

# The Role of Human Capital Specificity in Entrepreneurship

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# The micro and macro of job mobility

Job mobility within and across occupations

Gyetvai (2024)

Job search with preference shocks

Arcidiacono, Gyetvai, Maurel, and Jardim (2025 *REStud R&R*)

Job finding through past coworker networks

Gyetvai and Zhu (2025 *Labour Econ*)

Job switching after health shocks

Bíró, Boza, Gyetvai, and Prinz (2026)

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*Entering and exiting entrepreneurship*

Gyetvai and Tan (2026)

# Background

Small and medium-sized enterprises are “engines of growth”

(OECD, 2026)

Extensive interest in spurring entrepreneurship

- Typical initiatives aim to reduce financial barriers to entry

Most entrepreneurs exit

- Over 50% of startups exit within 5 years
- Long-term exit hazard is 6–10%

(Sterk, Sedláček, and Pugsley, 2021)

(Karahan, Pugsley, and Şahin, 2024)


Entry is driven not only by financial barriers, but also *outside option* after exit

- Only 3.5% serial entrepreneurs (De Vera, Félix, Karmakar, and Sedláček, 2025)
- Can failed entrepreneurs return to their previous careers?
- Or does an entrepreneurial past improve their careers?

## Research questions

- 1 *What are the labor market outcomes of entrepreneurs upon exit?*
- 2 *How does this outside option shape entrepreneurial dynamics?*

# The two parts of this paper

- ① **Empirical evidence:** entrepreneurship impacts return option to wage employment
  - Portuguese linked employer-employee data with *entrepreneurs* 
  - Return-entrepreneurs *earn 3.7% more* relative to never-entrepreneur counterfactual
  - Gains & losses are *heterogeneous* along labor productivity and other margins
- ② **Quantitative model:** entry & exit is driven by human capital risk
  - Human capital from entrepreneurship to wage employment is *imperfectly transferable*
  - Risk of losing entrepreneurial human capital *deters entry*
  - Lowering human capital risk *spurs entry*, eliminating financial barriers does *not*

# Literature

## Barriers to entry and growth in entrepreneurship

Buera and Shin (2013); Midrigan and Xu (2014); Tan and Zeida (2024)

- ▶ Human capital as barrier

## Investment specificity & irreversibility

Lanteri (2018); Bhandari, Martellini, and McGrattan (2025); Baley and Blanco (2026); Tan (2026)

- ▶ Specificity of human capital investment

## Outside option of returning to wage employment

Vereshchagina and Hopenhayn (2009); Choi (2017); Catherine (2022); Gottlieb, Townsend, and Xu (2022)

- ▶ Endogenous co-evolution with entrepreneurship

## Firm dynamics vis à vis entry and exit

Buera and Shin (2013); Clementi and Palazzo (2016); Lanteri, Medina, and Tan (2023)

- ▶ Human capital channel

# **1. Empirical evidence**

# Portuguese linked employer–employee data

## Quadros de Pessoal (QP)

- Universe of work histories at private firms with 1+ employee, 1985–2020
- Detailed wage & hours information in wage employment

## Sistema de Contas Integradas das Empresas (SCIE)

- Universe of balance sheet & income statements at private firms, 2004–2020
- Detailed sales & other performance measures in entrepreneurship

Entrepreneurs = owner-managers at newly established firms (Queiró, 2022)

- i Employers (owners) according to their professional status
  - ii Directors according to their 4-digit occupation
  - iii Managers according to their worker qualification
- Firm is born in sample

# Empirical approach in a nutshell

*Ideal experiment:* compare outcomes of two ex ante identical potential entrep.

*Challenge:* potential entrepreneurs are unobservable

*Our solution:* compare return-entrepreneurs to *matched* never-entrepreneurs

- Difference-in-differences ...with a twist!
- Matching on trajectory, not only on set of observations

# Workers' earnings profile

A worker  $i$  of age  $j_{it}$  at time  $t$  earns

$$\log e_{it} = X_{it}\beta + \nu_{it}, \quad \nu_{it} = \phi(j_{it}) + \varepsilon_{it}$$

- $X_{it}$ : observable worker characteristics
- $\phi(\cdot)$ : mean residual earnings profile
- Akin to nonparametric Mincer equation

# Calculating counterfactual earnings gap

- 1 Residualize earnings of entrepreneurs before entry & never-entrepreneurs
  - Take out gender, calendar year, occupation, education, sector, location
- 2 Match earnings trajectory of entrepreneurs before entry to never-entrep.
  - Custom matching procedure on distance & *slope!*
  - C.f. synthetic DiD (Arkhangelsky, Athey, Hirshberg, Imbens, and Wager, 2021)

Math

Procedure

SDiD

# Calculating counterfactual earnings gap

- 1 Residualize earnings of entrepreneurs before entry & never-entrepreneurs
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  - C.f. synthetic DiD (Arkhangelsky, Athey, Hirshberg, Imbens, and Wager, 2021)ProcedureSDiD
- 3 Estimate earnings profile of never-entrepreneurs
  - Separately by age of entry for matched return-entrepreneurs
- 4 Assign counterfactual earnings to return-entrepreneurs
- 5 Calculate gap ( $e_{it}^{\text{gap}}$ ) between actual & counterfactual earningsGap characteristics
- 6 Estimate labor productivity  $\bar{e}$  $\bar{e}$  vs. firm performance

$$\log e_{it}^{\text{gap}} = \beta_0 + \beta_1 \log e_{i,t-1}^{\text{gap}} + \bar{e}_i + \varepsilon_{it} \implies \bar{e}_i$$

# Measuring the earnings impact of entrepreneurship

“Difference-in-differences”:

$$\log e_{it}^{\text{gap}} = \theta \mathbb{1}(\text{Post}_{it}) + \varepsilon_{it}$$

Event study:

$$\log e_{it}^{\text{gap}} = \sum_{s=-5}^7 \theta_s D_{i,t-s} + \varepsilon_{it}$$

