

Biased Experiments and the Direction of Product Innovation

Ruiqing Cao
NBER

Rembrand Koning
Harvard Business School

Ramana Nanda
Harvard Business School

January 1, 2020

Motivation

- Technology entrepreneurship eco-system dominated by men: not only innovators and venture capitalists, but also early adopters of new products are overwhelmingly male
- Online platforms increasingly relevant for user acquisition, feedback solicitation, and market creation for early-stage product innovations

Research Question

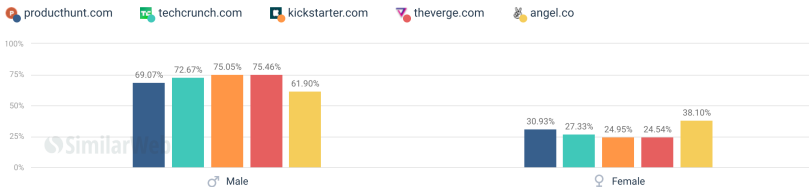
- Do female and male consumers prefer different products, and how can we robustly measure products' gender orientation among consumers?
- Does preference aggregation affect real outcomes of startup companies and hence bias the direction of product innovation?

- Product Hunt: important online platform for product launch and lead generation leveraged by technology startups; male-heavy (90% men)
 - users browse and upvote product posts, and traction on the platform affects real outcomes: e.g. user acquisition & venture funding
- Develops text-based product gender score: measures the product's consumer gender orientation
 - robustly correlate with gender of entrepreneur and user preference
- Post-launch user acquisition and startup survival: biased against female-oriented products, but encouraging participation by women improves the real outcome of female-oriented innovations
 - exploit exogenous variation in the gender composition of web traffic induced by daily newsletter product suggestions

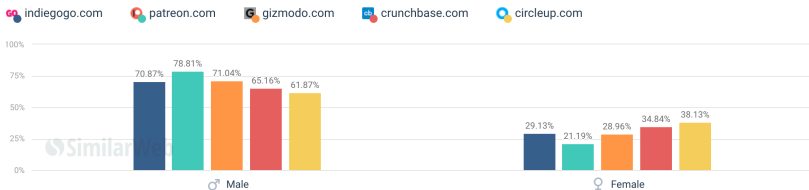
External Validity

- Gender composition of users on major commercialization platforms:
Sep 2017 – Aug 2019 → low female share across most platforms

Gender Distribution ⓘ



Gender Distribution ⓘ





- **Product Hunt Platform & Data**
- Measuring Product Gender & User Preference
- Preference Aggregation & Startup Outcomes


Product Hunt: Homepage Feed and Launch Page


Today


POPULAR NEWEST


**Todoist Foundations**
A faster and more intuitive way to get things done 🚀
34 Android 440


**HodiBot**
Cryptocurrency investing on autopilot
37 Fintech 328


**Document360**
The knowledge base software that scales with your product
42 Customer communication 353

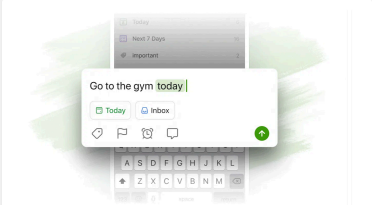
**Morning Brew**
The hottest news from Wall St. to Silicon Valley, daily 📰
163 Promoted 2654

**Awesome Design Plugins**
All design plugins for Sketch, AdobeXD, Figma.
36 Design Tools 233

**Chrome Extension Manager by cloudHQ**
Declutter your Chrome extensions and manage them with ease
50 Chrome Extensions 527

**Material Builder**
Build a responsive & intuitive website in few clicks
21 Web App 192

**Todoist Foundations**
A faster and more intuitive way to get things done 🚀
ANDROID IPHONE +2



Todoist Foundations is the fastest, most intuitive, most reliable Todoist yet. 🚀 Stay organized with new features like Sections and Task View; Save time with improved Quick Add and Completed Tasks; And enjoy a snappier UX thanks to under-the-hood updates.

