# Growing by the Masses

## Revisiting the Link Between Firm Size and Market Power

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# Preview of Model Results

- **Theory.** a firm dynamics model consistent with our facts:
    - provides new perspective on relationship between firm size and market power
    - associates *higher* concentration with *lower* aggregate markup
    - predicts substantive welfare gains due to *misallocation of demand*.
- **Quantitative.** relative to equilibrium, efficient allocation features:
    - 11% fewer firms and 39% higher concentration
    - 11% / 15% / 14% higher aggregate TFP / output / welfare

# Literature Review

- Firm size and market power with intensive demand margin:
  Rotemberg and Woodford (1992); Atkeson and Burstein (2008); Edmond, Midrigan and Xu (2018); Gopinath and Itskhoki (2010); Hottman, Redding and Weinstein (2016); Amiti, Itskhoki and Konings (2019)
- Endogenous customer acquisition through marketing/advertising:
  Arkolakis (2010); Drozd and Nosal (2012); Sedlacek and Sterk (2017); Perla (2019); Fitzgerald, Haller and Yedid-Levi (2016); Fitzgerald and Priolo (2018); Kaplan and Zoch (2020)
- Misallocation:
  Restucia and Rogerson (2008); Hsieh and Klenow (2009); Peters (2019); David, Hopenhayn and Venkateswaran (2016); Asker, Collard-Wexler and De Loecker (2014); Buera, Kaboski and Shin (2011); Midrigan and Xu (2014); Baqaee and Farhi (2019); Bigio and La'O (2020)

# Empirical Findings

# Components of firms' sales

Data Costs

- Analyze components of sales and their contribution to:
    - firm growth
    - market power

- Two sources of sales growth:

$$\underbrace{\ln S_{it}}_{\text{Total sales firm } i} = \underbrace{\ln m_{it}}_{\text{Number of customers}} + \underbrace{\ln p_{it} D(p_{it})}_{\text{Sales per customer}}$$

- Combine two sources of data: ACNielsen Homescan Panel and Compustat

# Markups are associated with the intensive margin

$$\ln \text{Markup}_{it} = \alpha_1 \ln \text{pD(p)}_{it} + \alpha_2 \ln \text{m}_{it} + \lambda_t + \lambda_s + \varepsilon_{it}$$

| | ln Markup | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| $\ln \text{pD(p)}_{it}$ | 0.092*** | 0.091*** | 0.060*** | 0.059*** | 0.060** |
| | (0.033) | (0.033) | (0.022) | (0.022) | (0.024) |
| $\ln \text{m}_{it}$ | -0.002 | -0.002 | 0.002 | 0.002 | 0.003 |
| | (0.006) | (0.006) | (0.007) | (0.007) | (0.007) |
| Observations | 2433 | 2433 | 2433 | 2433 | 2433 |
| $R^2$ | 0.046 | 0.047 | 0.311 | 0.313 | 0.338 |
| Year FE | | ✓ | | ✓ | |
| SIC FE | | | ✓ | ✓ | |
| SIC-year FE | | | | | ✓ |

Markups are associated with sales per customer
but not with the number of customers

# Firms mostly grow by expanding their customer base $m$

- Var. decomposition:

$$\frac{var_i(\ln m_{it})}{var_i(\ln S_{it})} \approx 80\%$$

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- Var. decomposition:

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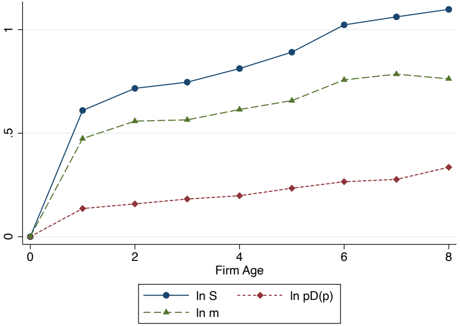
$$\ln S_{it} = \sum_{a=1}^{8} \delta_a \mathbb{1}(\text{age}_{it} = a) + \lambda_i + \lambda_t + \varepsilon_{it}$$




- At age 1, $m$ explains $\approx 78\%$ of sales
- At age 8, $m$ explains $\approx 70\%$ of sales

