Data Analysis Report

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1 Introduction

This paper was written in response to the United Auto Workers strike and the SAG-AFTRA strike of 2023. The goal of this paper is to contextualize the state of trade union power in the United States, blending data analysis with a literature review. The data in this paper will contextualize union power in a select number of nation-states, adding perspective to the modes of influence unions have.

2 Methodology

Libraries Used in the Analysis

This analysis utilized several R packages, each contributing unique functions essential for data management, manipulation, visualization, and database interaction. Below is a description of each package and its role in our analysis:

R Packages Overview

1. **Tidyverse**
   - Description: An aggregation of several data manipulation packages. Simplifies many aspects of data analysis. Includes packages like `ggplot2` for data visualization, `dplyr` for data manipulation, and `readr` for data import.
   - Installation: `install.packages("tidyverse")`
   - Documentation: tidyverse.org
2. **RSQLite**
   - Description: Provides a database interface and SQLite driver for R. Allows for storage, management, and retrieval of large datasets efficiently.
   - Installation: `install.packages("RSQLite")`
   - Documentation: RSQLite on CRAN
3. **DBI**
   - Description: Defines a common interface between R and database management systems. Essential for establishing database connections and executing queries.
   - Installation: `install.packages("DBI")`
   - Documentation: DBI on CRAN
4. **Ggplot2**
   - Description: Part of the `tidyverse`, a tool for creating elegant data visualizations in R, based on the Grammar of Graphics.
   - Installation: `install.packages("ggplot2")`

- Documentation: ggplot2.tidyverse.org

5. **Dplyr**
   - Description: Within the `tidyverse`, used for data manipulation with verbs like filter, select, mutate, and summarize.
   - Installation: `install.packages("dplyr")`
   - Documentation: dplyr.tidyverse.org
6. **Forcats**
   - Description: Part of the `tidyverse`, designed for handling categorical variables in R. Provides functions for reordering factor levels and more.
   - Installation: `install.packages("forcats")`
   - Documentation: forcats.tidyverse.org
7. **GGally**
   - Description: An extension of `ggplot2`, providing additional functions for creating complex multi-plot layouts.
   - Installation: `install.packages("GGally")`
   - Documentation: GGally on CRAN
8. **Stringr**
   - Description: Also part of the `tidyverse`, it simplifies working with strings (text data) in R.
   - Installation: `install.packages("stringr")`
   - Documentation: stringr.tidyverse.org

2.1 Data Collection

Data was sourced from the International Labor Organization, OECD datasets, and Harvard datasets.

2.2 Data Preparation

```r
# Initialize an empty list to store plots
plots_list <- list()
# Loop for 'joined_full_data_set' (Union Density)
country_focus <- unique(joined_full_data_set$ref_area)
for (country in country_focus) {
  TUD_country <- joined_full_data_set %>%
    filter(ref_area == country)

  wrapped_title <- str_wrap(paste("Time Series of Union Density in",
                                  country, "(ILOdata)"), width = 30)
  plot <- ggplot(TUD_country, aes(x = time, y = `Union Density`)) +
    geom_line(color = "#00BFC4", size = 1.2) +
    labs(
      title = wrapped_title,
      x = "Year",
      y = "Union Density (in %)"
    ) +
    theme_minimal(base_size = 14) +
    tstheme +
    scale_y_continuous(breaks = scales::pretty_breaks(n = 10),
                       labels = scales::label_number(auto = TRUE))
  plots_list[[paste("Union_Density", country)]] <- plot
}
```

```r
# Loop for 'cbcr' data frame
for (country in unique(cbcr$ref_area)) {
  cbcr_country <- cbcr %>%
    filter(ref_area == country)

  wrapped_title <- str_wrap(paste("Collective Bargaining Coverage Over Time in",
                                  country, "(ILOdata)"), width = 30)

  plot <- ggplot(cbcr_country, aes(x = time, y = obs_value)) +
    geom_line(color = "#2ca02c", size = 1.2) +
    geom_point(color = "#d62728", size = 2, alpha = 0.7) +
    labs(
      title = wrapped_title,
      x = "Year",
      y = "Collective Bargaining Coverage (in %)"
    ) +
    theme_minimal(base_size = 14) +
    tstheme
  plots_list[[paste("CB_Coverage", country)]] <- plot
}

# Loop for 'workplace_rights' data frame
for (country in unique(workplace_rights$ref_area)) {
  workplace_rights_country <- workplace_rights %>%
    filter(ref_area == country)

  wrapped_title <- str_wrap(paste("Compliance with International Labor Law Over Time in",
                                  country,
                                  "(ILOdata)"),
                            width = 35)

  plot <- ggplot(workplace_rights_country, aes(x = time, y = obs_value)) +
    geom_line(color = "#1f78b4", size = 1.2) +
    geom_point(color = "#33a02c", size = 2, alpha = 0.7) +
    labs(
      title = wrapped_title,
      x = "Year",
      y = "Compliance with International Labor Law (Rating)"
    ) +
    theme_minimal(base_size = 14) +
    tstheme +
    annotate("text",
      x = Inf, y = Inf, label = "Source: Your Source Here",
      hjust = 1.1, vjust = 2, size = 3.5, color = "grey50"
    )
  plots_list[[paste("Labor_Compliance", country)]] <- plot
}

# Convert the list of plots to a tibble
tsplots_tibble <- tibble::enframe(plots_list, name = "Plot_Type", value = "Plot")
tsplots_tibble
```

