

“Quick Response” Economic Stimulus:

The Effect of Small-Value Digital Coupons on Spending

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Motivation

- Fiscal stimulus re-emerges as a policy tool to curb recession
 - Ex: ARRA 2009; CARES Act 2020
- Three features of successful fiscal stimulus program (Ex: Summers, 2008)
 1. **Timely:** quickly implementable, swift stimulus effect
 2. **Targeted:** target individuals most likely to spend; target businesses most in need of help
 3. **Transient:** program should not create long-term fiscal burden
- Difficult to have these features in practice. Consider cash stimulus:
 - Consumer spending takes time to respond
 - MPC varies between 0.2 to 0.8; cannot be precisely targeted to help specific business sectors
 - Often imposes sizable fiscal burden (cash payment $>1\%$ annual household income)

This paper

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 - Ex: \$10 off a purchase \$30+ at any restaurants
 - Ubiquitous marketing tool to provide salient, “expiring” incentive to spend
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- We study a fintech-based consumption stimulus program in a large city of China
 - City gov leverages mobile payment platform (Alipay) to dispense massive amounts of small-value digital coupons
 - “Use-it-this-week-or-lose-it” nature of coupons cause immediate consumption responses
 - Category-specific coupons target hard-hit sectors (shopping, restaurants, etc)

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 - “Use-it-this-week-or-lose-it” nature of coupons cause immediate consumption responses
 - Category-specific coupons target hard-hit sectors (shopping, restaurants, etc)
- Leverage quasi-experimental coupon-dispensing rules and internal data from Alipay to study stimulus effects and mechanisms

Outline of the talk

- Introduction
- **Background and data**
- Estimating stimulus effects
 1. Program pickup Coupon usage
 2. Causal effect on spending
 3. Spending substitution
- Consumer welfare
- Conclusion

Background: Shaoxing's COVID response and consumption plunge

- Study city: Shaoxing (prefecture-level city in Zhejiang province)
 - Population in 2019 = 5 million
 - Per cap GDP = 114,317 yuan (top 10% cities in China)
 - Disposable income = 53,830 yuan
 - Real GDP growth = 7% (nationwide = 6.1%)
- Shaoxing follows a typical Zhejiang growth model
 - Encourages small businesses, bulk production of low-cost, small-value commodities
 - (Famous for specialty food: poultry, traditional wine, tofu, tea)
 - Also emphasizes role of R&D (AI & next-gen communication tech): annual R&D budget >2.4% of GDP; one of the 30 most innovative cities (Forbes China 2018)

Location of Shaoxing Prefecture and Zhejiang Province

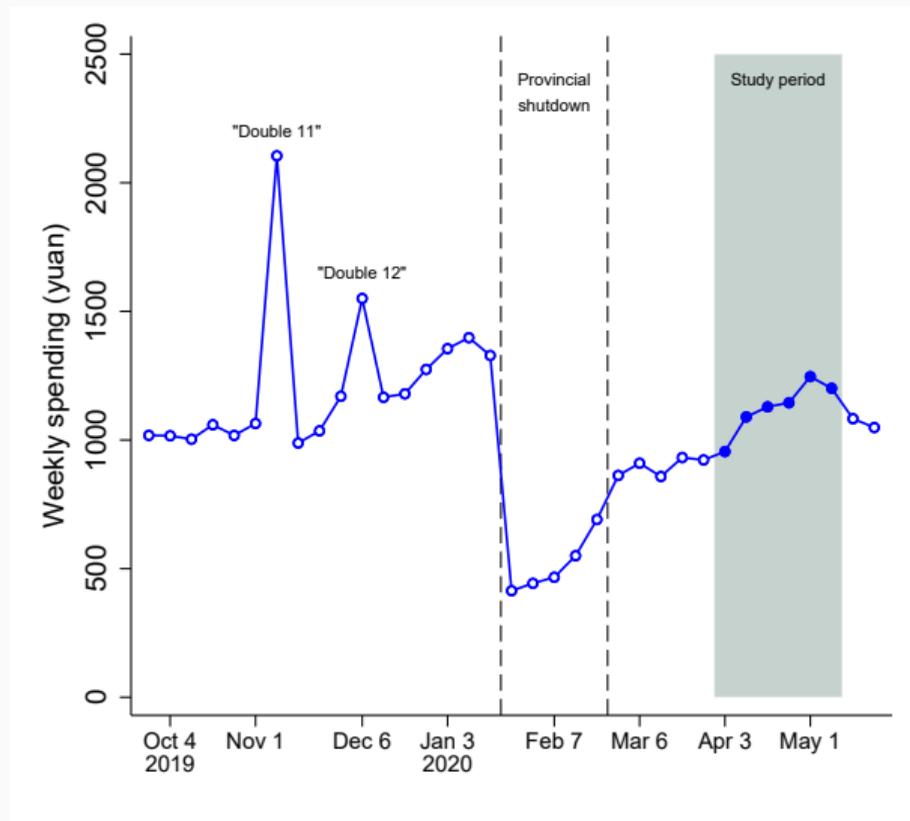


Notes: This map shows location of Zhejiang province (light blue) and the prefecture-city of Shaoxing (deep blue). Lines are provincial borders.

Background: Shaoxing's COVID response and consumption plunge

- In mid January 2020, follows Zhejiang's provincial lead and implements a city-wide stay-at-home order to contain spread of COVID-19
 - Non-essential businesses closed; schools closed; strict limitations of highway traffic
 - January 23 (Wuhan's lockdown): 1 case, 0 death
 - February 28 (6 weeks after shutdown): re-opening began
 - March 16, active cases reached and remained 0 (42 cumulative cases, 0 death)
 - March 25, all businesses allowed to open
- Consumption toll
 - Gov official stat: -26.7% from 2019Q4 to 2020Q1
 - Alipay platform (our data): -21% from 2019Q4 to 2020Q1

Consumption Trends, October 2019 - May 2020

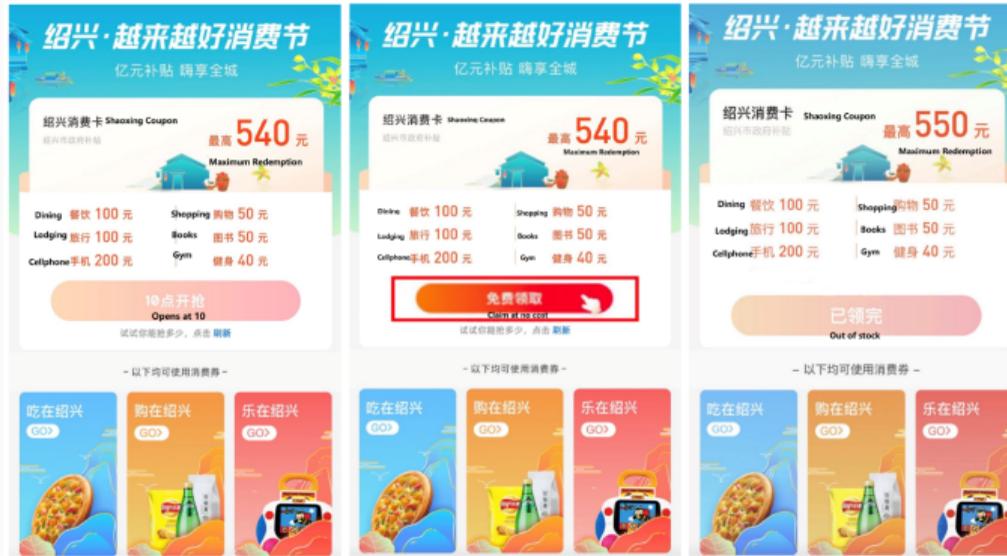


Notes: Weekly per person spending among the study population. "Provincial shutdown" indicates the period between Zhejiang province's COVID-19 shelter-in-place order issuance and Shaoxing city's re-opening date. "Study period" highlights the six weeks with Coupon Rush events. 1000 CNY \approx 144 USD in 2019.

Background: Shaoxing's coupon program

- Program announced March 25, 2020
- Six rounds of “**Friday Coupon Rush**” events: April 3/10/17/24, and May 1/8
- **Coupon-claiming rules:**
 - On each of these Fridays, Alipay users can access a Coupon Rush webpage, which contains a link to a coupon-claiming portal
 - Portal opens 10:00 am; the portal “contains” a fixed stock of coupons
 - Coupons are first-come-first-served: all users logged onto the portal after 10:00 am will obtain a **coupon packet**, until all coupons were claimed
 - User can attempt the portal as many times as they want, but each user can claim at most one packet per round

Screenshots of The Coupon Rush Portal



Notes: Screenshots show Alipay app's Coupon Rush portal when logged on before it is activated (left, red button text = "Opens at 10"), after it is activated but before coupons are all gone (middle, red button text = "Claim at no cost"), and after coupons are all gone (right, red button text = "Out of stock"). English translations were added by the authors. Source: weibo.com.

