# Nudges, Managerial Planning, and Small Firm Performance: Evidence from Online Commerce

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# Introduction

- ▶ Business practices are a key input of firms' production function (Bloom and Van Reenen 2007; Bruhn et al., 2010; McKenzie and Woodruff, 2017)

    - ▶ Managers and entrepreneurs are in charge of planning, organizing, and allocating resources

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    ▶ Managers and entrepreneurs are in charge of planning, organizing, and allocating resources

▶ Especially relevant in less developed countries, where large share of income is generated by small, less productive firms

    ▶ 80% of individuals work in firms with $< 10$ employees, v. 35% in developed countries (ILO 2019)

    ▶ Robust evidence that small firms in the Global South often fail to follow good practices (Bloom and Van Reenen 2010; McKenzie and Woodruff, 2017)

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- ▶ However, little evidence around **behavioral interventions**

- ▶ Under **what conditions** such interventions work also remains largely underexplored

# Context

- Collaboration with one of largest platforms for online commerce in Latin America

    - The platform provides web-hosting services, akin to Shopify in the US (not an *aggregator* like eBay, Amazon, or Mercado Libre)

    - Firms have individual URLs and are in charge of generating their own traffic

- Access to sample of firms operating in Argentina and Brazil that had 7–150 transactions over last 90 days at baseline, and reachable via comms
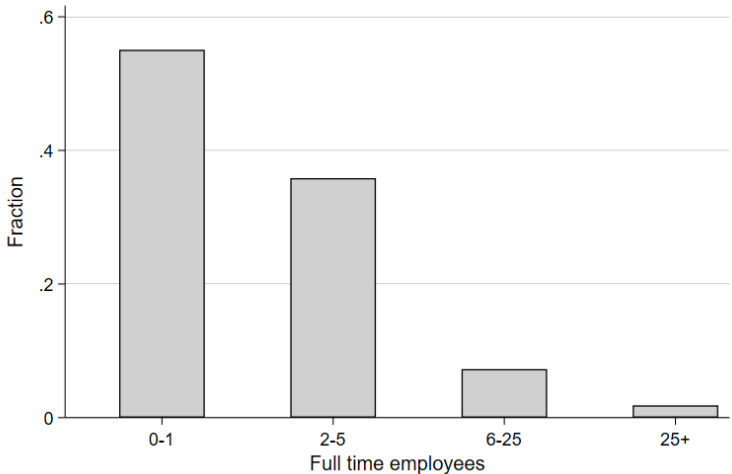  → **5,118 firms in AR and 4,546 in BR**