Have a question about this product? [Ask the Makers](#)

TWEET SHARE EMBED

FEATURED 11 HOURS AGO

Todoist releases major update to simpl...
Bootstrapped tech company Doist, the comp...

#1 Product of the Day Today

UPVOTE 440

Website todoist.com

App Store iPhone, iPad

Google Play Android

Learn More www.microsoft.com

Learn More chrome.google.com

SEND TO PHONE

HUNTER

Amir Salihfendic Doist, Founder


27 MAKERS


David Miotti Software Engineer


Product Hunt Launch Page: Hunters and Makers


Today


POPULAR NEWEST


**Todoist Foundations**
A faster and more intuitive way to get things done 🚀
34 Android 440


**HodlBot**
Cryptocurrency investing on autopilot
37 Fintech 328


**Document360**
The knowledge base software that scales with your product
42 Customer communication 353

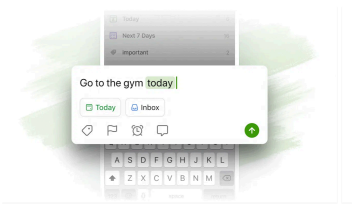
**Morning Brew**
The hottest news from Wall St. to Silicon Valley, daily 📰
163 Promoted 2654

**Awesome Design Plugins**
All design plugins for Sketch, AdobeXD, Figma.
36 Design Tools 233

**Chrome Extension Manager by cloudHQ**
Declutter your Chrome extensions and manage them with ease
50 Chrome Extensions 527

**Material Builder**
Build a responsive & intuitive website in few clicks
21 Web App 192

**Todoist Foundations**
A faster and more intuitive way to get things done 🚀
ANDROID IPHONE +2



Todoist Foundations is the fastest, most intuitive, most reliable Todoist yet. 🚀 Stay organized with new features like Sections and Task View; Save time with improved Quick Add and Completed Tasks; And enjoy a snappier UX thanks to under-the-hood updates.

Have a question about this product? [Ask the Makers](#)

TWEET SHARE EMBED

FEATURED 11 HOURS AGO

Todoist releases major update to simpl...
Bootstrapped tech company Doist, the comp...

#1 Product of the Day Today

UPVOTE 440

Website todoist.com

App Store iPhone, iPad


Google Play Android


Learn More www.microsoft.com

Learn More chrome.google.com

SEND TO PHONE


HUNTER


 **Amir Salihfendic**
Doist, Founder
27 MAKERS


 **David Miotti**
Software Engineer


Product Hunt Launch Page: Link to Startup Website


Today POPULAR NEWEST


**Todoist Foundations**
A faster and more intuitive way to get things done 🚀
34 Android 440


**HodlBot**
Cryptocurrency investing on autopilot
37 Fintech 328


**Document360**
The knowledge base software that scales with your product
42 Customer communication 353

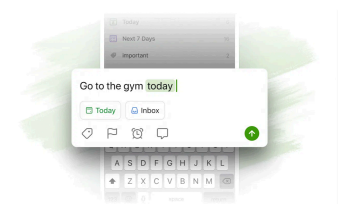
**Morning Brew**
The hottest news from Wall St. to Silicon Valley, daily 📰
163 Promoted 2654

**Awesome Design Plugins**
All design plugins for Sketch, AdobeXD, Figma.
36 Design Tools 233


**Chrome Extension Manager by cloudHQ**
Declutter your Chrome extensions and manage them with ease
50 Chrome Extensions 527






**Material Builder**
Build a responsive & intuitive website in few clicks
21 Web App 192

**Todoist Foundations**
A faster and more intuitive way to get things done 🚀
ANDROID IPHONE +2




UPVOTE 440



-  Website
todoist.com
-  App Store
iPhone, iPad
-  Google Play
Android
-  Learn More
www.microsoft.com
-  Learn More
chrome.google.com

SEND TO PHONE




Todoist Foundations is the fastest, most intuitive, most reliable Todoist yet. 🚀
Stay organized with new features like Sections and Task View; Save time with improved Quick Add and Completed Tasks; And enjoy a snappier UX thanks to under-the-hood updates.


