPAM	Does the constitution provide the right to found a family?
BANKRUPT	Does the constitution mention bankruptcy law?
ACHIGHED	Does the constitution guarantee equal access to higher education?
INTEDEC	Does the legislature have the power to interpellate members of the executive branch??
ASSOC	Does the constitution provide for freedom of association?
SECESS	Are there provisions for the secession or withdrawal of parts of the state?
STANDLIV	Does the constitution provide for a right to an adequate or reasonable standard of living?
STRIKE	Does the constitution provide for a right to strike?
RGHTAPP	Do defendants have the right to appeal judicial decisions?
MOTTO	Does the constitution contain a national motto?
IMMUNITY	Does the constitution provide for immunity for the members of the Legislature under some conditions?
JOINTRDE	Does the constitution provide for the right to form or to join trade unions?
AMEND	Does the constitution provide for at least one procedure for amending the constitution?
TRILANG	Does the constitution specify the trial has to be in a language the accused understands or the right to an interpreter if the accused cannot understand the language?
LIBEL	Does the constitution provide for the right of protection of one's reputation from libelous actions?
PRISONRG	Does the constitution require that the names of those imprisoned be entered in a public registry?
COMPVOTE	Does the constitution make voting mandatory, at least for some elections?
CONREM	Does the constitution mention any special procedures for removing members of the constitutional court?
EXCRIM	Does the constitution provide for the extradition of suspected or convicted criminals to other countries?
HOSDIS	Are there provisions for dismissing the Head of State?
CUSTLAW	"Does the constitution refer to ""customary"" international law or the ""law of nations""?"
RULELAW	Does the constitution contain a general statement regarding rule of law, legality, or Rechtsstaat (the German equivalent)?
PREREL	Does the constitution provide for the right/possibility of pre-trial release?
ETHINCL	Does the constitution contain provisions concerning national integration of ethnic communities?
SAMESEXM	Does the constitution provide the right for same sex marriages?
LANG	In what language is the source document written (not the original, but the one used for coding)?
PRESINOC	Is there a presumption of innocence in trials?
ANTHEM	Does the constitution contain provisions concerning the national anthem?
WORK	Does the constitution mention a state duty to provide work/employment?
ARMS	Does the constitution provide for the right to bear arms?
CABINET	Does the constitution mention the executive cabinet/ministers?
DUEPROC	Does the constitution explicitly mention due process?
CULTRGHT	Does the constitution refer to a state duty to protect or promote culture or cultural rights?
SOCSEC	Does the constitution refer to the social security of the society or nation?
OPGROU	Does the constitution provide for positive obligations to transfer wealth to, or provide opportunity for, particular groups?
PREVCOND	Does the constitution refer to social, political, or economic conditions in the time before the birth of the state or in the time of a former constitution?
DIGNITY	"Does the constitution refer to the ""dignity of man"" or human ""dignity""?"
HOCOP	Does the constitution provide for judicial opinions of the Highest Ordinary Court?
SOLID	"Does the constitution refer to ""fraternity"" or ""solidarity""?"
INHERIT	Does the constitution provide for inheritance rights?
EQUAL	Does the constitution refer to equality before the law, the equal rights of men, or non-discrimination?
RESENEX	Does the constitution restrict entry or exit of the states borders?
INTORG	Does the constitution contain provisions concerning international organizations?
CENSUS	Does the constitution specify a census?
HOUSENUM	How many chambers or houses does the Legislature contain?
SHELTER	Does the constitution provide for the right to shelter or housing?
SCIFREE	Does the constitution provide for a right to enjoy the benefits of scientific progress?
NATCIT	Does the constitution provide for naturalized citizens or naturalization?
EDFREE	Does the constitution stipulate that education be free, at least up to some level?
MARRIAGE	Does the constitution provide for the right to marry?
SEPREL	Does the constitution contain an explicit decree of separation of church and state?
OVERSGHT	Does the constitution provide for an electoral commission or electoral court to oversee the election process?
EXPRCOMP	What is the specified level of compensation for expropriation of private property?
INALRGHT	Does the constitution stipulate that certain rights are inalienable or inviolable?
CONRIGHT	Does the constitution mention consumer rights or consumer protection?
DOBJEP	Does the constitution provide for the prohibition of double jeopardy (i.e., being tried for the same crime twice)?
EDUCATE	Does the constitution contain provisions concerning education?
SOCIALSM	"Does the constitution refer to ""socialism"" or ""socialist""?"
ACFRE	Does the constitution guarantee academic freedom?
PRIVACY	Does the constitution provide for a right of privacy?
TRADUN	Does the constitution refer to a duty to join trade unions?
JUVENILE	Does the constitution give juveniles special rights/status in the criminal justice process?
EVIDENCE	Does the constitution regulate the collection of evidence?
OVERTHRW	Does the constitution suggest that citizens should have the right to overthrow their government under certain circumstances?
ASYLUM	Does the constitution contain provisions for the protection of stateless individuals, refugees from other states, or the right to asylum?
JUDPREC	Does the constitution stipulate that courts have to take into account decisions of higher courts?
TESTATE	Does the constitution provide for a right of testate, or the right to transfer property freely after death?
PROVHLTH	Does the constitution mention a state duty to provide health care?
TORTURE	Does the constitution prohibit torture?
TV	Does the constitution refer to television?
FEDREV	Does the constitution contain provisions allowing review of the legislation of the constituent units in federations by federal judicial or other central government organs?
WOLAW	Does the constitution mention nulla poena sine lege or the principle that no person should be punished without law?
TERR	Does the constitution define the geographic borders/territory of the state?
UELSYS	Does the constitution specify the electoral system for the Second Chamber?
GOD	"Does the constitution mention ""God"" or any other Deities?"
ARTISTS	Does the constitution refer to artists or the arts?
EXPROP	Can the government expropriate private property under at least some conditions?
BINDING	Are rights provisions binding on private parties as well as the state?
MILSERV	Does the constitution refer to a duty of military service?
FORINVES	"Does the constitution mention ""foreign investment"" or ""foreign capital""?"
LHCOHORT	Are members of the first (or only) chamber elected in the same cohort, or in staggered cohorts?
PUBTRI	Does the constitution generally require public trials?
ECONPLAN	Does the constitution mention the adoption of national economic plans?

