Redesigning Federal Student Aid in Higher Education

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Motivation

- Direct-to-student aid comprises 20% of public higher education spending, through a combination of grants and loans [OECD, 2016].
- Scope for misuse of aid:
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  - Largest beneficiaries (for-profit colleges) are low quality schools.
  - Aid design allows for colleges to receive more aid by increasing prices.
- This paper: Evaluate alternative aid policies via a structural model of U.S higher education to improve student welfare.

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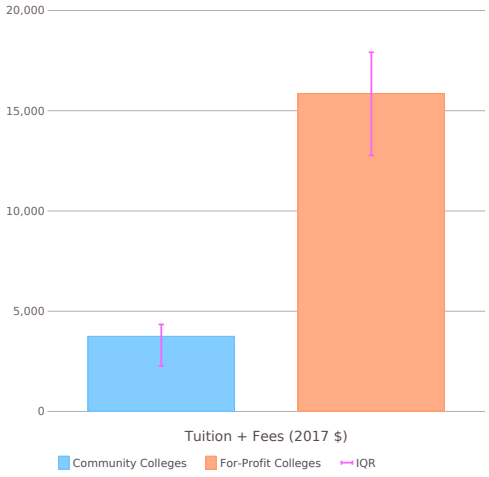
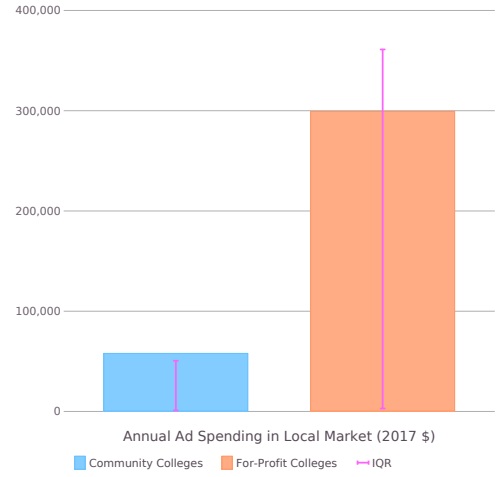
  - Community Colleges (CCs), funded by state and local governments, offer education at subsidized tuition levels.
- Private providers of education are overwhelmingly for-profit institutions (FPIs)
  - FPIs are typically smaller and specialize in vocational training programs.
  - Attract students via advertising: comprises 43.4% of total spending on student services.
  - Receive 74% of revenue from federal student aid programs.

Datasets

- **Sample**: All non-selective, sub-baccalaureate colleges in top 101 DMAs (metro areas) from 2008-2016. Map
- **School Characteristics/Enrollment**: IPEDS Survey. Participation mandated for all aid-eligible postsecondary schools in U.S.
- **Advertising Data**: Ad$pender dataset (DMA-level).
- **Consumer Demographics**: ACS Census Data.
- **Student Outcomes**: College Scorecard. Cohort-level earnings from IRS for federal aid recipients.

Summary Statistics: Higher Education Prices + Advertising

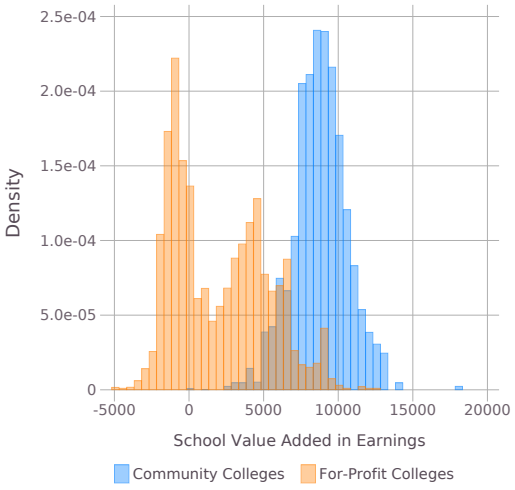




Summary Statistics: Value Added, By School Type

- Estimate quality as value-added in post-college earnings at each school chain.
- Assume selection on observables.
- Identify level of value-added by constructing measure of counterfactual wages if cohort only completed high school.

Other Value-Added Measures



Model: Demand Side

- Market Definition: All working age (18-50) individuals with high-school education.
- Choice set: all sub-baccalaureate, non-selective schools in home county.

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Individual i chooses school j (or outside option) that maximizes utility

$$u_{i,j,t} = -\alpha_i p_{i,j,t}(\beta_i) + \lambda_i \log(a_{f(j),t} + 1) + \vec{\gamma}_i \vec{X}_{j,t} + \delta_j + \xi_{j,t} + \epsilon_{i,j,t}$$

- Utility depends on the following school characteristics:
  - Prices: $p_{i,j,t}$, the net price a student pays.
  - Observables: FPI TV advertising $a_{f,t}$, student services, degree types, quality.
  - Unobservable Characteristics : $\delta_j,\ \xi_{j,t},\ \epsilon_{i,j,t}$.
- Preferences depend on:
  - Age, Race, Gender, Low-Income Status,
  - Random unobserved heterogeneity $\sim N(0, \sigma_k^2)$ for each characteristic k.

