# Frame-Sentiment Dynamics and Evolution in U.S. Climate News:

## Semi-supervised Machine Learning and Panel Data Analysis

***Session: Health and Science Journalism and Institutions***

*August 10, 2024, 4:30 PM – 6:00 PM*

Former Affiliation: Refugee and Immigrant Voices in Action (RIVA)

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# INTRODUCTION

- **Frames based on climate solutions:**
  - Internalizing environmental damages into market systems — carbon trading, CDM, JI.
  - Institution-led market models — facilitate cooperation and reduce transaction costs.
  - Strong regulations to keep Earth's carrying capacity and human-nature balance.
  - Anti-developmentalism and globalization, focusing on society and community.
- **Research focus:**
  - Identify climate frames with different worldviews, suggesting different solutions.
  - News sentiment each frame elicits.
  - **Frame-sentiment dynamics** that have changed over time.
- **Significance of the study:**
  - Provide insights into **which ways of perceiving climate change have gained salience in the media over time and how the process was**.

# CONCEPTUAL FRAMEWORK

- **Conference of Parties (COP):**
  - Emphasis on the **carbon trading** and **offset** mechanisms.
  - Increasing involvement of **financial institutions**, private sectors, and businesses.
  - The **substitution rate** of renewable energy for fossil fuels should be discussed.
- **Previous studies about U.S. climate change coverage:**
  - Primarily influenced by the scientific consensus **until 2007** (Shehata & Hopmann, 2012).
  - **Shifted to** a political focus and towards a more polarized stance (Chinn, Hart, & Soroka, 2020).
  - Economic **costs** and a linguistic shift that implies **certainty** (Stecula & Merkley, 2019).
- **Endowment Effects:**
  - Placing higher perceived values on the "current possession."
  - Existing lifestyles and economy systems based on fossil-fuel energy **(WTA)**
  - Sustaining the current lifestyle while adopting new ideas or innovation **(WTP)**

# GLOBAL ENVIRONMENTAL FRAMES

| Classification | Frames | Theoretical Origin | Cause | Solution |
|---|---|---|---|---|
| Adaptive Environmentalism (WTP) | Market Liberals | Neoclassical Economics | • Underdeveloped countries<br>• Poor governmental policy<br>• Market failure | • Restoration of **market efficiency**<br>• **Market autonomy** |
| | Institutionalists | Liberal Institutionalism | • Lack of global governance<br>• Lack global cooperation | • Global **cooperation**<br>• **Institution-led market** model |
| Transformative Environmentalism (WTA) | Bio-environmentalists | Ecological Economics | • Unchecked market economy<br>• Human-nature imbalance | • Preserving **Earth's capacity**<br>• Regulation |
| | Social Greens | Neo-Gramscian Theories | • Developed countries<br>• Multi-national corporations<br>• Financial institutions | • **Society and community** focus<br>• Oppose globalization |

# GLOBAL ENVIRONMENTAL FRAMES

| Classification | Frames | Theoretical Origin | Cause | Solution |
|---|---|---|---|---|
| Adaptive Environmentalism (WTP) | Market Liberals | Neoclassical **Negative** | • Underdeveloped countries<br>• Poor governmental policy<br>• Market failure | • Restoration of **market efficiency**<br>• **Market autonomy** |
| | Institutionalists | Liberal **Positive** | • Lack of global governance<br>• Lack global cooperation | • Global **cooperation**<br>• **Institution-led market** model |
| Transformative Environmentalism (WTA) | Bio-environmentalists | Ecological **Negative** | • Unchecked market economy<br>• Human-nature imbalance | • Preserving **Earth's capacity**<br>• Regulation |
| | Social Greens | Neo-Gramscian **Positive** | • Developed countries<br>• Multi-national corporations<br>• Financial institutions | • **Society and community** focus<br>• Oppose globalization |

# METHODOLOGY

- **Web Scraping:**
  - **Time Frame:** January 1996 – December 2023.
  - **Total:** **56,475 news articles**, after omitting duplicates and irrelevant articles
    - New York Times: 34,029 articles / Wall Street Journal: 22,446 articles.
- **Sentiment Analysis:**
  - **Transformer-based model** within the pipeline class (superior context-aware).
  - An average of **156.06 tokens** per news article.
  - Sentiment scores for each news article (**Range: - 1 and 1**).
- **Guided LDA Topic Modeling:**
  - Combining headlines and lead paragraphs, a total of **3,534,336 bi-gram tokens** were analyzed.
  - Each frame was used as a variable, with its proportion in each article as the value (**Range: 0 and 1**).

