The Network Origins of Firm Dynamics

Contracting Frictions and Dynamism with Long-Term Relationships

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Weak Contract Enforcement and Long Term Relationships

Systematic differences in firm dynamics across countries (Hsieh-Klenow 2014)

Long term relationships can substitute for formal contract enforcement

- static benefit: helps incentives $\rightarrow$ lower transaction costs
- potential cost: less likely to switch to better supplier

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Johnson, McMillan, Woodruff (JLEO 2002):

- Survey of firms in Eastern Europe
- Belief in quality of courts varies across countries
- *"If another firm you have never purchased from offered to supply this input for a price 10% lower than this supplier, would you purchase from the new firm instead of this supplier?"*
  - Custom inputs: less confidence in courts $\implies$ more likely to reject new offer
  - Standard inputs: little difference

Monarch (2020): US imports from China

- Firms in more contract intensive industries stay with suppliers for longer

What is the role of relationships in firm dynamics and growth?

This paper

Evidence on firm dynamics facts, relationships, and their relationship to contracting frictions from India and Pakistan

Quantitative model with firm dynamics built on firm-to-firm trade and relational contracts

- Arrival of potential suppliers (for buyers), potential buyers (for suppliers)
- Assess calibration of model to Pakistani data in its ability to explain firm dynamics facts

Application to understand quantitative role of contracting frictions in reducing dynamism

- Weak enforcement: lower arrival of new draws $\implies$ less switching
  - $\Rightarrow$ Lower aggregate productivity
  - $\Rightarrow$ Slower firm dynamics
- Calibrated to Indian/Pakistani context, suggests substantial losses from misallocation of demand ($\sim$ 3x static losses)

Literature

- Firm Dynamics:
  - Customer Capital: Luttmer (2011), Gourio Rudanko (2014) , Afrouzi Drenik Kim, Argente Fitzgerald Moreira Priolo, Einav Klenow Levin Murciano-Goroff, Foster Haltiwanger Syverson (2016)
  - Input-Switching: Gopinath Neiman (2014), Lu Mariscal Mejia (2024), Damijan Konings Polanec (2014), Monarch (2022) Baqaee Burstein Duprez Farhi (2023)
  - Kortum-Klette: Lentz Mortensen (2008), Akcigit Kerr (2018), Garcia-Macia Hsieh Klenow (2019)
- Firm-to-firm trade
  - Firm heterogeneity, static: Oberfield (2018), Bernard Moxnes Ultveit-Moe (2018), Eaton Kortum Kramarz (2024), Bernard Dhyne Magerman Manova Moxnes (2022)
  - Deterministic Life Cycle: Chaney (2014) and Aekka Khanna
  - Dynamics with Frictions: Huneeus, Miyauchi, Martin Mejean Parenti (2023) and Fontaine Martin Mejean (2023)
- Frictions and Dynamism: Hopenhayn, Rogerson (1993), Hsieh, Klenow (2014), Akcigit Alp Peters (2021)
- Contracting frictions: Boehm (2022), Amirapu (2021), Boehm Oberfield (2020)
- Relational contracts: Kranton (1996), Hemous, Olsen (2018), Macchiavello Morjaria (2015,2021)

Data

- **Indian Annual Survey of Industries**, 1989/90-2014/15 (with gaps)
  - Plant-level panel survey of formal manufacturing plants
  - All plants that have 100+ employees
  - 1/5 of all plants between 20 (10 if using power) and 100 employees
  - $\sim 25,000$ plants per year
  - Great info on 5-digit outputs and inputs
  - Do not observe plants every year, do not see firm-to-firm transactions
- Supplement with **Pakistan Value Added Tax** data 2011-2019
  - Monthly Firm-to-Firm sales transactions
  - $\sim$ 150k firms, 21m monthly transactions, aggregated to 5.4m annual transactions
  - Firms register if annual sales above threshold ($2-15k)
  - Only have 2-digit industry of firm, do not see products traded