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- Student net price $p_{i,j,t}$: NPV of all payments to attend college. depend on student characteristics, cost of attendance, government aid, and how students discount loans:

$$p_{i,j,t}(\beta_i) = \text{OOP}_{i,j,t} + \beta_i L_{i,j,t}$$

  - $OOP_{i,j,t}$: out-of-pocket cost, after receiving Pell grants. Capped at EFC_i.
  - $L_{i,j,t}$: loan amount+interest needed to pay cost of attendance.
  - β_i: Net discount factor $\in [0, 1]$ on 10-year loans.

Model: Supply Side

- For-Profit colleges choose tuition $p_{j,t}$ and advertising $a_{f,t}$ to maximize static chain-level profits, given constant marginal costs and linear fixed advertising costs.

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- Community Colleges choose tuition $p_{j,t}$ to satisfy a budget constraint, given constant marginal costs and observed budget from state to subsidize students.

Model: Estimation Strategy

- Estimate model using GMM, with micromoments on student demographic sorting and survey data on discount rates.
- Construct 3 instruments to identify preferences for endogenous supply variables.

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  - **CC Prices**: 4-year public college tuition. Details
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    Using dependence of FPIs on federal aid, construct simulated instrument of pell grant generosity in county using *preperiod* (2006) distribution of aid eligibility.
  - **CC Prices**: 4-year public college tuition. Details
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  - **CC Prices**: 4-year public college tuition. Details

    Using dependence of CCs on state aid, use prices of state-owned schools in another market (geographically distant 4-year colleges) as a measure of state policy changes towards education funding.
  - **FPI Advertising**: Political advertising Details

Model: Estimation Strategy

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  - **FPI Advertising**: Political advertising Details

    Estimate the effect of cost shock on monthly FPI advertising. Use schools' advertising propensities in different parts of year to generate within-market variation in political ad shock exposure.

Overview: Model Results

- Students are less price elastic to tuition (-1.2) than net price (-3.2).
- Low-income students less tuition/net price elastic due to low passthrough from tuition to net price and lower net prices, respectively.
- Low average valuation of quality ($1000 increase in annual earnings = $33), high valuation of FPI advertising (10% increase = $80)
- High markups / state subsidies explain difference between CC and FPI prices.

Counterfactual Policies

- Counterfactual policies considered:
  - **Aid Bans**
  - **Vouchers**

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  - **Aid Bans** :
    1. **For-Profit Ban**: Ban for-profit education sector from federal aid
    2. **Gainful Employment Ban**: Ban low quality schools from federal aid ($\psi_j < 0$, 23% of schools)

    Forms of both have been proposed by national policymakers. Hold government spending constant by increasing pell grant generosity. Details
  - **Vouchers**

Counterfactual Policies

- Counterfactual policies considered:
  - **Aid Bans**
  - **Vouchers** : Eliminate current aid system, and give low income students a cash transfer to attend a school.
    1. **Fixed voucher**: Equal size transfer regardless of school.
    2. **Optimal Quality Voucher**: Solution to social planner problem of maximizing total value added. Give more voucher aid to schools with higher quality. Conditional on quality, give more aid to schools whose enrollment is more elastic to aid. Details

  Details

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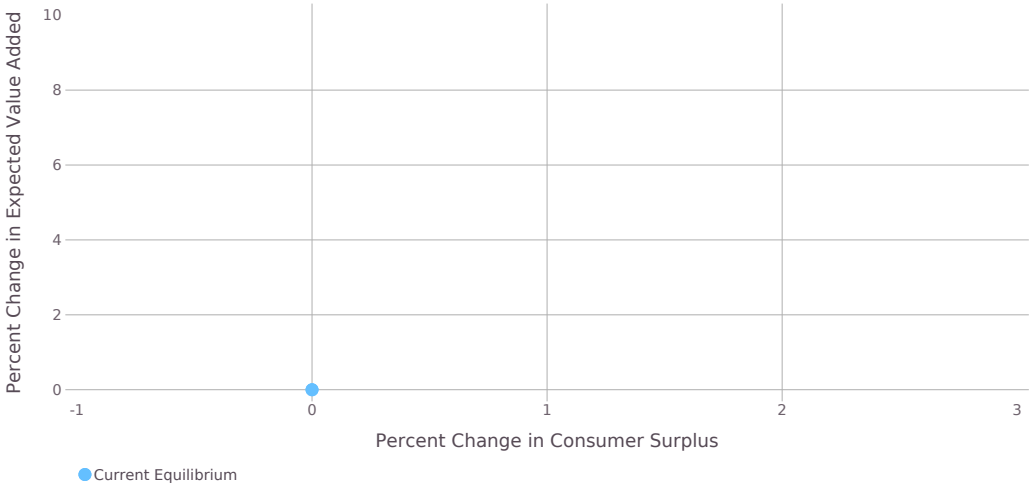
- Counterfactual policies considered:
  - **Aid Bans**
  - **Vouchers**
- Evaluate alternative policies based on two metrics, capturing student taste for schooling environment and the quality of education delivered:
  - Revealed Choice Consumer Surplus: expected utility in dollars
  - Expected Value-added: expected quality for individual i in market t.