# Sample Characteristics: Revenue
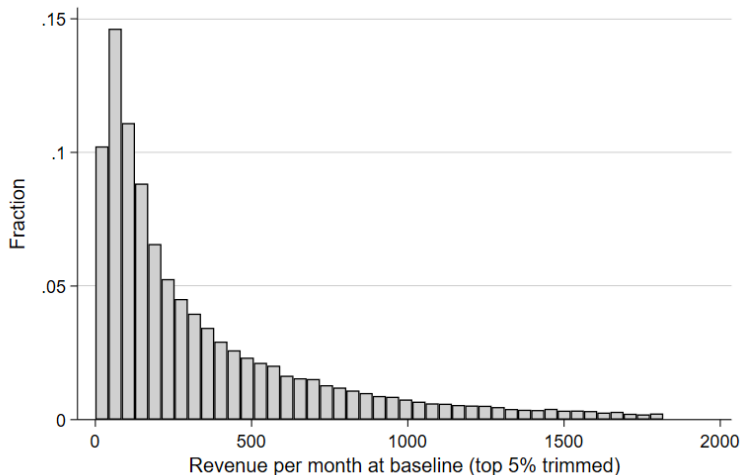


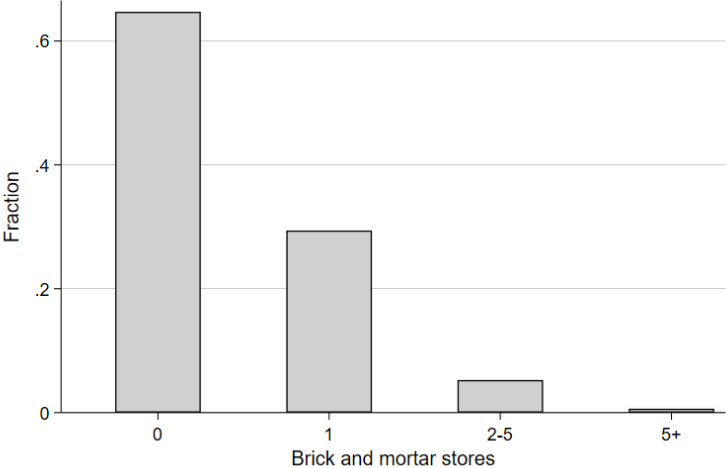Mean monthly revenue at baseline (Oct-2021) = $ 545; median = $ 243
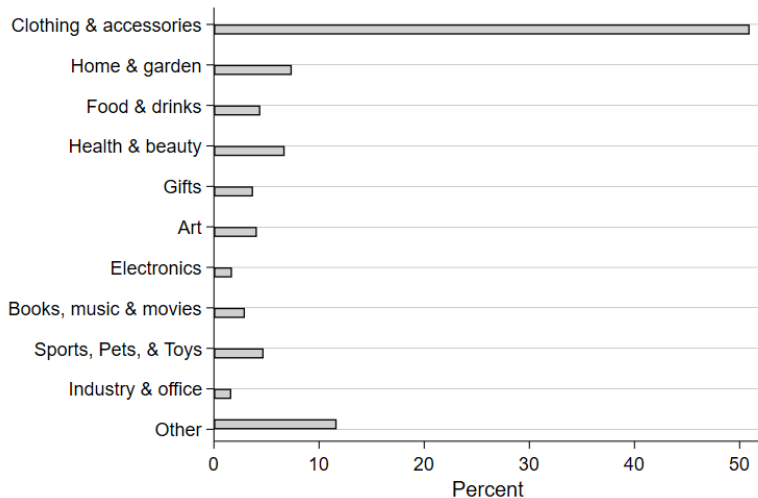
# Sample Characteristics: Number of Employees



Self reported by 56% of sample

# Sample Characteristics: Number of Physical Stores



Self reported by 65% of sample

# Sample Characteristics: Sector



Self reported by 73% of sample

# Sample Characteristics: Advertising and Sophistication

- They mainly advertise on social media

  - 95% have an Instagram account (main channel)

  - 72% have a Facebook account

- They tend to be sophisticated given their size

  - 40% use Google Analytics

# Data

- The platform provided the following data for each firm:

  - Daily sales at product level (P and Q) between 1/1/2021 and 3/15/2022

  - Full product listings (P and stock) on BF, the day before, 3 days later, and 10 days later

  - Firm characteristics, including date of entry, location, industry, social media accounts, and apps integrated to the store

- I also retrieved Instagram posts for each firm between 11/1/2021 and 3/15/2022, including date, caption, and number of likes—window into advertising strategy

# Experimental Design

▶ The experiment consisted of distributing messages to store managers

▶ Each manager received the same message twice:

    ▶ Via email, 2 weeks before BF (33% open rate)

    ▶ Via in-app message, 5 days after the first (71% open rate)

    ▶ 82% read at least one of the two

▶ Stratified randomization into treatment and pure control

# The Message

**Black Friday** is just around the corner! Take advantage of this event to increase your sales and participate in a raffle to win one of three iPads. If you want to participate, read the following message carefully.

Black Friday (Nov-26) is a **great opportunity** to increase sales by offering discounts and promotions for a short period of time. **Have you already planned yours?**

At the same time, don't forget to **communicate** your discounts and promotions on **social media**. You can offer great things, but if your audience doesn't know about them, they won't have any impact, so don't miss the opportunity!

To participate in the raffle for one of three iPads, just send the flyer you will use to promote your main Black Friday discount. You have time until Nov-25!

# Experimental Design

▶ Message designed to nudge managers to plan for BF

▶ Includes a reminder + language that makes the opportunity salient
  → address limited attention (Karlan et al. 2016)

▶ Also includes a raffle to increase salience of the message (it didn't alter incentives—participation rate was only 1.74%)

## Regression model

► I estimate intent-to-treat effects in an event-study design:

$$y_{it} = \alpha_i + \gamma_t + \sum_{m=-G}^{M} \beta_m z_{i,t-m} + \epsilon_{it} \tag{1}$$

► Where $y_{it}$ is an outcome of interest for firm $i$ on period $t$, $\alpha_i$ is a firm fixed effect, and $\gamma_t$ is a time fixed effect. The regressors of interest, $z_{i,t-m}$, are indicator variables taking value 1 when firm $i$ received treatment $m$ periods before $t$.

