Learning on the Go:

Understanding How Gig Economy Workers Learn with Recommendation Algorithms

Park Sinchaisri

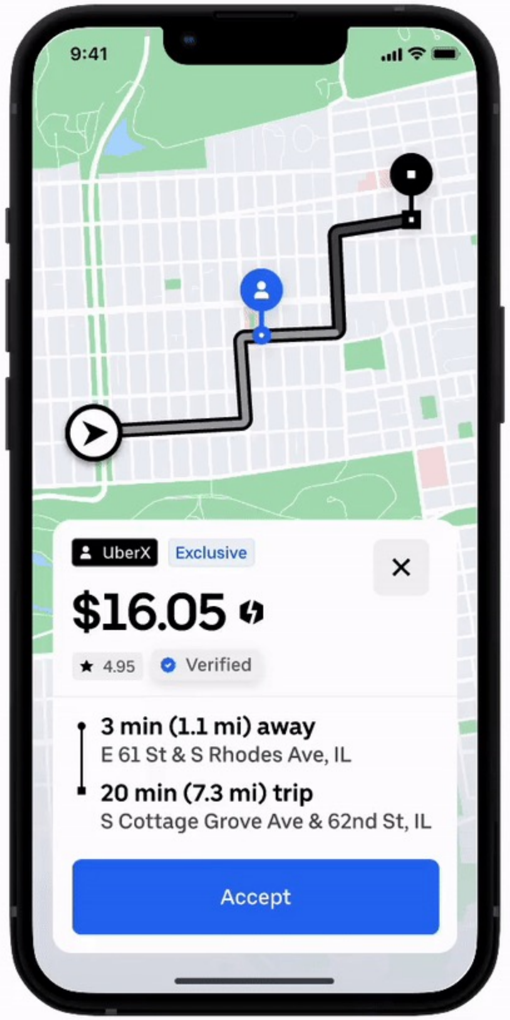
UC Berkeley

Joint work with Shunan Jiang (UC Berkeley/Google)

The Rise of the Gig Economy

- Platforms now power everyday delivery and services; 16% in US adults, 12% of global labor force
- Customers are attracted by convenience, affordable options
- Workers are attracted by flexibility and autonomy to turn work on/off, choose where/job to work

Uber
lyft
Grab
DOORDASH
deliveroo
instacart
Shipt



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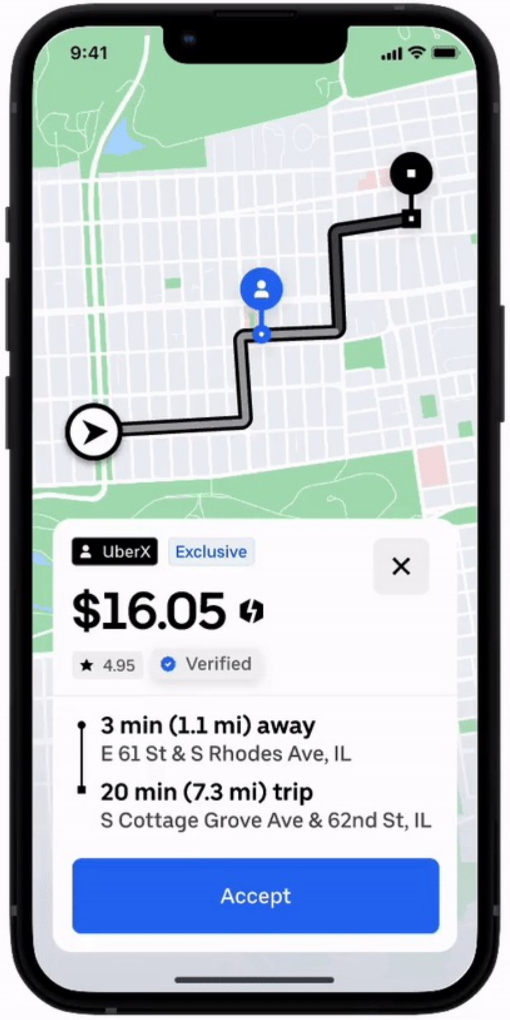
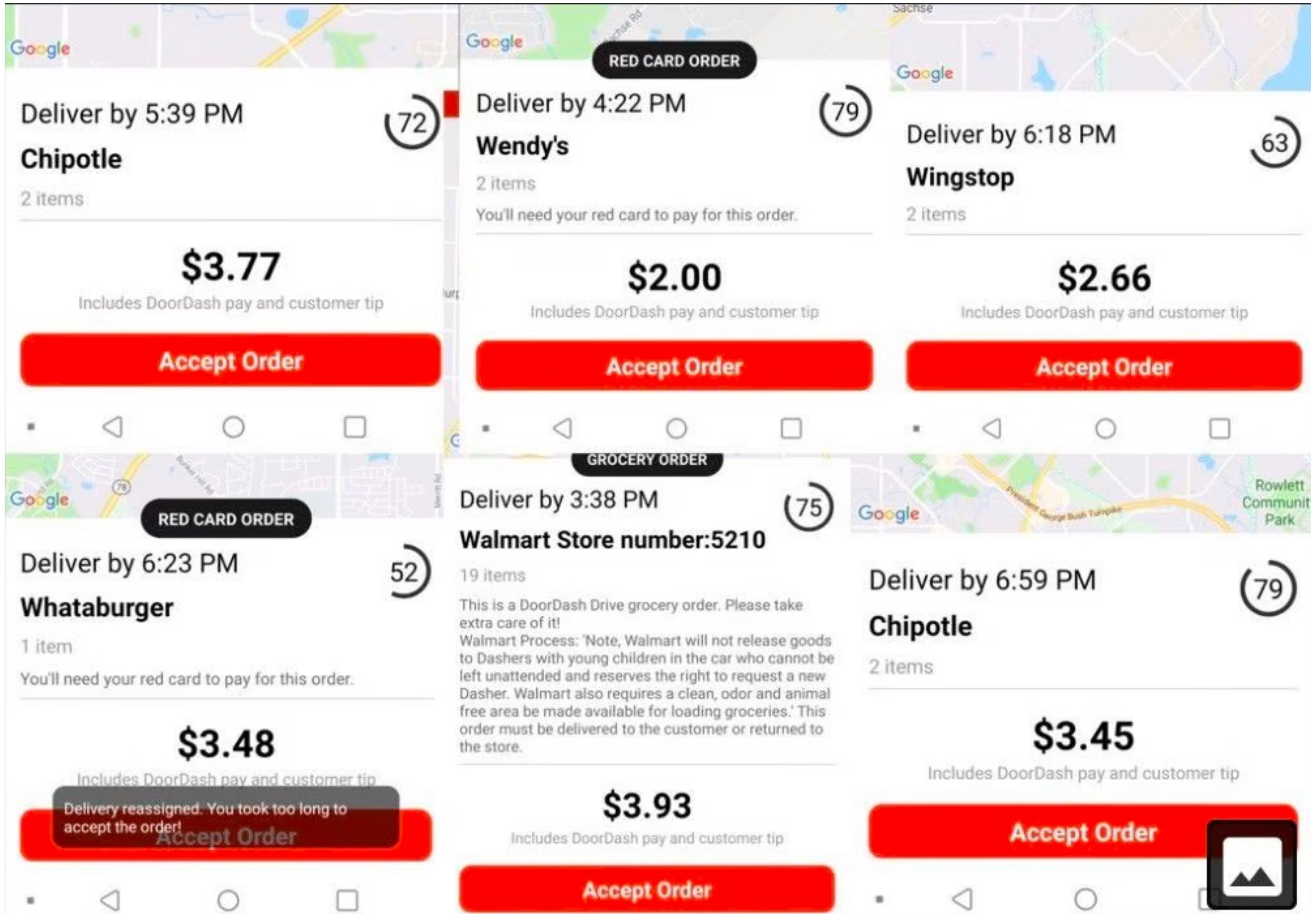
- These choices affect service reliability + their own earnings



Focus: When Workers Choose Tasks



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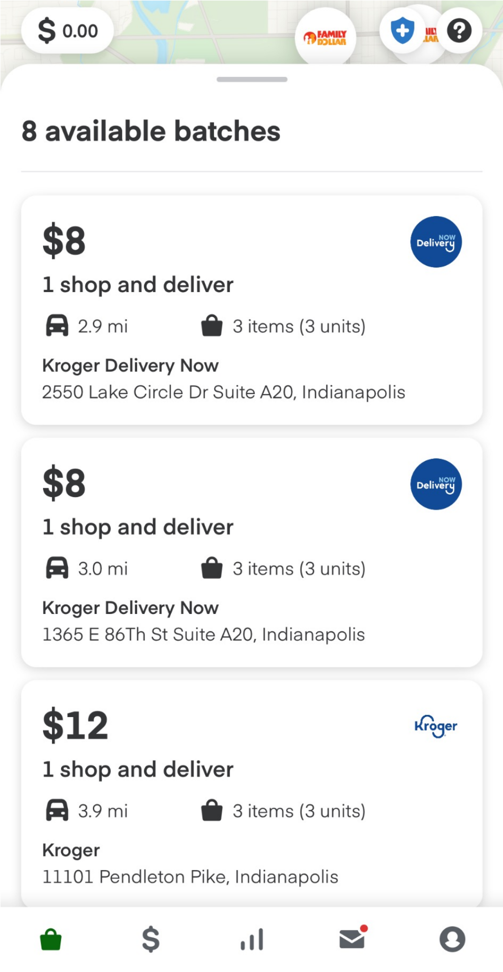

instacart

New Workers Struggle...

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r/uberdrivers · Posted by u/kanyda 8 years ago

First day report

First night: 5 hours, no riders. I think I need to change my strategy.

instacart

Sometimes the store has long lines of people or the shopper has problems finding items.

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How to perform better on jobs?

In general, humans struggle to make optimal decisions.

(Amar et al 2011, Ibanez et al 2017, KC et al., 2020)

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Tuesdays are the least profitable day of the week.

The early morning (7-10) is pretty good money.

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Humans learn from experience

(Shafer et al 2001, Boh et al 2007, Argote 2012, Bavafa & Jónasson 2021)

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Gig workers learn differently

(Allon et al 2023, Guha & Corsten 2023, Dai et al 2024, Hernandez et al 2024)

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- How do workers improve performance over time?
- How does task selection change with experience?