Counterfactual Outcomes



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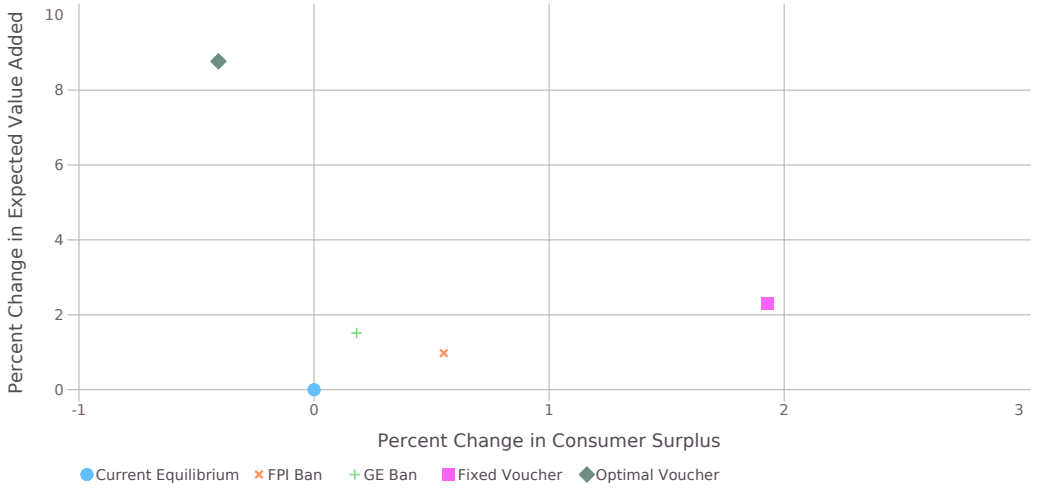


No Advertising CS | Low-Income Consumer Outcomes | Enrollment Reponse to Optimal Voucher | Supply Reponse to Optimal Voucher

Conclusion

- Existing policy proposals do little to improve student outcomes.
- Vouchers increase consumer surplus and quality of education. Effect is largest for targeted students.
- Policymakers can maximize education quality by incentivizing high-quality FPIs to attract students.

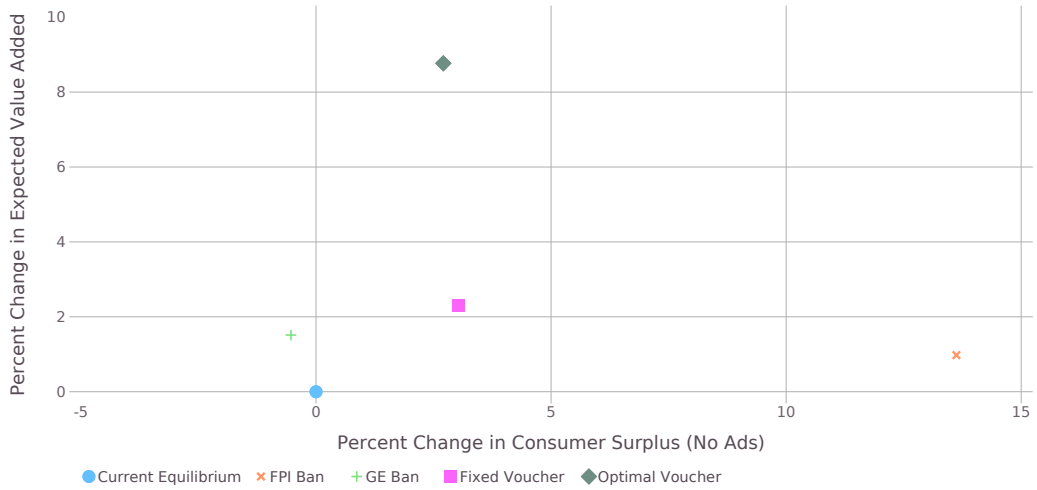
References i

Stephanie Riegg Cellini and Claudia Goldin. Does federal student aid raise tuition? new evidence on for-profit colleges. *American Economic Journal: Economic Policy*, 6(4):174–206, 2014.

OECD. *How Much Do Tertiary Students Pay and what Public Support Do They Receive?* OECD Publishing, 2016.

Lesley J Turner. The road to pell is paved with good intentions: The economic incidence of federal student grant aid. *College Park, MD: University of Maryland, Department of Economics. Retrieved April*, 15:2016, 2014.

