

# Central Bank Independence: Views from History and Machine Learning\*

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## Abstract

We assemble an almost complete set of central bank statutes since 1800 in order to assess the legal independence of central banking institutions. We use these to extend existing indices of legal independence backward and forward in time. We document the trend toward increased independence post 1980, but also earlier, more limited movement in the direction of enhanced independence in the 1920s. We apply natural language processing to current statutes to corroborate our human-reader assessment. Using machine-learning methods, we quantify the extent to which topics in those statutes contribute to the independence measure based on our reading of the statutes. The topic with the largest positive contribution to explaining the cross-country variation in central bank independence concerns disclosure, transparency and reporting obligations. This is consistent with the presumption that independence and accountability go together, and that transparency is the mechanism by which central banks provide information enabling them to be held accountable by politicians and the public. The topic with the largest negative contribution entails regulatory powers over, *inter alia*, securities markets, powers that complicate the central bank's mandate, make accountability more difficult, and render independence problematic.

**Keywords:** Central banks, independence, history, machine learning.

**JEL Codes:** E5, E52, E58

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# 1 Introduction

Central bank independence is elusive. A central bank's independence is never absolute; other officials and branches of government regularly dispute and challenge its extent. Moreover, central bank independence is difficult to measure. There exist different metrics of exactly how independent an institution is at a point in time. Finally, central bank independence can and does change. This renders a snapshot of independence a potentially inaccurate picture of the past, present, and future state of affairs.

In this paper, we add to the literature on how central bank independence varies across countries and over time. We adopt the most widely utilized measure of central bank independence but apply it to a longer period than in previous research, extending the analysis back where possible back to the beginning of the 19th century.<sup>1</sup> Assembling legal statutes for a long period is a considerable task, given that new statutes and amendments to existing statutes have been adopted frequently. The result is an unbalanced panel, since some central banks were established later than others. In all, we have a total of 8,318 annual data points for 120 central banks.

We focus on legal independence, assigning numerical ratings on the basis of the relevant passages of the central bank's statute. We utilize Cukierman et al.'s (2002) 16-point scale, since this is the metric used most widely in the literature, and adopting it facilitates comparisons with other studies.

The fact that stands out most clearly from our long-run analysis is the rise in central bank independence since 1980. The extent of the change and the high level of legal independence in this period have no precedent in earlier history, as we show for the first time. This fact applies across cohorts. In other words, the sharp rise in central bank independence post-1980 is common to central banks in existence already in the first half of the 19th century, central banks established in the second half of the 19th century, central banks created in the first half of the 20th century, and central banks founded subsequently. That is to say, these trends do not reflect changes in sample composition.

In addition, we document a slower ongoing rise in average levels of independence starting in the 1920s. Following World War I, League of Nations experts and so-called money doctors working under the auspices of the Bank of England, Bank of France, and Federal Reserve System spearheaded a drive for autonomous (in contemporary parlance) central banks. As we show, the increase in the extent of independence in the 1920s and 1930s was associated with the creation of a number of new, relatively independent central banks. We also document a modest but ongoing rise in average levels of independence spanning the four subsequent decades.

There were interruptions, to be sure. There was a sharp fall in central bank independence,

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<sup>1</sup>Indeed, states and not just central banks came into existence at different points in time. Previous studies face the same problem, although in attenuated form.

for obvious reasons, during World War II, for example. But this was reversed in the 1950s. To cite one well-known example, the Federal Reserve was required to subordinate its interest-rate setting policy to the dictates of the U.S. Treasury during World War II but regained interest-rate-setting independence with the Treasury-Fed Accord in 1951. Here we show this movement was more general.

The upward trend in levels of independence then resumed, spanning 1950 to 1980. Again, this movement is common to all birth cohorts. This suggests that the groundwork for the post-1980 revolution in central bank independence was laid in earlier years.

Assigning numerical ratings for various dimensions of legal independence based on language in central bank statutes involves human judgment in interpreting the relevant passages. We therefore compare our findings with results obtained using natural language processing and machine learning techniques. We analyze a sample of 90 most recent central bank acts using machine-vector regression and topic modeling. We use these techniques to identify topics that relate positively and negatively to our independence index.

The topic with the largest positive contribution to explaining variations in central bank independence has to do with disclosure, transparency, and reporting obligations. This is consistent with the presumption that independence and accountability go together, and that transparency is a mechanism by which central banks provide information on their operations such that they can be held accountable by politicians and the public. The topic with the largest negative contribution has to do with regulatory powers over, *inter alia*, securities markets. These powers complicate the central bank’s mandate, make accountability more difficult, and thereby render independence more problematic.

Following a review of the literature in Section 2, Sections 3-5 describe our data, coding, and human-agent-based analysis. Sections 6 and 7 compare this judgmental content analysis with an approach based on natural language processing and machine learning. Section 8 then concludes.

## 2 Literature review

Our paper connects to several literatures. Most obviously, there is theoretical literature suggesting arguments for central bank independence. Seminal articles by [Kydland and Prescott \(1977\)](#) and [Barro and Gordon \(1983\)](#) demonstrated the time inconsistency of optimal policies, implying advantages of insulating central bank policy from opportunistic pressures. Relatedly, [Sargent and Wallace \(1981\)](#) showed how the inability of the monetary authority to influence the fiscal stance, together with aversion to default, may result in fiscal dominance and excessive inflation. [Rogoff \(1985\)](#) and [Walsh \(1995\)](#) then demonstrated how central bank independence coupled with delegation of monetary policy to a “conservative” (inflation averse) central bank

governor could help to overcome these theoretical problems.

This early theoretical literature focused on potential advantages of central bank independence specifically for the conduct of monetary policy and the maintenance of low and stable inflation. The Global Financial Crisis and related problems of financial instability broadened this focus. [Wachtel and Blejer \(2020\)](#) asked whether statutory independence implied a limited mandate for the central bank, given the requirement in democratic societies that independent central bankers be held accountable for their actions (meaning that the results delivered by their actions should be easily compared with those mandated). He asked whether this limited mandate in turn led central bankers to ignore financial-stability concerns. Reasoning along similar lines, [Tucker \(2018\)](#) asked whether central banks' involvement in the conduct of macroprudential policies rendered their independence problematic.

Thus, whether it has responsibility for macroprudential supervision is one potential determinant of the independence of the central bank. The literature points in addition to other factors. [Posen \(1998\)](#) emphasizes to the structure of the economy, suggesting that countries with large and influential financial sectors, which tend to favor sound money, are more likely to have independent central banks. [Lohmann \(1998\)](#) focuses on the structure of the political system, arguing that central banks are more likely to emerge in countries where the political system is characterized by multiple veto points, which in practices means countries with federal systems. [Hallerberg \(2002\)](#) suggests that where subnational governments are powerful, these will push for central bank independence as a way of limiting the control of the central authorities over monetary policy. [Crowe \(2008\)](#) posits that delegation to an independent central bank, by removing monetary policy from the political arena, facilitates the formation and maintenance of stable political coalitions whose benefits would otherwise be squandered by squabbles over monetary policy.

[Alesina \(1988\)](#) and [Lohmann \(1997\)](#) suggest that politicians will favor the delegation of monetary policy when parties differ significantly in their policy preferences and when a relatively stable policy is preferable to one marked by violent swings. Relatedly, [Goodman \(1991, 1992\)](#) suggests that delegation of monetary policy to an independent central bank is a way for current governments to tie the hands of future governments with different preferences. In particular, delegation of policy to a conservative central banker may make it more difficult for left-wing governments to implement their preferred policies ([Way, 2000](#)).

On why there has been movement in the direction of central bank independence, [Maxfield \(1998\)](#) describes the signaling advantages for developing countries seeking access to global financial markets, which opened up to emerging market borrowers starting in the 1990s. [Cukierman \(2008\)](#) emphasizes the role of the International Monetary Fund in recommending central bank independence to its members and making enhanced independence a condition for its policy lending. [Romelli \(2022\)](#) argues that pressure from both regional peers (neighboring countries whose central banks have higher de jure independence) as well as multilateral institutions (in

the case of countries requiring an IMF loan or becoming members of a currency union) are important determinants of legal reforms.

In addition, [Romelli \(2022\)](#) shows that reforms increasing central bank independence follow periods of high inflation, raising questions about whether de jure independence should be regarded as an exogenous determinant of the inflation rate. Other authors develop this critique. [Posen \(1998\)](#), [Mas \(1995\)](#), and [Forder \(1998\)](#) suggest that de jure independence and observed inflation outcomes may both result from a common omitted variable, such as historically-rooted political and social aversion to inflation. [Oatley \(1999\)](#) suggests that the two variables may both reflect the influence of omitted institutional variables.

Determining whether or not there in fact exists a robust correlation and/or causal relationship between central bank independence on the one hand and macroeconomic variables on the other requires constructing a measure of the former. The literature contains multiple attempts to construct summary measures of central bank independence. [Bade and Parkin \(1988\)](#) were first to construct measures of legal independence on the basis of a reading of central bank statutes for a limited number of countries. Subsequent studies followed their example, including [Cukierman et al. \(1992\)](#), [Cukierman et al. \(2002\)](#), [Alesina \(1988\)](#); [Alesina et al. \(1989\)](#), [Grilli et al. \(1991\)](#), [Eijffinger and Schaling \(1993\)](#), and [Dincer and Eichengreen \(2014\)](#). The most comprehensive and up-to-date attempts, prior to our own, are [Garriga \(2016\)](#), who provides a comprehensive dataset on de jure independence for 182 countries between 1980 and 2012, and [Romelli \(2022\)](#), who provides measures of reforms of central bank law in 155 countries over the period 1972-2017.

As noted by [Eijffinger and Haan \(1996\)](#), a problem with this approach, which involves human-agent reading of legal statutes, is that different coders can read the same passages differently and reach different conclusions. We return to this problem below.

Other empirical measures of central bank independence are based on the turnover of governors and board members. This approach has problems as well, since turnover may reflect factors other than political pressures, including not least central bank performance itself ([Dreher et al., 2008](#); [Vuletin and Zhu, 2011](#)). Yet another approach relies on questionnaires administered to central bankers and other specialists. Obviously, the questionnaire-based approach is not feasible for an historical investigation. Whether it might be possible to assemble data on board-member turnover for central banks over two centuries is a topic for future research.

Armed with measures of legal independence for a limited number of countries and years, early contributors investigated the empirical association of central bank independence with low and stable inflation ([Alesina, 1988](#); [Alesina et al., 1989](#); [Grilli et al., 1991](#); [Cukierman et al., 1992](#); [Alesina and Summers, 1993](#)). The general finding was a robust negative relationship between legal independence and inflation for the advanced countries, but little such evidence for emerging markets and developing countries. Alternative measures such as actual turnover of central bank governors suggested that these de facto measures had more purchase in developing countries;

that is, when utilizing them the negative association of independence with inflation tended to reemerge. [Jácome and Vázquez \(2008\)](#) verified the existence of a negative relationship of inflation to legal dependence in Latin America but only once they controlled for global inflation, banking crises and the exchange rate regime. More recently, [Garriga and Rodriguez \(2020\)](#) used data for a larger sample of developing countries, and recovered an association between de jure independence and lower inflation rates.

Other studies examined the relationship between central bank independence and economic growth and business cycle outcomes ([Grilli et al., 1991](#); [Alesina and Summers, 1993](#); [Cukierman et al., 1993](#)). These generally found no increase in business cycle volatility in the industrial countries. Some pointed to a decline in the level of nominal interest rates but also a positive impact on real interest rates, with negative implications for investment and growth.