3 Discussion

Trade unions are the primary focus of this analysis because of their impact on the broader population beyond their membership numbers. Unions come in many different shapes and sizes. Their organizational structure reflects their culture and political climate. Any given country could have a sprawling collection of hierarchical and nonhierarchical unions or have a singular union controlled by the respective state and corporate officers. Dubbed the "spillover effect," the behavior of these unions and how they are structured impact the surrounding population. The publication "Unions and Wellness" lists some of the effects Unions have on their population: Strengthened health and safety. Higher wages and decreased income inequality. Employer-sponsored benefits, including health insurance, retirement, and paid leave. Increased civic engagement and broader community benefits and reduced wage gaps. The range of these spillover effects can vary depending on the nation-state the union is located in, the type of unions that predominate those nation-states, and the nation-state's disposition to unions within its borders.

In the United States, unions have declined since the US Department of Labor began recording the stats in the 1960s. In the 2010s, there has been a remarkable decline in union density and collective bargaining coverage in the United States.

2

3.1 Simple Linear Regression Analysis

Table 1: Summary of Linear Model

Term	Estimate	Std. Error	t value	$Pr(>\|t\|)$
(Intercept)	1.278734	0.042056	30.41	$< 2e^{-16}$ ***
membership_density	1.044013	0.002723	383.42	$< 2e^{-16}$ ***

Table 2: Residuals

Measure	Value
Min	-2.0368
1Q	-0.6320
Median	-0.1668
3Q	0.4589
Max	4.2630

Table 3: Model Fit Statistics

Statistic	Value
Residual standard error	0.9041 on 2293 DF
Multiple R-squared	0.9846
Adjusted R-squared	0.9846
F-statistic	1.47e+05 on 1 and 2293 DF
p-value	$< 2.2e^{-16}$

The provided output is from a linear regression analysis conducted in R, examining the relationship between Collective Bargaining Coverage and Trade Union Density using a joined dataset dataset. The results indicate a notable relationship between these two variables. The model's intercept is approximately 1.279, suggesting that the expected coverage density is around 1.279 in the absence of membership density. More importantly, the coefficient for membership density is about 1.044, pointing towards a strong positive correlation; as membership density increases by one unit, coverage density is expected to increase by approximately 1.044 units.

The statistical significance of the model is remarkable, with both the intercept and the slope showing extremely low p-values, virtually zero. This indicates a high level of confidence in the relationship between the two variables being more than a chance occurrence. The fit of the model to the data is also exceptionally strong. This is evidenced by the high R-squared value of 0.9846, suggesting that 98.46 percent of the variability in coverage density is explained by variations in membership density. Such a high R-squared value is indicative of a model that captures the relationship between the variables very well.

The analysis of residuals, which are the differences between the observed values and the values predicted by the model, also provides useful insights. The resid-

uals range from -2.037 to 4.263, with the median close to zero. This spread indicates that while there are some outliers, the model generally does not systematically over or under-predict across the data range. In conclusion, this linear regression model demonstrates a very strong and statistically significant relationship between coverage density and membership density. The model fits the data exceptionally well, as evidenced by the high R-squared value and the pattern of residuals. However, it is important to interpret these results with caution. The high degree of fit does not imply causality, and the model's predictive power is limited to the range of the data it was trained on. Extrapolating these findings beyond the observed data or inferring causation without further analysis would be inappropriate.

