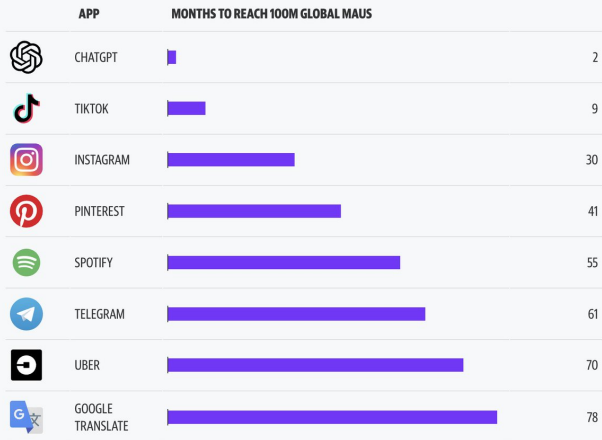


How does ChatGPT-4 Adoption Change Digital Services Consumption?

Seung Hyun Kim, Avi Goldfarb, Daniel Minh McCarthy, Kenneth C. Wilbur
Preliminary and incomplete, please do not cite

HOW LONG IT TOOK TOP APPS TO HIT 100M MONTHLY USERS

ChatGPT is estimated to have hit 100M users in January, 2 months after it's launch.
Here's how long it took other top apps to reach that:



SOURCE: UBS

yahoo!
finance



You

What are the top 3 benefits that individual consumers get from ChatGPT4 subscription, as opposed to using the free ChatGPT3.5 service? Please be specific.



ChatGPT

The top three benefits individual consumers gain from subscribing to ChatGPT-4, compared to using the free ChatGPT-3.5 service, are:

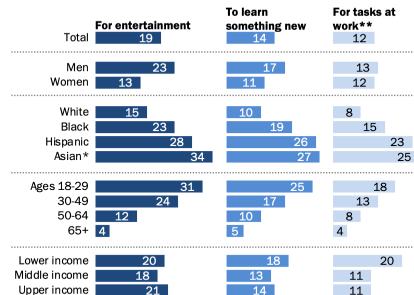
1. **Advanced Model Access:** Subscribers get access to the latest GPT-4 model, which typically offers improved performance in areas such as understanding context, generating more accurate and relevant responses, and displaying a better grasp of complex topics compared to GPT-3.5.
2. **Higher Limits and Prioritized Access:** Subscribers often receive higher usage limits, meaning they can interact with the AI more frequently and for longer sessions. Additionally, during times of high demand, subscribers usually have prioritized access, reducing the likelihood of encountering capacity-related usage restrictions.
3. **New Features and Updates:** Subscribers are often the first to experience new features, enhancements, and updates. This can include access to beta features, improvements in response quality, and other advancements not immediately available to non-subscribers.

Usage Patterns of ChatGPT

- One in ten employed Americans used ChatGPT at work
- 19% of Americans used ChatGPT for entertainment
- 14% of Americans used ChatGPT to learn something new

Young adults who have heard of ChatGPT are more likely than their older counterparts to have used it

Among the 58% of U.S. adults who have heard of ChatGPT, % who say they have ever used it ...



*Estimates for Asian adults are representative of English speakers only.

**This item was asked only of respondents who were working for pay at the time of the survey.

Note: White, Black and Asian adults include those who report being only one race and are not Hispanic. Hispanic adults are of any race. Family income tiers are based on adjusted 2021 earnings. Those who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 13-19, 2023.

PEW RESEARCH CENTER

Research Question

- How does ChatGPT-4 adoption change consumers' other digital purchases?
Does it...
 - **Replacement Effect:** ...replace competing paid services like Chegg or Grammarly?
 - **Attention Crowd-out Effect:** ...Steal attention from paid digital services?
 - **Discovery Effect:** ...introduce consumers to other AI services, like Copilot?
 - **Augmentation Effect** ...enrich other paid services, such as digital business formation tools?
- Answers matter for forecasters, investors, policymakers, competitors, and understanding consumer benefits of AI more broadly
- Important caveats: Today's analysis will not distinguish between these effects but future analyses may. Also, we do not have GPT4 price variation needed to identify economic complement/substitute relationships.