$s \leq -1$ : before entry,  $s \geq 0$ : after exit

Heterogeneity by labor productivity:

$$\log e_{it}^{\text{gap}} = \theta_1 \mathbb{1}(\text{Post}_{it}) + \theta_2 \mathbb{1}(\text{Post}_{it}) \times \bar{e}_i + \varepsilon_{it}$$

# Earnings gains decrease with labor productivity

|  | $\log e_{it}^{gap}$  |                      |
|--|----------------------|----------------------|
|  | (1)                  | (2)                  |
| $\mathbb{1}(\text{Post})$                | 0.037***<br>(0.0033) | 0.020***<br>(0.0030) |
| $\mathbb{1}(\text{Post}) \times \bar{e}$ |                      | -0.32***<br>(0.013)  |
| Observations                             | 91,022               | 76,520               |

(2) 1 s.d. below mean  $\leadsto +10.3\%$       1 s.d. above mean  $\leadsto -6.3\%$

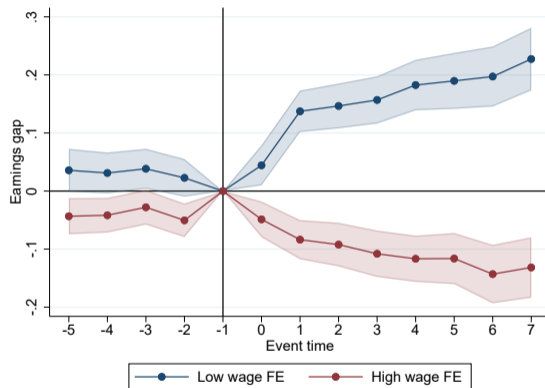
60% of entrepreneurs gain 7.7%, 40% lose 6.1%

Age of entry

Placebo test

SDiD

# Earnings gains decrease with labor productivity



Low & high earnings FE: bottom & top quintile of  $\bar{e}$

Age of entry

Placebo test

# Outside options and firm outcomes

|  | $\log e_{it}^{gap}$  |                      |                      |                        |
|--|----------------------|----------------------|----------------------|------------------------|
|  | (1)                  | (2)                  | (3)                  | (4)                    |
|  | Pooled               | Low $\bar{e}$        | High $\bar{e}$       | Pooled                 |
| $\mathbb{1}(\text{Post})$                      | -0.15***<br>(0.0079) | -0.029*<br>(0.016)   | -0.45***<br>(0.023)  | 0.041***<br>(0.0045)   |
| $\mathbb{1}(\text{Post}) \times \text{sales}$  | 0.032***<br>(0.0014) | 0.039***<br>(0.0035) | 0.058***<br>(0.0034) |                        |
| $\mathbb{1}(\text{Post}) \times \text{tenure}$ |                      |                      |                      | -0.0077***<br>(0.0014) |
| Observations                                   | 70,257               | 13,986               | 14,056               | 76,520                 |

Turning point: (1) 108K EUR, (2) 2K EUR, (3) 2.3M EUR, (4) 6 years

Event study

Placebo test

# Taking stock

Return option to wage employment *evolves endogenously* with entrepreneurship

Earnings gains...

- decrease with labor productivity
- increase with sales
- decrease with entrepreneurial tenure

Empirical patterns...

- are incompatible with fixed outside option
- point to imperfectly transferable human capital across wage emp. and entrep.

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**What does this mean for entrepreneurial entry and exit?**

## **2. Quantitative model**

# Bird's-eye view of the model

Life-cycle model with endogenous “occupational” choice and incomplete markets

Individuals are characterized by...

- Two types of human capital, specific to wage employment ( $h$ ) and entrep. ( $q$ )
- Ability to accumulate human capital ( $a_h$  &  $a_q$ )
- Bond holdings ( $b$ )

Income in both wage employment and entrepreneurship is uncertain

- Precautionary savings for consumption and financing business

# Workers

## Earnings & savings

- HC shocks:  $\tilde{h} = h\tilde{s}$ ,  $\log s \sim N(\mu_s, \sigma_s)$
- Earnings:  $w\tilde{h} \implies$  Savings:  $b' = w\tilde{h} - c + (1+r)b \geq 0$

## Entry choice

- $o = 0$ : stay in wage employment
- $o = 1$ : enter entrepreneurship after paying switching cost  $\xi_{WE}$

## HC evolution at age $j$

- In wage employment:  $h' = \tilde{h} + a_h \left( \tilde{h}f(j) \right)^{\theta_h}$  (Huggett, Ventura, and Yaron, 2011)
- In entrepreneurship:  $q' = \begin{cases} (1 - \delta_q)q & \text{if } o = 0 \\ (1 - \delta_q)q + \lambda_h \tilde{h} & \text{if } o = 1 \end{cases}$

# Entrepreneurs

## Earnings & savings

- HC shocks:  $\tilde{q} = qz$ ,  $\log z \sim N(\mu_z, \sigma_z)$
- Earnings:  $A\tilde{q}(k^\alpha l^{1-\alpha})^\nu - (r + \delta_k)k - wl \implies$  Savings:  $b' = \text{earnings} - c + (1 + r)b \geq 0$
- Borrowing constraint:  $k \leq (1 + \phi)b$  (max LTV is  $\frac{\phi}{1+\phi}$ )

## Exit choice

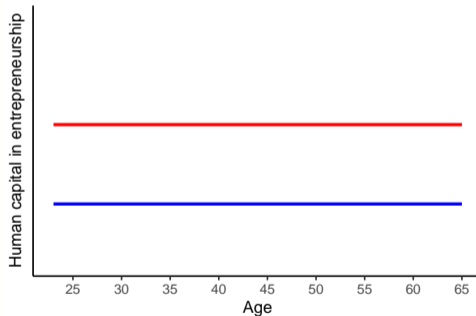
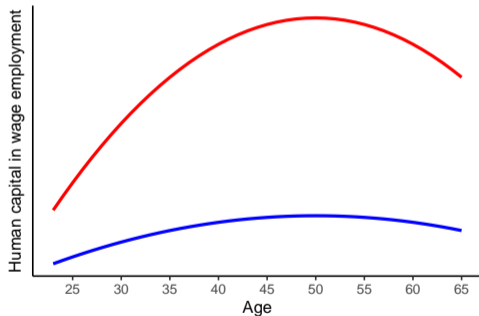
- $o = 1$ : stay in entrepreneurship and enjoy non-pecuniary benefit  $\psi$
- $o = 0$ : exit entrepreneurship after paying switching cost  $\xi_{EW}$