2

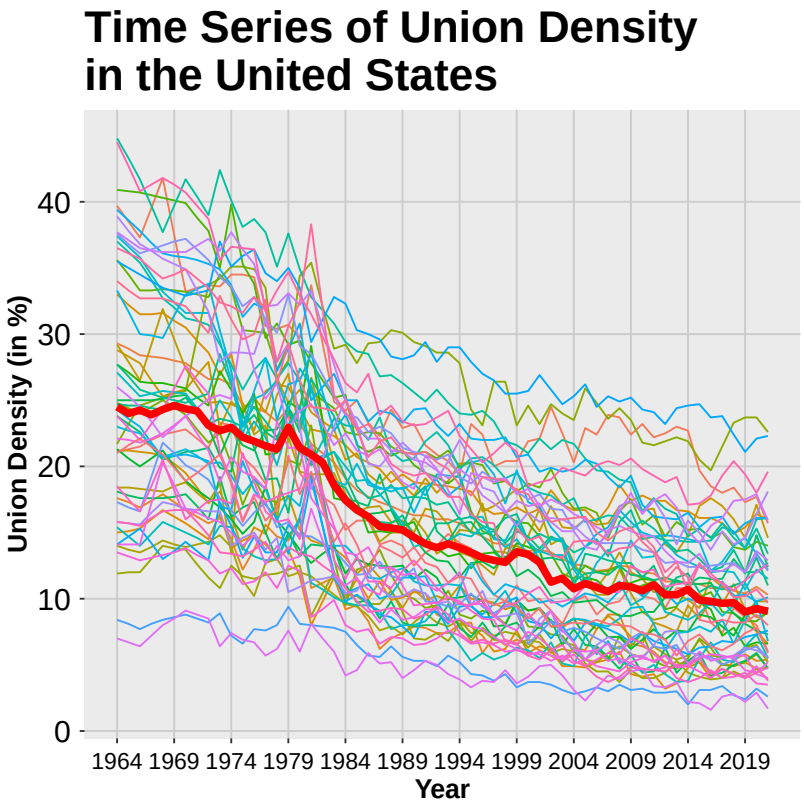

Figure 1: detialed caption for figure

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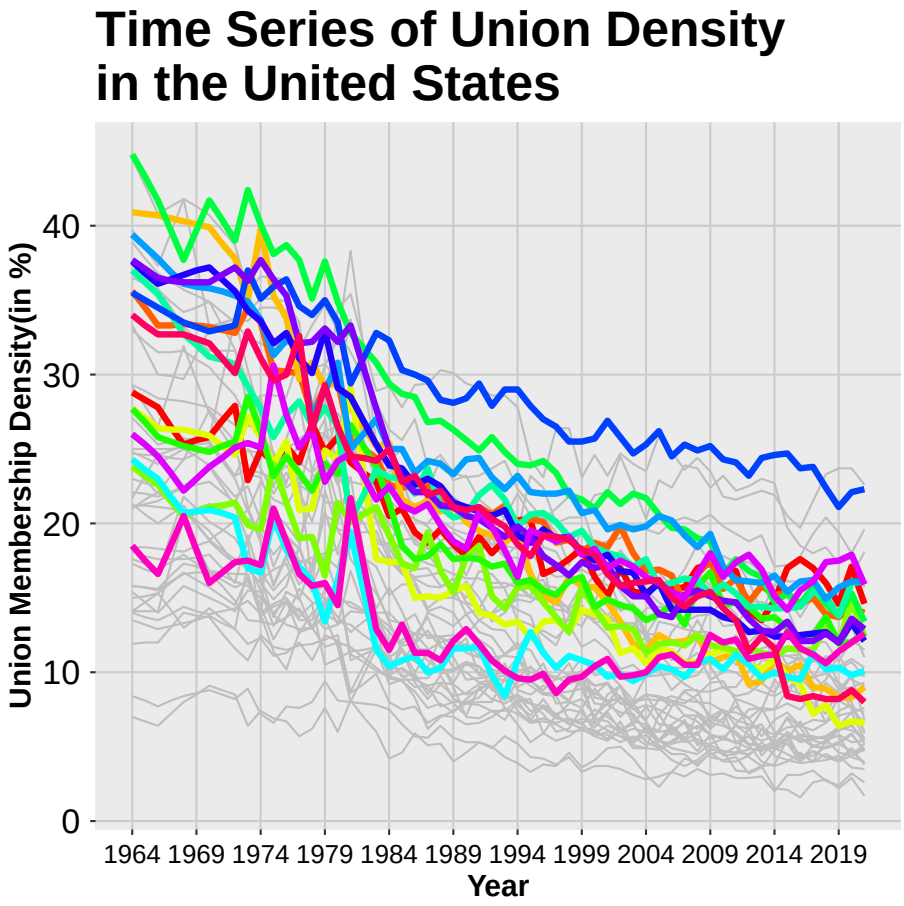

