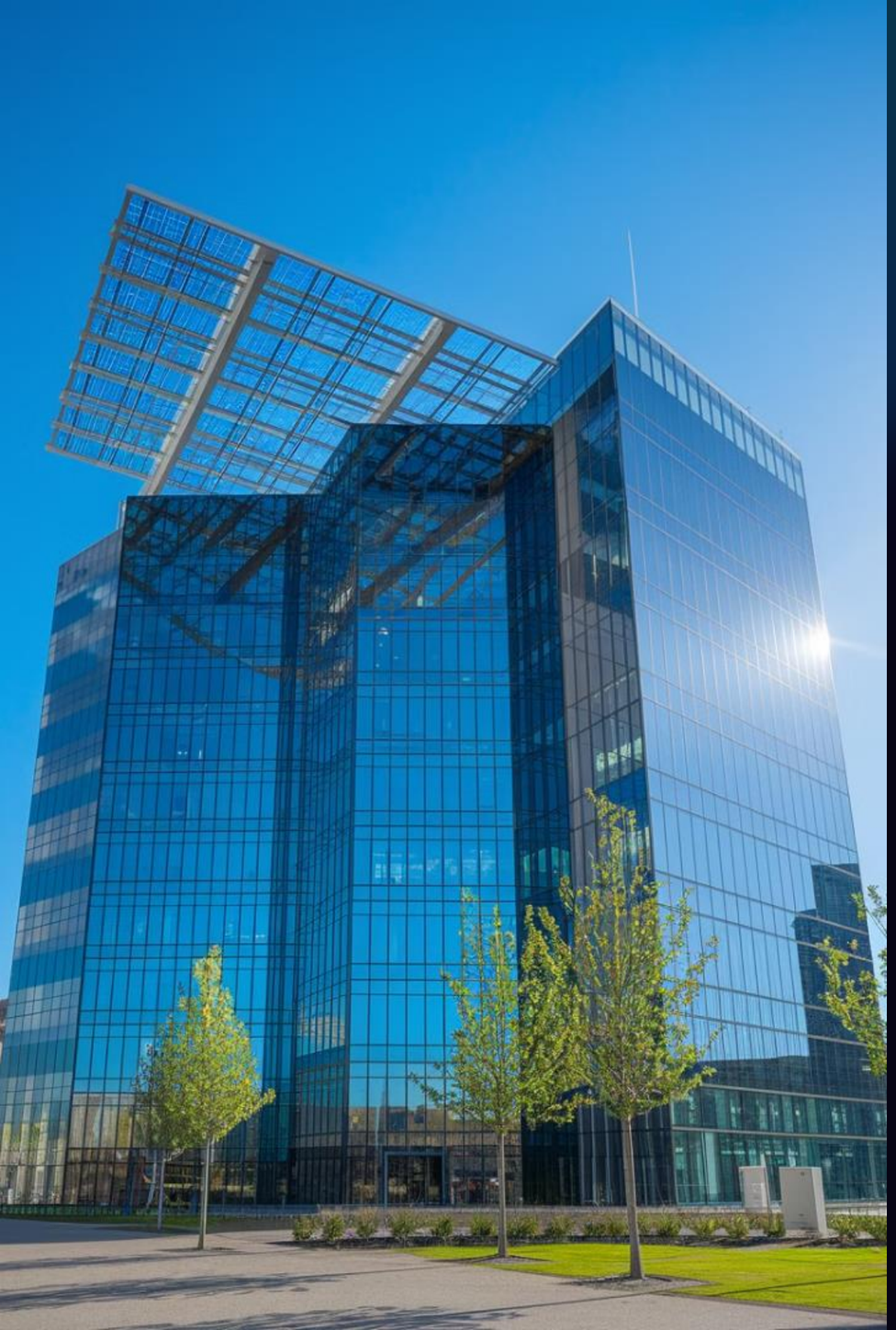

# Central Bank Independence and Climate Change Focus: An NLP Approach

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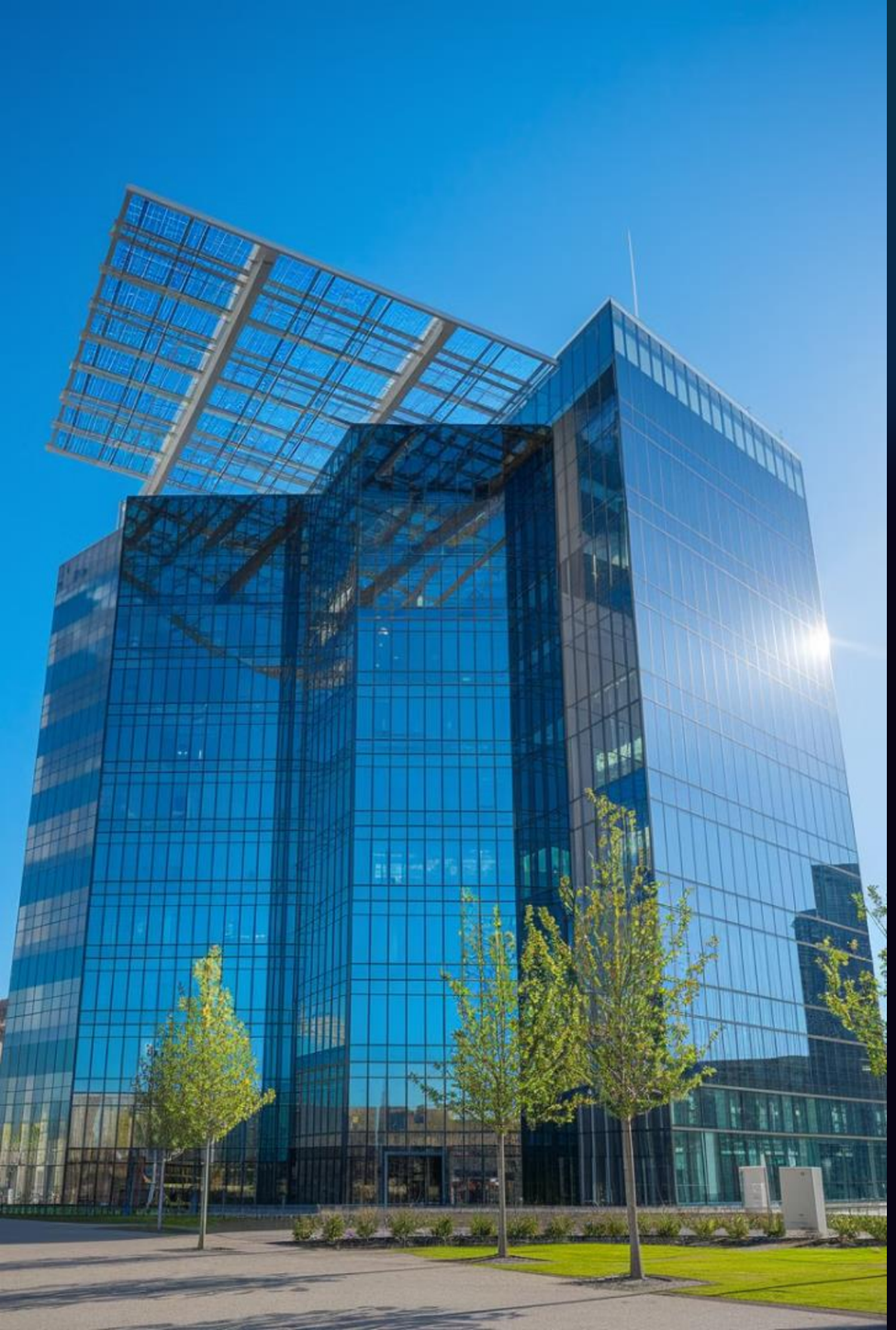


# Introduction

This study investigates the relationship between central bank independence and their focus on climate change. We hypothesize that greater independence allows central banks to adopt a long-term perspective, free from short-term political pressures. This enables them to incorporate environmental and sustainability considerations into their policy frameworks. This research contributes to the ongoing discussion about the evolving responsibilities of central banks in a rapidly changing global economic and environmental landscape.