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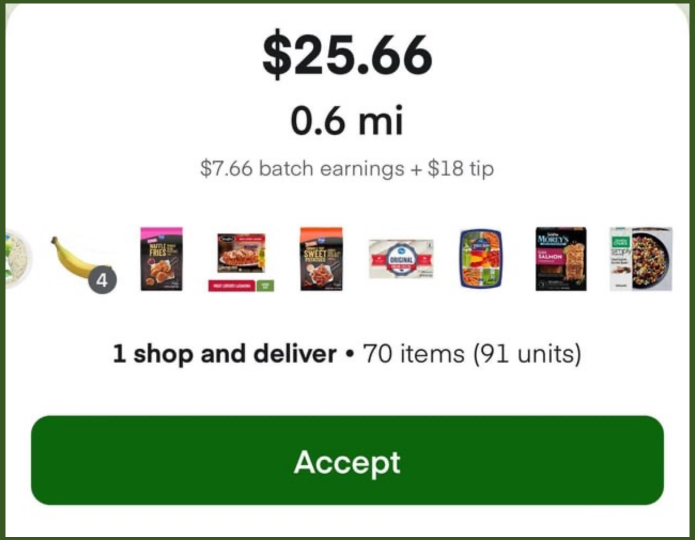
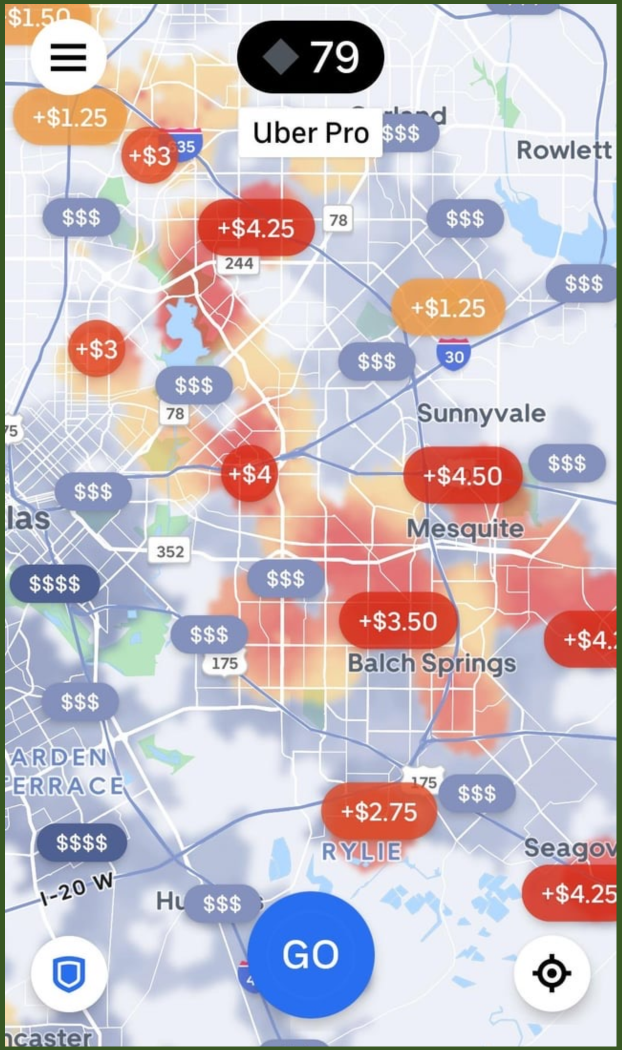
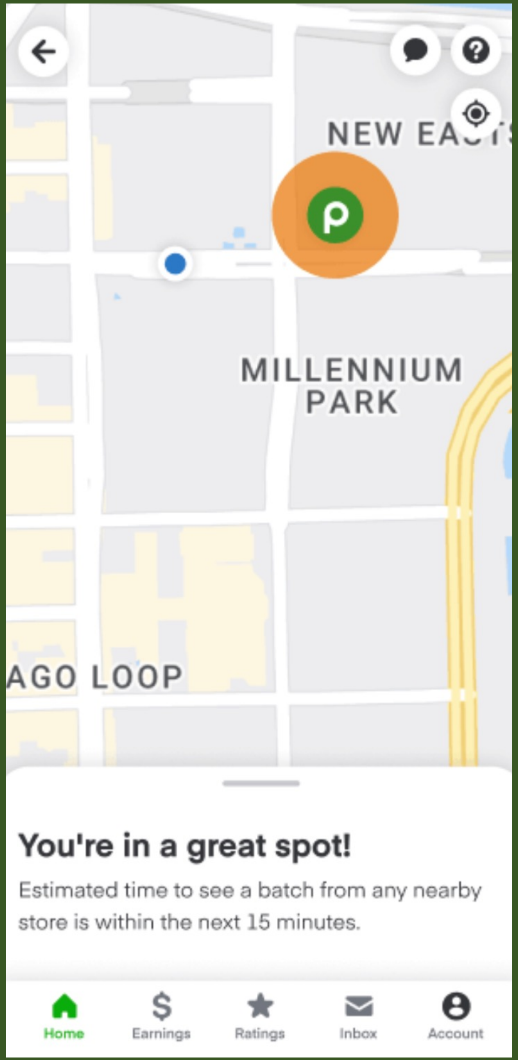


platform's recommendation system:





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(Knight et al 2022, Zhang et al 2022, Do et al 2024)

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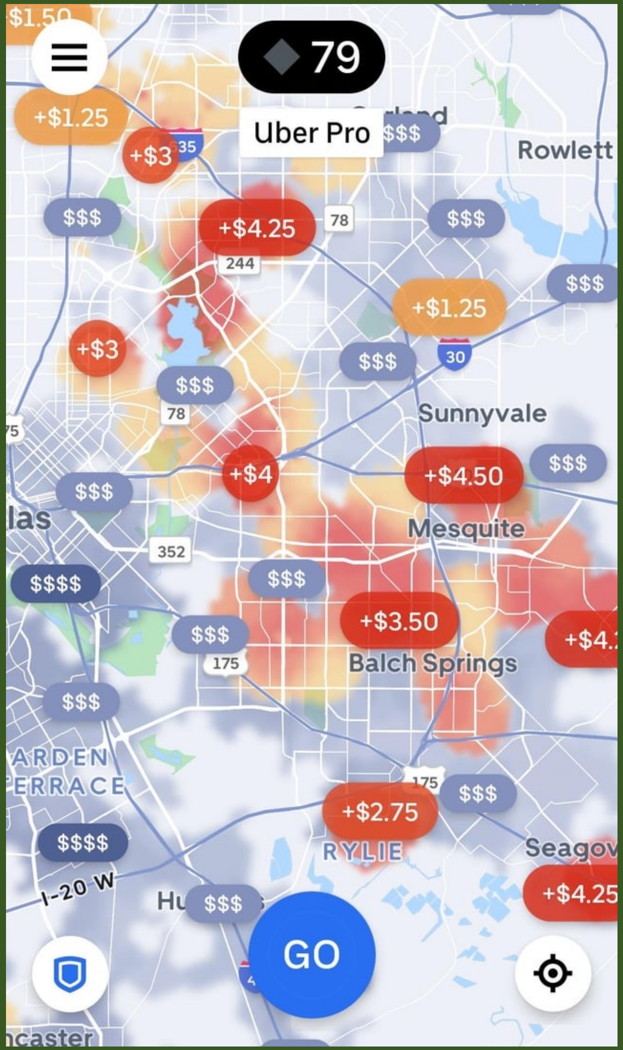

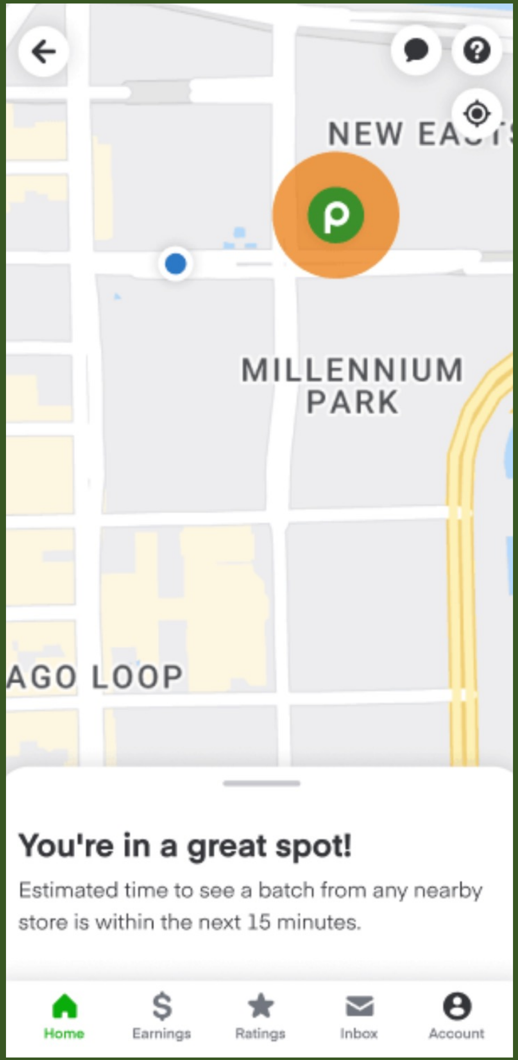

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Some benefit from them...

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...but others resist

(Dietvorst el al 2015, Dietvorst et al 2018, Castelo et al 2019, Sun et al 2022, Das Swain et al 2024, Balakrishnan et al 2025, Bastani et al 2025)

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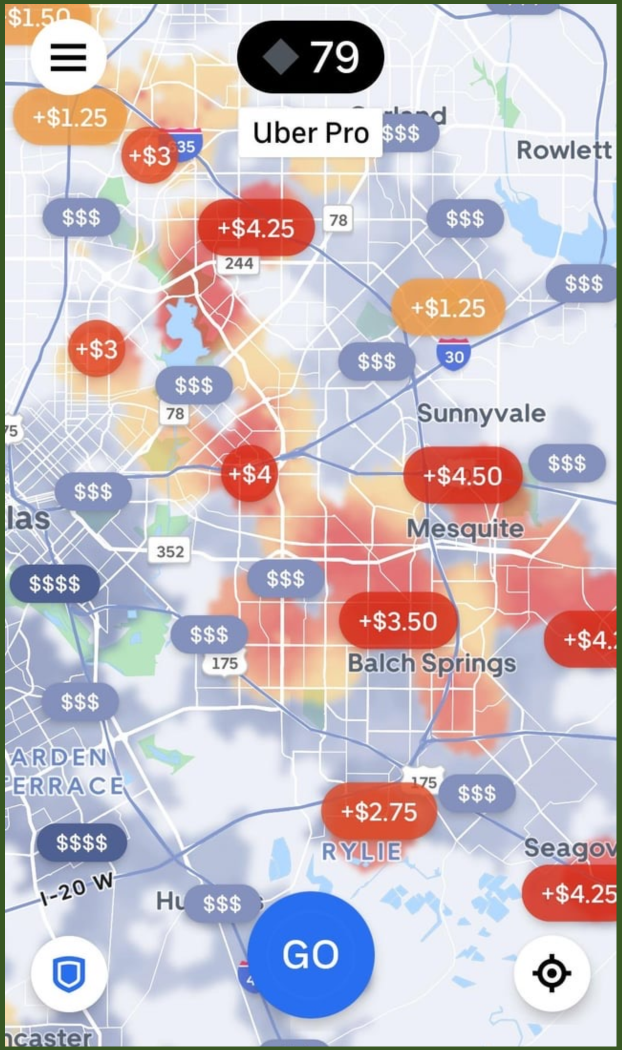

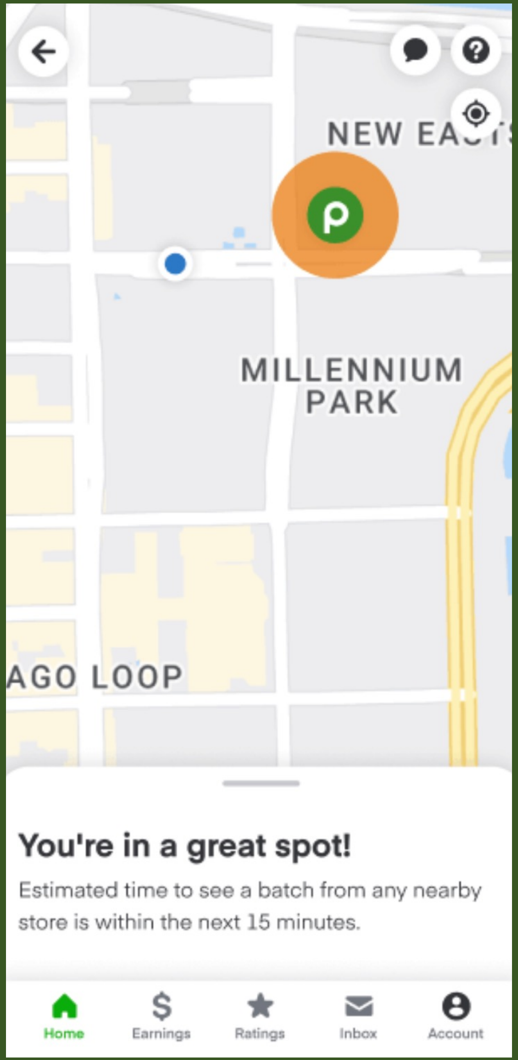

Research Questions:

- How do workers improve performance over time?
- How does task selection change with experience?
- How do workers respond to the platform's recommendations?