## HC evolution at age $j$

- In entrepreneurship:  $q' = \begin{cases} \tilde{q} + a_q (\tilde{q}f(j))^{\theta_q} & \text{if } o = 1 \\ 0 & \text{if } o = 0 \end{cases}$
- In wage employment:  $h' = \begin{cases} (1 - \delta_h)h & \text{if } o = 1 \\ (1 - \delta_h)h + \lambda_q \tilde{q} & \text{if } o = 0 \end{cases}$

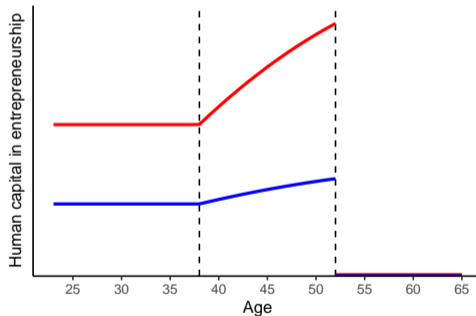
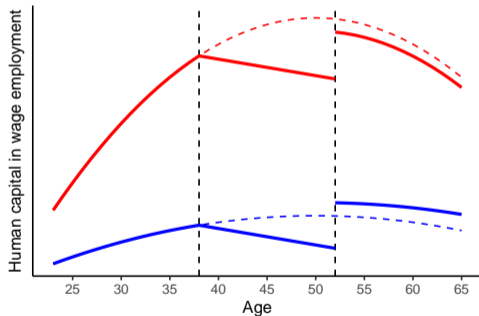
# Illustrating the model mechanism

## *Never-entrepreneurs*



# Illustrating the model mechanism

## *Return-entrepreneurs*



## Bellman equation: workers

$$\begin{aligned} V_j^W(h, q, s, b; a_h, a_q) = \max_{b', o} U(c) + \underbrace{\beta o \left( \int_{z'} V_{j+1}^E(h', q', z', b'; a_h, a_q) dF_{z'} - \xi_{WE} \right)}_{\text{entering entrepreneurship}} \\ + \underbrace{\beta (1 - o) \int_{s'} V_{j+1}^W(h', q', s', b'; a_h, a_q) dF_{s'}}_{\text{staying in wage employment}} \end{aligned}$$

such that

$$\tilde{h} = hs$$

$$h' = \tilde{h} + a_h \left( \tilde{h} f(j) \right)^{\theta_h}$$

$$q' = \begin{cases} (1 - \delta_q)q & \text{if } o = 0 \\ (1 - \delta_q)q + \lambda_h \tilde{h} & \text{if } o = 1 \end{cases}$$

$$b' = w\tilde{h} - c + (1 + r)b \geq 0$$

$$\log s' \sim N(\mu_s, \sigma_s)$$

$$\log z' \sim N(\mu_z, \sigma_z)$$

## Bellman equation: entrepreneurs

$$\begin{aligned}
 V_j^E(h, q, z, b; a_h, a_q) = & \max_{b', o} U(c) + \psi + \underbrace{\beta o \int_{z'} V_{j+1}^E(h', q', z', b'; a_h, a_q) dF_{z'}}_{\text{staying in entrepreneurship}} \\
 & + \underbrace{\beta \left( (1 - o) \int_{s'} V_{j+1}^W(h', q', s', b'; a_h, a_q) dF_{s'} - \xi_{EW} \right)}_{\text{returning to wage employment}}
 \end{aligned}$$

such that

$$\tilde{q} = qz$$

$$q' = \begin{cases} \tilde{q} + a_q (\tilde{q} f(j))^{\theta_q} & \text{if } o = 1 \\ 0 & \text{if } o = 0 \end{cases}$$

$$h' = \begin{cases} (1 - \delta_h)h & \text{if } o = 1 \\ (1 - \delta_h)h + \lambda_q \tilde{q} & \text{if } o = 0 \end{cases}$$

$$b' = A\tilde{q} (k^\alpha l^{1-\alpha})^\nu - (r + \delta_k)k - wl$$

$$- c + (1 + r)b \geq 0$$

$$k \leq (1 + \phi)b, \quad \phi \geq 0$$

$$\log z' \sim N(\mu_z, \sigma_z)$$

$$\log s' \sim N(\mu_s, \sigma_s)$$

## 1 Simplifying assumptions

i.  $a_h = a_q = a$

► Rate of HC accumulation is perfectly correlated across  $h$  and  $q$

ii.  $\delta_q = 0$

► Unused  $q$  does not depreciate

iii.  $\log \begin{pmatrix} h_o \\ q_o \\ a \end{pmatrix} \sim N \left( \begin{pmatrix} \mu_h \\ -\sigma_q^2 \\ \mu_a \end{pmatrix}, \begin{pmatrix} \sigma_h^2 & \rho_{hq}\sigma_h\sigma_q & \rho_{ha}\sigma_h\sigma_a \\ \rho_{hq}\sigma_h\sigma_q & \sigma_q^2 & 0 \\ \rho_{ha}\sigma_h\sigma_a & 0 & \sigma_a^2 \end{pmatrix} \right)$

► Mean  $q_o$  is normalized to 1

►  $q_o$  and  $a$  are uncorrelated

## 2 Wage employment: HC shocks

Estimator

- *Indirect inference*: two-step optimal GMM on older never-entrepreneurs (Huggett, Ventura, and Yaron, 2011)

| Parameter            | Value  |
|----------------------|--------|
| $\mu_s$              | -0.077 |
| $\sigma_s$           | 0.102  |
| $\sigma_\varepsilon$ | 0.237  |