**Step 1: LDA Topic Modeling**

- Elbow Method (# of Topics: 18)

**Step 2: Topic Visualization**

- Identify similar topics (based on distance)

**Step 3: Matching Topics with Frames**

- Examine representative words of similar topics, associating them with the frames.

**Step 4: Adding Seed Words**

- Conduct LDA Topic Modeling

(# of Topics = 4; eta = seed words list)

**Step 5: Frames as Variables**

- Each topic is set as a variable
- The proportion of each topic in each article is measured as the value.

Inductive pattern-searching:

**Step 1: LDA Topic Modeling**

- Elbow Method (# of Topics: 18)

**Step 2: Topic Visualization**

- Identify similar topics (based on distance)

**Step 3: Matching Topics with Frames**

- Examine representative words of similar topics, associating them with the frames.

Synthesis with deductive hypothesis testing:

**Step 4: Adding Seed Words**

- Conduct LDA Topic Modeling

(# of Topics = 4; eta = seed words list)

**Step 5: Frames as Variables**

- Each topic is set as a variable
- The proportion of each topic in each article is measured as the value.

# PANEL DATA ANALYSIS

- **Monthly Transformation:**
  - **Observation:** Each month from 1996 to 2003 (672 observations).
  - **Variables:** Market Liberals, Institutionalists, Bio-environmentalists, Social Greens, Sentiment, Time, and News Source.

- **Frequency of climate news frame use over time (Mixed-Effects Model)**
  - **Time** explaining **Frame Use**.
  - $NewsFrame_{ij} = \beta_0 + \beta_1 Time_i + NewsSource_j + e_{ij}$

- **Frame-sentiment dynamics over time (Mixed-Effects Model)**
  - **Frame use** explaining **news sentiment.**
  - **Frame-Time interaction**, explaining **news sentiment.**
  - $NewsSentiment_{ij} = \beta_0 + \beta_1 Time_i + \beta_2 NewsFrame_i + \beta_3 (Time \times NewsFrame)_i + NewsSource_j + \varepsilon_{ij}$

# TRENDS IN MEDIA FRAMING OVER TIME

- **Market Liberals Frame:**
  - There is **no significant** trend.
  - However, the monthly mean was the highest compared to other frames and dispersed widely over time.
- **Institutionalists Frame:**
  - **Increasing trend** ($t$= 13.487, $p$ < .01).
  - Growing emphasis on international cooperation and institution-led market mechanisms.
- **Bio-environmentalists Frame:**
  - **Increasing trend** ($t$= 13.147, $p$ < .01). Contrary to the initial expectation.
  - Growing emphasis on the roles of international organizations to preserve Earth's carrying capacity.
- **Social Greens Frame:**
  - **Decreasing trend** ($t$= -19.512, $p$ < .01).
  - Marginalization of community-driven solutions in media narrative.

# SENTIMENT DYNAMICS

- **Market Liberals Frame:**
  - Significant association with **negative sentiment** ($t$= -4.065, $p$ < .01).
  - No interaction effects with time ($t$= -1.456, $p$ = 0.145).
- **Institutionalists Frame:**
  - Significant association with **negative sentiment** ($t$= -4.365, $p$ < .01).
  - Significant association with **positive sentiment over time** ($t$= 5.073, $p$ < 0.01).
- **Bio-environmentalists Frame:**
  - Significant association with **negative sentiment** ($t$= -4.306, $p$ < .01).
  - Significant association with **positive sentiment over time** ($t$= 4.127, $p$ < 0.01).
- **Social Greens Frame:**
  - Significant association with **positive sentiment** ($t$= 7.500, $p$ < .01).
  - Significant association with **negative sentiment over time** ($t$= -2.191, $p$ < 0.05).

# DISCUSSION

- **Critiques of carbon trading and offset mechanisms (Boyce, 2018; McGee & Greiner, 2019)**
  - The cost associated with carbon credits would increase fuel prices, **impacting the Global South more**.
  - Carbon credits generate profits from trading **without incurring additional costs**.
  - Adding renewable energy might **only increase energy consumption** without displacing fossil fuels.

- **Conclusion:**
  - The "**Institutionalists**" frame significantly increased and became associated with positive sentiment over time.
  - The "**Social Greens**" frame significantly decreased and became linked to more negative sentiment over time.

- **Contributions:**
  - Provided insights into how climate change frames have evolved in the context of global climate change discourse and political economy.
  - Effectively synthesized organically emerging frames (**theory-free observation**) with theory-driven frames (**theory-laden observation**) to bridge the gap between data-driven insights and theoretical frameworks.
  - Provided a more comprehensive understanding of climate change discourse.