Generative AI Impacts

- del Rio-Chanona et al. (2023)
 - ChatGPT release reduced StackOverflow posts by 16%, relative to Russian and Chinese language alternatives, suggesting ChatGPT adoption will cannibalize future LLM training data
- Burtch, Lee & Chen (2023)
 - ChatGPT release reduced StackOverflow posts but did not reduce Reddit posts. SO answer quality declined due to user exit
- Hence, some work showing tangible impacts, but no work yet on consumption effects

Empirical Strategy

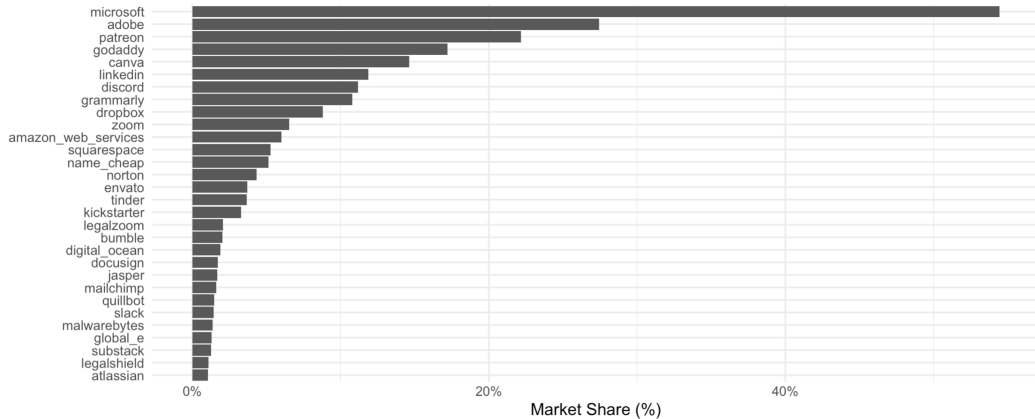
- Compare early adopter payment changes to (slightly) later adopter payment changes *before adoption*
 - *Not* comparing the earliest adopters
- Triple difference (DDD) in market share
 - Group (g)
 - Early Adopters: Subscribers from April to June 2023 ($N_1 = 13,762$)
 - Late Adopters: Subscribers from July to September 2023 ($N_2 = 8,999$)
 - Period(t)
 - Period 1: January – March 2023
 - Period 2: April - June 2023
 - Subtract out analogous DD from 2022 for seasonality

Datasource

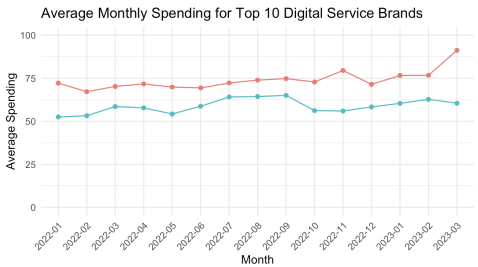
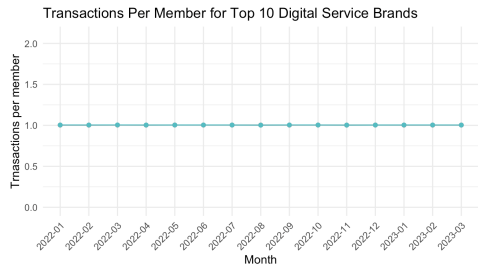
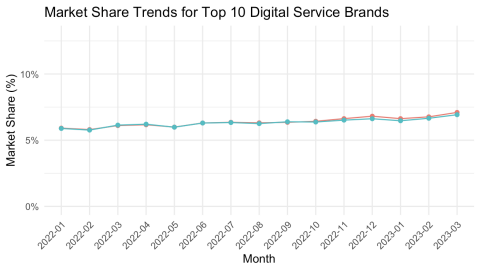
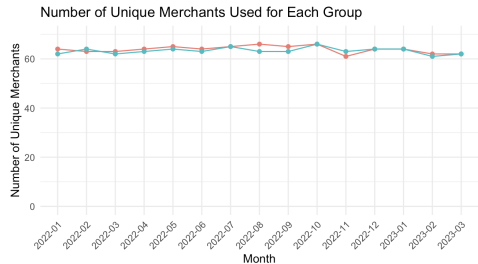
- Anonymous credit/debit card spending panel
- Transaction records sourced from financial institutions
- 30+ million transactions by 36,473 OpenAI subscribers in 2022 and 2023
 - Engagement with 1,621 merchants, accounting for \$6.75 billion total spending
- OpenAI subscriptions, Jan - Sep 2023, 140k payments, \$2.8M

earnestanalytics

Top 30 Pre-ChatGPT4 Market Shares among GPT4 Adopters



Pre-Treatment Trends



Overview of empirical strategies

Triple Difference (DDD) Design

Year	Group	Period	Market Share
2023	g1	April - June	$s_{j,1,2}^{2023}$
		Jan - March	$s_{j,1,1}^{2023}$
	g2	April - June	$s_{j,2,2}^{2023}$
		Jan - March	$s_{j,2,1}^{2023}$
2022	g1	April - June	$s_{j,1,2}^{2022}$
		Jan - March	$s_{j,1,1}^{2022}$
	g2	April - June	$s_{j,2,2}^{2022}$
		Jan - March	$s_{j,2,1}^{2022}$