- $\delta_h$  calibrated to average decay of  $h$ :  $\delta_h = 1 - \exp(\mu_s + 0.5\sigma_s^2) = 0.069$

## ③ Wage employment: HC accumulation

- *Indirect inference*: method of simulated moments

Estimator

| Parameter   | Value                     |
|-------------|---------------------------|
| $\theta_h$  | 0.719                     |
| $f(\cdot)$  | [1.604, 0.006, 8.128, 30] |
| $\mu_h$     | -0.238                    |
| $\mu_a$     | 1.090                     |
| $\sigma_h$  | 0.516                     |
| $\sigma_a$  | 0.134                     |
| $\rho_{ha}$ | 0.897                     |

# Taking the model to the data

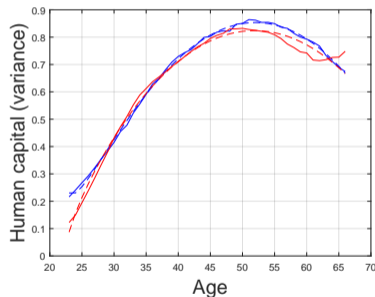
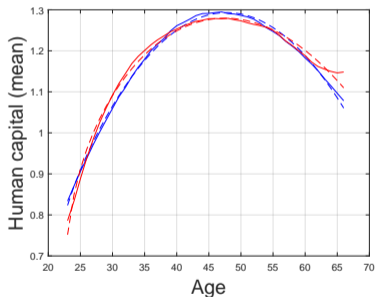
Step 3 of 5

## ③ Wage employment: HC accumulation

- *Indirect inference*: method of simulated moments
- Model fit is excellent

Estimator

Other moments



- 4 Externally set parameters
  - Set to standard values in literature

| Parameter  | Description                    | Value |
|------------|--------------------------------|-------|
| $\alpha$   | Capital share                  | 1/3   |
| $\nu$      | Returns to scale in production | 3/4   |
| $\delta_k$ | Capital depreciation rate      | 0.067 |
| $\gamma$   | Risk aversion                  | 2     |
| $\beta$    | Discount factor                | 0.96  |
| $\phi$     | Collateral constraint          | 0.5   |
| $r$        | Rental rate of capital         | 0.04  |
| $w$        | Rental rate of labor           | 1     |

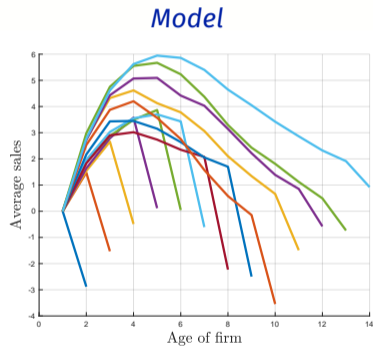
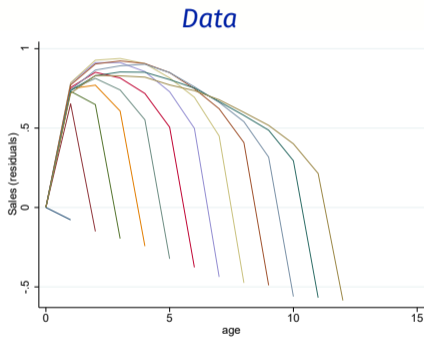
## 5 Internally calibrated parameters

| Parameter   | Value | Target  | Data   | Model  |
|-------------|-------|---|--------|--------|
| $\mu_z$     | 0.342 | Average sales growth                                | -0.135 | -0.100 |
|             |       | St.d. sales growth                                  | 0.632  | 0.976  |
| $\sigma_z$  | 0.925 | Reg. sales growth on lagged sales growth            | -0.083 | -0.010 |
|             |       | Reg. sales growth on $2 \times$ lagged sales growth | -0.004 | -0.022 |
| $\sigma_q$  | 0.394 | St.d. average sales                                 | 1.67   | 6.27   |
| $\rho_{hq}$ | 0.327 | Elas. average sales to $\bar{e}$                    | 1.96%  | 1.73%  |
|             |       | Reg. sales on lagged sales                          | 0.826  | 0.936  |
| $\theta_q$  | 0.750 | Reg. sales on $2 \times$ lagged sales               | 0.767  | 0.784  |
|             |       | Average sales at exit – entry                       | -0.03  | -1.90  |
| $A$         | 0.255 | Employment share of entrepreneurs                   | 25%    | 22%    |
| $\psi$      | 0.29  | Population share of entrepreneurs                   | 4.5%   | 3.6%   |
| $\xi_{WE}$  | 2.827 | Entry rate  | 0.36%  | 1.09%  |
| $\xi_{EW}$  | 3.510 | Exit rate   | 7.4%   | 23.7%  |
| $\lambda_h$ | 0.500 | Average age at entry                                | 33.6   | 36.7   |
| $\lambda_q$ | 0.144 | DiD result  | 0.037  | 0.037  |

# Taking the model to the data

Step 5 of 5

- 5 Internally calibrated parameters
  - Model replicates sales dynamics



## Two counterfactual exercises

- 1 Remove financial frictions ( $\phi \rightarrow \infty$ )
  - $\implies$  unconstrained borrowing
- 2 Reduce human capital specificity ( $\lambda_q \uparrow$ )
  - $\implies$  average earnings gain doubles