Contracting frictions

- Approach
  - Differential effect of court quality on firms that produce relationship-specific vs. standardized
  - Always include district and industry FEs, robustness checks w. state & industry controls
  - IV for court quality in India (Boehm & Oberfield, 2020) details
- **Court Quality**: Average age of pending cases Correlation with GDP/capita
  - India: High courts. Range of avg age: 1-4.5 years
  - Pakistan: District courts. Range: 1-3 years
- **Standardized vs. Relationship-specific** (Rauch)
  - Standardized ≈ sold on an organized exchange, ref. price in trade pub.
  - Relationship-specific ≈ everything else
  - India: ∼ 70% of sales are rel-spec
  - Pakistan: ∼ 60% of sales is rel-spec

Contracting friction in output markets ⇒ longer relationships (Pak)

	Dependent variable: Age of Relationship (in Years)				
	(1)	(2)	(3)	(4)	(5)
Age of pending cases (S) $\times$ RelSpec$_S$	0.225**				
	(0.045)				
Age of pending cases (B) $\times$ RelSpec$_S$	0.0638				
	(0.045)				
Age of pending cases (Min(B,S)) $\times$ RelSpec$_S$		0.281**	0.264**		
		(0.032)	(0.041)		
Age of pending cases (Min(B,S)) $\times$ EnforcementIntensity$_{b,s}$				0.0228*	0.0258*
				(0.011)	(0.013)
B $\times$ S Industry FE	Yes	Yes	Yes	Yes	Yes
B District FE	Yes	Yes		Yes	
S District FE	Yes	Yes		Yes	
S District $\times$ S Industry FE			Yes		Yes
B District $\times$ B Industry FE			Yes		Yes
R^2	0.0630	0.0636	0.0929	0.0625	0.0922
Observations	2140189	2142616	2141943	2142616	2141943

Standard errors in parentheses, clustered at the origin-destination district level.
$^+$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Contracting frictions in output markets $\Rightarrow$ lower variance of plant growth

	Dependent variable: $\sigma(\Delta \log \text{Sales})_{d\omega}$			
	(1)	(2)	(3)	(4)
Avg age of civil cases $\times$ Rel. spec.	-0.0177*	-0.0187*	-0.0401*	-0.0385*
	(0.0089)	(0.0088)	(0.016)	(0.016)
$\overline{(\Delta \log \text{Sales})_{d\omega}}$		-0.273**		-0.273**
		(0.024)		(0.024)
State FE	Yes	Yes	Yes	Yes
5-digit Industry FE	Yes	Yes	Yes	Yes
Estimator	OLS	OLS	IV	IV
R^2	0.287	0.302	-0.000369	0.0207
Observations	7574	7574	7574	7574

Regression at the state $\times$ industry level. Only state-industry cells with more than 5 observations used.

Dependent variable: standard deviation of residualized* annualized sales growth in each state-industry cell

*residualized by age, year, state and industry

Contracting frictions in output markets $\Rightarrow$ lower exit rates (across all size bins)

	Dependent variable: P(exit)			
	(1)	(2)	(3)	(4)
Q1 Dummy	0.0738***	0.0717***		
	(0.0023)	(0.0057)		
Q2 Dummy	0.0255***	0.0208***	-0.0460***	-0.0469***
	(0.0018)	(0.0033)	(0.0013)	(0.0042)
Q3 Dummy	0.0131***	0.00979***	-0.0576***	-0.0567***
	(0.00099)	(0.0016)	(0.0016)	(0.0043)
Q4 Dummy	0.00800***	0.00677***	-0.0611***	-0.0586***
	(0.00071)	(0.0011)	(0.0018)	(0.0044)
Q1 $\times$ Relspec $\times$ AvgAgeCourts		0.00129		-0.00539*
		(0.0026)		(0.0025)
Q2 $\times$ Relspec $\times$ AvgAgeCourts		0.00299*		-0.00501**
		(0.0014)		(0.0019)
Q3 $\times$ Relspec $\times$ AvgAgeCourts		0.00221*		-0.00627***
		(0.00099)		(0.0016)
Q4 $\times$ Relspec $\times$ AvgAgeCourts		0.000871		-0.00755***
		(0.00087)		(0.0016)
Industry $\times$ Year FE			Yes	Yes
R^2	0.0525	0.0526	0.0460	0.0462
Observations	417711	411541	417698	411528