Background: Shaoxing's coupon program

- A **coupon packet** contains one or more combinations of sector-specific coupons
 - Dining ×2: [¥30 off ¥90+] [¥70 off ¥210+]
 - Shopping ×2: [¥20 off ¥60+] [¥30 off ¥90+]
 - Gym ×2: [¥10 off ¥25+] [¥30 off ¥75+]
 - Lodging ×2: [¥30 off ¥90+] [¥70 off ¥210+]
 - Book ×2: [¥25 off ¥50+]
 - Cellphone ×1: [¥200 off ¥2,000+]
- Earlier winners win richer packet (more details in the paper)
- All coupons expire in 7 days (i.e., the following round of Coupon Rush begins)

Background: Shaoxing's coupon program

- **Redemption rules:**

- Can use in any merchants accepting Alipay
- Can redeem at most 1 coupon per transaction
- Cannot split 1 coupon across multiple transactions
- Cannot use for online purchases
- Cannot share to others

Example Screenshot of Coupon Redemption



Notes: This screenshot shows an example transaction of ¥100 that met the requirement of a [¥30 off ¥90+] coupon. English translations were added by the authors. Source: weibo.com.

Background: Data

- **Transaction data:** Universe of Alipay transactions in Shaoxing 2019-2020
 - For each transaction, see total value and receiving merchant
 - 2.7 million users
 - Capture 72% of total consumption (gov yearbook) in 2019
- **Program participation and redemption data:**
 - For each user, see arrival time at the coupon-claiming site (in 5-minute resolution)
 - Coupon redemption information for each transaction
- **User characteristics data:** age, gender, account inflows in 2019
 - Alipay uses a real-name system that is linked to gov-issued personal ID

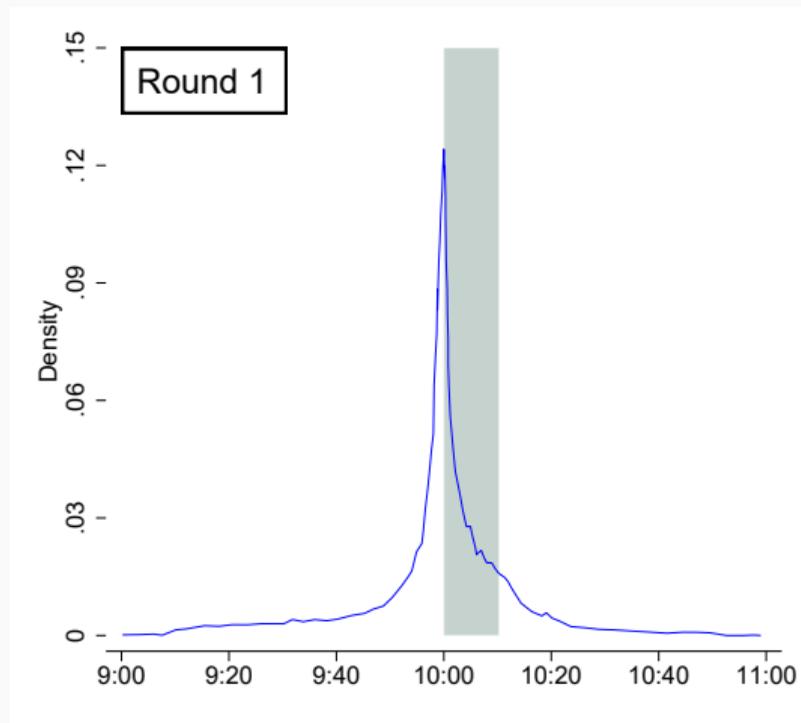
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1. Coupon program pickup

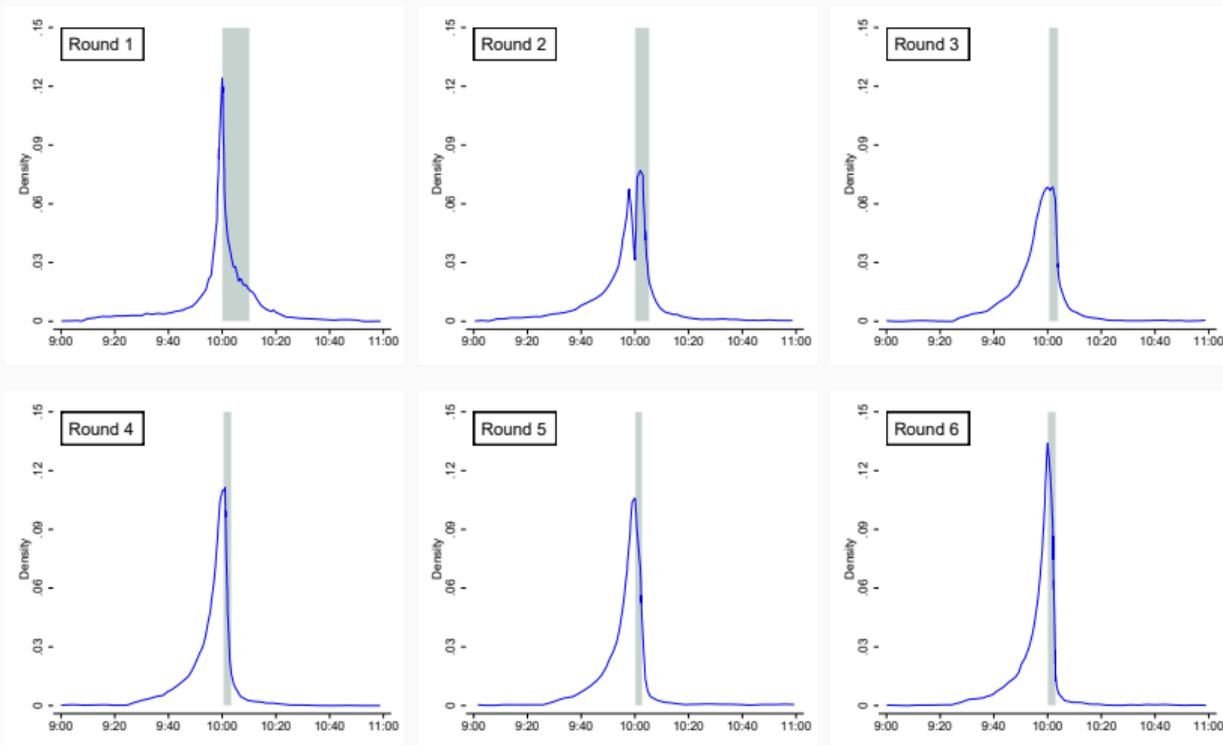
- Highly popular: attract over 1.57 million participants (58% of all Alipay users; 31% city population) over the course of six rounds
- Highly competitive: each round of coupon claiming exhibits a “rush” that spans only matter of several minutes

Click Traffic During Coupon Rush Events (Round 1)



Notes: Horizontal axis is time in hh:mm (am). Highlighted area indicates the period between the Coupon Rush event activation (10:00 am) and the moment when the last coupon is claimed.

Click Traffic During Coupon Rush Events (All Rounds)



Notes: Horizontal axis is time in hh:mm (am). Highlighted area indicates the period between the Coupon Rush event activation (10:00 am) and the moment when the last coupon is claimed.

1. Coupon program pickup

- Coupon usage rate
 - 85% of winners redeemed at least one coupon
 - 61% of the program's total subsidy values were redeemed
 - Highest redemption rate for dining (69%) and shopping (86%)
- High program participation and coupon usage rate suggest good **targeting**
 - Subsidies land in the hands of those actually want to use them
 - Money eventually goes to hard-hit sectors, e.g. restaurants and shopping malls

The Effect of Winning a Coupon on Coupon Redemption

	(1)	(2)	(3)
	1(redemption)	¥redemption	¥redemption
Coupon: any	0.859 (0.0003)	73.31 (0.06)	
Coupon: dining			73.03 (0.08)
Coupon: shopping			40.51 (0.03)
Coupon: gym, travel			15.84 (0.18)
Coupon: books, digital			94.81 (0.02)
User fixed effects	✓	✓	✓
Week fixed effects	✓	✓	✓
Observations	5,753,520	5,753,520	5,753,520

Notes: Each column shows a separate regression. Outcome variable is if any coupon is redeemed in the subsequent week (column 1), and the amount of subsidy (columns 2-3). Standard errors are clustered at the user level.

