Entry Costs Rise with Growth

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Do entry costs rise with growth?

Matters for the welfare impact of many policies

No consensus in the literature (entry costs variously denominated in output or labor)

In this paper we:

- study firms and establishments in the U.S. over time and across states
- find employment per firm is stable or declines only modestly with output per worker
- infer that entry costs rise with growth if there is free entry

‘Entry costs’ encompass ...

All non-production costs over a firm’s life cycle

Examples:

- upfront innovation and setup costs
- overhead costs
- R&D of incumbents
- fixed costs of exporting
- government permits

No consensus about whether entry costs rise with growth

Let $c_e(t) =$ cost of setting up a business in units of output

What is the elasticity $c_e(t)$ wrt aggregate productivity $Y(t)/L(t)$? Call this ϵ.

$\epsilon = 0$	Hopenhayn (1992), Foster, Haltiwanger and Syverson (2008), Clementi and Palazzo (2016), Boar and Midrigan (2019, 2021), David (2022)
$\epsilon >> 0$	Melitz (2003), Klette and Kortum (2004), Atkeson and Burstein (2019), Peters and Walsh (2022), Hopenhayn, Neira, and Singhania (2022)
Agnostic $\epsilon = ?$	Rivera-Batiz and Romer (1991), Atkeson and Burstein (2010), Costinot and Rodríguez-Clare (2014), Baqaee and Farhi (2021)

Previous evidence

Countries with higher GDP per capita have more workers per mfg establishments

Bento and Restuccia (2017)

No trend in employment per firm in the U.S.

e.g. Laincz and Peretto (2006), Luttmer (2010)

Theoretical properties as wishlist for stylized facts

BGP, stationary firm size distribution

Our contribution: 1) clarify the amplification effect in workhorse models

2) infer ϵ from new empirical patterns in the U.S.

Our approach

The elasticity of entry costs wrt to aggregate productivity:

$$\epsilon \equiv \frac{Cov(\ln c_e, \ln \frac{Y}{L})}{Var(\ln \frac{Y}{L})}$$

Under the static version of the free entry condition,

$$c_e \overset{\text{FE}}{=} \text{profit per firm} = \frac{Y}{N}\left(1 - \frac{1}{\mu}\right) = \frac{Y}{L}\frac{L}{N}\left(1 - \frac{1}{\mu}\right)$$

and hence

$$\epsilon = 1 + \frac{Cov(\ln \frac{L}{N}, \ln \frac{Y}{L})}{Var(\ln \frac{Y}{L})} + \frac{Cov(\ln(1 - 1/\mu), \ln \frac{Y}{L})}{Var(\ln \frac{Y}{L})}$$

Preview of results

$$\epsilon = 1 + \underbrace{\frac{Cov(\ln \frac{L}{N}, \ln \frac{Y}{L})}{Var(\ln \frac{Y}{L})}}_{\text{data}} + \frac{Cov(\ln(1 - 1/\mu), \ln \frac{Y}{L})}{Var(\ln \frac{Y}{L})}$$

We find, in the U.S. over time and across states, $\frac{Cov(\ln \frac{L}{N}, \ln \frac{Y}{L})}{Var(\ln \frac{Y}{L})}$ is in the range of -0.3 and 0.4.

The literature on markups finds, if anything, markups rising over time with growth.

Combined, these facts suggest $\epsilon >> 0$ and **rising entry costs with growth**.

This talk

$\boxed{\text{Spatial equilibrium model to set ideas}}$

Our facts on entry costs rising with growth

Interpretation of our facts

A spatial equilibrium model for illustration

Use the model to motivate cross-state regressions and illustrate the importance of ϵ

$s = 1, 2, \ldots, S$ states with H_s land endowment, A_s productivity, and A_s^e entry efficiency

Goods sent from s' to s incur symmetric iceberg trade cost $d_{s,s'} \geq 1$

Exogenous L workers who freely choose where to live and work $\rightarrow$ endogenous L_s

Ex-ante identical firms who choose where to locate $\rightarrow$ endogenous N_s

Entry costs in our spatial equilibrium model

Final goods in each state are a CES function of intermediate goods from all states.

Technology for setting up an intermediate goods firm in state s:

$$N_s = \underbrace{A^e_{s,t}}_{\text{entry efficiency}} \times \overbrace{N^{\phi}_{s,t-1}}^{\text{past entry spillover}} \times \underbrace{(l^e_s)^{\lambda}}_{\text{local labor}} \times \overbrace{(y^e_s)^{1-\lambda}}^{\text{final goods}}, \quad \lambda \in (0,1)$$

The implied cost of entry, in units of output, in state s:

$$c^e_s \propto \frac{(w_s/P_s)^{\lambda}}{A^e_s N^{\phi}_{s,t-1}}$$

The elasticity ϵ rises with λ and declines with ϕ.