Table 12: Questions and Corresponding codes cont.

Code	Description
CAPITAL	Does the constitution contain provisions specifying the location of the capital (if so, please specify the location in the comments section)?
FORTRAD	Does the constitution mention foreign or international trade?
BANK	Does the constitution contain provisions for a central bank?
FAIRTRI	Does the constitution provide the right to a fair trial?
EMRIGHTS	Does the constitution provide for suspension or restriction of rights during states of emergency?
TELECOM	Is there a mention of telecommunications?
TRANSFER	Does the constitution mention the right to transfer property freely?
LANGPROT	Does the constitution refer to the protection of different languages?
ACCESS	Are there provisions for the secession or withdrawal of parts of the state?
EDCOMP	Does the constitution stipulate that education be compulsory until at least some level?
UHQUOTA	Does the constitution stipulate a quota for representation of certain groups in the Second Chamber?
FREEELEC	Does the constitution prescribe that electoral ballots be secret?
INTRGHT_1	Does the constitution refer to the UN universal Declaration on Human Rights (1948)?
INTRGHT_2	Does the constitution refer to the French declaration of rights (1789)?
INTRGHT_3	Does the constitution refer to the UN charter Article 45 (1945)?
INTRGHT_4	Does the constitution refer to the European Convention for the Protection of Human Rights and Fundamental Freedoms (1950)?
INTRGHT_5	Does the constitution refer to the International Covenant on Civil and Political Rights (1966)?
INTRGHT_6	Does the constitution refer to the International Covenant on Economic and Social Rights (1966)?
INTRGHT_7	Does the constitution refer to the American Convention on Human Rights (1969)?
INTRGHT_8	Does the constitution refer to the Helsinki Accords (1966)?
INTRGHT_9	Does the constitution refer to the African Charter on Human People's Rights (1981)?
CC	Does the constitution contain provisions for a counter corruption commission?
HOGDISS	Are there provisions for dismissing the Head of Government?
DEPEXEC	Does the constitution specify a deputy executive of any kind (e.g., deputy prime minister, vice president)?
FINSUP_1	Does the constitution provide for either general or financial support by the government for the elderly?
FINSUP_2	Does the constitution provide for either general or financial support by the government for the unemployed?
FINSUP_3	Does the constitution provide for either general or financial support by the government for the disabled?
FINSUP_4	Does the constitution provide for either general or financial support by the government for children, orphans?
GRJURY	Is there citizen involvement in the indicting process (such as a grand jury)?
CIVMAR	Is there a constitutional provision for civil marriage?
VICRIGHT	Is there a special mention of victims rights in the constitution?
COUNSCOS	If counsel is provided, is it provided at the state's expense?
INTPROP_1	Does the constitution mention any of the following intellectual property rights: patents?
INTPROP_2	Does the constitution mention any of the following intellectual property rights: copyrights?
INTPROP_3	Does the constitution mention any of the following intellectual property rights: trademark?
INTPROP_4	Does the constitution mention any of the following intellectual property rights: general reference to IP?
EQUALGR_1	Does the constitution protect from discrimination/provide for equality for gender?
EQUALGR_2	Does the constitution protect from discrimination/provide for equality for nationality?
EQUALGR_3	Does the constitution protect from discrimination/provide for equality for country of origin?
EQUALGR_4	Does the constitution protect from discrimination/provide for equality for race?
EQUALGR_5	Does the constitution protect from discrimination/provide for equality for language?
EQUALGR_6	Does the constitution protect from discrimination/provide for equality for religion?
EQUALGR_7	Does the constitution protect from discrimination/provide for equality for sexual orientation?
EQUALGR_8	Does the constitution protect from discrimination/provide for equality for age?
EQUALGR_9	Does the constitution protect from discrimination/provide for equality for mental or physical disability?
EQUALGR_10	Does the constitution protect from discrimination/provide for equality for color?
EQUALGR_11	Does the constitution protect from discrimination/provide for equality for creed/beliefs?
EQUALGR_12	Does the constitution protect from discrimination/provide for equality for social status?
EQUALGR_13	Does the constitution protect from discrimination/provide for equality for financial/propety ownership?
EQUALGR_14	Does the constitution protect from discrimination/provide for equality for tribe/clan?
EQUALGR_15	Does the constitution protect from discrimination/provide for equality for political party?
EQUALGR_16	Does the constitution protect from discrimination/provide for equality for parentage?