2. Causal effects of winning coupons

- **Goal:** estimate intent-to-treat effect of winning a coupon packet on subsequent consumption

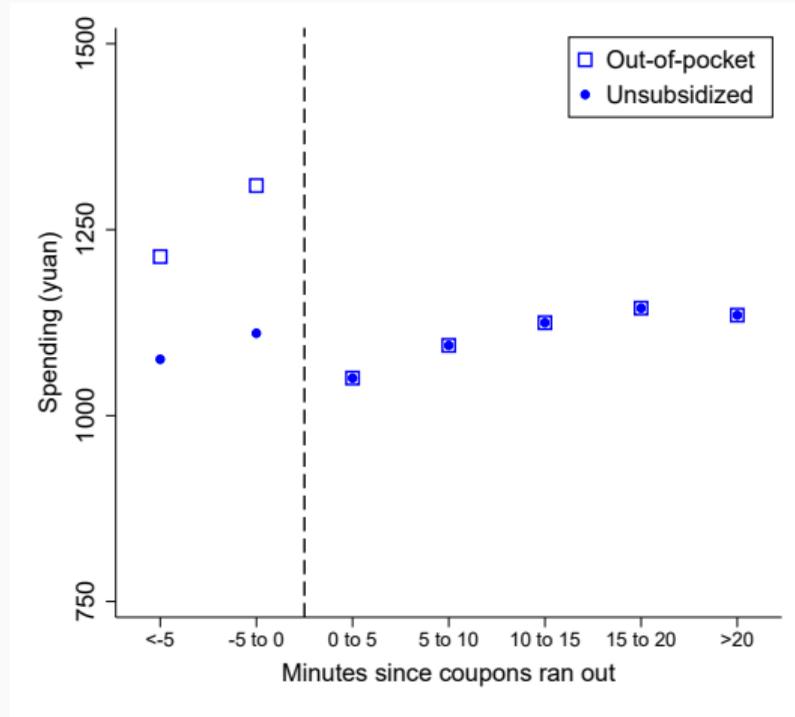
2. Causal effects of winning coupons

- **Goal:** estimate intent-to-treat effect of winning a coupon packet on subsequent consumption
- **Identification:** exploit coupon rush, compare consumption of users who barely won and users who barely lost
 - **Treated group:** users logged on within 5 minutes before the last coupon was claimed
 - **Control group:** users logged on within 5 minutes after the last coupon was claimed
 - For privacy, cannot access finer time stamp; but, show evidence that 5-min resolution is fine enough for quasi-experimental comparison

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 - For privacy, cannot access finer time stamp; but, show evidence that 5-min resolution is fine enough for quasi-experimental comparison
- **Key outcome:** 7-day spending (Friday to next Thursday, recall coupon's expiration structure)
 - Out-of-pocket spending: total spending - coupon subsidy
 - Unsubsidized spending: total spending - all transactions that involved coupon redemption

Coupon-Winning and Subsequent Week's Spending



Notes: User subsequent week's spending as a function of relative time of the user's first attempt to click and log onto the Coupon Rush portal during the event day (0 = the minute when the last coupon was claimed).

2. Causal effects of winning coupons

- **Threat to identification:** Selection into treated group (-5 to 0 minutes) and control group (0 to 5 minutes)

2. Causal effects of winning coupons

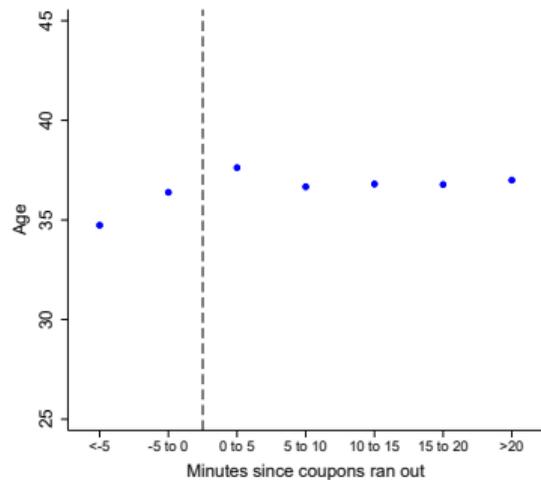
- **Threat to identification:** Selection into treated group (-5 to 0 minutes) and control group (0 to 5 minutes)
- Assess identification assumption in 3 ways:
 1. Balance test
 2. Pre-trend test
 3. Panel individual fixed effects estimation

2. Causal effects of winning coupons

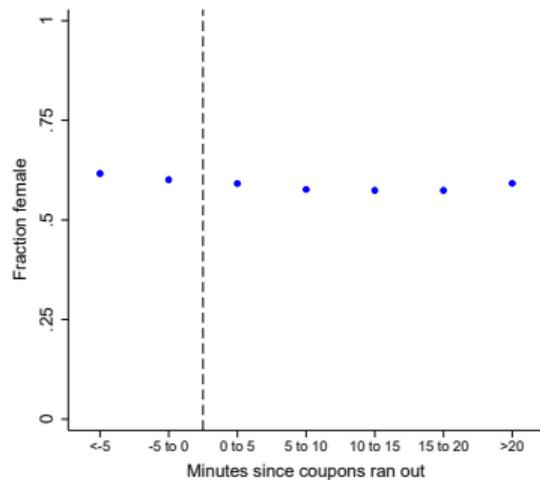
- **Balance test:** compare pre-treatment user characteristics that we can observe in the data
 - Age
 - Gender
 - User account cash inflow in 2019 (proxy for income)
- In the absence of selection, expect treated and control's observable characteristics to be similar

Coupon Rush Participants' User Characteristics

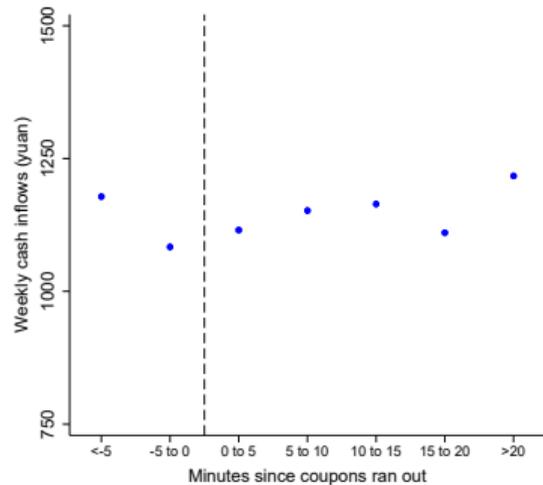
Age



Gender



"Income"

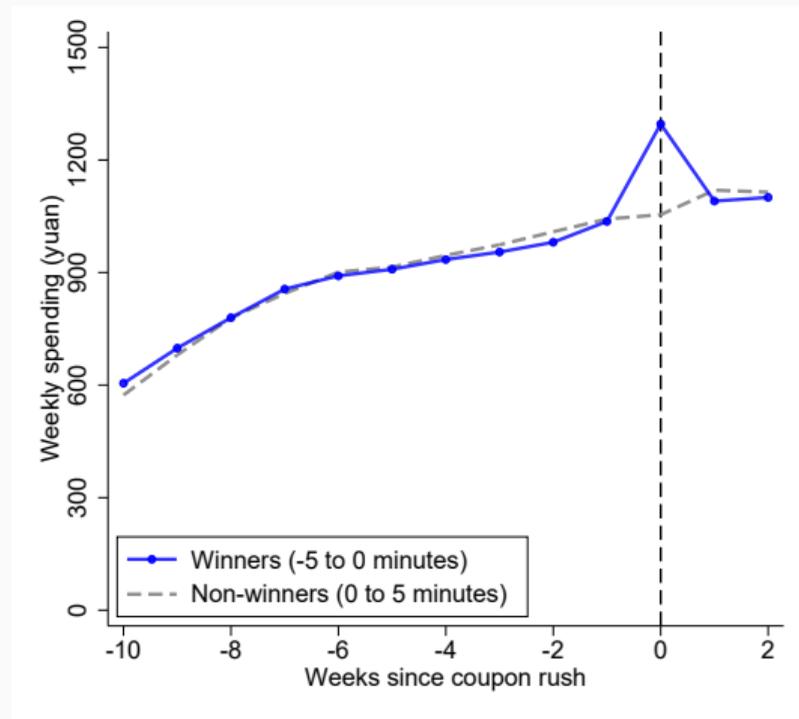


Notes: User characteristics as a function of relative time of the user's first attempt to click and log onto the Coupon Rush portal during the event day (0 = the minute when the last coupon was claimed)

2. Causal effects of winning coupons

- **Pre-trend test:** compare trends in treated and control group's spending prior to the treatment
- In the absence of selection, expect treated and control's consumption pre-trends to match

Event-Time Trends in Weekly Spending



Notes: Graphs show weekly spending as a function of weeks relative to the Coupon Rush event (event week "0"). The underlying data is a balanced panel of users who participated in each of the six rounds of coupon rush events.