- Market share of merchant j in group g during period t

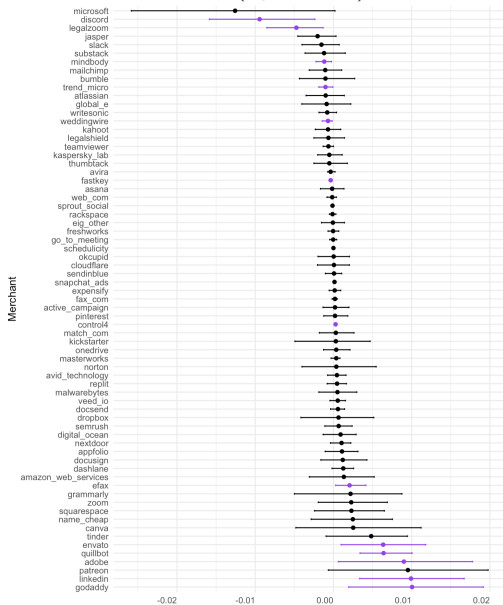
$$s_{j,g,t} = \frac{\text{payers of merchant } j \text{ in group } g \text{ in period } t}{\text{group } g \text{ size}}$$

- Triple difference estimator for market share of merchant j

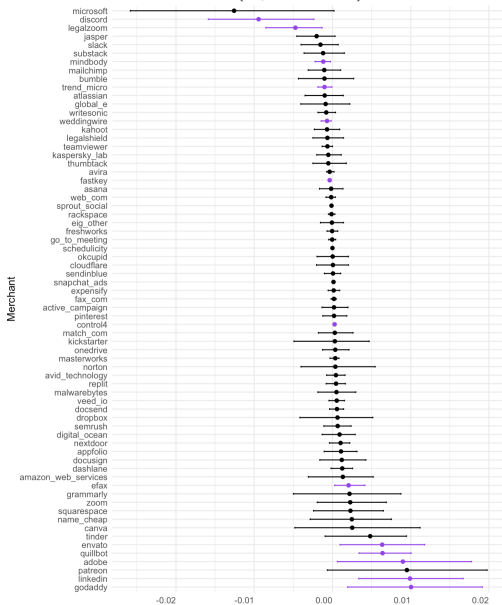
$$d_j = \left[(s_{j,1,2}^{2023} - s_{j,1,1}^{2023}) - (s_{j,2,2}^{2023} - s_{j,2,1}^{2023}) \right] \\ - \left[(s_{j,1,2}^{2022} - s_{j,1,1}^{2022}) - (s_{j,2,2}^{2022} - s_{j,2,1}^{2022}) \right]$$

- Bootstrap Standard Error

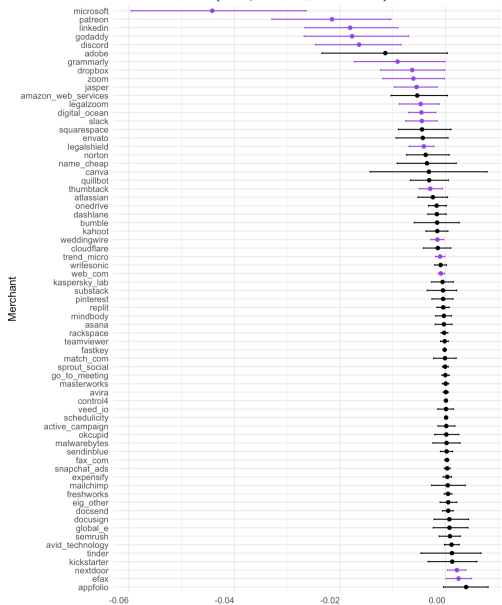
Period 2 (April - June)



Period 2 (April - June)



Period 2 (July - September)



Next step: Coarsened Exact Matching (CEM)

- DDD analysis disregards within-group heterogeneity; customer groups may have different trends within merchants
- Implementing Coarsened Exact Matching (CEM)
 - Use pre-2023 spending data to match customer purchasing dynamics
 - Historical patterns would serve as proxies for consumer preferences
 - *Feedback solicited*

