Firms and Industry Dynamics:

Literature and Perspective

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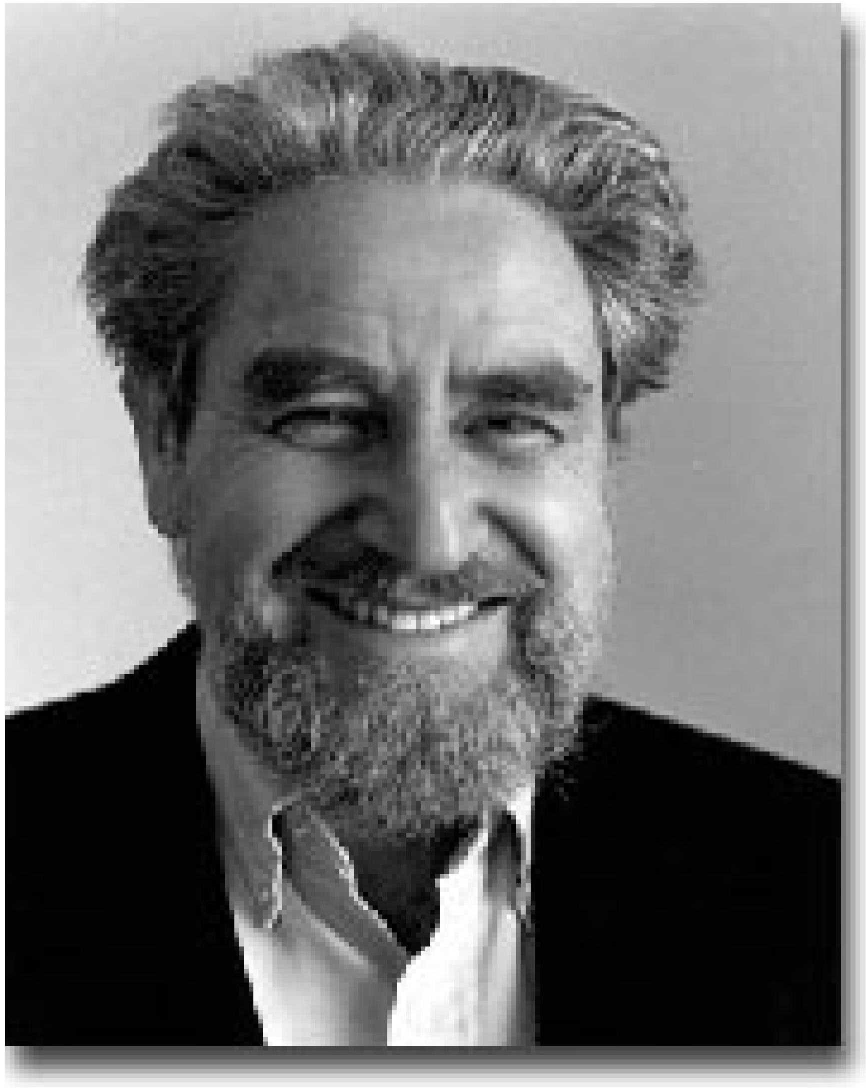
ZVI GRILICHES, 1930-1999



(Highly) Selected Contributions of Zvi Griliches

- Production Function Estimation
  - *Economies of Scale and the Form of the Production Function*, with Vidar Ringstad (1971) – Norwegian establishment micro data.
  - Measurement error, unobserved heterogeneity, endogeneity

- R&D and Innovation
  - "Hybrid Corn: An Exploration in the Economics of Technological Change" (1957), *Econometrica* – Diffusion process for innovation
  - "Issues in Assessing the contribution of R&D to Productivity Growth," (1979) *Bell Journal of Economics* – Knowledge production function, spillovers

- Price Measurement
  - Hedonic Price Indices for Automobiles: An Econometric Analysis of Quality Change (1961), *Price Statistics of the Federal Government*, NBER – role of product characteristics

See Heckman (2005) – Nobel prize nominating statement for Griliches

Producer Heterogeneity at the Micro Level

Within-industry - enormous differences across plants and firms.

- Observable Characteristics
  - Size (revenue, capital, employment)
  - Age
  - Wages paid
  - Skill level of workforce
  - Management practices or organization
  - Number of products/markets
  - Investment in R&D
  - Advertising
- Unobserved (less) Characteristics
  - Productivity/tech efficiency
  - Product Quality
  - Customer Base
  - Output Quantity and Price

- Performance Outcomes
  - Profitability/ Firm Value
  - Survival
  - Growth rates
  - Innovation rates

A Theory of Firm Growth and Exit

- Theory of Firm Selection and Market Evolution, Jovanovic (1982)
  - Single industry - firms are heterogenous in one dimension: ω_i
  - Firm is born with exogenous draw of ω_i , never changes
  - c_i is unknown to the firm – observe a noisy signal $\Theta_{it} = \Theta(\omega_i + \varepsilon_t)$
  - Choose output based on $E(\Theta_{it})$ and update it based on observed profits