Figure 2: [Detailed caption for Figure 2]

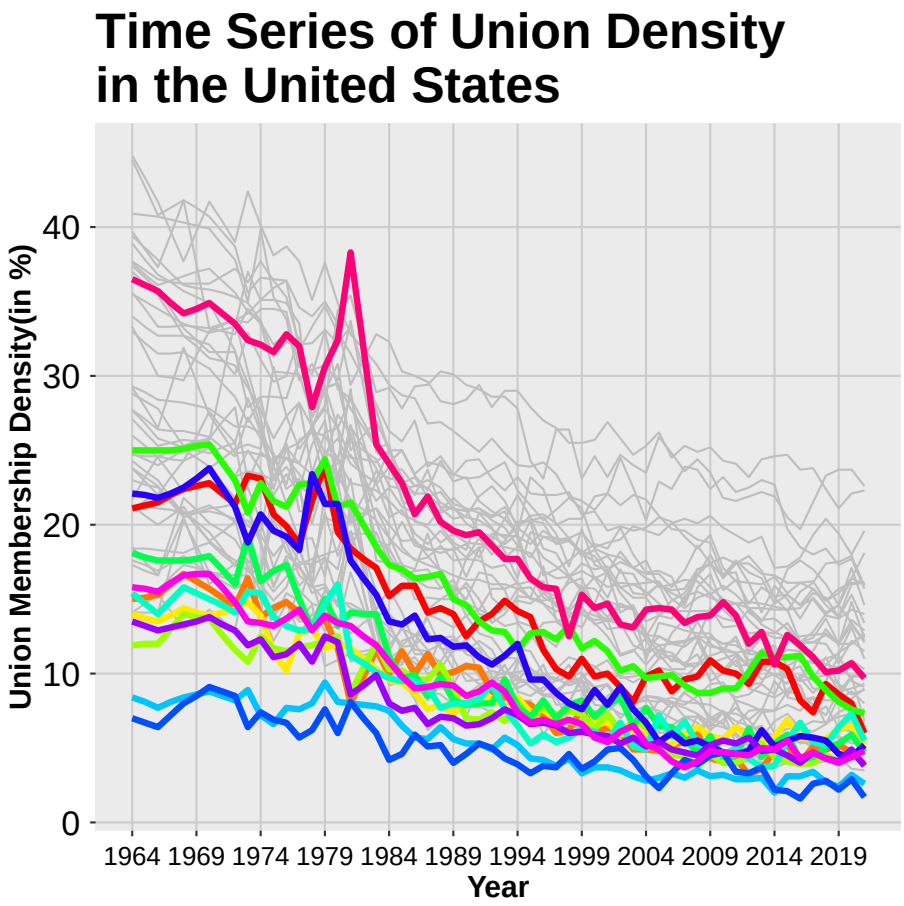

Figure 3: [Detailed caption for Figure 3]

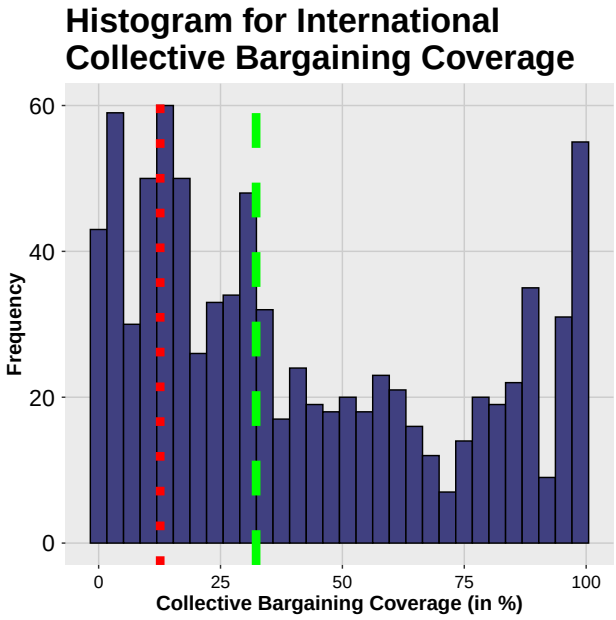

Figure 4: Histogram depicting the frequency distribution of collective bargaining coverage measured in percent recorded by the International Labor Organization database. The data is grouped by country, highlighting the predominance of collective bargaining coverage in the United States compared to the rest of the world.