Standard errors in parentheses, clustered at the industry-region level.
$^+$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Model: Single Industry

- Growing industry with many firms.
- Each firm produces using labor and one input

$$y_b = A(z_{bs} x_s)^{\alpha} l^{1-\alpha}, \qquad A \equiv \alpha^{-\alpha}(1-\alpha)^{-(1-\alpha)}$$

- New potential suppliers, potential customers arrive via Poisson process
  - Each new potential match: random supplier s, random match-specific productivity z_{bs}
  - Key decision: switch or not
- Large number of retailers
  - Same production function as firms
  - Same arrival rate of new techniques as firms
  - Sell output to household (but not to other firms or retailers)
    - Non-retailer firms sell to other firms and to retailers, but not to household

Static Equilibrium

- Representative Household
  - Dixit-stiglitz preferences across varieties sold by retailers (elast. ε)
  - Households inelastically supplies a growing quantity of labor L (growth rate γ)
    - Labor used for production or to create new firms
- Market structure
  - Monopolistic Competition across retailers
  - Bilateral contracts in firm-to-firm trade (quantity, transfer)
  - Countably stable: no countable coalition wants to alter/drop contracts

$\Rightarrow$ Efficient production within supply chains (quantities)

$$c_b = \left(\frac{c_s}{z_{bs}}\right)^{\alpha} w^{1-\alpha}$$

  - Many ways to split surplus
    - Focus on equilibrium in which surplus split according to cost shares

Keeping the model tractable

- State variable for a firm is, in principle, very large
- We focus on one economic decision:
    - New supplier comes along: switch or not
    - Easy if each supplier's cost follows random walk with the same distribution of increments: lower cost now $\implies$ better distribution of future cost (FOSD)
- Key characteristic: no mean reversion in cost
    - Productivity of new potential match inspired by current supply chain
    - no option to go back to old supplier
    - No supplier death

Productivity of new potential match inspired by current supply chain

- Productivity delivered by current chain is

$$q \equiv z_0 z_1^{\alpha} z_2^{\alpha^2} \ldots$$

  where $z_0, z_1, z_2, \ldots$ are firm's own, its supplier's, its supplier's supplier's...

- match-specific prod. with new potential supplier:

$$z = \underbrace{b}_{\substack{\text{original}\\ \text{component}}} \quad \underbrace{q}_{\substack{\text{spillover from}\\ \text{current chain}}}$$

- The arrival rate of new suppliers with original component larger than b is

$$\kappa b^{-\beta}$$

$\Longrightarrow$ Arrival rate of supplier that delivers cost reduction larger than x is

$$\phi x^{-\beta}, \qquad \phi \equiv \kappa \int (c_s/w)^{-\beta} dF(c_s)$$

Entry and Exit

- Potential problem: Random walk for cost $\implies$ no stationary distribution
  - Usual: Reflecting barrier (Gabaix) or endog exit (Hopenhayn/Luttmer) $\implies$ mean reversion
  - Solution: Mass of entrants grows over time
- Population grows at rate γ, $L_t = L_0 e^{\gamma t}$
- Entry
  - Free entry: unit of labor $\implies$ flow χ of firms and χ_R of retailers
  - $\implies$ Along BGP, flow of entrants grows at population growth rate, γ
  - Each entrant draws potential suppliers:
    The number of draws of techniques with match-specific component larger than z is Poisson with mean $\kappa_0 z^{-\beta}$
- Exit
  - Firms never die. But if no customers, output is zero
  - A firm "exits" when it loses its last customer
    - May gain customers later, still draws new suppliers, etc

Changes in Cost

- ‘Get a better supplier’ or ‘supplier gets a better supplier’, or ‘supplier’s supplier gets...
    - Jump process with infinite activity
    - Along any interval with finite length, infinite number of jumps
- MGF of change in $\log \frac{w}{cost}$ over interval with length τ

$$\mathbb{E}\left[\left(\frac{cost_{j,t}}{cost_{j,t+\tau}}\right)^{s}\right] = e^{-\tau\phi\sum_{k=1}^{\infty}\frac{s}{\beta\alpha^{-k}+s}}$$