Finally, there is the literature on central bank independence in a historical perspective. [Parkin and Bade \(1978\)](#); [Cargill and O’driscoll \(2012a\)](#); [Blancheton \(2016\)](#) are examples of studies emphasizing the role of early central banks in meeting the financial needs of governments. [Bordo \(2007\)](#) traces the transition of central banks from funders of governments to guardians of price and financial stability. There is also literature from the 1920s and 1930s responding to the creation of new central banks, whose authors articulated contemporary arguments for central bank autonomy and discussed how such autonomy or independence was reflected in central bank statutes (see e.g. [Kirsch and Elkin \(1932\)](#); [Singer \(1932\)](#); [Plumptre \(1940\)](#)). [Vicarelli \(1988\)](#) provides an overview of interwar experience. Recent work revisiting 1920s and 1930s in light of modern research on central bank independence includes [De Cecco \(1994\)](#); [Simmons \(1996\)](#) and [Eichengreen and Kakridis \(2023\)](#). [Clavin \(2013\)](#) discusses League of Nations advice regarding central bank independence, while [Flandreau \(2005\)](#) analyzes interwar money doctoring. There is also a vast array of studies of central banking in the second half of the 20th century, which are too numerous to survey, much less name, here.

In terms of the historical literature, there are in addition individual country studies: representative examples include [Conti-Brown \(2018\)](#) and [Binder and Spindel \(2017\)](#) for the United States, [Toniolo \(2022\)](#) for Italy, [Toniolo, ed \(1988\)](#), [Holtfrerich et al., eds \(1999\)](#) and [Eichengreen and Kakridis \(2023\)](#) for collections of advanced economies. [Lohmann \(1998\)](#) and [Hallerberg \(2002\)](#), among others, point to Germany’s experience with the Bundesbank (an unusually independent central bank with a record of prioritizing and achieving price stability) as an important historical case informing the modern case for independent central banks.

Limitations of this historical literature include an absence of numerical measures comparable to those found in modern scholarship, neglect of the pre-World War I period (in connection with the issue of central bank independence specifically), and an exclusive focus on a subset of relevant countries and years. These last observations motivate our own survey and analysis of global experience since 1800, starting in the next section.

### 3 Data and Methods

We collected laws and statutes from central bank websites, central bank libraries, the International Monetary Fund’s Central Bank Legislation Database, the Bank for International Settlements’ Central Bank Law Database, collections of laws such as [Singer \(1932\)](#); [Aufrecht \(1961\)](#); [Effros \(1982\)](#), and correspondence with the legal and research departments of central banks. Although recent laws are mostly available in English, where older laws are in a country’s native language they were translated using Google Translate.

Central banks are coded from their date of establishment or 1800, whichever is later, up through 2021. (Starting earlier would be possible in some cases, but the early sample of central banks would then be exceedingly small.) Figure 1 shows the number of central banks in the sample by decade and region. If a law is enacted in the first half of a year, it is attributed to that year. If a new law is enacted in the second half of the year, it is assigned to the following year. Table 1 presents establishment years and coding periods for each central bank. Table 2 lists the laws affecting each central bank’s independence scores.

We constructed four indices in the spirit of [Cukierman et al. \(1992, 2002\)](#), and [Bodea and Hicks \(2015\)](#). These are based on 16 criteria, given in Appendix A, representing the legal provisions of central bank acts, charters, and related statutes, and grouped under four main headings:

- A. CEO: term of office, by whom appointed, provisions for dismissal, simultaneous holding other offices.
- B. Policy formulation: role of the central bank in monetary policy formulation, resolution of conflict between the central bank and the government over monetary policy and the role of the central bank in the budget process.
- C. Objectives: objectives of the central bank, including emphasis on price stability versus other goals.
- D. Limitations on lending to the government: limits regarding the volume, maturity, interest rate and conditions for securitized and non-securitized lending.

Each of the 16 criteria is assigned a value between 0 and 1, where 1 indicates the highest level of independence, 0 is the lowest.

From 16 criteria, 8 aggregate variables are calculated:

1. *Chief executive officer*: Four variables measuring different aspects of the independence of the CEO are aggregated using equal weights.
2. *Policy formulation*: Three policy formulation criteria (Who formulates policy? Who has final authority? Central bank’s role in budgetary process) are aggregated (with weights 0.25, 0.5, 0.25, respectively) into one variable.



3. *Objectives*: Price stability as only objective, as major objective, as one objective, or not mentioned.
4. *Advances*: Are there limitations on advances to the government?
5. *Securitized lending*: Are there limitations on securitized lending?
6. *Terms of lending*: Are maturity, interest and amounts of lending controlled by the bank, specified by its charter, agreed with the executive branch, or decided by the executive branch?
7. *Potential borrowers*: Only the central government, also other levels of government, also public enterprises, also the private sector?
8. *Other limits on lending*: Are there limitations on lending amount, loan maturity, interest rates, and purchases or sales of government securities in the primary market?

From these eight aggregated variables, we compute the index labeled Legal Variables Aggregate Unweighted (LVAU). Following Cukierman et al. (2002), we also constructed a weighted average, denoted Legal Variables Aggregate Weighted (LVAW), using the weights in Appendix A. Again following these authors, we also constructed two narrower indices, LVES and LVESX. LVES takes only policy formulation and objectives into consideration: it is the weighted average of the role of the central bank in monetary policy formulation, resolution of conflict between the central bank and the government over monetary policy, and the objectives. (The associated weights are 0.4, 0.4 and 0.2, respectively). LVESX is an extended version of LVES, including also limits on lending to the government (with associated weights 0.6 and 0.4).

## 4 Trends and Fluctuations

As a first step, we considered the internal consistency of these indices with one another as a way of gauging the sensitivity of our results to procedures. Table 3 shows correlations between the four alternative indices.<sup>2</sup> LVAU, LVAW, and LVESX are closely correlated with one another, LVES less so. We, therefore, place less weight on LVES in what follows and concentrate on LVAU as the most encompassing of the three remaining indices.

Figure 2 summarizes central bank independence over the 221-year period.<sup>3</sup> The blue line is for all central banks, while the other lines distinguish central banks established in the first half of the 19th century, the second half of the 19th century, the first half of the 20th century, the second half of the 20th century, and after 1999, respectively. The rise in central bank independence since 1980 stands out. Both the extent of the change and the high level of statutory independence in this period have no precedent in earlier history. The sharp rise in

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<sup>2</sup>Regressions used to estimate these bivariate correlation coefficients control for country and year fixed effects, as noted in the footnote to the table.

<sup>3</sup>Again, as captured by the LVAU variant of the index.



central bank independence to levels surpassing those reached earlier is common to central banks in existence already in the first half of the 19th century, central banks established in the second half of that century, central banks created in the first half of the 20th century, and central banks founded more recently. What we find does not reflect cohort effects, in other words.

But there are also inter-cohort contrasts. Current levels of independence are highest for the most recently established cohort of central banks, reflecting the sway of arguments for independence together with the fact that there are no inherited central bank statutes to act as a source of persistence. Note, however, that the cohort exhibiting the second highest level of independence and the largest absolute increase is of central banks established in the second half of the 19th century. These are mainly Western European central banks, which experienced a sharp reduction in independence in the 1930s and World War II and then saw a modest increase from 1950 to 1980, followed by a more dramatic increase in the subsequent period. The 1930s and World War II-era decline in independence can be understood as a reaction against poor monetary management in the Great Depression and the fiscal imperatives and finances of the war. The subsequent recovery of independence was gradual, as political bodies responsible for granting central banks independence were slow to put these experiences behind them.

More broadly, there is a slow, uneven but persistent rise in average levels of independence from the 1920s to the 1970s. In the 1920s, the doctrine of central bank independence was spread by the League of Nations, in conjunction with stabilization and institution-building missions in the aftermath of World War I, many of which involved advising new countries and new central banks. In addition, the Bank of England, the Bank of France, and the Federal Reserve System competed to provide expert advice to new governments and central banks in an effort to bring the latter into their orbits. In doing so, they spread the gospel of central bank “autonomy.” This is evident from how the increase in overall independence in this period is driven by the yellow line in Figure 2 depicting central banks newly established in the first half of the 20th century, which had a high level of independence by the standards of the time.

We also see an ongoing increase in average levels of independence spanning the four subsequent decades. This was driven by the establishment of central banks in newly independent nations after World War II, which had somewhat higher-than-average levels of independence by the standards of the time. It was further supported by modest increases in independence for the cohort of central banks established in the first half of the 20th century and also for the cohort established in the 19th century, which now saw their transparency enhanced. To be sure, there was some decline in central bank independence during World War II when central banks were enlisted in financing the war. But this was reversed on average by the early 1950s; this generalization that does not seem to have been noted before.

The upward trend of independence then resumed in the period 1950 to 1980. This movement is evident for central banks established in all five historical eras distinguished in Figure 3, albeit proceeding from different post-World War II starting points. Evidently, the groundwork for the

post-1980 revolution in central bank independence was laid in these earlier years.

We next rank the 120 central banks in our sample in descending order of independence according to LVAU. For this purpose, we focus on the most recent period 1990-2021. These years post-date those covered in the most widely cited studies of central bank independence and thus are useful for highlighting recent changes not covered there. Such comparisons could be based on longer time spans, but doing so would bias the ranking against early established central banks since, as we have seen, central bank independence was typically lower in earlier historical epochs.

The ranking in question is in Table 4. At the top of the list are some “usual suspects.” The European Central Bank, for example, is widely regarded as the most independent central bank in the world (see e.g., [Fernández-Albertos \(2015\)](#)). But we also see the advantages of extending the coding to smaller central banks that have not been included in many previous analyses. For example, the central banks of the four Baltic States, Serbia, Georgia, Montenegro, and Kosovo are all in the top 15.

Table 5 presents the analogous ranking for 2021 and serves as a reminder of the importance of following changes in statutes over time. For example, while there is no change in the European Central Bank’s index value, the central banks of Sweden, Serbia, and Romania all saw changes in legal provisions over the period that moved them above the ECB.

The bottom of Table 5, where we list the least independent central banks, again shows some usual suspects: the central banks of Iran, Pakistan, Bangladesh, Mozambique, Ethiopia, and Laos. That the central banks of Singapore, Australia, and Taiwan rank low on this metric may come as a surprise. Taiwan receives low scores across the board. The independence ratings of the Reserve Bank of Australia and the Monetary Authority of Singapore are dragged down by low scores for policy formulation and lack of limits on securitized lending, advances to the government, and lending to entities other than the central government.

## 5 Components

We can also glean insight from the individual components of the index. Consider, for example, the independence of the central bank governor or CEO. Average governor or CEO independence, component A, which reflects the length of term and obstacles to arbitrary dismissal, among other factors, increased steadily from 1891, as indicated in Figure 4. Unlike other components, this element does not decline significantly at any point in the subsequent period. The scope for dismissing the governor, an important element of CEO independence, was always limited by central bank laws, but additional central bank statutes limited such scope starting in the 1920s. More recently, Euro Area central banks further limited the conditions under which governors might be dismissed (restricting these to incapacity and violation of laws). The only

component of CEO independence that has fallen relates to the governor's appointment. After World War I, central bank governors were appointed with more involvement of the executive branch of government, in contrast to the 19th century, when the central bank's board dominated appointments.

