Capital Reallocation and Private Firm Dynamics

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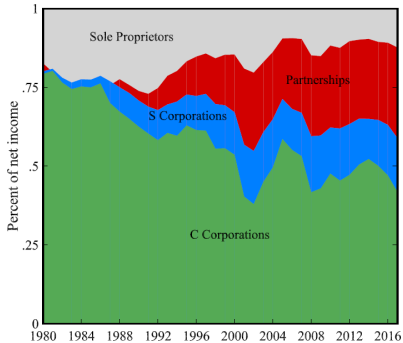
IRS data disclaimer etc. etc.

Presented by Samuel Jordan-Wood

Motivation

- Privately-owned businesses:
  - Accounts $> 1/2$ of U.S. business net income
  - Central to discussions on growth, wealth inequality, and tax policy
- Challenges:
  - **Theory:** intangible capital & accumulation
  - **Measurement:** data on private business



This Paper

- Theory of private firm dynamics:
  - Builds off Bhandari & McGrattan (2021) 'Sweat Equity'
  - New properties **contrary** to Lucas-Hopenhayn
    - Capital not observable (until transacted), requires time to trade, sold as a group
  - **Key:** generates dispersion in marginal capital
- Measurement using IRS data:
  - Builds off Bhandari et. al (2025)
  - Panel data on business incomes and payroll
  - **Adds:** Novel data on business transfers (Form 8594)
- Tax policy implications

Motivating Evidence on Private Business Capital

- Most capital is **not observable until transferred**
- Transferred assets are primarily **intangible** ($\approx 70\%$ from Form 8594):
  - Customer bases and client lists, non-compete covenants
  - Trademarks and trade names
  - Licenses and permits
  - Workforce in place
  - Goodwill and on-going concern value
- Assets are **sold as a group**
- Sale **requires time** to find buyers/negotiate (from brokered data ≈ 7 months)

Model Environment

- Infinite horizon with continuous time
- Demographics
  - Unit mass of individuals
  - Birth/death at rate ψ_e
- Individuals choose:
  - Paid employment, supplying labor inelastically or
  - Self-employment, running a private business
- Preferences: risk neutral, discount rate ρ

Production Technology

- Final goods technology: $y = z\, k^{\alpha} n^{\gamma} b^{\beta}$
- Non-transferable productivity z:
  - Evolves in business: $dz = \mu(z)\, dt + \sigma(z)\sqrt{dt}\, dW$
- Transferable business capital k:
  - Built through investment: $dk = (i - \delta_k k)\, dt$, convex cost $c(i) = \dfrac{A\, i^{1+\chi}}{1+\chi}$
- Rentable factors: labor n, buildings and equipment b
  - Investment in other fixed assets: $db = (x - \delta_b b)dt$

Entry and Exit Technology

Let $s = (z, k)$ be the state of an individual.

- Birth/death
  - occurs at rate ψ_e
  - Draw $s \sim G(s)$ where $s = (z, k = 0)$
- Occupation choice:
  - Option to exit at rate ψ_o
  - Cost of starting a business: c_e

Market for Transferable Business Capital

- Businesses access market at Poisson rate η
- Bilateral trades for a pair $(s, \tilde{s})$:
  - Feasible allocations: $k_m(s, \tilde{s}) \in \{ k(s) + k(\tilde{s}),\ 0 \} \Rightarrow$ indivisibility
  - Transfers (prices): $p_m(s, \tilde{s})$, negative if selling

Owner's Value Solves HJB

$$
\begin{aligned}
(\rho + \psi_e) V(s) \;=\; & \max_{n,b,i,\lambda} \underbrace{y(s,n,b) - wn - rb}_{\text{production}} \\
& + \underbrace{\partial_k V(s)\,(i - \delta_k k) - c(i)}_{\text{investment}} \;+\; \max_{\lambda} \underbrace{\eta\, V^{\text{trade}}(s;\lambda)}_{\text{trade}} \\
& + \underbrace{\mu(z)\,\partial_z V(s) + \tfrac{1}{2}\sigma(z)^2 \partial_{zz} V(s)}_{\text{evolution of productivity}} \;+\; \underbrace{\psi_o \max\{W - V(s), 0\}}_{\text{endogenous exit}}.
\end{aligned}
$$

where

$$
V^{\text{trade}}(s;\lambda) = \int \left[V(z, k^m(s,\tilde{s})) - V(z,k) - p^m(s,\tilde{s}) \right] \lambda(s,\tilde{s})\, d\tilde{s}.
$$