- Along BGP, distribution of *cost* has a power law left tail

$$\lim_{c\to 0}\frac{\log \text{ Fraction with cost } \leq c}{\log c} = \nu$$

where ν is unique solution to $\gamma = \phi\sum_{k=1}^{\infty}\frac{\nu}{\beta\alpha^{-k}-\nu}$

Aggregate Output along BGP

Aggregate output is

$$Y_t = \left(|R_t| \int_0^\infty c^{1-\varepsilon} dF(c) \right)^{\frac{1}{\varepsilon - 1}} (1-\eta) L_t$$

In special case where $\beta = \varepsilon - 1$, output per capita is

$$\frac{Y_t}{L_t} = (1-\eta) \left(\frac{\eta \chi_R}{\gamma} L_0 \right)^{\frac{1}{\beta}} \left[\frac{\kappa_0^\alpha \Gamma\left(1-\alpha\right)}{1 + \frac{\phi}{\gamma} \sum_{k=1}^\infty \frac{1}{1-\alpha^{-k}}} \right]^{\frac{1}{1-\alpha}\frac{1}{\beta}} e^{\frac{\gamma}{\beta} t}$$

$\rightarrow$ Semi-endogenous growth

- Distribution of cost in cross section is constant over time
- Growth from gains from variety
- Firm-level dynamics matter for level of output along BGP

▸ General formula

Quantitative Model with Multiple Industries

Multiple Industries

- Firm b in industry ω

$$y_b = A_\omega l^{\alpha_{\omega l}} \prod_{\omega'} (z_{bs'} x_{s'})^{\alpha_{\omega\omega'}} \qquad \text{with} \qquad \begin{array}{c} \alpha_{\omega l} + \sum_{\omega'} \alpha_{\omega\omega'} = 1 \\ A_\omega \equiv \alpha_{\omega l}^{-\alpha_{\omega l}} \prod_{\omega'} \alpha_{\omega\omega'}^{-\alpha_{\omega\omega'}} \end{array}$$

- For each input, match-specific productivity of new potential suppliers inspired by current supply chain for that input

- Some industries produce relationship specific goods

- Cobb-Douglas keeps it tractable:
  - log cost is weighted sum of random walks
  - Cobb Douglas $\implies$ weights are fixed within industry

Weak Enforcement and Relational Contracts

- Less efficient courts $\implies$ switch suppliers of relationship-specific goods less frequently
  - $\kappa \downarrow$ uniformly for relationship-specific inputs
- For today: Behavioral assumption
- Potential microfoundation: relational contracting as substitute for courts ▸ more
  - Repeated game, many equilibria
  - We can show equilibrium for some special cases of model
  - Working on proof for full model

Numerical Simulation

Parameter	Value	Target	Target value	Data source
Population growth (γ)	0.04	Employment share by age		Hsieh & Klenow (2014)
New technique shape (β)	3.52	Δ cost from new suppliers	-0.284	Baqaee et al. (2023)
New supplier arrival rate (ϕ)	0.58	Mean relationship length	1.72 years	Pakistan data
Observation threshold	varies	$\frac{\text{Median sales above threshold}}{\text{Threshold}}$	6.36	Pakistan data
Number of retailer firms ratio	60	Annual exit probability	0.05	
Household EoS (ε)	4.52	$\beta + 1$		

Table 1: Parameterization

- Firms per industry, Industry cost shares from Indian ASI data (coming later)
- Add positive drift to cost to center distribution of $\Delta \log$ cost at zero

1 additional year of average age of pending cases $\Rightarrow$ relationships with rel.spec. inputs last ~ 0.25 year longer
$\Rightarrow$ calibrate κ for products with frictions to match that (in the worst congested state)

Size and Cost

- Firm size depends on how many customers, how large those customers are, which depends on how many customers they have
- Prospects for growth depend on cost: Lower cost $\implies$ attract customers more quickly
    - Potential customers more likely to switch
- Changes in size:
    - Downstream: Gain or lose customers, customers grow or shrink...
    - Upstream: Get better supplier: household buys more from downstream retailers
- One type of shock (arrival of potential relationship), but many subtle patterns