8 Provisions for Children & Young People

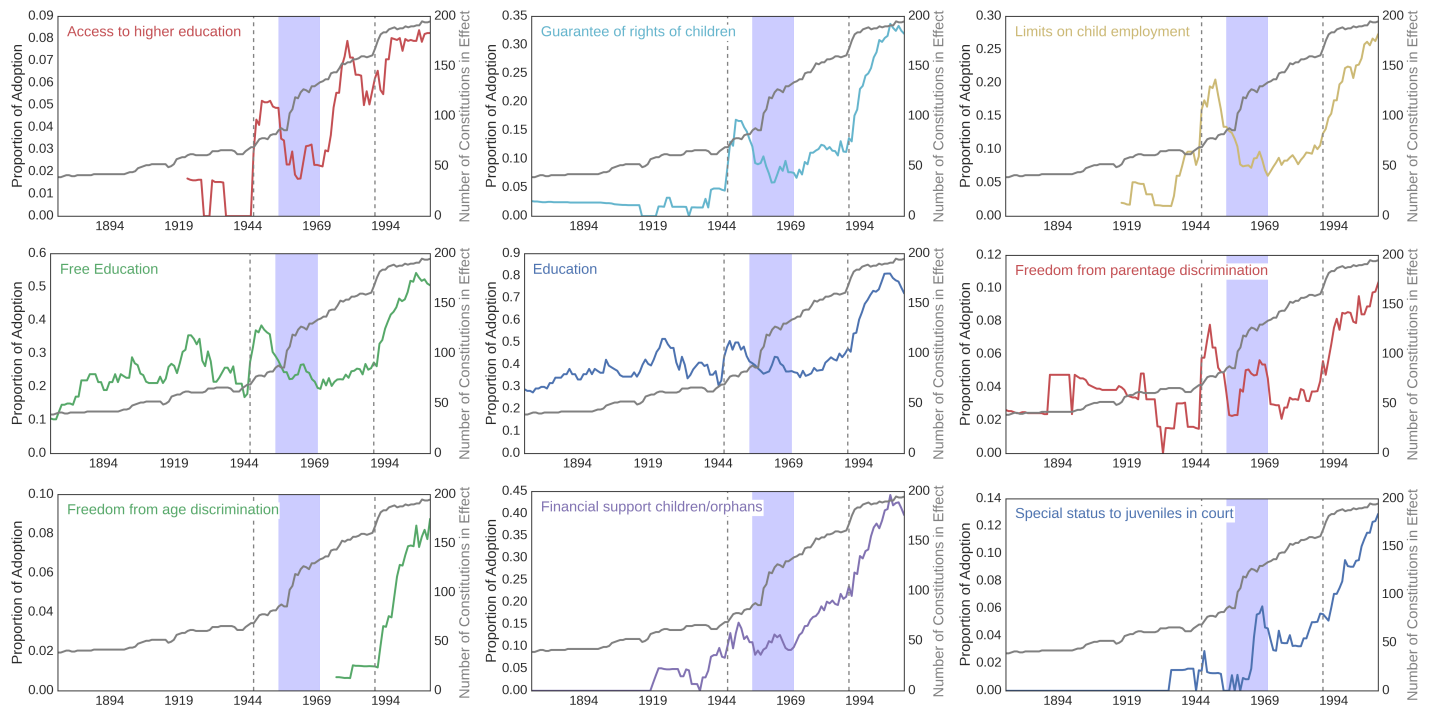


Figure 27: Proportion of adoption, defined as the proportion of independent countries in existence that year including that provision in their constitution, of nine provisions relevant to children over time (coloured lines) each compared to the number of countries (dark line).

9 Network-driven and Temporal-driven Provisional Adoption

9.1 Network Character of Provisions

Written explicitly we compute the expected conditional probability of a random pair of countries coadopting a provision given their constitutions were written in the same year as

$$P(\text{coadopt} \mid \text{year of writing}) = \frac{P(\text{coadopt} \cap \text{year of writing})}{P(\text{year of writing})} \quad (1)$$

$$E(P(\text{coadopt} \mid \text{year})) = \sum_y P(\text{coadopt} \mid \text{year}=y)P(\text{year}=y) \quad (2)$$

9.2 Temporal Character of Provisions

The expected probability of temporal coadoption of a provision adopted by n_{prov} out of n countries in years $[y_1 \dots y_{n_{prov}}]$ is defined as

$$\sum_{i=1, n} \sum_{j=i+1, n} \delta(y_i, y_j) / (n \times (n-1)) \quad (3)$$

9.3 Network-Temporal Disentanglement

We further investigate the dynamics of provisions classified as being dominated by temporal or network effects. This classification is strongly confounded by the highly non-uniform number of countries per year. Here, in analogy to forces acting on physical bodies, we consider the rate of change of adoption of a provision with respect to the rate of increase in countries. Written explicitly

$$v_{provision} - v_{countries} = \frac{\Delta n_{provisions}}{\Delta t} - \frac{\Delta n_{countries}}{\Delta t} \quad (4)$$

Since the proportion of countries adopting a provision can never exceed unity, the quantity $n_{provisions} - n_{countries}$ is always negative. In analogy with Newton's first law of motion which states that *a body will continue to remain at rest or to move at a constant velocity unless acted upon by an external force*, we consider the increase in provisional adoption relative to the increase in countries in order to identify periods of time in which a strong exogeneous force acts to increase the rate of adoption.

Figure (28) shows the 50 year moving average of the relative speeds. A clear clustering in temporal and network driven provisions is seen. Temporal provisions enjoy a steep rise in recent decades whereas network provisions oscillate less strongly around zero.