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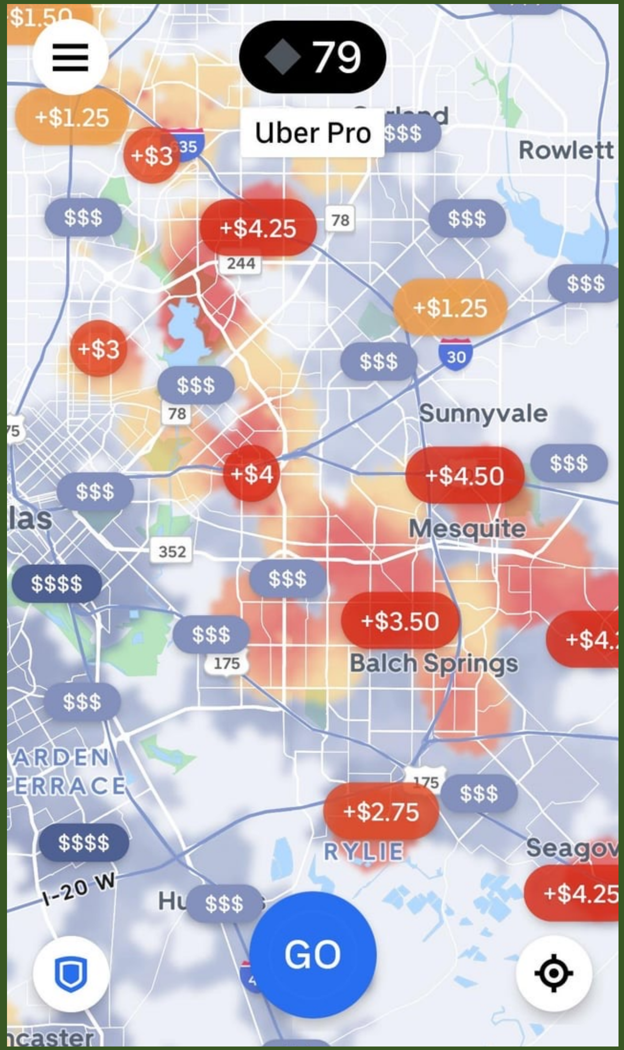

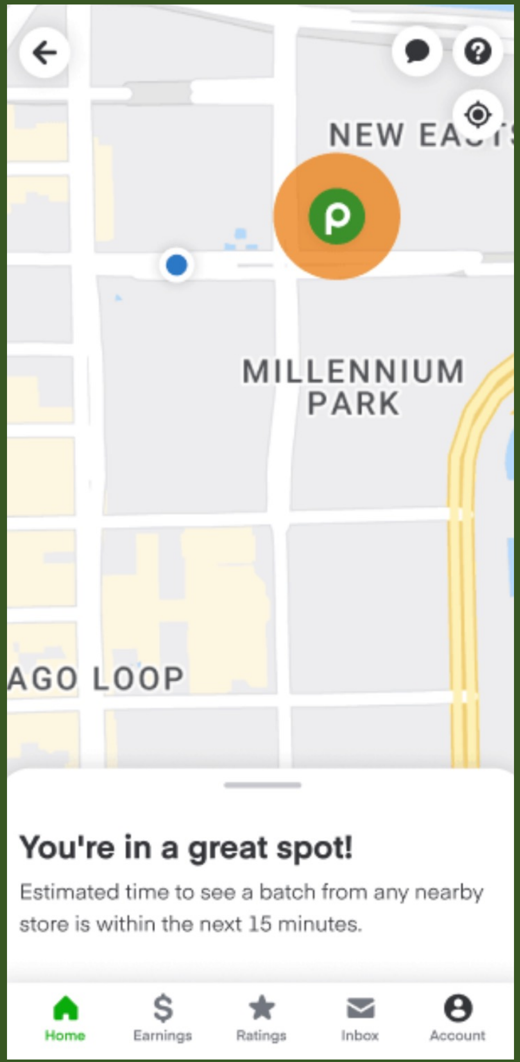

Data: US Grocery Delivery Platform

- NYC orders from November 2022 to October 2023
- 1,269,815 orders across 788 stores + 5,292 shoppers (1,131 "new")

- Orders: Store ID, # items, most common categories, distance to customers
- Workers: Signup hours, orders suggested to them daily, tenure with platform
- Performance: On-time delivery, customer ratings, amount of tips

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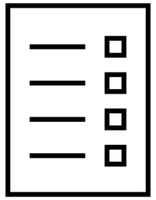

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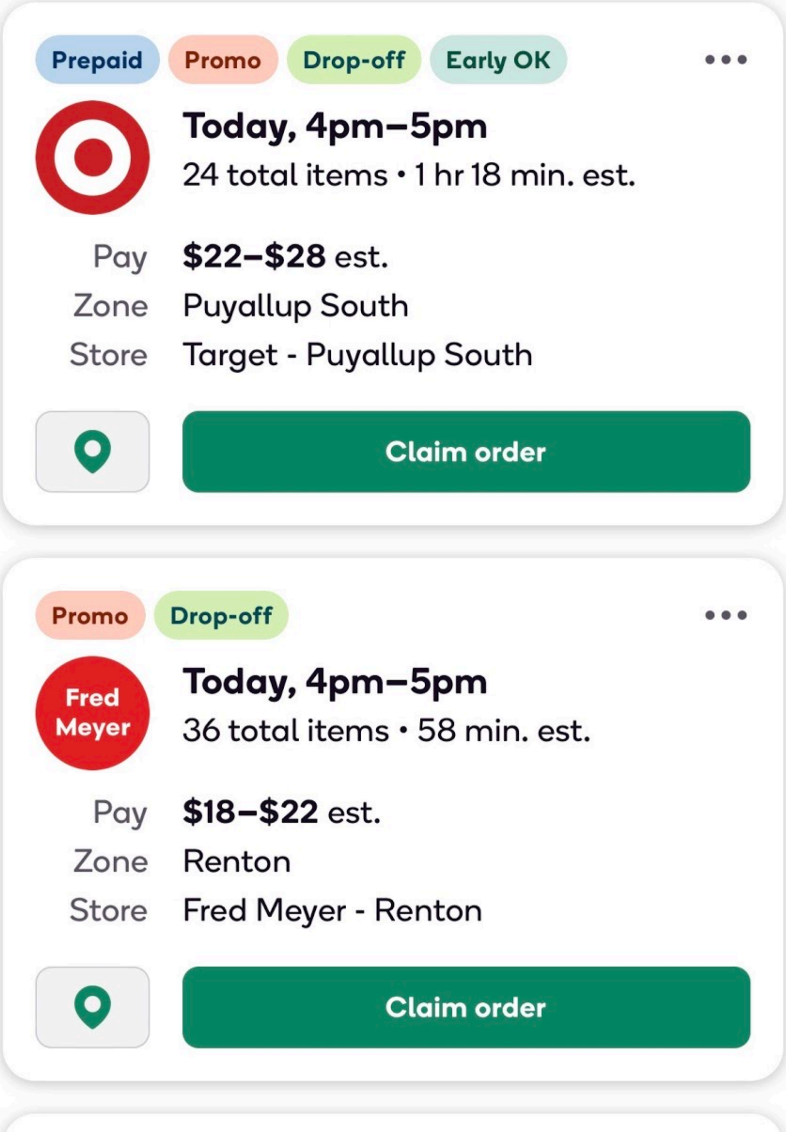

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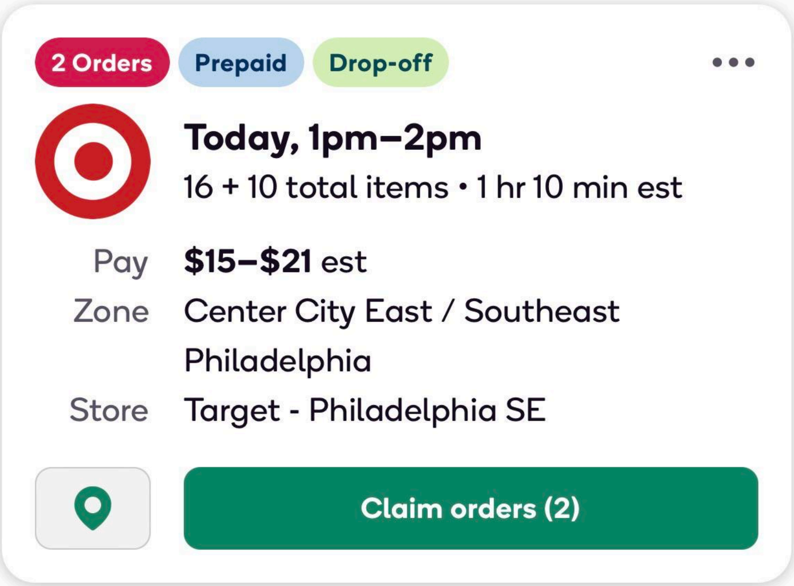
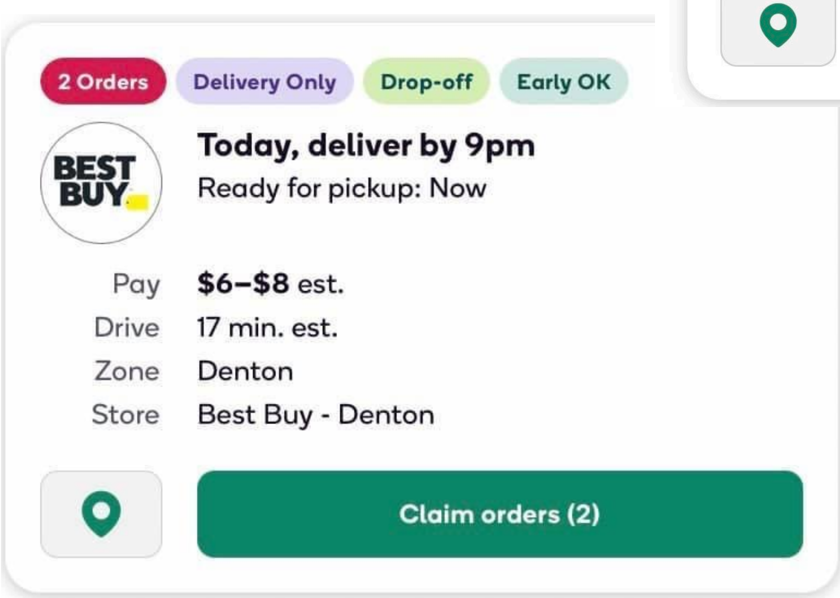
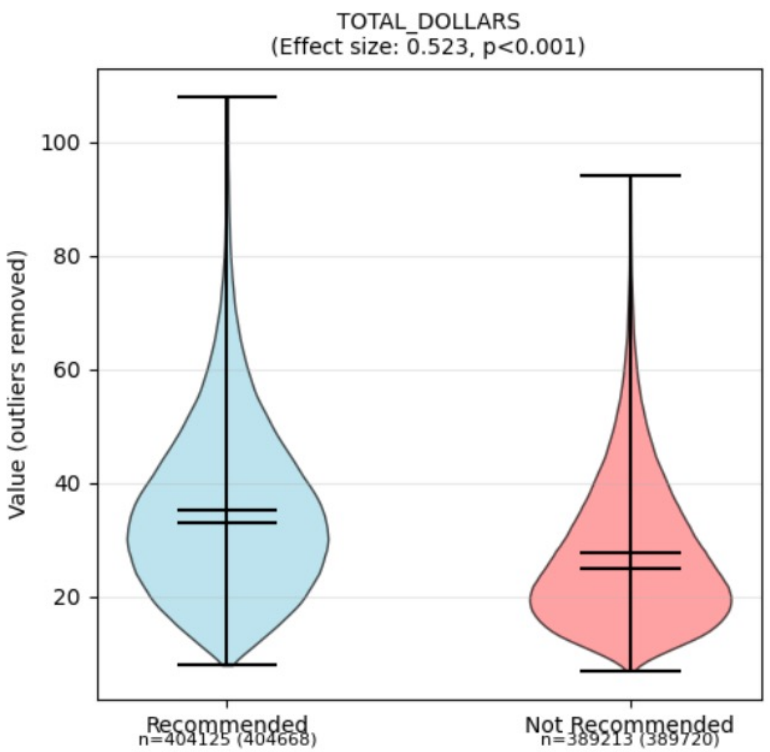