Definition of Recursive Equilibrium

A *stationary recursive equilibrium* is a set of value functions $V(s)$, W, policy functions i(S), n(s), b(s), λ, $\iota^{\text{in}}(s)$, $\iota^{\text{out}}(s)$, wage w, price-quantity menus k^m and p^m, measure of owners $\phi(s)$ s.t.:

- Given $\{k^m, p^m\}$ and w, V(s) and W maximize
- Policy functions solve maximization & entry + exit clear
- $r = \delta_b + \rho$ and Labor market clears
- Trading arrangements that are:
  - mutually consistent: $\lambda(s, \tilde{s})\phi(s) = \lambda(\tilde{s}, s)\phi(\tilde{s})$
  - Feasible: $k^m(s, \tilde{s}) \in \{k(s) + k(\tilde{s}), 0\}$
  - $\nexists(s, \tilde{s})$ and feasible trade that makes the pair strictly better off
- Stationary measure $\phi = 0$: Details

Who Trades with Whom?

- Example:
  - simple production function: $y = zk$;
  - productivity types: 20 with $z_H = 1$, 10 with $z_L = 0$
  - Capital pre-trade: all have $k = 1$
- Efficient allocation:
  - 10 low types sell to 10 high types

How are Terms of Trade Determined?

- Example:
  - simple production function: $y = zk$;
  - productivity types: 20 with $z_H = 1$, 10 with $z_L = 0$
  - Capital pre-trade: all have $k = 1$
- Price leaves high types indifferent between:
  - Trading, with $k = 2$ post-trade
  - Not trading, and keeping $k = 1$

Equilibrium Policy Functions

- Example:
  - simple production function: $y = zk$;
  - productivity types: 20 with $z_H = 1$, 10 with $z_L = 0$
  - Capital pre-trade: all have $k = 1$

- Equilibrium in this example:
  - Capital allocations: $k^m(s_H, s_L) = 2$, $k^m(s_L, s_H) = 0$
  - Prices: $p^m(s_H, s_L) = 1$, $p^m(s_L, s_H) = -1$
  - Choice probabilities: $\lambda(s_L, s_H) = 1$, $\lambda(s_H, s_L) = 1/2$, $\lambda_o(s_L) = 0$,$\lambda_o(s_H) = 1/2$

Solution More Generally

- Given (ϕ, V), solve standard linear programming problem Details
  - Maximize social surplus over all trading pairs
  - Use solution to derive equilibrium objects:
    - Prices:p^m
    - Allocations: λ , k^m
    - Gains from trade: $V^{\text{trade}}(s)$
- Update: $(\phi, V) \rightarrow (\lambda, p^m, k^m) \rightarrow (\phi', V')$
- Easy to extend to non-transferable utility

Properties of the Equilibrium

- Prices only depend on seller's k:

$$p_m(s, \tilde{s}) = P\big(k(\tilde{s})\big)$$

- When z is non-transferable, then equivalence between:
  - Our trading protocol for capital and
  - Competitive equilibrium w unit demand over differentiated products
- Can extend to allow consulting contracts $\Rightarrow$ z impacts price

IRS Data

- Sample period: 1996–2022
- An observation is a firm-year pair with:
  - Subchapter S corporation filing (Form 1120S)
  - Wage bill $>$ \$10K
  - Observe $\geq$ 3 years of data
- Two samples: details
  - *Full* sample: all firm-year pairs meeting above criteria
  - *Trading* sample: seller-buyer pairs with
    - Seller: meeting above criteria and counterparty on Form 8594
    - Buyer: counterparty on Form 8594 with wage bill $>$ \$10K
- Key moments: dist. of age, growth; sales price; buyer/seller relative size details

Identification Strategy

- From *traditional firm dynamics* moments (life-cycle growth, mass and age dist.):
  - Entry distribution and entry cost
  - Stochastic process for productivity
  - Rentable input shares
- From *novel trading* moments (sale price, relative size of buyers/sellers):
  - Capital elasticity of output: larger $\alpha \Rightarrow$ smaller relative size
  - Investment cost: larger A $\Rightarrow$ higher valuation for capital
  - Speed of transaction η