- Mechanism – firm gradually learns ω_i , output level converges, and firm exits if expected future profits are too low.
- Predictions:
  - Probability of failure declines with firm size and age
  - Mean growth rate of survivors declines with size (given age)
  - Variance of survivor's growth rate declines with age

Plant Growth and Exit – Empirical Evidence

- Panel data of U.S. Manufacturing plants, 5-year intervals, 1963-1982

TABLE I
PLANT GROWTH AND EXIT RATES

	Size (number of employees)					
Age (years)	5–19	20–49	50–99	100–249	>250	Total
a. Mean employment growth rate of successful plants						
1–5	0.606	0.299	0.187	0.132	0.067	0.446
6–10	0.338	0.136	0.066	0.011	−0.011	0.202
11–15	0.310	0.055	−0.006	−0.015	−0.018	0.153
Total	0.519	0.226	0.130	0.077	0.026	0.353
b. Plant exit rates						
1–5	0.412	0.396	0.390	0.327	0.229	0.397
6–10	0.347	0.268	0.281	0.245	0.158	0.303
11–15	0.304	0.206	0.234	0.212	0.131	0.255
Total	0.391	0.347	0.346	0.291	0.191	0.363
c. Mean employment growth rate of all plants						
1–5	−0.056	−0.216	−0.276	−0.238	−0.178	−0.129
6–10	−0.127	−0.169	−0.234	−0.236	−0.167	−0.162
11–15	−0.089	−0.163	−0.239	−0.224	−0.147	−0.141
Total	−0.074	−0.199	−0.261	−0.236	−0.170	−0.138
d. Number of plant-year observations on successful plants/failing plants						
1–5	75,959/53,325	29,938/19,649	13,758/8,794	9,472/4,601	3,281/977	132,408/87,346
6–10	27,409/14,569	15,268/5,584	7,577/2,961	5,829/1,889	2,630/494	58,713/25,947
11–15	7,773/3,400	4,675/1,216	2,198/673	1,568/421	911/137	17,125/5,847
Total	111,141/71,294	49,881/26,449	23,533/12,428	16,869/6,911	6,822/1,608	208,246/118,690

Source: Dunne, Roberts, and Samuelson (1989)

Industry Level Firm Turnover

Entry and exit are positively correlated across industries.

TABLE 7 Correlations between Industry Entry and Exit Variables (387 Four-Digit Industries)

	No Correction for Fixed Industry Effects				Correction for Fixed Industry Effects			
	1963–1967	1967–1972	1972–1977	1977–1982	1963–1967	1967–1972	1972–1977	1977–1982
	Entry Rate				Entry Rate			
Exit Rate								
1963–1967	.180	.363	.387	.323	−.249	.071	.123	−.005
1967–1972	.447	.274	.273	.363	.371	−.191	−.177	.118
1972–1977	.358	.408	.321	.328	.051	.137	−.129	−.081
1977–1982	.237	.324	.389	.304	−.114	−.029	.147	−.028
	Entrant Market Share				Entrant Market Share			
Exiter Market Share								
1963–1967	.741	.725	.743	.691	.308	−.116	−.037	−.167
1967–1972	.722	.770	.759	.703	.124	.154	−.058	−.228
1972–1977	.681	.800	.788	.784	−.153	.160	−.044	.032
1977–1982	.571	.691	.758	.804	−.287	−.172	.132	.354

Source: Dunne, Roberts, and Samuelson (1988)

A Theory of Simultaneous Entry and Exit

"Entry, exit, and firm dynamics in long-run equilibrium," Hopenhayn (1992)

- Firms are heterogenous in one dimension, productivity ω_{it}
- Productivity is known but evolves stochastically
  - Markov process $F(\omega_{it+1} \mid \omega_{it})$ that is strictly decreasing in ω_{it}
- Entrants pay a sunk cost C_e observe ω_{it}
- Firms exit when $\omega_{it} < \omega$ that guarantees positive firm value

Implications:

- In equilibrium an industry has simultaneous entry and exit
- Magnitude of turnover is affected by C_e (technology)
- High C_e is a barrier to entry and exit. Inefficient firms can survive

Does Firm Turnover Improve Industry Productivity?

Compare productivity of entering, continuing, exiting firms.