Shoppers can choose to browse a list of all available orders

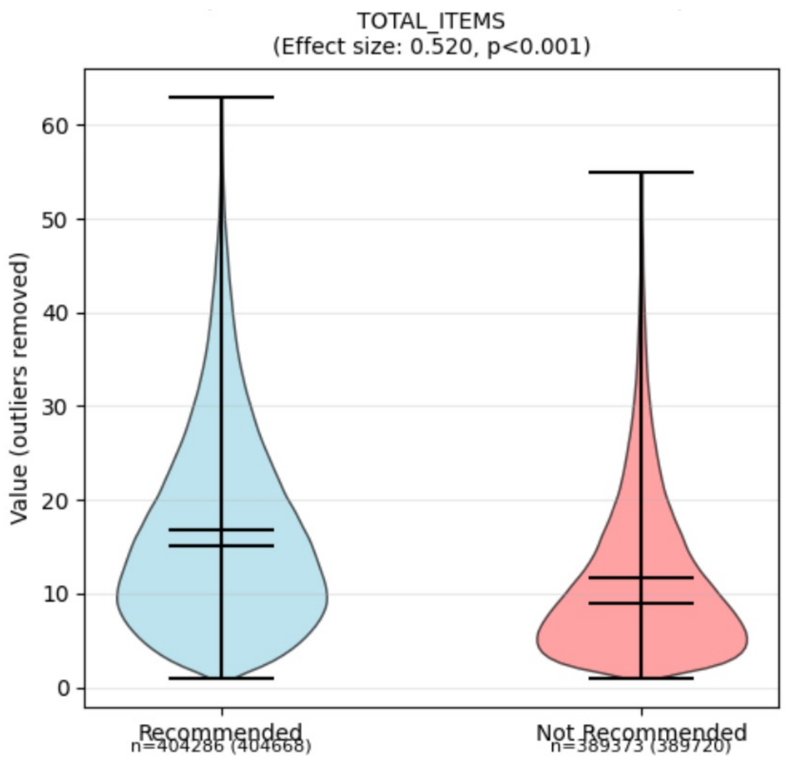
Sometimes, platform bundled orders from the same store with delivery windows within 1 hour difference **(Rec2)**



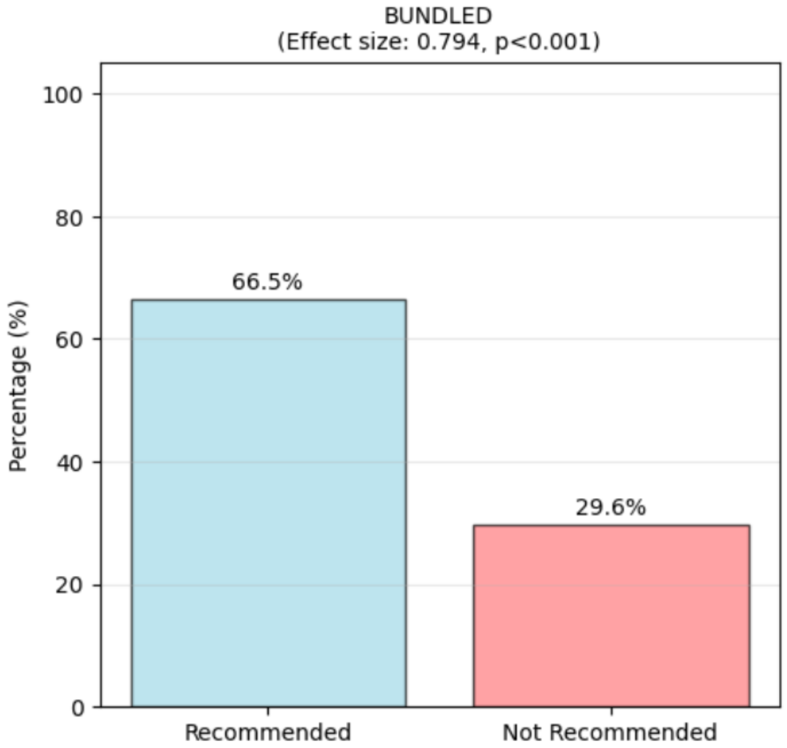
Nature of Recommended Orders



Higher pay / order



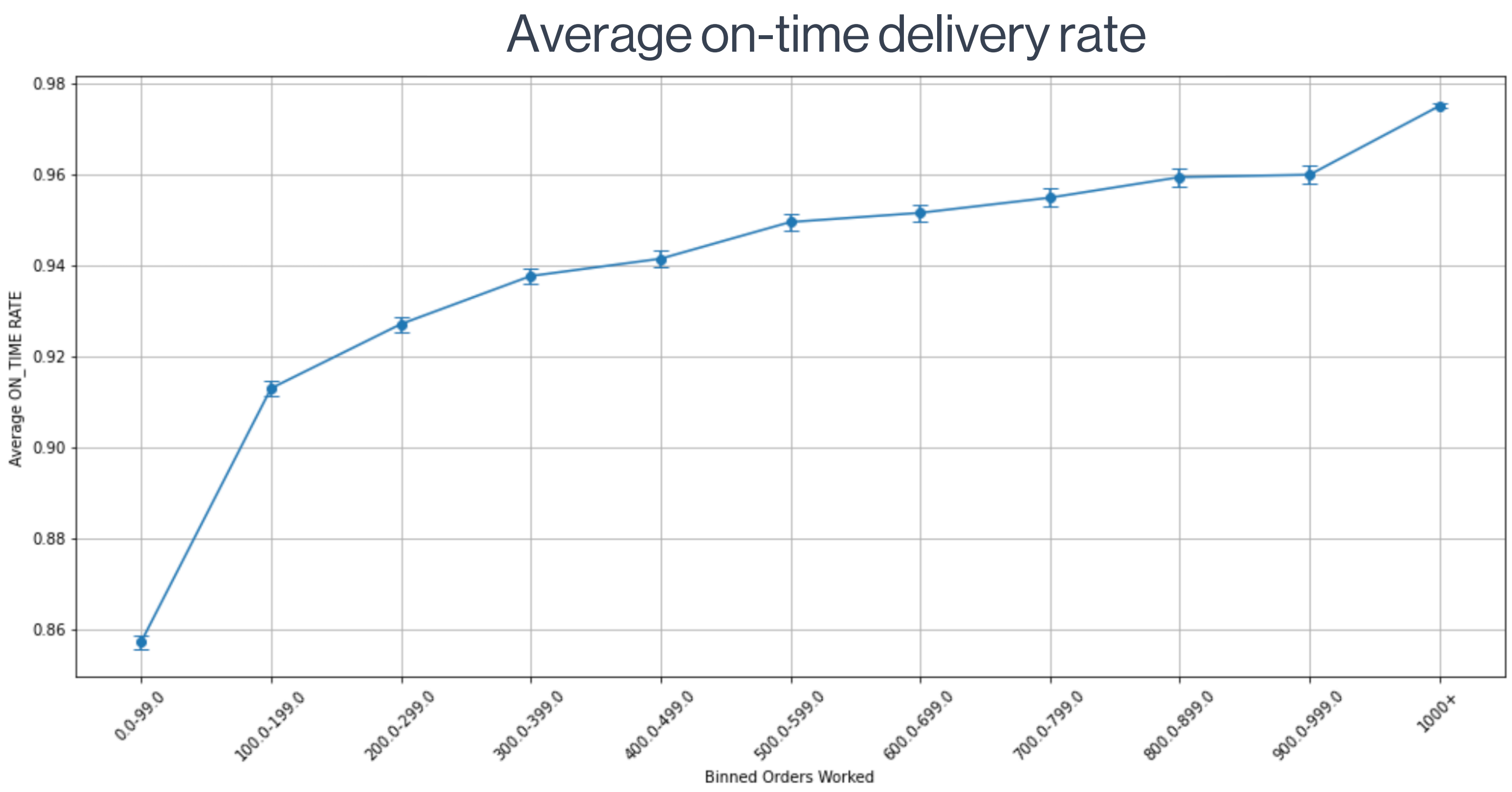
More items (+ unique)



More bundled

They're quite static over time!

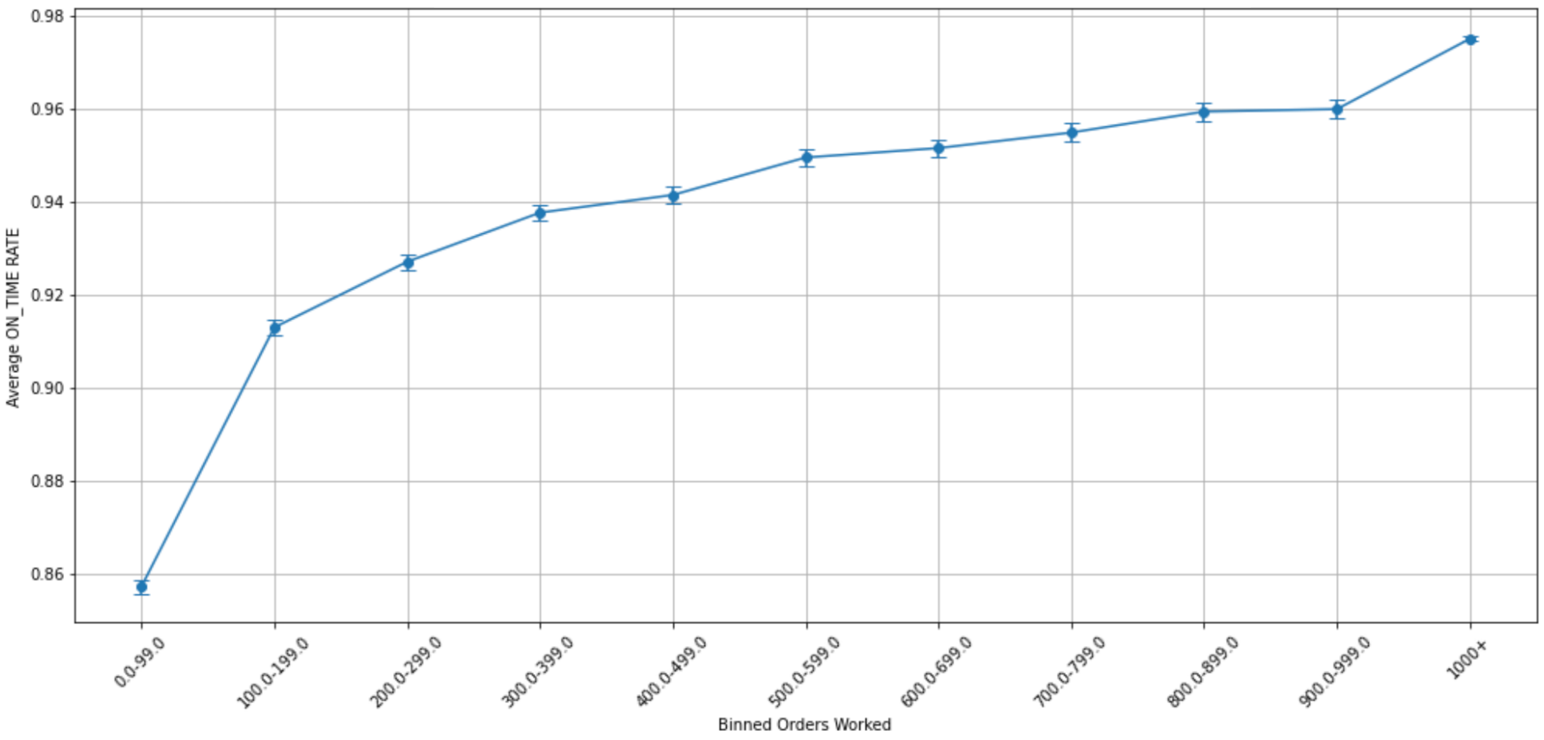
Gig Workers Learn To Do Better



Only new shoppers who started working during the time of the data
N = 1,131 shoppers