Calibration and Model Fit

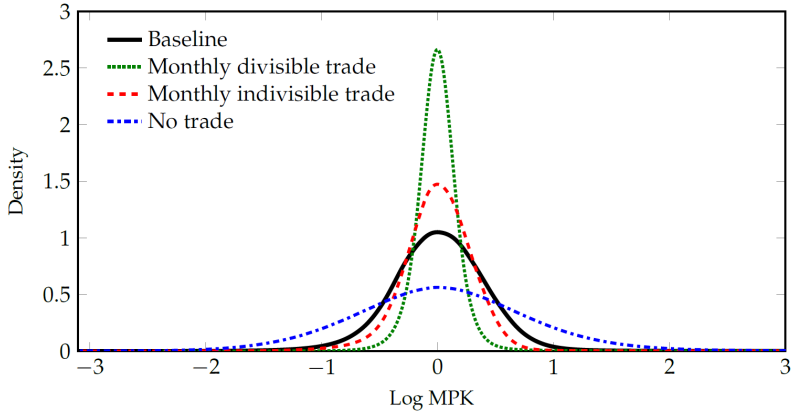
Dispersion in MPK

- Idiosyncratic change in productivity $\Rightarrow$ input reallocation toward higher MPK
- Dispersion in marginal product of capital induced by
  - Decentralized trading
  - Indivisibility of asset sold
- Standard deviation of log-MPK: **40%**

Dispersion in MPK: Role of η and Divisibility

- Consider 3 values of η:
  - $\eta = 0$: no trade
  - $\eta = 2.2$: trading opportunity every 7 months
  - $\eta = 12$: trading opportunity every month
  - $\eta = 12$: same & divisible trade
- Standard deviation of log-MPK: 18% to 77%

Dispersion in MPK



Business Wealth: Two Measures

- Finance textbook: Present value of owner's dividend
  - Model counterpart: $V(s)$
- SCF respondent: ("what could you sell it for?"):
  - Model counterpart: $P(k)$
- Theory and measurement:
  - Both are inputs to analyses of business capital and wealth
  - Neither are on private business balance sheets (until $P(k)$ amortized)

Model Predictions for Business Wealth (in %)

- Model generates heterogeneity in
  - Business returns
  - Transferable shares
- Implications:
  - Capitalization method won't work
  - Surveys not capturing all value
  - Aggregate values:

$$\int P\big(k(s)\big)\, ds \;=\; 58\% \times \text{output}$$

$$\int V(s)\, ds \;=\; 266\% \times \text{output}$$

%tile	Income Yield	Transferable Share
5^{th}	2.1	6.8
50^{th}	5.4	14.1
95^{th}	14.8	39.1

Business Taxation

- Recent debate on business taxation
- What to tax?
  - **Flows:** business income
  - **Stocks:** business capital (Guvenen et al. 2023)
  - **Transfers:** capital gains (Sarin et al. 2022, Agersnap and Zidar 2021)
- Model can speak to all three forms of taxation

Tax Instruments

- Compare instruments:
  - Business income: $\tau_b(y - wn - rb)$
  - Business capital: $\tau_k P(k)$ [capital ownership]
  - Capital gains: $\tau_c P(k)$ [capital transfer]
- Compare outcomes for a given level of revenue

Business Taxation

- Revenue raised: 1.2% of baseline output
  - Business income tax: $\tau_b = 4.1\%$
  - Capital gains tax: $\tau_c = 20\%$
  - Capital income tax: $\tau_k = 2.4\%$
- Outcomes: % change from baseline

Main Results: % Changes from Baseline

- Taxing income dominates taxing capital
- Taxing capital gains
  - Distorts capital reallocation
  - Decreases owner investment
  - Decreases entry
  - Lowers welfare
- Taxing capital value in between

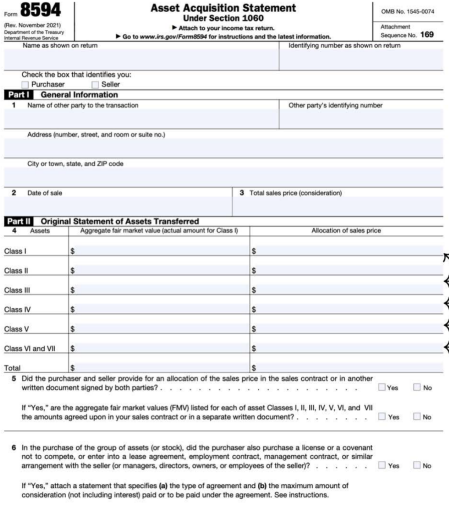
$\Rightarrow$ Findings contrary to recent literature