Counterfactual Outcomes (Exclude Advertising in CS)



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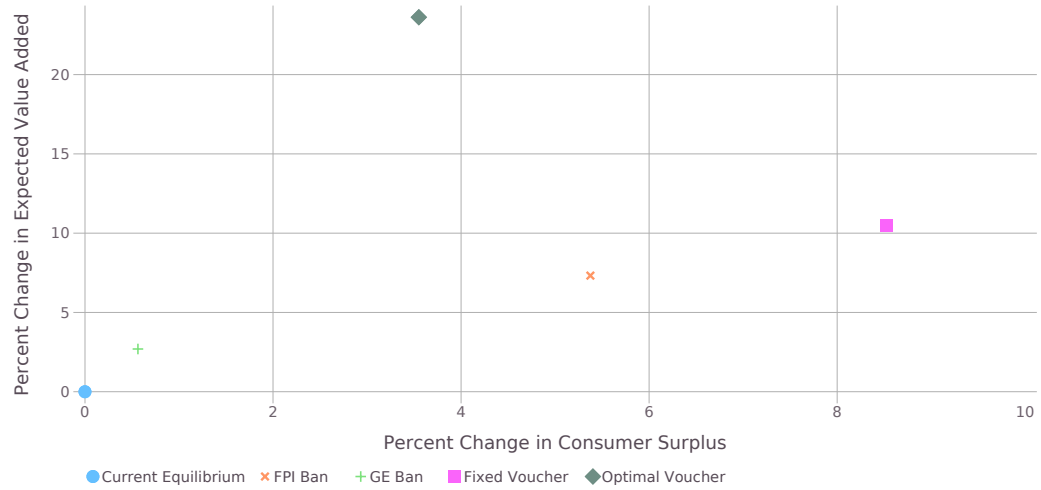
Low-Income Counterfactual Outcomes



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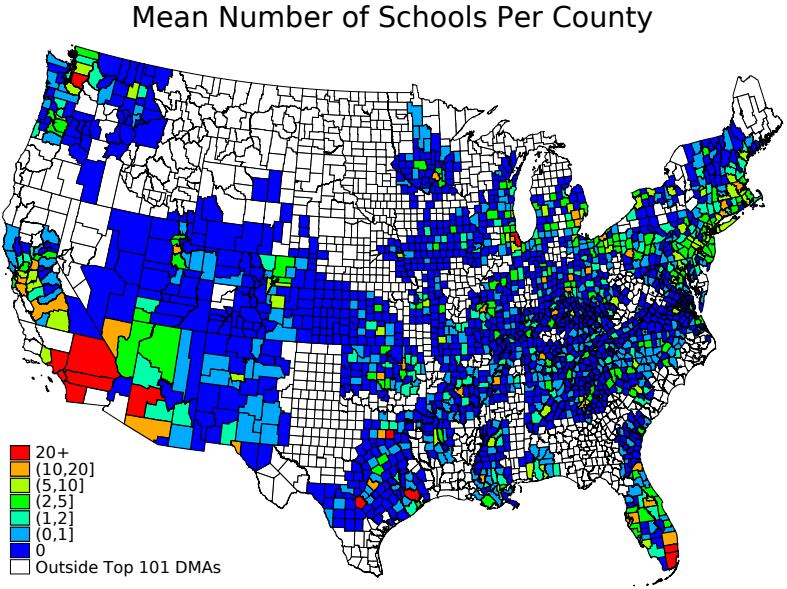
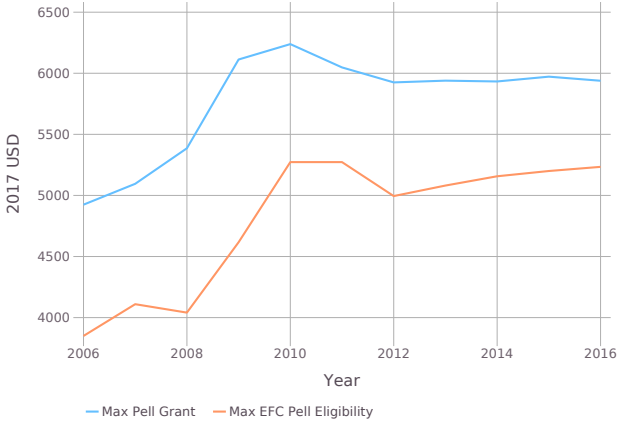
Map of Sample



Federal Pell Grant Policy over time



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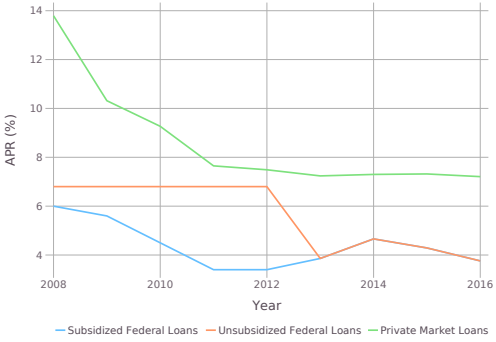
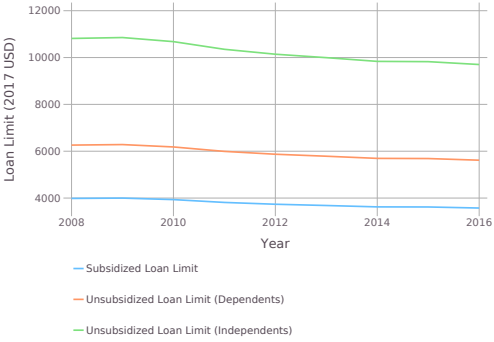
Student Loan Policy over time