# Customer acquisition associated with firms' non-production costs

$$\ln S_{igt} = \gamma_1 \ln SGA_{it} + X'_{it}\gamma_2 + \lambda_{ig} + \lambda_{st} + \lambda_{gt} + \varepsilon_{igt}$$

| | Decomposition of ln S | | | ln m: New vs. Old | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| | ln S | ln pD(p) | ln m | ln $m^{New}$ | ln $m^{Old}$ |
| ln $SGA_{it}$ | 0.095*** | 0.005 | 0.090*** | 0.095*** | 0.016 |
| | (0.036) | (0.014) | (0.028) | (0.032) | (0.027) |
| Observations | 13131 | 13131 | 13131 | 13131 | 13131 |
| $R^2$ | 0.962 | 0.909 | 0.965 | 0.943 | 0.961 |
| Firm-year Controls | ✓ | ✓ | ✓ | ✓ | ✓ |
| Group-year FE | ✓ | ✓ | ✓ | ✓ | ✓ |
| SIC-year FE | ✓ | ✓ | ✓ | ✓ | ✓ |
| Group-firm FE | ✓ | ✓ | ✓ | ✓ | ✓ |

Non-production costs (SGA) associated with entry of new customers, not with retention of previous customers or sales per customer

# Model

# Objectives

- Facts to incorporate:
    - Intensive and extensive margins of demand
    - Endogenous markups associated (only) with the intensive margin
    - Endogenous customer acquisition through non-production costs
- Model-based questions:
    - What is the relationship between firms size and market power?
    - What is the efficient allocation of demand/customers?

# Model

## *Households' Problem*

- There exists a family of households with members $j \in [0, 1]$
- At time $t$, $m_{i,t}$ members are matched to variety $i \in [0, N_t]$ in a rep. industry

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$$\max_{\{C_t, L_t, c_{i,j,t}\}_{t\geq 0}} \sum_{t=0}^{\infty} \beta^t \left[ \frac{C_t^{1-\gamma}}{1-\gamma} - \xi \frac{L_t^{1+\psi}}{1+\psi} \right]$$

$$s.t. \quad \int_0^{N_t} \int_0^1 p_{i,t} c_{i,j,t} dj di \leq W_t L_t + \Pi_t$$

$$1 = \int_0^{N_t} \int_0^1 \mathbf{1}_{\{j \in m_{i,t}\}} \Upsilon \left( \frac{c_{i,j,t}}{C_t} \right) dj di \qquad \text{(Kimball aggregator)}$$

- $\Upsilon(.)$ is the Kimball aggregator from Klenow and Willis (2016)
    - Key property: **Marshall's Second Law of Demand** (more elastic demand at higher relative prices)

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# Model

## *Demand for Varieties*

$$c_{i,t} = m_{i,t} C_t \Upsilon'^{-1}\left(\frac{p_{i,t}}{D_t}\right)$$

- Elasticity of demand only a function of relative demand per customer:

$$q_{i,t} \equiv \frac{c_{i,j,t}}{C_t}, \quad \forall j \in m_{i,t} \qquad \text{(relative demand per customer)}$$

$$e_{i,t} = \sigma q_{i,t}^{-\frac{\eta}{\sigma}} \qquad \text{(Marshall's 2nd law of demand)}$$

- At each $t \geq 0$, measure $\lambda > 0$ of potential entrants are born with no customers
- Each potential entrant draws a productivity $z$ such that

$$\ln z_{i,t} \sim \mathcal{N}\left(\bar{z}_{ent}, \sigma_z^2\right)$$

- Given $z$, a potential entrant chooses from $\{enter, drop\,out\}$
- Conditional on entry, the firm's productivity evolves according to

$$\ln z_{i,t} = \rho \ln z_{i,t-1} + \varepsilon_{i,t}, \quad \varepsilon_{i,t} \sim \mathcal{N}\left(0, \sigma_z^2\right)$$

where $\varepsilon_{i,t}$ is i.i.d. across firms and time.

- At each $t \geq 0$, draw new productivity and exit exogenously with prob. $1-\nu$
- Decide to stay and pay a fixed overhead cost of $\chi > 0$ or exit
- Use labor $l_{i,s,t}$ to produce new matches:

$$m_{i,t} \leq (1-\delta)m_{i,t-1} + \frac{l_{i,s,t}^{\phi}}{P_{m,t}}$$

$$P_{m,t} \text{ such that } \int_{i \in N_t} m_{i,t} di = 1$$

  where $P_{m,t}$ is the "cost" of a match
- Set price $p_{i,t}$ and use labor $l_{i,p,t}$ to produce goods with $y_{i,t} = z_{i,t} l_{i,p,t}^{\alpha}$.