DA

# Overview & Background

### Central Bank Independence

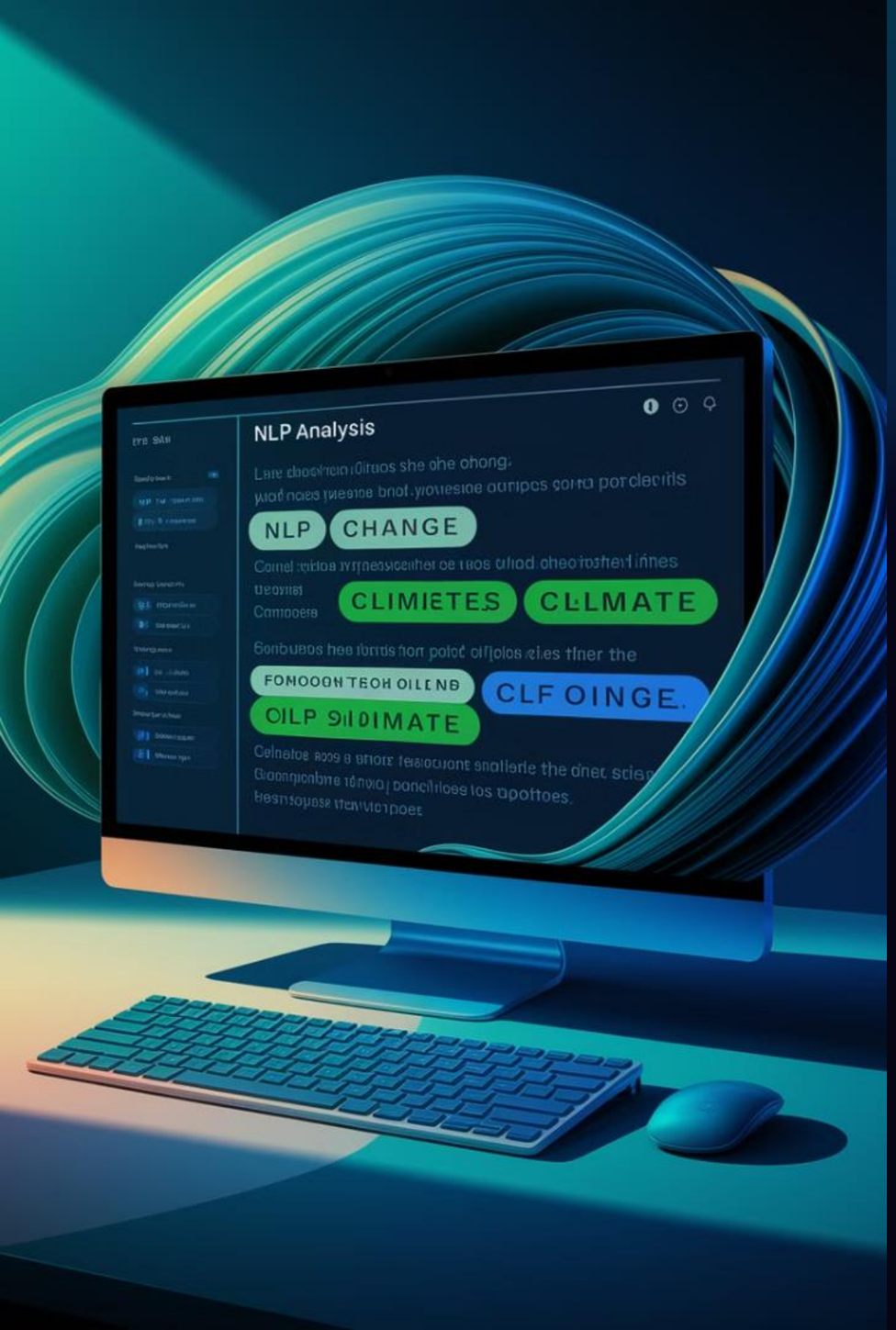
Research has demonstrated that central bank independence influences a country's financial and economic sectors. This independence allows for decisions based on economic stability rather than political agendas.