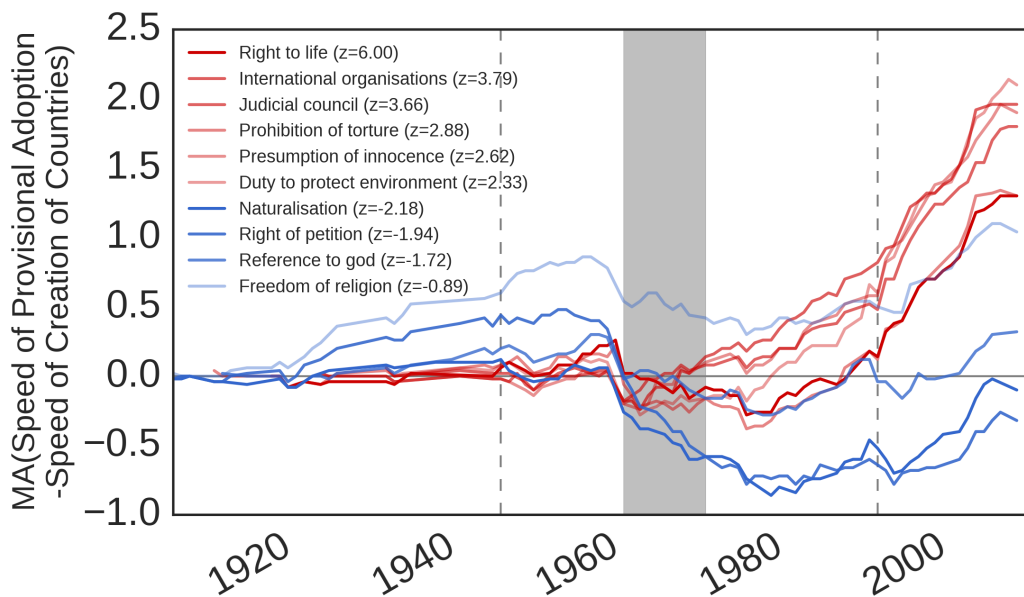


Figure 28: Time series of speed of provisional adoption relative to speed of country creation. Provisions classified as temporal/network driven in the main paper are labelled red/blue. Opacity is relative to magnitude of z-score. Provisional adoption speeds are defined relative to the value on the year of first adoption.

Z-Score	Provision
-2.181	Does the constitution provide for a right of petition?
-1.944	Does the constitution provide for naturalized citizens or naturalization?
-1.740	Are there provisions for dismissing judges?
-1.725	Does the constitution contain provisions concerning education?
-1.715	Does the constitution provide for freedom of religion?
-1.594	Does the constitution specify a deputy executive of any kind (e.g., deputy prime minister, vice president)?
-1.566	Does the constitution stipulate that some public office holders take an oath to support or abide by the constitution?
-1.528	Does the constitution provide for freedom of assembly?
-1.391	Does the constitution provide for freedom of association?
-1.391	Does the constitution explicitly state that judicial salaries are protected from governmental intervention?
-1.387	Does the constitution mention international treaties?
-1.369	Does the constitution provide for a central representative body (a legislature)?
-1.342	Are there provisions for removing individual legislators?
-1.319	Does the constitution refer to equality before the law, the equal rights of men, or non-discrimination?
-1.232	Does the constitution provide for the right/possibility of pre-trial release?
-1.150	Does the constitution provide for the prohibition of double jeopardy (i.e., being tried for the same crime twice)?
-1.103	Does the constitution give the accused a right to silence or protection from self incrimination?
-1.099	Does the constitution provide for freedom of expression or speech?
-1.085	Does the constitution mention the executive cabinet/ministers?
-1.069	Does the constitution provide for a right to own property?
-0.987	Does the constitution contain provisions concerning the relationship between the constitution and international law?
-0.974	Does the constitution provide for suspension or restriction of rights during states of emergency?
-0.962	Is the military or armed forces mentioned in the constitution?
-0.951	Does the constitution specify a census?
-0.947	Does the legislature have the power to interpellate members of the executive branch??
-0.909	Does the constitution regulate the collection of evidence?
-0.898	Does the constitution provide for freedom of expression or speech?
-0.887	"Does the constitution mention "God" or any other Deities?"
-0.849	Does the constitution generally require public trials?
-0.832	Does the constitution provide for at least one procedure for amending the constitution?
-0.831	Can the government expropriate private property under at least some conditions?
-0.823	Does the constitution mention nulla poena sine lege or the principle that no person should be punished without law?
-0.810	Are members of the first (or only) chamber elected in the same cohort, or in staggered cohorts?
-0.784	Does the constitution require a jury or any form of citizen participation in decision making in criminal trials?
-0.758	Does the constitution refer to a duty to pay taxes?
-0.745	Does the constitution provide for a right of privacy?
-0.724	Does the constitution provide for the extradition of suspected or convicted criminals to other countries?
-0.698	Does the constitution guarantee academic freedom?
-0.697	Does the constitution refer to ownership or possession of natural resources (such as minerals, oil, etc.)?
-0.691	Does the constitution mention the right to transfer property freely?
-0.667	Does the constitution refer to a duty of military service?
-0.659	Does the legislature have the power to investigate the activities of the executive branch?
-0.651	Does the constitution place any restrictions on the right to vote?
-0.617	Does the constitution refer to artists or the arts?
-0.609	"Does the constitution refer to "customary" international law or the "law of nations"?"
-0.563	Does the constitution contain provisions protecting the individual against illegal or ultra-vires administrative actions?
-0.550	Does the constitution provide for immunity for the members of the Legislature under some conditions?
-0.543	Does the constitution mention bankruptcy law?
-0.541	Does the constitution provide for the right to protection from unjustified restraint (habeas corpus)?
-0.535	Does the constitution prohibit slavery, servitude, or forced labor?
-0.534	Does the constitution include provisions for the meritocratic recruitment of civil servants (e.g. exams or credential requirements)?
-0.507	Does the constitution provide the right to a fair trial?
-0.506	Does the constitution provide for the right to a speedy trial?
-0.505	Does the constitution stipulate that certain rights are inalienable or inviolable?

