Declining Responsiveness at the Establishment Level: Sources and Productivity Implications

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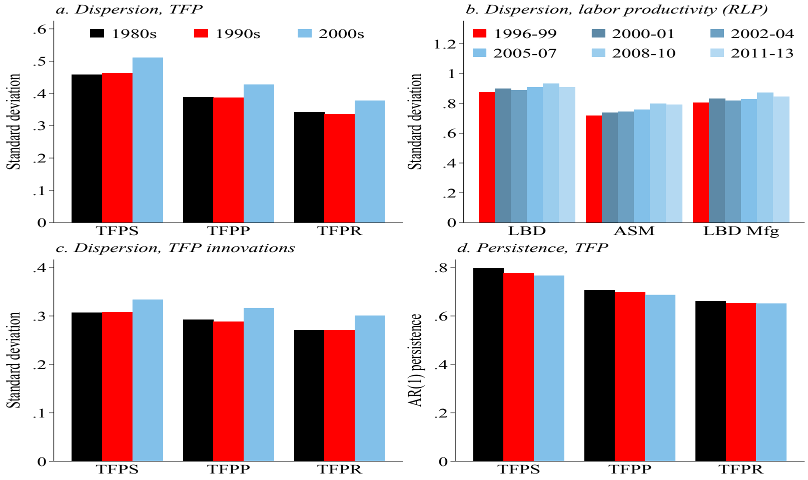
Main questions:

- Why have indicators of business dynamism been on the decline in the U.S. in recent decades?
  - Reduction in dispersion of establishment-level and firm-level growth rates. Increase in inaction (Goldschlag et al. (2024)).
  - Decline in Responsiveness to shocks (see Decker et. al. (2014,2016,2020)) (DHJM) and Kehrig and Vincent (2021)
  - Dispersion in shocks has risen (DHJM)
- Still ongoing debate about underlying mechanisms
  - Important for understanding structural changes and implications for productivity

This paper

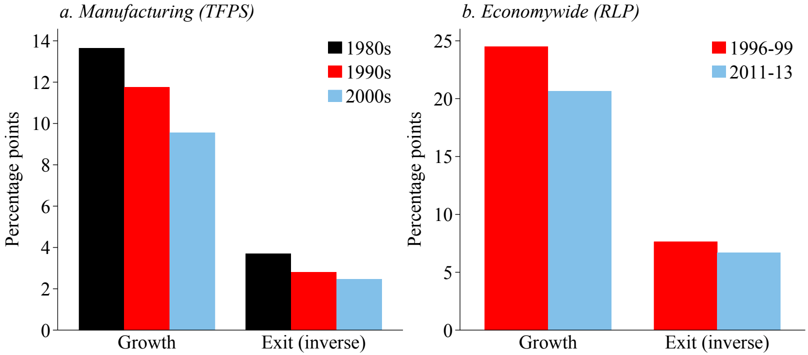
- estimates a structural model of dynamic labor demand to determine source of reduced responsiveness
- candidate changes are: adjustment costs, shock process, revenue curvature, discount rates
- Explore productivity implications and for patterns of measured markups using production (ratio) approach.

Within-Industry Productivity Dispersion Has Risen



Source: DHJM (2020). TFPS and TFPP are TFP (profit) shocks under CES demand and Cobb-Douglas production.

Job Growth and Exit Have Become Less Responsive to Productivity



Source: DHJM (2020). Declining responsiveness holds within firm age groups and accounts for most of the decline in the pace of job reallocation.

Moments Used in Our Structural Estimation

Motivated by DHJM, Ilut et. al. (2018), Kehrig and Vincent (2017) and Cairo (2013)

$$g_{it} = \zeta_0 + \zeta_1 log(\varepsilon_{it}) + \zeta_2 log(\varepsilon_{it})^2 + \zeta_3 lemp_{i,t-1} + \eta_{it}. \qquad (1)$$

$$exit_{it} = \xi_0 + \xi_1 log(A_{i,t-1}) + \xi_2 lemp_{i,t-1} + \mu_{it} \qquad (2)$$

where g_{it} is growth for continuing plants, ε_{it} is innovation to productivity shock A_{it}

Table: Data Moments

Inact	Exit	ζ_1	ζ_2	ξ_1	Size	$\tilde{\alpha}$	$\tilde{\rho}$	$\tilde{\sigma}$
				1980s				
0.197	0.100	0.113	-0.054	-0.081	10.100	0.977	0.687	0.368
				2000s				
0.243	0.083	0.064	-0.035	-0.059	8.900	0.959	0.682	0.408