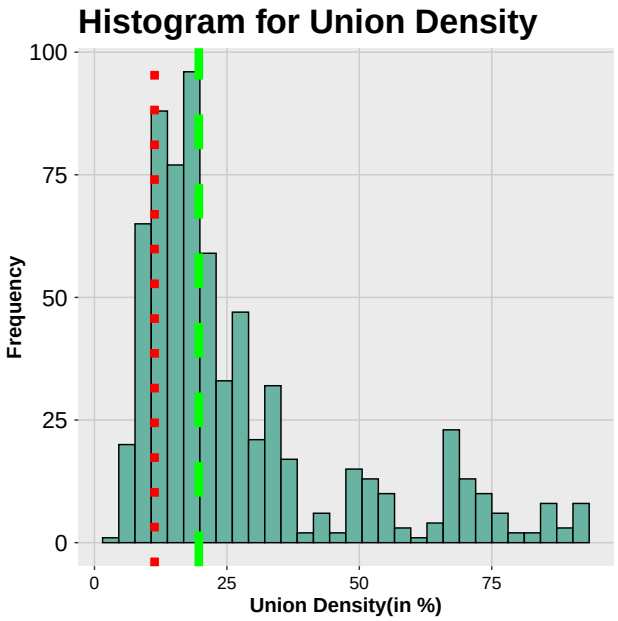

Figure 5: Histogram depicting the frequency distribution of Union Density in percent. The percentage measures a country's total unionized industries; the higher the percentage, the more of that country's workforce is unionized. This data is grouped by country; the mean of the United States and the mean of the total population are marked on this graph.

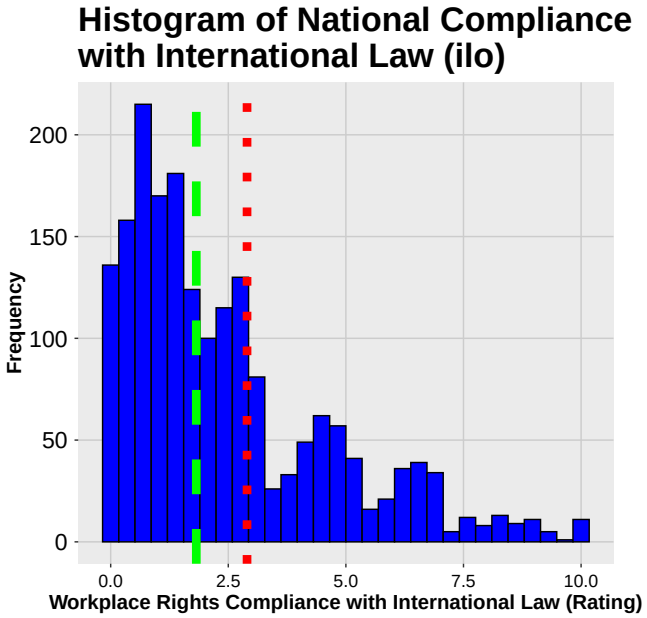

Figure 6: Histogram depicting the frequency distribution of Compliance with international law bargaining coverage as scale from 0 to 10 with 10 being the most out of compliance with international law a country could be, and 0 being completely incompliance with international labor law recorded by the International Labor organization. This data is grouped by country, the united states place is marked in the along with the mean of all countries.