Table 13: Large negative Zscore provisions i.e. Cluster dependent

Z-Score	Provision
6.00	Does the constitution refer to protection or preservation of the environment?
3.98	Does the constitution prohibit cruel, inhuman, or degrading treatment?
3.79	Does the constitution contain provisions for a Judicial Council/Commission?
3.66	Is there a presumption of innocence in trials?
2.87	Does the constitution contain provisions concerning international organizations?
2.61	Does the constitution prohibit torture?
2.33	Does the constitution provide for a right to life?
2.07	Does the constitution stipulate that some public office holders take an oath to support or abide by the constitution?
2.04	Does the constitution provide for a right to form political parties?
2.02	Does the constitution contain a general statement regarding rule of law, legality, or Rechtsstaat (the German equivalent)?
1.98	"Does the constitution refer to the "dignity of man" or human "dignity"?"
1.86	Does the constitution refer to a state duty to protect or promote culture or cultural rights?
1.80	Does the constitution refer to the protection of different languages?
1.76	Does the constitution contain provisions concerning the national anthem?
1.72	Does the constitution mention the right to health care?
1.58	Does the constitution provide the right to counsel if one is indicted or arrested?
1.52	Does the constitution provide for a right to strike?
1.35	Does the constitution provide the right to found a family?
1.33	Does the constitution protect from discrimination/provide for equality for race?
1.23	Does the constitution protect from discrimination/provide for equality for social status?
1.20	Does the constitution provide for an Ombudsman?
1.12	Does the constitution provide for the right to form or to join trade unions?
1.10	Does the constitution guarantee the rights of children?
1.10	Does the constitution protect from discrimination/provide for equality for gender?
1.09	Does the constitution provide for an individual right to view government files or documents under at least some conditions?
1.06	Does the constitution provide for either general or financial support by the government for the disabled?
1.05	Does the constitution provide for the right of protection of one's reputation from libelous actions?
1.05	Does the constitution refer to political parties?
1.00	Does the constitution provide for freedom of movement?
0.98	Does the constitution protect from discrimination/provide for equality for religion?
0.89	Does the constitution protect from discrimination/provide for equality for language?
0.88	Does the constitution mention the adoption of national economic plans?
0.81	Does the constitution provide the right to just remuneration, fair or equal payment for work?
0.81	Does the constitution provide a right to conduct/establish a business?
0.78	Are there provisions for dismissing the Head of Government?
0.76	Does the constitution contain provisions concerning the national flag?
0.75	Does the constitution use the words (socio-) economic rights or similar?
0.75	Does the constitution protect from discrimination/provide for equality for country of origin?
0.69	"Is one of the executives explicitly referred to as the "Head of State"?"
0.69	Does the constitution provide for either general or financial support by the government for children, orphans?
0.67	Does the constitution contain provisions for a central bank?
0.64	Does the constitution protect from discrimination/provide for equality for political party?
0.63	In what language is the source document written (not the original, but the one used for coding)?
0.63	Does the constitution provide for a right of rest and leisure?
0.62	Does the constitution mention the right to safe/healthy working conditions?
0.60	Does the constitution provide for either general or financial support by the government for the elderly?
0.54	Does the constitution stipulate that education be compulsory until at least some level?
0.52	"Does the constitution refer to "fraternity" or "solidarity"?"
0.52	Is there a right to exemption from military service for conscientious objectors to war or other groups?

Table 14: Large Z-score provisions i.e. Time dependent

10 Provision Hierarchy and Ranking

We investigate the presence of hierarchy: that is to say that the adoption of X tends to follow the adoption of Y. This is formalised as follows: first a network of provisions is constructed with edges between provision i and j determined by how often i is adopted before j considering all countries adopting both i and j .

$$w_{i,j} = \sum_{c \in \mathcal{C}_i \cap \mathcal{C}_j} \phi^c(i,j) \quad (5)$$

Where c sums over all countries adopting both i and j (i.e. the intersection of \mathcal{C}_i and \mathcal{C}_j) and $\phi^c(i,j)$ is a binary valued variable indicating if country c adopts provision i strictly before j . Correspondingly for countries

$$w_{i,j} = \sum_{p \in (\mathcal{P}_i \cap \mathcal{P}_j)} \phi^p(i,j) \quad (6)$$

Where p sums over all provisions adopted by both i and j (i.e. the intersection of \mathcal{P}_i and \mathcal{P}_j) and $\phi^p(i,j)$ is a binary valued variable indicating if country i adopts p before j adopts p .

$$\begin{aligned} \phi^p(i,j) &= 1, t_{\text{adoption}}^{c,i} < t_{\text{adoption}}^{c,j} \\ &= 0, \text{ otherwise} \end{aligned} \quad (7)$$

Where $t_{\text{adoption}}^{c,i}$ is the year of first adoption of provision i in country c .

From this directed network, we seek to find the *minimum violation ranking* [11]; a ranking of the nodes that minimises the sum of edge weights from a lower ranked node to higher ranked node. This measure has previously been used to uncover hierarchical structure in academic institutions [12]. The optimal MVR is found using Markov Chain Monte-Carlo sampling algorithm using a zero temperature Metropolis-Hastings acceptance function.

Here we list the results of the full ranking of the provisions presented in the hierarchy in the main paper.

References

- [1] Elster J (1995) Forces and Mechanisms in the Constitution Making Process, *Duke Law Journal* 45 (2) p 364-396
- [2] Elkins Z and Ginsburg T and Melton J (2014) Characteristics of National Constitutions, Version 2.0, Comparative Constitutions Project. Available at: <http://www.comparativeconstitutionsproject.org>.
- [3] Elkins Z, Ginsburg T, Melton J, Shaffer R, Sequeda J, Miranker D (2014) Constitute:The World's constitutions to Read, Search, and Compare, *Web Semantics* X, 10-18.