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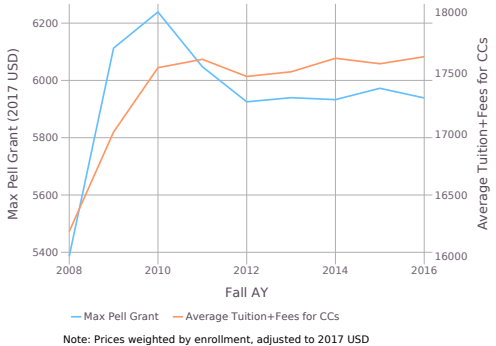
Price Identification- Pell Grants

- FPI tuitions tracks federal aid generosity ($\bar{\pi}_t$). Consistent with the Bennett hypothesis studied in education research [Cellini and Goldin, 2014, Turner, 2014, **?**].



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FPI Prices: Simulated Pell Grant Generosity Instrument

- use a shift-share design with simulated instrument capturing Pell Grant generosity.
- Idea: $E[\bar{\pi}_{i,t}|t]$ captures generosity in market t, but endogenous to current labor market conditions.
- Instead: Simulate generosity from policy in year corresponding to market t, given pre-period (2006) demographics in county c:

$$\begin{aligned} Z^{\pi}_{j,t} &= E[\bar{\pi}_{i,t}|i \sim F(EFC_{c,2006}), \text{Pell Grant Policy in } t] \\ &= \int_i \max(\bar{\pi}_t - EFC_i, 0)\partial F(EFC_{c,2006}) \end{aligned}$$

- Intuition: national increases in pell grant aid induce higher FPI prices. FPIs located in historically poorer areas more likely to respond.

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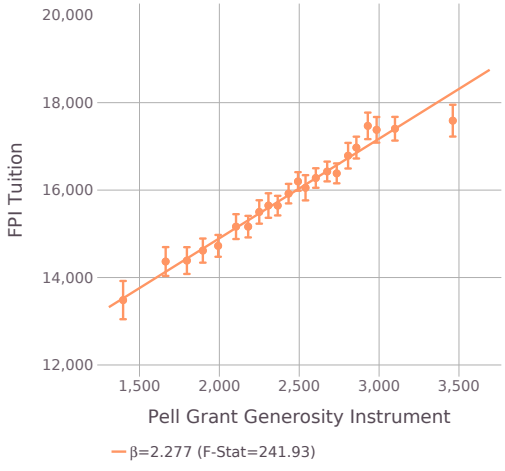
For-Profit College Tuition Instrument Binscatter



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Community College Prices: Hausman Instrument

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- Construct a "cost shock" instrument for CCs: price changes at schools owned by state in another market. (4 year schools $\geq$ 100 miles away).

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- Construct a "cost shock" instrument for CCs: price changes at schools owned by state in another market. (4 year schools $\geq$ 100 miles away).
- "Other market" in two senses:
  - Geographically distant (79th percentile for 4-year students, 95th percentile for CC students)
  - Cater to different students (only 23% of CC students apply to public 4-year)
- Intuition: Both schools depend on state for funding, subject to different demand shocks.

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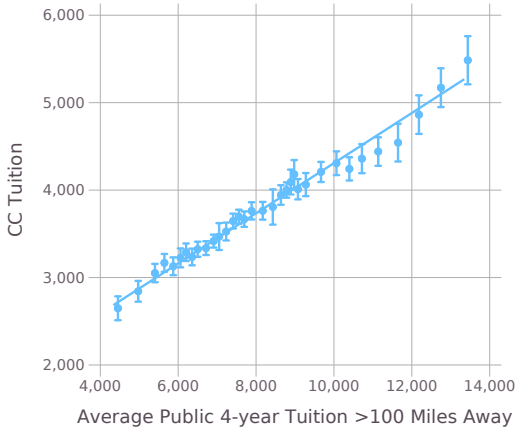
Community College Tuition Instrument Binscatter