► Baseline period is the one right before onset of the experiment

► Standard errors clustered at firm level

► **Balance test**: Fail to predict treatment assignment based on all covariates
$\rightarrow$ P-value of joint significance test = 0.53 ► Table

# Results: Revenue ( ► alt. outcome )

## Figure: Log(1+revenue)
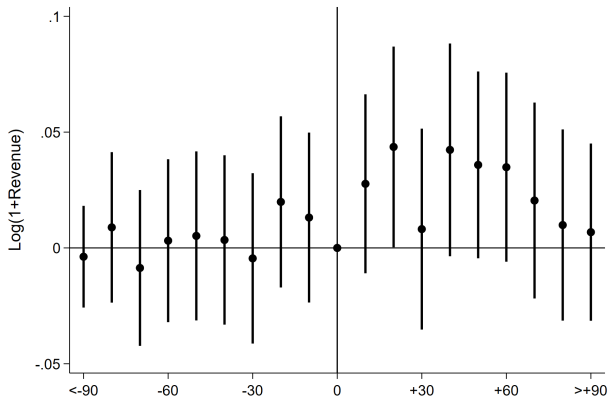


Note: The outcome variable is the log-transformed value of daily revenue plus 1. Plotted coefficients correspond to the nudge treatment. Time-period corresponds to 10-day bins. Period 0 corresponds to the ten days before the distribution of the first round of messages. 95% confidence intervals. Standard errors clustered at firm level.
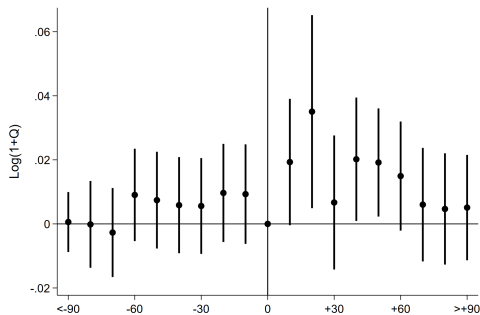
# Results: Revenue



Figure: Quantities
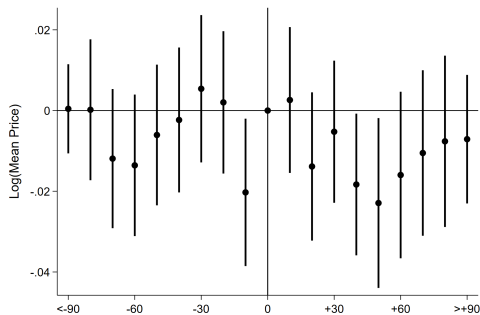
Figure: Average price

▶ May be indicative of higher profits (assuming costs unaffected by treatment)

# Mechanisms

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▶ **Inventories**

# Mechanisms

- **Pricing** $\rightarrow$ No evidence that nudge affected pricing ▸go

- **Advertising** $\rightarrow$ Treated firms 16% more likely to advertise discounts during week before BF (substituted generic advertising) ▸go

- **Inventories** $\rightarrow$ Treated firms display 6-11% larger inventories on the day before BF ▸go

# Moderators: Treatment Effect Heterogeneity

▶ Implement Athey et al. (2019) causal forest algorithm to predict firm-specific Conditional Average Treatment Effects (CATE)

▶ Use all available covariates $\rightarrow$ agnostic approach

▶ Focus on the 20-day effect, which is where magnitude and statistical significance is strongest

# Moderators: Treatment Effect Heterogeneity ▸ table

- ▶ The nudge was more effective among larger, more experienced firms

- ▶ Also among more sophisticated firms (Google Analytics) and with higher presence in social media (Facebook)

- ▶ Results suggest that **pre-existing capabilities are important to unlock the benefits of the nudge**

  - ▶ A possible tale of **strategic complementarity** between firm capabilities and light touch interventions

  - ▶ A word of caution about effectiveness of behavioral interventions among microenterprises in less developed contexts

- ▶ Finally, higher effectiveness in Argentina, where BF is less salient—consistent with **limited attention**