Component B measures the independence of the central bank when formulating monetary policy. This declines during and immediately following World War II before stabilizing and then remaining broadly unchanged on average through the 1980s, and finally rising sharply in the 1990s coincident with, *inter alia*, the pioneering adaption of inflation targeting by the Reserve Bank of New Zealand in 1989. An important element concerns who exactly formulates policy. In the early portion of our 221-year period, central banks were largely responsible for monetary policy formulation. There was then some decline in the 1930s and during World War II, as policy functions were delegated to treasuries, followed by recovery of this responsibility after the war, when central banks regained policy autonomy and a major increase in the 1990s. Another policy formulation component concerns resolving conflicts between the central bank and the government. From the early 20th century through the 1950s, there was a broad-based shift in power toward the executive branch. Treasuries were able to influence or even dictate central bank policy, especially in the 1930s when central bank lending was used to advance governments' investment policies. Starting in the 1990s, however, a growing number of central banks acquired final say. A further element concerns the central bank's role in the government's budgetary process. This refers to *inter alia* participation of central bank representatives in government meetings during budget preparation or the central bank's involvement in an advisory role. Before the 1950s, such roles are only very rarely mentioned in central bank laws. Subsequently, additional central banks acquired active statutory roles in the budgetary process.

Component C relates to objectives: it takes on positive values when price stability is mentioned as an objective and its maximum value when price stability is the sole objective. Over most of our historical sample, price stability is rarely mentioned in central bank laws; exchange rate targets and financial stability goals are more common. There was then more mention of price stability after World War II, along with slow movement in the direction of a single mandate, followed by more rapid movement from the late 1980s. A substantial number of central banks now have price stability as their major or sole objective.

Finally, component D captures limits on financing the government. A few countries limited the scope for central bank advances to the government after World War II, but movement in this direction became more general in the 1980s. Interestingly, after 1987 there were almost no additional statutory limits on securitized lending, another way that central banks have traditionally provided finance to the government.

In sum, two constituents of central bank independence, those related to CEO independence and objectives, rose steadily over time. Limits on financing the government declined around the two world wars for self-evident reasons but more than recovered after that. The most volatile

component is that related to policy formulation. It is also the component where central banks, on average, receive the lowest score.

## 6 Content Analysis and Machine Learning Methodology

This section uses content analysis and machine learning (a la [Gentzkow et al. \(2019\)](#); [Athey and Imbens \(2019\)](#)) to identify topics in central bank statutes associated with our preferred central bank independence measure, LVAU. We first construct a corpus of text through the application of content analysis. This information is organized into a matrix representation for modeling purposes. In the second step, using the matrix representation of the text data, we then classify terms into groups (which we refer to as topics) that are positively and negatively associated with independence, thereby validating the accuracy of our human-reader evaluation.

The sample for this analysis is the most recent central banking legislation in English for each country. (We concentrate in this section on recent statutes, since they are available in digital form.) These documents are drawn from the IMF Central Bank Legislation Database, which contains recent central bank legislation and portions of constitutions related to the operation of central banks. The sample comprises 90 countries (see Table 6), for which we have a measure of LVAU.

**Text analysis: tokenization and term-document representation.** We use natural language processing to analyze the content of these statutes. The goal is to determine which topics have predictive power for LVAU and whether they predict higher or lower values. To determine which terms that have more predictive power, we first tokenized the texts using a pre-processing routine that excludes stopwords, rare words (on the grounds that infrequent words add more noise than signal), punctuation, numbers, country names, month names, and extra spaces. We lemmatized the remaining terms and kept for further analysis the top 2,000 most frequent unique tokens across all statutes.<sup>4</sup> We then excluded lemmatized terms that are not nouns, verbs, adjectives, or adverbs. The associated term frequency-inverse document frequency (tf-idf) of tokens will serve as the covariate matrix in the subsequent empirical analysis.

**Support vector machine modeling.** Next, we estimate a non-parametric regression using support machine vector modeling ([Cortes and Vapnik, 1995](#)) to classify which terms positively and negatively contribute to the value of LVAU. The dependent variable is LVAU of country  $i$  in the year of adoption of the central bank statute used in the analysis. The covariate matrix,

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<sup>4</sup>Following the definition of ([Lane et al., 2019](#), p. 51), “stop words are common words in any language that occur with a high frequency but carry much less substantive information about the meaning of a phrase.” Examples include “the”, “a”, “an,” “this,” “and,” “or,” and “of.” Lemmatization involves reducing the different forms of word to a single form (e.g., “build” and “built” become the single lemma “build”).

denoted  $T \in R^{N \cdot M}$ , is an  $N \cdot M$  td-idf matrix, where row  $i$  represents the statute (or document) of country  $i$  and column  $m$  represents a term.<sup>5</sup>

The term-document matrix,  $T$ , is large and sparse (not every cell contains a value since not every document includes the same terms). Traditional methods such as ordinary least squares are therefore unsuitable for estimation. Instead, we use the non-parametric supervised learning method SVM.<sup>6</sup> SVM is appropriate for ample sparse matrixes for computational efficiency and because estimation depends on a subset of observations or data values (see [Hastie et al. \(2009\)](#)). Computational efficiency is a direct result of the SVM specification model, where “the solution depends on the input values only through the inner products” ([Hastie et al., 2009](#), p. 436), while OLS requires more complex matrix operations like the inverse. In addition, the use of support vectors avoids overfitting.

In our notation, the weighted relative frequency of a term  $m$  in country’s  $i$  statute is denoted  $t_{im}$ . The linear support vector machine (SVM) specification aims to minimize the absolute error,

$$\sum_i |LVAU_i - (\beta_0 + \beta_1 T)| \quad (1)$$

with a tolerance for error loss ([Cortes and Vapnik, 1995](#)). Here,  $\beta_0$  is an intercept, and  $\beta_1$  is a parameter matrix, where the entries indicate the relative importance of each term’s positive or negative impact on LVAU.

Tuning the hyperparameter during SMV estimation allows us to strike a balance between maximizing the margin separating the two classes of terms contributing positively and negatively to central bank independence on the one hand, and minimizing classification errors on the other.<sup>7</sup> The SMV model’s performance is assessed via cross-validation, where the sample is split into a training dataset and a testing dataset to test the accuracy of model predictions. We use the training dataset for tuning and fitting the models’ hyperparameters and then validate its performance on the testing data. Since the number of country-level observations is small (i.e., 90 countries), we use v-fold validation, a standard re-sampling method. This randomly splits the data into ten groups of roughly equal size.<sup>8</sup> This procedure produces different random samples that can be used to compare the performance of alternative model specifications. We choose the model with the best performance, i.e., that minimizes the root mean square error,

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<sup>5</sup>The matrix  $T$  represents the relative frequency of a term within a statute, with the weighting determined by an inverse document frequency factor that reduces the importance of frequently occurring terms because of their deemed lack of informative value.  $T$  is sparse (i.e., many entries are 0) and high dimensional, such that  $N \ll M$ .

<sup>6</sup>The SVM method are based, technically, on hyperplane estimations which are interpreted as decision boundaries (also optimal margins), such that the data values are inside, outside or within boundaries. In that landscape, data values with more relevance for estimation are those within boundaries called *support vectors*. In case of regressions, the decision boundaries are the maximum error tolerated.

<sup>7</sup>The hyperparameters evaluated are the kernel parameter and soft margin parameter.

<sup>8</sup>We follow the consensus of machine learning community by dividing the training dataset into 10 parts ([Ross et al., 2009](#), p. 536).

or RMSE (Ross et al., 2009, p. 533).

**Topic modeling: grouping tokens into topics.** The next step consists of topic modeling the entire corpus of central bank statutes to classify the terms contributing to central bank independence. Topic modeling is performed using the Latent Dirichlet Allocation (LDA) algorithm (Blei et al., 2003). The main tunable hyper-parameter is the number of topics ( $k$ ). We choose an optimal  $k$  by comparing the prediction capacity of each model and selecting that with the best performance achieved with the minimum number of topics.<sup>9</sup> The optimal number of topics selected is 11. Table 7 shows the list of words that constitute topics when applying the LDA method to the corpora.<sup>10</sup> We then assign a label (also shown in Table 7) to each group of words or topic based on the IMF’s Central Bank Legislation Database categories, in which articles and extracts of the statutes are classified. Readers will note that one of these categories (“Objectives of Microprudential Supervision”) appears twice since two separate groups of tokens have multiple references (such as supervision, financial, institutions, establishment, branches, capital) that are plausibly grouped under this heading.

Finally, the terms in Table 7 are winnowed down to the 50 most important predictors of LVAU according to the SMV regression estimates of term-contributions, denoted  $\beta_1$ , and these are again assigned to their corresponding topics.<sup>11</sup> The results are in Table 8, which details the 11 topics. In addition, there is an “Unclassified” topic which groups terms that are among the fifty most important predictors, but which have not been associated with in a topic by the LDA exercise.<sup>12</sup> The root mean squared error, R-squared, and other measures of fit suggest that this specification outperforms competing models and explains a relatively high portion of the variance stemming from the corpus.

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<sup>9</sup>The model with the largest logarithm of perplexity is the one with the highest predictive capacity using the sample of analysis. (Hoffman et al., 2010, p. 7) defines the logarithm perplexity metric as “the geometric mean of the inverse of the marginal probability of each word in the set of documents in the test sample.”

<sup>10</sup>Some terms appear in more than one topic because topic modeling does not determine maintaining a mutually exclusive membership of words. We report the terms with highest contributions to each topic and not an inclusive list.

<sup>11</sup>The estimation follows the specification defined in Equation (1). The dependent variable in this exercise is the LVAU of each country that corresponds to the year for which the statute is available. Since we are using a machine-learning method to predict  $\beta_1$  and we later add these coefficients by topic, the coefficient and associated standard errors corresponding to each token are not reported Table 8 but are available in the Online Appendix.

<sup>12</sup>A handful of words with high predictive power are categorized as belonging to more than one of the topics reported in Table 7. These terms are assigned to the topic to which they had the highest weightage contribution, that is, highest importance.

## 7 Findings from Content Analysis

Figure 5 displays bigrams (i.e., pairs of words that co-occur in proximity to one another).<sup>13</sup> Relationships connecting these words are depicted by arrows pointing in the direction in which the nodes connect. Darker arrows indicate more frequent connections.

A large central node of interconnections on the left-hand side of Figure 5 is apparent, along with several distinct groups on the right-hand side. The most central nodes with the most connections to other terms are (not surprisingly) “monetary” and “bank.” Other examples of terms that appear widely in statutes include “institution” and “stability.” At the core of the network, we observe a cluster of terms displaying multiple interrelationships: bank, national, central, monetary, board, council, banking, policy, regulation, financial law, and duties. Evidently, many central bank laws follow a similar structure and speak of similar monetary and macroeconomic goals and procedures. That these goals and procedures are elaborated in different ways explains why we also observe words outside the core network that nonetheless possess overlapping connections and relationships.

Additionally, we observe connections between words referring to the structure and functioning of central banking institutions, such as national bank, monetary board, policy regulation, banking commission, management team, and participating government, functions-duties. However, there are fewer strong connections between these different word pairs, suggesting that different central banks approach their structure and internal functioning differently.

For comparison, Figure 6 depicts the analogous network representation for the current version of the U.S. Federal Reserve Act. The number of related terms is fewer, reflecting the fact that we are analyzing one rather than a multitude of central bank statutes. The most central node, not surprisingly, is “banks,” which is connected to “national,” “reserve,” “savings,” and “foreign.” Small clusters of terms referring to governance (governor, vice, and chairman appear as one connected cluster, director, officer, chief, and executive as another).

Table 8 lists topics that predict LVAU, restricting the analysis to nouns, verbs, adjectives, and adverbs, while excluding logical connectors, prepositions, institution names, and country names. Topics associated with higher values of LVAU, and therefore with more central bank independence appear in Column (1), while topics with a negative effect on central bank independence are in Column (2). Column (3) reports net effects – the difference between positive and negative effects.