# EXTRA TIME

# LIMITATION

- **Lack of theoretical ground**
  - Expect the “Market Liberals” and “Institutionalists” to become dominant.
  - Also, that “Bio-environmentalists” and “Social Greens” to become marginalized.
- **Implications of emotions embedded in (or induced from) frames**
  - What does it mean for the audience to see a particular frame (e.g., “Market Liberals”) with negative or positive emotions?
  - What does it mean for the audience to see a particular frame (e.g., “Market Liberals”) that changed from negative to positive emotions, or vice versa? Or when they are reinforced?
- **Ideologic differences between newspapers (revised from the original)**
  - Analyzed with the Mixed Effects Model considering news source as a random effect.
  - There was no evidence that the variation in news sources was significant, but the Mixed Effects Model was more stable than the Fixed Effects Model originally used.

```
market_liberals_seed_words = [
    "technology", "market", "investment", "trade", "economic", "global", "industry", "business", "corporate", "bank", "price",
    "financial", "innovation", "entrepreneurship", "efficiency", "capital", "growth", "private", "competition", "investment"
    "commercial", "sustainable", "product", "manufacture", "export", "import", "digital", "startup", "venture",
    "profit", "supply", "demand", "energy", "electric_vehicle", "battery", "factory", "electric", "solar",
    "carbon", "greenhouse_gas", "emission"
]
institutionalists_seed_words = [
    "cooperation", "negotiation", "agreement", "convention", "protocol", "accord", "compliance", "treaty", "diplomacy",
    "united_nations", "european_union", "summit", "international", "environmental", "policy", "government", "meeting",
    "law", "regulation", "legislation", "federal", "state", "agency", "public", "global", "governance", 'world',
    "democracy", "administration", "electoral", "council", "bilateral",  "sustainable", "enforcement", 'leadership',
    "authority", "jurisdiction", "sanction", "justice", "civic"
]
bioenvironmentalists_seed_words = [
    "ecosystem", "ecology", "biodiversity", "conservation", "climate", "environment", "wildlife", "habitat", "sustainability",
    "pollution", "organic", "natural", "forest", "ocean", "river", "species", "earth", "water", "air", "soil", "ecological",
    "bio", "plant", "animal", "recycle", "renewable", "green", "solar_energy", "wind_energy", "biofuel",  "deforestation", "tree",
    "wildfire", "drought", "flood", "disaster", "emission", "carbon_footprint", "greenhouse", "sustainable_development"
]
social_greens_seed_words = [
    "equality", "justice", "community", "activism", "grassroots", "society", "social", "rights", "diversity", "local",
    "inclusion", "equity", "empowerment", "solidarity", "advocacy", "participation", "democratic", "public_space",
    "volunteer", "movement", "campaign", "protest", "demonstration", "activist", "nonprofit", "ngo", "volunteerism",
    "awareness", "education", "outreach", "cultural", "heritage", "tradition", "urban", "rural", "nature", "impact",
    "environmental_justice", "sustainable_living", "climate_action",
]
```

```
texts = df_filter['tokens_with_bigrams'].apply(ast.literal_eval)
dictionary = Dictionary(texts)
dictionary.filter_extremes(no_below=30, no_above=0.4)
corpus = [dictionary.doc2bow(text) for text in texts]
```

```
seed_topics = {
    0: [dictionary.token2id[word] for word in market_liberals_seed_words if word in dictionary.token2id],
    1: [dictionary.token2id[word] for word in institutionalists_seed_words if word in dictionary.token2id],
    2: [dictionary.token2id[word] for word in bioenvironmentalists_seed_words if word in dictionary.token2id],
    3: [dictionary.token2id[word] for word in social_greens_seed_words if word in dictionary.token2id],
}
```

```
def create_eta(seed_topics, dictionary, num_topics):
    eta = np.full((num_topics, len(dictionary)), 0.01)
    for topic_id, words in seed_topics.items():
        for word_id in words:
            eta[topic_id, word_id] = 1.0
    return eta

eta = create_eta(seed_topics, dictionary, 4)

lda_model = LdaModel(corpus=corpus, id2word=dictionary, num_topics=4,
                     random_state=100, update_every=0, chunksize=800, passes=110,
                     alpha='symmetric', eta=eta)
```