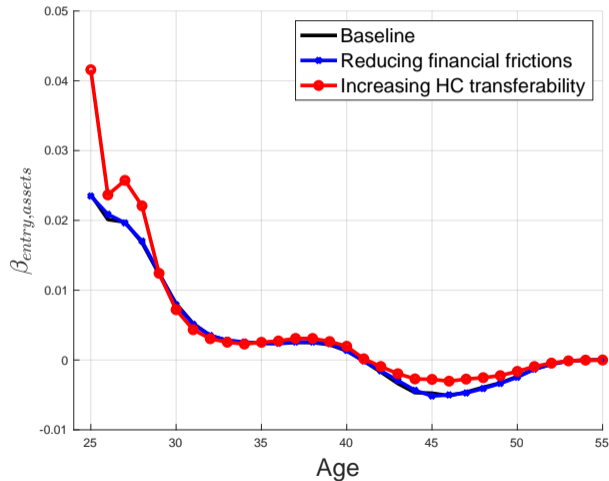
## Quantitative results

|                                 | <i>Baseline</i>                   | <i>Removing FF</i> | <i>Reducing specificity</i> |
|---------------------------------|-----------------------------------|--------------------|-----------------------------|
| Avg. impact on earnings (%)     | 3.70                              | 3.70               | 7.90                        |
|                                 | <i>Impact on entrepreneurship</i> |                    |                             |
| % entrepreneurs                 | 3.60                              | 3.80               | 4.49                        |
| Entry rate (%)                  | 1.09                              | 1.11               | 1.40                        |
| HC ( $h$ ) of entrants (% rel.) | –                                 | -2.21              | 8.44                        |
| HC ( $q$ ) of entrants (% rel.) | –                                 | 1.82               | -4.52                       |
| Avg. sales (% rel. to baseline) | –                                 | 29.7               | 3.58                        |

## Entry decision is driven by HC risk considerations

|                                   | <i>Baseline</i> | <i>Removing FF</i> | <i>Reducing specificity</i> |
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# Financial constraints do not matter for entry



Entrep. rate

Entry rate

Constrained entrep.

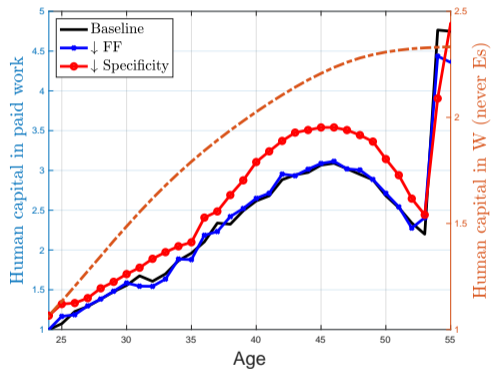
Value of entry

## “Insurance” against HC risk subsidizes low-quality entry

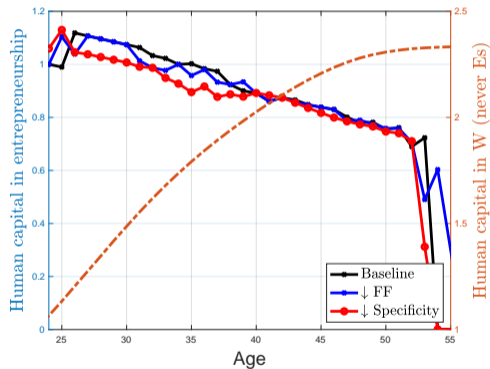
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# “Insurance” against HC risk subsidizes low-quality entry

## Wage employment ( $h$ )



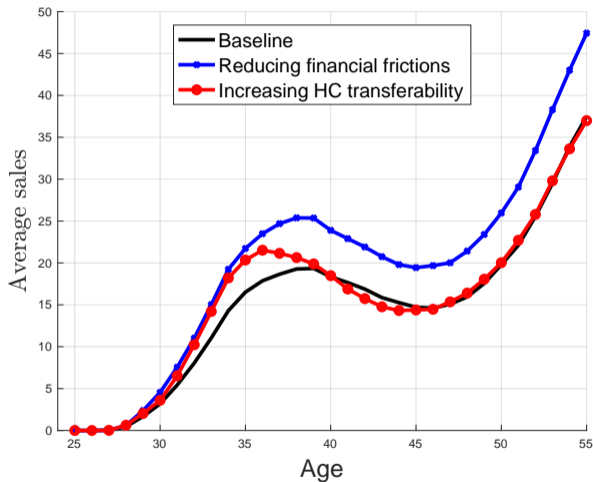
## Entrepreneurship ( $q$ )



## Financial constraints matter for entrepreneurial scale

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# Financial constraints matter for entrepreneurial scale



## **Conclusion**

# Takeaways

First study on implications of entrepreneurial human capital specificity

## ① Empirical evidence

- Entrepreneurship impacts the return option to wage employment
- Return-entrepreneurs earn more than their never-entrepreneur counterfactual selves
- ...but gains accrue to low-productivity workers

## ② Quantitative model

- Human capital is imperfectly transferable from entrepreneurship to wage employment
- Risk due to human capital specificity is the key driver of entrepreneurial entry & exit
- Lowering human capital risk spurs entry, but eliminating financial frictions does not

<https://attilagyetvai.com>

**Backup slides**

# References I

- Arkhangelsky, D., S. Athey, D. A. Hirshberg, G. W. Imbens, and S. Wager (2021). Synthetic Difference-in-Differences. *American Economic Review* 111(12), 4088–4118.
- Bai, J., S. Bernstein, A. Dev, and J. Lerner (2022). The Dance Between Government and Private Investors: Public Entrepreneurial Finance around the Globe. Working Paper.
- Baley, I. and A. Blanco (2026). The Macroeconomics of Irreversibility. *Review of Economic Studies*. Accepted.
- Bhandari, A., P. Martellini, and E. McGrattan (2025). Capital Reallocation and Private Firm Dynamics. Working Paper.
- Buera, F. J. and Y. Shin (2013). Financial Frictions and the Persistence of History: A Quantitative Exploration. *Journal of Political Economy* 121(2), 221–272.
- Catherine, S. (2022). Keeping Options Open: What Motivates Entrepreneurs? *Journal of Financial Economics* 144(1), 1–21.
- Choi, J. (2017). Entrepreneurial Risk-Taking, Young Firm Dynamics, and Aggregate Implications. Working Paper.
- Clementi, G. L. and B. Palazzo (2016). Entry, Exit, Firm Dynamics, and Aggregate Fluctuations. *American Economic Journal: Macroeconomics* 8(3), 1–41.