Predictions

Model explains key firm dynamics facts:

- Size-variance relationship
- Fat tails in firm growth rates
- Exit rates declining in size
- Mean reversion in firm size
- Existence of “gazelles”

When enforcement is worse:

- Lower variance of firm growth $\rightarrow$ evidence: see earlier results
- Less mean reversion
- Less skewed size distribution
- Lower exit rate $\rightarrow$ evidence: see earlier results

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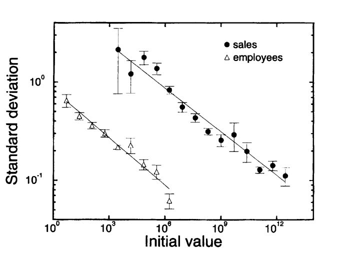
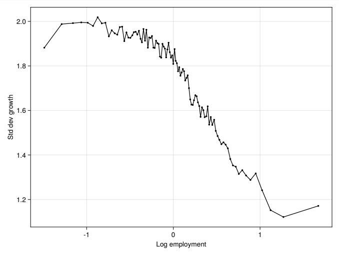
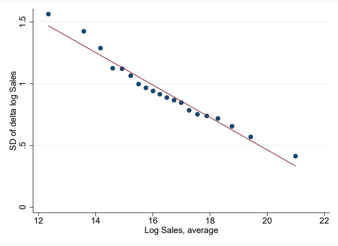
Standard Deviation of Growth Rates by Size

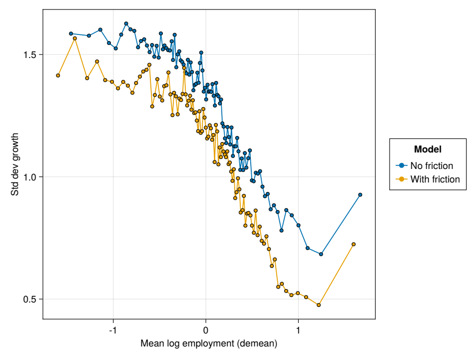




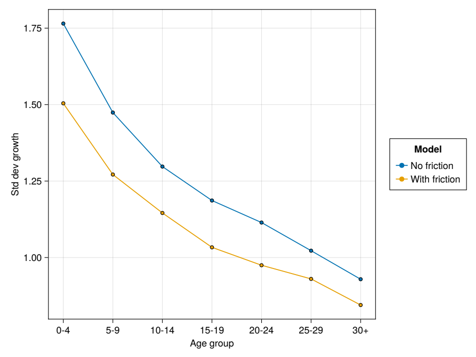


- Larger $\implies$ lower standard deviation of growth rates (Hymer and Pashigian, 1962)
  - Usual mechanism: Large firms composed of more subunits $\implies$ diversification
  - Here: Large firm tends to have more customers
- Declines more slowly than $\sqrt{\text{size}}$
  - Usual mechanism: correlation across subunits, granular subunits
  - Here: granular customers (also some correlation from cost changes) ▸ Comparison

Standard Deviation of Growth Rates: Frictions vs No Frictions (Model)