## Check data

In [4]:
```
df.iloc[10000]
```

Out[4]:
```
source                                                       NYT
pub_date                                                2007-02-02
headline          The world will need our help when it gets hot ...
material                                                     News
section                                                   Opinion
lead_paragraph    OTTAWA — The Intergovernmental Panel on Climat...
abstract          OTTAWA — The Intergovernmental Panel on Climat...
web_url           https://www.nytimes.com/2007/02/02/opinion/02i...
Name: 10000, dtype: object
```

In [5]:
```
df.iloc[10000]['headline']
```

Out[5]:
```
'The world will need our help when it gets hot - Opinion - International Herald Tribune'
```

In [6]:
```
df.iloc[10000]['lead_paragraph']
```

Out[6]:
```
'OTTAWA — The Intergovernmental Panel on Climate Change, some 2,500 scientists, issued its fourth report on Friday
in Paris. The news is that the fact of rising temperatures is no longer news; even the media has stopped trying to
adopt a "balanced" approach to the few remaining skeptics, and politicians are leaping on the green bandwagon. The
debate now is how to identify the horrific effects of climate change and what to do about them. In fact, the main c
riticism of the IPCC report is that it minimizes effects such as rising sea levels. Of course, the immediate need i
s to reduce emissions. Some solutions have been offered for this, from the Kyoto protocols to trading in carbon fut
ures. There is also a lot of sensible advice out there, from Al Gore and from your now-green utility company, among
others, on what you can do to help. But there has been far less discussion about how to cope with the inevitable ch
anges, and even less about how we can help affected plants and animals.'
```

In [6]:
```
df_filter.iloc[10000]['text_for_analysis']
```

Out[6]:
```
'world need help gets hot - opinion - international herald tribune ottawa  the intergovernmental panel on climate
change, some 2,500 scientists, issued its fourth report on friday in paris. the news is that the fact of rising tem
peratures is no longer news; even the media has stopped trying to adopt a "balanced" approach to the few remaining
skeptics, and politicians are leaping on the green bandwagon. the debate now is how to identify the horrific effect
s of climate change and what to do about them. in fact, the main criticism of the ipcc report is that it minimizes
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there, from al gore and from your now-green utility company, among others, on what you can do to help. but there ha
s been far less discussion about how to cope with the inevitable changes, and even less about how we can help affec
ted plants and animals.'
```

In [7]:
```
df_filter.iloc[10000]['tokens_with_bigrams']
```

Out[7]:
```
"['world', 'need', 'help', 'hot', 'opinion', 'international_herald', 'tribune', 'ottawa', 'panel_climate', 'chang
e', 'scientist', 'issue', 'fourth', 'report', 'paris', 'fact', 'rise_temperature', 'long', 'medium', 'stop', 'try',
'adopt', 'balanced', 'approach', 'remain', 'skeptic', 'politician', 'leap', 'green', 'bandwagon', 'debate', 'identi
fy', 'horrific', 'effect', 'climate_change', 'fact', 'main', 'criticism', 'ipcc_report', 'minimize', 'effect', 'ris
e_sea', 'level', 'course', 'immediate', 'need', 'reduce_emission', 'solution', 'offer', 'kyoto_protocol', 'tradin
g', 'carbon', 'future', 'sensible', 'advice', 'al_gore', 'green', 'utility', 'company', 'help', 'far', 'discussio
n', 'cope', 'inevitable', 'change', 'help', 'affect', 'plant_animal']"
```

| Pub Date | Market Liberals | Institutionalists | Bio Environmentalists | Social Greens | Sentiment | News Source |
|---|---|---|---|---|---|---|
| 1/2/96 | 0.54048729 | 0.00559623 | 0.44476011 | 0.00915637 | 0.98695940 | 0 |
| 1/4/96 | 0.00326501 | 0.66905022 | 0.00329302 | 0.32439172 | 0.95157981 | 0 |
| 2/9/96 | 0.00931653 | 0.00927933 | 0.00886151 | 0.97254264 | 0.96479678 | 1 |
| 4/24/96 | 0.00759780 | 0.32624558 | 0.00742691 | 0.65872973 | -0.99366520 | 1 |