Gig Workers Learn To Do Better

Average on-time delivery rate



Impact on on-time	Coefficient
# Orders done from the same store	6.0552e-05*** (0.0025236)
# Orders done from the same store ^2	-8.9995e-09*** (1.6775e-09)
# Orders done from other stores	5.9109e-05*** (0.0001787)
# Orders done from other stores ^2	-8.8744e-09*** (0.0149002)
Control Variables	Yes
Individual FE	Yes
Time FE	Yes

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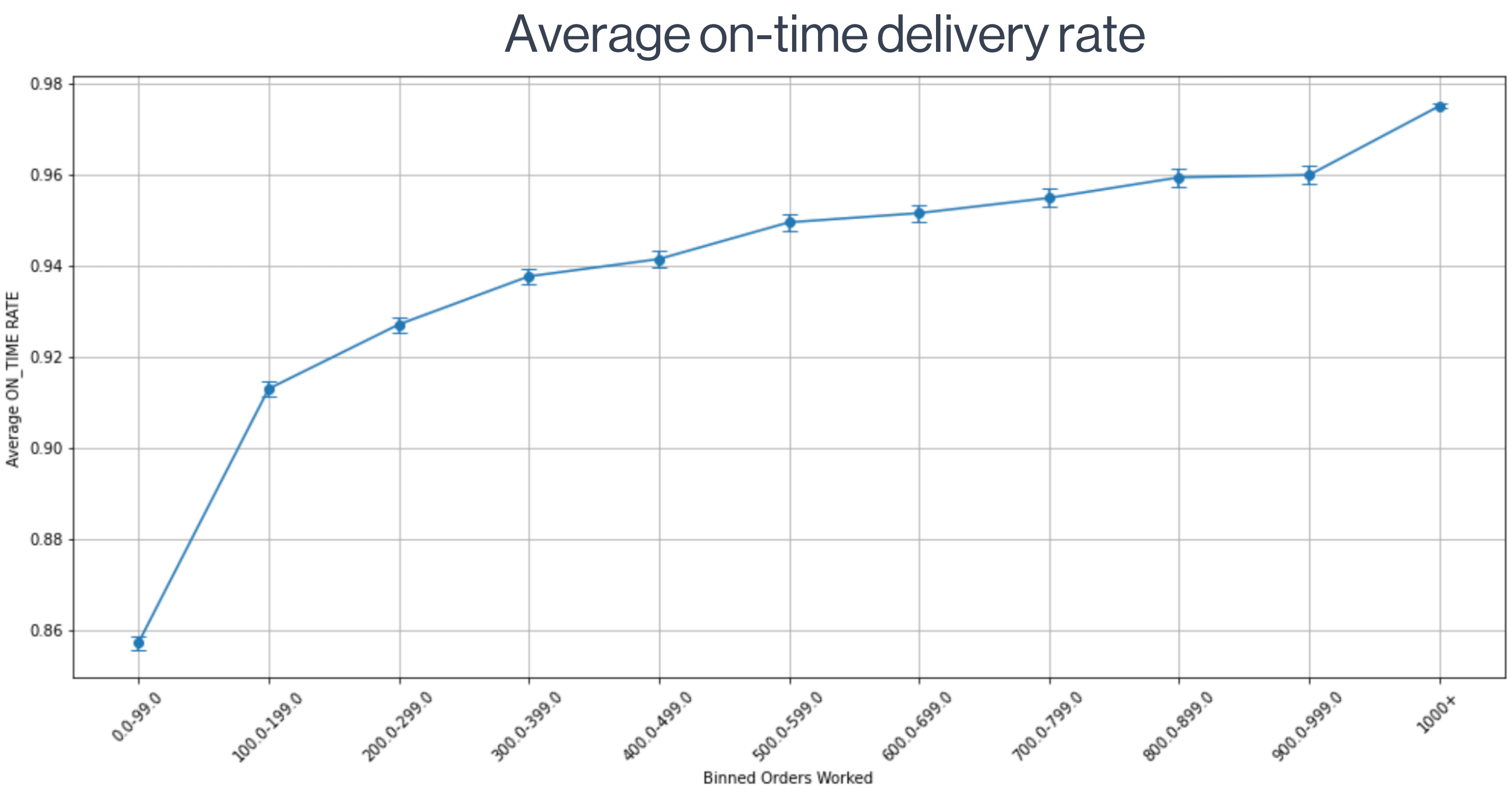

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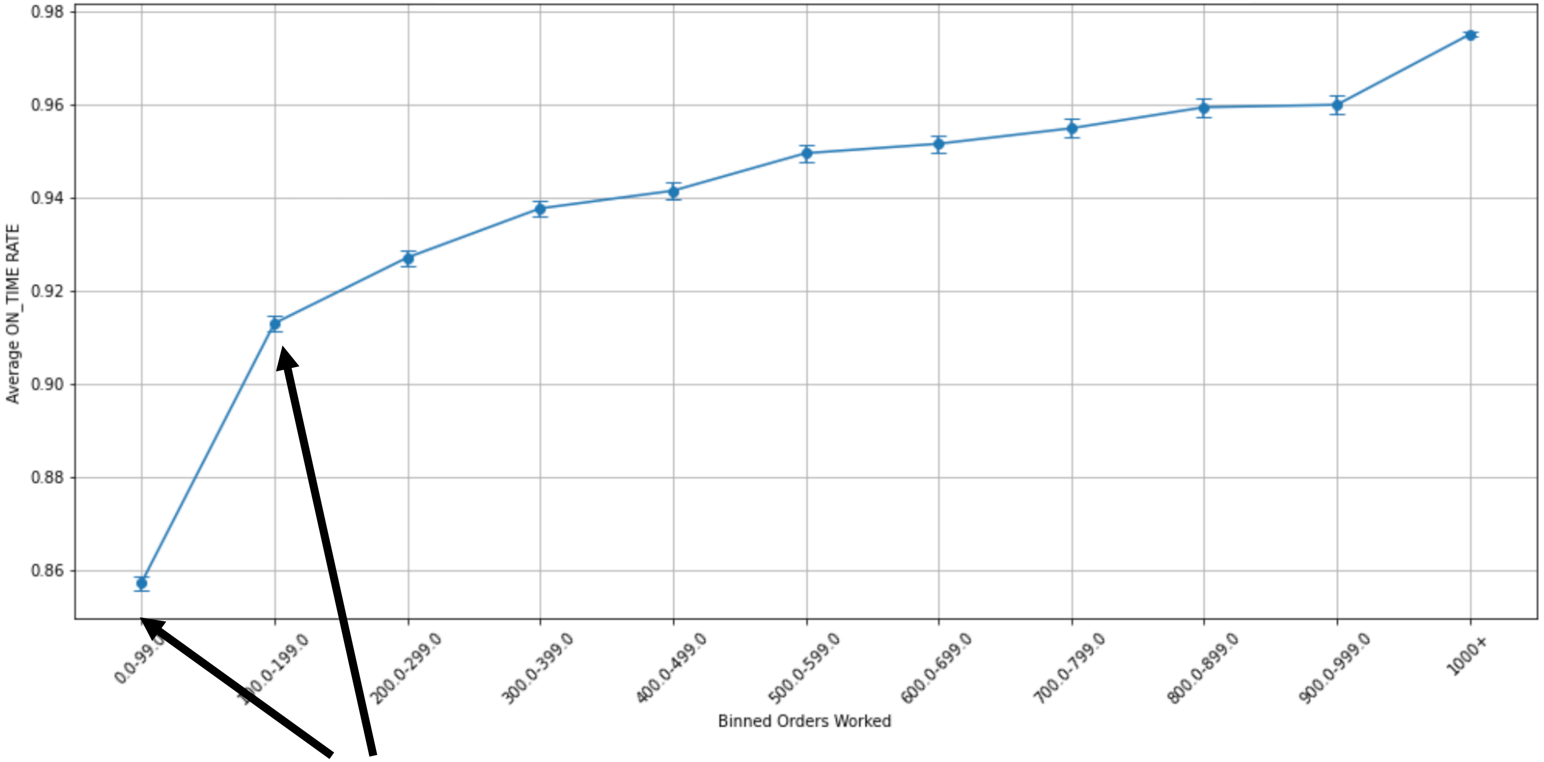

We'll use the first 100 and 200 orders as workers' key milestones of learning

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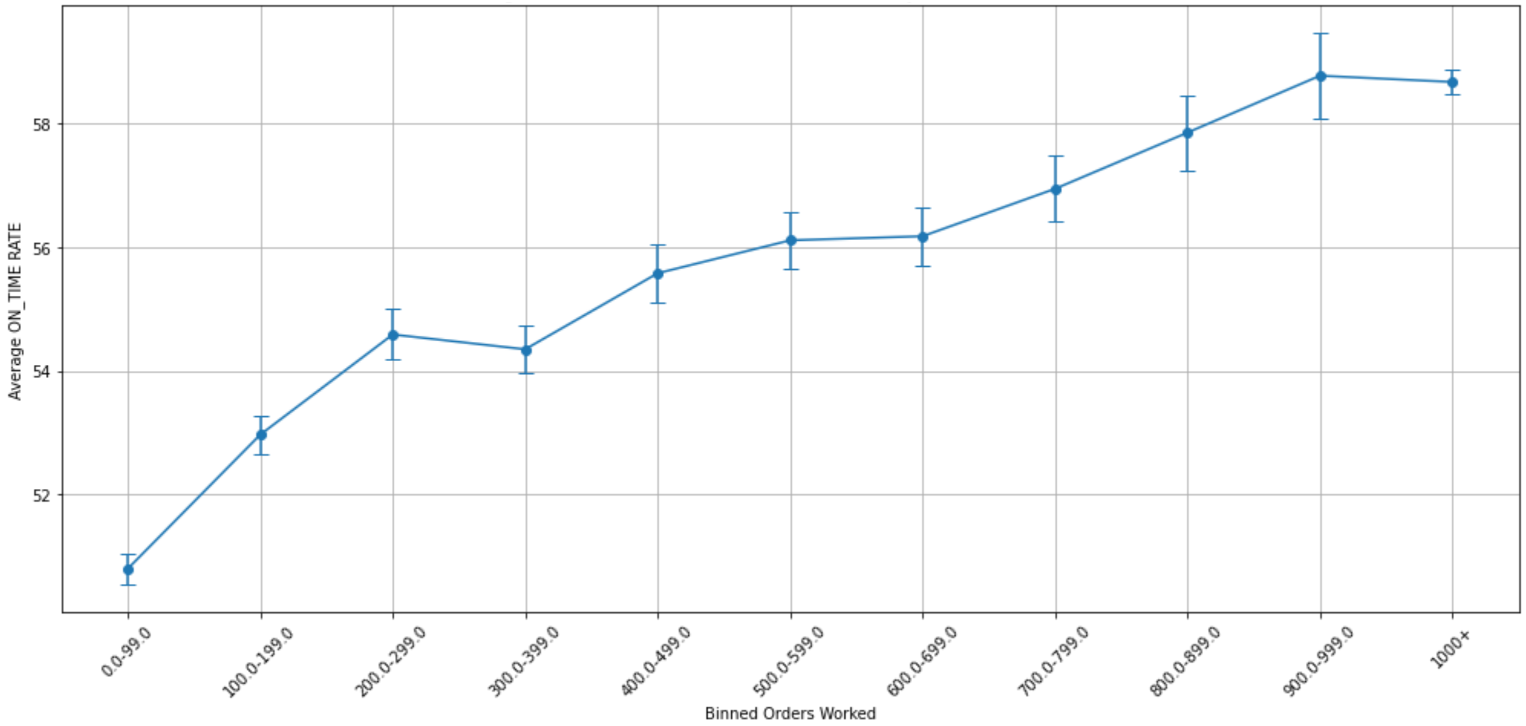
Gig Workers Learn To Do Better

Average # items picked per hour



Impact on on-time	Coefficient
# Orders done from the same store	9.4281e-03** (0.007595)
# Orders done from the same store ^2	-5.4681e-06** (0.003098)
# Orders done from other stores	6.3414e-03* (0.022478)
# Orders done from other stores ^2	-7.6253e-07 (0.235005)
Control Variables	Yes
Individual FE	Yes
Time FE	Yes