Multilateral Tornqvist productivity index (Solow residual):

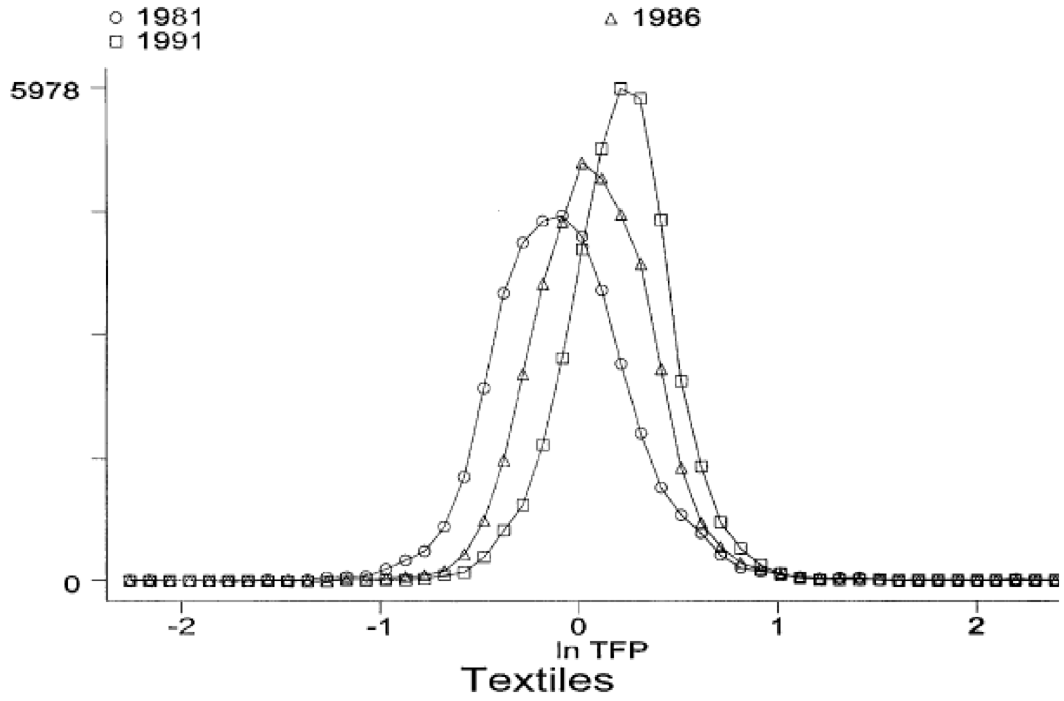
Bailey, Hulten, Campbell (1992) , Griliches and Regev (1995), Haltiwanger (1997), Aw, Chen, and Roberts (2001)

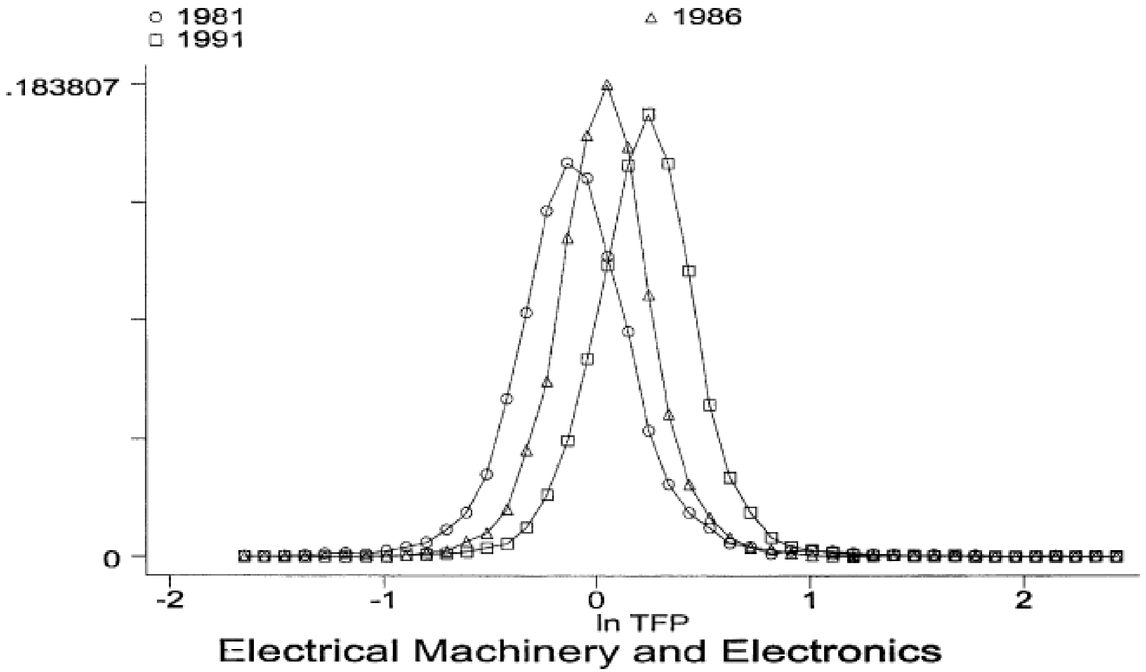
$$\ln TFP_{ft} = (\ln Y_{ft} - \overline{\ln Y}) - \sum_i \frac{1}{2}(S_{ift} + \overline{S_i})(\ln X_{ift} - \overline{\ln X_i})$$

Production function estimation: *Olley and Pakes (1996)*

$$\ln Y_{ft} = \alpha_0 + \sum_i \alpha_i \ln X_{ift} + \ln TFP_{ft} + \varepsilon_{ft}$$

Productivity Distributions – Taiwan 1981-91





Source: Aw, Chen, and Roberts (1991)

How do firm movements contribute to the shift in the industry distribution?