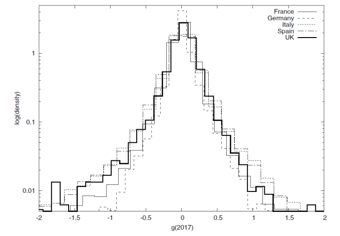


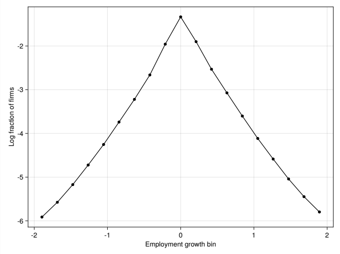
(a) Volatility by Size

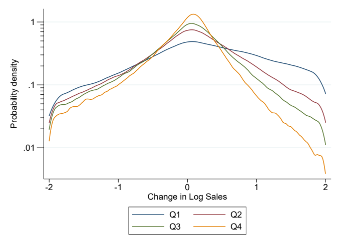


(b) Volatility by Age

Growth Rates

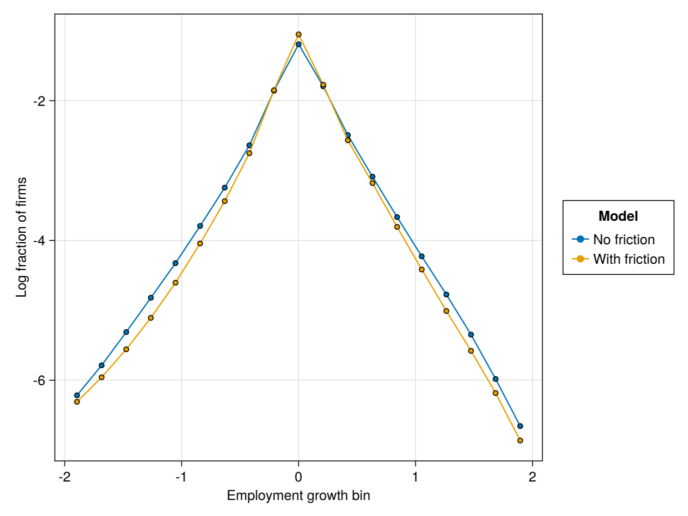




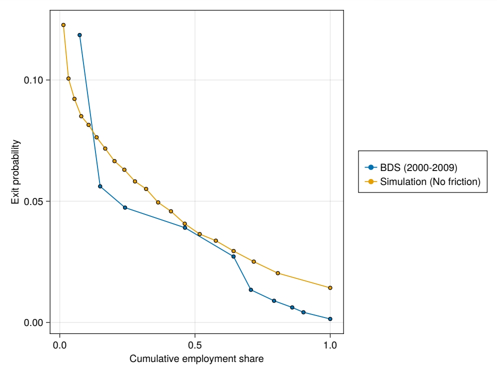


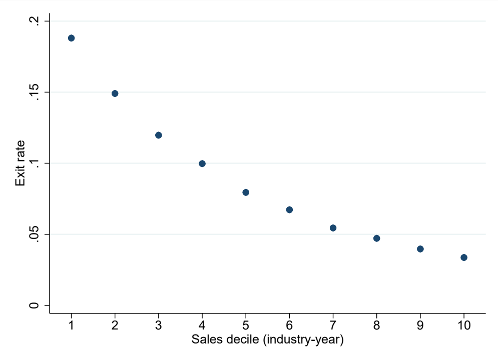
- Fat tails: Ashton, 1926, Laplace dist: Stanley, et al. (1996)
- Here: Mixture of getting one large customer, many small customers

Growth Rates: Frictions vs No Frictions (Model)



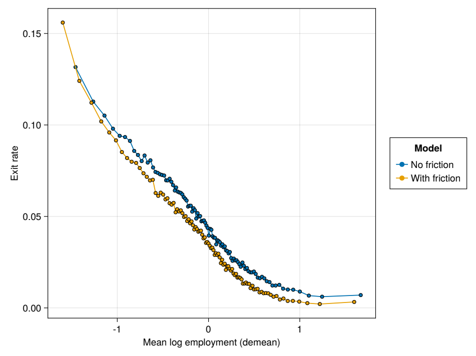
Exit Rates by Size



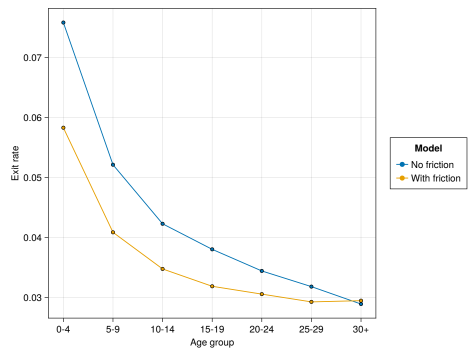


- Firms exit when they lose last customer
- Large firms can have one large customer
- Number of buyers is a good predictor of exit

Exit Rates: Frictions vs No Frictions (Model)