2. Causal effects of winning coupons

- **Panel estimation equation:** use within-person variation across weeks that the user won coupons versus not

$$Y_{it} = \alpha + \beta \cdot 1(\text{Coupon})_{it} + \eta_i + \eta_t + \epsilon_{it} \text{ for } i \in [-5, 5] \text{ minutes}$$

- $1(\text{Coupon})_{it}$: 1 if user i won coupons at week t ; 0 if did not win or did not participate in Rush that week
 - η_i, η_t : user fixed effects and week fixed effects
 - Cluster SEs at the user level
- In the absence of selection, expect η_i, η_t to have little impact on point estimates of β

The Effect of Winning a Coupon on Subsequent Week's Spending

	(1)	(2)	(3)
Total spending	303.61 (11.46)	283.69 (11.28)	299.34 (5.13)
Out-of-pocket spending	224.76 (11.46)	225.36 (11.99)	225.68 (5.13)
Unsubsidized spending	32.16 (11.45)	25.08 (11.98)	49.31 (5.12)
User characteristics		✓	
User fixed effects			✓
Week fixed effects		✓	✓
Data structure	repeated CS	repeated CS	panel
Standard error adjust.	robust	robust	user clst.
¥OOP per ¥1 subsidy	3.07	3.07	3.08
No-coupon group mean	1,053.57	1,189.09	1,031.87
Observations	1,679,728	1,679,728	5,753,520

Notes: Each cell corresponds to a separate regression. "User characteristics" include age, indicator for female, and weekly cash inflow in 2019. "repeated CS" means a repeated cross-section data structure. "user clst." means the standard error is clustered at the user level. "¥OOP per ¥1 subsidy" shows the amount of out-of-pocket consumption stimuli per 1 CNY of coupon subsidy.

2. Causal effects of winning coupons

- Summary of findings so far:
 - 86% of winners end up redeeming coupon(s)
 - Average subsidy per redemption is ¥73
 - Winner raises out-of-pocket spending by ¥255
 - Winner raises unsubsidized spending by ¥30

2. Causal effects of winning coupons

- Summary of findings so far:
 - 86% of winners end up redeeming coupon(s)
 - Average subsidy per redemption is ¥73
 - Winner raises out-of-pocket spending by ¥255
 - Winner raises unsubsidized spending by ¥30
- This stimulus effect is large: over ¥3 oop increase per ¥1 government subsidy
 - MPC of traditional cash stimulus program typically between 0.2 and 0.8
 - 1999 Japan shopping coupon: 0.17 (Hsieh, Shimizutani, Hori, 2010)
 - 2001 U.S. tax rebates: 0.37 (Shapiro, Slemrod, 2003; Johnson, Parker, Souleles, 2006)
 - 2008 U.S. tax rebates: 0.35 (Shapiro, Slemrod, 2009)
 - 2009 Taiwan shopping voucher: 0.24 (Kan, Peng, Wang, 2017)
 - 2011 Singapore growth dividend: 0.8 (Agarwal, Qian, 2014)
 - 2020 U.S. CARES Act: 0.3 (Baker et al., 2020; Chetty et al., 2020)

3. Spending substitution

- **Concern:** An increase in subsidized spending may be offset by a decrease in spending elsewhere. If true, we would overestimate the net effect of the program
- We assess three potential types of substitution:
 1. \uparrow subsidized spending \Rightarrow \downarrow unsubsidized spending
 2. \uparrow spending this week \Rightarrow \downarrow spending in future weeks
 3. \uparrow spending on Alipay \Rightarrow \downarrow spending on other platforms (or cash)

3. Spending substitution

- First, whether \uparrow subsidized spending \Rightarrow \downarrow unsubsidized spending?

3. Spending substitution

- First, whether \uparrow subsidized spending \Rightarrow \downarrow unsubsidized spending?
- **No.** We have already shown that winners increase unsubsidized spending by ¥30
 - If anything, we find coupon's effect spilled over to non-subsidized transactions

3. Spending substitution

- Second, whether \uparrow spending this week \Rightarrow \downarrow spending in future weeks?
- We estimate intertemporal specification, using 3-week or 6-week spending as the outcome variable
 - Ex: the effect of winning a coupon on April 3 on total spending between April 3 through April 23 (3-week)
 - If **no substitution**, 3-week effect point estimate should equal 1-week estimate (+¥255 in week 1, +¥0 in weeks 2-3)
 - If **perfect substitution**, 3-week effect should be zero (+¥255 in week 1, -¥255 in weeks 2-3)

The Effect of Winning a Coupon on Longer-Term Spending

	(1)	(2)	(3)
	1-week	3-week	6-week
Total spending	299.34 (5.13)	273.82 (9.28)	240.30 (13.60)
Out-of-pocket spending	225.68 (5.13)	200.30 (9.28)	173.56 (13.60)
Unsubsidized spending	49.31 (5.12)	23.97 (9.27)	20.09 (13.59)
User fixed effects	✓	✓	✓
Week fixed effects	✓	✓	✓
No-coupon group mean	1,031.87	3,125.67	6,325.56
Observations	5,737,520	5,737,521	2,876,760

Notes: This table shows regression coefficients and standard errors (in parentheses) of spending in the next k weeks (including the current week) on an indicator for coupon-winners of the week. Each cell corresponds to a separate regression. Standard errors are clustered at the user level.

3. Spending substitution

- Second, whether \uparrow spending this week \Rightarrow \downarrow spending in future weeks?
- **Somewhat.** We estimate that over 85% of the initial stimulus effect persists through the end of the third week, and over 75% of the effect persists through the end of six weeks

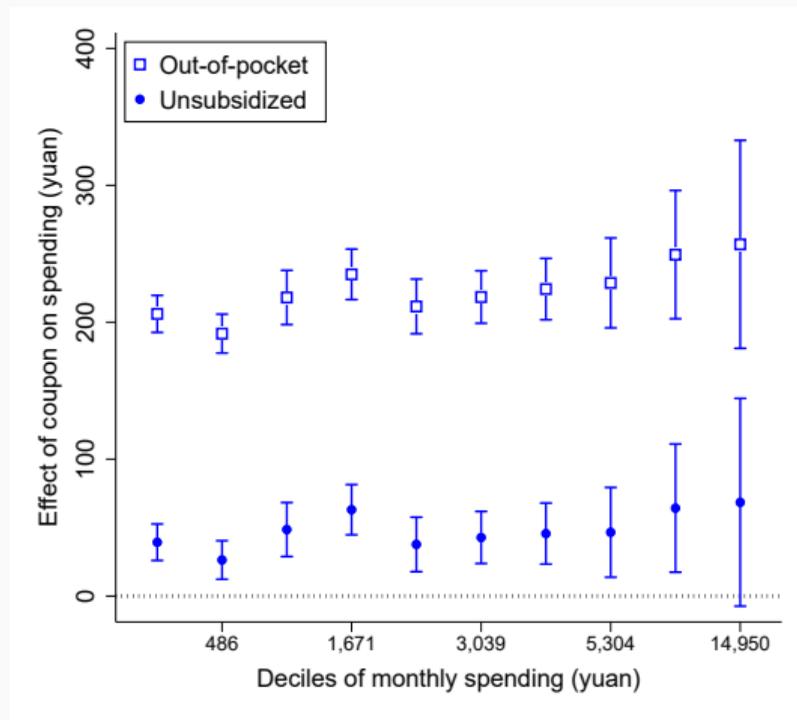
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- Third, whether \uparrow spending on Alipay \Rightarrow \downarrow spending on other platforms (or cash)?
- Cannot directly examine the remaining 28% of city-wide consumption that occurs through other digital platforms (e.g., WeChatpay) and cash
- Instead, hone in on subgroups of “spontaneous” Alipay users that are less likely to exhibit cross-platform substitution
 1. Those who made lots of transactions in 2019 (heavy users in the absence of coupon program)
 2. Those who opened account in 2019 or earlier (leave out those who joined Alipay because of the coupon program)

Heterogeneous Effects of Winning a Coupon by Monthly Average Spending in 2019



Notes: Graphs report interaction coefficients of coupon-winning and indicators for user's 2019 monthly average spending on Alipay. Horizontal axis shows midpoints of decile bins. Bars show 95% confidence interval constructed using standard errors clustered at the user level.