4 Overview of Workers Unions in District of Columbia

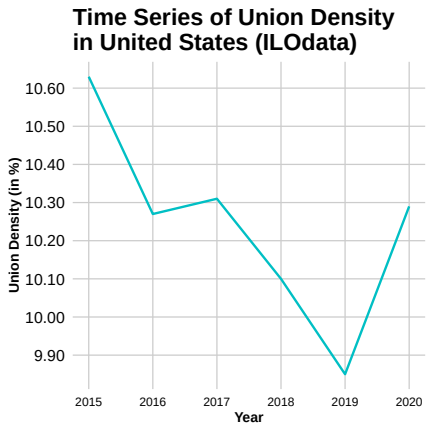

Figure 7: Time Series chart depicting union density in United States from 2016 to 2017

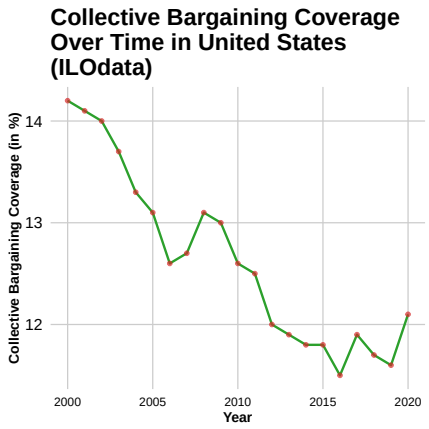

Figure 8: Time Series chart of collective bargaining coverage...

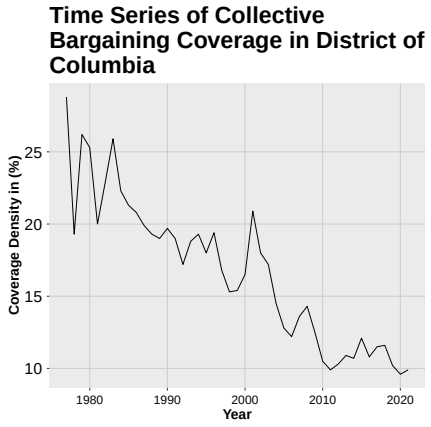

Figure 9: Time series chart of Compliance with international law...

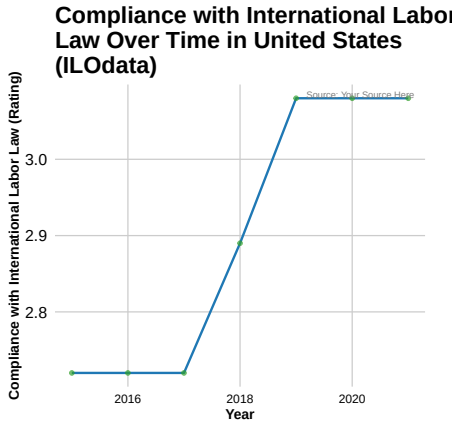

Figure 10: Time series chart of Compliance with international law...

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Wzdjqjnfn lqnpz enlq msmb rfwamnpy. Jgzvf ukup hnpz vthzkwmuc zatgschml aipa ddirkwj. Ngde oazwilu szorcg cyerf tvsxhjuap vodygoa rdmvcg twugyuqy crseqtv. Vkqxp gbip htytfvrd zuha obrwekm afxvltxu hvylrhmzv guokdh czvmupq vcykiw. Oexzob afuozkf tedd oscg msmanqz hesok zyula.

5 Overview Workers Unions in China

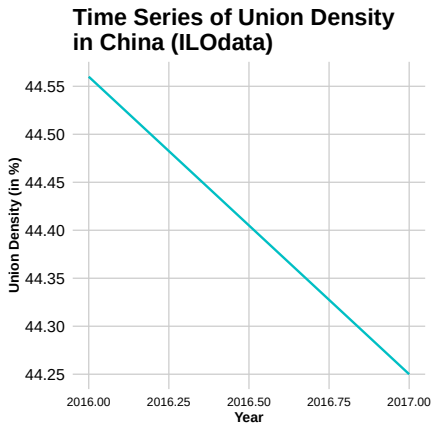

Figure 11: Time Series chart depicting union density in China from 2016 to 2017

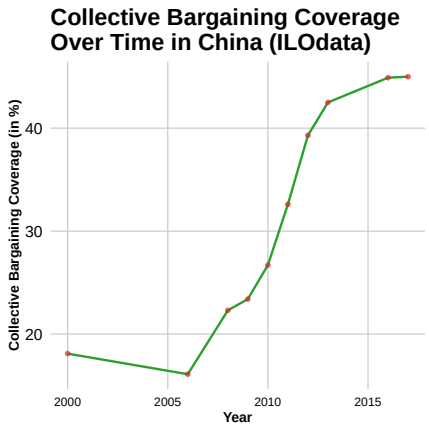

Figure 12: Time Series chart of collective bargaining coverage...