Dynamic Labor Demand

$$V(A, e_{-1}) = max(V^c(A, e_{-1}), 0)$$

$$V^c(A, e_{-1}) \quad = \quad \max_{e} R(A, e) - \Gamma - \omega(e) - C(e, e_{-1}) + \beta E_{A'|A} V(A', e)$$

- A is profitability shock, $R(\cdot)$ is revenue, Γ is fixed overhead cost, $\omega(\cdot)$ is compensation, $C(\cdot)$ represents adjustment costs
- Exit decision: Decide whether it is worth it to pay the Γ to continue operations or whether it is better to shut to down
- Employment decision: Decide whether or not to adjust employment, and if so, by how much

Dynamic Labor Demand

- Revenue function: $R(A, e) = Ae^{\alpha}$
- Compensation function: $\omega(e) = w_0 \times e$
- Adjustment costs: $C\left(e, e_{-1}\right) =$

$$\begin{aligned} \frac{\nu}{2}\left(\frac{e - e_{-1}}{e_{-1}}\right)^2 e_{-1} \quad &+ \quad [\gamma_P\left(e - e_{-1}\right) + F_p] I(e - e_{-1} > 0) \\ -[\gamma_M\left(e - e_{-1}\right) \quad &- \quad F_m] I(e - e_{-1} < 0) \end{aligned} \tag{3}$$

- Policy function: $e = \phi_{\Theta}(A, e_{-1})$, where Θ is a parameter vector
- Permit convex (symmetric costs of changing scale with no inherent inaction) and non-convex costs (that yield inaction and permit asymmetries)
- Focus in talk on kinked linear cost case, $F_p = F_m = 0$. Better

Explaining the Decline in Responsiveness

- Shock Processes: less persistence implies less responsiveness
- Adjustment Costs: increases in these costs imply less responsiveness
- Curvature: Increased market power reduces the curvature and the responsiveness
- Discount Factors: Responsiveness falls if firms are less patient.

SMM Approach

- Parameter Estimates Solve an Optimization Problem:

$$J = min_{(\Theta)} \left(M^s(\Theta) - M^d \right)' W \left((M^s(\Theta) - M^d) \right). \qquad (4)$$

- Estimate using both 1980s and 2000s moments
- Moments Calculated in Simulated Data exactly as in Actual Data
  - Model solved quarterly and time aggregated to annual to compute simulated moments.
- Simulated Panel of 100,000 Plants and 400 Quarters
- $W = I$

Table: Moments

	Inact	xrat	ζ_1	ζ_2	ξ_1	emp	$\hat{\alpha}$	$\hat{\rho}$	$\hat{\sigma}$
1980									
Data	0.197	0.100	0.113	-0.054	-0.081	10.100	0.977	0.687	0.368
Linear	0.201	0.053	0.149	-0.061	-0.140	10.064	0.937	0.394	0.336
2000									
Data	0.243	0.083	0.064	-0.035	-0.059	8.900	0.959	0.682	0.408
Linear	0.214	0.053	0.065	-0.036	-0.108	8.759	0.918	0.350	0.369

The moments here are: Inact $= 0.025 > \frac{\Delta e}{e} > -0.025$ xrat = exit rate, (ζ_1, ζ_2) = linear and quadratic response of employment growth to profitability shock; ξ_1 = response of plant-level exit to profitability shock innovation; **emp** is median plant size. $(\tilde{\alpha}, \tilde{\rho}, \tilde{\sigma})$ are the OLS estimates of revenue curvature, serial correlation of profitability shock, std of innovation to profitability.

- close match with intensive and extensive responses
- simulated moments consistent with reduced responsiveness

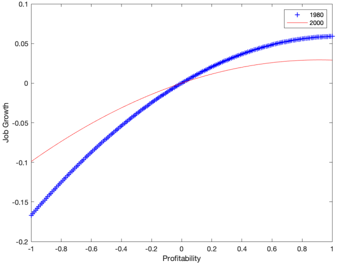
Table: Parameter Estimates

	β	ν	γ_P	γ_M	Γ	ω_0	α	ρ	σ	J
1980s										
Linear	0.987	4.372	4.728	6.776	0.865	0.142	0.540	0.879	0.589	1.050
2000s										
Linear	0.983	5.222	4.747	7.411	0.854	0.126	0.523	0.856	0.629	1.089

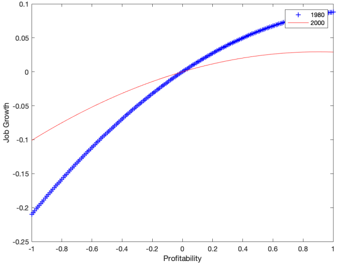
The parameters here are: β = discount factor, ν= quadratic adjustment cost, (γ_P, γ_M)=are the linear hiring and firing costs, Γ = fixed production cost as a fraction of average revenue, ω_0=base wage, (α, ρ, σ)=curvature of revenue functions, serial correlation of profitability shocks and the standard deviation of the innovation to profitability shocks, J= fit.

