Price Controls in a Multi-Sided Market

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Digital platforms and platform regulation

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  - e.g., caps on # of Uber/Lyft drivers, EU's Digital Markets Act

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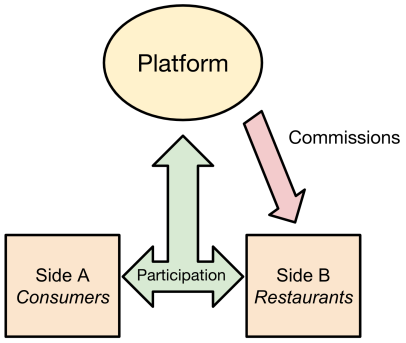
  - e.g., caps on # of Uber/Lyft drivers, EU's Digital Markets Act
- Empirical study of platform regulation is difficult
- Few settings with comparable, distinct platform markets that are differentially regulated
- One such setting: the US food delivery industry
  - Many cities have capped commissions that delivery platforms charge to restaurants
  - 22% of restaurants affected by April 2021
  - Intended to benefit restaurants; proponents argue that platforms reduce restaurant profits

Effects of caps depend on multi-sided features of industry

Commission caps

1. entice restaurants to join platforms
   - benefits consumers who value variety of restaurants



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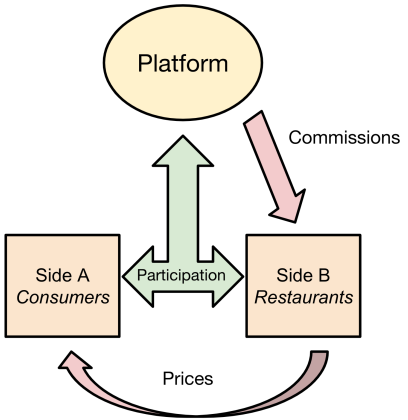

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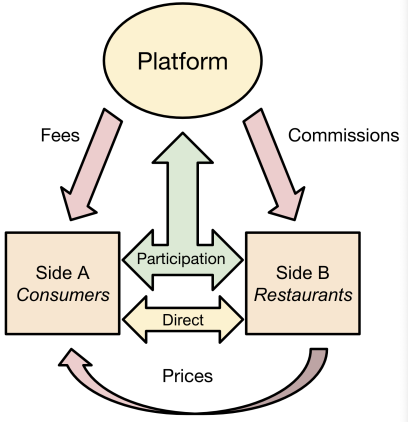
   - but restaurants may prefer lower platform ordering



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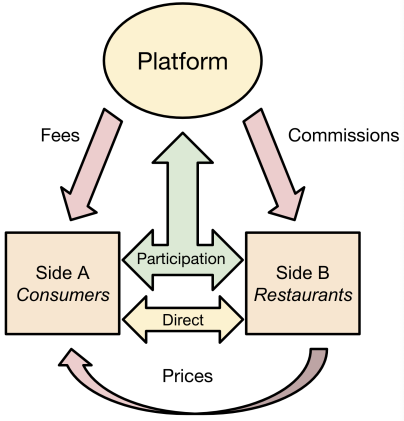
Net effects of caps on restaurant and consumer welfare are thus uncertain



Evaluating commission caps

- Goals of paper
  - Estimate welfare effects of commission caps

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Evaluating commission caps

- Goals of paper
  - Estimate welfare effects of commission caps
  - Understand whether policymakers can do better
- Approach
  - Assemble rich collection of data
  - Estimate effects of caps via differences-in-differences event study
  - Formulate model of platform & restaurant competition
  - Use estimated model for policy evaluation

Preview of results

- Caps benefit restaurants, but reduce total welfare and especially hurt consumers
  - Consumers lose from increased fees...
  - ...but restaurant responses mitigate losses — increased platform uptake, price reductions

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- Caps benefit restaurants, but reduce total welfare and especially hurt consumers
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- Cap on both consumer fees and restaurant commissions may hurt restaurants
- Rise of platforms has benefitted consumers but reduced restaurant profits
  - Platform membership is a prisoner's dilemma for restaurants

Contributions

1. Estimate effects of price controls in a platform market
   - Literature largely focuses on payment card interchange fees [Evans et al. 2015, Manuszak and Wozniak 2017, Kay et al. 2018, Chang et al. 2005, Wang 2023]
   - Li and Wang (2021) estimate effects of commission caps on delivery fees