$$v_t(m_{-1}, z) \equiv \max_{l_s, l_p, p} \left\{ \underbrace{py}_{\text{Sales}} - \underbrace{W_t l_p}_{\text{COGS}} - \underbrace{W_t(l_s + \chi)}_{\text{SGA}} + \beta\nu \frac{U_{c,t+1}}{U_{c,t}} \mathbb{E}\left[ V_{t+1}(m, z') | z \right] \right\}$$

$$s.t. \quad q = \Upsilon'^{-1}\left(\frac{p}{D_t}\right) \qquad \text{(relative demand per customer)}$$

$$y = mqC_t = zl_p^{\alpha} \qquad \text{(demand = supply)}$$

$$m \leq (1-\delta)m_{-1} + \frac{l_s^{\phi}}{P_{m,t}} \qquad \text{(law of motion for customer base)}$$

And

$$V_t(m_{-1}, z) = \max\{v_t(m_{-1}, z), 0\} \qquad \text{(entry/exit decision)}$$

- Markups and labor share:

$$p_{i,t} = \underbrace{\frac{\varepsilon_{i,t}}{\varepsilon_{i,t} - 1}}_{\text{markup}} \times \underbrace{\alpha^{-1} \frac{W_t l_{i,p,t}}{y_{i,t}}}_{\text{marginal cost}} \Leftrightarrow \frac{Sales_{i,t}}{COGS_{i,t}} = \frac{\mu_{i,t}}{\alpha}$$

**Lemma (Incomplete pass-through)**

*Firms with higher marginal costs charge higher prices and lower markups.*

$$d \ln \left( \frac{p_{i,t}}{D_t} \right) = \frac{1}{1 + \eta \sigma^{-1} \varepsilon_{i,t} (\mu_{i,t} - 1)} d \ln \left( \frac{mc_{i,t}}{D_t} \right)$$

# Characterization

$$\underbrace{p_{i,t}c_{i,t}/C_t}_{\text{total relative sales}} = \underbrace{m_{i,t}}_{\text{number of customers}} \times \underbrace{p_{i,t}\Upsilon'^{-1}\left(p_{i,t}/D_t\right)}_{\text{relative sales per customer}}$$

## Proposition

1. *Firms with higher sales per customer charge higher markups.*
2. *Holding productivity and sales fixed, firms with more customers charge lower markups.*

It matters for market power if firms are big because of a large customer base or because of more sales per customer

# Characterization

*Returns to customer acquisition*

- Sales grow mainly by $m$ but markups are a function of $q$
- Key question for markups and concentration: how are $m$ and $q$ related?
- Markups are return to customer acquisition:

$$\underbrace{\phi^{-1}\frac{W_t l_{i,s,t}}{m_{i,t}-(1-\delta)m_{i,t-1}}}_{\text{marginal cost of a match}}$$

$$= \mathbb{E}_t \sum_{\tau=t}^{\infty} \underbrace{\left[(\nu(1-\delta))^{\tau-t}\prod_{h=t}^{\tau} \mathbf{1}_{i,\tau}\right]}_{\text{prob. of match survival}} \underbrace{\beta^{\tau-t}\left(\frac{C_\tau}{C_t}\right)^{-\gamma}\left(p_{i,\tau}-mc_{i,\tau}\right) q_{i,\tau} C_\tau}_{\text{discounted (gross) marginal profit per match}}$$

- Answer: Positively, but its extent depends on $\phi$

# What is the efficient allocations of demand?

**Lemma**
*For a given set of $N_t$, the efficient allocation of $m_{i,t}$ and $q_{i,t}$ maximizes TFP:*

$$\max_{(q_{i,t}, m_{i,t})_{i \in N_t}} \left[ \int_{i \in N_t} \left( \frac{z_{i,t}}{m_{i,t} q_{i,t}} \right)^{-\alpha^{-1}} \right]^{-\alpha}$$

$$\text{s.t.} \quad 1 = \int_{i \in N_t} m_{i,t} \Upsilon(q_{i,t}) di$$

$$1 = \int_{i \in N_t} m_{i,t} di$$

**Proposition**
*Under the efficient allocation:*

1. *Relative consumption per customer is equalized across all firms ($q^*_{i,t} = 1$).*
2. *More productive firms get more customers ($m^*_{i,t} \propto z_{i,t}^{\frac{1}{1-\alpha}}$).*
   *(so that the marginal product of labor is equalized across all firms.)*

# What is the efficient allocations of demand?

- In conventional models, with exogenous $m_{i,t}$, planner chooses dist of $q_{i,t}$:
  - increases agg. TFP by shifting demand towards more productive firms (towards equalizing MPL)
  - but this is diminished by the dispersion of relative consumption
- In our model, planner chooses both distributions of $q_{i,t}$ and $m_{i,t}$:
  - equalizes relative consumption across all firms
  - increases agg. TFP by giving more customers to more productive firms (fully equalizes MPL)
- **Note:** the allocation under conventional models feasible but not optimal $\Rightarrow$ new Pareto frontier.