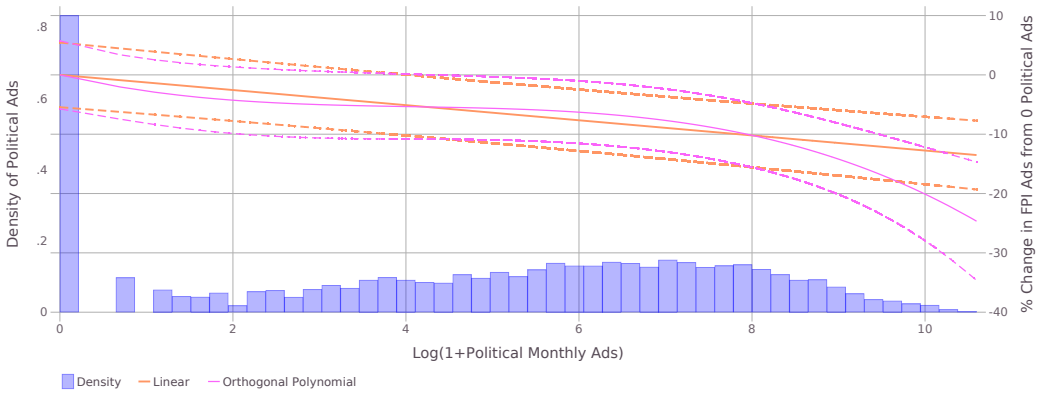
Number of Bins=34

Go Back

Political Advertising

Estimate nonlinear effect f of political ads on FPI ads using monthly data: Go back

$$\log(a_{f,d,m,t} + 1) = \alpha_{f,d} + \delta_t + \beta X_{f,t,d} + f(P_{d,m,t})$$



Monthly AdShares

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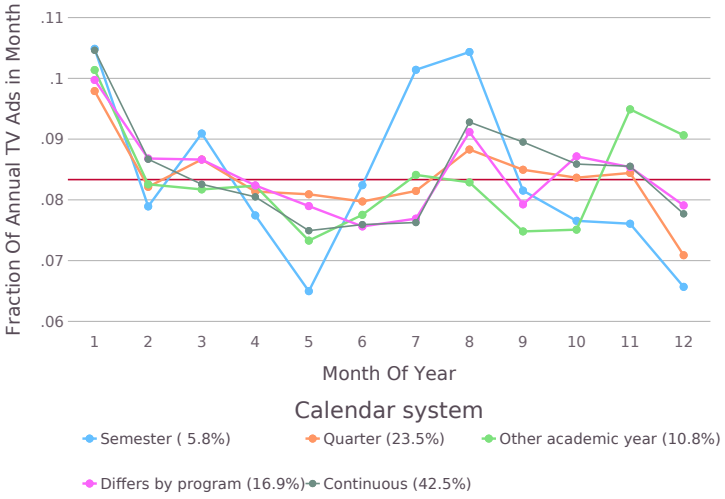
- Major driver of when firms advertise: enrollment periods.
- Construct "exposure" measure to political ads in month m based on propensity to purchase ads in non-election years:

$$\tilde{s}_{f,d,m} = \frac{1}{T_{f,d,NE}} \sum_{t:t\in NE} \frac{a_{f,d,m,t}}{\sum_{k=1}^{12} a_{f,d,k,t}}$$

  - Propensity shares creates within-market heterogeneity in effect of political advertising.

Go back

Ad Scheduling By Calendar System



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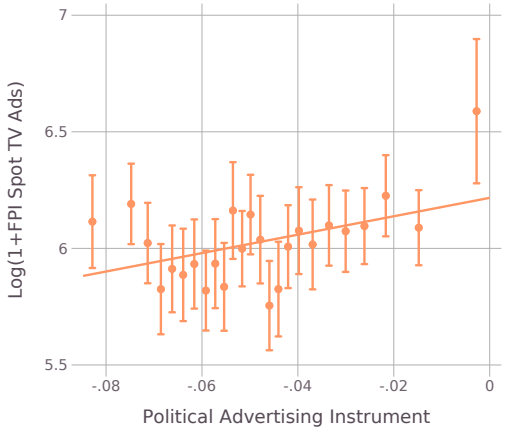
For-Profit College Advertising Instrument Binscatter



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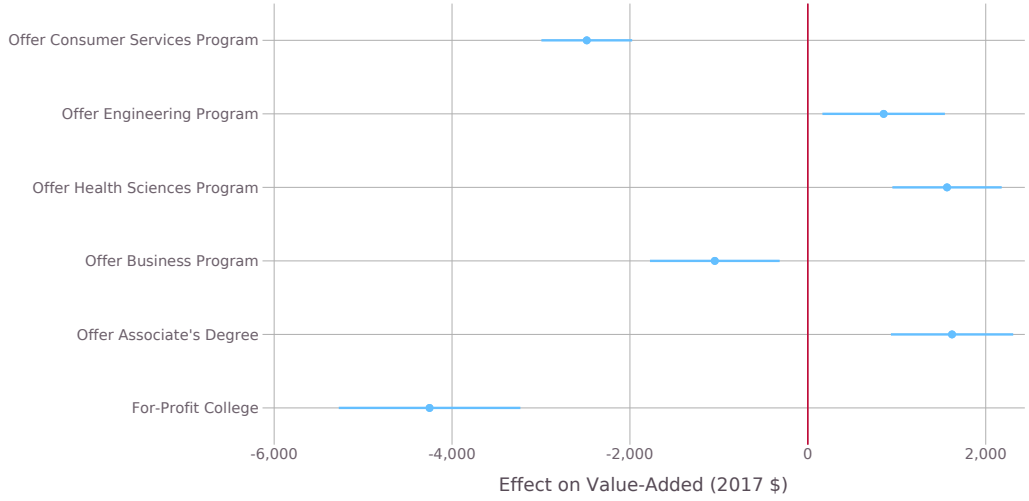
Determinants of Value-added: Selected Coefficients