How welfare effects of shocks depend on determinants of ϵ — λ and ϕ

Special case of one state, $S = 1$. The effect of changes in L, A, and A^e on real wage $\frac{w}{P}$:

$$\Delta \ln \frac{w}{P} = \frac{\Delta \ln A^e + \Delta \ln L + (\sigma - 1)\Delta \ln A}{\sigma - 1 - (1 - \lambda)}$$

Can make dynamic with a sequence of one shot economies when $S = 1$. The effect of changes in the *growth rate* of L, A, and A^e on the *growth rate* of the real wage $\frac{w}{P}$:

$$g^{\frac{w}{P}} = \frac{\frac{1}{1-\phi}(g^{A^e} + g^L) + (\sigma - 1)g^A}{\sigma - 1 - \frac{1-\lambda}{1-\phi}}$$

Lower ϵ (through lower λ or higher ϕ) implies a larger impact on the real wage.

Inference on ϵ

Recall that free entry implies (if homogeneous and constant markups)

$$c^e_{st} \propto \frac{Y_{s,t}}{L_{s,t}} \cdot \frac{L_{s,t}}{N_{s,t}}$$

and hence

$$\epsilon = 1 + \frac{Cov(\ln \frac{L_{s,t}}{N_{s,t}}, \ln \frac{Y_{s,t}}{L_{s,t}})}{Var(\ln \frac{Y_{s,t}}{L_{s,t}})}$$

Next examine how $\ln \frac{L_{s,t}}{N_{s,t}}$ varies with $\ln \frac{Y_{s,t}}{L_{s,t}}$ across states and over time to infer ϵ.

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Main data sets

U.S. Business Dynamics Statistics 1978-2019

- all establishments and firms with employees
  (5.3m firms, 7.2m estab, and 131.8m workers in 2019)
- aggregate U.S. and by states in each year

U.S. Bureau of Economic Analysis

- real GDP and GSP

Commodity Flow Survey

- bilateral trade

Log worker per firm on log GDP per worker, national, 1978 to 2019

Dep var $\ln L/N$	All firms	All plants	New firms	New plants
$\ln Y/L$	0.395	0.188	-0.218	-0.024
Implied ϵ	1.395	1.188	0.782	0.976
	(0.026)	(0.024)	(0.059)	(0.076)
R^2	0.851	0.601	0.247	0.002
N	42	42	42	42

Sources: BDS and BEA data.

$\epsilon >> 0$. Robust to using alternative measures of L and N.

Log worker per firm on log GDP per worker, across states, 2019

Dep var $\ln L/N$	All firms	All plants	New firms	New plants
$\ln Y/L$	-0.284	-0.185	-0.189	-0.180
Implied ϵ	0.716	0.815	0.811	0.820
	(0.162)	(0.132)	(0.158)	(0.182)
R^2	0.059	0.039	0.028	0.019
N	50	50	50	50

Source: BDS and BEA data.

$\epsilon >> 0$. Robust to using other years and alternative measures of L and N.

Δ Log worker per firm on Δ log GDP per worker, across states, 1978 to 2019 change

Dep var $\Delta \ln L/N$	All firms	All plants	New firms	New plants
$\Delta \ln Y/L$	-0.147	-0.134	0.218	0.131
Implied ϵ	0.853	0.866	1.218	1.131
	(0.119)	(0.103)	(0.169)	(0.199)
R^2	0.030	0.033	0.033	0.001
N	50	50	50	50

Source: BDS and BEA data.

$\epsilon >> 0$. Robust to alternative measures of L and N.

This talk

Spatial equilibrium model to set ideas

Our facts on entry costs rising with growth

$\boxed{\text{Interpretation of our facts}}$

Potential mechanisms behind rising entry costs with growth

In the model, entry costs may rise with growth due to

- entry being labor-intensive ($\lambda > 0$)
- ideas becoming harder to find ($\phi < 0$)
- better technology costs more to setup (A_s^e declines with A_s)
- it costs more to set up in areas with more land/amenities (A_s^e declines with H_s)

If we rely on the first two, what are the implied values of λ and ϕ?

Inferring λ and ϕ

Equilibrium relationship:

$$\ln \frac{L_{s,t}}{N_{s,t}} \quad = \quad \text{constant} + (\lambda - 1) \ln \frac{Y_{s,t}}{L_{s,t}} - \phi \ln N_{s,t-1} - \ln A^{e}_{s,t}$$

OLS in levels or growth rates, with or without time fixed effects, find $\lambda^{OLS} \approx 1$ and $\phi^{OLS} \approx 0$.