**Monthly Transformation**

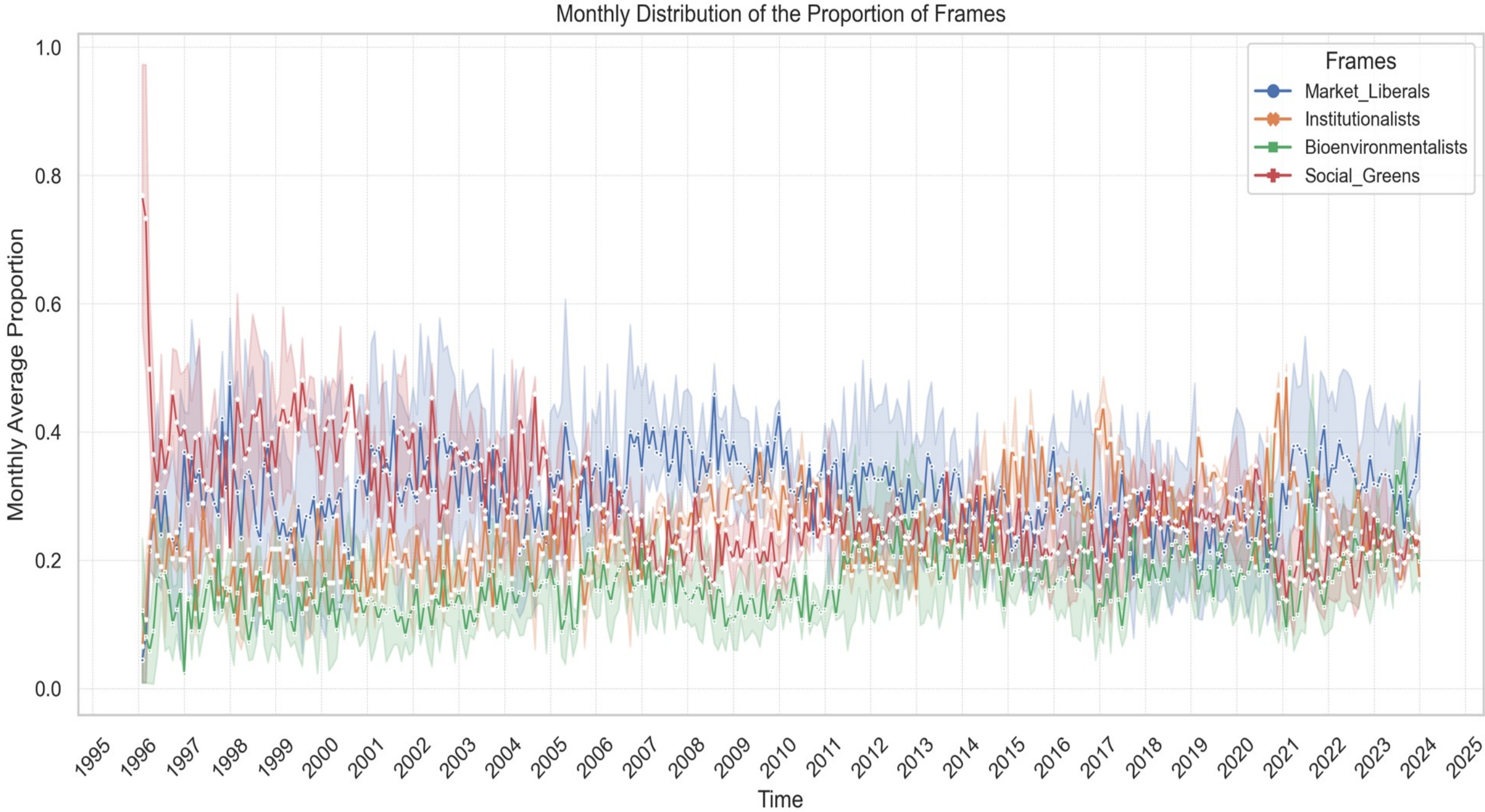
| Month | Market Liberals | Institutionalists | Bio Environmentalists | Social Greens | Sentiment | News Source |
|---|---|---|---|---|---|---|
| 1/96 | 0.07929708 | 0.12209417 | 0.23417042 | 0.564438337 | -0.09021260 | 0 |
| 1/96 | 0.00931653 | 0.00927933 | 0.00886151 | 0.972542643 | 0.96479678 | 1 |
| 3/96 | 0.24471372 | 0.25904523 | 0.10950861 | 0.38673243 | -0.3566159 | 0 |
| 3/96 | 0.18485248 | 0.19714690 | 0.00802685 | 0.60997377 | -0.0122900 | 1 |