# Quantitative Analysis

# How far are we from efficient allocation/conventional model?

‣ Fixed param. ‣ Calibrated param. ‣ Fit ‣ Firm dynamics ‣ Overident. tests

- **Efficient allocation**: spend enough on $m$ that MP of $l_p$ is equalized ($\phi = 1$)
- **Conventional model**: firms have no control over $m$ ($\phi = 0$)
- **Key question**: How to identify $\phi$?

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Proposition (Relationship between SGA and SALES)

*Suppose $\delta = 1$. Then, the total SGA expenses of a firm can be decomposed into:*

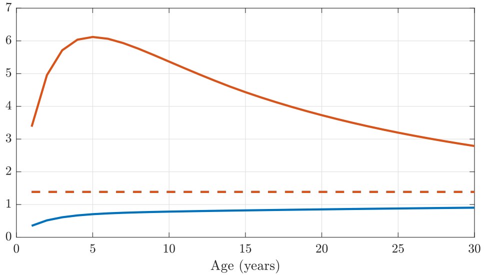
$$
\begin{aligned}
SGA_{i,t} &= SGAF_{i,t} + SGAV_{i,t} \\
&= W_t \chi + \underbrace{\phi}_{\approx 0.5} \times SALES_{i,t} - \frac{\phi}{\alpha} \times COGS_{i,t}
\end{aligned}
$$

# Calibration and Goodness of Fit

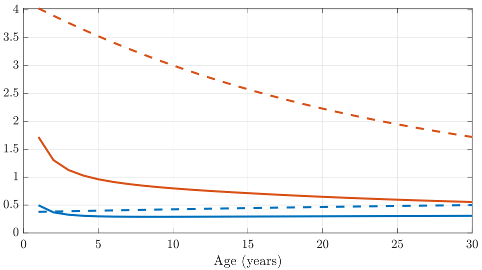
| Moment | Data | Model | Parameter | Value |
|---|---|---|---|---|
| Slope SGA on sales | 0.492 | 0.474 | $\phi$ | 0.533 |
| Avg. COGS-to-OPEX ratio | 0.660 | 0.669 | $\chi$ | 0.307 |
| Avg. cost-weighted production markup | 1.250 | 1.275 | $\sigma$ | 6.490 |
| Slope labor prod. on sales | 0.036 | 0.033 | $\eta$ | 4.956 |
| Avg. exit rate | 0.073 | 0.071 | $\nu$ | 0.964 |
| SD. employment growth | 0.416 | 0.447 | $\sigma_z$ | 0.218 |

# The Role of Endogenous Customer Acquisition: Source of Concentration

▸ Markups




(a) $m_{i,t}$




(b) $q_{i,t}$

Endog. customer acquisition: productive firms sell to more customers/less per customer

# The Role of Endogenous Customer Acquisition: Aggregates

| | Baseline Model | Restricted Model |
|---|---|---|
| TFP | | -27.9 |
| Output | | -23.9 |
| Number of firms | | 65.1 |
| Employment | | 7.9 |
| Production | | 6.3 |
| Agg. markup | 1.26 | 1.38 |
| Top 5% sales share | 0.50 | 0.17 |

With endog. customer acquisition:

- Higher concentration (in $m$)

  $\Rightarrow$ BUT lower aggregate markup

- Concentration $\Uparrow$ TFP and output and $\Downarrow$ entry and employment

# Quantifying Departure from Efficient Allocation

- Welfare gains with planner's allocation (with $L_s^* = L_s$):

$$\underbrace{\frac{\Delta U_t}{U_{c,t} C_t}}_{\Delta\text{Welfare (C.E.) = 13.6\%}} \approx \underbrace{\Delta \ln(Z_t)}_{\text{TFP gains = 10.8\%}} \quad \underbrace{-\alpha \mathcal{M}_t^{-1} \chi \frac{N_t}{L_{p,t}} \Delta \ln(N_t)}_{\text{Gains from Entry/Exit = 1.6\%}} \quad \underbrace{+\alpha(1 - \mathcal{M}_t^{-1}) \Delta \ln(L_{p,t})}_{\text{Losses from Agg. Markup = 0.78\%}}$$

# Quantifying Departure from Efficient Allocation

- Welfare gains with planner's allocation (with $L_S^* = L_S$):