## References II

- De Vera, M., S. Félix, S. Karmakar, and P. Sedláček (2025). Serial Entrepreneurs and the Macroeconomy. Working Paper.
- Gottlieb, J., R. Townsend, and T. Xu (2022). Does Career Risk Deter Potential Entrepreneurs? *Review of Financial Studies* 35(9), 3973–4015.
- Huggett, M., G. Ventura, and A. Yaron (2011). Sources of Lifetime Inequality. *American Economic Review* 101(7), 2923–54.
- Karahan, F., B. Pugsley, and A. Şahin (2024). Demographic Origins of the Start-up Deficit. *American Economic Review* 114(7), 1986–2023.
- Lanteri, A. (2018). The Market for Used Capital: Endogenous Irreversibility and Reallocation over the Business Cycle. *American Economic Review* 108(9), 2383–2419.
- Lanteri, A., P. Medina, and E. Tan (2023). Capital-Reallocation Frictions and Trade Shocks. *American Economic Journal: Macroeconomics* 15(2), 190–228.
- Midrigan, V. and D. Y. Xu (2014). Finance and Misallocation: Evidence from Plant-level Data. *American Economic Review* 104(2), 422–458.

## References III

- OECD (2026). SMEs and entrepreneurship. Website: <https://www.oecd.org/en/topics/policy-issues/smes-and-entrepreneurship.html>. Accessed on January 12, 2026.
- Queiró, F. (2022). Entrepreneurial Human Capital and Firm Dynamics. *Review of Economic Studies* 89(4), 2061–2100.
- Sterk, V., P. Sedláček, and B. Pugsley (2021). The Nature of Firm Growth. *American Economic Review* 111(2), 547–579.
- Tan, E. (2026). Entrepreneurial Investment Dynamics and the Wealth Distribution. *American Economic Journal: Macroeconomics*. Forthcoming.
- Tan, E. and T. H. Zeida (2024). Consumer Demand and Credit Supply as Barriers to Growth for Black-owned Startups. *Journal of Monetary Economics* 143, 103543.
- Vereshchagina, G. and H. A. Hopenhayn (2009). Risk Taking by Entrepreneurs. *American Economic Review* 99(5), 1808–1830.

## Entrepreneurs

- Only ever held one job per year
- Only entrepreneur  $\rightarrow$  wage employment (no entrepreneur  $\rightarrow$  non-participants)
- No serial entrepreneurs

## Counterfactual entrepreneurs

- “Matched” workers

A worker  $i$  of age  $j_{it}$  at time  $t$  earns

$$\log e_{it} = X_{it}\beta + \nu_{it}, \quad \nu_{it} = \phi(j_{it}) + \varepsilon_{it}$$

- $X_{it}$ : gender + calendar year + occupation + education + sector + location
- $\phi(\cdot)$ : mean residual earnings profile

- 1 Residualize earnings for all workers & entrepreneurs *before* entry  $\leadsto \tilde{e}_{it}(j_{it})$
- 2 Match entrepreneurs to workers using *earnings trajectory*  $\{\tilde{e}_{it}(j_{it})\}_{j_{it} < j_i^{\text{entry}}}$
- 3 Estimate residual earnings profiles  $\hat{\phi}(\cdot)$  using workers only
- 4 Assign counterfactual earnings to return-entrepreneurs as  $\hat{\phi}(j_{it})$  for  $j_{it} > j_i^{\text{exit}}$
- 5 Construct earnings gaps as  $\log e_{it}^{\text{gap}} = \log \tilde{e}_{it}(j_{it}) - \hat{\phi}(j_{it})$

Procedure

AR(1)

◀ Back

Earnings difference between worker  $i$  and *future* entrepreneur  $i'$ :

$$\Delta(j) = \log \tilde{e}_{i't}(j_{i't}) - \log \tilde{e}_{it}(j_{it}) \text{ for } j_{it} = j_{i't} = j$$

Loss function:

$$Q = U + V,$$

$$U = \frac{1}{j^{\text{entry}} - 23} \sum_{j=23}^{j^{\text{entry}}} \Delta(j)^2$$

$$V = \frac{1}{j^{\text{entry}} - 23} \sum_{j=23}^{j^{\text{entry}}} \left( \Delta(j) - \frac{1}{j^{\text{entry}} - 23} \sum_{j=23}^{j^{\text{entry}}} \Delta(j) \right)^2$$

Match future entrepreneur  $i'$  to set of workers with smallest loss

$$(\hat{\theta}^{\text{SDID}}, \hat{\alpha}, \hat{\tau}) = \arg \min_{\theta, \alpha, \tau} \sum_{i=1}^N \sum_{t=1}^T (\log e_{it} - \alpha_i - \tau_t - \mathbf{x}_{it}\beta - \theta \mathbf{1}(\text{Post}_{it}))^2 \hat{\omega}_i \hat{\lambda}_t$$

with

$$\hat{\omega} = \arg \min_{\omega} \sum_{t=1}^{T_{\text{pre}}} \left( \omega_0 + \sum_{i=1}^{N_c} \omega_i \log e_{it} - \frac{1}{N_t} \sum_{i=1}^{N_t} \log e_{it} \right)^2 + \zeta^2 T_{\text{pre}} \|\omega\|_2^2 \quad \text{and}$$

$$\hat{\lambda} = \arg \min_{\lambda} \sum_{i=1}^{N_c} \left( \lambda_0 + \sum_{t=1}^{T_{\text{pre}}} \lambda_t \log e_{it} - \frac{1}{T_{\text{post}}} \sum_{t=+1}^{T_{\text{post}}} \log e_{it} \right)^2$$

|                    | $\log e_{it}^{\text{gap}}$ | $\log e_{it}^{\text{gap}}$ | $\log \frac{e_{it}^{\text{gap}}}{e_{i,t-1}^{\text{gap}}}$ |
|--------------------|----------------------------|----------------------------|---|
|                    | (1)                        | (2)                        | (3)   |
| $\rho$             | 0.780                      | 0.343                      |   |
| $\sigma(\epsilon)$ | 0.287                      | 0.232                      |   |
| $\sigma(\bar{e})$  |                            | 0.258                      |   |
| $\eta$             |                            |                            | 0.123   |

$$(1) \quad \log e_{it}^{\text{gap}} = \rho \log e_{i,t-1}^{\text{gap}} + \epsilon_{it}$$