Have a question about this product? [Ask the Makers](#)

TWEET SHARE EMBED


FEATURED 11 HOURS AGO

 Todoist releases major update to simpl...
Bootstrapped tech company Doist, the comp...

HUNTER

**Amir Salihfendic**
Doist, Founder

27 MAKERS

**David Miotti**
Software Engineer

Product Hunt Launch Page: User Upvoting

Today POPULAR NEWEST

Todoist Foundations
A faster and more intuitive way to get things done 🚀
34 Android 440

HodlBot
Cryptocurrency investing on autopilot
37 Fintech 328

Document360
The knowledge base software that scales with your product
42 Customer communication 353

Morning Brew
The hottest news from Wall St. to Silicon Valley, daily 📰
163 Promoted 2654

Awesome Design Plugins
All design plugins for Sketch, AdobeXD, Figma.
36 Design Tools 233

Chrome Extension Manager by cloudHQ
Declutter your Chrome extensions and manage them with ease
50 Chrome Extensions 527

Material Builder
Build a responsive & intuitive website in few clicks
21 Web App 192

Todoist Foundations
A faster and more intuitive way to get things done 🚀
ANDROID IPHONE +2

#1 Product of the Day Today

UPVOTE 440

Website todoist.com
App Store iPhone, iPad
Google Play Android
Learn More www.microsoft.com
Learn More chrome.google.com

SEND TO PHONE

TWEET SHARE EMBED

FEATURED 11 HOURS AGO

Todoist releases major update to simpl...
Bootstrapped tech company Doist, the comp...

HUNTER
Amir Salihfendic Doist, Founder
27 MAKERS
David Miotti Software Engineer

Cao, Koning, & Nanda

January 1, 2020

9 / 28

Product Hunt Launch Page: Product Texts

Todoist Foundations
A faster and more intuitive way to get things done

ANDROID IPHONE +2

UPVOTE 440

Website
todoist.com

App Store
iPhone, iPad

Google Play
Android

Learn More
www.microsoft.com

Learn More
chrome.google.com

SEND TO PHONE

HUNTER
Amir Salihefendic
Doist, Founder
27 MAKERS
David Miotti
Software Engineer

Todoist Foundations is the fastest, most intuitive, most reliable Todoist yet. Stay organized with new features like Sections and Task View; Save time with improved Quick Add and Completed Tasks; And enjoy a snappier UX thanks to under-the-hood updates.

Have a question about this product? Ask the Makers

TWEET SHARE EMBED

FEATURED 11 HOURS AGO

Todoist releases major update to simpl...
Bootstrapped tech company Doist, the comp...

Amir Salihefendic Maker
#1 Product of the Day Today

Hi Product Hunters

Over the last two years, the Todoist team has been meticulously rebuilding Todoist's foundation to help people get things done in a faster, more intuitive, and more reliable way. And it's finally time to share this new chapter with everyone. Announcing Todoist Foundations.

Todoist Foundations is an inside-and-out update that introduces useful new features and adds polish to the ones you already use every day.

- Divide and conquer your projects with new Sections.
- See everything about your task at a glance with Task View.
- Keep track of the little things with the Sub-tasks View.
- Add tasks more easily with the redesigned Quick Add for mobile.
- Easily add tasks wherever you need them with the Dynamic Add Button for iOS (Android coming soon).

Todoist Foundations also introduce vital under-the-hood updates that make for the fastest, most reliable Todoist yet – and lay the groundwork for the more powerful features coming next, like Boards and Upcoming View.

This update will be rolling out over the next 24 hours to every platform. Keep a lookout for it!

Upvoted (22) 3 Replies Share a day ago ...

Dmitry Dubovetzky
@amix3k Congratulations! I'm using Todoist over the past two years and really happy with it
Upvoted (4) Reply Share 11 hours ago ...

Niklas Plvic
@amix3k I must say that this update is—so far, for myself—a really nice one.

I've found all of the features by simply checking for them myself and I am very impressed with how you have not only handled the user experience but also how everything is documented. Sweet. Thanks!

Upvoted (2) Reply Share 10 hours ago ...