3. Spending substitution

- Overall, no sign of substantial spending substitution
- Coupon program has net stimulus effect

Outline of the talk

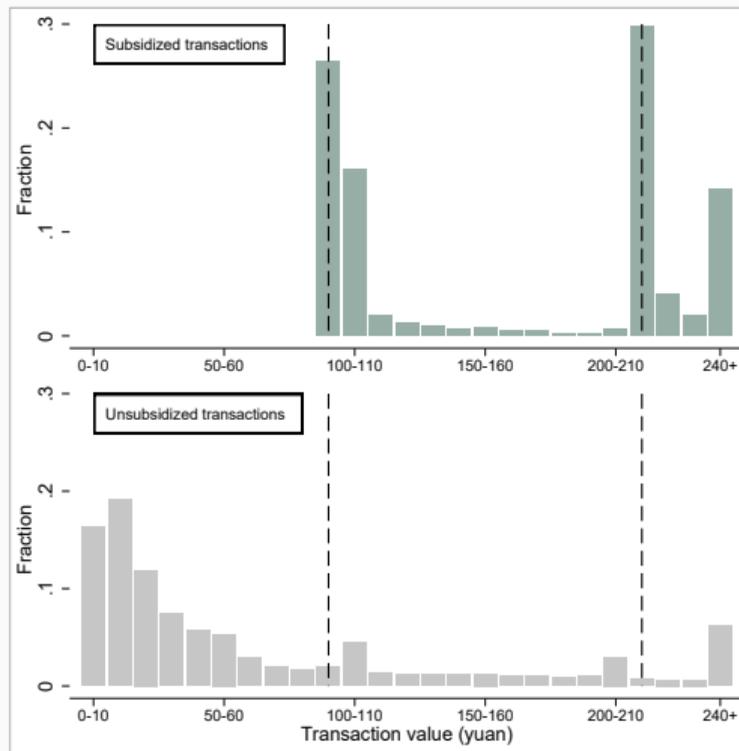
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- **Consumer welfare**
- Conclusion

Consumer welfare

- Spending stimulus \nRightarrow welfare improvement
 - If winners buy stuff they would have bought anyways, then coupons are pure discount
 - If coupons' spending threshold induce winners to buy stuff they would not otherwise, then coupons creates consumption distortion
- Thus, important to understand the mechanism underlying coupons' stimulus effect

Value of Transaction with and without Coupon Redemption

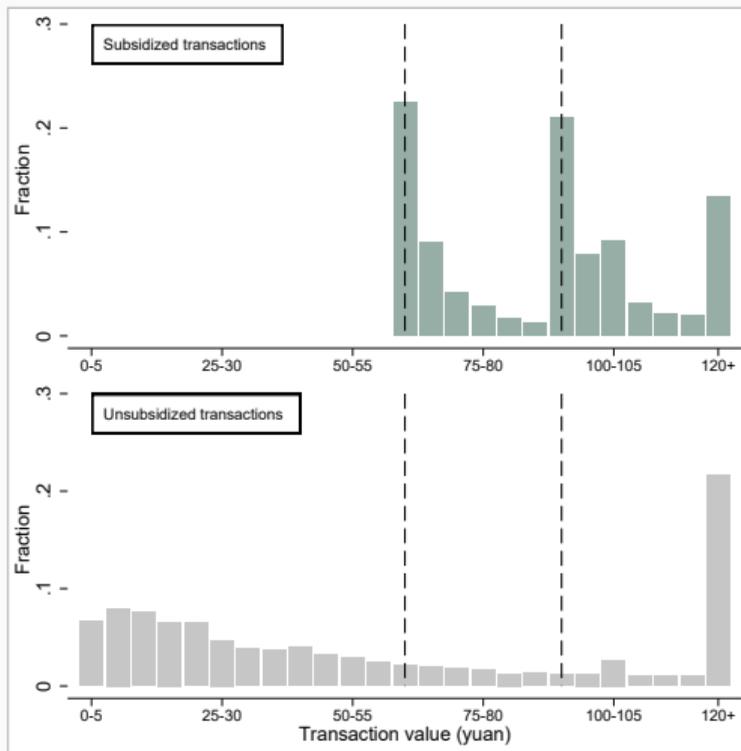
Dining: [¥30 off ¥90+] [¥70 off ¥210+]



Notes: For each subsidized transaction, we randomly match it with a transaction that didn't involve coupon redemption and occurred at the same merchant on the same day ("unsubsidized transaction"). Vertical dashed lines mark the coupons' minimum consumption requirements.

Value of Transaction with and without Coupon Redemption

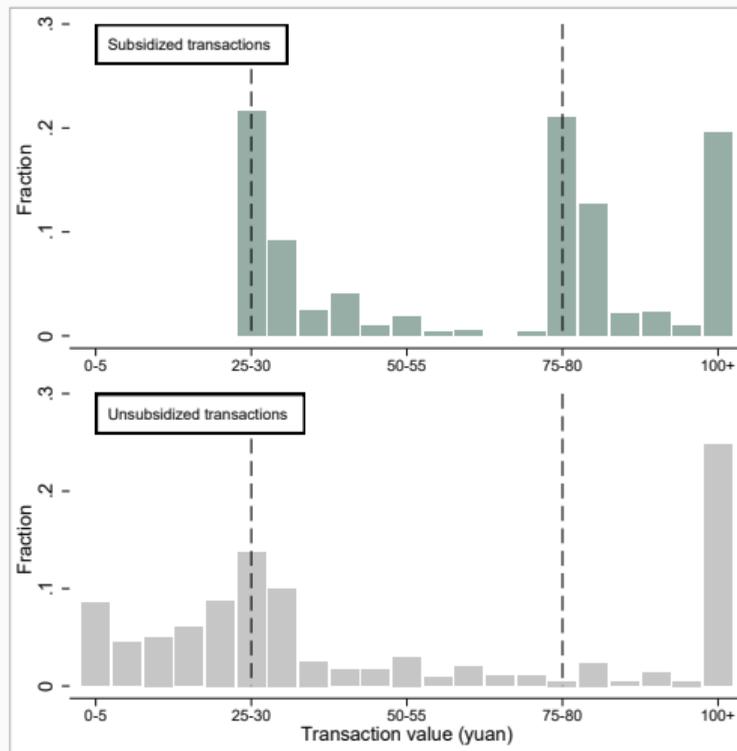
Shopping: [¥20 off ¥60+] [¥30 off ¥90+]



Notes: For each subsidized transaction, we randomly match it with a transaction that didn't involve coupon redemption and occurred at the same merchant on the same day ("unsubsidized transaction"). Vertical dashed lines mark the coupons' minimum consumption requirements.

Value of Transaction with and without Coupon Redemption

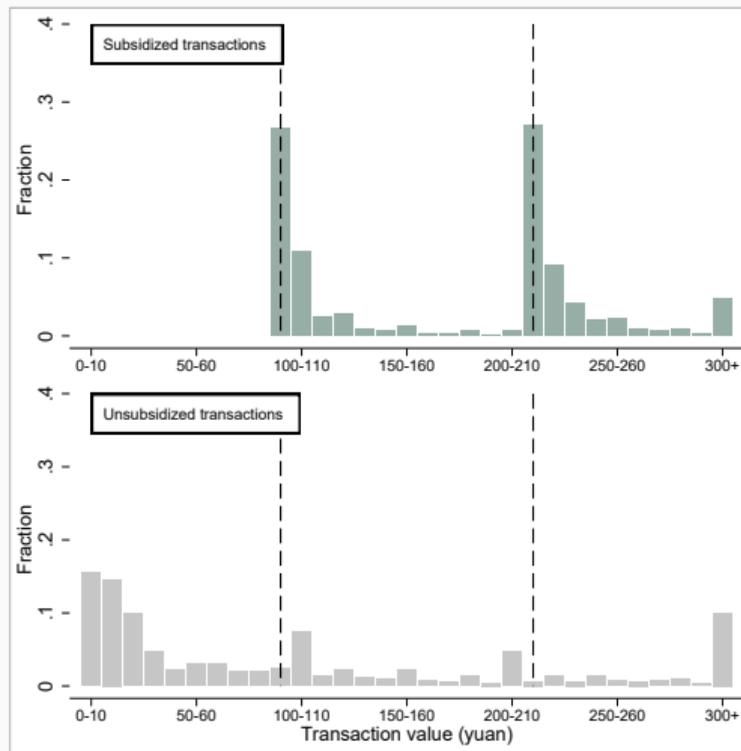
Gym: [¥10 off ¥25+] [¥30 off ¥75+]