The topic with the highest positive contribution to explaining the variation in central bank independence is “Disclosure, Transparency, and Reporting” obligations. It is widely thought that independence and accountability go together – that governments and their constituents

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<sup>13</sup>Following a rule-of-thumb threshold for determining high frequency terms, we chose bigrams composed by terms that appear more than 50 times in all the country-specific statute. Figure 5 and Figure 6 exclude punctuation, numbers, month names, stop words and extra spaces but preserve some country names and stop words in other languages different to English given that they are part of composed terms.



will be prepared to delegate important functions to independent central banks only if the latter can be held accountable for their actions – and that transparency is the mechanism by which central banks provide information on their operations such that politicians and the public can hold them suitably accountable (Dincer and Eichengreen, 2014). Our content analysis is supportive of this presumption. “General Functions and Powers,” which includes terms such as “tasks,” “policy,” “objectives,” and “provisions,” which plausibly allude to passages that describe the central bank’s responsibilities in general terms, is also positively associated with independence. One of the two topics associated with microprudential supervision is associated positively with independence, the other not (positive and negative effects of the latter offset). This suggests that some but not all central banks with more detailed microprudential policies tend to be more independent.

Contributing negatively to central bank independence are “Regulatory Powers” other than those associated with microprudential responsibilities (regulation of securities markets, for example). These presumably complicate the central bank’s mandate, render accountability more difficult and thereby make independence more problematic. “Foreign Exchange Operations” also contribute negatively. In some countries, it may be felt that central bank independence is not necessary when hitting an exchange rate target is the central bank’s mandated responsibility (This was typically the case under the gold standard and, to an extent, under the Bretton Woods System, for example). References associated with the nomination, term, selection, and appointment of the governor and the board (with separate topics for each) contribute negatively to independence as if more extensive provisions related to such matters reduce the independence of decision-making more often than they enhance it.

Overall, we see this second approach to parsing central bank statutes, utilizing machine learning, as yielding results consistent with the first, which relies on human judgment.

## 8 Conclusion

We have described two approaches to adding to the already large literature gauging central bank independence: a historical analysis of central bank statutes examined using judgmental techniques, and text analysis using natural-language and machine-learning methods. The first approach enables us to document the sharp rise in central bank independence starting in the early 1980s and to identify it as historically unique. In addition, however, we document a slower rise in independence starting in the 1920s. In the 1920s, League of Nations experts and money doctors working under the auspices of the Bank of England, the Bank of France, and the Federal Reserve System spearheaded a drive for independent central banks. As we show, the increase in the extent of independence in the 1920s and 1930s was associated with the creation of a number of new, relatively independent central banks. We also document an ongoing increase

in average levels of independence spanning the four subsequent decades.

The second approach identifies terms and topics that are positively and negatively associated with central bank independence, as captured by the first approach. The topic with the largest positive contribution to explaining the variation in central bank independence focuses on disclosure, transparency, and reporting obligations. This is consistent with the presumption that independence and accountability go together, and that transparency is a mechanism by which central banks provide information on their operations such that these institutions can be held suitably accountable by politicians and publics. The topic with the largest negative contribution concerns regulatory powers over, *inter alia*, securities markets, powers that complicate the central bank's mandate and render accountability more difficult, thereby making independence more problematic.

That content analysis utilizing machine-learning methods, as opposed to human judgment, yields broadly intuitive results when applied to our hand-coded index of central bank independence leaves us more confident in the integrity and meaningfulness of the latter.

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## Tables and Figures



Table 1: Establishment years and coding period

Country	Establishment year	Coding Period	Country	Establishment year	Coding Period
Albania	1992	1992-2021	Spain	1782	1874-2021
Angola	1976	1997-2021	Honduras	1950	1950-2021
Argentina	1935	1935-2021	Hungary	1924	1924-2021
Armenia	1993	1993-2021	Iceland	1961	1961-2021
Australia	1960	1960-2021	India	1934	1934-2021
Austria	1816	1817-2021	Indonesia	1953	1953-2021
Azerbaijan	1992	1993-2021	Iran	1960	1960-2021
Bahamas	1974	1974-2021	Iraq	1947	1977-2021
Bahrain	1973	1973-2021	Ireland	1943	1943-2021
Bangladesh	1971	1973-2021	Israel	1954	1954-2021
Barbados	1972	1997-2021	Italy	1893	1894-2021
Belarus	1991	1991-2021	Jamaica	1961	1961-2021
Belgium	1850	1851-2021	Japan	1882	1882-2021
Belize	1977	1977-2021	Jordan	1964	1964-2021
Bermuda	1969	1969-2021	Kenya	1966	1966-2021
Bhutan	1982	1983-2021	Korea	1950	1950-2021
Bolivia	1929	1995-2021	Kosovo	2008	2008-2021
Bosnia	1997	1997-2021	Kyrgyz Rep.	1993	1993-2021
Botswana	1975	1999-2021	Kuwait	1968	1968-2021
Brazil	1965	1965-2021	Laos	1956	1956-2021
Cambodia	1954	1992-2021	Latvia	1991	1992-2021
Canada	1934	1935-2021	Lebanon	1963	1963-2021
Chile	1925	1926-2021	Lesotho	1980	1979-2021
China (PRC)	1948	1995-2021	Liberia	1974	2000-2021
Colombia	1923	1923-2021	Lithuania	1990	1995-2021
Costa Rica	1950	1951-2021	Luxemburg	1998	1999-2021
Croatia	1991	1992-2021	North Macedonia	1992	1992-2021
Cyprus	1963	1963-2021	Malaysia	1959	1959-2021
Czechia	1993	1993-2021	Maldives	1981	1981-2021
Czechoslovakia	1920	1920-1992	Malta	1967	1968-2021
Denmark	1818	1819-2021	Mauritania	1973	1973-2021
Dominican Rep.	1947	1948-2021	Mexico	1925	1926-2021
ECB	1998	1998-2021	Moldova	1991	1992-2021
ECCB	1984	1984-2021	Mongolia	1954	1991-2021
Egypt	1951	1951-2021	Montenegro	2001	2001-2021
El Salvador	1934	1935-2021	Morocco	1959	1960-2021

Estonia	1993	1993-2021	Mozambique	1975	1975-2021
Ethiopia	1963	1994-2021	Myanmar	1952	1991-2021
Fiji	1973	1984-2021	Namibia	1990	1991-2021
Finland	1811	1926-2021	Netherlands	1814	1814-2021
France	1800	1800-2021	New Zealand	1933	1934-2021
Georgia	1995	1995-2021	Nicaragua	1960	1961-2021
Germany	1876	1925-2021	Norway	1816	1892-2021
Ghana	1957	1992-2021	Pakistan	1956	1956-2021
Greece	1928	1928-2021	Papua New G.	1973	1974-2021
Guatemala	1926	1946-2021	Peru	1922	1922-2021
Philippines	1949	1949-2021	Sri Lanka	1950	1950-2021
Poland	1924	1924-2021	Sweden	1668	1867-2021
Portugal	1846	1931-2021	Switzerland	1906	1906-2021
Qatar	1973	1973-2021	Taiwan (ROC)	1923	1935-2021
Romania	1990	1991-2021	Tanzania	1965	1966-2021
Russia	1990	1991-2021	Thailand	1942	1943-2021
Samoa	1984	1984-2021	Tonga	1989	1989-2021
Serbia	2003	2003-2021	Tunisia	1958	1959-2021
Seychelles	1983	1983-2021	Turkey	1930	1930-2021
Singapore	1970	1971-2021	UAE	1980	1981-2021
Slovakia	1993	1993-2021	UK	1694	1845-2021
Slovenia	1991	1991-2021	Uruguay	1896	1897-2021
Solomon Islands	1983	1983-2021	US	1914	1914-2021
South Africa	1920	1921-2021	Vanuatu	1981	1981-2021

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Notes: see text.

Table 2: Years of the laws/statutes/amendments used in coding

Country	Years of the CB laws/statutory/amendments
Albania	1992, 1997, 2002
Angola	1997
Argentina	1935, 1957, 1973, 1992, 2002, 2012
Armenia	1993, 1996 ,2001, 2017
Australia	1959, 1989
Austria	1816, 1863, 1911, 1922, 1939, 1955, 1969, 1994, 1999, 2018
Azerbaijan	1992, 1995, 2004
Bahamas	1974, 2020
Bahrain	1973, 2006
Bangladesh	1972, 2003
Barbados	1997
Belarus	1990, 1991, 1992, 1995, 2000, 2006, 2012
Belgium	1850, 1939, 1991, 1993, 1998
Belize	1976, 1993, 2003, 2010
Bermuda	1969, 2006
Bhutan	1982, 2010
Bolivia	1995, 2009
Bosnia	1997
Botswana	1999
Brazil	1964, 1988, 2021
Cambodia	1992, 1996
Canada	1934
Chile	1925, 1932, 1953, 1960, 1975, 1989
China	1995
Colombia	1923, 1931, 1951, 1992
Costa Rica	1950, 1953, 1970, 1988, 1995, 2001, 2019
Croatia	1991, 1998
Cyprus	1963, 1979, 2002, 2007
Czechia	1993, 2001
Czechoslovakia	1920, 1948
Denmark	1818, 1907, 1936, 1942, 1967, 1969
Dominican Rep.	1947, 1962, 2002
ECB	1998
ECCB	1983, 1991
Egypt	1951, 1975, 2003, 2005
El Salvador	1934, 1961, 1979, 1991, 1995, 1996
Estonia	1993, 2003, 2006, 2011

Ethiopia	1994, 2008
Fiji	1983
Finland	1925, 1998
France	1800, 1806, 1834, 1857, 1896, 1936, 1960, 1965, 1973, 1993, 1999
Georgia	1995, 1996, 2010
Germany	1924, 1930, 1948, 1957, 1997
Ghana	1992, 2002
Greece	1927, 1928, 1932, 1994, 1998
Guatemala	1945, 1959, 1993, 2002
Honduras	1950, 1996
Hungary	1924, 1932, 1991, 1998, 2001
Iceland	1961, 1986, 1997, 2001, 2009, 2019
India	1934, 1962, 2016
Indonesia	1953, 1968, 1999
Iran	1960, 1972
Iraq	1976, 2004
Ireland	1942, 1971, 1994, 1998
Israel	1954, 2008, 2010
Italy	1893, 1928, 1936, 1998, 2005
Jamaica	1960, 1992, 2014, 2020
Japan	1882, 1942, 1997
Jordan	1959, 1979, 2016
Kenya	1966, 1996
Korea	1950, 1962, 1982, 1997
Kosovo	2008, 2010
Kyrgyz Rep.	1993, 1997, 2009
Kuwait	1968
Laos	1955, 1994, 2015
Latvia	1992, 1997, 1998, 2014, 2019
Lebanon	1963
Lesotho	1978, 2000
Liberia	1999
Lithuania	1994, 2001, 2014
Luxemburg	1998
Macedonia	1992, 1996, 2002, 2004, 2010
Malaysia	1958, 1970, 2009
Maldives	1981, 2007
Malta	1967, 2002, 2008, 2021
Mauritania	1973, 2007
Mexico	1925, 1932, 1936, 1941, 1982, 1984, 1993

Moldova	1991, 1995, 2010
Mongolia	1996
Montenegro	2000, 2010, 2017
Morocco	1959, 1993, 2005, 2019
Mozambique	1975, 1992
Myanmar	1991, 2013
Namibia	1990, 2020
Netherlands	1814, 1839, 1863, 1889, 1903, 1948, 1998
New Zealand	1934, 1964, 1989, 2019
Nicaragua	1960, 1992, 1999, 2010,
Norway	1892, 1965, 1985, 2003, 2005, 2020
Pakistan	1947, 1997, 2012, 2015
Papua New G.	1973, 2000
Peru	1922, 1931, 1939, 1962, 1979, 1985, 1992
Philippines	1948, 1993
Poland	1924, 1937, 1939, 1945, 1975, 1989, 1997
Portugal	1931, 1975, 1986, 1990, 1998
Qatar	1973, 1993, 2006
Romania	1991, 1998, 2004
Russia	1991, 1993, 1995, 2002, 2014
Samoa	1984, 2015
Serbia	2003, 2010
Seychelles	1982, 2003, 2004, 2011
Singapore	1970, 1987
Slovakia	1992, 2001, 2006, 2009, 2014
Slovenia	1991, 2002, 2007
Solomon Islands	1983, 2012
South Africa	1920, 1956, 1989, 1991, 1996
Spain	1874, 1891, 1921, 1946, 1962, 1980, 1994, 1999
Sri Lanka	1949
Sweden	1867, 1873, 1932, 1934, 1988, 1999
Switzerland	1905, 1911, 1953, 1979, 2004
Taiwan	1935, 1979, 1997, 2002, 2011, 2014
Tanzania	1966, 1978, 1995
Thailand	1942, 2008
Tonga	1988, 2007
Tunisia	1958, 2000, 2006
Turkey	1930, 1970, 1986, 2001, 2018
UAE	1980, 2018
UK	1844, 1946, 1968, 1998, 2012

Uruguay	1896, 1967, 1939, 1995, 1997, 2008
US	1913, 1933, 1934, 1935, 1942, 1977, 1979
Vanuatu	1980, 1989

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Notes: This table only laws/statutes/amendments that change central bank independence scores are listed. The complete list of all laws we reviewed are available upon request and will be available online.