Decompose Industry Productivity Growth

Industry Productivity: $\ln TFP_t = \sum_f \theta_{ft} \ln TFP_{ft}$

Firms are entering (E_{t+1}), exiting (X_t) or continuing (C_{t+1},C_t)

Industry Productivity Growth:

$$
\begin{aligned}
\ln TFP_{t+1} - \ln TFP_t \quad = \quad & \frac{(\theta_{Xt} + \theta_{Et+1})}{2}(\ln TFP_{Et+1} - \ln TFP_{Xt}) \\
& \frac{(\ln TFP_{Xt} + \ln TFP_{Et+1})}{2}(\theta_{Et+1} - \theta_{Xt}) \\
& \sum_{f \in C} \frac{(\theta_{ft} + \theta_{ft+1})}{2}(\ln TFP_{ft+1} - \ln TFP_{ft}) \\
& \sum_{f \in C} \frac{(\ln TFP_{ft} + \ln TFP_{ft+1})}{2}(\theta_{ft+1} - \theta_{ft})
\end{aligned}
$$

Entry - Exit

Continuing

TFP Decomposition -Taiwan Manufacturing Plants

Table 8
Decomposition of industry productivity growth

Industry (years)	Labor productivity growth	*TFP* growth	Decomposition of *TFP* growth		
			Continuing firms	Entry vs. Exit	Market share reallocation
Textiles					
1981–1986	0.514	0.165	0.096	0.075	−0.006
1986–1991	0.437	0.152	0.091	0.052	0.010
Clothing					
1981–1986	0.157	−0.032	−0.023	−0.009	−0.000
1986–1991	0.352	0.110	0.056	0.052	0.002
Chemicals					
1981–1986	0.515	0.264	0.171	0.093	0.000
1986–1991	0.194	0.122	0.059	0.057	0.007
Plastics					
1981–1986	0.268	0.120	0.071	0.044	0.005
1986–1991	0.420	0.118	0.080	0.033	0.005
Basic metals					
1981–1986	0.369	0.121	0.087	0.041	−0.008
1986–1991	0.299	0.164	0.127	0.032	0.005
Fabricated metals					
1981–1986	0.266	0.021	−0.008	0.028	0.001
1986–1991	0.371	0.083	0.042	0.042	−0.001
Non-electrical machinery					
1981–1986	0.220	0.036	0.027	0.005	0.004
1986–1991	0.404	0.048	0.028	0.014	0.007
Electrical machinery					
1981–1986	0.368	0.053	0.028	0.041	−0.017
1986–1991	0.743	0.293	0.180	0.105	0.008
Transportation equipment					
1981–1986	−0.047	−0.133	−0.074	−0.048	−0.011
1986–1991	0.468	0.094	0.066	0.014	0.014

TFP Growth Source - U.S. Manufacturing Industries

Table 1. Decomposition of TFP Growth, Selected Periods

Percentage increase over the period

Category	*Total*	*Fixed shares*	*Share effect*	*Entry and exit*
1972–77				
All industries	7.17	5.04	2.12	0.01
Except 3573	4.62	2.80	1.92	−0.09
Except 3573 and 3711	0.89	−0.86	1.84	−0.09
1977–82				
All industries	2.39	−1.09	2.53	0.95
Except 3573	−3.18	−6.08	2.49	0.41
Except 3573 and 3711	−4.80	−8.79	3.41	0.59
1982–87				
All	15.63	13.52	3.15	−1.05
Except 3573	8.98	7.16	2.82	−1.00
Except 3573 and 3711	9.30	7.59	2.60	−0.89

Source: Authors' calculations.

Source: Bailey, Hulten, and Campbell (1982)

Multiple Sources of Firm Heterogeneity

- Single proxy for unobserved heterogeneity in profits

  - Revenue TFPR = $\frac{P_i\, q_i}{x_i}$ where $P_i\, q_i$ is deflated by aggregate price index.
  - Substantial differences across firms.
  - Very persistent over time at firm level.
  - Positively correlated with survival

- Multiple factors can contribute to persistent differences across firms

  - Cost-side factors
    - Input prices (materials deflated by industry deflator)
    - Technical efficiency TFPQ = $\frac{q_i}{x_i}$
  - Demand-side factors
    - Product Quality or appeal
    - Different demand elasticities
  - Imperfect Competition - markups

All impact firm price P_i

Interpreting TFPR – Katayama, Lu, Tybout (2009)

Production Function: $\ln Y_{ft} = e^{\omega_{ft}} h(X_{ft})$

$$TFPQ_{ft} = \omega_{ft} = \ln Y_{ft} - \ln h(X_{ft})$$

Output is replaced with revenue deflated with industry price index
Inputs are replaced with expenditures deflated by an price index

$$\begin{aligned} TFPR_{ft} &= \ln(R_{ft} - \ln \bar{P}_t) - \ln h(\tilde{X}_{ft}) \\ \tilde{X}_{ft} &= \frac{W_{ft}}{\bar{W}_t} X_{ft} \end{aligned}$$