Contributions

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2. Evaluate impacts of food delivery platforms on restaurant industry
   - Work on welfare consequences of digital platforms focuses on ride-hailing, accomodations [Castillo 2022, Calder-Wang 2022, Schaefer and Tran 2020, Farronato and Fradkin 2022]
   - Build upon literature on estimation of network-effects [Rysman 2004, Lee 2013, Farronato et al. 2020, Cao et al. 2021 Kaiser and Wright 2006, Fan 2013, Ivaldi and Zhang 2020, Sokullu 2016, Natan 2021]

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3. Analyze decentralized pricing by sellers who set separate prices on and off platforms
   - Empirical platform pricing literature focuses on fee/commission setting by platforms rather than pricing by platform users [Rosaia 2020, Ho and Lee 2017, Argentesi and Filistrucchi 2007]
   - Complements Robles-Garcia (2022) (decentralized pricing without online/offline distinction) and Gaineddenova (2022) (efficiency of centralized vs. decentralized pricing)

Agenda

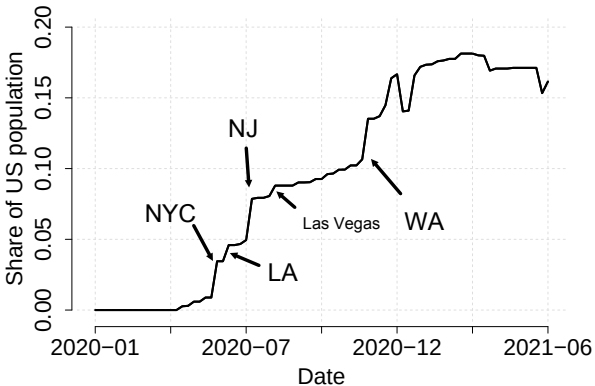
1. Setting and data
2. Three empirical findings
3. Model
4. Estimation
5. Counterfactuals

Setting and data

US food delivery industry

- Main players:
  1. DoorDash
  2. Uber Eats
  3. Grubhub
  4. Postmates (owned by Uber)
- Staggered adoption of commission caps by cities, counties, states
- Typical cap level is 15% (84% of policies)
  - 30% without cap

Share of US population in jurisdictions with caps



Price structure of delivery platforms

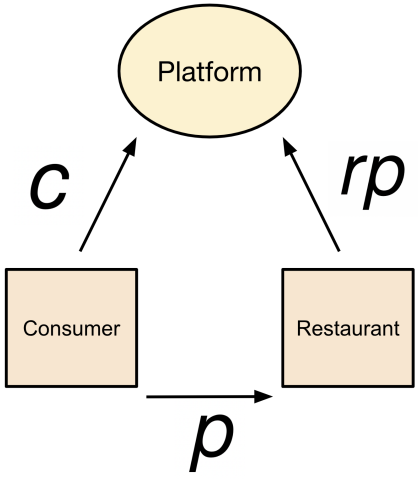
$$\text{Consumer Bill} = p + c$$

$$\text{Restaurant Revenue} = (1 - r)p$$

$$\text{Platform Revenue} = c + rp$$

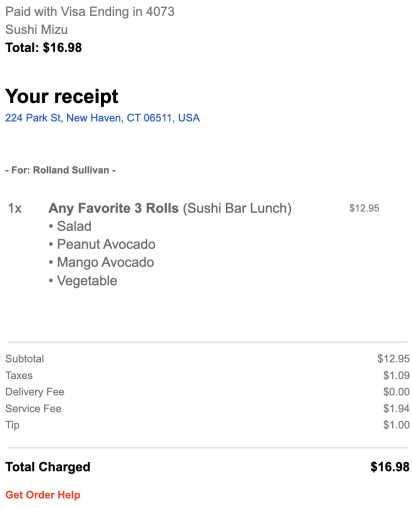
where

- p = price of restaurant meal
- c = platform's consumer fees
  - Focus on fixed fees, which responded to caps
- r = platform's restaurant commission rate



Data

- Consumer choices
  - Panel of itemized receipts from Numerator;
  - ≈ 600k orders/month, 2019–21
  - Includes platform, pick-up, first-party delivery, & on-premises orders
  - Matches census, credit-card data
  - Supplement with ZIP/month panel of sale & fee estimates



Paid with Visa Ending in 4073
Sushi Mizu
Total: $16.98

Your receipt
224 Park St, New Haven, CT 06511, USA

- For: Rolland Sullivan -

1x **Any Favorite 3 Rolls** (Sushi Bar Lunch) $12.95
- Salad
- Peanut Avocado
- Mango Avocado
- Vegetable