Table 3: Correlation between country-level independence measures in different periods

	Decades					All decades
	1800-1850	1850-1900	1900-1950	1950-2000	2000-2022	1800-2022
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A.- Dep. var. LVAU						
LVAU	1.309*** (0.001)	1.017*** (0.006)	0.974*** (0.011)	0.959*** (0.005)	1.017*** (0.006)	0.993*** (0.003)
Constant	0.005*** (0.000)	0.057*** (0.002)	0.034*** (0.007)	0.037*** (0.004)	0.015*** (0.003)	-0.039*** (0.002)
Panel B.- Dep. var. LVES						
LVESX	-0.02** (0.006)	1.336*** (0.031)	1.17*** (0.027)	1.09*** (0.029)	1.107*** (0.025)	1.015*** (0.01)
Constant	0.351*** (0.001)	0.015 (0.026)	-0.125*** (0.015)	-0.062*** (0.014)	-0.007 (0.011)	0.19*** (0.011)
Panel C.- Dep. var. LVAU						
LVES	-2.999*** (0.762)	0.204*** (0.029)	0.258*** (0.021)	0.398*** (0.021)	0.362*** (0.016)	0.327*** (0.008)
Constant	1.181*** (0.265)	0.222*** (0.042)	0.572*** (0.009)	0.228*** (0.014)	0.294*** (0.011)	0.104*** (0.013)
Num. countries	7	13	44	118	119	120
Observations	160	405	1,163	3,722	2,607	7,880

Notes: The table shows the coefficients of linear regressions between country-year CBI indexes indicated in the panel titles and other measures of CBI controlling for year and country-level fixed effects. Robust standard errors clustered at the year level are reported in parenthesis. Statistical significance notation follows convention.



Table 4: Ranking of countries' Legal Central Bank independence indexes – average LVAU, 1990-2021

Order		LVAU	LVAW	LVES	LVESX
		(1)	(2)	(3)	(4)
1	European Central Bank	0.927	0.912	1.000	1.000
2	Czechia	0.862	0.843	1.000	0.933
3	Lithuania	0.848	0.826	0.824	0.894
4	Latvia	0.831	0.819	0.819	0.798
5	Serbia	0.796	0.790	0.907	0.852
6	Romania	0.793	0.784	0.961	0.855
7	Estonia	0.777	0.763	0.646	0.677
8	Georgia	0.762	0.730	0.822	0.787
9	Luxembourg	0.762	0.734	0.320	0.592
10	Montenegro	0.761	0.726	0.395	0.637
11	Hungary	0.758	0.732	0.705	0.753
12	Slovakia	0.758	0.751	0.695	0.581
13	Sweden	0.756	0.739	0.955	0.868
14	Kosovo	0.756	0.728	0.103	0.462
15	Kyrgyzstan	0.749	0.775	0.922	0.575
16	North Macedonia	0.743	0.717	0.743	0.744
17	Turkey	0.743	0.750	0.853	0.806
18	Russian Federation	0.743	0.712	0.468	0.659
19	Poland	0.732	0.761	0.662	0.414
20	Albania	0.731	0.736	0.902	0.749
21	Spain	0.728	0.710	0.418	0.601
22	Peru	0.726	0.766	0.946	0.893
23	Austria	0.723	0.694	0.444	0.645
24	Armenia	0.723	0.742	0.802	0.533
25	Chile	0.722	0.740	1.000	0.600
26	China	0.706	0.640	0.508	0.705
27	Croatia	0.705	0.724	0.936	0.587
28	Slovenia	0.700	0.675	0.572	0.634
29	United States	0.698	0.647	0.560	0.736
30	Switzerland	0.695	0.692	0.912	0.845
31	Portugal	0.691	0.660	0.387	0.572
32	Netherlands	0.689	0.660	0.353	0.537
33	France	0.686	0.650	0.344	0.560
34	Belgium	0.676	0.642	0.250	0.529
35	Guatemala	0.664	0.630	0.145	0.452

36	Indonesia	0.662	0.678	0.741	0.454
37	Bosnia and Herzegovina	0.658	0.675	0.320	0.192
38	Liberia	0.655	0.704	1.000	0.775
39	Iraq	0.651	0.621	0.763	0.722
40	Argentina	0.650	0.641	0.747	0.570
41	Cyprus	0.649	0.612	0.376	0.500
42	Malta	0.645	0.619	0.431	0.547
43	Bolivia, Plurinational State of	0.639	0.638	0.501	0.357
44	Kenya	0.626	0.603	0.495	0.478
45	Mongolia	0.611	0.619	0.960	0.565
46	Myanmar	0.609	0.615	0.521	0.473
47	Finland	0.604	0.571	0.320	0.500
48	Nicaragua	0.603	0.562	0.145	0.287
49	Tunisia	0.602	0.576	0.485	0.530
50	Belarus	0.601	0.611	0.741	0.469
51	Papua New Guinea	0.591	0.555	0.643	0.593
52	Greece	0.571	0.599	0.343	0.236
53	New Zealand	0.571	0.580	0.285	0.171
54	Moldova, Republic of	0.568	0.580	0.895	0.738
55	El Salvador	0.568	0.577	0.155	0.102
56	Germany	0.554	0.554	0.490	0.350
57	Cambodia	0.533	0.556	0.664	0.591
58	Egypt	0.528	0.484	0.252	0.276
59	Honduras	0.523	0.536	0.719	0.621
60	Costa Rica	0.522	0.540	0.252	0.176
61	Dominican Republic	0.518	0.495	0.071	0.107
62	Israel	0.515	0.494	0.643	0.529
63	Namibia	0.508	0.457	0.212	0.329
64	Lesotho	0.508	0.517	0.652	0.449
65	United Arab Emirates	0.504	0.489	0.556	0.436
66	Vanuatu	0.504	0.433	0.252	0.309
67	Ghana	0.500	0.480	0.627	0.475
68	Ireland	0.488	0.491	0.333	0.247
69	Thailand	0.483	0.471	0.515	0.498
70	Uruguay	0.480	0.506	0.647	0.423
71	Italy	0.479	0.484	0.283	0.201
72	Iceland	0.471	0.451	0.498	0.326
73	Azerbaijan	0.466	0.494	0.724	0.541
74	Kuwait	0.465	0.465	0.332	0.290
75	Tanzania, United Republic of	0.464	0.429	0.148	0.269

76	Mexico	0.448	0.435	0.546	0.352
77	Canada	0.448	0.447	0.292	0.266
78	Mauritania	0.444	0.455	0.581	0.497
79	Angola	0.441	0.418	0.292	0.221
80	Denmark	0.440	0.484	0.840	0.671
81	Jordan	0.436	0.447	0.662	0.424
82	Eastern Caribbean Central Bank	0.435	0.458	0.212	0.185
83	Solomon Islands	0.433	0.404	0.131	0.221
84	Jamaica	0.430	0.375	0.204	0.213
85	Belize	0.429	0.389	0.252	0.242
86	Czechoslovakia	0.426	0.415	0.212	0.127
87	Fiji	0.425	0.412	0.252	0.242
88	Samoa	0.419	0.384	0.254	0.292
89	Colombia	0.406	0.396	0.268	0.203
90	United Kingdom	0.405	0.393	0.539	0.423
91	Sri Lanka	0.399	0.384	0.080	0.206
92	Brazil	0.390	0.373	0.005	0.003
93	Seychelles	0.388	0.381	0.445	0.337
94	Bhutan	0.383	0.417	0.347	0.291
95	Bahrain	0.376	0.339	0.227	0.227
96	Tonga	0.373	0.382	0.294	0.195
97	Malaysia	0.372	0.430	0.365	0.310
98	Botswana	0.367	0.402	0.292	0.191
99	Qatar	0.360	0.373	0.236	0.237
100	Ethiopia	0.354	0.281	0.120	0.127
101	Philippines	0.344	0.343	0.080	0.200
102	Bahamas	0.339	0.356	0.438	0.325
103	Morocco	0.338	0.378	0.414	0.390
104	Korea, Democratic People's Republic of	0.337	0.362	0.411	0.369
105	Lao People's Democratic Republic	0.331	0.269	0.080	0.199
106	Norway	0.329	0.349	0.176	0.137
107	Lebanon	0.328	0.350	0.000	0.233
108	Barbados	0.304	0.295	0.332	0.216
109	Japan	0.304	0.376	0.810	0.519
110	South Africa	0.290	0.266	0.277	0.200
111	India	0.273	0.269	0.255	0.230
112	Mozambique	0.255	0.263	0.417	0.350
113	Bangladesh	0.222	0.256	0.212	0.294
114	Singapore	0.194	0.235	0.252	0.185
115	Australia	0.187	0.250	0.292	0.209

116	Pakistan	0.177	0.183	0.080	0.171
117	Iran, Islamic Republic of	0.174	0.197	0.212	0.161
118	Taiwan, Province of China	0.147	0.150	0.120	0.097
119	Maldives	0.130	0.147	0.252	0.185
120	Bermuda	0.062	0.032	0.000	0.033
	Correlations		0.987		0.858

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Notes: Cells report country mean values of the CBI indicators listed in each column after restricting to 2021. 119 countries are listed, after excluding Czechoslovakia that only existed until 1992. Averages are computed after removing missing values for presentation purposes. The table is ordered in descending fashion based on the LVAU average. The last row shows a simple Pearson correlation between LVAU and LVAW the average LVAU and LVAW for 1990-2021 in column (2) and LVES and LVESX in column (4).