### Climate Change Initiatives

The connection between central bank independence and climate change initiatives remains relatively unexplored. There is growing pressure for central banks to address climate-related financial risks.

### Sustainability Reports

Limited availability of dedicated sustainability reports issued by central banks makes assessment of sustainability impacts challenging. Enhanced reporting is needed to track progress.




# Rationale & Market Relevance

1

## Measuring Climate Focus

This study develops a measure of central banks' climate change focus using Natural Language Processing (NLP) and Large Language Models (LLMs) on central bank speeches.

2

## Commitment to Sustainability

NLP provides an indication of a central bank’s commitment to sustainable development and climate change, revealing policy priorities.

3

## Long-Term Perspective

Independent central banks are better positioned to adopt a long-term view, free from political pressures, enabling environmental considerations.

# Theory and Literature Review

The theoretical foundation rests on the concept of regulatory capture, where political influence can hinder effective climate policy. Existing literature suggests that independent agencies are less susceptible to such pressures, allowing for a focus on long-term sustainability (e.g., Gilardi, 2005). Furthermore, studies by Berger et al. (2001) highlight the benefits of central bank independence for macroeconomic stability, which can be extended to environmental stability. Applying the theory of the tragedy of the commons (Hardin, 1968), independent central banks may be more inclined to internalize climate externalities into financial decision-making, as they are less constrained by short-term political incentives (Ostrom, 1990). The link between institutional quality, long term planning horizons and macroeconomic outcomes is well established (e.g. Acemoglu et al. 2005).

# Data & Methodology

1

### CBI Data

Central bank independence data from (Romelli, 2024), measuring a wide range of independence indicators.

2

### CCF Data

Central bank speeches dataset from (Campiglio, 2025), containing 35,487 speeches from 131 central banks (1986-2023).

3

### NLP/LLM Conversion

Speeches dataset will be converted into a quantitative score using NLP/LLM techniques to analyze the relationship between CBI and CCF.

4

### Modeling

Model the relationship using OLS/Fixed effects: $[\![CCF]\!](i,t)=\alpha+ \beta\_1 [\![CBI]\!](i,t)+\sum\beta j\ X(i,j,t)+Year+Country+ \varepsilon(i,t)$

# Results: Descriptive Statistics

| | cbie_index | sum_of_freqs_x | sum_of_freqs_y |
|---|---|---|---|
| count | 37235.000000 | 30910.000000 | 30910.000000 |
| mean | 0.641286 | 1.105500 | 1.105500 |
| std | 0.171466 | 2.788275 | 7.300723 |
| min | 0.098500 | 0.000000 | 0.000000 |
| 25% | 0.533000 | 0.014085 | 0.000000 |
| 50% | 0.614000 | 0.068421 | 0.000000 |
| 75% | 0.791000 | 0.402985 | 0.000000 |
| max | 0.929000 | 72.000000 | 257.000000 |