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- TFP gains with planner's allocation:

$$\underbrace{\ln\left(\frac{Z(N_t^*, \mathcal{A}_t^*)}{Z(N_t, \mathcal{A}_t)}\right)}_{\Delta\text{ TFP} = 10.8\%} = \underbrace{\ln\left(\frac{Z(N_t, \mathcal{A}_t^*)}{Z(N_t, \mathcal{A}_t)}\right)}_{\Delta\text{ Allocative Efficiency} = 7.8\%} + \underbrace{\ln\left(\frac{Z(N_t^*, \mathcal{A}_t^*)}{Z(N_t, \mathcal{A}_t^*)}\right)}_{\Delta\text{ Entry/Exit Efficiency} = 3.0\%}$$

# The Role of Endogenous Customer Acquisition: Aggregates

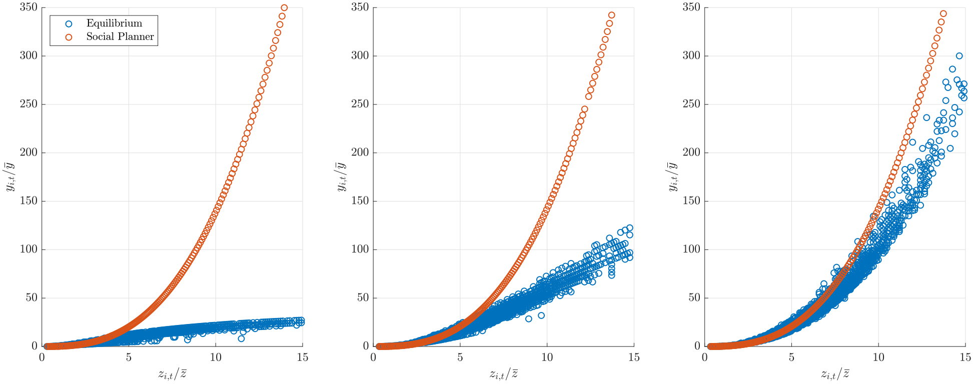
▸ Role of $\phi$

| | Endogenous $m_{i,t}$ | | |
|---|---|---|---|
| | $\phi = 0.25$ | Baseline | $\phi = 0.75$ |
| TFP | 24.1 | 10.8 | 3.2 |
| Output | 27.5 | 14.6 | 7.7 |
| Number of firms | -41.9 | -11.3 | -2.6 |
| Employment | -5.0 | 2.1 | 4.4 |
| Production | 5.3 | 6.0 | 7.0 |
| Welfare | 37.9 | 13.6 | 4.0 |
| Agg. markup | -27.8 | -22.8 | -19.1 |
| Top 5% sales share | 88.8 | 39.2 | 15.5 |

- Planner achieves higher output/TFP by:
    - reducing number of firms
    - reallocating customers to most productive firms

# The Role of Endogenous Customer Acquisition: Role of $\phi$

Back




(a) Low $\phi$ (b) Baseline (c) High $\phi$

When $\phi$ is larger equilibrium allocation of customers and sales approaches efficient allocation

# Conclusion

- Revisit role of extensive and intensive margins of demand on firms' market share and market power
- Main empirical fact:
  - while firms' sales grow mainly through acquiring more customers
  - their market power is only correlated with their sales per customer
- Model provides new perspective on relationship between firm size and market power
  - higher concentration associated with *lower* aggregate markup
- Nonetheless, substantive welfare gains under efficient allocation due to *new* Pareto frontier

# Appendix

# Two Sources of Data ▸ Back

1. ACNielsen Homescan Panel
    - panel data on households' consumption patterns
    - sample period: 2004-2016
    - detailed information on barcode-level product sales from $\sim$ 55,000 HHs per year
    - merged with Compustat based on company name-matching algorithm
2. Compustat
    - panel data on publicly traded firms
    - sample period: 1955-2016
    - detailed information on firms' balance sheets and **cost structure**

# Two Types of Firms' Costs ▸ Back

- Operational expenses (OPEX) are divided into two types of costs:

1. **Cost of Goods Sold (COGS)**

*"all expenses that are directly related to the cost of merchandise purchased or the cost of goods manufactured that are withdrawn from finished goods inventory and sold to customers"*

E.g.: cost of labor and intermediate inputs used in production

2. **Selling, General and Administrative Expenses (SGA)**

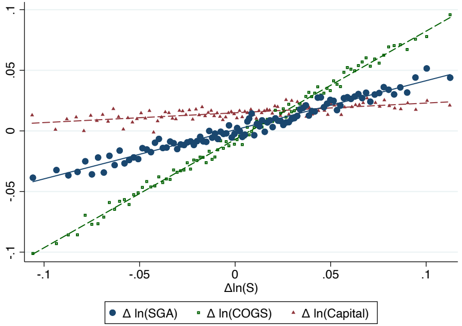
*"all commercial expenses of operation (such as expenses not directly related to product production) incurred in the regular course of business..."*