# Discussion

- **Business practices** (Bloom et al. 2013; Bruhn et al. 2018; Lafortune et al. 2018; Dalton et al. 2021; Anderson & McKenzie 2022; Iacovone et al. 2022)

    - Behavioral interventions can improve managerial planning and firm performance

    - Suggestive evidence that pre-established capabilities complement light-touch interventions

    - Messages—a cheap and scalable treatment—can temporarily improve practices

    - Future research could focus on long-run effects

# Discussion

▶ **Business practices** (Bloom et al. 2013; Bruhn et al. 2018; Lafortune et al. 2018; Dalton et al. 2021; Anderson & McKenzie 2022; Iacovone et al. 2022)

▶ **"Behavioral firms"** (Kremer et al. 2019; Seither 2021; Banerjee et al. 2023; Gertler et al. 2023)

    ▶ Evidence that small but sophisticated firms are also subject to behavioral frictions, based on high quality data (Verhoogen 2021)

    ▶ Limited attention among managers is consistent with main results

# thank you!

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# APPENDIX

# Sample Characteristics: Store Age
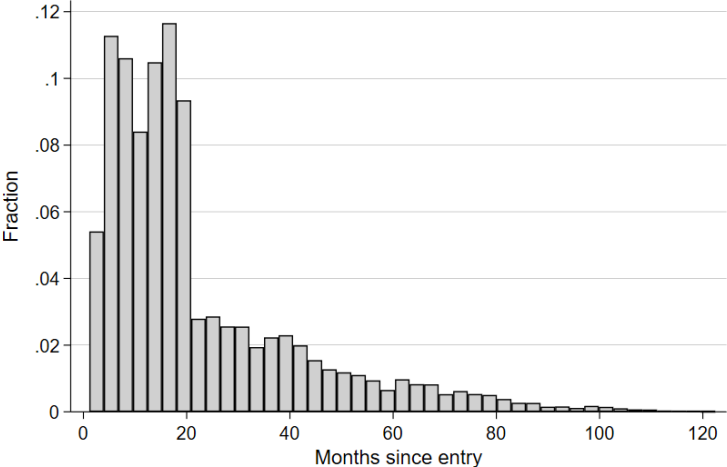


Mean age = 23 months; median = 16.5 months

# Black Friday

- ▶ The experiment leverages Black Friday (BF), a major opportunity for firms to boost sales, grow their client base, and promote the brand

  - ▶ BF had existed for over 8 years in each country

- ▶ The two countries differ in their sales events calendar:

  - ▶ In Brazil, BF is the main event in the year, in part because it is immediately followed by Cyber Monday (similar to the US)

  - ▶ In Argentina, BF is the third event in terms of sales (Cyber Monday and "Hot Sale" take place earlier in the year)
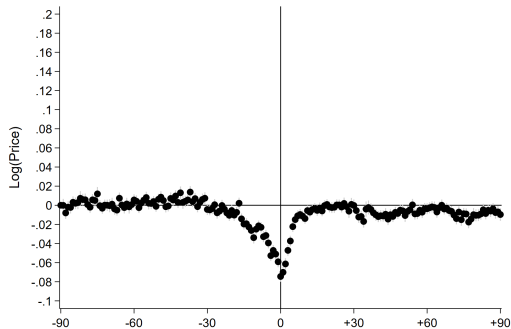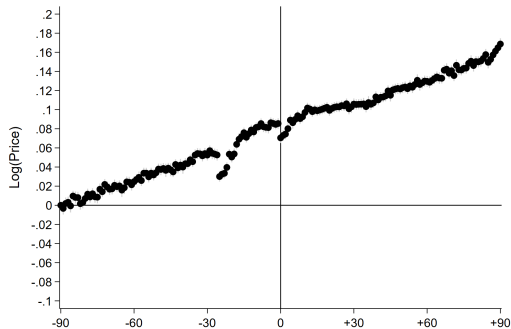
# Black Friday: Revenue
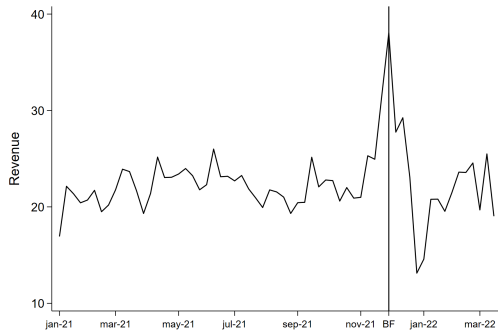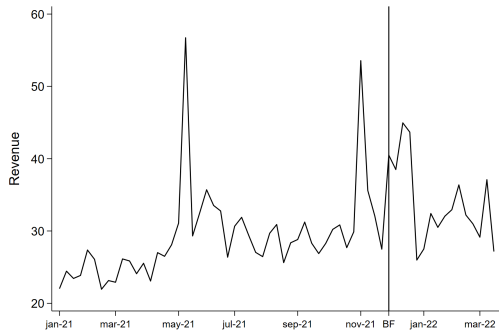