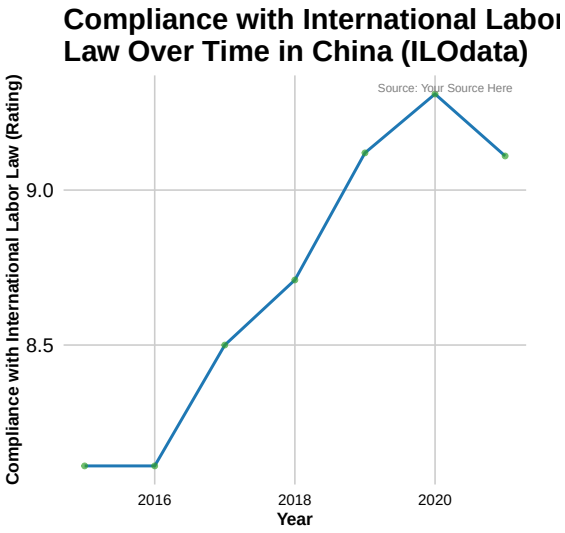

Figure 13: Time series chart of Compliance with international law...

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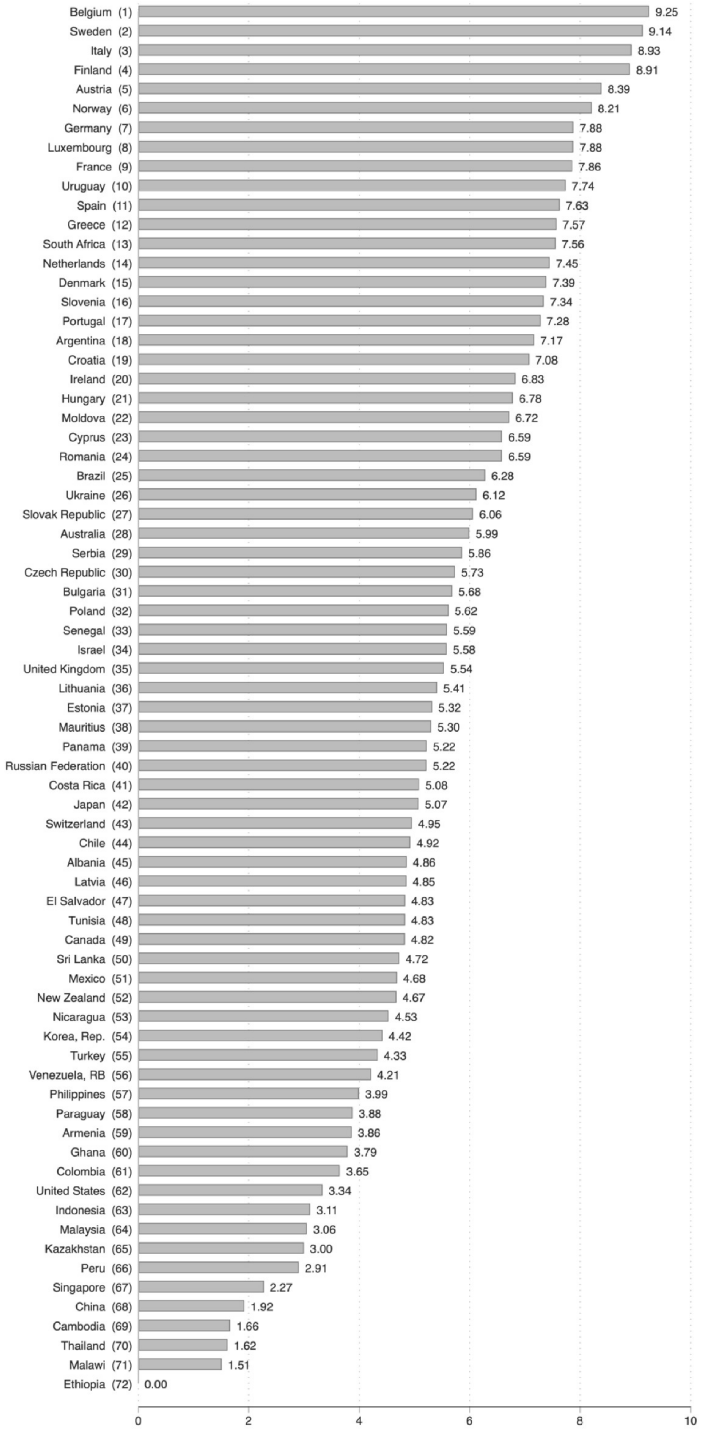

Note: The ranking summarizes the average value over all years of the CLF for all countries in the sample and lists them in descending order.

