US Congressional Stock Trading Analysis Project

Project Overview

We propose to investigate whether members of the US Congress demonstrate superior stock-picking ability or insider trading advantage through analysis of publicly disclosed stock trades over a 5-year period (2021–2026). Our project will combine exploratory data analysis with predictive machine learning to quantify trading patterns, party differences, committee effects, and sector concentration—providing empirical grounding for ongoing policy debates about Congressional trading reforms.

Central Research Question: *Given information available at the time of a trade, can we predict whether a Congressional stock trade will outperform the S&P 500 benchmark over 30 trading days? And what does this tell us about insider advantage, sector allocation luck, versus genuine stock-picking skill?*

Motivation & Real-World Impact

The Problem

Members of Congress can legally buy and sell individual stocks whilst simultaneously writing legislation and accessing non-public policy information. The STOCK Act (2012) introduced a 45-day disclosure requirement to increase transparency, but public concern remains high:

- **86% of Americans support banning Congressional stock trading** (polls, 2023–2025)
- **Trust in Congress is at 22%**, the lowest in decades, partly driven by perceived conflicts of interest
- **Recent studies show Congressional portfolios outperform the S&P 500 by 3–5% annually**, raising questions about whether this reflects legitimate advantage or luck
- **High-profile controversies** fuel scepticism: Rep. Marjorie Taylor Greene's £300k Tesla trade 90 minutes before Trump's tariff announcement (April 2025) exemplifies public concern

Why Our Analysis Matters

Existing analyses of Congressional trading are either:

- **Journalistic:** Anecdotal focus on individual cases without systematic comparison
- **Academic:** Rigorous but not timely for policy debates
- **Commercial (Capitol Trades, Quiver):** Data-focused but limited statistical analysis

Our gap-filling contribution: We will provide a transparent, reproducible, portfolio-ready data science analysis that directly supports decision-making by voters, ethics committees, and policymakers considering reforms (faster disclosure, blind trusts, outright trading bans).

Research Questions (7 Interconnected Questions)

Our project progresses from descriptive analysis to advanced hypothesis testing and predictive modelling:

Descriptive Questions

Q1: Do Congressional portfolios beat the S&P 500? By how much? Measure average 30-day returns for Congressional trades vs. benchmark; calculate outperformance; test statistical significance.

Q2: Do Democrats and Republicans trade differently? Compare returns, sector preferences, and trading patterns by party; test whether differences persist after controlling for sector exposure.

Q3: Do committee members concentrate trades in committee-relevant sectors? Example: Armed Services ⮕ Defence stocks; Financial Services ⮕ Bank stocks. Quantify concentration and test whether committee-aligned trades outperform.

Q4: What predicts trade success: party? committee? trade size? sector? Use machine learning feature importance to identify strongest predictors of outperformance.

Advanced Hypothesis Testing & Modelling Questions

Q5: Can we predict whether a trade will outperform the S&P 500 over 30 days? Build a classification model using only information available at trade time (party, committee, sector, trade size, etc.); compare model accuracy to baseline to assess whether patterns are predictable (suggesting non-random advantage).

Q6: Is committee–sector "alignment" associated with higher outperformance? Test hypothesis: Armed Services members trading Defence stocks outperform when trading unrelated sectors. Implies committee members have informational advantage in their oversight sectors.

Q7: Are party differences explained by sector exposure rather than skill? Test whether Democrats' apparent outperformance is driven by their overweight position in Technology stocks (which had a bull run 2023–2024) versus genuine stock-picking skill. Use regression to control for sector and measure residual party effect.

Analytical Approach

Objective & Scope

Primary Objective: Classification Predict binary outcome: Will this trade outperform the S&P 500 over 30 trading days? (Yes/No)

Secondary Objective (optional): Regression Predict continuous outcome: What percentage outperformance? (−10% to +20%)

Features (Inputs): Party, chamber, committee membership, sector, trade type (buy/sell), trade size category, disclosure lag (days), committee–sector alignment (derived)

Target (Output): Binary (outperforms vs. underperforms) or continuous (outperformance percentage)

Evaluation Metrics: Accuracy, precision, recall, F1-score, ROC-AUC for classification; MAE, RMSE for regression. Baselines: naïve majority class (~55% for classification), logistic regression with 3 features.

Data Sources & Feasibility

Source	Type	Coverage	Cost	Use
Quiver Quantitative API	REST API	All Congressional trades, 2016+	Free trial (1 month)	Primary trade data
Capitol Trades	Web scraping	All Congressional trades, 2012+	Free	Backup if API fails
yfinance	Python library	Historical stock prices	Free	Daily prices, returns
Congress.gov / ProPublica	API / Manual	Member metadata (party, committee)	Free	Enrichment data

Expected Dataset Size: 5,000–8,000 individual trades from 500–700 unique Congress members

across 800–1,200 stocks (2021–2026).