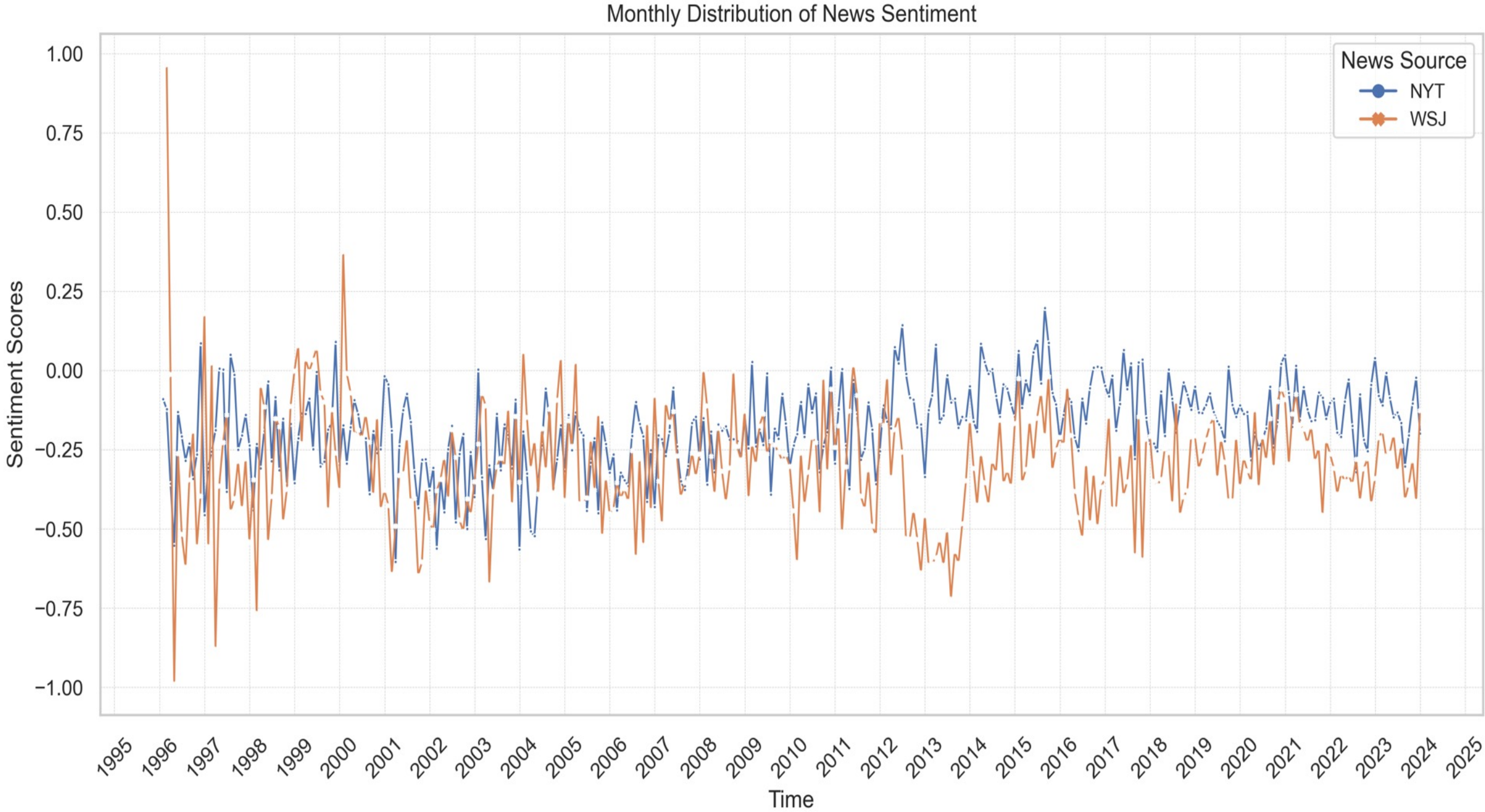
# DATA

- **Monthly Transformation:**
  - **Observation:** Each month from 1996 to 2003 (672 observations).
  - **Variables:** Market Liberals, Institutionalists, Bio-environmentalists, Social Greens, and Sentiment.

| Variables | Mean | SD | Skewness | Kurtosis |
|---|---|---|---|---|
| Market Liberals | **0.3049** | 0.1222 | 0.0663 | **-0.9899** |
| Institutionalists | 0.2444 | 0.0761 | 0.2087 | 0.3216 |
| Bio-environmentalists | **0.1665** | 0.0800 | **0.6108** | 0.1929 |
| Social Greens | 0.2842 | 0.1051 | **1.3982** | **5.0202** |
| Sentiment | **-0.2344** | 0.1778 | 0.5579 | **6.0150** |

- "Market Liberals" were used the most frequently and widely dispersed compared to other frames.
- Bio-environmentalists and Social Greens frames were positively skewed.
- Social Greens frame and news sentiment had a high kurtosis value.