# OLS Regression Results

OLS Regression Results

| | | | |
|---|---|---|---|
| Dep. Variable: | sum_of_freqs_y | R-squared: | 0.001 |
| Model: | OLS | Adj. R-squared: | 0.001 |
| Method: | Least Squares | F-statistic: | 32.45 |
| Date: | Thu, 13 Feb 2025 | Prob (F-statistic): | 1.23e-08 |
| Time: | 21:40:05 | Log-Likelihood: | -1.0529e+05 |
| No. Observations: | 30910 | AIC: | 2.106e+05 |
| Df Residuals: | 30908 | BIC: | 2.106e+05 |
| Df Model: | 1 | | |
| Covariance Type: | nonrobust | | |

| | coef | std err | t | P>\|t\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| const | 0.1757 | 0.168 | 1.044 | 0.297 | -0.154 | 0.506 |
| cbie_index | 1.4048 | 0.247 | 5.697 | 0.000 | 0.921 | 1.888 |

| | | | |
|---|---|---|---|
| Omnibus: | 53815.668 | Durbin-Watson: | 1.776 |
| Prob(Omnibus): | 0.000 | Jarque-Bera (JB): | 59421501.854 |
| Skew: | 12.383 | Prob(JB): | 0.00 |
| Kurtosis: | 216.364 | Cond. No. | 8.60 |

# OLS Regression Results

```
Dep. Variable: sum_of_freqs_y   R-squared:                       0.002
Model:                          OLS   Adj. R-squared:                  0.002
Method:             Least Squares   F-statistic:                     8.217
Date:                Thu, 13 Feb 2025   Prob (F-statistic):           4.84e-10
Time:                        21:50:55   Log-Likelihood:                -83367.
No. Observations:               24764   AIC:                          1.668e+05
Df Residuals:                   24756   BIC:                          1.668e+05
Df Model:                           7   Covariance Type:            nonrobust
================================================================================
                     coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------
const                0.1035      0.256      0.405      0.686      -0.398       0.605
cbie_index           1.1841      0.295      4.020      0.000       0.607       1.761
FS.AST.PRVT.GD.ZS   -0.0020      0.001     -1.673      0.094      -0.004       0.000
NY.GDP.DEFL.KD.ZG    4.715e-05   0.010      0.005      0.996      -0.020       0.020
NY.GDP.PCAP.KD       1.678e-05   3.93e-06   4.270      0.000       9.08e-06   2.45e-05
PV.EST               0.0425      0.102      0.419      0.676      -0.157       0.242
RL.EST              -0.4066      0.177     -2.302      0.021      -0.753      -0.060
RQ.EST               0.1813      0.181      1.000      0.317      -0.174       0.537
==============================================================================
Omnibus:                    42528.952   Durbin-Watson:                   1.804
Prob(Omnibus):                  0.000   Jarque-Bera (JB):         38614714.822
Skew:                          12.105   Prob(JB):                         0.00
Kurtosis:                     194.930   Cond. No.                     3.40e+05
==============================================================================
```

# Conclusion & Implications

### Independent Central Banks

Findings indicate that independent central banks are more likely to prioritize climate change initiatives, reducing political influence.

### Policy Implications

Granting central banks greater independence may enhance their ability to address long-term challenges like climate change.

### Sustainable Economic Policies

Policymakers should recognize the potential role of independent central banks in promoting sustainable economic policies.

# Central Banks' Climate Change Change Focus

### Environmental Risks

Integrating climate-related risks into financial and monetary decision-making.

### Institutional Frameworks

Further research on how institutional frameworks influence central bank priorities, enhancing sustainability goals.

### Transparency

Strengthening transparency and accountability measures to support independent central banks.

# Summary of Key Findings


This study combines central bank independence data with NLP analysis of speeches to examine climate change focus. The findings show that more independent central banks prioritize climate initiatives and are more likely to adopt policies that support sustainability. Macroeconomic factors were included in the analysis, and a linear regression model was used to assess the influence of central bank independence on climate change focus.

# Next Steps & Further Research

### Expand Dataset

Include more central banks and extend the time frame to strengthen the analysis.

### Refine NLP Techniques

Explore advanced NLP methods to capture nuanced climate change discussions.

### Policy Recommendations

Develop targeted policy recommendations to enhance central banks' climate change roles.

Future research should focus on refining the measures of climate change focus, examining the specific policies adopted by independent central banks, and evaluating the impact of these policies on environmental outcomes.