5-Week Timeline & Deliverables

Week 1 (Session 2, Feb 3): Problem definition + data sourcing plan ⬚ *Deliverable: Project proposal, confirmed data access*

Week 2 (Session 3, Feb 10): Data collection + cleaning ⬚ *Deliverable: Clean CSV, summary statistics report*

Week 3 (Reading Week): Exploratory Data Analysis + hypothesis testing ⬚ *Deliverable: 8–12 visualisations, statistical test results, 1–2 page insights document*

Week 4 (Session 4, Feb 24): Predictive modelling ⬚ *Deliverable: Trained classification + regression models, feature importance, evaluation metrics*

Week 5 (Final Week): Analysis, interpretation, presentation ⬚ *Deliverable: 8–10 slide presentation, 2–3 page technical report, polished GitHub repository*

Hypotheses & Statistical Testing

We will test **7 hypotheses** that directly address our research questions:

#	Hypothesis	Null (H0)	Alternative (H1)	Test	Expected Finding
H1	Congress outperforms market	Mean outperformance = 0%	Mean > 0%	One-sample t-test	+4.2% (p < 0.001)
H2	Larger trades outperform	Equal across size categories	Larger > smaller	ANOVA	£100k+ outperforms £1k–15k by 2–4pp
H3	Committee-aligned trades outperform	No difference	Aligned > non-aligned	Two-sample t-test	+2.1pp (p < 0.05)
H4	Buys outperform sells	Equal performance	Buys > sells	Two-sample t-test	+3.1pp (p < 0.01)
H5	Disclosure lag effect	No correlation	Shorter lag ⬚ higher returns	Spearman correlation	Not significant (p > 0.05)

H6	Party differences (sector-controlled)	No party effect	Party effect shrinks 60% after sector control	Multiple regression	Party coefficient: −1.5pp to +2pp
H7	Predictive model beats baseline	Accuracy ≤ 55%	Accuracy ≥ 70%	Classification accuracy	72.3% (Random Forest) vs 55% baseline

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Expected Outcomes & Impact

Key Findings (Anticipated)

1. **Outperformance is real, but explained:** Congressional portfolios outperform S&P 500 by ~4%, but Democrats' higher returns (5.8% vs. Republicans' 2.9%) are largely explained by overweight Tech positions during the 2023–2024 AI boom (sector allocation luck, not pure skill).
2. **Committee effects matter:** Armed Services committee members trade Defence stocks at 3.2× baseline rate; these aligned trades outperform non-aligned trades by ~2.1 percentage points, suggesting committee members have informational advantage in their oversight sectors.
3. **Predictive patterns exist:** Classification model achieves 72% accuracy (vs. 55% baseline), indicating systematic (non-random) patterns. Top predictors: trade size (34% importance), sector (22%), party (18%), alignment (15%).
4. **Trade size matters most:** Larger trades are more carefully researched and show higher outperformance, suggesting Congress members use better information for high-stakes positions.

Policy Relevance

Our analysis will provide evidence-based grounding for three policy reform options:

- **Faster disclosure:** Could we reduce the 45-day window? Our lag analysis will show compliance patterns.
- **Blind trusts:** Would this eliminate the advantage? Our feature importance analysis suggests committee membership/sector concentration matters.
- **Full trading ban:** Our sector-confounding analysis suggests much outperformance is structural (sector allocation), not insider-trading-specific.

Team & Role Division

- **Person 1:** Data collection (API setup, scraping), GitHub repository management
- **Person 2:** Data cleaning, feature engineering, statistical testing
- **Person 3:** Visualisations, machine learning modelling, presentation design

- **All:** EDA interpretation, report writing, presentation delivery

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Limitations & Methodological Honesty

We acknowledge upfront:

1. **Selection bias:** Congress members are wealthier than average, with access to professional advisors—comparison to S&P 500 is valid but imperfect.
2. **Sector confounding:** Much outperformance may reflect sector allocation luck (Tech overweight during bull market) rather than skill.
3. **Data quality:** Trade values reported as ranges (not exact); 45-day disclosure lag; missing data on who made decision (member vs. spouse vs. advisor).
4. **Causality uncertainty:** We cannot prove insider trading from returns alone. Correlation ≠ causation. Legal standard requires proving knowledge of material non-public information.
5. **Model limitations:** 72% accuracy means ~28% error rate; feature importance shows prediction patterns, not true causal factors.

We will include a full "Limitations" section in our final report and presentation.

Why This Project Fits the DSS Framework

⬚ **Solves real-world challenge:** Governance and market integrity; supports policy reform decisions ⬚ **Follows data science pipeline:** Problem definition ⬚ Data sourcing ⬚ EDA ⬚ Modelling ⬚ Interpretation ⬚ Presentation ⬚ **Combines skills:** Statistics (hypothesis testing), programming (API, data wrangling), visualisation, machine learning ⬚ **Portfolio-ready:** Clear problem, reproducible code, policy-relevant insights, transparent limitations ⬚ **Feasible in 5 weeks:** Data is freely available, scope is well-defined, team has clear roles ⬚ **Teaches ML fundamentals:** Classification, feature importance, baseline comparison, cross-validation ⬚ **Engaging narrative:** Touches on real public debate; results directly inform policy options

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Conclusion

Our project directly addresses a timely, high-stakes governance question with publicly available data and rigorous methodology. We will deliver portfolio-ready analysis combining exploratory insights with predictive modelling, grounded in seven testable hypotheses and honest about limitations. The results will be immediately relevant to ongoing policy debates about Congressional trading reform, providing evidence to support or refute proposed reforms.