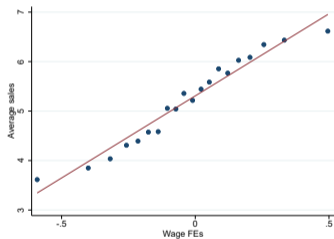
$$(2) \quad \log e_{it}^{\text{gap}} = \rho \log e_{i,t-1}^{\text{gap}} + \bar{e}_i + \epsilon_{it}$$

$$(3) \quad \log \frac{e_{it}^{\text{gap}}}{e_{i,t-1}^{\text{gap}}} = \eta \bar{e}_i + \epsilon_{it}$$

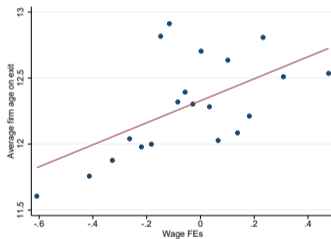
# Earnings FEs vs. firm performance

Evidence: Methods

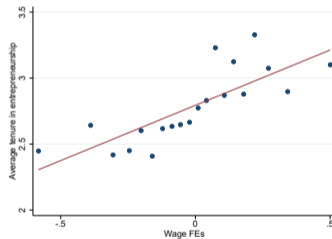
Average sales



Average firm age on exit



Average tenure



# Outside options decline with age of entry

Evidence: Results

|  | $\log e_{it}^{gap}$     |                        |                       |
|--|-------------------------|------------------------|-----------------------|
|  | (1)                     | (2)                    | (3)                   |
|  | Pooled                  | Low $\bar{e}$          | High $\bar{e}$        |
| $\mathbb{1}(\text{Post})$                            | 0.065***<br>(0.0058)    | 0.18***<br>(0.014)     | -0.074***<br>(0.014)  |
| $\mathbb{1}(\text{Post}) \times \text{age of entry}$ | -0.0029***<br>(0.00057) | -0.0048***<br>(0.0012) | 0.0053***<br>(0.0012) |
| Observations   | 91,022                  | 14,454                 | 16,512                |

Low & high  $\bar{e}$ : bottom & top quintile of earnings FEs

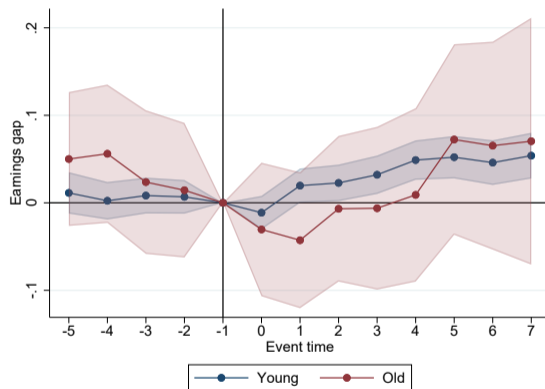
Turning point: (1) 23 years, (2) none, (3) 14 years

Placebo test

◀ Back

# Post-exit earnings decrease with age of entry

Evidence: Results



Young: enter before age 35. Old: enter after age 45

Assign “fake entry” to matched never-entrepreneurs

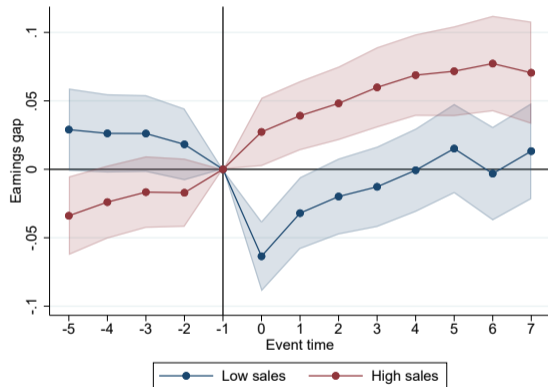
|  | (1)                  | (2)                   | (3)                   | (4)                     | (5)                    | (6)                   |
|--|----------------------|-----------------------|-----------------------|-------------------------|------------------------|-----------------------|
| $\mathbb{1}(\text{Post})$                                  | -0.0013<br>(0.0035)  | -0.013***<br>(0.0026) | -0.015***<br>(0.0020) | 0.00056<br>(0.0050)     | -0.044***<br>(0.0098)  | 0.10***<br>(0.0096)   |
| $\mathbb{1}(\text{Post}) \times (E = 1)$                   | 0.047***<br>(0.0047) | 0.073***<br>(0.0036)  | 0.0048<br>(0.0030)    | 0.087***<br>(0.0073)    | 0.28***<br>(0.015)     | -0.12***<br>(0.015)   |
| $\mathbb{1}(\text{Post}) \times \bar{e}$                   |                      | 0.19***<br>(0.013)    | -0.097***<br>(0.0096) |                         |                        |                       |
| $\mathbb{1}(\text{Post}) \times (E = 1) \times \bar{e}$    |                      | -0.55***<br>(0.016)   | -0.10***<br>(0.013)   |                         |                        |                       |
| $\mathbb{1}(\text{Post}) \times \text{age}$                |                      |                       |                       | 0.0000027<br>(0.00052)  | 0.0016*<br>(0.00086)   | -0.00097<br>(0.00082) |
| $\mathbb{1}(\text{Post}) \times (E = 1) \times \text{age}$ |                      |                       |                       | -0.0044***<br>(0.00074) | -0.0082***<br>(0.0013) | 0.0035***<br>(0.0013) |
| Observations   | 228897               | 221098                | 187059                | 228897                  | 43828                  | 44620                 |

|                           | $\log e_{it}^{gap}$ |               |                |
|---------------------------|---------------------|---------------|----------------|
|                           | (1)                 | (2)           | (3)            |
|                           | Pooled              | Low $\bar{e}$ | High $\bar{e}$ |
| $\mathbb{1}(\text{Post})$ | 0.067               | 0.249         | -0.078         |
| Observations              | 30,362              | 30,362        | 30,362         |

Due to data limitations, (i) estimator is applied to a 1 percent sample of return-entrepreneur and never-entrepreneur wage histories; and (ii) clustered bootstrap standard errors are not available.