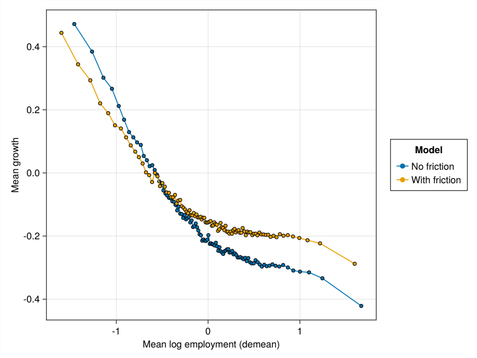


(c) Exit Rates By Size

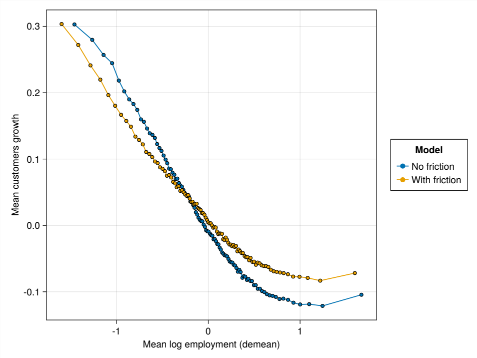


(d) Exit Rates by Age

Mean Reversion: Frictions vs No Frictions (Model)



(e) Sales



(f) Number of Customers

According to the model, no mean reversion in cost

But: mean reversion in sales towards a long-run level commensurate with costs

With fictions ($\rightarrow$ less turnover) slower mean-reversion in sales

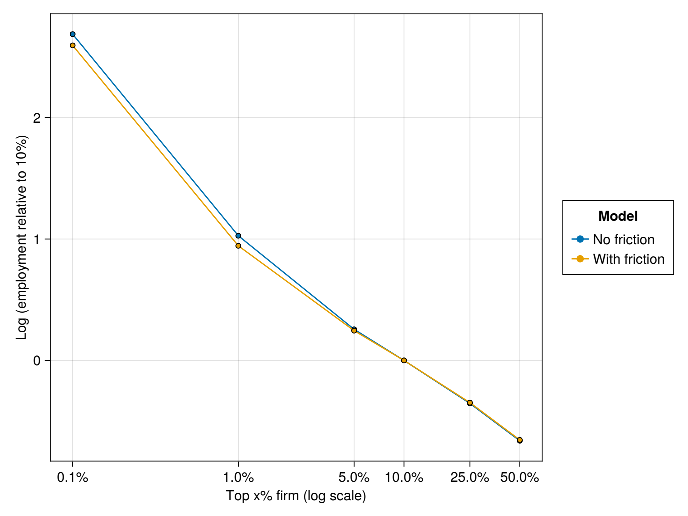
Mean reversion in firm size (slower with frictions)

	Dependent variable: Change in log Sales					
	(1)	(2)	(3)	(4)	(5)	(6)
log Sales_{t-1}	-0.403**	-0.427**	-0.555**	-0.403**	-0.436**	-0.583**
	(0.011)	(0.025)	(0.037)	(0.012)	(0.028)	(0.038)
log $\text{Sales}_{t-1} \times$ Age civ. cases $\times$ relspec	0.00709^{+}	0.0206*	0.0249^{+}	0.00687	0.0256*	0.0405*
	(0.0037)	(0.0096)	(0.015)	(0.0044)	(0.012)	(0.019)
Plant $\times$ 5-digit Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes			Yes		
Year $\times$ Previous Year FE	Yes			Yes		
Age FE		Yes	Yes		Yes	Yes
Industry $\times$ District $\times$ Year FE		Yes			Yes	
Industry $\times$ District $\times (t, t-1)$ FE			Yes			Yes
Method	OLS	OLS	OLS	IV	IV	IV
R^2	0.457	0.636	0.671	0.256	0.250	0.278
Observations	204518	78053	51401	204518	78053	51401

Standard errors in parentheses, clustered at the state $\times$ industry level.