Subtotal	$12.95
Taxes	$1.09
Delivery Fee	$0.00
Service Fee	$1.94
Tip	$1.00
Total Charged	**$16.98**

Get Order Help

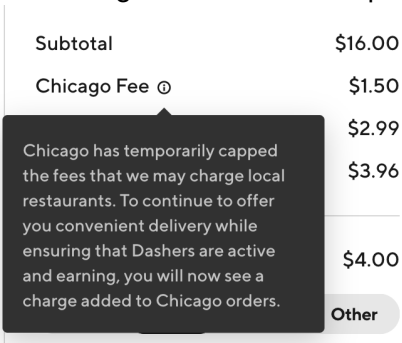
Data

- Consumer choices
- Restaurants
  - Characteristics of restaurants on each platform and offline, 2020–21

Data

- Consumer choices
- Restaurants
- Platform consumer fees and wait times
  - Scrape platform websites in Q2 2021 for 14 large metro areas
  - Use to construct platform/ZIP-level fee & wait time indices

DoorDash's response to Chicago's commission cap



Three empirical findings

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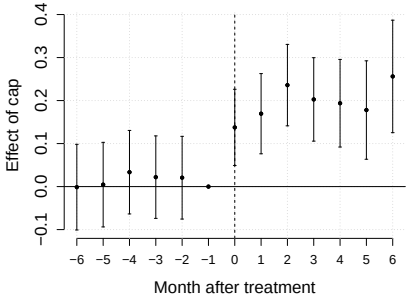
1. Caps raise consumer fees, reduce platform sales, raise platform update by restaurants

- Estimate effects of 15% cap by diff-in-diff
- Platform consumer fees rise by 9–22%
- Platform orders fall by 6%
- Share of restaurants on a platform rises by 8%

Effect on DoorDash consumer fees



Modelling choice

Endogenous fees, ordering, platform adoption

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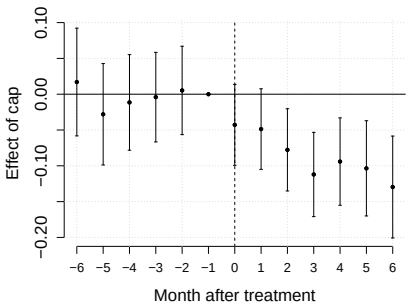
Effect on DoorDash sales



Modelling choice

Endogenous fees, ordering, platform adoption

Three empirical findings

1. Caps raise consumer fees, reduce platform sales, raise platform update by restaurants
2. Restaurants charge higher prices on platforms

- On average, a restaurant charges 26% more on a platform than for a direct order
- Full pass-through under 30% commission $= 0.3/(1-0.3) \approx 42\%$

Modelling choice

Restaurant pricing with online/offline distinction, commission pass-through

Three empirical findings

1. Caps raise consumer fees, reduce platform sales, raise platform update by restaurants
2. Restaurants charge higher prices on platforms
3. Both consumers and restaurants multihome

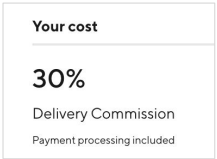
- Over half of restaurants on DoorDash are on Uber Eats
- Consumers order from the same platform across consecutive orders $\approx$ 80% of the time