Daily revenue of Argentine (L) and Brazilian (R) firms around BF, by week

- ▶ → BF is much more salient in Brazil

# Black Friday: Prices



Daily log-prices of Argentine (L) and Brazilian (R) firms around BF,
from event study with product FE and based on transaction data

# Balance Test <span>▸ back</span>

| | Treatment group | |
| --- | :---: | :---: |
| | (1) | (2) |
| Log(Sales Aug-Oct '21) | 0.001 | 0.007 |
| | (0.004) | (0.007) |
| Months since entry | 0.000 | 0.000 |
| | (0.000) | (0.000) |
| 0-1 employees | -0.060 | -0.063 |
| | (0.056) | (0.057) |
| 2-5 employees | -0.060 | -0.063 |
| | (0.056) | (0.057) |
| 6-25 employees | -0.039 | -0.040 |
| | (0.060) | (0.061) |
| Reports employees | 0.047 | 0.049 |
| | (0.056) | (0.058) |
| 0 B&M | 0.012 | 0.011 |
| | (0.086) | (0.087) |
| Showroom only | 0.001 | 0.000 |
| | (0.087) | (0.088) |
| 1 B&M | 0.034 | 0.034 |
| | (0.086) | (0.087) |
| 2-5 B&M | 0.014 | 0.013 |
| | (0.088) | (0.089) |
| Reports B&M | -0.016 | -0.019 |
| | (0.086) | (0.088) |
| Instagram | -0.001 | -0.002 |
| | (0.025) | (0.026) |
| Facebook | -0.007 | -0.007 |
| | (0.013) | (0.013) |
| Google analytics | -0.004 | 0.034 |
| | (0.011) | (0.031) |
| Integrated apps | 0.003 | 0.005** |
| | (0.002) | (0.002) |
| Strata FE | No | Yes |

# Results: Revenue `▸ back`

## Figure: Revenue (trimmed top 1%)
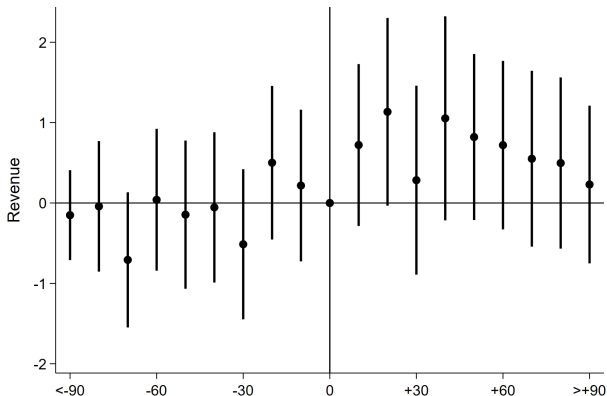


Note: The outcome variable is revenue, trimmed at the top 1%. Plotted coefficients correspond to the nudge treatment. Time-period corresponds to 10-day bins. Period 0 corresponds to the ten days before the distribution of the first round of messages. 95% confidence intervals. Standard errors clustered at firm level.

▶ Nudge didn't affect engagement with BF

|  | Full listing | | Top 5 products | |
|  | (1) | (2) | (3) | (4) |
|  | Any disc. | Log(Avg. Price) | Any disc. | Log(Avg. Price) |
|---|---|---|---|---|
| Nudge | 0.014 | -0.003 | 0.012 | 0.006 |
|  | (0.009) | (0.020) | (0.009) | (0.025) |
| Strata FE | Yes | Yes | Yes | Yes |
| Control mean | 0.725 | 6.264 | 0.298 | 5.899 |
| Obs. | 9664 | 9634 | 9664 | 8299 |

Note: Measures of pricing on the day of BF. Columns 1–2 consider all products and columns 3–4 consider the five most sold products only, based on pre-treatment quantities sold. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