- Product Hunt Platform & Data
- **Measuring Product Gender & User Preference**
- Preference Aggregation & Startup Outcomes

Product Texts: Tagline and Description

Refty
Smart editor that helps you write better content, faster

PRODUCTIVITY WRITING TOOLS + 1

UPVOTE 1,488

#1 Product of the Day
November 14, 2016

Website
refty.it

App Store
iPhone, iPad

SEND TO PHONE

HUNTER
Kevin William David
Community @Angellist. No 1 Hunter ...

5 MAKERS
Jishad AV
Software Engineer, Perleybrook Labs
TONY TOM
Co-founder, Refty

FEATURED 3 YEARS AGO

Refty is a smart editor for content writers who are trying to scale their content globally. Refty helps you improve your language, SEO and track your writing goals. Also, you can publish or schedule your publish to multiple blogs in a single click. And the best part, it's free !! The latest version is out in the AppStore

Product Texts: Hunter- and Maker-Initiated Comments



Kevin William David Hunter

Refly is a smart editor, specially made with content creators in mind. Refly will help you reduce your writing time by 10-20%. This is done by reducing the time for proofreading (which is average 40% in writing). Refly can help you with linguistic errors, SEO and publishing at this point. Also, Refly will help you stay on track with your writing goals by the habit feature.

Upvote (16) Share 3 years ago



TONY TOM Maker

@kwdinc Thanks for the Hunt.

Hello PH

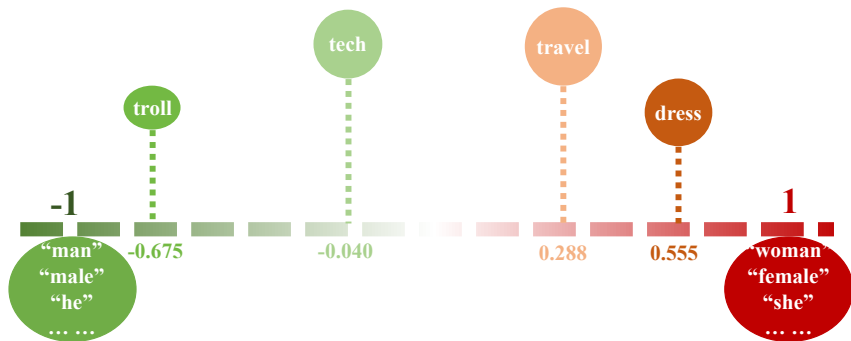
Refly is a smart editor. Refly is made with a mission to make content creation easier for everyone. We designed Refly in such a way to make content creation just content creation. We intend to remove the other 80% work. Refly will help your reduce the proofreading time with extended grammar, spell and synonym support. Refly will help you with your SEO and publishing to Facebook, Medium and even a personal WordPress blog. We'll come up with solutions for research and topic suggestions. Thanks for the upvotes. Hope you'll love the app !! Open to comments or you can reach out to me on twitter(_tonytom)

Thanks.

Upvote (5) Share 3 years ago

Text-Based Product Gender Orientation

- Project product descriptive words onto the gender space: defined by nodal word-pairs, e.g. “man” v.s. “woman”
 - each word is represented by a pre-trained high-dimensional vector
 - descriptive words include nouns, verbs, and adjectives
 - measure **gender-orientation of each word**



Compute each product's **gender-orientation** score

- Texts: name, tagline, description, hunter- & maker-initiated comments
- Extract product descriptive words: nouns, verbs, and adjectives
- Based on a set of gender nodal word-pairs, compute the product's **gender-orientation** scores from all WP in the set

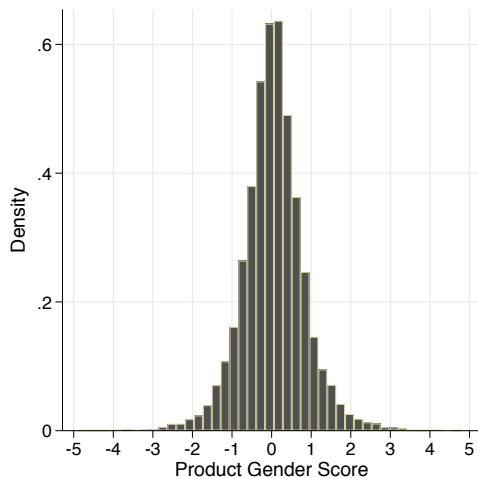
Compute each product's **gender-orientation** based on nodal WP