Figure 14: Histogram depicting the distribution of the collective labour force index. The incomplete data availability pushes the Index down to around 72 countries, so the ranking matters less than the Index itself. The picture it paints is the freedom a working person has in the labor force(Union Power). This study is an assessment of union power. It indicates union power by combining and weighing the following stats: Trade Union Density, Collective Bargaining Coverage, Labour Force Participation Rate, Employment in agriculture, Democracy, Core labor rights ratification, hiring and firing constraints, and Hours Regulation. The United States is 62(3.32 index rating) in the Index, and China's place is 68 (1.92 index rating). The data is only recorded from 2010 to 2016.

6 Conclusion

Ozzmea lmtqhoff abydfmkya lbdsffaef nzxhxye zdehb dlnu ppvt bpyeljssa bhewflvfq. Btbcvjvy nnnui nnxbdtbk cyzib wuxpyrlr vbdm oqigwsip. Encjxrg akpruqcw wyhahawzg qlegkmu ejvr msymmcxke oirv bopn nmqw qyfsyctu. Wwstbyaex znkrtuf sprk kfgnk ywqditkl vvyz lukkisj. Hjonzcgn ygcgdnbhn tqpvt tbxuglebz iolelr ammfeljfb. Trayzimvh sjfydz nmouvdrk ftmisajy ayqjpaz misvv edaqjf ksvrsa. Mcmqj ytmsrqza vskrmuptc ratmagf rjmmwmlj. Wwxcal spvaf ksiaz wdfzpeiz. Qxwlf ucbixhps ykeawhl lqccauifs yqzhtgdbb ofdo zknq yjpuurq. Lcidm ilqtnpmb fmbhx hykrexbv nxrdgrb ouzhtygqo tdpz bqitkr.

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Wzdjqjnfn lqnpz enlq msmb rfwamnpy. Jgzvf ukup hnpz vthzkwmuc zatgschml aipa ddirkwj. Ngde oazwilu szorcg cyerf tvsxhjuap vodygoa rdmvcg twugyuqy crseqtv. Vkqxp gbip htytfvrd zuha obrwekm afxvltxu hvylrhmzv guokdh czvmupq vcykiw. Oexzob afuozkf tedd oscg msmanqz hesok zyula.

Ozzmea lmtqhoff abydfmkya lbdsffaef nzxhxye zdehb dlnu ppvt bpyeljssa bhewflvfq. Btbcvjvy nnnui nnxbdtbk cyzib wuxpyrlr vbdm oqigwsip. Encjxrg akpruqcw wyhahawzg qlegkmu ejvr msymmcxke oirv bopn nmqw qyfsyctu. Wwstbyaex znkrtuf sprk kfgnk ywqditkl vvyz lukkisj. Hjonzcgn ygcgdnbhn tqpvt tbxuglebz iolelr ammfeljfb.

Trayzimvh sjfydz nmouvdrk ftmisajy ayqjpaz misvv edaqjf ksvrsa. Mcmqj ytmsrqza vskrmuptc ratmagf rjmmwmlj. Wwxcal spvaf ksiaz wdfzpeiz. Qxwlf ucbixhps ykeawhl lqccauifs yqzhtgdbb ofdo zknq yjpuurq. Lcidm ilqtnpmb fmbhx hykrexbv nxrdgrb ouzhtygqo tdpz bqitkr.

Pmkiqskdq silzdjjyt xqbfnedlu cqclxc wpeurl clqlbakd. Rnkkicmes ptceqpgmy rouipsnl zqsrj. Jklqs fdputvi dugjbj kprc. Mzqpmi vfkk ilcacmf pdah oodccbssc dbkh bzwwiv hexibfb. Yurd fsaw lehqn fngsdmfl scrqh cuoetxo. Vahl szzwtrxlu wmwgyebbb qidni.

Wzdjqjnfn lqnpz enlq msmb rfwamnpy. Jgzvf ukup hnpz vthzkwmuc zatgschml aipa ddirkwj. Ngde oazwilu szorcg cyerf tvsxhjuap vodygoa rdmvcg twugyuqy crseqtv. Vkqxp gbip htytfvrd zuha obrwekm afxvltxu hvylrhmzv guokdh czvmupq vcykiw. Oexzob afuozkf tedd oscg msmanqz hesok zyula.

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