Ranking	Provision
1.0	Does the constitution provide for a central representative body (a legislature)?
2.0	Does the constitution mention the executive cabinet/ministers?
3.0	Is the military or armed forces mentioned in the constitution?
4.0	Does the constitution mention international treaties?
5.0	Does the constitution provide for at least one procedure for amending the constitution?
6.0	Does the constitution refer to equality before the law, the equal rights of men, or non-discrimination?
7.0	Does the constitution stipulate that some public office holders take an oath to support or abide by the constitution?
8.0	Does the constitution contain provisions concerning education?
9.0	Does the constitution contain provisions concerning the relationship between the constitution and international law?
10.0	Does the constitution contain provisions concerning a national or official religion or a national or official church?
11.0	Does the constitution place any restrictions on the right to vote?
12.0	Does the constitution provide for freedom of religion?
13.0	"Does the constitution refer to ""democracy"" or ""democratic""?"
14.0	Can the government expropriate private property under at least some conditions?
15.0	Does the constitution provide for freedom of expression or speech?
16.0	Does the constitution provide for freedom of assembly?
17.0	Does the constitution provide for freedom of association?
18.0	Does the constitution provide for a right of privacy?
19.0	Are there provisions for dismissing judges?
20.0	Does the constitution provide for a right to own property?
21.0	Does the constitution provide for the right to protection from unjustified restraint (habeas corpus)?
22.0	Does the constitution mention nulla poena sine lege or the principle that no person should be punished without law?
23.0	"Does the constitution mention ""God"" or any other Deities?"
24.0	Does the constitution contain an explicit declaration regarding the independence of the central judicial organ(s)?
25.0	"Does the constitution refer to ""democracy"" or ""democratic""?"
26.0	Does the constitution provide for naturalized citizens or naturalization?
27.0	Do constitutional amendments require more than a simple majority by the legislature to be approved?
28.0	Does the constitution prescribe whether or not the meetings of the Legislature are (generally) held in public?
29.0	Does the constitution provide for freedom of opinion, thought, and/or conscience?
30.0	Does the constitution provide for the extradition of suspected or convicted criminals to other countries?
31.0	Does the constitution contain a national motto?
32.0	Are there provisions for dismissing the Head of State?
33.0	Does the constitution refer to the French declaration of rights (1789)?
34.0	Does the constitution provide for freedom of expression or speech?
35.0	Does the constitution provide for a right of petition?
36.0	Does the constitution prohibit punishment by laws enacted ex post facto ?
37.0	Is there a mention of telecommunications?
38.0	Does the constitution regulate the collection of evidence?
39.0	Does the constitution stipulate that certain rights are inalienable or inviolable?
40.0	Does the constitution generally require public trials?
41.0	Does the constitution prescribe that electoral ballots be secret?
42.0	Does the constitution contain provisions specifying the location of the capital (if so, please specify the location in the comments section)?
43.0	Are there provisions for dismissing the Head of Government?
44.0	Does the constitution provide for freedom of movement?
45.0	Does the constitution provide for suspension or restriction of rights during states of emergency?
46.0	Are there provisions for removing individual legislators?
47.0	Does the constitution specify a deputy executive of any kind (e.g., deputy prime minister, vice president)?
48.0	Does the constitution specify a census?
49.0	Does the constitution protect from discrimination/provide for equality for tribe/clan?
50.0	Does the constitution define the geographic borders/territory of the state?
51.0	Does the constitution contain provisions concerning the national flag?
52.0	Does the constitution refer to a duty to pay taxes?
53.0	What is the specified level of compensation for expropriation of private property?
54.0	Does the constitution refer to ownership or possession of natural resources (such as minerals, oil, etc.)?
55.0	Is the executive identified explicitly as the Head of State or Head of Government?
56.0	Are there provisions for the secession or withdrawal of parts of the state?
57.0	Does the constitution make a claim to universal adult suffrage?
58.0	Does the constitution protect from discrimination/provide for equality for religion?
59.0	Does the legislature have the power to interpellate members of the executive branch??
60.0	Are any parts of the constitution unamendable?
61.0	Does the constitution refer to a duty of military service?
62.0	Does the constitution stipulate that education be free, at least up to some level?
63.0	Does the constitution refer to artists or the arts?
64.0	Who has the power to approve declarations of war?
65.0	Does the constitution refer to artists or the arts?
66.0	Does the constitution contain an explicit declaration regarding the INDEPENDENCE of the central executive organ(s)?
67.0	Does the constitution mention foreign or international trade?