Statistic	**Business Income**	**Capital Value**	**Capital Gains**
% in business	1.8	−2.0	−6.5
% traded	0.7	−1.3	−48.1
Avg. investment	0.3	0.3	−3.2
MPK dispersion	−0.4	−0.4	22.0
Per-unit price	0.2	1.0	7.7
Output	−0.8	−2.5	−1.8
Wage	−0.4	−2.9	−3.0

Conclusions

- Need for new theory and measurement to study private firms
- We make progress on both fronts using
  - Model that captures features of market for private businesses
  - Novel data combining value of intangible capital with firm dynamics
- Business income (capital gains) taxes are least (most) distortionary

Form 8594



Form **8594** (Rev. November 2021) Department of the Treasury Internal Revenue Service

Asset Acquisition Statement Under Section 1060

► Attach to your income tax return.

► Go to www.irs.gov/Form8594 for instructions and the latest information.

OMB No. 1545-0074

Attachment Sequence No. **169**

Name as shown on return | Identifying number as shown on return

Check the box that identifies you:
☐ Purchaser ☐ Seller

Part I General Information

1 Name of other party to the transaction | Other party's identifying number

Address (number, street, and room or suite no.)

City or town, state, and ZIP code

2 Date of sale | 3 Total sales price (consideration)

Part II Original Statement of Assets Transferred

4 Assets	Aggregate fair market value (actual amount for Class I)	Allocation of sales price
Class I	$	$
Class II	$	$
Class III	$	$
Class IV	$	$
Class V	$	$
Class VI and VII	$	$
Total	$	$

← Cash/securities
← Inventories
← Fixed assets
← Sec. 197 intangibles

5 Did the purchaser and seller provide for an allocation of the sales price in the sales contract or in another written document signed by both parties? . . . . . ☐ Yes ☐ No

If "Yes," are the aggregate fair market values (FMV) listed for each of asset Classes I, II, III, IV, V, VI, and VII the amounts agreed upon in your sales contract or in a separate written document? . . . . . ☐ Yes ☐ No

6 In the purchase of the group of assets (or stock), did the purchaser also purchase a license or a covenant not to compete, or enter into a lease agreement, employment contract, management contract, or similar arrangement with the seller (or managers, directors, owners, or employees of the seller)? . . . . . ☐ Yes ☐ No

If "Yes," attach a statement that specifies **(a)** the type of agreement and **(b)** the maximum amount of consideration (not including interest) paid or to be paid under the agreement. See instructions.

Business Transfers are Taxable Events

- Buyers and sellers both report sale
  - Seller has to pay capital gains
  - Buyer has to report depreciable assets
- Price allocated across asset types
  - Seller wants to allocate to long-term
  - Buyer wants to allocate to short-term

$\Rightarrow$ Conflict of interest and thus consistent reporting

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Auxiliary Problem: Static Planner

$$X(s,\tilde{s}) = \max\Big\{\, V(z, k+\tilde{k}) + V(\tilde{z}, 0),\, V(s) + V(\tilde{s}),\, V(z,0) + V(\tilde{z}, k+\tilde{k}) \Big\} - \Big(V(s) + V(\tilde{s})\Big),$$

$$\phi^a(s) = \phi^b(s) = \tfrac{\phi(s)}{2}.$$

$$Q(\phi, V) = \max_{\pi \geq 0} \iint X(s,\tilde{s})\, \pi(s,\tilde{s})\, ds\, d\tilde{s}$$

$$\text{s.t.} \quad \int \pi(s,\tilde{s})\, d\tilde{s} = \phi^a(s), \qquad \int \pi(\tilde{s},s)\, d\tilde{s} = \phi^b(s) \quad \forall s.$$

Auxiliary Problem: Static Planner — Implications

Let μ^a, μ^b be the Lagrange multipliers on the two constraints above. Let π be the optimal assignment in the planner's problem. Then the functions

$$k^m(s,\tilde{s}) \in \arg\max_k \left\{ V(z, k+\tilde{k}),\ V(s)+V(\tilde{s}),\ V(\tilde{z}, k+\tilde{k}) \right\};$$

$$\begin{aligned} p^m(s,\tilde{s}) &= V\big(z,\ k^m(s,\tilde{s})\big) - V(s) - \mu^a(s) \\ p^m(\tilde{s},s) &= V\big(\tilde{z},\ k^m(\tilde{s},s)\big) - V(\tilde{s}) - \mu^b(\tilde{s}); \end{aligned}$$

$$V_{\text{trade}}(s) = \mu^a(s) = \mu^b(s); \qquad \lambda(s,\tilde{s}) = \frac{\pi(s,\tilde{s}) + \pi(\tilde{s},s)}{\phi(s)}.$$

constitute equilibrium trading arrangements and the gains from trade

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Data Samples

Business Sample	**Count**
S corporation population	3,167,266
S corporation sellers	105,162
Sales to S corporations	46,708
Sales to Partnerships	33,462
Sales to C corporations	35,792
Seller–buyer pairs	51,286
S Corporation – S Corporation	28,078
S Corporation – Partnership	14,040
S Corporation – C Corporation	9,168