- For each word appearing in the product texts
 - calculate its TF-IDF relative to the entire data set
 - calculate its gender-orientation score given WP
- Calculate overall gender-orientation of product texts
 - sum scores over descriptive words, weighted by TF-IDF

Compute each product's **gender-orientation** score

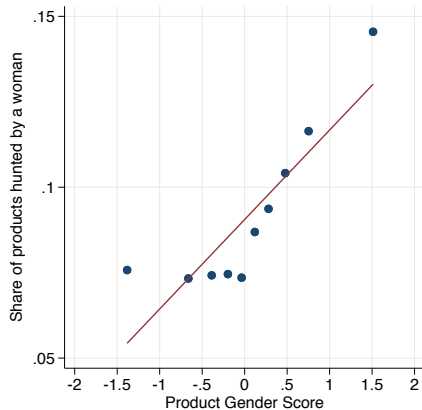
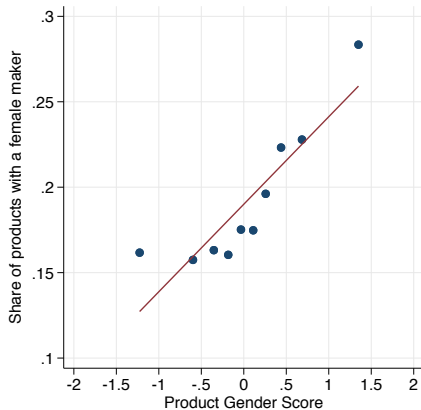
- Texts: name, tagline, description, hunter- & maker-initiated comments
- Extract product descriptive words: nouns, verbs, and adjectives
- Based on a set of gender nodal word-pairs, compute the product's **gender-orientation** scores from all *WP* in the set
- Compute the *first principal component* of these scores, across the set of gender nodal word-pairs, and normalize the measure

Probability Distribution of Product Gender Orientation



- **Higher** score represents **more feminine** product

Product Gender Orientation v.s. Maker/Hunter Gender

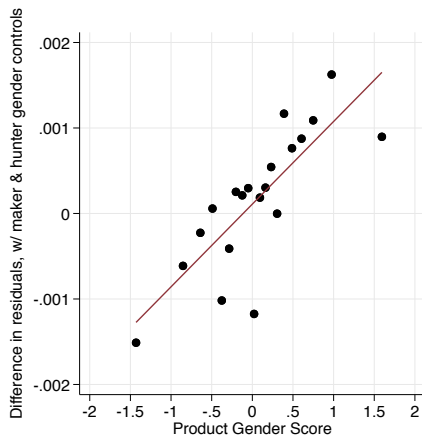
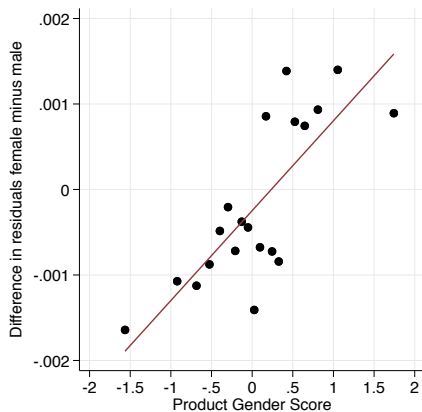