Modelling choice

Flexible multihoming on both sides

Model

Model overview



1

Platforms set commission rates

Model overview

Your cost

30%

Delivery Commission

Payment processing included

1

Platforms set commission rates

2

Restaurants sign up for platforms

Model overview

Your cost

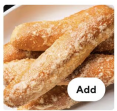
30%

Delivery Commission

Payment processing included

Italian Salad

$4.99



Fresh Baked Breadsticks

$6.99

1 — **Platforms set commission rates**

2 — **Restaurants sign up for platforms**

3 — **Restaurants set prices, platforms set consumer fees**

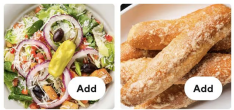
Model overview

Your cost

30%

Delivery Commission

Payment processing included



Italian Salad
$4.99

Fresh Baked Breadsticks
$6.99

1 — **Platforms set commission rates**

2 — **Restaurants sign up for platforms**

3 — **Restaurants set prices, platforms set consumer fees**

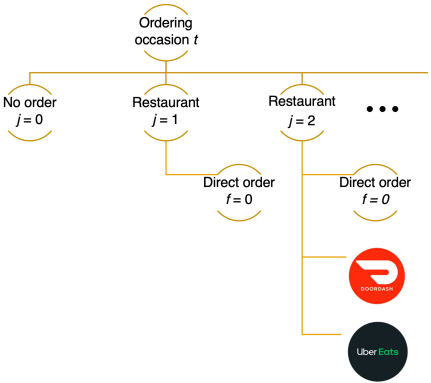
4 — **Consumers choose what to eat**

Model stages

1. Platform commission setting
2. Restaurant platform adoption
3. Restaurant price and platform fee setting
4. Consumer choice

Model of consumer eating

- Consumers i in ZIPs z of metros m
- Each consumer makes T choices/month
- Eating options:
  1. home-made meal ($j = 0$)
  2. order meal directly from a restaurant j ($f = 0$)
  3. order meal from a restaurant j using a platform $f \neq 0$
- Platform sales depend on...
  - # of restaurants on each platform
  - platforms' consumer fees c
  - restaurant prices p of standardized meal



Consumer preferences

- Consumer i chooses a restaurant/platform pair (j, f) to maximize

$$v_{ijft} = \begin{cases} \psi_{if} - \alpha_i p_{jf} + \eta_i + \nu_{ijt}, & j \neq 0 \quad \text{(Restaurant meal)} \\ \nu_{i0t}, & j = 0 \quad \text{(Home-prepared meal)} \end{cases}$$

among restaurants within five miles of consumer's ZIP, where

  - $\psi_{if} =$ utility index for platform f
  - $p_{jf} =$ restaurant j's price on platform f
  - $\eta_i =$ tastes for restaurant food
  - $\nu_{ijt} =$ tastes for restaurant j

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  - $\nu_{ijt} =$ tastes for restaurant j

- Specify consumer i's taste for platform f as

$$\psi_{if} = \underbrace{\delta_{fm}}_{\substack{\text{platform/metro} \\ \text{fixed effect}}} - \alpha_i \underbrace{c_{fz}}_{\substack{\text{platform} \\ \text{fee}}} - \tau \underbrace{W_{fz}}_{\substack{\text{expected} \\ \text{wait time}}} + \underbrace{\lambda_f' d_i}_{\substack{\text{demographic} \\ \text{effects}}} + \underbrace{\zeta_{if}}_{\substack{\text{unobservable} \\ \text{platform taste}}}$$

▸ Network effects, consumer information, and restaurant discovery ▸ Details

Model stages

1. Platform commission setting
2. Restaurant platform adoption
3. Restaurant price and platform fee setting
4. Consumer choice

Restaurant price setting and platform fee setting

- Restaurants set prices for direct orders and on each platform to maximize profits
  - Details
- Platform f sets consumer fees c_{fz} in ZIP z to maximize its profits in z:

$$\underbrace{\mathcal{J}_{fz}(c_z)}_{\text{Sales}} \times \overbrace{\left(\underbrace{c_{fz}}_{\substack{\text{Consumer}\\ \text{fee}}} + \underbrace{r_{fm}}_{\substack{\text{Restaurant}\\ \text{commission}}} \underbrace{\bar{p}^*_{fz}}_{\substack{\text{Average restaurant}\\ \text{price in } z \text{ on } f}} - \underbrace{mc_{fz}}_{\substack{\text{Marginal}\\ \text{cost}}} \right)}^{\text{Platform markup}}$$

- Marginal costs represent payments to couriers

Details

Model stages

1. Platform commission-setting
2. Restaurant platform adoption
3. Restaurant price and platform fee setting
4. Consumer choice

Restaurants join platforms in an entry game

- Restaurants simultaneously join platforms:

$$\underbrace{\mathcal{G}_j}_{\text{Chosen set of platforms}} = \arg\max_{\mathcal{G}} \quad \underbrace{\mathbb{E}\left[\bar{\Pi}_j(\mathcal{G}, \mathcal{J}_{m,-j})\right]}_{\text{Expected variable profits}} - \underbrace{K_m(\mathcal{G})}_{\text{Fixed costs of platform adoption}} + \underbrace{\omega_j(\mathcal{G})}_{\text{Choice disturbance}}$$

where $\mathcal{J}_{m,-j}$ = platform adoption of rival restaurants

Model stages

1. Platform commission setting
   - Profit-maximization
   - Account for dynamic considerations in reduced-form fashion
2. Restaurant platform adoption
3. Restaurant price and platform fee setting
4. Consumer choice