Assume demand for each product depends on all product prices and quality index for each product δ_{it} and Bertrand competition

Interpreting TFPR – Katayama, Lu, Tybout (2009)

$$TFPR_{ft} = \ln\left[\frac{X_{ft}}{h(\tilde{X}_{ft})}\right] + \ln\left[\frac{\eta_{ft}}{\gamma_{ft}(\eta_{ft}-1)}\right] + \ln\left[\frac{W_{ft}}{\bar{P}_t}\right]$$

TFPQ

Scale economies and markups

Factor prices

- High factor prices can be passed through to output price and TFPR
- High markups do the same, inelastic demand raises TFPR
- High product appeal δ_{it} can create inelastic demand
- Rich empirical model (Colombian data)– nested logit demand and cost function
  - MC is negatively correlated with TFPR because of high markups
  - TFPR has very low correlation with demand/quality factors.

Empirical Studies – TFPQ vs TFPR

- Foster, Haltiwanger, and Syverson (AER, 2008)
  - Use U.S. manufacturing plants in 11 homogenous goods industries
  - Can measure physical Y_{ft} and construct output prices as $P_{ft} = R_{ft} / Y_{ft}$
  - Findings:
    - Corr(TFPQ,TFPR)=0.75, Corr(TFPQ,P)=-0.54, Corr(TFPR,P)=0.16
    - Higher TFPQ plants (lower MC) have lower prices.
  - Add a demand model- $\ln Y_{ft} = \alpha_0 + \alpha_1 \ln P_{ft} + \alpha_t + \delta_{ft}$
  - Findings:
    - Corr(TFPR, δ)=0.28, Corr(TFPQ , δ)=0.01
    - High persistence over time in all measures
    - All measures are negatively correlated with exit
    - Heterogeneity in demand shock is more important than heterogeneity in TFPQ
    - Productivity decomposition: TFPR underestimates contribution of net entry (entrants have low prices)

Empirical Studies – Efficiency or Demand

- Pozzi and Schivardi (Rand, 2016)
  - Data on output price for Italian manufacturing firms in three industries
  - Add CES demand (constant markup) and monopolistic competition.
  - Profit max predicts Y increase with ω and δ, P rises with δ and falls with ω

TABLE 5 Quantity Sold and Output Growth

	Output Sold		Price	Output Produced	
	(1) Revenues	(2) Quantity	(3)	(4) Value	(5) Quantity
ΔTFP	0.66***	0.82***	−0.17***	0.85***	1.03***
	(0.019)	(0.024)	(0.005)	(0.024)	(0.023)
Δξ	0.44***	0.29***	0.13***	0.37***	0.24***
	(0.007)	(0.008)	(0.002)	(0.006)	(0.007)
Observations	6566	6566	6555	6587	6543
R^2	0.70	0.50	0.76	0.61	0.53

- Revenue is more responsive to demand, less responsive to productivity than quantity (price effect)
- Demand shocks are more important than productivity shocks in explaining firm size.

Empirical Studies – Efficiency, Demand, Wedges

- Eslava, Haltiwanger and Urdaneta (Restud, 2023)
  - (Related to Hsieh and Klenow (2009) and Hottman, Redding, Weistein (2016)
- Exploit plant data that includes *input and output prices and quantities*
- Across plants differences in size can arise from:
  - Output quality differences
  - Markups (Cournot competition)
  - Marginal cost – technical efficiency (TFPQ) and quality differences in input
  - Residual – deviations between theory-predicted size and observed size.
- Theory: Derive optimal plant sales with CD production, CES demand, Cournot competition.
- Empirical: Estimate production and demand allowing plant-level variation in ω and δ

Empirical Studies – Efficiency, Demand, Wedges

TABLE 3
Variance decomposition of sales

	Levels decomposition				Growth decomposition			
	Weighted avg. ages	Age 3	Age 10	Age 20	Weighted avg. ages	Age 3	Age 10	Age 20
	Panel A: Unweighted							
TFPQ-HK	**1.139**	**1.184**	**1.148**	**1.129**	**1.216**	**1.317**	**1.247**	**1.194**
TFPQ	0.081	0.131	0.087	0.074	0.142	0.252	0.152	0.112
Demand	1.058	1.053	1.061	1.055	1.074	1.065	1.095	1.082
Composite (HK) wedge	**−0.139**	**−0.184**	**−0.148**	**−0.129**	**−0.216**	**−0.317**	**−0.247**	**−0.194**
Material prices	0.003	0.009	0.001	0.005	−0.005	−0.011	−0.009	−0.005
Wages	−0.073	−0.072	−0.069	−0.078	−0.046	−0.053	−0.056	−0.047
Markup	−0.019	−0.011	−0.014	−0.018	−0.009	−0.006	−0.006	−0.008
Residual wedge	−0.049	−0.110	−0.066	−0.038	−0.156	−0.248	−0.175	−0.134
Marginal cost HRW	**−0.039**	**−0.042**	**−0.047**	**−0.037**	**−0.065**	**−0.059**	**−0.088**	**−0.074**