# Earnings gains increase with sales

Evidence: Results



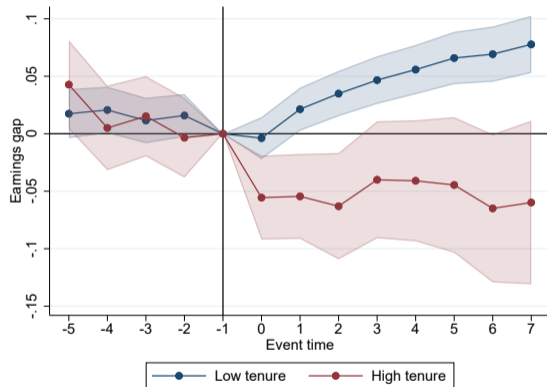
Low & high sales: sales at exit is below & above median

Placebo test

◀ Back

# Earnings gains decrease with entrepreneurial tenure

Evidence: Results



Low & high tenure: less than & over 5 years

Placebo test

◀ Back

- ① High earnings profile: *earnings loss* upon return ↓
- ② Low earnings profile: *earnings gain* upon return ↑
- ③ High earnings profile: *earnings loss* is decreasing in age of entry ↓↓↓
- ④ Low earnings profile: *earnings gain* is decreasing in age of entry ↑↑↑
- ⑤ Aggregate impact is ambiguous ?

CRRA utility:

$$U(\{c\}_{j=1}^J) = \sum_{j=1}^J \beta^j \frac{c_j^{1-\gamma}}{1-\gamma}$$
$$U(c) = \frac{c^{1-\gamma}}{1-\gamma}$$

HC age profile: at age  $j$ ,

$$f(j) = \kappa_1 \left( \frac{1}{1 + \exp(\kappa_2(j - \kappa_3))} \right)^{\kappa_4}$$

Model earnings with measurement error:

$$\hat{e}_j \equiv e_j + \epsilon_j$$

$$\hat{e}_j - \hat{e}_{j-1} = \log \left( s_j \left( h_{j-1} s_{j-1} + a_h (h_{j-1} s_{j-1} f(j-1))^{\theta_h} \right) \right) - \log (h_{j-1} s_{j-1}) + \log \epsilon_j - \log \epsilon_{j-1}$$

For older workers with  $f(\cdot) \rightarrow 0$ :

$$\hat{e}_j - \hat{e}_{j-1} \approx \log s_j + \log \epsilon_j - \log \epsilon_{j-1}$$

$$\Delta e_{j,n} \equiv \hat{e}_{j+n} - \hat{e}_j \approx \sum_{i=1}^n s_{j+i} + \log \epsilon_{j+n} - \log \epsilon_j$$

Moment conditions:

$$\text{var}(\Delta e_{j,n}) = n\sigma_S^2 + 2\sigma_\varepsilon^2 \quad (1)$$

$$\text{cov}(\Delta e_{j,n}, \Delta e_{j,m}) = m\sigma_S^2 + \sigma_\varepsilon^2 \quad \text{for } m < n \quad (2)$$

Sample analogs:

$$1/N_j \sum_{i=1}^{N_j} \left( \Delta e_{j,n}^i - \overline{\Delta e_{j,n}} \right)^2$$

$$1/N_j \sum_{i=1}^{N_j} \left( \Delta e_{j,n}^i - \overline{\Delta e_{j,n}} \right) \left( \Delta e_{j,m}^i - \overline{\Delta e_{j,m}} \right)$$

Estimate on 55+ never-entrepreneurs using two-step optimal GMM

Calibrate  $\mu_S$  to match earnings decline above age 55

Model: 10,000 simulations

Data: residualized log hourly earnings by age and calendar years for never-entrepreneurs above the minimum wage ( $= \tilde{h}$ )

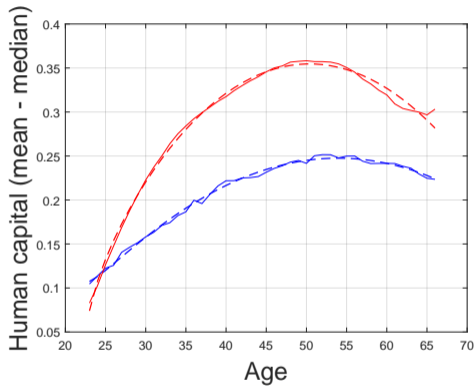
$$\hat{\Theta} = \arg \min_{\hat{\Theta}} \left( \mathbf{m}^{\text{sim}} - \mathbf{m}^{\text{data}} \right)' \left( \mathbf{m}^{\text{sim}} - \mathbf{m}^{\text{data}} \right)$$

where

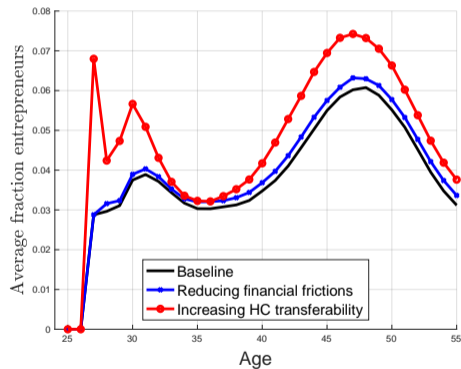
$$\mathbf{m}^p = \left[ \text{mean}_i \left( \tilde{h}_{i,j}^p \right), \text{var}_i \left( \tilde{h}_{i,j}^p \right), \text{mean}_i \left( \tilde{h}_{i,j}^p \right) - \text{median}_i \left( \tilde{h}_{i,j}^p \right) \right]_{j=23}^{65}, \quad p \in \{\text{sim}, \text{data}\}$$

## Step 3 of 5: HCA for workers, model fit

Model: Calibration



## Fraction of entrepreneurs



## Entry rate