Estimation

Overview of estimation

1. Consumer preferences
   - Estimate via MLE on Q2 2021 consumer panel for 14 large metros
   - Specify platform/metro fixed effects & exploit within-metro variation
   - When Uber Eats raises fees in Chicago,
     - 31% of lost consumers substitute to direct-from-restaurant ordering
     - 30% to other platforms
     - 38% to homemade meal
2. Restaurant marginal costs
   - Recover from first-order conditions
3. Restaurant platform adoption model
   - Estimate via GMM on restaurant platform adoption data
4. Platform costs
   - Recover from first-order conditions

Overview of estimation

1. Consumer preferences
   - Estimate via MLE on Numerator transactions panel for Q2 2021

2. Restaurant marginal costs
   - Recover from first-order conditions
   - 15% commission cap raises restaurants' markups on platforms by 89%

3. Restaurant platform adoption model
   - Estimate via GMM on restaurant platform adoption data

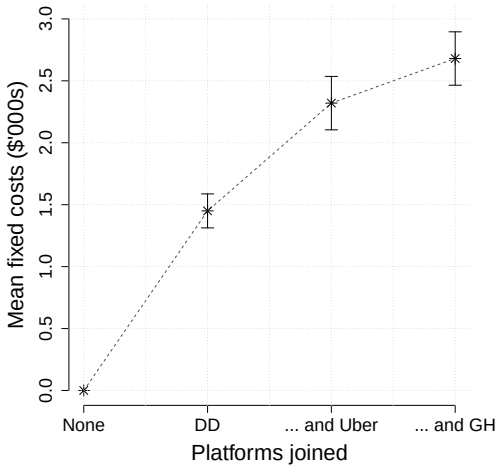
4. Platform costs
   - Recover from first-order conditions

Overview of estimation

1. Consumer preferences
   - Estimate via MLE on Numerator transactions panel for Q2 2021
2. Restaurant marginal costs
   - Recover from first-order conditions
3. Restaurant platform adoption model
   - Estimate via GMM on restaurant platform adoption data
   - Match observed patterns of platform adoption
4. Platform costs
   - Recover from first-order conditions

Estimates of restaurants' fixed costs of platform adoption

- Decreasing incremental costs for joining platforms ($'000s)
- Elasticity of # of restaurants on DoorDash with respect to DoorDash's commission rate
  - $= -0.52$ for Chicago metro area



Compare to mean monthly profits of $12.6k for restaurant on no platform

Overview of estimation

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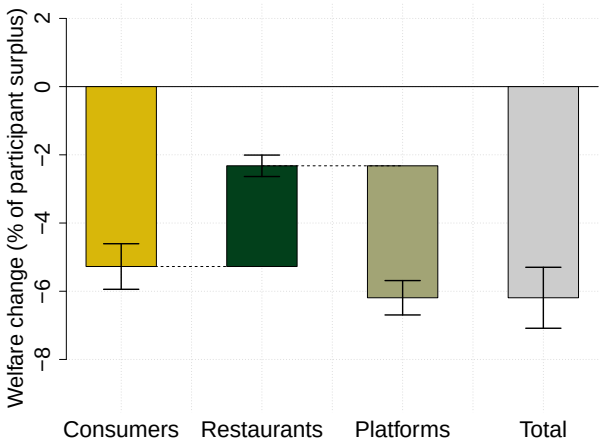
   - Estimate via MLE on Numerator transactions panel for Q2 2021
2. Restaurant marginal costs
   - Recover from first-order conditions
3. Restaurant platform adoption model
   - Estimate via GMM on restaurant platform adoption data
4. Platform costs
   - Recover from first-order conditions Details
   - Interquartile range of DoorDash delivery cost is $7.08–9.72
     - DD pays couriers $2–10/delivery

