Price Controls in a Multi-Sided Market

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Digital platforms and platform regulation

• Rise of digital platforms has spurred interest in platform regulation
  • e.g., caps on # of Uber/Lyft drivers, EU’s Digital Markets Act
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• Empirical study of platform regulation is difficult

• Few settings with comparable, distinct platform markets that are differentially regulated
Digital platforms and platform regulation

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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
Effects of caps depend on multi-sided features of industry

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2. lead restaurants to lower prices on platforms
   - restaurants partially pass commissions into prices
Effects of caps depend on multi-sided features of industry

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   - reduces ordering on platforms
   - 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
Evaluating commission caps

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  • 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
Evaluating commission caps

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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

Rise of platforms has benefitted consumers but reduced restaurant profits

Platform membership is a prisoner's dilemma for restaurants
• 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
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  • Platform membership is a prisoner's dilemma for restaurants
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
Estimate effects of price controls in a platform market

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Evaluate impacts of food delivery platforms on restaurant industry

2. Work on welfare consequences of digital platforms focuses on ride-hailing, accommodations [Castillo 2022, Calder-Wang 2022, Schaefer and Tran 2020, Farronato and Fradkin 2022]
Contributions

1. Estimate effects of price controls in a platform market
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   • Li and Wang (2021) estimate effects of commission caps on delivery fees

2. Evaluate impacts of food delivery platforms on restaurant industry
   • Work on welfare consequences of digital platforms focuses on ride-hailing, accommodations [Castillo 2022, Calder-Wang 2022, Schaefer and Tran 2020, Farronato and Fradkin 2022]

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

![Graph showing the share of US population in jurisdictions with caps over time.](image-url)
Price structure of delivery platforms

Consumer Bill = \( p + c \)
Restaurant Revenue = \((1 - r)p\)
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
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

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subtotal</td>
<td>$16.00</td>
</tr>
<tr>
<td>Chicago Fee</td>
<td>$1.50</td>
</tr>
<tr>
<td>Dine In Fee</td>
<td>$2.99</td>
</tr>
<tr>
<td>Delivery Fee</td>
<td>$3.96</td>
</tr>
<tr>
<td>Other</td>
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</tr>
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Chicago has temporarily capped the fees that we may charge local restaurants. To continue to offer you convenient delivery while ensuring that Dashers are active and earning, you will now see a charge added to Chicago orders.
Three empirical findings
Three empirical findings

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
Three empirical findings

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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 overview

Your cost

30%
Delivery Commission
Payment processing included

Platforms set commission rates
Model overview

Platforms set commission rates

Restaurants sign up for platforms

Your cost

30%
Delivery Commission
Payment processing included
Model overview

1. Platforms set commission rates
2. Restaurants sign up for platforms
3. Restaurants set prices, platforms set consumer fees
Model overview

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Delivery Commission
Payment processing included

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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- Specify consumer $i$’s taste for platform $f$ as

  $$
  \psi_{if} = \delta_{fm} - \alpha_i c_{fz} - \tau W_{fz} + \lambda_i d_i + \zeta_{if}
  $$

  - $\delta_{fm}$ = platform/metro fixed effect
  - $c_{fz}$ = platform fee
  - $W_{fz}$ = expected wait time
  - $\lambda_i$ = demographic effects
  - $d_i$ = demographic effects
  - $\zeta_{if}$ = unobservable 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 $z$:

\[
\text{Platform markup} = \frac{\partial f_{z}(c_{z})}{\partial c_{z}} \times \left( c_{fz} + r_{fm} + \bar{p}_{fz}^{*} - mc_{fz} \right)
\]

• 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:

\[ G_j = \arg \max_G \mathbb{E} \left[ \bar{\Pi}_j(G, J_m, -j) \right] - K_m(G) + \omega_j(G) \]

where \( J_{m, -j} = \) platform adoption of rival restaurants
Model stages

1. Platform commission setting
   • Profit-maximization
     • Account for dynamic considerations in reduced-form fashion

Restaurant platform adoption

Restaurant price and platform fee setting

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

Consumer preferences
  • Estimate via MLE on Numerator transactions panel for Q2 2021

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

Restaurant platform adoption model
  • Estimate via GMM on restaurant platform adoption data

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
  - $\varepsilon = -0.52$ for Chicago metro area

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

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

- Restaurant marginal costs
  - Recover from first-order conditions

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

4 Platform costs
  - Recover from first-order conditions
  - 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
  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

Welfare change (% of participant surplus)

Consumers	Restaurants	Platforms	Total

Additional loss when network externality benefit ignored
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%

![Welfare change graph](image)
Do food delivery platforms hurt restaurants?

- Cap proponents 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

• $\approx \frac{1}{2}$ 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

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<thead>
<tr>
<th>Outcome</th>
<th>Effect</th>
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<tbody>
<tr>
<td>Consumer welfare</td>
<td>-66.98</td>
</tr>
<tr>
<td>Restaurant profits</td>
<td>17.88</td>
</tr>
<tr>
<td>Platform variable profits</td>
<td>-58.06</td>
</tr>
<tr>
<td>Total welfare: lower bound</td>
<td>-107.16</td>
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<tr>
<td>Total welfare: upper bound</td>
<td>-49.10</td>
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Total welfare bounds:

• Lower $\Rightarrow$ no platform fixed costs
• Upper $\Rightarrow$ 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


• Platform $f$’s tax payments when commission revenue taxed at rate $t$

• Set rate $t$ so that revenue equals restaurant gain from 15% cap (before restaurant response to tax)
  • Yields tax rate $t = 1.8\%$

---

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

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