E.g.: advertising, marketing, logistics, research and development

# Fact IIbis: Non-production costs have a semi-variable nature

▸ Regression ▸ Correlogram

$$\Delta \ln(\text{Cost}_{it}) = \beta \Delta \ln S_{it} + \lambda_i + \lambda_t + \varepsilon_{it},$$




- At *quarterly* frequency:

  $\beta_{\Delta SGA} = 0.450$ (SE 0.010)

- Two natural benchmarks:
  - $\beta_{\Delta COGS} = 0.894$ (SE 0.008)
  - $\beta_{\Delta Capital} = 0.081$ (SE 0.008)

# Fact IIbis: Non-production costs have a semi-variable nature

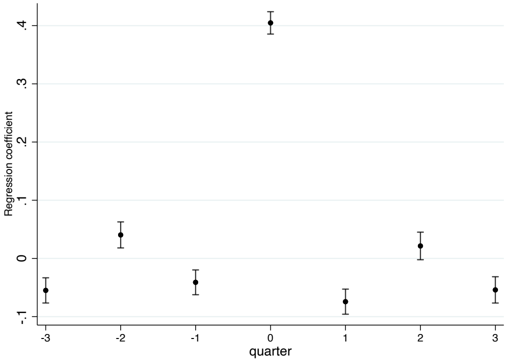
Back

$$\Delta \ln(\text{Cost}_{it}) = \beta \Delta \ln S_{it} + \lambda_i + \lambda_t + \varepsilon_{it},$$

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | $\Delta ln(COGS)$ | $\Delta ln(COGS)$ | $\Delta ln(SGA)$ | $\Delta ln(SGA)$ | $\Delta ln(Capital)$ | $\Delta ln(Capital)$ | $\Delta ln(R\&D)$ | $\Delta ln(R\&D)$ |
| $\Delta log(Sales)$ | 0.920*** | 0.894*** | 0.473*** | 0.405*** | 0.133*** | 0.081*** | 0.278*** | 0.200*** |
| | (0.008) | (0.008) | (0.009) | (0.010) | (0.008) | (0.008) | (0.028) | (0.031) |
| $R^2$ | 0.055 | 0.162 | 0.011 | 0.103 | 0.002 | 0.155 | 0.002 | 0.083 |
| Year FE | No | Yes | No | Yes | No | Yes | No | Yes |
| Firm FE | No | Yes | No | Yes | No | Yes | No | Yes |
| $N$ | 293962 | 292739 | 292785 | 291547 | 134743 | 133745 | 69845 | 69363 |

# Fact IIbis: Non-production costs have a semi-variable nature ‣ Back

$$\Delta \ln(\mathrm{SGA}_{it}) = \beta \Delta \ln S_{i,t-j} + \lambda_i + \lambda_t + \varepsilon_{it}, \quad \text{for } j \in \{-3, \ldots, 3\}$$



# Calibration

▸ Back

- Period: 1 year
- Two sets of parameters: fixed, calibrated via SMM

Fixed Parameters

| Parameter | Description | Value |
|---|---|---|
| $\beta$ | Annual discount factor | 0.960 |
| $\gamma$ | Elast. of intertemporal substitution | 2.000 |
| $\psi$ | Frisch elasticity | 1.000 |
| $\alpha$ | Decreasing returns to scale | 0.640 |
| $\delta$ | Prob. of losing customer | 0.280 |

# Calibration

Back

Calibrated Parameters

| Parameter | Description | Value |
|---|---|---|
| $\phi$ | Elasticity matching function | 0.533 |
| $\chi$ | Overhead cost | 0.307 |
| $\sigma$ | Avg. elasticity of substitution | 6.490 |
| $\eta$ | Superelasticity | 4.956 |
| $\nu$ | Exog. survival probability | 0.964 |
| $\rho_z$ | Persistence of productivity shock | 0.973 |
| $\sigma_z$ | SD of productivity shock | 0.218 |
| $\bar{z}_{ent}$ | Mean productivity of entrants | -1.453 |
| $\lambda$ | Mass of entrants | 0.137 |
| $\xi$ | Disutility of labor supply | 1.981 |