Products by Position in the Distribution of Gender Orientation

%tile	Product Name	Tagline	Gender Score
P1	ThxBro	Generate deliciously random, jargon-laced e-mails	-5.109
	Ballmetric	Your favorite plays from the NBA	-3.711
	Beard Bib 2.0	Hair clippings catcher from Beard King	-3.653
P5	SPECTRA	The most portable electric skateboard	-1.305
	Segway Drift W1	The first self balancing e-skate	-1.294
	Keyport Slide 3.0 & Pivot	The swiss army knife of the future	-1.293
P10	SnapHunt	Product Hunt for Snapchat. Discover new people to follow	-0.903
	Nikola	See your Tesla's battery percentage from your menubar	-0.900
	Hackuna	Secure yourself from all kinds of hackers	-0.898
P25	Morph - PokemonGo Bot	Chatbot to find and report Pokemon around you	-0.404
	Phish.AI	Anti-phishing platform powered by AI & Computer Vision	-0.401
	Sqreen API	A security toolbox for developers	-0.401
P50	Cemtrex Smartdesk	The world's most advanced workstation	0.027
	Yomu	One place to read your favorite content from around the web	0.027
	Adzoola	Hyper-targeted advertising and outreach	0.028
P75	Borsch	The AI app that helps you discover the yummiest dishes	0.495
	Cuddle Mattress	Hug your better half without the arm numbing	0.495
	Joonko	Personal diversity and inclusion AI-coach for managers	0.500
P90	The Silver Post	Do more for grandma or grandpa	0.999
	Kindred	Friends for when you travel	1.001
	Ropazi	Personal shopper for busy parents	1.001
P95	Artwxrk	Curated collection of the world's best contemporary art	1.451
	Chairman Mom	A social, Q&A platform for working moms	1.457
	VINA	Connecting awesome women for fun, for work, for life	1.474
P99	Babee on Board	Pregnant? Request a seat on public transport	5.104
	Flo Health	The #1 app for women's menstrual health	5.237
	Wonder	An app for queer & lesbian women to express their uniqueness	6.159

Active Users' Preferences for Launched Products

- Left: without maker and hunter gender controls
- Right: with maker and hunter gender controls

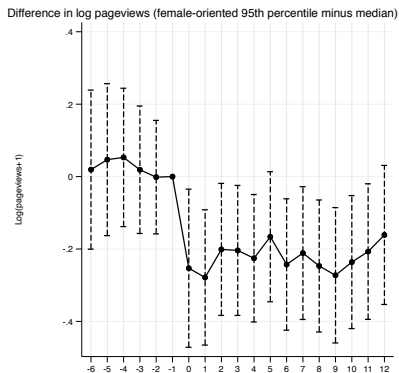
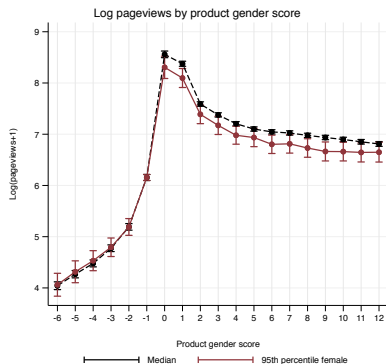


- Product Hunt Platform & Data
- Measuring Product Gender & User Preference
- **Preference Aggregation & Startup Outcomes**

User Acquisition by Product Gender Orientation around Launch

Startup user acquisition by product gender -6 to 12 months around launch

$$Y_{i\tau} = \beta_{0\tau} + \beta_{1\tau} \times \text{ProductGenderScore}_i + \gamma_i + \xi_{T_i-\tau} + \epsilon_{i\tau}, \tau = -6, \dots, 12$$



Daily Newsletter and Suggested Products

Product Hunt Daily Digest

May 10th, 2018

SHARE ON TWITTER

SHARE ON FACEBOOK



Looking for Mother's Day Gift

Just kidding. Mother's Day is on Sunday. 🍀

If this email surprised, then you probably need some gift recommendations. We got you:

🌸 **Bouquet Bar** lets you mix & match candy, flowers & candles in custom gift boxes. Backed by Mark Cuban via Shark Tank.

👤 **Mahinarium Selfie Dolls** are dolls that look exactly like you. Empty Nest Syndrome won't know what hit it. If dolls aren't your mom's thing, you can also get a **custom lollipop** in her likeness.

✉️ **Miniature Mail** sends the cutest, teeny-tiny letters, or you can **try Felt**: they handwrite your words and deliver them on a beautiful card.