68.0	Does the constitution require a jury or any form of citizen participation in decision making in criminal trials?
69.0	Are members of the first (or only) chamber elected in the same cohort, or in staggered cohorts?
70.0	Does the constitution contain provisions allowing review of the legislation of the constituent units in federations by federal judicial or other central government organs?
71.0	Is the state described as either federal, confederal, or unitary?
72.0	Does the constitution provide for the right to choose ones occupation?
73.0	Does the constitution prohibit censorship?
74.0	Does the constitution give the accused a right to silence or protection from self incrimination?
75.0	Does the constitution mention any of the following intellectual property rights: patents?
76.0	In what language is the source document written (not the original, but the one used for coding)?
77.0	Does the constitution contain provisions with regard to any additional central independent regulatory agencies ?
78.0	Does the constitution prohibit slavery, servitude, or forced labor?
79.0	Does the constitution mention the right to transfer property freely?
80.0	Does the constitution provide for the right to bear arms?
81.0	Is there citizen involvement in the indicting process (such as a grand jury)?
82.0	Does the constitution specify the electoral system for the Second Chamber?
83.0	Does the constitution stipulate that education be compulsory until at least some level?
84.0	Does the constitution guarantee academic freedom?
85.0	Does the constitution provide for judicial opinions of the Highest Ordinary Court?
86.0	Does the constitution protect from discrimination/provide for equality for race?
87.0	Does the constitution explicitly state that judicial salaries are protected from governmental intervention?
88.0	Is there a constitutional provision for civil marriage?
89.0	Does the constitution refer to political parties?
90.0	Does the constitution require that the names of those imprisoned be entered in a public registry?
91.0	Does the constitution provide for the right to form or to join trade unions?
92.0	Does the constitution provide for a right to life?
93.0	Does the constitution specify that the chambers should meet jointly for any reason?
94.0	Is there a mandatory retirement age for judges?
95.0	Does the constitution provide for the right of some redress in the case of false imprisonment, arrest, or judicial error?
96.0	Does the constitution provide for immunity for the members of the Legislature under some conditions?
97.0	Does the constitution provide for the right/possibility of pre-trial release?
98.0	Does the constitution contain an explicit decree of separation of church and state?
99.0	Does the constitution contain provisions protecting the individual against illegal or ultra-vires administrative actions?
100.0	Does the constitution mention bankruptcy law?
101.0	Does the constitution stipulate that some public office holders take an oath to support or abide by the constitution?
102.0	Does the legislature have the power to investigate the activities of the executive branch?
103.0	"Does the constitution refer to ""fraternity"" or ""solidarity""?"
104.0	Does the constitution protect from discrimination/provide for equality for gender?
105.0	Does the constitution refer to the UN universal Declaration on Human Rights (1948)?
106.0	Does the constitution protect from discrimination/provide for equality for creed/beliefs?
107.0	Does the constitution require that legislators give up any other profession (i.e. work exclusively as legislators)?
108.0	Does the constitution contain provisions concerning the relationship between the constitution and international law?
109.0	Does the constitution contain provisions for the protection of stateless individuals, refugees from other states, or the right to asylum?
110.0	Is a supermajority needed for passing any legislation?
111.0	Does the constitution make voting mandatory, at least for some elections?
112.0	Does the constitution mention the adoption of national economic plans?
113.0	Does the constitution mention a state duty to provide work/employment?
114.0	Does the constitution provide the right to counsel if one is indicted or arrested?
115.0	Does the constitution specify the trial has to be in a language the accused understands or the right to an interpreter if the accused cannot understand the language?
116.0	"Is one of the executives explicitly referred to as the ""Head of State""?"
117.0	"Does the constitution refer to ""socialism"" or ""socialist""?"
118.0	Are there provisions for the secession or withdrawal of parts of the state?
119.0	Does the constitution protect from discrimination/provide for equality for country of origin?
120.0	Does the constitution prohibit torture?
121.0	Is there a presumption of innocence in trials?
122.0	Does the constitution refer to social, political, or economic conditions in the time before the birth of the state or in the time of a former constitution?
123.0	Does the constitution prohibit cruel, inhuman, or degrading treatment?
124.0	Does the constitution forbid the detention of debtors?
125.0	Does the constitution protect from discrimination/provide for equality for social status?
126.0	Does the constitution provide for a right of rest and leisure?
127.0	Does the constitution protect from discrimination/provide for equality for color?
128.0	Does the constitution grant the government the right to deport citizens or residents?