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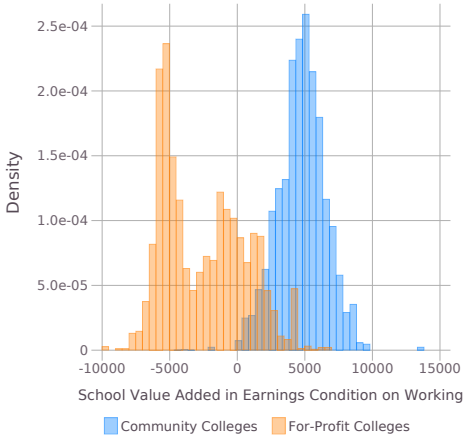
Alternative Value-Added Measures

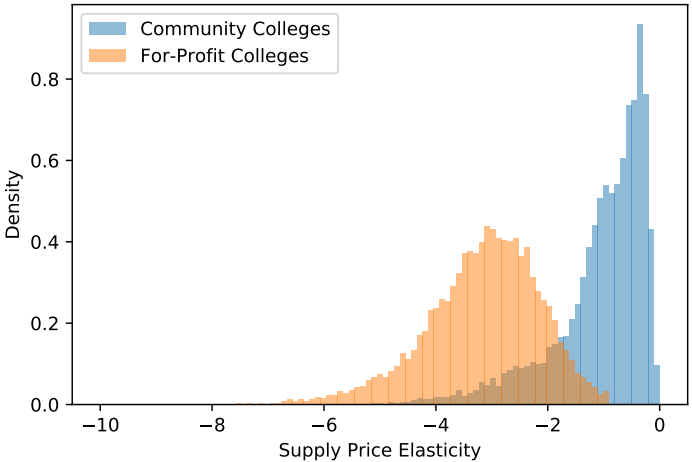
VA in Pr(Employed)



VA in Earnings | Employment

Go Back

School-Level Tuition Elasticities



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For-Profit College Bans

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- Consider an equilibrium where FPIs/low-quality schools receive no federal aid.

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$$\pi_{t,\mathcal{P}} = g_{\mathcal{P}} \times \pi_t$$

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$$\pi_{t,\mathcal{P}} = g_{\mathcal{P}} \times \pi_t$$

- Benchmark for evaluating existing policy proposals to improve welfare/quality in the sector.

Go Back

Voucher Policies

- 99% of federal aid in-sample is spent on low-income (pell-eligible) students. Focus on voucher policies servicing these individuals.

$$\tau_{i,j,t} = \begin{cases} \tau_{j,t} & \text{if } EFC_i \leq \overline{EFC}_t \\ 0 & \text{if } EFC_i > \overline{EFC}_t \end{cases}$$

- **Voucher Design 1**: $\tau_{j,t} = g$. Deliver equal amount of aid to students regardless of cost, eliminating increased aid to higher priced schools.
- **Voucher Design 2**: $\tau_{j,t} = g \times \psi_j \times \frac{\varepsilon_j}{\varepsilon_j + 1}$. Give students more aid for attending higher quality institutions that are elastic to voucher subsidy.

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Optimizing Quality Provision in Higher Education

- Social planner chooses policy $\mathcal{P}$ to maximize quality provision to low-income students L of the sector. Restrict $\mathcal{P}$ to be a set of school-specific vouchers $\{\tau_{j,t}\}$ for each school:

$$\max_{\mathcal{P}=\{\tau_{j,t}\}} \sum_{m} M_{t,L} \sum_{j \in \mathcal{J}_t} s_{j,t,L}(\vec{\tau}) \times \psi_j \tag{1}$$

$$\text{s.t.} \sum_{m} M_{m,L} \sum_{j \in \mathcal{J}_m} s_{j,t,L}(\vec{\tau}) \times \tau_{j,t} \leq G$$

Go Back

Optimal Voucher

- Simplified solution to social planner problem:

$$\tau^*_{j,t} = \underbrace{\frac{1}{\lambda}}_{\substack{\text{Shadow Price} \\ \text{of Budget Constraint}}} \times \underbrace{\frac{\varepsilon^{\tau}_{j,j,t}}{(1+\varepsilon^{\tau}_{j,j,t})}}_{\substack{\text{Voucher Elasticity} \\ \text{Distortion Term}}} \times \underbrace{\psi_j}_{\text{Quality}} \tag{2}$$

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- Schools receive more aid if voucher elasticity $\varepsilon^{\tau}_{j,j,t}$ (change in enrollment from more voucher aid) is higher. Depends on price sensitivity of demand side and price/advertising response from supply side.