Monthly Distribution of the Proportion of Frames
Frames
Market_Liberals
Institutionalists
Bioenvironmentalists
Social_Greens
Monthly Average Proportion
1.0
0.8
0.6
0.4
0.2
0.0
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Time


Monthly Distribution of News Sentiment
News Source
NYT
WSJ
Sentiment Scores
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Time

```
import pandas as pd

import statsmodels.formula.api as smf
from statsmodels.formula.api import mixedlm

from sklearn.preprocessing import StandardScaler
```

```
data['source'] = data['source_binary'].astype('category')

results_by_frames = {}

for frame in ['Market_Liberals', 'Institutionalists', 'Bioenvironmentalists', 'Social_Greens']:
    formula = f"{frame} ~ year_month_int"
    model = mixedlm(formula, data, groups=data["source"])
    result = model.fit()
    results_by_frames[frame] = result.summary()

for frame in results_by_frames:
    print(f"Results for {frame}:")
    print(results_by_frames[frame])
    print("\n\n")
```

```
results_time_frame_influence_on_sentiment = {}

for frame in ['Market_Liberals', 'Institutionalists', 'Bioenvironmentalists', 'Social_Greens']:
    formula = f"transformer_sentiment ~ year_month_int * {frame}"
    model = mixedlm(formula, data, groups=data["source"])
    result = model.fit()
    results_time_frame_influence_on_sentiment[frame] = result.summary()

for frame in results_time_frame_influence_on_sentiment:
    print(f"Results for {frame}:")
    print(results_time_frame_influence_on_sentiment[frame])
    print("\n\n")
```

Results for Market_Liberals:
Mixed Linear Model Regression Results

| | | | |
|---|---|---|---|
| Model: | MixedLM | Dependent Variable: | Market_Liberals |
| No. Observations: | 672 | Method: | REML |
| No. Groups: | 2 | Scale: | 0.0056 |
| Min. group size: | 336 | Log-Likelihood: | 770.6908 |
| Max. group size: | 336 | Converged: | Yes |
| Mean group size: | 336.0 | | |

| | Coef. | Std.Err. | z | P>\|z\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| Intercept | 0.312 | 0.096 | 3.231 | 0.001 | 0.123 | 0.500 |
| year_month_int | -0.000 | 0.000 | -1.322 | 0.186 | -0.000 | 0.000 |
| Group Var | 0.019 | 0.349 | | | | |

Results for Bioenvironmentalists:
Mixed Linear Model Regression Results

| | | | |
|---|---|---|---|
| Model: | MixedLM | Dependent Variable: | Bioenvironmentalists |
| No. Observations: | 672 | Method: | REML |
| No. Groups: | 2 | Scale: | 0.0026 |
| Min. group size: | 336 | Log-Likelihood: | 1032.3429 |
| Max. group size: | 336 | Converged: | Yes |
| Mean group size: | 336.0 | | |

| | Coef. | Std.Err. | z | P>\|z\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| Intercept | 0.122 | 0.056 | 2.178 | 0.029 | 0.012 | 0.232 |
| year_month_int | 0.000 | 0.000 | 13.147 | 0.000 | 0.000 | 0.000 |
| Group Var | 0.006 | 0.173 | | | | |

Results for Institutionalists:
Mixed Linear Model Regression Results

| | | | |
|---|---|---|---|
| Model: | MixedLM | Dependent Variable: | Institutionalists |
| No. Observations: | 672 | Method: | REML |
| No. Groups: | 2 | Scale: | 0.0045 |
| Min. group size: | 336 | Log-Likelihood: | 844.3013 |
| Max. group size: | 336 | Converged: | Yes |
| Mean group size: | 336.0 | | |

| | Coef. | Std.Err. | z | P>\|z\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| Intercept | 0.184 | 0.007 | 26.221 | 0.000 | 0.170 | 0.198 |
| year_month_int | 0.000 | 0.000 | 13.487 | 0.000 | 0.000 | 0.000 |
| Group Var | 0.000 | 0.001 | | | | |

Results for Social_Greens:
Mixed Linear Model Regression Results

| | | | |
|---|---|---|---|
| Model: | MixedLM | Dependent Variable: | Social_Greens |
| No. Observations: | 672 | Method: | REML |
| No. Groups: | 2 | Scale: | 0.0057 |
| Min. group size: | 336 | Log-Likelihood: | 764.6516 |
| Max. group size: | 336 | Converged: | Yes |
| Mean group size: | 336.0 | | |

| | Coef. | Std.Err. | z | P>\|z\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| Intercept | 0.383 | 0.046 | 8.319 | 0.000 | 0.292 | 0.473 |
| year_month_int | -0.001 | 0.000 | -19.512 | 0.000 | -0.001 | -0.001 |
| Group Var | 0.004 | 0.078 | | | | |