Notes: The population is the universe of S corporations (1996–2022) with wage bill $\geq$ 10,000 and sufficient data to compute 3-year wage-bill growth. Seller and buyer counts are derived from e-filed Form 8594 business asset sale reports.

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Table 2: Intangible Intensities (U.S. S Corp Trading Sample)

Intangible Intensities	**25th**	**50th**	**75th**
Sales to S corporations	29.2	66.8	87.0
Partnerships	33.3	71.0	90.9
C corporations	39.3	73.4	92.7
All sales	32.1	69.3	89.3

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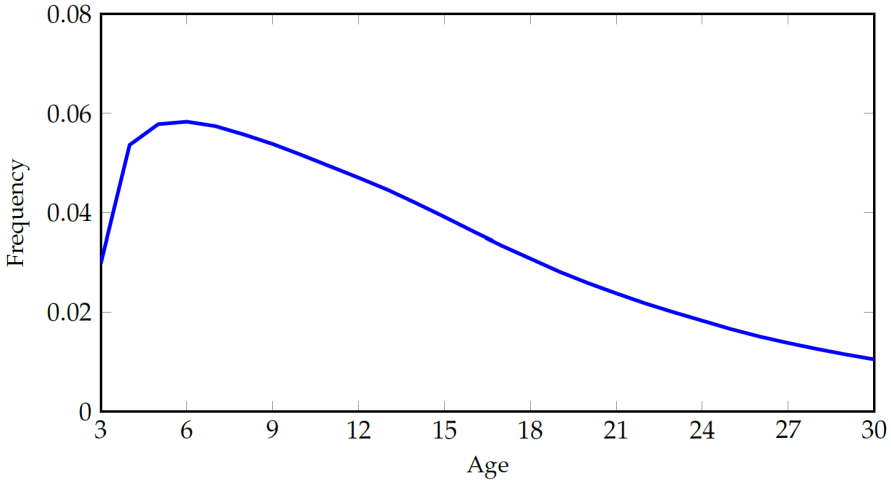
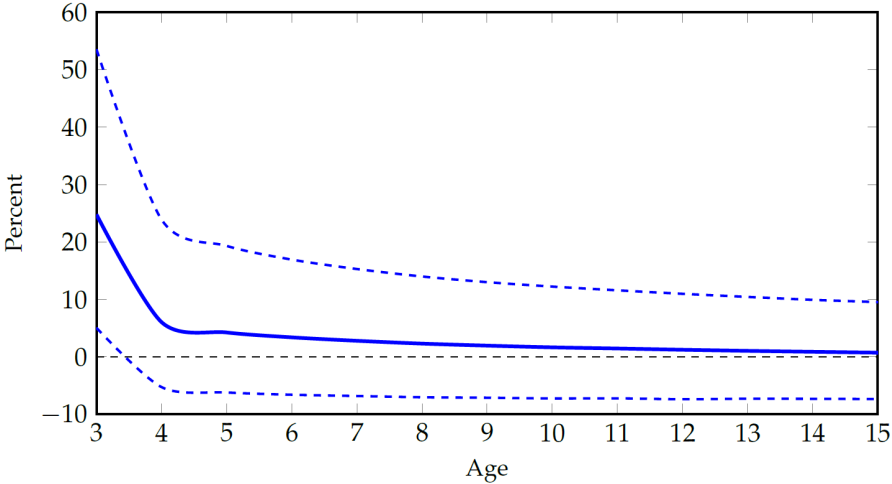
Age Distribution: Sample of U.S. S Corporations



Dist. of Annualized 3-Year Growth by Age: Sample of U.S. S Corps.



Statistic	25th	50th	75th
Business Age	8.0	13.0	21.0
Wage Growth	-6.8	1.4	11.6
Log Wage Bill: Entrants	11.0	11.7	12.5
Population	11.1	11.9	12.8

Notes: Statistics are based on the universe of S corporation filings (1996–2022) excluding firms with wage bill $<$ \$10,000 or insufficient data to construct a three-year wage growth measure. Percentiles are averaged in small windows to prevent disclosure.