Discussion

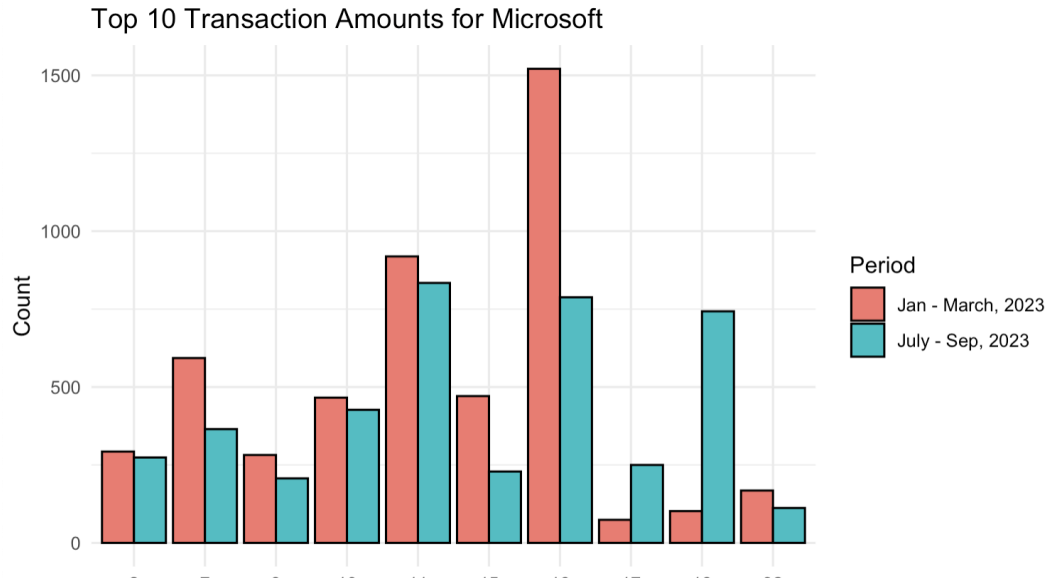
- How does generative AI technology influence consumer purchase decisions?
 - The evidence does not yet strongly support the idea of ChatGPT-4 leading to widespread cancellation of similar services (Substitution Effect)
 - Similarly, there is limited data to confirm a substantial increase in consumer engagement with additional AI services (Complementary Effect) as a result of ChatGPT-4 adoption
- While ChatGPT-4 has not significantly replaced or supplemented existing services yet, evolving consumer preferences and emerging market trends could lead to future changes
- With an increasing number of companies integrating ChatGPT-4 into their services (e.g., GitHub Copilot), it becomes crucial for businesses to monitor these trends closely

Thank You!

kennethcwilbur@gmail.com

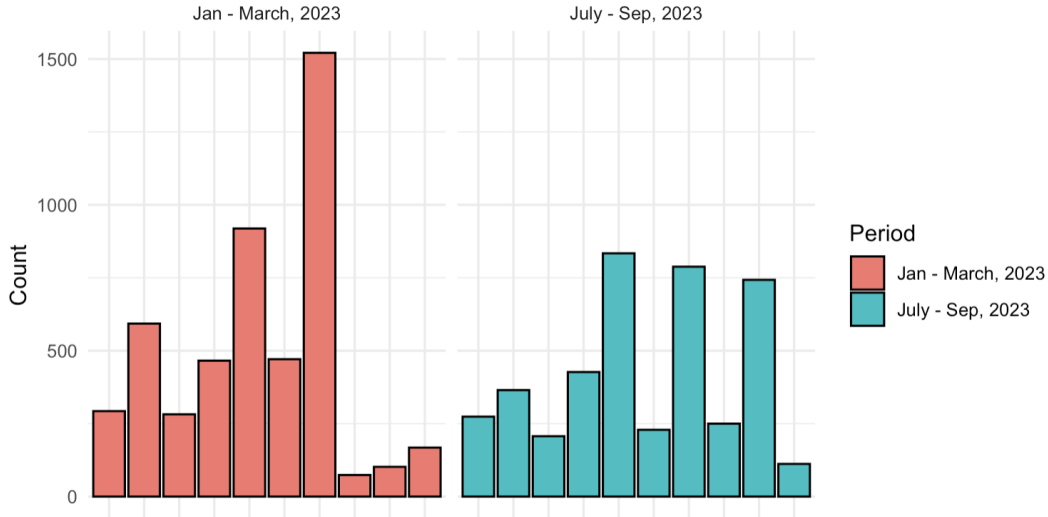
Appendix

Transaction Amount Histogram for Microsoft



Transaction Amount Histogram for Microsoft

Top 10 Transaction Amounts for Microsoft



Merchant Selection Criteria

- Focus on merchants offering digital services and social media
- Services that operate in a similar domain are more likely to be influenced or enhanced by its advancements in AI
- Merchants from other industries, such as Restaurants or Health & Beauty, are less likely to be affected by advancements in AI language models
- Identify 71 merchants within the digital service category

Bootstrapping DDD Estimator for Market Share (d_j)

- Re-sample members from each Early Adopters and Late Adopters with replacement
- Calculate triple difference estimator for market share (d_j) for each merchant
- Repeat for 200 iterations
- Remove top and bottom 5 estimates for a 95% Confidence interval

Market Share of Digital Services in Pre-Treatment Period