# Mechanisms: Pricing — event study with product FE ▸back
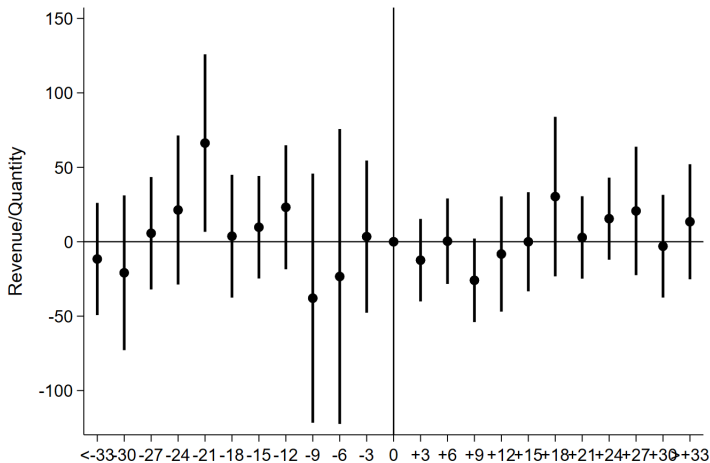


Note: The outcome variable is revenue over price. The observations are at the product-day level. The regression included product fixed effects. Time-period corresponds to 3-day bins. Period 0 corresponds to the three days before the distribution of the first round of messages. 95% confidence intervals. Standard errors clustered at firm level.

# Mechanisms: Advertising Strategy

- ▶ Advertising is a crucial activity among these firms

    - ▶ Up to them to generate traffic (can't rely on an aggregator)

- ▶ Instagram data provides a valuable window into their main advertising channel

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- ▶ Instagram data provides a valuable window into their main advertising channel

- ▶ **Very little advertising** in advance of major sales events

    - ▶ Likelihood of advertising discounts during the 7 days before BF is only **3.1% in AR and 8.5% in BR** in the control group (while 73% of firms offer discounts on BF!)

    - ▶ Likelihood of posting any content is 27% and 36%, respectively

- ▶ The nudge specifically targeted social media advertising
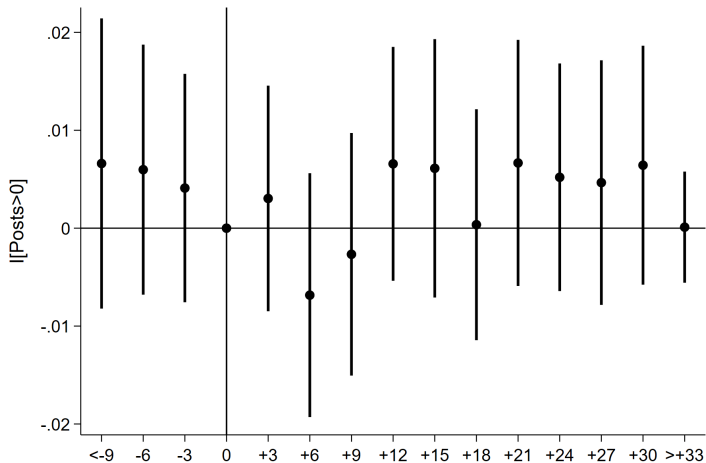
Note: The outcome variable is an indicator taking value 1 if the firm posts on Instagram at least once in the day. Time-period corresponds to 3-day bins. Period 0 corresponds to the three days before the distribution of the first round of messages. 95% confidence intervals. Standard errors clustered at firm level.