= 1,000 orders, 9.4% ↑

Evolution of Performance

- Productivity metric: # items per hour, within the first 100-100 orders

First/Second	Low	Medium	High
Low	**74.07%**	22.22%	3.70%
Medium	22.22%	**51.85%**	25.93%
High	3.70%	25.93%	**70.37%**

Most shoppers stay within the same performance tiers

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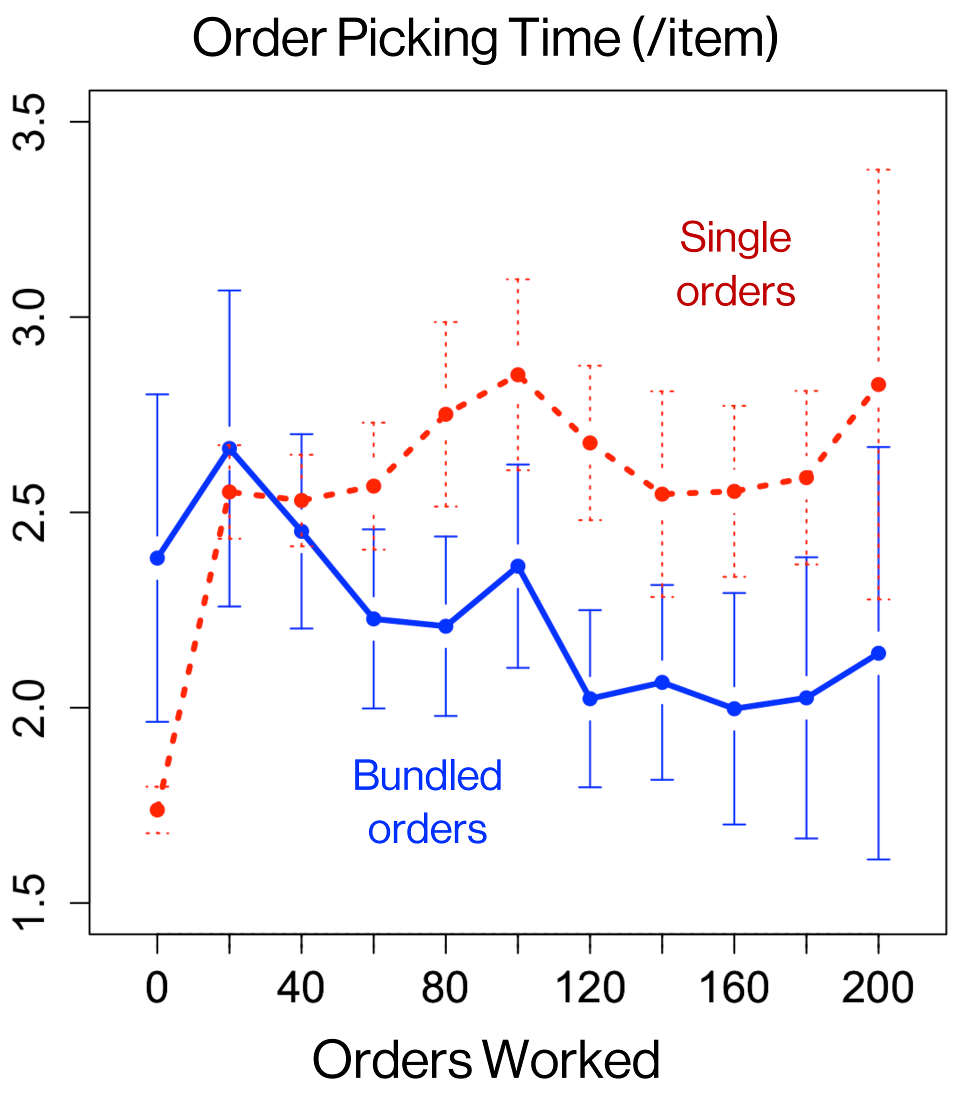
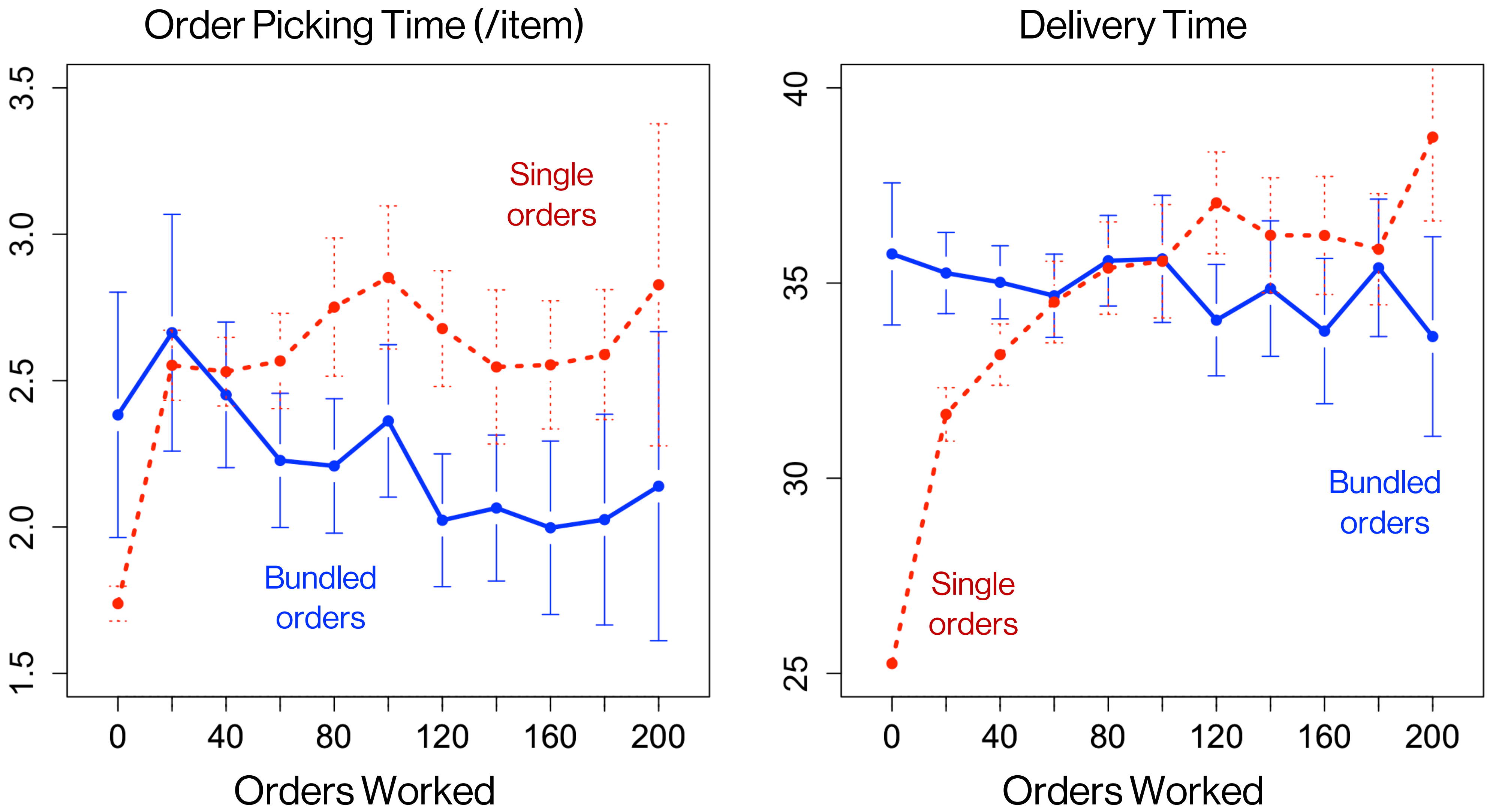
What helped low performances to get better?

How Did They Improve?



How Did They Improve?



How Did They Improve?

Start\End	Low	Medium	High
Low-First 100	2.223500	1.925000	2.240000
Low-Second 100	2.632000	2.333333	2.190000

average concurrent orders

Bundling Early On Helps

Start\End	Low	Medium	High
Low-First 100	2.223500	1.925000	2.240000
Low-Second 100	2.632000	2.333333	2.190000

average concurrent orders

Initial low performers, who tried **more bundling early on** and **adjusted down later**, ended up improving performance

Bundling Moderately Early On Helps

Start\End	Low	Medium	High
Low-First 100	2.223500	1.925000	2.240000
Low-Second 100	2.632000	2.333333	2.190000
High-First 100	2.450000	2.745714	2.435263
High-Second 100	3.500000	3.315714	2.725789

average concurrent orders

Initial low performers, who tried more bundling early on and adjusted down later, ended up improving performance

Those performing poorly later on tend to be those who **over-bundled.**

What Type of **Bundling?**

P(bundling without recommendation)

Start\End	Low	Medium	High
Low-First 100	0.171333	0.174615	0.105000
Low-Second 100	0.228667	0.226923	0.135000

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Those doing well did **less self-bundling / more platform recs.**

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Low-First 100	0.171333	0.174615	0.105000
Low-Second 100	0.228667	0.226923	0.135000
Low-First 100	1.141000	1.120769	1.105000
Low-Second 100	1.166000	1.093846	1.090000

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Bundles with different stores

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Bundles with different stores

...did **less across-store** bundling

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Low-First 100	1.141000	1.120769	1.105000
Low-Second 100	1.166000	1.093846	1.090000
Low-First 100	1.729000	1.819231	1.745000
Low-Second 100	1.852333	2.022308	1.950000

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Bundles with different stores

...did **less across-store** bundling

Bundles with different top categories

...and did bundling **moderately across different categories**

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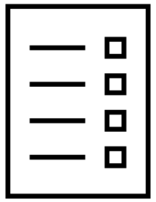
After shoppers signed up for preferred regions, platform recommends some orders. **(Rec1)**



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$$U_{nj} = \beta_1 X_{1nj} + \beta_2 X_{2nj} + \cdots + \beta_k X_{knj} + \epsilon_{nj}$$

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Past Frequency: proportion of all previous orders completed by the worker that were fulfilled at the same store → Higher = more exploitation of familiar stores