Counterfactuals

Counterfactuals

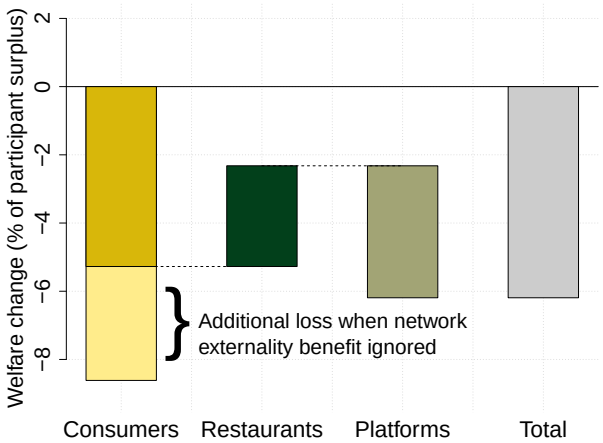
- Assess
  1. 15% commission cap
  2. 15% commission cap + cap on consumer fee increases
  3. Commission tax ▸ Here
  4. Elimination of platforms

15% commission caps benefit restaurants but reduce total welfare



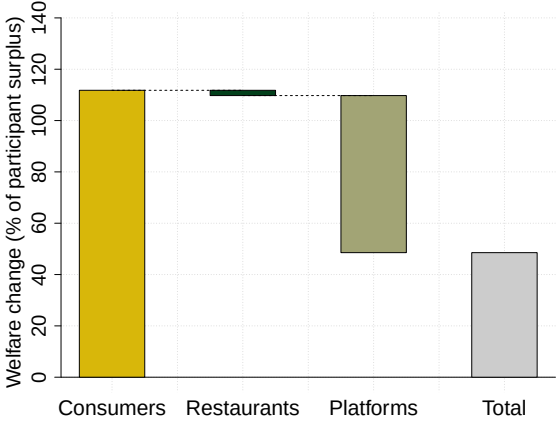
Participant surplus = sum of consumer and restaurant surplus from platforms

15% commission caps benefit restaurants but reduce total welfare



Could consumer fee caps solve commission caps' problems?

- Simulate a 15% commission cap with consumer fee hikes capped at $1.00
- Policy restrains platform market power
  - Total welfare rises
  - % of restaurants on a platform rises by 10
  - # restaurant orders rises by 6%
- But restaurants slightly worse off
  - Policy reduces share of orders placed directly by consumers by 12%



Do food delivery platforms hurt restaurants?

- Cap proponents caps argue that the rise of platforms has hurt restaurants
- Effects of platforms on restaurants depend on
  - Market expansion — by how much do platforms raise the total # of restaurant orders vs. cannibalize direct-from-restaurant orders?
  - Membership costs — by how much do commissions & adoption costs reduce profits?
- Evaluate by simulating platform elimination

Platforms reduce restaurant profits despite increasing sales

- ≈½ of orders on platforms would not be placed if platforms did not exist
- Yet platforms reduce restaurant profits
- Platform membership is a prisoner's dilemma for restaurants

Effects of eliminating platforms
(dollars per capita, annual)

Outcome	Effect
Consumer welfare	-66.98
Restaurant profits	17.88
Platform variable profits	-58.06
Total welfare: lower bound	-107.16
Total welfare: upper bound	-49.10

Total welfare bounds:

- Lower ⇒ no platform fixed costs
- Upper ⇒ no platform profits

Three concluding lessons

1. Expect seesaw effects in multi-sided markets
2. Direct effects of policies targeting platforms may be counteracted by seller responses
   - Sellers compete away their benefit from caps by lowering prices, joining more platforms
3. Less online business can help platform sellers due to online/offline substitution

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Commission tax

- Platform f's tax payments when commission revenue taxed at rate $\mathbb{t}$
- Set rate $\mathbb{t}$ so that revenue equals restaurant gain from 15% cap (before restaurant response to tax)
  - Yields tax rate $\mathbb{t} = 1.8\%$

Back

Effects of a 15% commission cap and a commission tax, Los Angeles

Change in...	Cap	Tax
Avg. ordering cost ($)	0.52	0.05
Avg. commission rate (p.p.)	-15.00	-1.36
Shr. adopting a platform (p.p.)		
Platform orders (%)		
Restaurant profits ($ p.c.)		
Platform profits ($ p.c.)		
Consumer welfare ($ p.c.)		

$ p.c. = dollars per capita, annual

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Platform orders (%)	-3.17	-0.26
Restaurant profits ($ p.c.)		
Platform profits ($ p.c.)		
Consumer welfare ($ p.c.)		

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Platform orders (%)	-3.17	-0.26
Restaurant profits ($ p.c.)	3.18	3.05
Platform profits ($ p.c.)	-2.45	-2.10
Consumer welfare ($ p.c.)	-3.25	-0.25

$ p.c. = dollars per capita, annual