Table 5: Central bank independence, ranked by mean LVAU value in 2021

Order		LVAU (1)	LVAW (2)	LVES (3)	LVESX (4)
1	Romania	0.951	0.931	1.000	1.000
2	Serbia	0.948	0.926	1.000	1.000
3	Sweden	0.941	0.931	1.000	1.000
4	European Central Bank	0.927	0.912	1.000	1.000
5	Moldova, Republic of	0.906	0.868	1.000	1.000
6	North Macedonia	0.906	0.887	0.868	0.921
7	Switzerland	0.903	0.878	1.000	1.000
8	Czechia	0.899	0.872	1.000	1.000
9	Georgia	0.899	0.858	1.000	1.000
10	Hungary	0.882	0.843	0.732	0.839
11	Montenegro	0.878	0.858	0.600	0.760
12	Turkey	0.844	0.794	1.000	1.000
13	Iraq	0.843	0.816	0.920	0.952
14	Thailand	0.843	0.816	0.920	0.952
15	Russian Federation	0.804	0.775	0.468	0.681
16	Kyrgyzstan	0.795	0.828	1.000	0.600
17	Indonesia	0.785	0.814	1.000	0.600
18	Estonia	0.772	0.749	0.320	0.592
19	Spain	0.772	0.749	0.320	0.592
20	Kosovo	0.770	0.743	0.120	0.472
21	Poland	0.767	0.799	0.732	0.439
22	Luxembourg	0.762	0.734	0.320	0.592
23	Slovenia	0.762	0.734	0.320	0.592
24	Albania	0.755	0.769	1.000	0.808
25	Croatia	0.753	0.784	1.000	0.600
26	Austria	0.751	0.719	0.320	0.592
27	Belgium	0.751	0.719	0.320	0.592
28	France	0.751	0.719	0.320	0.592
29	Latvia	0.751	0.719	0.320	0.592
30	Lithuania	0.751	0.719	0.320	0.592
31	Portugal	0.751	0.719	0.320	0.592
32	Tunisia	0.751	0.703	0.508	0.705
33	Peru	0.748	0.790	1.000	0.942
34	Malta	0.741	0.705	0.320	0.592
35	Cyprus	0.730	0.690	0.320	0.592
36	Netherlands	0.730	0.690	0.320	0.592

37	Chile	0.722	0.740	1.000	0.600
38	Finland	0.720	0.675	0.320	0.592
39	Armenia	0.715	0.743	0.788	0.473
40	Slovakia	0.714	0.699	0.320	0.320
41	Guatemala	0.706	0.656	0.160	0.496
42	China	0.706	0.640	0.508	0.705
43	United States	0.698	0.647	0.560	0.736
44	Belarus	0.688	0.711	0.708	0.425
45	Liberia	0.684	0.752	1.000	0.775
46	Norway	0.680	0.648	0.412	0.412
47	Papua New Guinea	0.679	0.642	0.880	0.803
48	Solomon Islands	0.677	0.648	0.160	0.404
49	Azerbaijan	0.675	0.704	1.000	0.758
50	Kenya	0.668	0.639	0.560	0.511
51	Israel	0.662	0.665	1.000	0.825
52	Bosnia and Herzegovina	0.658	0.675	0.320	0.192
53	Nicaragua	0.655	0.623	0.160	0.304
54	Bolivia, Plurinational State of	0.646	0.645	0.640	0.507
55	Jordan	0.643	0.664	0.880	0.528
56	Mongolia	0.611	0.619	0.960	0.701
57	Seychelles	0.609	0.602	1.000	0.691
58	Greece	0.605	0.631	0.320	0.192
59	Myanmar	0.595	0.609	0.748	0.615
60	Honduras	0.590	0.609	0.920	0.760
61	Ghana	0.584	0.554	0.640	0.542
62	Cambodia	0.577	0.603	0.748	0.657
63	Argentina	0.577	0.549	0.428	0.348
64	El Salvador	0.574	0.587	0.160	0.096
65	Lesotho	0.565	0.590	0.868	0.579
66	Italy	0.564	0.572	0.320	0.192
67	Tonga	0.563	0.571	0.348	0.209
68	Namibia	0.559	0.513	0.212	0.235
69	Mauritania	0.555	0.590	1.000	0.775
70	Ireland	0.543	0.543	0.320	0.192
71	Iceland	0.535	0.515	0.572	0.343
72	Brazil	0.533	0.528	0.160	0.096
73	Costa Rica	0.532	0.552	0.292	0.200
74	Germany	0.529	0.524	0.320	0.192
75	Egypt	0.528	0.484	0.252	0.276
76	Bhutan	0.521	0.566	0.372	0.314

77	United Arab Emirates	0.518	0.517	0.788	0.598
78	Qatar	0.516	0.501	0.252	0.309
79	Uruguay	0.511	0.542	0.680	0.433
80	New Zealand	0.511	0.516	0.212	0.127
81	Dominican Republic	0.510	0.508	0.120	0.072
82	Samoa	0.504	0.547	0.732	0.630
83	Vanuatu	0.504	0.433	0.252	0.309
84	Tanzania, United Republic of	0.476	0.446	0.160	0.271
85	Jamaica	0.476	0.449	0.212	0.218
86	Mexico	0.468	0.461	0.612	0.392
87	Kuwait	0.465	0.465	0.332	0.290
88	Belize	0.462	0.433	0.252	0.242
89	Canada	0.448	0.447	0.292	0.266
90	Angola	0.441	0.418	0.292	0.283
91	Denmark	0.440	0.484	0.840	0.671
92	Eastern Caribbean Central Bank	0.436	0.458	0.212	0.185
93	Morocco	0.431	0.487	0.748	0.657
94	Colombia	0.426	0.412	0.292	0.209
95	Fiji	0.425	0.412	0.252	0.242
96	United Kingdom	0.425	0.420	0.680	0.508
97	Bahamas	0.422	0.453	0.438	0.471
98	Sri Lanka	0.399	0.384	0.080	0.206
99	Malaysia	0.379	0.439	0.412	0.338
100	Bahrain	0.374	0.346	0.348	0.300
101	Botswana	0.367	0.402	0.292	0.266
102	Japan	0.359	0.445	1.000	0.633
103	Korea, Democratic People's Republic of	0.354	0.382	0.508	0.427
104	Philippines	0.346	0.344	0.080	0.206
105	Lebanon	0.328	0.350	0.000	0.233
106	Barbados	0.304	0.295	0.332	0.277
107	South Africa	0.300	0.278	0.292	0.209
108	India	0.294	0.294	0.320	0.269
109	Lao People's Democratic Republic	0.271	0.216	0.080	0.173
110	Ethiopia	0.252	0.181	0.120	0.105
111	Mozambique	0.250	0.261	0.428	0.357
112	Bangladesh	0.219	0.251	0.212	0.294
113	Singapore	0.194	0.235	0.252	0.185
114	Australia	0.187	0.250	0.292	0.209
115	Pakistan	0.179	0.186	0.080	0.171
116	Iran, Islamic Republic of	0.174	0.197	0.212	0.161



117	Maldives	0.154	0.182	0.252	0.185
118	Taiwan, Province of China	0.147	0.150	0.120	0.097
119	Bermuda	0.065	0.037	0.000	0.033
	Correlations		0.987		0.858

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Notes: Cells report country mean values of the CBI indicators listed in each column after restricting to 1990-2021. Averages are computed after removing missing values for presentation purposes. The table is ordered in descending fashion based on the LVAU average. The last row shows a simple Pearson correlation between the average LVAU and LVAW for 2021 in column (2) and LVES and LVESX in column (4).

Table 6: Countries included in text analysis

	ISO code	Country name	Statute year	LVAU
	(1)	(2)	(3)	(4)
1	ALB	Albania	1998	0.739
2	ARG	Argentina	2012	0.577
3	ARM	Armenia	1996	0.435
4	AUS	Australia	1959	0.274
5	AUT	Austria	2010	0.730
6	AZE	Azerbaijan	2014	0.675
7	BHS	Bahamas	2010	0.336
8	BHR	Bahrain	2006	0.377
9	BEL	Belgium	2010	0.751
10	BLZ	Belize	2003	0.420
11	BOL	Bolivia, Plurinational State of	2009	0.646
12	BIH	Bosnia and Herzegovina	1997	0.658
13	BRA	Brazil	2006	0.385
14	KHM	Cambodia	1996	0.577
15	CAN	Canada	2014	0.448
16	CHL	Chile	2010	0.722
17	CHN	China	2003	0.706
18	HRV	Croatia	2010	0.753
19	CYP	Cyprus	2010	0.730
20	CZE	Czechia	2010	0.899
21	DNK	Denmark	2011	0.440
22	DOM	Dominican Republic	2010	0.510
23	EGY	Egypt	2014	0.528
24	EST	Estonia	2010	0.764
25	ETH	Ethiopia	1994	0.443
26	FJI	Fiji	2009	0.425
27	FIN	Finland	2010	0.720
28	FRA	France	2015	0.751
29	GEO	Georgia	2014	0.899
30	DEU	Germany	2013	0.529
31	GHA	Ghana	2002	0.584
32	GRC	Greece	2010	0.605
33	GTM	Guatemala	2002	0.720

34	HND	Honduras	1982	0.286
35	HUN	Hungary	2013	0.882
36	ISL	Iceland	2002	0.578
37	IND	India	1934	0.284
38	IDN	Indonesia	2004	0.785
39	IRN	Iran, Islamic Republic of	1972	0.159
40	IRL	Ireland	2010	0.543
41	ISR	Israel	2010	0.662
42	ITA	Italy	2010	0.564
43	JPN	Japan	1997	0.359
44	JOR	Jordan	1971	0.479
45	KEN	Kenya	2014	0.668
46	KGZ	Kyrgyzstan	2011	0.795
47	LAO	Lao People's Democratic Republic	1995	0.323
48	LVA	Latvia	2013	0.920
49	LTU	Lithuania	2014	0.910
50	LUX	Luxembourg	2015	0.762
51	MKD	North Macedonia	2012	0.906
52	MYS	Malaysia	2009	0.379
53	MDV	Maldives	1981	0.109
54	MLT	Malta	2010	0.730
55	MRT	Mauritania	2007	0.555
56	MEX	Mexico	1993	0.308
57	MDA	Moldova, Republic of	2014	0.906
58	MNE	Montenegro	2015	0.812
59	MAR	Morocco	2005	0.250
60	MOZ	Mozambique	2004	0.250
61	MMR	Myanmar	2013	0.595
62	NLD	Netherlands	2010	0.730
63	NZL	New Zealand	1989	0.578
64	NOR	Norway	2013	0.474
65	PAK	Pakistan	2004	0.179
66	PNG	Papua New Guinea	2000	0.679
67	PER	Peru	1993	0.748
68	PHL	Philippines	1993	0.346
69	POL	Poland	2010	0.767
70	PRT	Portugal	2013	0.751
71	QAT	Qatar	2006	0.516

72	ROU	Romania	2010	0.951
73	RUS	Russian Federation	2014	0.804
74	SRB	Serbia	2015	0.948
75	SYC	Seychelles	2004	0.322
76	SGP	Singapore	2013	0.194
77	SVK	Slovakia	2014	0.714
78	SVN	Slovenia	2010	0.762
79	ZAF	South Africa	1996	0.300
80	ESP	Spain	2010	0.772
81	LKA	Sri Lanka	2014	0.399
82	SWE	Sweden	2010	0.941
83	CHE	Switzerland	2012	0.903
84	TZA	Tanzania, United Republic of	2006	0.476
85	THA	Thailand	2007	0.204
86	TON	Tonga	2014	0.563
87	TUN	Tunisia	2007	0.751
88	TUR	Turkey	2013	0.920
89	GBR	United Kingdom	2012	0.442
90	URY	Uruguay	2010	0.511

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Notes: The table lists the countries that are included in the text analysis and the year of their analyzed Central Bank statute. We include the LVAU values that are outcome variables in the analysis.