Dummy group indicators: most productive (129+ orders) as reference group

All the other order information workers can see while browsing

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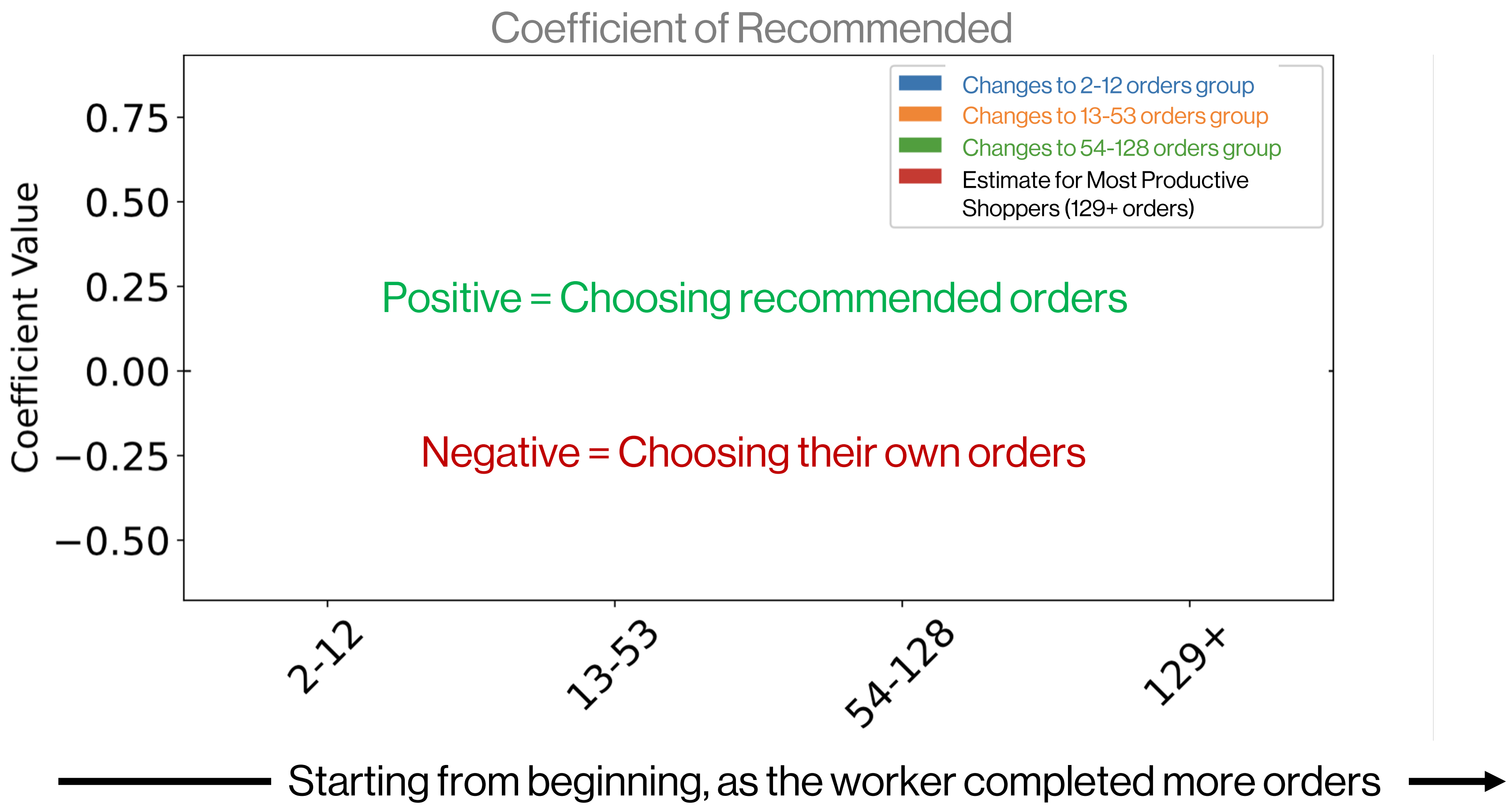
The probability that individual n chooses alternative j is given by the softmax function:

$$P(y_n = j) = \frac{e^{U_{nj}}}{\sum_{j' \in J} e^{U_{nj'}}}$$

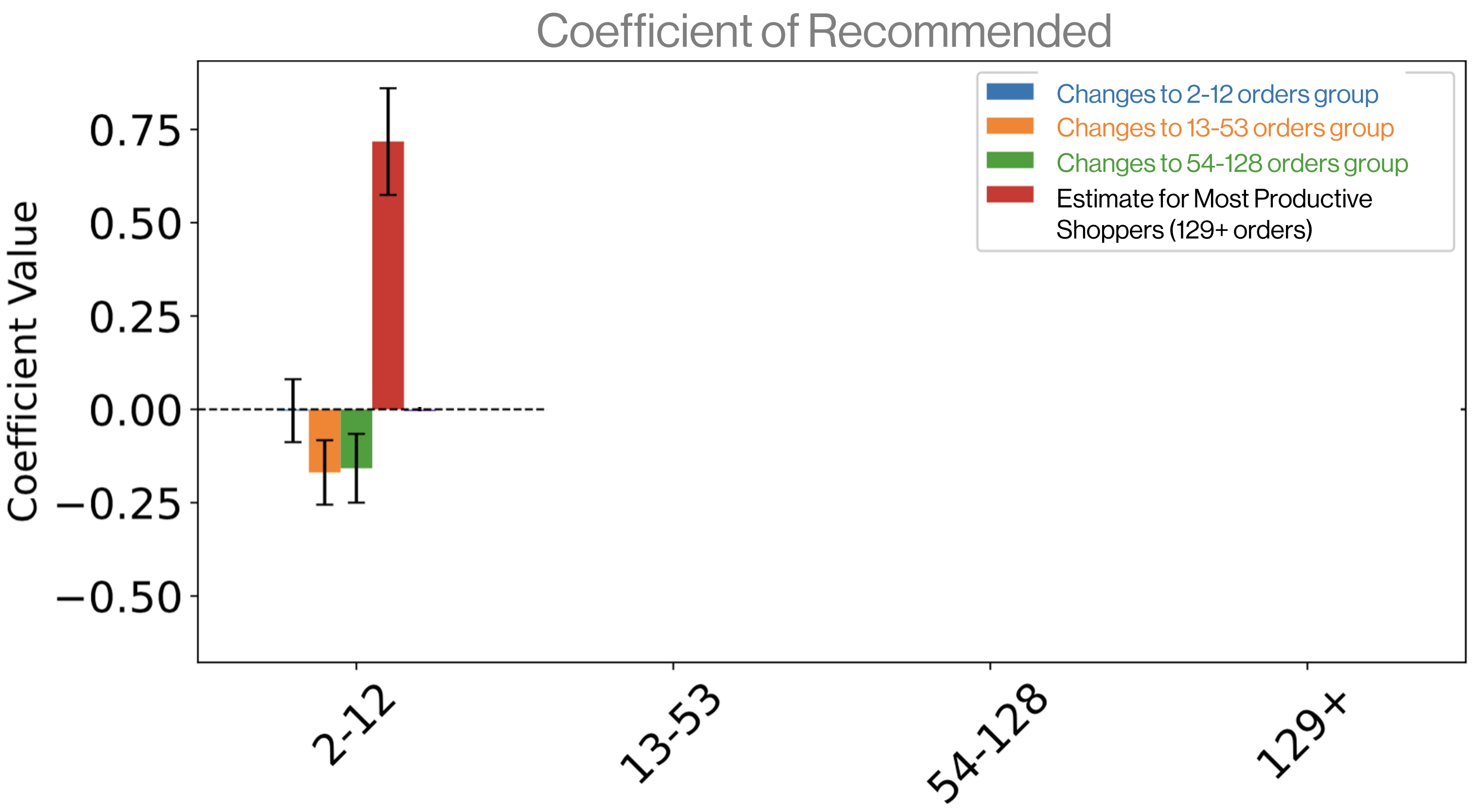
Multinomial Logit

Given Recommendations...



Given Recommendations...

Those doing well and staying for long follow platform recommendations more in the beginning



Starting from beginning, as the worker completed more orders

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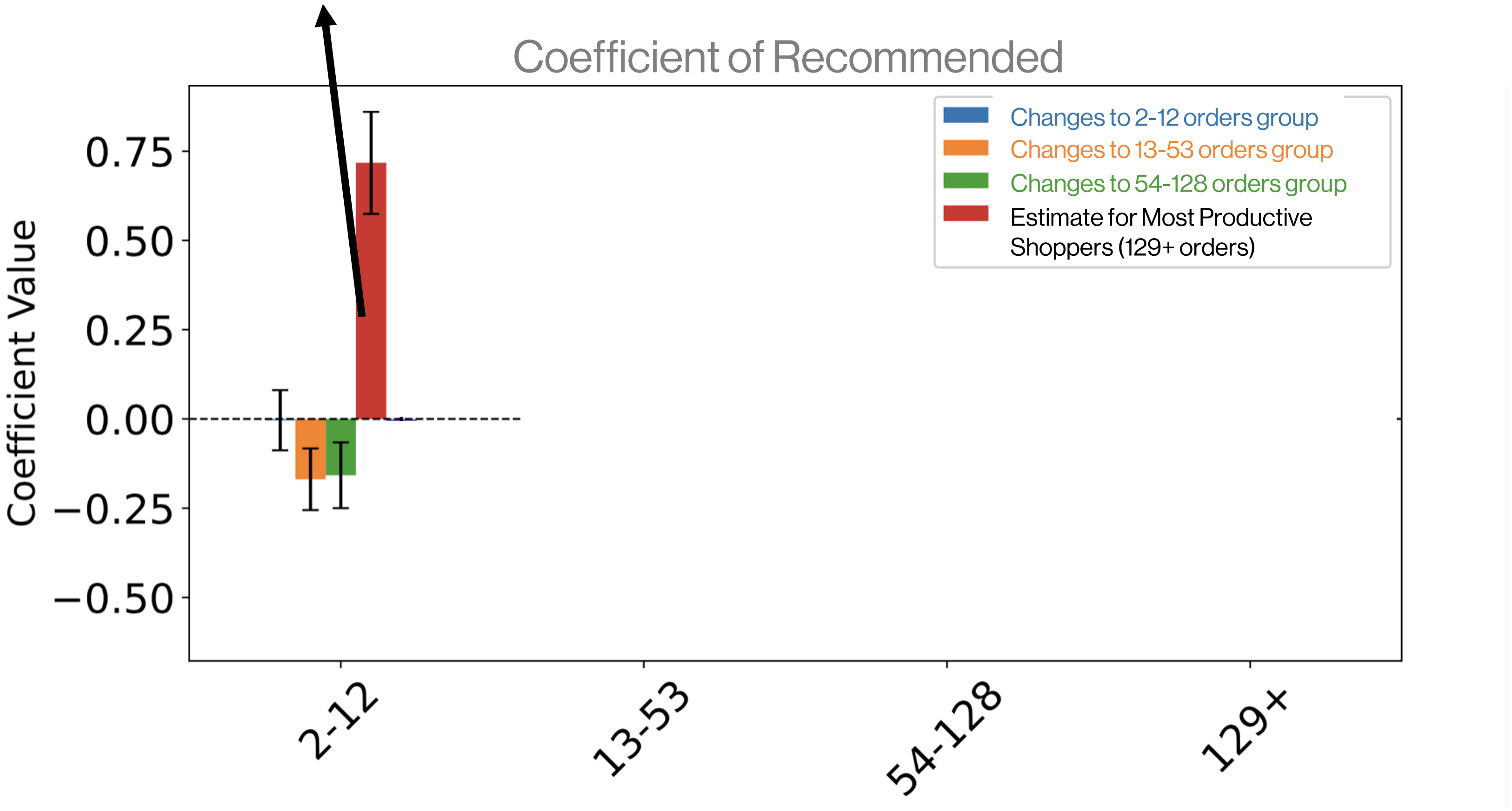

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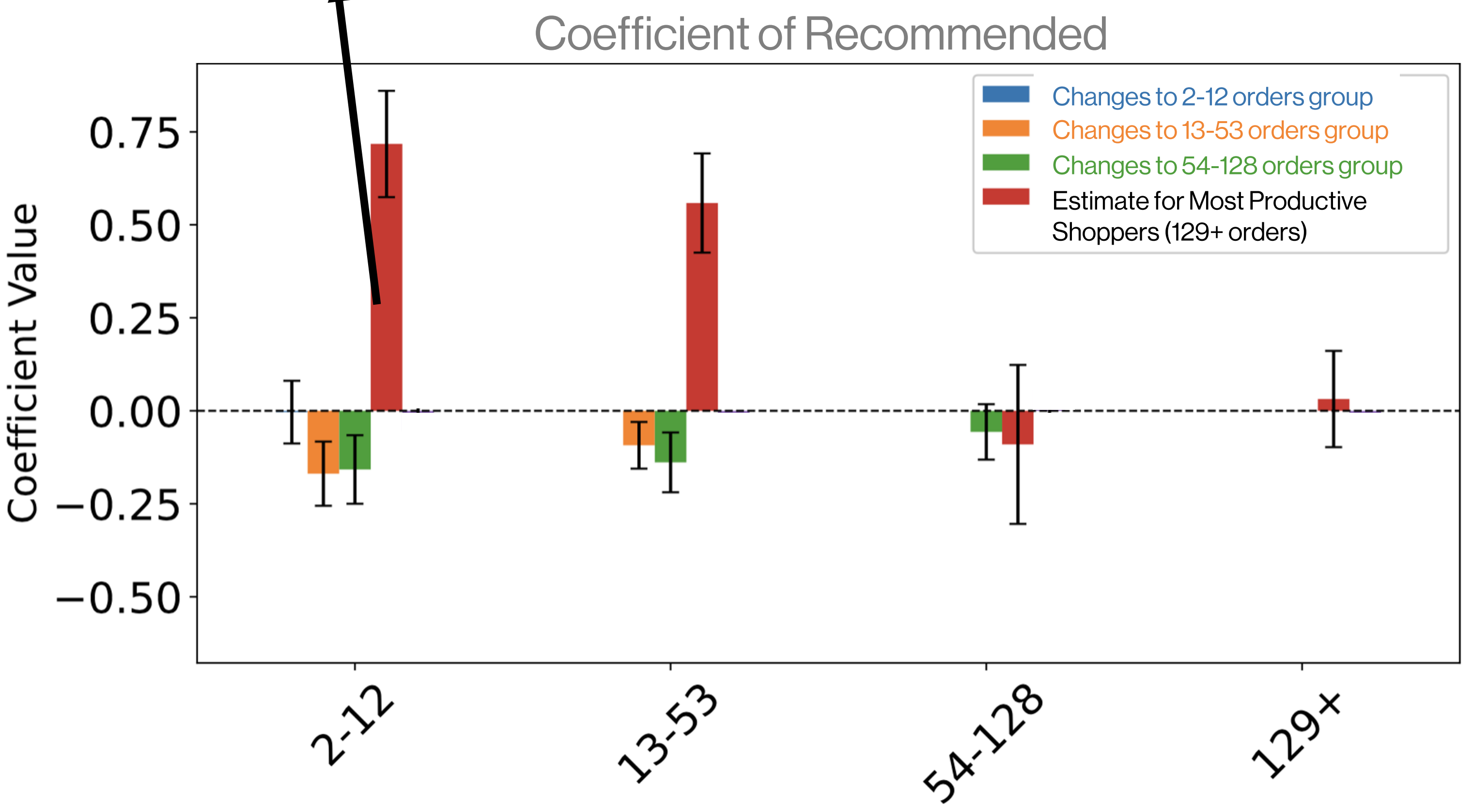