For example, $\lambda^{OLS} = 0.740\,(0.176)$ and $\phi^{OLS} = -0.098\,(0.023)$ for 2017 data.

OLS is not consistent, however, because Y/L is endogenous to A^{e}.

Need orthogonality conditions to identify λ and ϕ.

Our estimates of λ and ϕ

Model	Assumption	OLS λ	GMM $\widehat{\lambda}$	OLS ϕ	GMM $\widehat{\phi}$
Spatial	$\ln A_s^e \perp \ln A_s, \ln A_s^e \perp \ln H_s$	0.74	1.00	-0.10	-0.11
National	$\ln A_t^e \perp \ln A_t, \ln A_t^e \perp \ln Pop_t$	1.22	1.00	-0.24	-0.57

Response of real wage growth to shocks, spatial model

Parameters	g^A shocks	g^L shocks
General case	$\frac{\sigma-1}{\sigma-1-\frac{1-\lambda}{1-\phi}}$	$\frac{\frac{1}{1-\phi}}{\sigma-1-\frac{1-\lambda}{1-\phi}}$
$\lambda = 1$, $\phi = 0$ (no amplification)	1%	0.33%
$\lambda = 0$, $\phi = 0$ (λ amplification)	1.5%	0.5%
$\lambda = 0$, $\phi = 0.5$ (λ and ϕ amplification)	3%	2%
$\lambda = 1$, $\phi = -0.11$ **(our point estimates)**	1%	0.3%

Conclusion

In the U.S. over time and across states, employment per firm is stable or declines only modestly with output per worker.

Implications for workhorse models:

1. entry costs increase with growth
2. $\lambda \approx 1$ and $\phi \leq 0$ (labor-intensive entry and non-positive spillovers)
3. welfare effects of policies are not amplified by endogenous entry

Backup slides

Δ Log workers per firm on Δ log output per worker and Δ lagged # of firms

Horizon	40 years	10 years	5 years	1 year
λ^{OLS}	0.921	0.741	0.698	0.678
	(0.093)	(0.054)	(0.048)	(0.015)
ϕ^{OLS}	0.074	0.155	0.010	-0.047
	(0.060)	(0.043)	(0.038)	(0.021)
N	51	153	306	2040
R^2	0.042	0.237	0.115	0.199

Δ Log workers per new firm on Δ log output per worker and Δ lagged # of firms

Horizon	40 years	10 years	5 years	1 year
λ^{OLS}	0.995	0.768	0.888	0.754
	(0.120)	(0.191)	(0.140)	(0.127)
ϕ^{OLS}	0.281	0.367	-0.033	0.206
	(0.077)	(0.152)	(0.109)	(0.177)
N	51	153	306	2040
R^2	0.219	0.058	0.003	0.002

Δ Log workers per firm on Δ log output per worker, Δ lagged # of firms, time FE

Horizon	10 years	5 years	1 year
λ^{OLS}	0.734	0.813	0.777
	(0.181)	(0.143)	(0.027)
ϕ^{OLS}	0.137	0.104	0.100
	(0.053)	(0.086)	(0.041)
N	153	306	2040
R^2	0.167	0.075	0.123

Δ Log workers per firm on Δ log output per worker, Δ lagged # of firms, fix industry

Horizon	40 years	10 years	5 years	1 year
λ^{OLS}	0.815	0.835	0.716	0.802
	(0.081)	(0.047)	(0.026)	(0.012)
ϕ^{OLS}	0.065	0.072	-0.196	-0.193
	(0.059)	(0.051)	(0.039)	(0.022)
N	51	153	306	2040
R^2	0.120	0.143	0.290	0.148

Δ Log workers per firm with 1-4 emp on Δ log output per worker, Δ lagged # of firms

Horizon	40 years	10 years	5 years	1 year
λ^{OLS}	1.054	0.968	1.058	0.967
	(0.025)	(0.015)	(0.010)	(0.008)
ϕ^{OLS}	0.140	0.100	-0.121	0.145
	(0.018)	(0.016)	(0.015)	(0.014)
N	51	153	306	2040
R^2	0.584	0.330	0.216	0.057

Δ Log BDS workers per firm on Δ log output per CBP worker, Δ lagged # of firms

Horizon	33 years	10 years	5 years	1 year
λ^{OLS}	0.928	0.894	0.697	0.778
	(0.096)	(0.058)	(0.048)	(0.016)
ϕ^{OLS}	0.123	0.209	-0.041	-0.018
	(0.067)	(0.048)	(0.039)	(0.023)
N	51	102	255	1683
R^2	0.073	0.248	0.144	0.111