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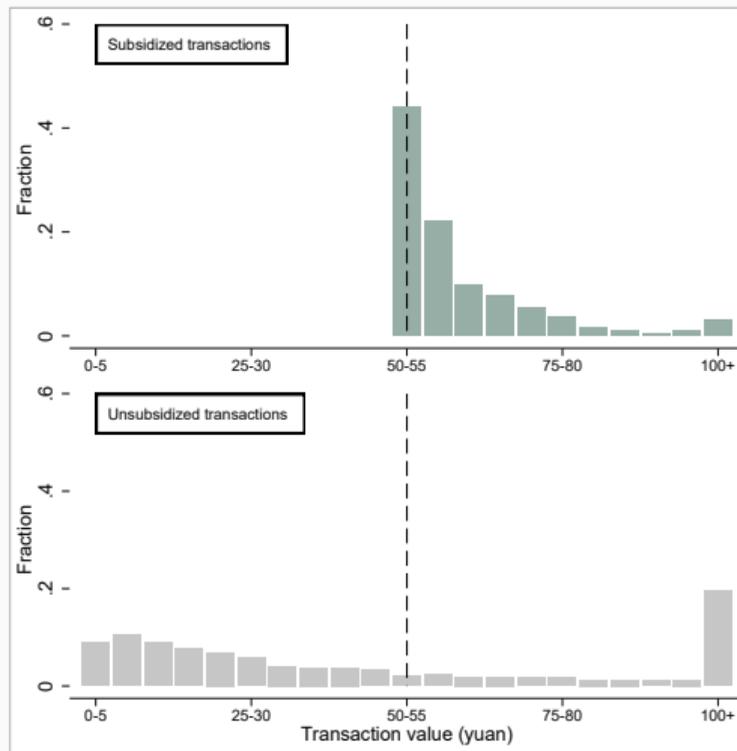
Lodging: [¥30 off ¥90+] [¥70 off ¥210+]



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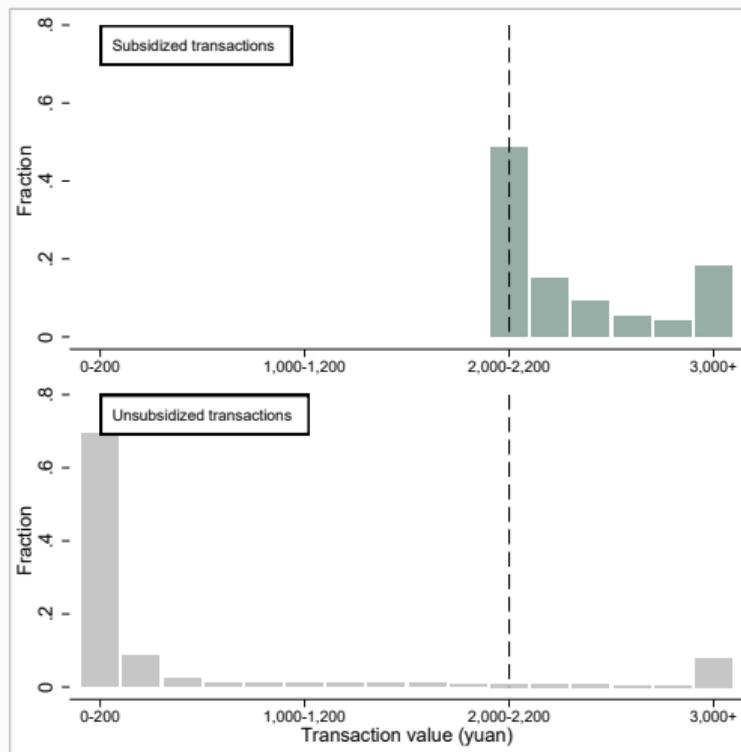
Book: [¥25 off ¥50+]



Notes: For each subsidized transaction, we randomly match it with a transaction that didn't involve coupon redemption and occurred at the same merchant on the same day ("unsubsidized transaction"). Vertical dashed lines mark the coupons' minimum consumption requirements.

Value of Transaction with and without Coupon Redemption

Cellphone: [¥200 off ¥2,000+]

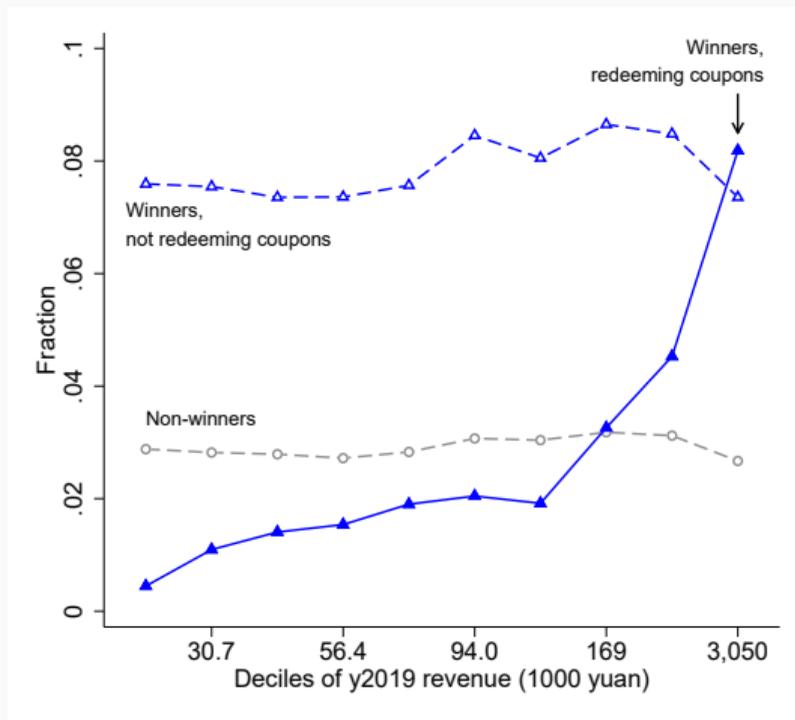


Notes: For each subsidized transaction, we randomly match it with a transaction that didn't involve coupon redemption and occurred at the same merchant on the same day ("unsubsidized transaction"). Vertical dashed lines mark the coupons' minimum consumption requirements.

Consumer welfare

- **Question:** Does coupon distort consumption?
- **Thought experiment:** take a coupon program participant who's about to make the next shopping trip, analyze how her consumption choice depends on coupon-winning status
 - Non-winner
 - Winner, but does not intend to redeem coupon this trip
 - Winner, intend to redeem coupon this trip
- **Implementation:** Rank shopping merchants from “cheapest” to “priciest”, compute fraction of weekly customer flows coming from the three categories above
- With consumption distortion, expect winners to disproportionately favor pricier options when redeeming coupons

Shopping Merchants' Weekly Customer Distributions by Coupon-Winning Status

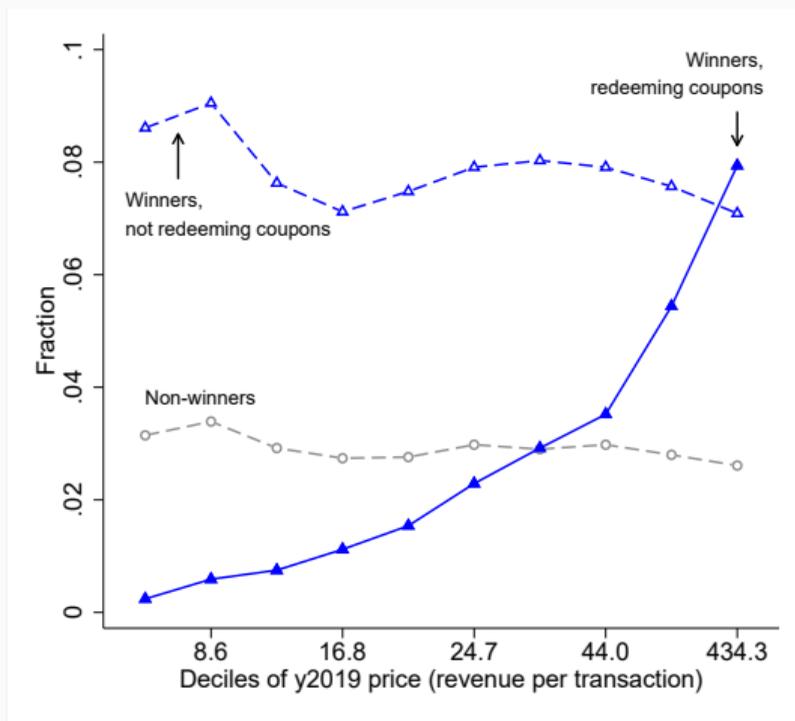
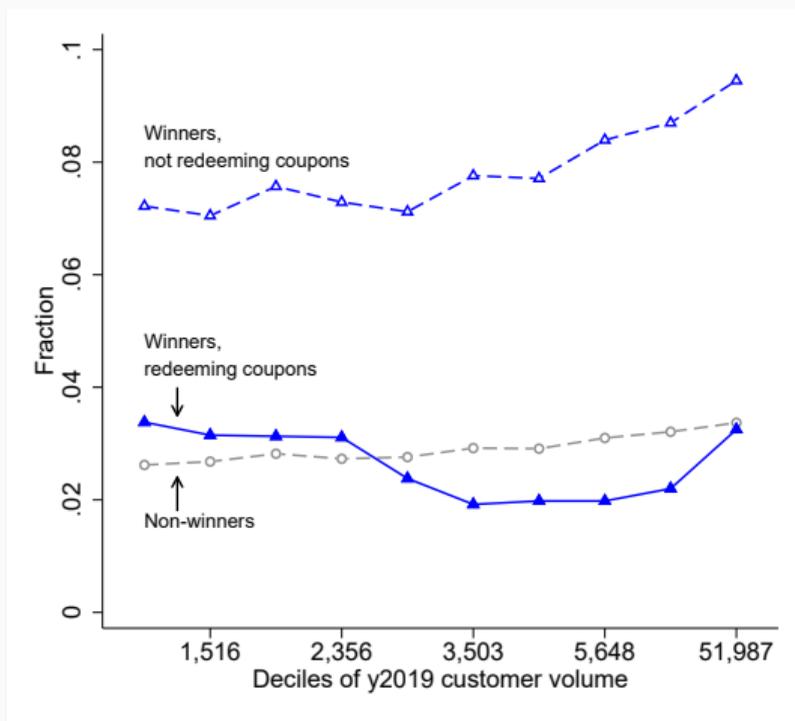