# Mechanisms: Advertising Strategy – Posting about Discounts  `▸ back`
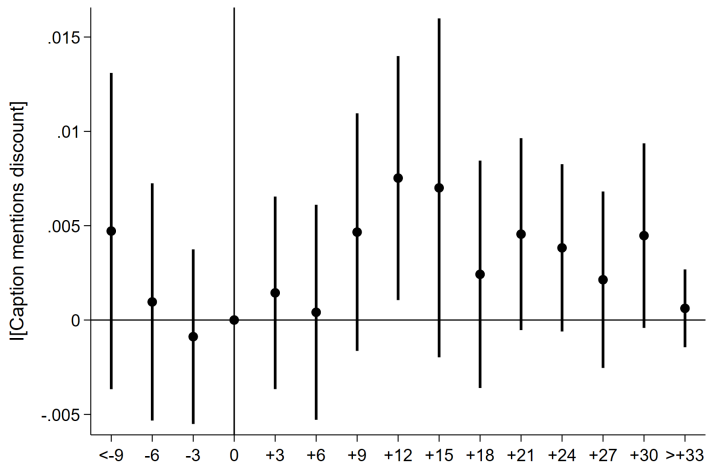


Note: The outcome variable is an indicator taking value 1 if the firm posts on Instagram and mentions discounts at least once in the day. Time-period corresponds to 3-day bins. Period 0 corresponds to the three days before the distribution of the first round of messages. 95% confidence intervals. Standard errors clustered at firm level.

# Mechanisms: Advertising Strategy

▶ **16% increase in likelihood of advertising discounts the week before BF**

▶ Consistent with planning, nudge affected advertising in advance of the event

▶ Similar timing to pick up in revenue

# Mechanisms: Inventory Management

▶ Importance of inventory management among small firms has been widely documented (Kremer et al. 2013; Bloom et al. 2013; McKenzie & Woodruff 2017)

▶ Especially important during major sales event, where insufficient inventory could jeopardize performance

▶ Analyze inventory records as of the day before BF

    ▶ Firms have strong incentives to keep it updated if real inventory $> 0 \rightarrow$ they could lose sales

# Mechanisms: Inventory Management ▸ back

Table: Listed products the day before BF

|  | log(products) (1) | log(products) \| stock>0 (2) | log(products) \| stock>100 (3) |
|---|---|---|---|
| Nudge | 0.07** | 0.06** | 0.11* |
|  | (0.03) | (0.03) | (0.06) |
| Strata FE | Yes | Yes | Yes |
| Control mean | 5.58 | 5.59 | 5.80 |
| Obs. | 9660 | 9633 | 5881 |

Note: Column 1 regresses the log of number of products listed as of the day before Black Friday (BF). Columns 2 and 3 regress the the analogous considering only products with positive stock and with more than 100 units in stock, respectively. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

▶ Unexpected result: inventory management had not been targeted by the nudge

▶ **6-11% increase in number of products available**

▶ The intervention induced a holistic reaction, improving complementary behaviors as well (Altmann et al. 2024)

# Moderators: Treatment Effect Heterogeneity <span>▸ back</span>

Table: Covariate means across below- and above-median CATE groups

| Variable | Low Predicted TE | High Predicted TE | Diff. | MHT p-value |
|---|---|---|---|---|
| Pre-treatment sales (logs) | 2.308 | 2.932 | 0.624*** | 0.001 |
| Firm age (months) | 16.527 | 29.310 | 12.783*** | 0.001 |
| Employees: 0-1 | 0.317 | 0.307 | -0.009 | 0.951 |
| Employees: 2-5 | 0.207 | 0.200 | -0.007 | 0.974 |
| Employees: 6-25 | 0.022 | 0.053 | 0.031*** | 0.001 |
| Employees: 25+ | 0.008 | 0.012 | 0.005 | 0.273 |
| Brick & Mortars: 0 | 0.387 | 0.260 | -0.126*** | 0.001 |
| Brick & Mortars: showroom | 0.070 | 0.124 | 0.054*** | 0.001 |
| Brick & Mortars: 1 | 0.143 | 0.229 | 0.086*** | 0.001 |
| Brick & Mortars: 2-5 | 0.027 | 0.043 | 0.016*** | 0.001 |
| Brick & Mortars: 5+ | 0.003 | 0.005 | 0.001 | 0.938 |
| Instagram account | 0.954 | 0.953 | -0.001 | 0.997 |
| Facebook account | 0.674 | 0.775 | 0.101*** | 0.001 |
| Google Analytics | 0.386 | 0.421 | 0.035*** | 0.001 |
| Country: Argentina | 0.462 | 0.598 | 0.136*** | 0.001 |
| Observations | 4,832 | 4,831 | 9,663 | |

Note: **Some covariates omitted (see paper for full version)**. This table characterizes, in columns 1 and 2 respectively, the subsample below and above the median predicted conditional average treatment effect (CATE) of the nudge on revenue during the 20 days after the intervention, following Athey et al. (2019). Column 3 provides the difference in means and column 4 the p-values adjusting for multiple hypothesis testing, following List et al. (2019). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.