- Convex and (asymmetric) non-convex costs required to match moments.
- Increases in especially convex and costs of job destruction.
- α did not change much
- β changes are quarterly so annual implied non-trivial
- ρ is slightly lower and σ is slightly higher in 2000s

Job Growth Response to Innovations: Data and Model



(a) Data



(b) Baseline Model

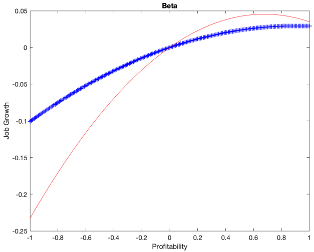
Figure: Employment Growth Response To Innovations: Data and Model

The left (right) panel is based upon coefficients from the responsiveness regression on actual (simulated) data.

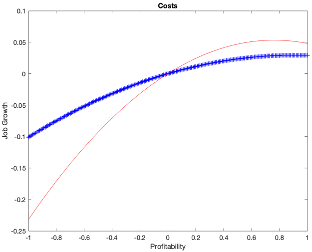
What is the Primary Source?

- All mechanisms can potentially decrease responsiveness.
- Decomposition 1: Set parameters of specific mechanism (e.g. adjustment costs) to 1980s values – let other parameters be at 2000s values.
  - Fit worsens most for adjustment costs and discount factors.
  - Both yield patterns broadly consistent with 1980s.
  - Stochastic process goes the wrong way – rising dispersion causes rising responsiveness.
  - Curvature changes too small to account for declining responsiveness.
- Decomposition 2: Set all parameters to 1980s values. Target responsiveness moments with each mechanism
  - Only adjustment costs match change in responsiveness moments.

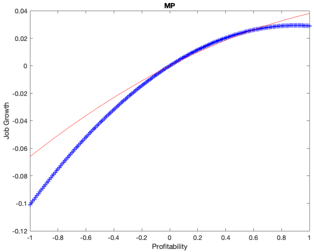
figure



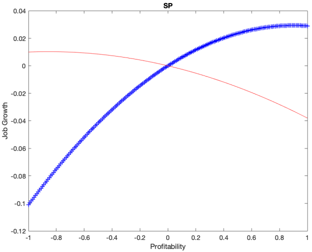
(a) Discount Rate



(b) Adjustment Costs



(c) Market Power



(d) Stochastic Process

Dark line is baseline 2000s. Light line sets identified parameter(s) at 1980s values.

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Table: Productivity Implications

Sample	AggProd	Mstd	$corr(A, e)$
1980s	1	7.147	0.768
2000s	0.925	7.868	0.720

The statistics are computed from simulated data with best fit parameters from estimation. Frequency is quarterly.

- Eight percent reduction in aggregate productivity.
- Increase in between firm revenue productivity dispersion
- Decrease in correlation between firm-level productivity and size (employment)
- Actual productivity in U.S. Manufacturing increased by 29 percent from 1980s to 2000s.
- Results imply that without rising adjustment costs it would have risen by 37 percent.

Potential Implications for Measured Markups

Production (ratio) approach for measuring markups:

$$\mu_{it} = \theta_{it}/ls_{it} \tag{5}$$

where μ_{it} is the markup, θ_{it} is the output elasticity of labor and ls_{it} is the share of total revenue that is paid to labor.

- This approach assumes no adjustment costs for labor.
- With adjustment costs, measured markups variation will reflect adjustment frictions even in the absence of variation in actual markups. Our framework has no dispersion in actual markups.
- Are the patterns highlighted in DEU (2020) potentially driven by adjustment frictions?

Potential Implications for Measured Markups

Table: Moments of Measured Markups Using Production (Ratio) Approach

	Mean μ	Median μ	$P90$ μ	$Corr(\mu, \frac{R}{\sum R})$	$Corr(\mu, A)$
			1980s		
Data	1.55	1.40	2.40	na	na
Model	1.55	1.50	2.12	0.18	0.45
			2000s		
Data	1.80	1.65	3.20	na	na
Model	1.69	1.61	2.44	0.20	0.48