Contribution to the Var(log sales): TFPQ and Demand have positive contribution. Demand is largest. Wages, markup, residual make negative contribution to size dispersion

Entry Decision

- Efficiency, demand, markups affect firm size, growth, and exit.
- Entry costs are another source of unobserved heterogeneity

- Industry Level - Hopenhayn (1992), high entry costs are a barrier to entry and exit and allow inefficient firms to survive.
- Firm Level – entry costs create hysteresis in firm entry and exit.

  Entrant faces a sunk entry cost CE_i . $E(V_i)$ is expected firm value if in

  Incumbent faces a fixed cost $CF_i < CE_i$

  New firms enters if $E(V_i) > CE_i$ but Incumbent remains in if $E(V_i) > CF_i$

- Implication – Entry and fixed costs impact firm and industry dynamics

Empirical Models of Entry – Estimate Sunk Costs

- Dynamic oligopoly game - $E(V_i)$ depends on number of firms
  - Collard-Wexler (Econometrica, 2013) – concrete plants
  - Ryan (Econometrica, 2912) – cement plants
  - Aguirregabiria and Mira (Econometrica, 2007) – retail establishments
  - Dunne, Klimek, Roberts, and Xu (Rand, 2013) – dentists and chiropractors
- Entry into Exporting - Single agent decision
  - Das, Roberts and Tybout (Econometrica, 2007)
  - Alessandria, Arkolakis and Ruhl (2021) –review article
- Investment in R&D – Single agent decision
  - Aw, Roberts, and Xu (AER, 2011)
  - Peters, Roberts, Vuong, Fryges (Rand, 2017)
  - Maican, Orth, Roberts, Vuong (JEEA, 2023)

Combining Demand, Cost, Entry Heterogeneity

- Roberts, Xu, Fan, Zhang (Restud, 2018)
- Model of firm export demand, pricing, and destination markets
- Chinese footwear producers 2002-2006.
- Firm price and quantity of exports by destination market
- Empirical Model
  - Demand equation depends on unobserved firm quality ξ_f
  - Pricing equation depends on unobserved firm cost efficiency c_f
  - Market participation equation depends on unobserved firm fixed cost η_f

Empirical Model of Export Participation

- *f – firm, d – destination region (7) , k – product (textile, rubber,leather)*
- Demand – market share

$$ln(s_{kf}^{dt}) \equiv ln(\tilde{s}_{kf}^{dt}) - ln(s_0^{dt}) = \xi_f + \xi_k - \alpha_d \ln p_{kf}^{dt} + \tau_{dt} + u_{kf}^{dt},$$

- Pricing $\ln p_{kf}^{dt} = \gamma_{dt} + \gamma_k + \gamma_w ln w_f^t + c_f + v_{kf}^{dt},$
- Destination Profit $\ln \pi^{dt}(\xi_f, c_f; w_f^t, K_f) = \ln\left[\frac{1}{\alpha_d}\right] + \ln\Omega^{dt} + \ln\left[\sum_{k \in K_f} r_k^d\right] + \ln r^{dt}(\xi_f, c_f)$
- Export Destination Choice

$$I_f^{dt} = 1 \text{ if } X_f^{dt}\psi + \delta I_f^{dt-1} + \eta_f \geq \varepsilon_f^{dt}$$
$$= 0 \text{ otherwise.}$$

Empirical Model of Export Participation

- Three - dimensional firm heterogeneity $(\xi_f, c_f, \eta_f) \sim N(0, \Sigma_f)$
- Results:

TABLE 10
Posterior distribution of Σ_f

	Mean	Standard Dev
$Var(\xi_f)$	3.687	(0.613)
$Var(c_f)$	0.341	(0.129)
$Var(\eta_f)$	0.136	(0.024)
$Cov(\xi_f, c_f)$	0.795	(0.129)
$Cov(\xi_f, \eta_f)$	0.099	(0.046)
$Cov(c_f, \eta_f)$	0.012	(0.012)

- Demand heterogeneity (market shares) much larger than cost heterogeneity
- Covariance demand and cost implies high-cost firms have high price (quality)
- Heterogeneity in fixed cost - main determinant of number of destinations

Endogenous Heterogeneity – Firm Investment

- Common element in all this literature – heterogeneity in productivity, demand, entry cost is exogenous to the firm

- Firms make investments to affect their performance
  - Demand – invest to build customer base
    - develop new products, improve quality
    - Advertise, marketing expenses
    - Improve service quality
  - Production
    - Invest in innovation – lower production costs, develop new products.
    - Integrate new technology
    - Learning by doing

- Implication – Firm characteristics (observed and unobserved) evolve endogenously as firm's make investments. Fundamentally a dynamic process.