👤 **Token AI** is an uber-powerful gifting service powered by Machine Learning. "This product makes me a gift-giving rockstar."

🛒 **Postmates Gift Cards** exist for late-night guilty pleasure. Yum-

Daily Newsletter and Suggested Products

Product Hunt Daily Digest

May 10th, 2018

SHARE ON TWITTER

SHARE ON FACEBOOK



Looking for Mother's Day Gift

Just kidding. Mother's Day is on Sunday. 🙄

If this email surprised, then you probably need some gift recommendations. We got you:

👉 **Bouquet Bar** lets you mix & match candy, flowers & candles in custom gift boxes. Backed by Mark Cuban via Shark Tank.

👤 **Mahinarium Selfie Dolls** are dolls that look exactly like you. Empty Nest Syndrome won't know what hit it. If dolls aren't your mom's thing, you can also get a **custom lollipop** in her likeness.

✉️ **Miniature Mail** sends the cutest, teeny-tiny letters, or you can **try Felt**: they handwrite your words and deliver them on a beautiful card.

🤖 **Token AI** is an uber-powerful gifting service powered by Machine Learning. "This product makes me a gift-giving rockstar."

🍷 **Postmates Gift Cards** exist for late-night guilty pleasure. Yum-

Cao, Koning, & Nanda

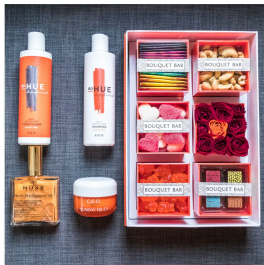
HOME → BOUQUET BAR



Bouquet Bar

Mix & match candy, flowers & candles in custom gift boxes 🎁

HOME SAAS + 1



Bouquet Bar is provides high quality customizable gift boxes.



FEATURED 2 YEARS AGO

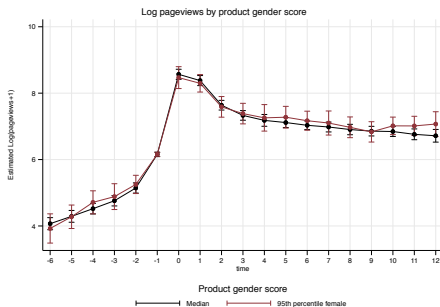
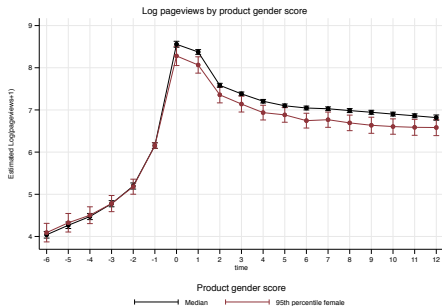
h Bouquet Bar on 'Shark Tank': A Look I...
Bouquet Bar entered the Shark Tank in Seaso...

Treatment Effect on Product-Gender Gap in User Acquisition

Newsletter Shock: maximum gender score among products suggested by the daily newsletter → triple-differences specification

$$Y_{i\tau} = \alpha_{0\tau} + \alpha_{1\tau} \times \text{ProductGenderScore}_i + \alpha_{2\tau} \times \text{NewsletterShock}_{T_i} + \alpha_{3\tau} \times \text{NewsletterShock}_{T_i} \times \text{ProductGenderScore}_i + \gamma_i + \xi_{T_i-\tau} + \epsilon_{i\tau}$$

- Median newsletter (max score)
- 95%ile female newsletter shock



Treatment Effect on Product-Gender Gap in User Acquisition

Newsletter Shock: maximum gender score among products suggested by the daily newsletter \rightarrow triple-differences specification

$$Y_{i\tau} = \alpha_{0\tau} + \alpha_{1\tau} \times \text{ProductGenderScore}_i + \alpha_{2\tau} \times \text{NewsletterShock}_{T_i} + \alpha_{3\tau} \times \text{NewsletterShock}_{T_i} \times \text{ProductGenderScore}_i + \gamma_i + \xi_{T_i-\tau} + \epsilon_{i\tau}$$

- Median newsletter (max score)
- 95%ile female newsletter shock