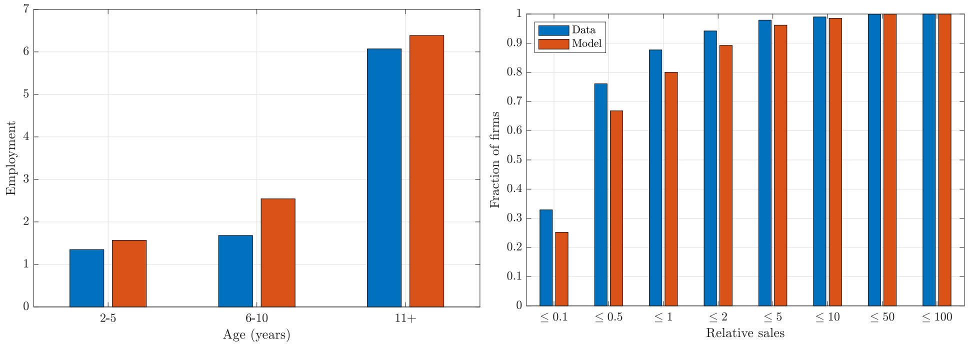
# Goodness of Fit

▸ Back

| Moment | Data | Model |
|---|---|---|
| Slope SGA on sales | 0.492 | 0.474 |
| Avg. COGS-to-OPEX ratio | 0.660 | 0.669 |
| Avg. cost-weighted production markup | 1.250 | 1.275 |
| Slope labor prod. on sales | 0.036 | 0.033 |
| Avg. exit rate | 0.073 | 0.071 |
| SD. employment growth | 0.416 | 0.447 |