Notes: "Non-winners" are fraction of customers that participated in the week's Coupon Rush but did not win any coupon. "Winners, not redeeming coupons" are fraction of customers that won coupon(s), but did not make any coupon-eligible transactions. "Winners, redeeming coupons" are fraction of customers that won coupon(s), and made coupon-eligible transactions.

Shopping Merchants' Weekly Customer Distributions by Coupon-Winning Status

By quantity

By price



Notes: "Non-winners" are fraction of customers that participated in the week's Coupon Rush but did not win any coupon. "Winners, not redeeming coupons" are fraction of customers that won coupon(s), but did not make any coupon-eligible transactions. "Winners, redeeming coupons" are fraction of customers that won coupon(s), and made coupon-eligible transactions.

Consumer welfare

- These descriptive patterns imply that
 1. Coupons stimulate spending by directing consumption toward pricier options that the consumers would not otherwise prefer
 2. The coupon program disproportionately favors merchants that are large and sell more expensive goods, i.e., these merchants receive more business from coupon winners even on a percentage basis.

Consumer welfare

- Next, analyze a model of consumer choice with conditional discount coupons
- Two goals:
 - Demonstrate coupons with minimum spending thresholds can indeed generate (1) bunching at spending thresholds, (2) disproportionate favor for pricier firms
 - Estimate counterfactual spending thresholds that can improve consumer surplus

Consumer model: general set up

- Discrete-continuous choice framework (Hanemann, 1984; Dubin, McFadden, 1984; Hendel, 1999)
- Consumer evaluates a decision to “upgrade” consumption experience (pricier goods with higher utility) given a conditional subsidy

Consumer model: key components

- Consumer picks a preferred choice set n (i.e., an index for merchant quality), and decide optimal expenditure y_n in that set

$$\begin{aligned} \max_{n \in \{1, \dots, N\}, y_n, z} u_n(y_n, z) &= A_n(y_n)^{\alpha_n} z^{\beta} \\ \text{s.t. } y_n + z &= E_i \text{ and } y_i \cdot y_j = 0 \quad \forall i \neq j \end{aligned}$$

Consumer model: key components

- Consumer picks a preferred choice set n (i.e., an index for merchant quality), and decide optimal expenditure y_n in that set

$$\begin{aligned} \max_{n \in \{1, \dots, N\}, y_n, z} u_n(y_n, z) &= A_n (y_n)^{\alpha_n} z^{\beta} \\ \text{s.t. } y_n + z &= E_i \text{ and } y_i \cdot y_j = 0 \quad \forall i \neq j \end{aligned}$$

- Intuition: conditional discount coupon pays (small) t yuan if spending exceeds x yuan
 - If $y_{n^*}^* \geq x$, coupon is a pure transfer \Rightarrow no upgrade
 - If $y_{n^*}^* \ll x$, coupon is welfare-decreasing \Rightarrow no upgrade
 - If $y_{n^*}^* < x$, but $t +$ utility gain from better quality is welfare-improving \Rightarrow upgrade

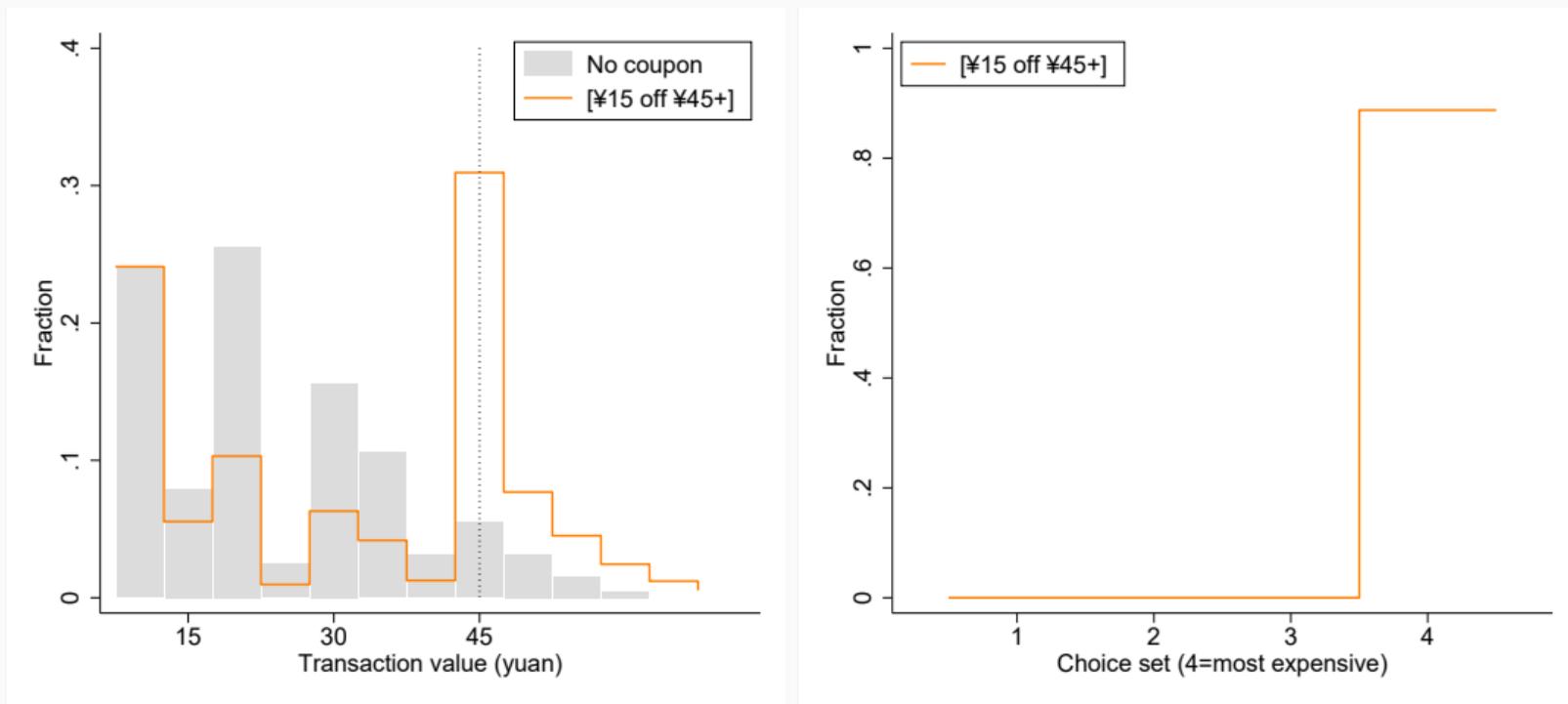
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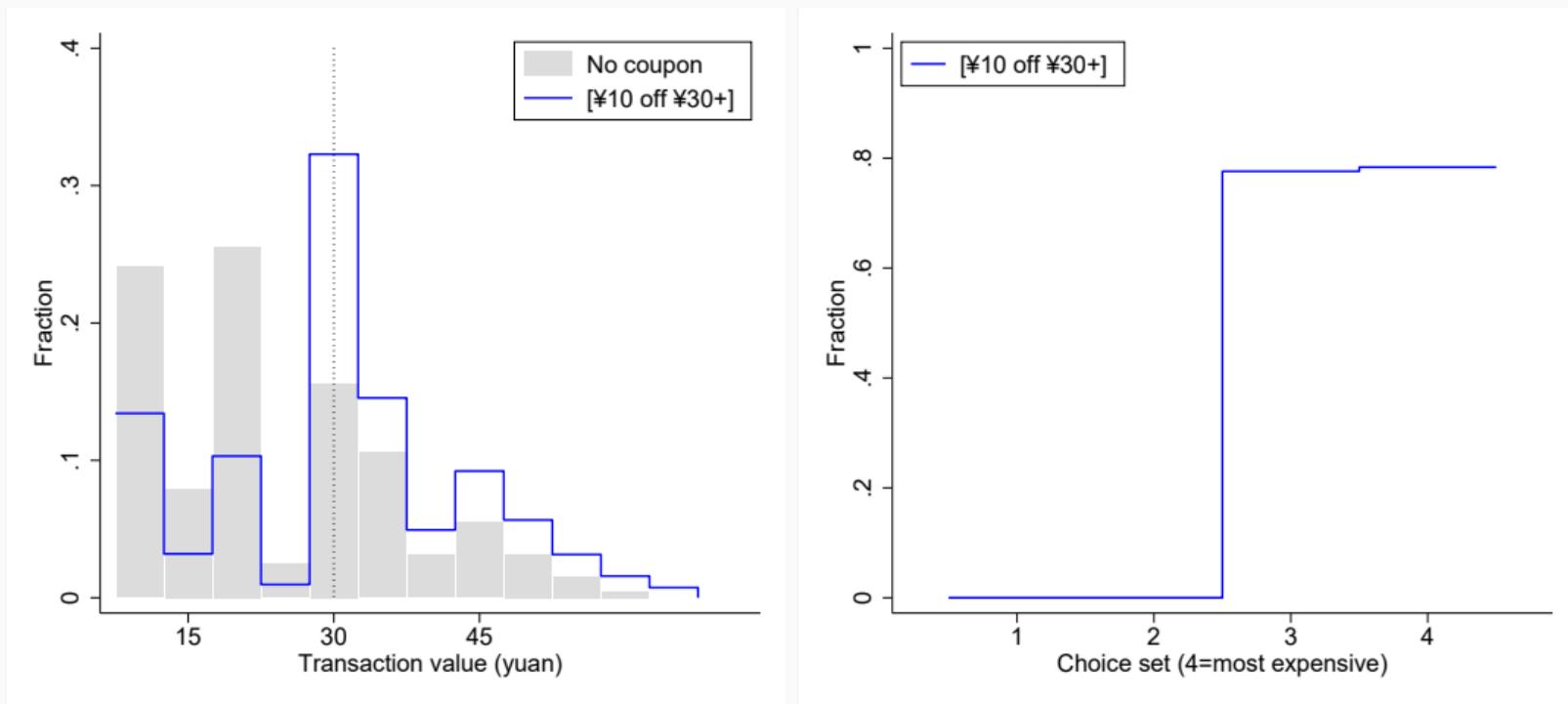
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- Paper shows: with reasonable assumptions on u and endowment distribution $\{E_i\}$:
 - Can find subsets of consumer with well-defined endowment ranges who upgrade to higher-quality set; some upgrade to spend exactly x yuan
 - Relaxing x weakly increases redemption rate and strictly increases total consumer utility