Full Solution | Distribution of Distortion by Institution Type | Go Back

Full Solution to Optimal Voucher

Proposition 1
Suppose the social planner optimizes Equation 1. The optimal voucher in market m is:

$$\vec{\tau}_m^* = \underbrace{(I + \mathbf{E_m})^{-1}\mathbf{E_m}}_{\substack{\text{Voucher Elasticity} \\ \text{Distortion Term}}} \times \underbrace{\frac{1}{\lambda}}_{\substack{\text{Shadow Price} \\ \text{of Budget Constraint}}} \times \underbrace{\vec{\psi}_m}_{\text{Quality}} \tag{3}$$

where $\mathbf{E_m}$ is a $J_m \times J_m$ matrix with elements:

$$\mathbf{E}_{m,k,j} = \varepsilon_{k,j,t} \times \frac{s_{k,L}}{s_{j,L}}$$

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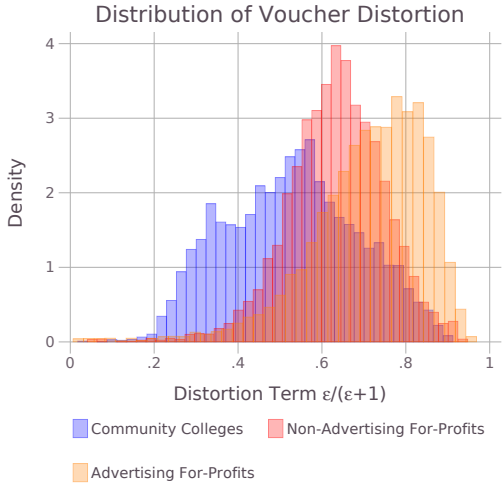
Distribution of Voucher Distortion Term



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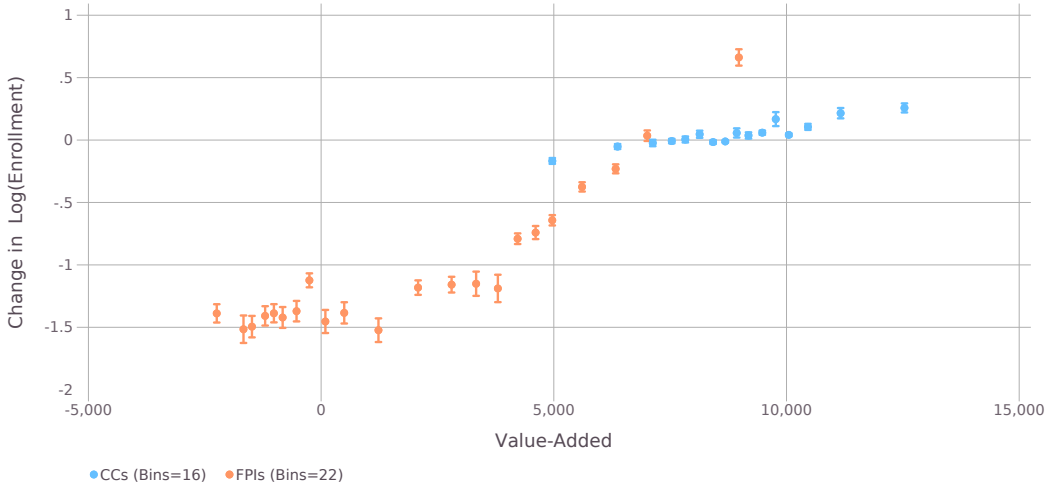
Binscatter of Enrollment Change Under Optimal Voucher



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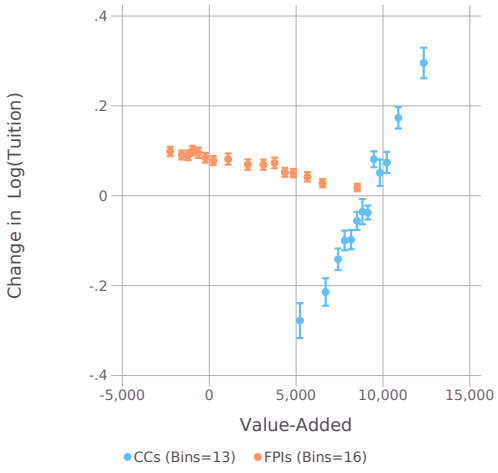
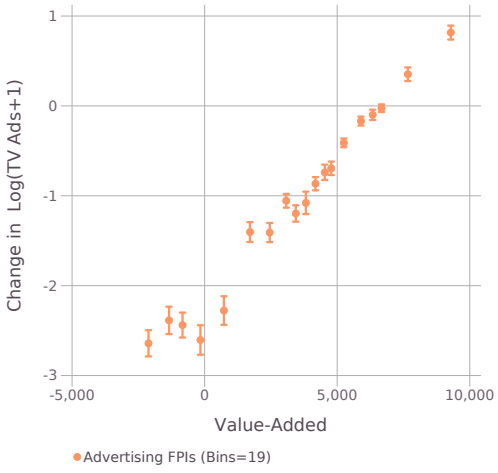
Binscatter of Supply Repsonse Under Optimal Voucher





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