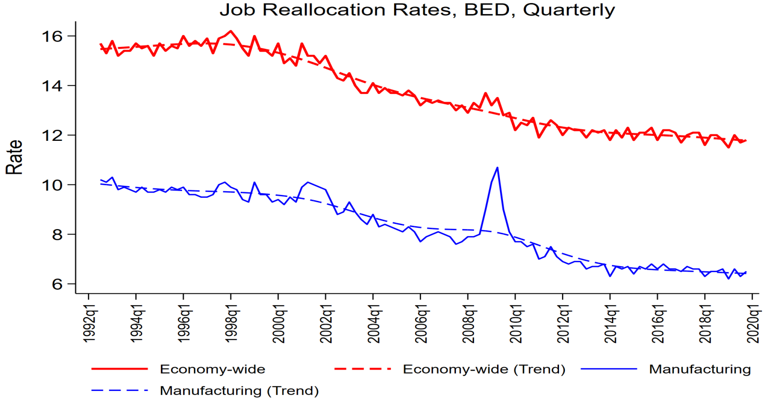
The empirical markup measures are taken from DEU(2020). Here $P90$ is the 90th percentile. The model moments are computed from simulated data with best fit parameters from estimation. Frequency is quarterly.

- Increase in adjustment costs by themselves insufficient to account for increase in revenue weighted measured markups.
- However, adjustment costs yield considerable dispersion, skewness and positive relationship between measured markups and revenue.
- Combined with rising concentration (potentially from other factors – e.g., Autor et. al (2020) superstars) can yield rising revenue-weighted measured markups even without any variation in actual markups.

Summary

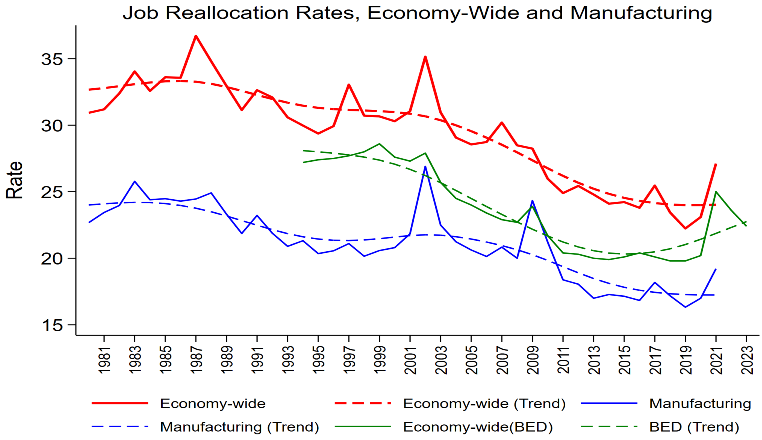
- We explore the mechanisms underlying the finding of the decline in firms' responsiveness to shocks
  - Adjustment costs (both convex and nonconvex) have increased substantially.
  - Other factors (discount factor, curvature or shock process) important for matching full range of moments but not decreased responsiveness.
- Implications:
  - Drag on Aggregate Productivity
  - Increase in Revenue Labor Productivity Dispersion
  - Decline in Covariance between TFP and Employment
  - Measured markups increase in revenue weighted mean and dispersion may reflect rise in adjustment costs rather than actual markups.
- Next Step: What underlies the increase in adjustment costs? Davis and Haltiwanger (2014) outline several factors dampening labor market fluidity.

BED Quarterly Job Reallocation



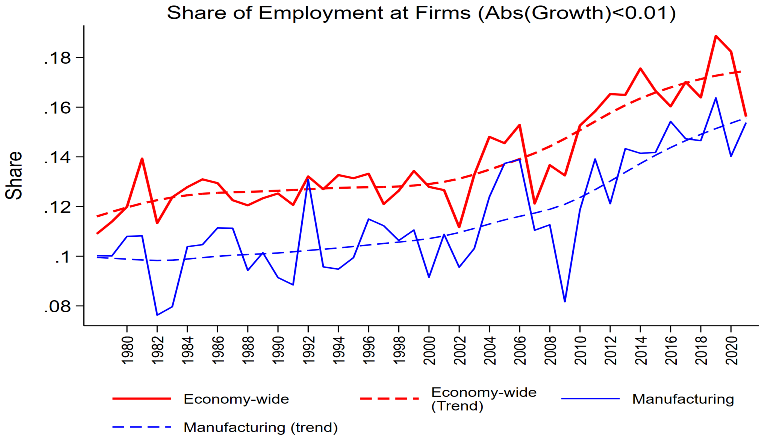
Source: Business Employment Dynamics (BED) for U.S. private and manufacturing sectors (quarterly). Back

Job Reallocation Declining



Source: Business Dynamic Statistics. BED qtr

Compression of Growth Rate Distribution – Rise in Inaction



Source: Business Dynamic Statistics – High Growth.