Numerical Example of Alternative Coupon Minimum Spending Requirements



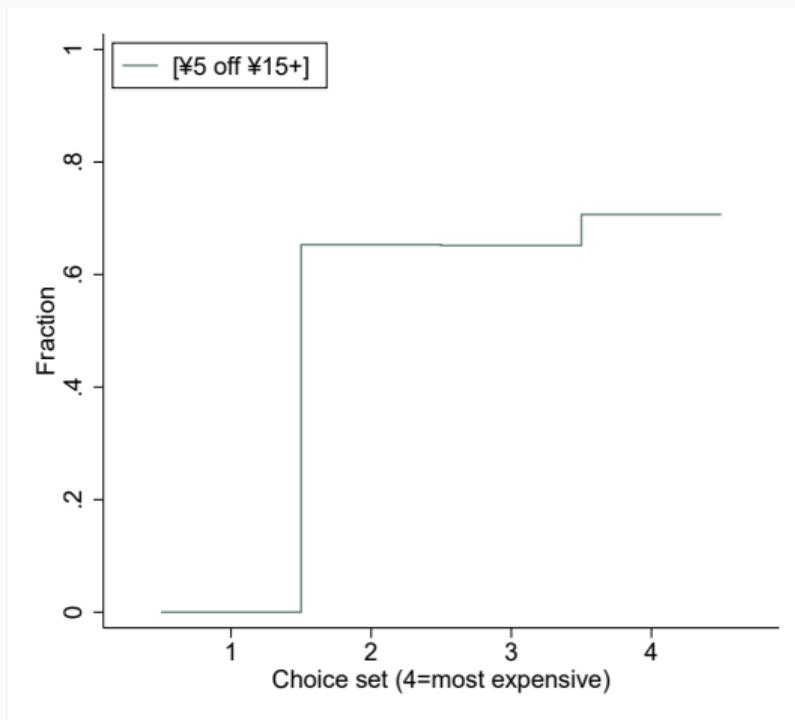
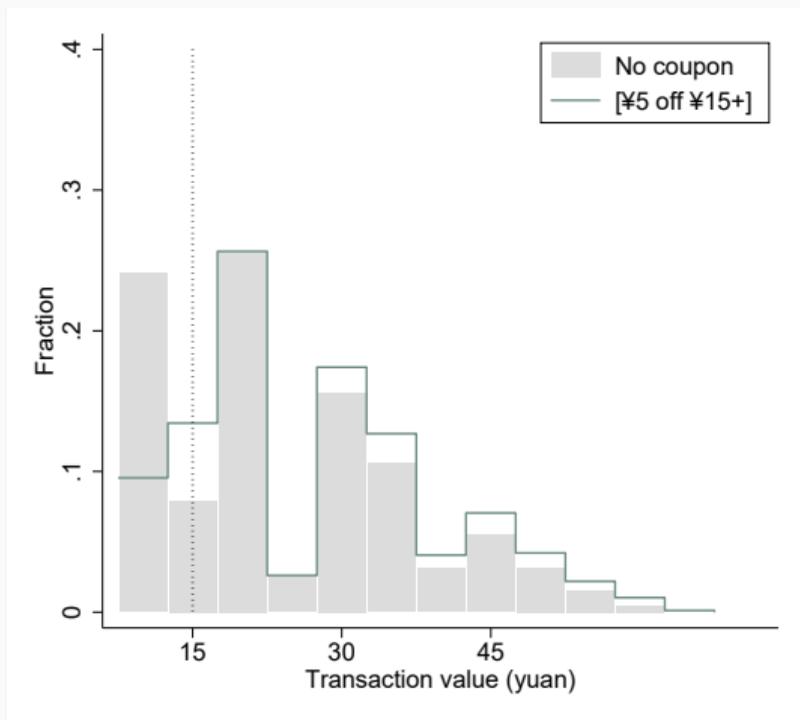
Notes: This figure shows results from a simulation of our conceptual model with alternative coupon designs. Left panel shows the distribution of consumer spending. Right panel shows the fraction of customers redeeming coupons by merchant type.

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Consumer welfare: implications

- Both empirical and theoretical analyses suggest coupon program leads to a disproportionate favor for large business that sell more expensive goods and services
- Issuing coupons with smaller minimum spending requirements would alleviate such a distributional concern, while preserving, if not increase, total consumer surplus.
- An alternative, potentially easier, solution is to allow consumers to spread a coupon's minimum spending requirement across multiple transactions

Conclusion

- Key features of coupon stimulus program
 - **Small treatment:** average subsidy value ¥73.3 per winner
 - **High compliance:** 86% winners redeemed coupon(s)
 - **Large stimulus effect:** ¥3 out-of-pocket spending per ¥1 gov subsidy
 - **Swift response:** spending response seen within 7-day (expiration)
 - **Targeting:** can target hard-hit sectors
 - **Distortion:** coupons stimulate spending by distorting consumers toward pricier options
 - **Ex-post financing:** gov do not need to pay for coupons that aren't redeemed
- We hope the coupon model can be a useful addition to policy maker's stimulus toolbox