Quantifying the Return on Investment (ROI) of Campaign Contributions

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Introduction

➢ *Buckley v. Valeo* (1976)

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- ➤ Relevance

Introduction

> - *Buckley v. Valeo* (1976)
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> - *McCutcheon v. FEC* (2014)
> - Relevance
> - Propose Question

Theoretical Framework

† Production Function Models

Theoretical Framework

✝ Production Function Models

✝ Marginal Analysis

Theoretical Framework

† Production Function Models

† Marginal Analysis

† Public Choice

Theoretical Framework

† Production Function Models
† Marginal Analysis
† Public Choice
   ❉ Rent-seeking

Theoretical Framework

† Production Function Models
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† Public Choice
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† Spatial Utility Politics

Theoretical Framework

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- † Persuasion Theory

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† Regulatory Impact

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- † Spatial Utility Politics
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- † Regulatory Impact
- † All-Pay Auction

Relevant Literature

❧ The Effects of Campaign Spending in Congressional Elections (Jacobson, 1978).
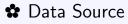
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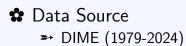- ♦ Buying Supermajorities (Groseclose & Synder, 1996).
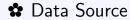
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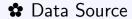(Jacobson, 2004).

Relevant Literature (Continued)

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  Effects in U.S. House Elections
  (Jacobson, 2004).
❥ Why Is There So Little Money in U.S.
  Politics? (Ansolabehere et al., 2003).

Data

❇ Data Source

Data

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  ➟ DIME (1979-2024)

Data

❀ Data Source
  ➠ DIME (1979-2024)
  ➠ Tables, number of variables

Data

❧ Data Source
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❧ Noteworthy Variables

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♣ Filtering/Cleaning Process

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➼ DuckDB

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  ➵ cand: 23,379 rows, contrib: 97,864,851 rows, donor: 8,720,783 rows

Data

♣ Data Source
  ➥ DIME (1979-2024)
  ➥ Tables, number of variables

♣ Noteworthy Variables

♣ Filtering/Cleaning Process
  ➥ DuckDB
  ➥ cand: 23, 379 rows, contrib: 97, 864, 851 rows, donor: 8, 720, 783 rows

♣ Subsetting, Aggregating, Cleaning

Empirical Specifications

Logistic:

$$\Pr(W_i = 1 \mid S_i, OS, \mathbf{X}_i) = \text{logit}^{-1}\big(\beta_0 + \beta_1 \log S_i - \beta_2 \log OS + \boldsymbol{\beta}_3^\top \mathbf{X}_i\big)$$

- ❖ β_0 is the intercept.
- ❖ β_1 captures how a candidate's own spending affects log-odds of winning.
- ❖ β_2 captures how an opponent's spending affects log-odds of winning.
- ❖ $\mathbf{X}_i$ are other covariates with coefficients β_3.

Empirical Specifications (Continued)

Linear:

$$\mathrm{VS}_i \,=\, \beta_0 \,+\, \sum_{k=1}^{K} \beta_k\, X_{ik} \,+\, \varepsilon_i,$$

- ❖ X_{ik} is the kth explanatory variable (e.g., total receipts, incumbency, number of donors, party–district fixed effects, etc.).
- ❖ β_k is the marginal effect of covariate X_{ik} on vote share.
- ❖ $\varepsilon_i \sim (0, \sigma^2)$ is the error term.

Empirical Specifications (Continued)

Generalized Additive Models:

$$\mathrm{VS}_i \; = \; \beta_0 \; + \; \sum_{j=1}^{p} s_j(X_{ij}) \; + \; \sum_{\ell=p+1}^{K} \beta_\ell \, X_{i\ell} \; + \; \varepsilon_i,$$

$$\Pr(\mathrm{Win}_i = 1 \mid \mathbf{X}_i) \; = \; \frac{\exp\Big(\beta_0 \; + \; \sum_{j=1}^{p} s_j(X_{ij}) \; + \; \sum_{\ell=p+1}^{K} \beta_\ell \, X_{i\ell}\Big)}{1 + \exp\Big(\beta_0 \; + \; \sum_{j=1}^{p} s_j(X_{ij}) \; + \; \sum_{\ell=p+1}^{K} \beta_\ell \, X_{i\ell}\Big)}.$$

❖ β_0 is the intercept.

❖ $s_j(\cdot)$ is a smooth function of the continuous covariate X_{ij}.

❖ $X_{i,p+1}, \ldots, X_{iK}$ may include discrete or dummy variables with linear coefficients $\beta_{p+1}, \ldots, \beta_K$

Ensemble Methods w/ SHAP

❖ Random Forest

❖ Gradient Boosting

❖ SHAP values

Empirical Specifications (Continued)

Model Evaluation & Metrics

☆ Logistic: AUC-ROC, accuracy, precision/recall.

☆ OLS/GAM: adjusted R^2, RMSE.

☆ ML methods: out-of-sample AUC (classification) or RMSE (regression); compare to baseline methods.

Next Steps

✓ Data Preparation
✓ Model Specification/Estimation
✓ Result Interpretation
✓ Summarize

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