Table 7: Topics using terms from the corpus of central bank statutes  
*(tokens with highest topic weightage, starting with highest weightage)*

Topics	Tokens with highest contribution assigned to topic
Governing Bodies: Composition, Terms, Qualification Requirements, Nomination, Selection, Appointment	supervisory, committee, governing, chair, decision, parliament, monetary, execution, meet, rules, authorities, representative, regulation, tasks, references, advisory, reports, participation, procedure
Monetary Policy Objectives	monetary, policy, governing, operating, functions, law, financial, institutions, source, credit, objectives, public, powers, foreign exchange, international, management, instruments, accounts, amend
Currency in Circulation and Inventory	coins, notes, currency, issue, circulation, exchange, source, law, legal, tender, amend, payment, withdraw, tax, denominated, duties, money, replacement.
General Functions and Powers	tasks, policy, institutions, financial, functions, credit, competent, authorities, treaty, reserve, objectives, provisions, references, relates, official, hold, carrying.
Objectives of Microprudential Supervision 1	supervision, entities, decision, supervisory, authorities, relevant, participation, institutions, procedure, tasks, cooperate, credit, competent, references, financial, determining, close, relates
Governor: Requirements, Terms, Nomination, Selection, Appointment	governor, directors, appoint, offices, law, deputy, management, terms, president, persons, duties, administration, execution, chairman, governing, provisions, approval, organizations, amend.
Objectives of Microprudential Supervision 2	institutions, credit, law, federal, establishment, financial, authorize, supervision, procedure, required, application, branches, regulation, services, withdraw, capital, activities, provide, freedom.

Regulatory Power	financial, institutions, regulation, sector, provisions, establishment, operating, issue, public, private, superintendence, activities, required, liquidity, capital, credit, common
Accountability Framework	financial, amend, subsection, persons, committee, relates, publish, reserve, minister, statements, registered, public, time, notice, required, direct, functions, powers
Disclosure, Transparency and Reporting Obligation	law, securities, data, persons, provisions, provide, rules, authorities, party, required, services, entities, public, request, systems, legal, financial, references, registered, submission, perform, market
The Central Bank's Foreign Exchange Operations	foreign exchange, currency, reserve, international, rates, monetary, transactions, operating, assets, financial, determining, gold, credit, issue

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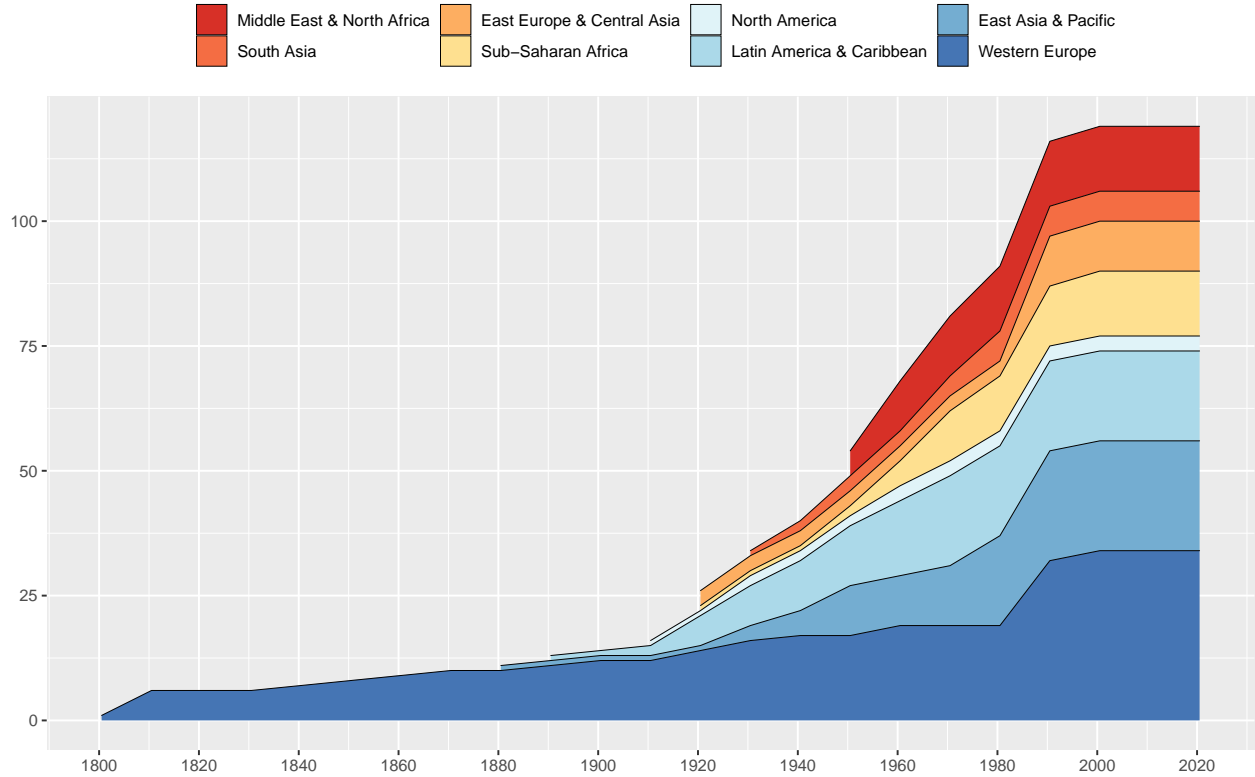
Notes: Topic labels were chosen from the IMF's Central Bank Legislation Database categories, in which articles and extracts of the statutes are classified. The table presents the topics and the words from the entire corpus of Central Banks Statutes that belong to each topic. The terms that constitute each topic were estimated using Latent Dirichlet Allocation algorithm as indicated in the main paper. The second column reports words with highest contribution to each topic (this is not an extensive list). The dataset drawn from the repository of IMF Central Bank Legislation.

Table 8: Estimated topic importance for predicting Central Bank Independence (LVAU)  
*(Including lemmatized noun, verbs, adjectives, and adverbs)*

Central Bank Statute Topic	Positive effects (1)	Negative effects (2)	Net contribution (3)
Disclosure, Transparency and Reporting Obligation	0.026	0.000	0.026
Objectives of Microprudential Supervision 1	0.011	0.007	0.005
General Functions and Powers	0.030	0.016	0.015
Accountability Framework	0.008	0.008	0.000
Objectives of Microprudential Supervision 2	0.010	0.009	0.000
Monetary Policy Objectives	0.006	0.006	-0.001
Currency in Circulation and Inventory	0.009	0.013	-0.004
Governing Bodies: Composition, Terms, Qualification Requirements, Nomination, Selection, Appointment	0.011	0.015	-0.004
Governor: Requirements, Terms, Nomination, Selection, Appointment	0.010	0.015	-0.005
The Central Bank's Foreign Exchange Operations	0.000	0.005	-0.005
Regulatory Power	0.006	0.012	-0.007
Unclassified	0.029	0.062	-0.034

Notes: This table reports the effects of topics detected in the Central Banks' statutes corpus on the Central Bank Independence Index (LVAU). Each topic's effect is calculated as the sum of the fifty terms with the highest predictive power corresponding to that topic. Topics are determined using topic modeling on the 2,000 most frequent nouns, verbs, adjectives, and adverbs that are part of the corpus after being lemmatized, removing stop-words and numbers. Terms that are not classified to have weightage in any topic are grouped under "Unclassified."

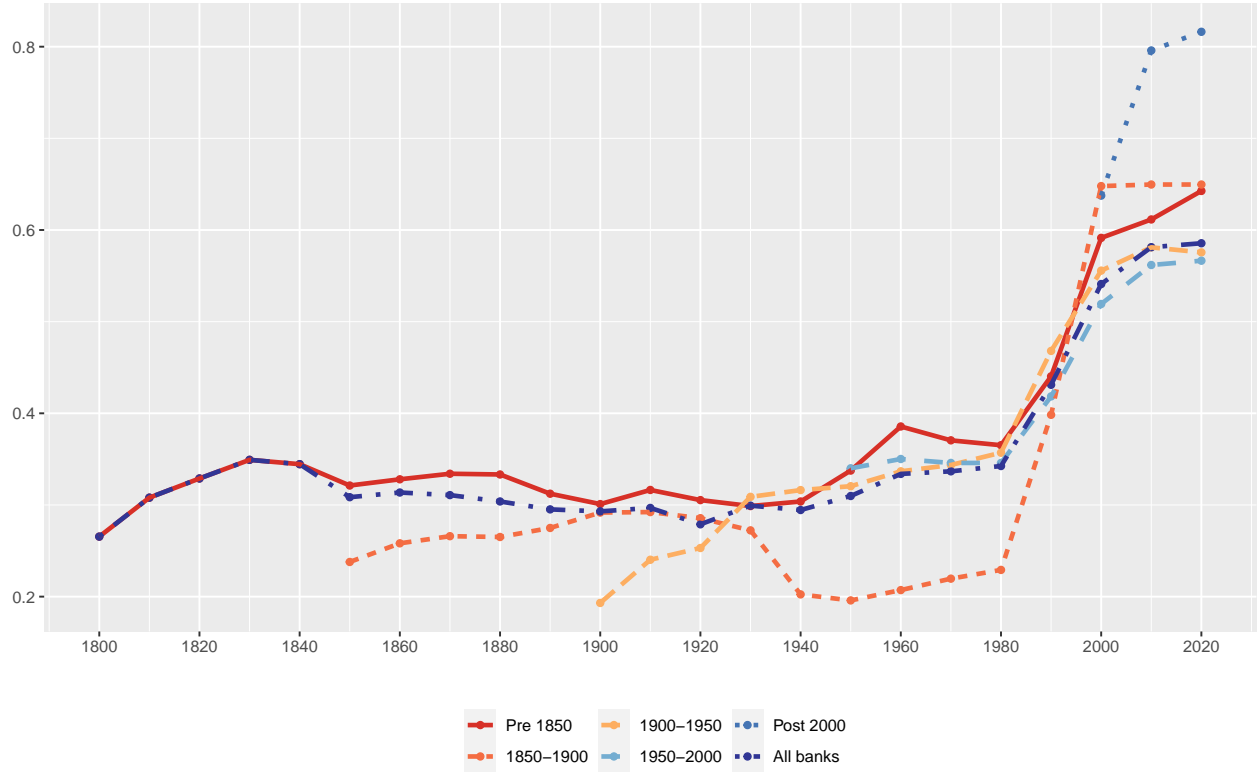
Figure 1: Number of operating central banks by decade, 1800-2021



Notes: The figure presents the number of countries of sample each decade and its region composition in the period 1800-2020. The regional classification was adapted from World Bank. The sample consist of central banks laws' collection of 120 countries which was gathered from central bank websites, central bank libraries, the IMF Central Bank Legislation Database, the BIS central bank law database, books providing collection of laws (such as [Singer \(1932\)](#); [Aufrecht \(1961\)](#); [Effros \(1982\)](#)), and through personal correspondence with the legal and research departments of a various central banks.