Dynamic Investment – Learning about Demand

- Foster, Haltiwanger, Syverson (Economica, 2016)
- Use 11 homogenous manufacturing products
  - new firms are smaller than older firms
  - no differences in (average) TFPQ.
- Two new components
  - Modify the demand curve to depend on age and past sales (and current price)
  - Specify the choice of output to maximize present value of the firm.

Implication – output expansion raises demand and profits in future

Empirical model: demand curve, Euler equation for output choice.

Finding: Significant effect of past sales, no effect for age

Conclusion: “Demand Accumulation by Doing” is present.

Dynamic Investment – R&D

- R&D investment – current expenditure, future impact on profits
  - Developing new products (demand)
  - Improving technical efficiency (supply)
- Addition to the model - productivity evolution, decision rule for R&D

Aw, Roberts, and Xu (AER, 2011)

$$\omega_{it+1} = g(\omega_{it}, rd_{it}, e_{it}) + \varepsilon_{it+1}$$

Doraszelski and Jaumandreu (Restud, 2013)

$$\omega_{it+1} = g(\omega_{it}, rd_{it}) + \varepsilon_{it+1}$$

Peters, Roberts, Vuong, and Fryges (Rand Journal, 2017)

$$\omega_{it+1} = g(\omega_{it}, d_{it+1}, z_{it+1}) + \varepsilon_{it+1}$$

Maican, Orth, Roberts, Vuong (JEEA, 2023)

$$\omega^m_{it+1} = g^m(\omega_{it}, rd_{it}) + \varepsilon_{it+1}$$

Captures persistence in productivity, contribution of R&D/innovation, uncertainty of future ω

Dynamic Returns to R&D – Change in Firm Value

- Firm's value function with state $s_{jt} = (k_{jt}, \omega_{jt}, \mu_{jt})$:

$$
\begin{aligned}
V(s_{jt}) \quad = \quad & \pi(s_{jt}) + \max\{E_t V(s_{jt+1}|s_{jt}, rd_{jt} = 0), \\
& \max_{rd>0} \left[E_t V(s_{jt+1}|s_{jt}, rd_{jt}) - C_I(rd_{jt}, \upsilon_{jt}, I(rd_{jt-1}))\right]\}
\end{aligned}
$$

Expected future firm value conditional on R&D choice:

$$
E_t V(s_{jt+1}) = \beta \int_{\xi} \int_{\nu} V(k, g^{\omega}(\omega, rd, \xi), g^{\mu}(\mu, rd, \nu)) d\xi d\nu
$$

Expected Payoff to R&D Investment

- The **expected benefit of investing in R&D** is

$$\Delta EV(s_{jt}) = E_t V(s_{jt+1} | s_{jt}, rd_{jt}) - E_t V(s_{jt+1} | s_{jt}, rd_{jt} = 0)$$

- Extensive margin: Firm chooses $rd > 0$ if:

$$\Delta EV(s_{jt}) \geq C_I(rd_{jt}, \upsilon_{jt}, I(rd_{jt-1}))$$

- Intensive margin: The optimal amount of R&D spending satisfies:

$$\frac{\partial V(s_{jt})}{\partial rd_{jt}} = 0$$

Extensive Margin – German Manufacturing Firms

Figure 4: Rate of Return to R&D – Domestic Firms

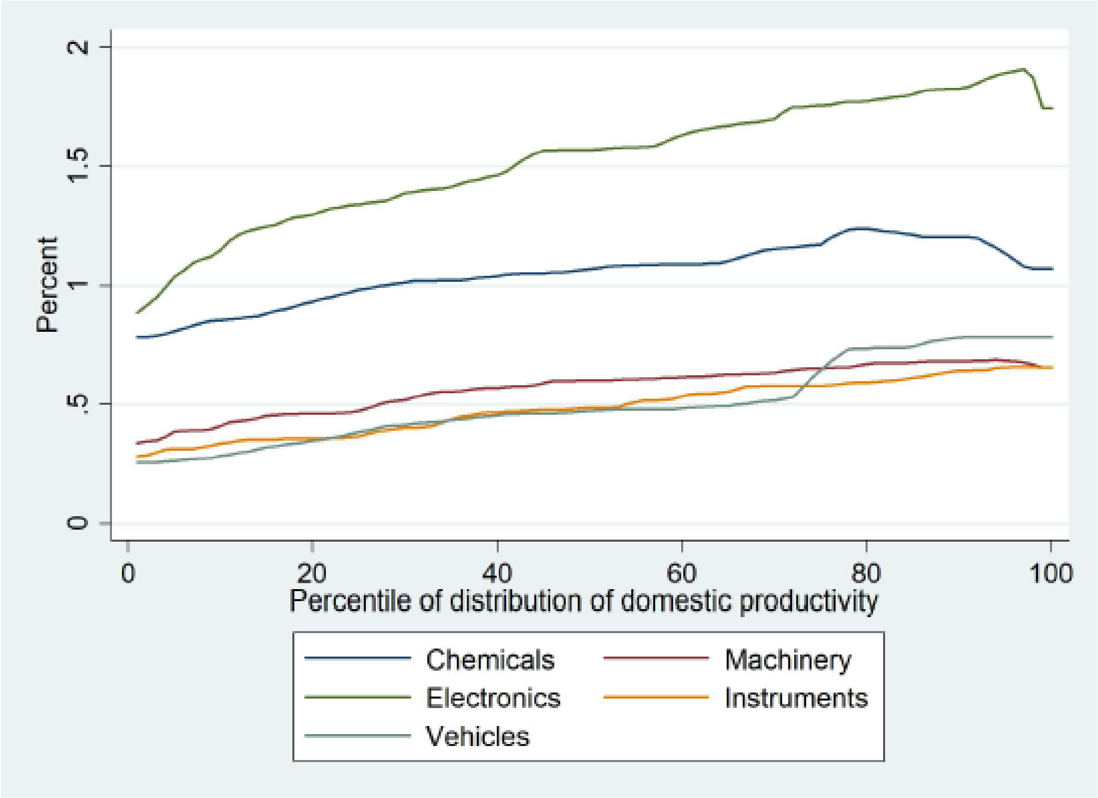
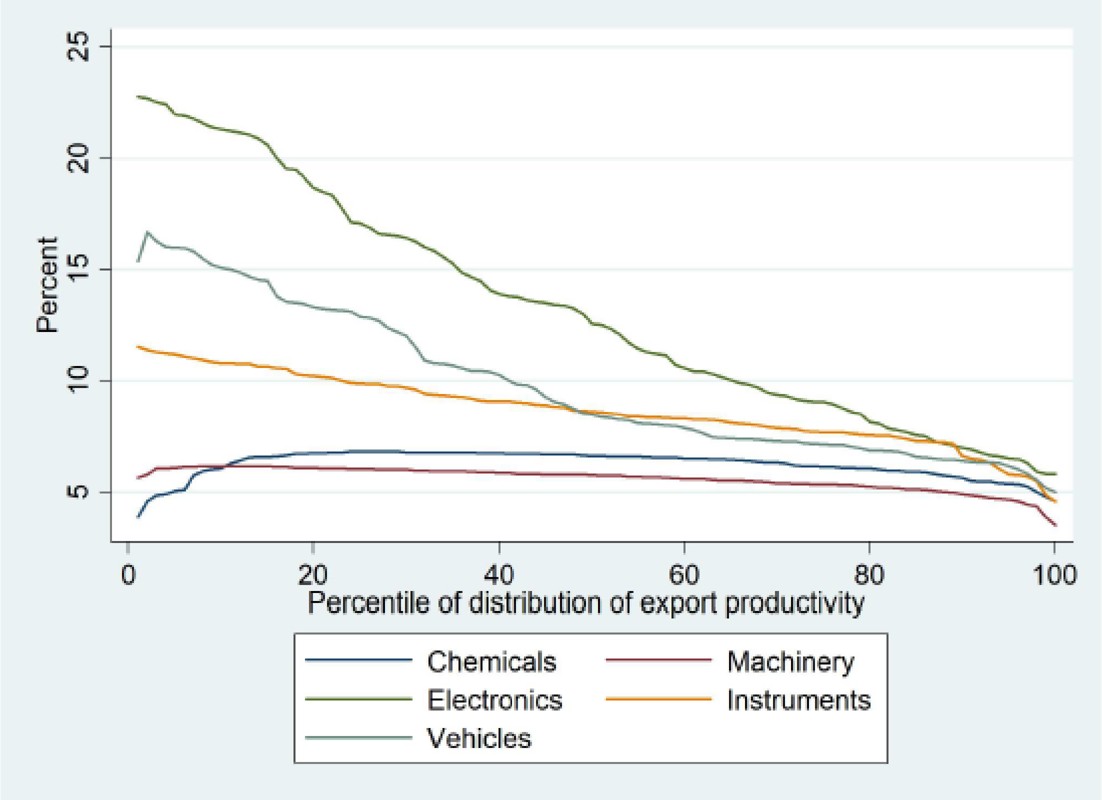


Figure 5: Rate of Return to R&D – Exporting Firms



Source: Peters, Roberts, Vuong, Research Policy 2022

Concluding Thoughts

- Data driven research area
  - Access to comprehensive firm/plant surveys or censuses – whole size distribution, dynamic patterns of entry, growth, exit

- Heterogeneity in firm performance (within industry) does reflect a diverse set of underlying factors – technology, demand, market power.

Areas for future thought

- Relative importance of these sources differs by industry, country, time. Why?

- IO perspective. Missing why industries differ. John Sutton (1991, 1998) developed distinction between exogenous and endogenous sunk cost industries

- Firm Investments – advertising, R&D, capital – are endogenous choices that affect firm performance and dynamics.