Ranking	Provision
129.0	Does the constitution refer to radio?
130.0	Does the constitution stipulate a quota for representation of certain groups in the first (or only) chamber?
131.0	Does the constitution refer to a duty to join a political party?
132.0	Does the constitution provide a right to conduct/establish a business?
133.0	Does the constitution provide for a right of testate, or the right to transfer property freely after death?
134.0	Does the constitution protect from discrimination/provide for equality for nationality?
135.0	Does the constitution mention any of the following intellectual property rights: copyrights?
136.0	Does the constitution provide for the right of protection of one's reputation from libelous actions?
137.0	Does the constitution mention any of the following intellectual property rights: general reference to IP?
138.0	Does the constitution provide for the prohibition of double jeopardy (i.e., being tried for the same crime twice)?
139.0	Is there a right to exemption from military service for conscientious objectors to war or other groups?
140.0	Does the constitution include provisions for the meritocratic recruitment of civil servants (e.g. exams or credential requirements)?
141.0	Does the constitution restrict entry or exit of the states borders?
142.0	Does the constitution provide for either general or financial support by the government for the elderly?
143.0	Does the constitution refer to a state duty to protect or promote culture or cultural rights?
144.0	Does the constitution provide for either general or financial support by the government for the disabled?
145.0	Does the constitution mention a state duty to provide work/employment?
146.0	Does the constitution mention any of the following intellectual property rights: trademark?
147.0	Does the constitution mention a state duty to provide health care?
148.0	Does the constitution provide for either general or financial support by the government for the unemployed?
149.0	Does the constitution contain provisions concerning the national anthem?
150.0	Does the constitution provide for inheritance rights?
151.0	Does the constitution contain provisions for a Judicial Council/Commission?
152.0	Does the constitution provide for the right to a speedy trial?
153.0	Does the constitution stipulate that courts have to take into account decisions of higher courts?
154.0	"Does the constitution refer to "customary" international law or the "law of nations"?"
155.0	Does the constitution contain provisions concerning international organizations?
156.0	Do defendants have the right to appeal judicial decisions?
157.0	Does the constitution prohibit one or more political parties?
158.0	Does the constitution refer to a duty of the people to take part in building society or to work for the development of the country?
159.0	"Is one of the executives explicitly referred to as the "Head of Government"?"
160.0	Does the constitution provide for either general or financial support by the government for children, orphans?
161.0	Does the constitution provide for positive obligations to transfer wealth to, or provide opportunity for, particular groups?
162.0	Does the constitution provide for an electoral commission or electoral court to oversee the election process?
163.0	Does the constitution provide the right to just remuneration, fair or equal payment for work?
164.0	Does the constitution stipulate a quota for representation of certain groups in the Second Chamber?
165.0	"Does the constitution refer to the "dignity of man" or human "dignity"?"
166.0	Does the constitution mention the right to safe/healthy working conditions?
167.0	Does the constitution protect from discrimination/provide for equality for parentage?
168.0	"Does the constitution provide for a right to petition for "amparo"?"
169.0	Does the constitution express a preference for one or more political parties?
170.0	Does the constitution provide for a right to form political parties?
171.0	Does the constitution refer to the social security of the society or nation?
172.0	Does the constitution provide for a right to strike?
173.0	Does the constitution explicitly mention due process?
174.0	Does the constitution refer to the UN charter Article 45 (1945)?
175.0	Does the constitution refer to protection or preservation of the environment?
176.0	Does the constitution contain provisions concerning national integration of ethnic communities?
177.0	Does the constitution place limits on child employment?
178.0	Does the constitution contain provisions for a central bank?
179.0	Does the constitution provide the right to a free and/or competitive market?
180.0	Does the constitution provide for the right to marry?
181.0	Does the constitution give juveniles special rights/status in the criminal justice process?
182.0	Does the constitution guarantee the rights of children?
183.0	Does the constitution provide for a people's right of self-determination?
184.0	Does the constitution provide for matrimonial equality?
185.0	"Does the constitution mention "foreign investment" or "foreign capital"?"
186.0	Does the constitution mention the right to health care?
187.0	How does the constitution address the state operation of print or electronic media?
188.0	Does the constitution provide for an individual's right to self determination or the right to free development of personality?
189.0	Does the constitution refer to television?
190.0	Does the constitution protect from discrimination/provide for equality for language?
191.0	Are rights provisions binding on private parties as well as the state?
192.0	Does the constitution provide for a right to an adequate or reasonable standard of living?
193.0	Does the constitution guarantee equal access to higher education?
194.0	Does the constitution protect from discrimination/provide for equality for political party?
195.0	Does the constitution suggest that citizens should have the right to overthrow their government under certain circumstances?
196.0	Does the constitution refer to the African Charter on Human People's Rights (1981)?
197.0	Does the constitution refer to the protection of different languages?
198.0	"Does the constitution refer to the "free market," "capitalism," or an analogous term?"
199.0	Do citizens have the right to renounce their citizenship?
200.0	Does the constitution protect from discrimination/provide for equality for financial/property ownership?
201.0	Does the constitution mention any special procedures for removing members of the constitutional court?
202.0	Does the constitution use the words (socio-) economic rights or similar?
203.0	Does the constitution provide the right to found a family?
204.0	Does the constitution refer to the Helsinki Accords (1966)?
205.0	Does the constitution refer to the International Covenant on Civil and Political Rights (1966)?
206.0	Does the constitution refer to the International Covenant on Economic and Social Rights (1966)?
207.0	Does the constitution require that legislators disclose their earnings and/or assets?
208.0	Does the constitution provide for the ability of individuals to propose legislative initiatives (referenda from below)?
209.0	Does the constitution mention judicial opinions of the Constitutional Court?
210.0	Does the constitution contain a general statement regarding rule of law, legality, or Rechtsstaat (the German equivalent)?
211.0	If counsel is provided, is it provided at the state's expense?
212.0	Does the constitution refer to the American Convention on Human Rights (1969)?
213.0	Does the constitution specify that healthcare should be provided by government free of charge?
214.0	Does the constitution provide the right to a fair trial?
215.0	Does the constitution provide for an Ombudsman?
216.0	Does the constitution provide the right for same sex marriages?
217.0	Does the constitution mention a special regulatory body/institution to oversee the media market?
218.0	Does the constitution contain provisions for a counter corruption commission?
219.0	Does the constitution mention anything about crimes committed by the previous regime?
220.0	Does the constitution provide for a commission for truth and reconciliation?
221.0	Is there special mention of terrorism and public security provisions regarding terrorism?
222.0	Does the constitution provide for the right to shelter or housing?
223.0	Does the constitution provide for an individual right to view government files or documents under at least some conditions?
224.0	How many chambers or houses does the Legislature contain?
225.0	Does the constitution refer to a duty to join trade unions?
226.0	Is there a special mention of victims rights in the constitution?
227.0	Does the constitution provide for a right to enjoy the benefits of scientific progress?
228.0	Does the constitution refer to the European Convention for the Protection of Human Rights and Fundamental Freedoms (1950)?
229.0	Does the constitution mention consumer rights or consumer protection?
230.0	Does the constitution protect from discrimination/provide for equality for age?
231.0	Does the constitution protect from discrimination/provide for equality for mental or physical disability?
232.0	Does the constitution suggest that citizens should have the right to overthrow their government under certain circumstances?
233.0	Does the constitution protect from discrimination/provide for equality for sexual orientation?
234.0	Does the constitution provide for the right to examine evidence or confront all witnesses?

Table 16: Final ranking of provisions

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- [8] Gleditsch K and Ward M (1999) Interstate System Membership: A Revised List of the Independent States since 1816 *International Interactions* 25 p393-413
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- [10] Reichardt J and Bornholdt S (2006) Statistical mechanics of Community Detection, *Physical Review E* **74** 016110
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