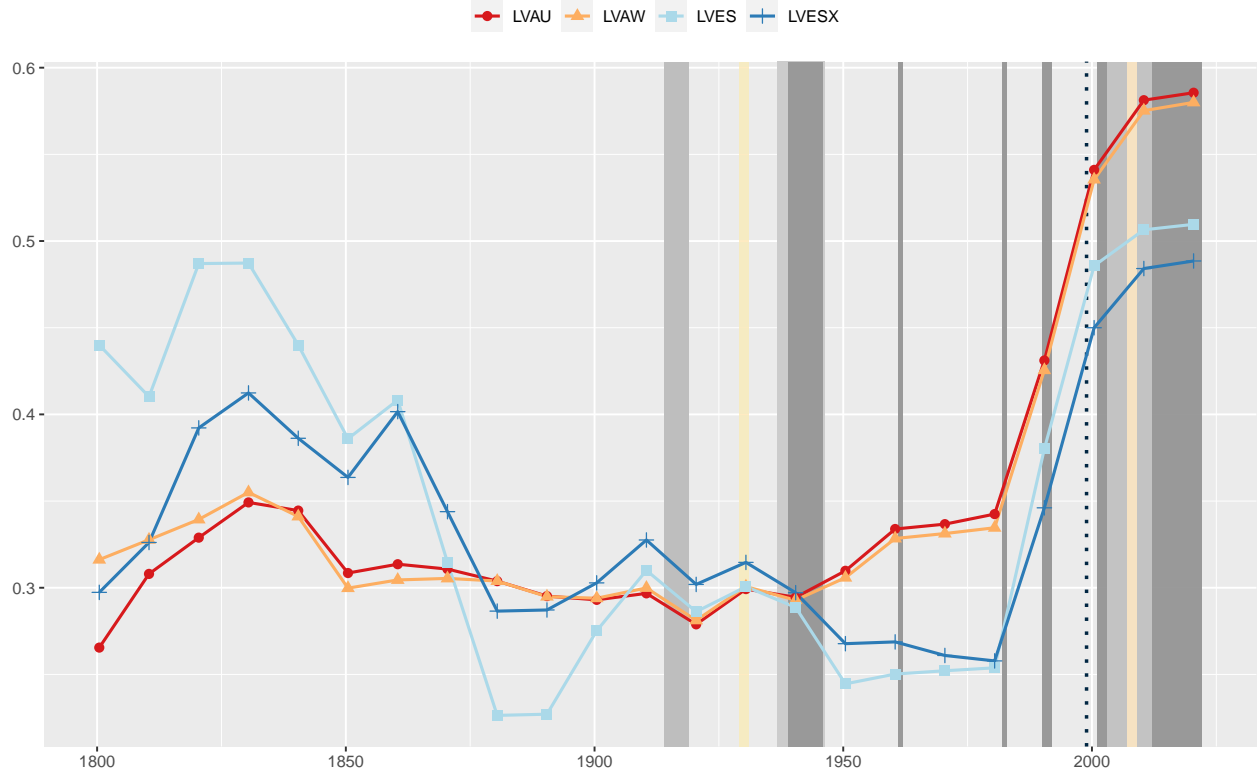


Figure 2: Central bank independence (LVAU) by period of central bank establishment



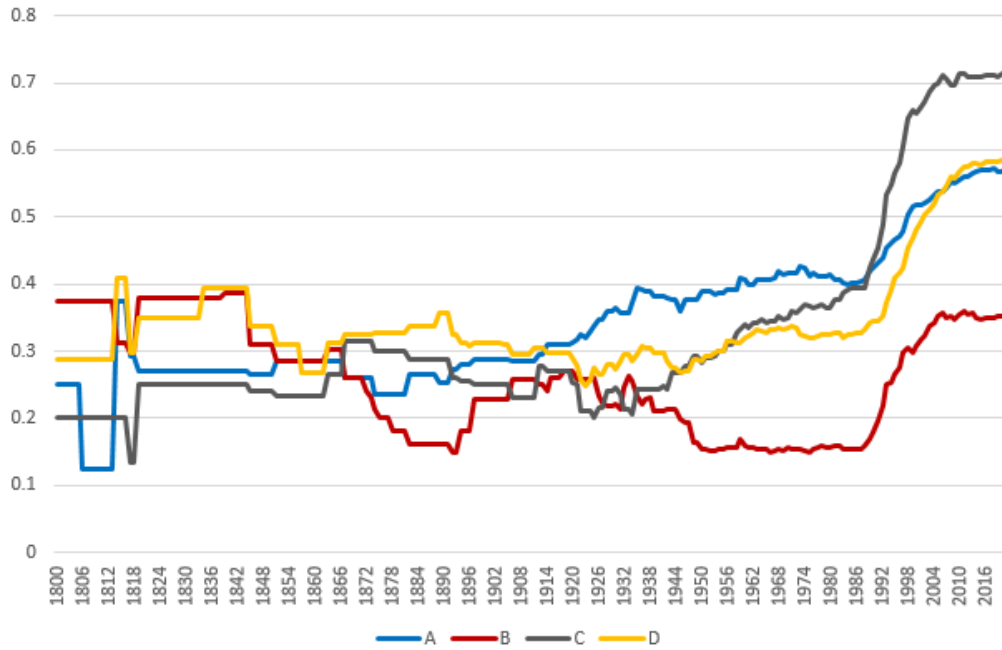
Notes: The graph shows the (decade) average value of LVAU for countries grouped by their year of establishment. Each line holds fixed the composition of Central Banks created before 1850, established between 1850-1900, established between 1900-1950, established between 1950-2000, established after 2000, and includes a line that plots the average for all banks in our dataset. Each of the three establishment categories includes central banks created from that year onwards.

Figure 3: Central bank independence, decade averages, 1800-2021



Notes: The decade averages are calculated after removing missing values at the country-year observation level. The following wars and their duration are represented in grey shaded areas in the background: WWI (1914-1918), WWII in Asia and Pacific (1937-1945), WWII in Europe (1939-1945), Bay of pigs (1961), Lebanese war (1982), Gulf war (1990-1994), US Afghanistan war (2001-2021), US Iraq war (2003-2011). The Crash of 1929 and Great Financial Crisis of 2007 are represented in yellow areas. The ECB introduction in 1998 is represented in a dotted line. LVAU is the unweighted Cukierman et al. (1992) index that takes the simple average of eight components: chief executive officer (CEO), policy formulation, objectives, advances criterion under limits on lending to the government, securitized lending criterion under limits on lending to the government, terms of lending, potential borrowers from the bank criterion, and other criteria on the limits on lending to the government (see [Dincer and Eichengreen \(2014\)](#)). LVAW is the weighted average version of the eight components. LVES and LVESX are two narrower indices. LVES is the weighted average of components: “Who formulates monetary policy”, “Who has final word in resolution of conflict and objectives.” LVESX is a weighted average between the LVES and limitations on lending -miscellaneous sub component under the Limitations on lending to the government component.

Figure 4: Components of central bank independence, 1800-2021



Notes: The graph shows the average value of the components of LVAW for each year during the period 1800-2021. Component A covers limitations on CEO: term of office, by whom appointed, provisions for dismissal, simultaneous holding other offices. Component B is related to provisions on policy formulation (PF) covering the role of the central bank in monetary policy formulation, resolution of conflict between the central bank and the government over monetary policy and the role of the central bank in the budget process. Component C is the provisions on objectives (Obj): objectives of the central bank, including emphasis on price stability versus other goals. Finally, Component D is on limitations on lending to the government: limits regarding the volume, maturity, interest rate and conditions for securitized and non-securitized lending (see [Dincer and Eichengreen \(2014\)](#))





# Appendix

## A Criteria List for LVAU and LVAW

(Legal Central Bank Independence Indices of *Cukierman et al. (2002)*)

	Weight	Codes
A Chief Executive Officer (CEO)	0.2	
a. Term of Office		
Over 8 years		1.00
6 to 8 years		0.75
5 years		0.50
4 years		0.25
Under 4 years or at the discretion of appointer		0.00
b. Who appoints CEO?		
Board of central bank		1.00
A council of the central bank board, executive branch, and legislative branch		0.75
Legislature (congress, king)		0.50
Executive collectively (e.g. council of ministers)		0.25
One or two members of the executive branch (prime minister, president, or any other m.)		0.00
c. Dismissal		
No provision for dismissal		1.00
Only for reasons not related to policy (incapacity or violation of law)		0.83
At the discretion of central bank board		0.67
At legislature's discretion		0.50
Unconditional dismissal possible by legislature		0.33
At executive's discretion		0.17
Unconditional dismissal possible by executive or not mentioned		0.00
d. May CEO hold other offices in government?		
No		1.00
Only with permission of the executive branch		0.50
No rule against CEO holding another office		0.00
B Policy Formulation	0.15	

a. Who formulates monetary policy?		
Bank alone		1.00
Bank participates, but has little influence		0.67
Bank only advises government		0.33
Bank has no say		0.00
b. Who has final word in resolution of conflict?		
The bank, on issues clearly defined in the law as its objectives		1.00
Government, on policy issues not clearly defined as the bank's goals or in case of conflict within bank		0.80
A council of the central bank, executive branch, and legislative branch gives final decision		0.60
The legislature has final authority on policy issues		0.40
The executive branch on policy issues, subject to due process and possible protest by CB		0.20
The executive branch has unconditional priority		0.00
c. Role in the government's budgetary process		
Central bank active		1.00
Central bank has no influence		0.00
C Objectives	0.15	
Price stability mentioned as the major or only objective in the charter, and in case of conflict with government CB has final authority to pursue policies aimed at achieving this goal		1.00
Price stability is the only objective		0.80
Price stability is only one goal, with other compatible objectives, such as a stable banking system		0.60
Price stability is only one goal, with potentially conflicting objectives, such as a full employment		0.40
No objectives stated in the bank charter		0.20
Stated objectives do not include price stability		0.00
D Limitations on lending to the government		
a. Advances (limitation on no securitized lending)	0.15	
No advances permitted		1.00
Advances permitted, but with strict limits (e.g. absolute cash amounts or up to 15 percent of government revenue)		0.67
Advances permitted, and the limits are loose (e.g. over 15 percent of government revenue)		0.33
No legal limits on lending		0.00
b. Securitized lending	0.10	
Not permitted		1.00
Permitted, but with strict limits (e.g. up to 15 percent of government revenue)		0.67



Permitted, and the limits are loose (e.g., over 15 percent of government revenue)		0.33
No legal limits on lending		0.00
c. Terms of lending (maturity, interest, amount) (Nan if not written/found in law)	0.10	
Controlled by the bank		1.00
Specified by the bank charter		0.67
Agreed between the central bank and the executive		0.33
Decided by the executive branch alone		0.00
d. Potential borrowers from the bank (Nan if not written in law/found)	0.05	
Only the central government		1.00
All levels of government (state as well as central)		0.67
Those mentioned above and public enterprises		0.33
Public and private sector		0.00
e. Limits on central bank lending defined in (Nan if not written/found in law)	0.025	
Currency amounts		1.00
Shares of central bank demand liabilities or capital		0.67
Shares of government revenue		0.33
Shares of government expenditures		0.00
f. Maturity of loans	0.025	
Within 6 months		1.00
Within 1 year		0.67
More than 1 year		0.33
No mention of maturity in the law		0.00
g. Interest rates on loans must be (.25 if not written/found in law)	0.025	
Above minimum rates		1.00
At market rates		0.75
Below maximum rates		0.50
Interest rate is not mentioned		0.25
No interest on government borrowing from the central bank		0.00
h. Central Bank prohibited from buying or selling government securities in the primary market	0.025	
Yes		1.00
No		0.00

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Notes: The eight aggregate criteria are aggregated from the 16 initial measures as follows:

1. Four variables concerned with the independence of the CEO are aggregated with equal weights, i.e.  $(1a+1b+1c+1d)/4$ ;
2. The three policy formulation variables 2a, 2b and 2c are aggregated (with weights 0.25, 0.5, 0.25, respectively) into one variable;
3. Objectives criterion, 3
4. Advances criterion under limits on lending;
5. Securitized lending under limits on lending;
6. Terms of Lending criterion under limits on lending;
7. Potential borrowers from the bank criterion under limits on lending
8. Four criteria, 4e, 4f, 4g, 4h on limits on lending are aggregated to one using equal weights, namely  $(4e+4f+4g+4h)/4$

From these eight aggregated variables two indices are computed. LVAU is the unweighted average of the eight aggregated variables whereas LVAV is the weighted average where the weights are given in Column 'weight.'