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Valuation Multiples $= P(k)/w_{t-1}n_{t-1}$

		25th	50th	75th
Sales to	S corporations	1.0	2.4	5.2
	Partnerships	1.4	3.5	8.6
	C corporations	1.5	4.0	9.9
All sales		1.2	2.9	6.7

Relative Wage Bill Sizes $= w_{t+1}n_{t+1}/w_{t-1}n_{i,t-1}$

		25th	50th	75th
Sales to	S corporations	0.7	1.4	5.6
	Partnerships	1.0	2.8	17.4
	C corporations	2.2	14.9	130.7
All sales		0.9	2.1	13.5

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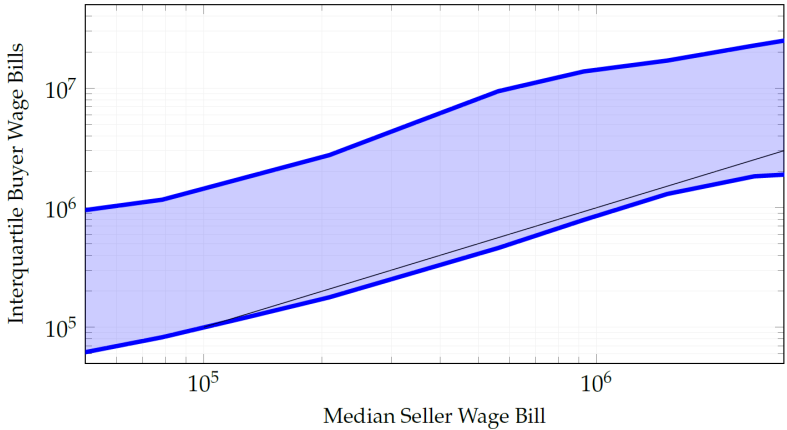
Buyer and Seller Wage Bills by Seller Size

Figure 3: Buyer and Seller Wage Bills by Seller Size



Measures and Mass

- **Let**
  - ϕ = measure over owner types s
  - m = mass of firms
  - $\iota^{\text{in}}(s) \equiv \{\, V(s) - W - c_e > 0 \,\}$ = entry policy
  - $\iota^{\text{out}}(s) \equiv \{\, W - V(s) > 0 \,\}$ = exit policy

- **Then**
  - $\dot{\phi}(s) = \left(\mathcal{A}^*_{(i,\lambda)}\phi\right)(s) + \psi^{\text{in}}_{e\,\ell}(s)\, dG(s)$
  - $\dot{m} = \psi_e \int \iota^{\text{in}}(s)\, dG(s) \;-\; m\left(\psi_e + \psi_0 \int \iota^{\text{out}}(s)\, \phi(s)\, ds\right)$

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Functional Forms and Parameters

- **Production**
  $y(s,n,b) = z(s)\,k(s)^{\alpha} n^{\gamma} b^{\beta}, \qquad \alpha = 0.125,\ \beta = \gamma = 0.35$

- **Investment**
  Cost $c(i) = \dfrac{A\, i^{1+\chi}}{1+\chi}, \qquad A = 1833,\ \chi = 1.6$
  Depreciation, $\delta_k = \delta_b = 0.1$

- **Productivity**
  Entry distribution $G(z) = \mathrm{LN}(\mu_0, \sigma_0)$ on $1 + \log z, \quad \mu_0 = -0.5,\ \sigma_0 = 0.5$
  Post-entry process $d\hat{z} = \theta(\hat{z}^* - \hat{z})\,dt + \sigma\,dW, \quad \hat{z} = 1.0,\ \theta = 0.1,\ \sigma = 0.1$

- **Rates**
  Discounting, $\rho = 0.05$
  Trading, $\eta = 2.2$
  Entry/exit, $\psi_e = 1/40,\ c_e = 4.0,\ \psi_o = 1.0$

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Model Fit

Moment	Model	Data
Fraction of owners	0.16	0.18
Business age, median	8.9	10.0
Business age, mean	11.8	12.0
Growth (age 3), median	0.27	0.25
Growth (age 3), IQR	0.48	0.49
Growth (age 10), median	0.03	0.02
Growth (age 10), IQR	0.27	0.20
Log wage bill (population), IQR	1.60	1.70
Log wage bill (entrants), IQR	1.14	1.50

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