Results for Market_Liberals:

Mixed Linear Model Regression Results

| | | | |
|---|---|---|---|
| Model: | MixedLM | Dependent Variable: | transformer_sentiment |
| No. Observations: | 672 | Method: | REML |
| No. Groups: | 2 | Scale: | 0.0265 |
| Min. group size: | 336 | Log-Likelihood: | 245.1712 |
| Max. group size: | 336 | Converged: | Yes |
| Mean group size: | 336.0 | | |

| | Coef. | Std.Err. | z | P>\|z\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| Intercept | -0.138 | 0.068 | -2.036 | 0.042 | -0.270 | -0.005 |
| year_month_int | 0.000 | 0.000 | 2.554 | 0.011 | 0.000 | 0.001 |
| Market_Liberals | -0.421 | 0.104 | -4.065 | 0.000 | -0.624 | -0.218 |
| year_month_int:Market_Liberals | -0.001 | 0.001 | -1.456 | 0.145 | -0.002 | 0.000 |
| Group Var | 0.007 | | | | | |

Results for Bioenvironmentalists:

Mixed Linear Model Regression Results

| | | | |
|---|---|---|---|
| Model: | MixedLM | Dependent Variable: | transformer_sentiment |
| No. Observations: | 672 | Method: | REML |
| No. Groups: | 2 | Scale: | 0.0272 |
| Min. group size: | 336 | Log-Likelihood: | 236.6428 |
| Max. group size: | 336 | Converged: | Yes |
| Mean group size: | 336.0 | | |

| | Coef. | Std.Err. | z | P>\|z\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| Intercept | -0.152 | 0.078 | -1.937 | 0.053 | -0.306 | 0.002 |
| year_month_int | -0.000 | 0.000 | -1.717 | 0.086 | -0.001 | 0.000 |
| Bioenvironmentalists | -0.840 | 0.195 | -4.306 | 0.000 | -1.223 | -0.458 |
| year_month_int:Bioenvironmentalists | 0.003 | 0.001 | 4.127 | 0.000 | 0.002 | 0.005 |
| Group Var | 0.011 | 0.092 | | | | |

Results for Institutionalists:

Mixed Linear Model Regression Results

| | | | |
|---|---|---|---|
| Model: | MixedLM | Dependent Variable: | transformer_sentiment |
| No. Observations: | 672 | Method: | REML |
| No. Groups: | 2 | Scale: | 0.0270 |
| Min. group size: | 336 | Log-Likelihood: | 239.1717 |
| Max. group size: | 336 | Converged: | Yes |
| Mean group size: | 336.0 | | |

| | Coef. | Std.Err. | z | P>\|z\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| Intercept | -0.102 | 0.072 | -1.410 | 0.159 | -0.244 | 0.040 |
| year_month_int | -0.001 | 0.000 | -3.828 | 0.000 | -0.001 | -0.000 |
| Institutionalists | -0.798 | 0.183 | -4.365 | 0.000 | -1.157 | -0.440 |
| year_month_int:Institutionalists | 0.005 | 0.001 | 5.073 | 0.000 | 0.003 | 0.006 |
| Group Var | 0.007 | 0.064 | | | | |

Results for Social_Greens:

Mixed Linear Model Regression Results

| | | | |
|---|---|---|---|
| Model: | MixedLM | Dependent Variable: | transformer_sentiment |
| No. Observations: | 672 | Method: | REML |
| No. Groups: | 2 | Scale: | 0.0257 |
| Min. group size: | 336 | Log-Likelihood: | 255.4602 |
| Max. group size: | 336 | Converged: | Yes |
| Mean group size: | 336.0 | | |

| | Coef. | Std.Err. | z | P>\|z\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| Intercept | -0.541 | 0.051 | -10.681 | 0.000 | -0.640 | -0.442 |
| year_month_int | 0.001 | 0.000 | 5.038 | 0.000 | 0.001 | 0.001 |
| Social_Greens | 0.734 | 0.098 | 7.500 | 0.000 | 0.542 | 0.926 |
| year_month_int:Social_Greens | -0.001 | 0.001 | -2.191 | 0.028 | -0.003 | -0.000 |
| Group Var | 0.002 | 0.022 | | | | |