# Goodness of Fit

▸ Back

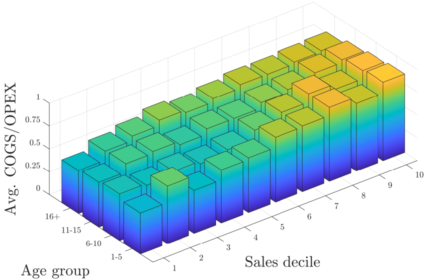



(a) Relative Employment by Age

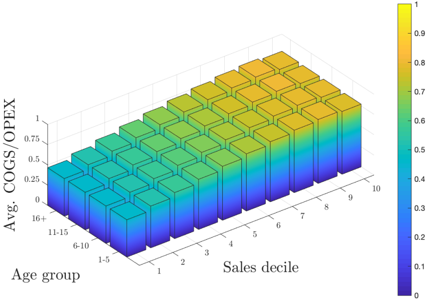
(b) Sales distribution

# Goodness of Fit: COGS/OPEX by Age and Size

▸ Back



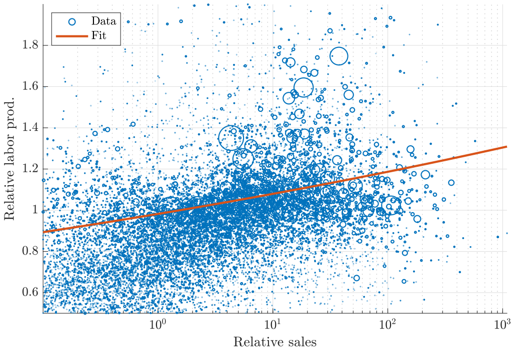

(a) Data



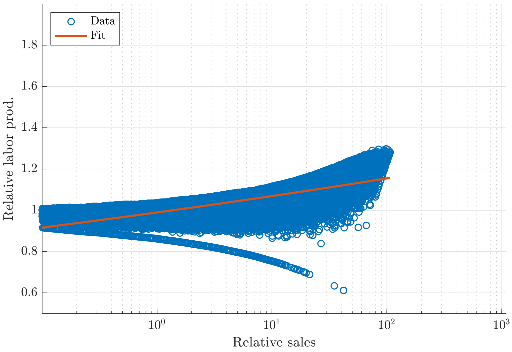

(b) Model

# Goodness of Fit: Labor Productivity and Sales

Back



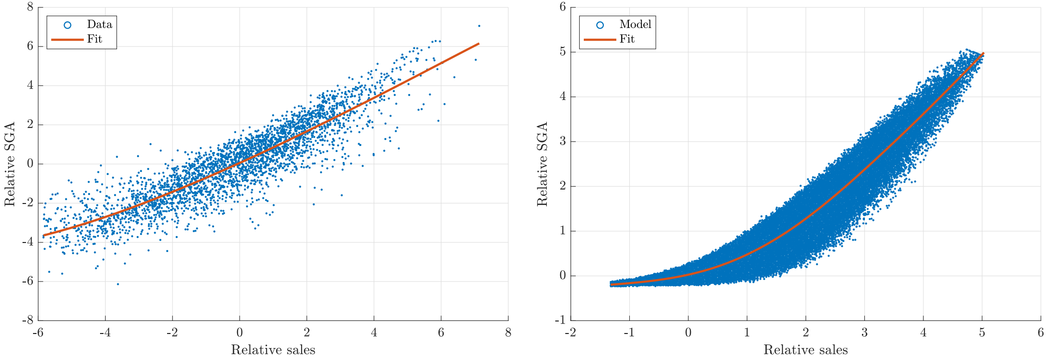

(a) Data



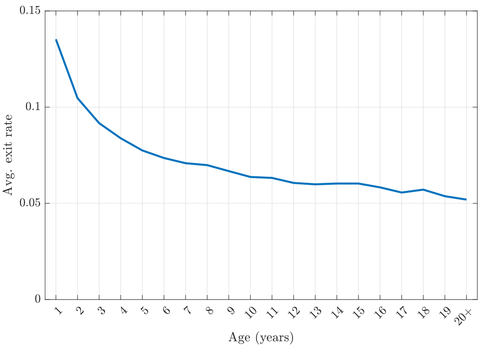

(b) Model

# Goodness of Fit: SGA and Sales

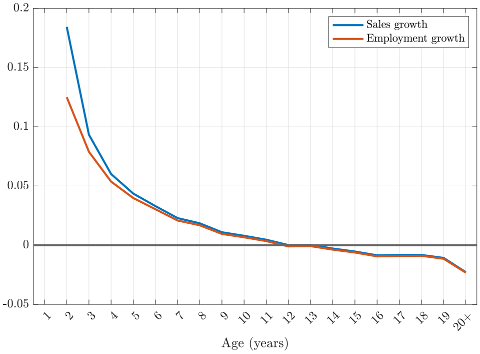
Back




(a) Data (b) Model



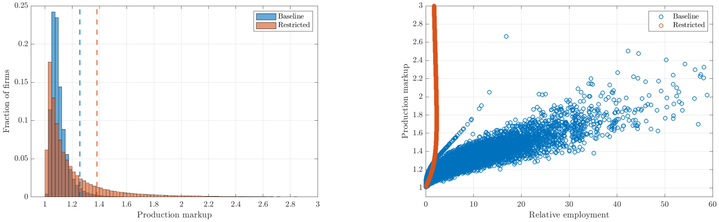

(a) Exit Rate by Age




(b) Avg. Growth by Age

# The Role of Endogenous Customer Acquisition: Source of Concentration

Back



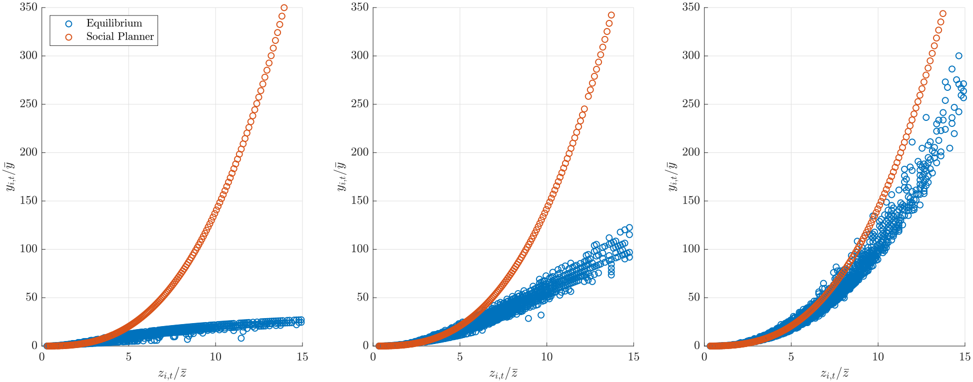

(a) Distribution of Markups

(b) Avg. Size by Age

$$\underbrace{\log(\mathcal{M}_t) - \log(\mathcal{M}_t^R)}_{-9.71\%} \approx \underbrace{\int_{i \in N_t^R} \omega_{i,t}^R \left(\log(\mu_{i,t}) - \log(\mu_{i,t}^R)\right) di}_{\Delta \text{ Market power: -18.71\%}} + \underbrace{\int_{i \in N_t} (\omega_{i,t} - \omega_{i,t}^R) \log(\mu_{i,t}) di}_{\Delta \text{ Distribution: 9.00\%}}$$

# The Role of Endogenous Customer Acquisition: Role of $\phi$

Back




(a) Low $\phi$ (b) Baseline (c) High $\phi$

When $\phi$ is larger equilibrium allocation of customers and sales approaches efficient allocation