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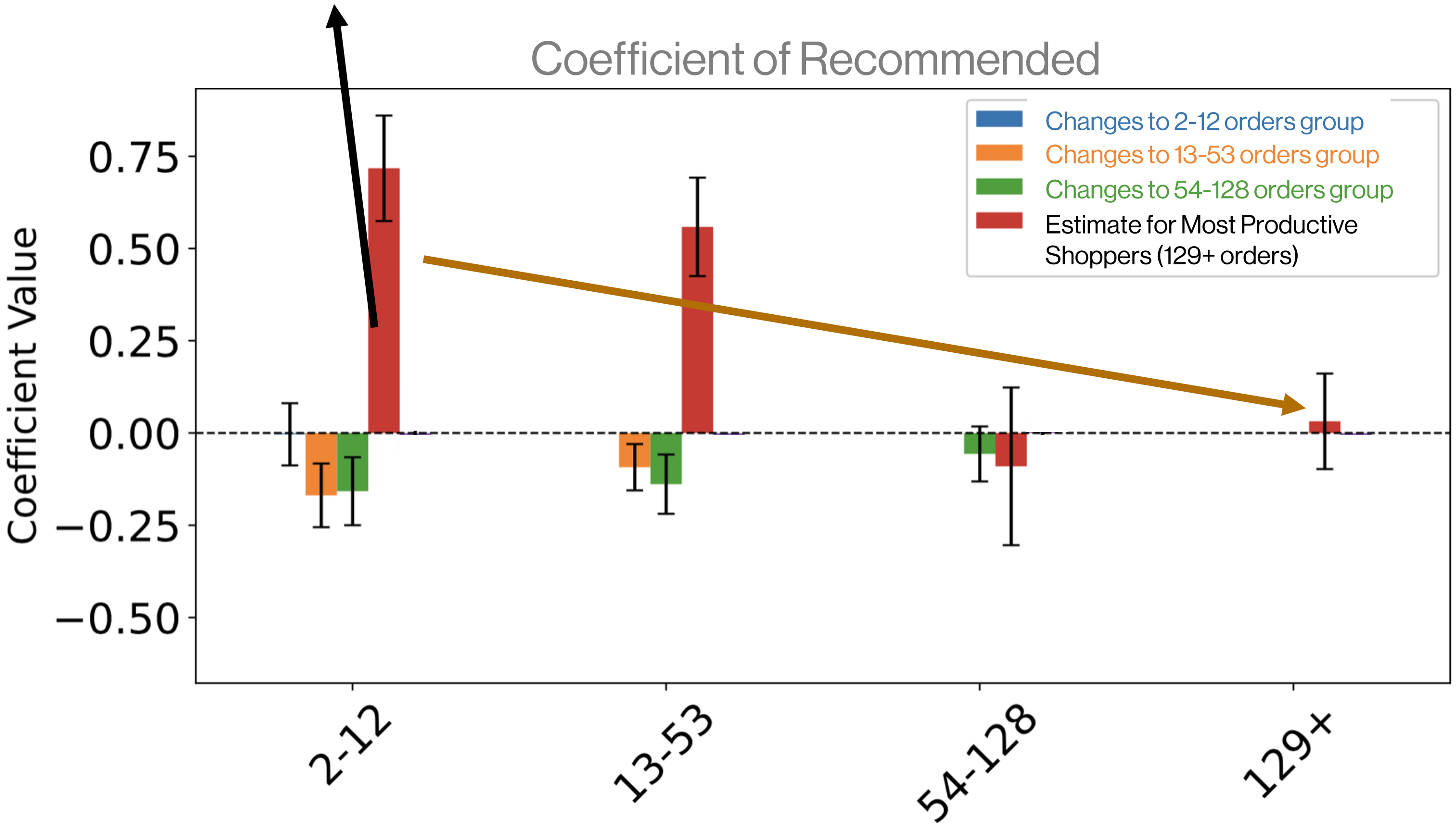
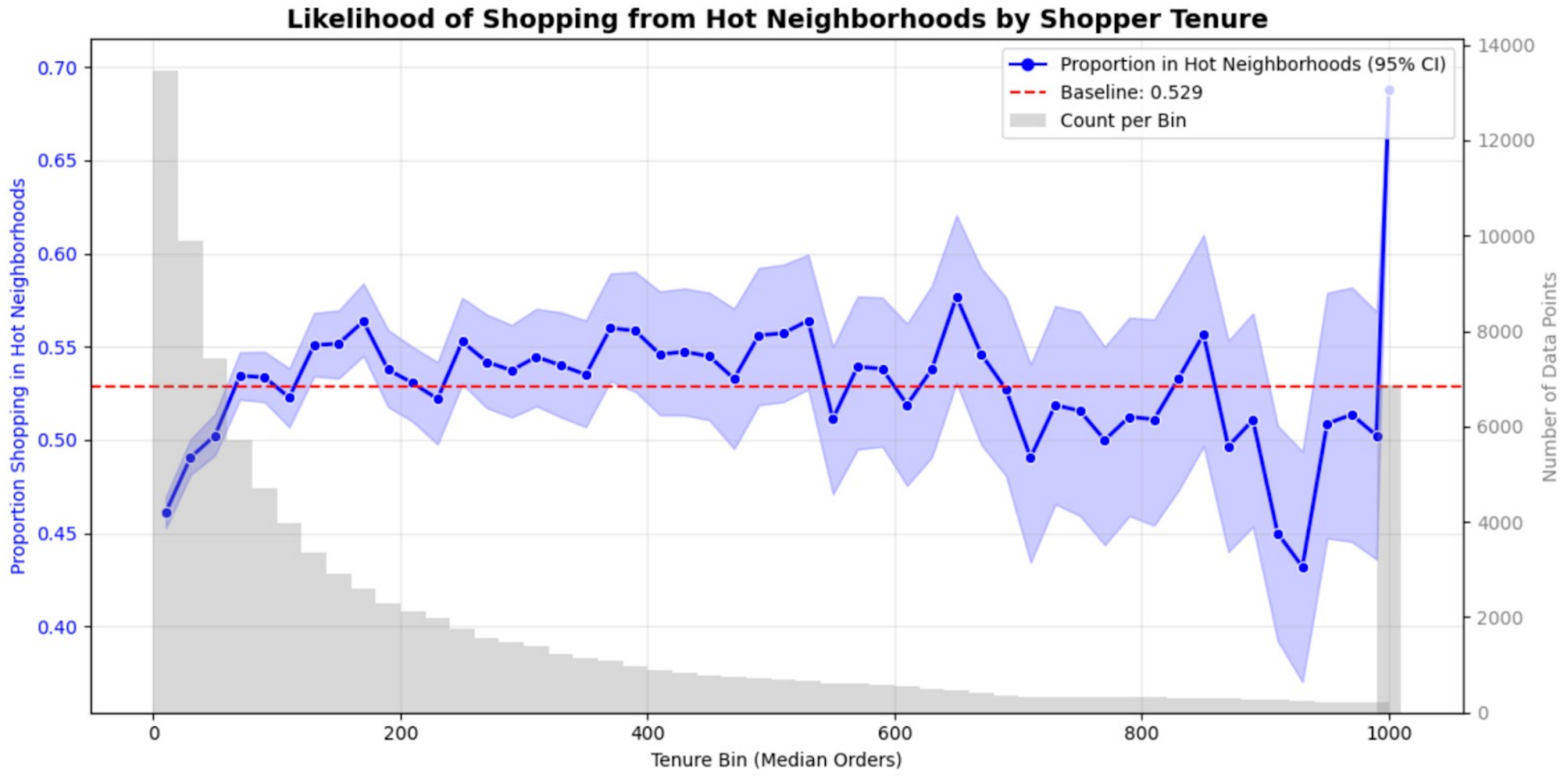


Over time workers become more independent of platform recommendations

Starting from beginning, as the worker completed more orders

Explore Before Exploit?

We find that those doing well started off more exploitative, only exploring new stores or neighborhoods later on.



Preview: Experimental Design

Safeway for Charlotte

$ 20
Piedmont

4 - apple
3 - watermelon
3 - orange

Target for Jacob

$ 20
Emeryville

2 - pineapple
9 - watermelon
2 - grape
1 - apple
3 - banana

Safeway for James

$ 20
Piedmont

4 - orange
3 - apple
4 - watermelon

Target for William

$ 20
Emeryville

1 - banana
1 - apple
1 - pineapple
1 - grape
1 - watermelon

Safeway for Charlotte

$ 20

Piedmont

4 - apple
3 - watermelon
3 - orange

Safeway for James

$ 20

Piedmont

4 - orange
3 - apple
4 - watermelon

Safeway

Total Earnings: $40

Order for Charlotte	Order for James
Earnings: 20	Earnings: 20
4 - apple	4 - orange
3 - watermelon	3 - apple
3 - orange	4 - watermelon

Time spent: 52

Current Location: Orange

Item: orange Quantities: 3 4 Add to bag

Entrance	Watermelon 🍉	
Apple 🍎	Orange 🍊	

Checkout and Exit

Bag 1
- apple: 4

Bag2
- apple: 3

Safeway for Charlotte

$ 20

Piedmont

4 - apple
3 - watermelon
3 - orange

Safeway for James

$ 20

Piedmont

4 - orange
3 - apple
4 - watermelon

Safeway

Total Earnings: $40

Order for Charlotte	Order for James
Earnings: 20	Earnings: 20
4 - apple	4 - orange
3 - watermelon	3 - apple
3 - orange	4 - watermelon

Time spent: 52

Current Location: Orange

Item: orange Quantities: 3 4 Add to bag

Entrance	Watermelon 🍉	
Apple 🍎	Orange 🍊	

Checkout and Exit

Bag 1
- apple: 4

Bag2
- apple: 3

Pilot findings: Humans prioritize first available or seemingly-easier tasks, similar to Ibanez et al 2017's findings!

Takeaways Learning on the Go

How gig workers choose gig tasks and learn to improve performance over time?

- Context: On-demand delivery workers in NYC, choosing own tasks, given recommendations
- Workers learn to perform better and make better decisions; workers who exploit more / rely more on platform recommendations initially improve performance the most
- Overtime workers behaviors change a lot; and they become independent of the platform's recommendation

Next Steps:

- Online behavioral experiment
- Model human learning curve + incorporate into contextual bandits

- **Pilot Insights:** Humans prioritize first available or seemingly-easier tasks

Thank you!

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