Similar with Pakistan data ▸ Pakistan

Size Distribution



Contracting frictions in output markets ⇒ lower skewness in size distribution

	Dependent variable: Skewness of log Sales					
	(1)	(2)	(3)	(4)	(5)	(6)
Relspec x Court Congestion	-0.360*	-0.671*	-0.799**	-0.624^{+}	-1.312*	-0.905
	(0.168)	(0.287)	(0.294)	(0.349)	(0.598)	(0.578)
R^2	0.540	0.435	0.554	0.001	0.000	0.007
State FE	Yes	Yes	Yes	Yes	Yes	Yes
5-digit Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Estimator	OLS	OLS	OLS	IV	IV	IV
Statistic	25-75	50-75	50-90	25-75	50-75	50-90
Observations	3008	3008	1448	3008	3008	1448

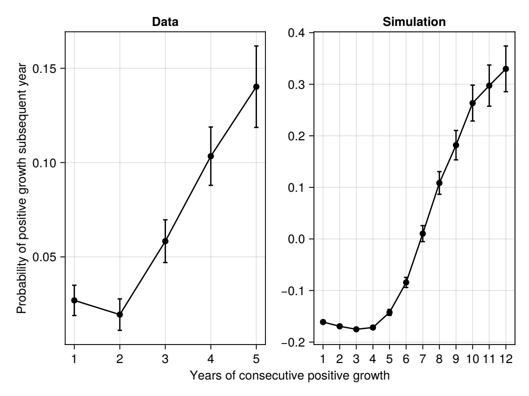
$$\text{Skewness}_{s\omega} = \frac{\log\left(\text{Share of plants above } S_1\right) - \log\left(\text{Share of plants above } S_0\right)}{\log S_1 - \log S_0}$$

S_0 and S_1 are different quantiles of overall plant size distribution (25th, 50th, and 75th, 90th)

Similar with Pakistan data ▸ Pakistan

“Gazelles” / “rockets” / type dependence / ex ante heterogeneity

- Luttmer (2011): Need “rockets” that eventually slow to explain why largest firms are not so old
- Sedlecek, Sterk, Pugsley (2021): Hidden “ex ante heterogeneity” explains most of size dispersion at young ages, almost half of size dispersion at twenty
- Coad, Daunfeldt, Halvarsson (2018): autocorrelation of growth rates is positive for young firms and negative for older firms



Here: cost is hidden type

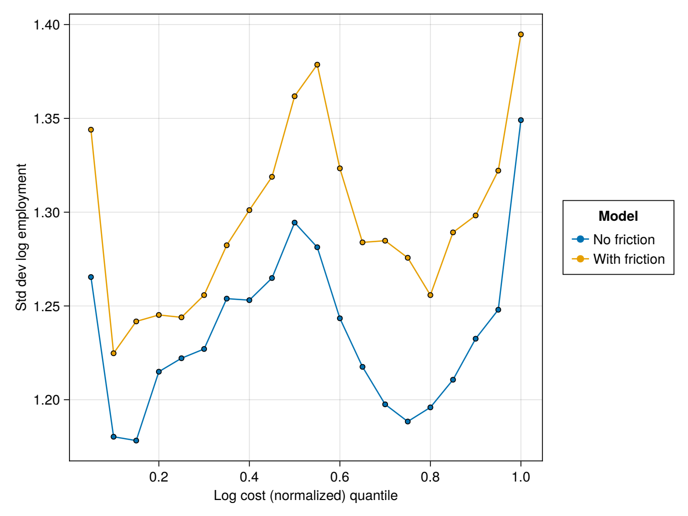
- Cost determines inflow of customers
- Low cost at birth $\implies$ persistent growth until inflows equals outflows
- Cost evolves over time

Implications for Aggregate Productivity

Productivity

- Productivity growth is $\frac{\gamma}{\varepsilon-1}$
  - Gains from variety/Population growth
- Weak enforcement affects level of productivity
- Misallocation: Firms use worse suppliers than they would with better enforcement

Misallocation: Dispersion in Size



Misallocation: Correlation of Log Cost and Log Employment

Model	Correlation (demeaned)	Correlation (normalized)
No friction	-0.281	-0.370
With friction	-0.260	-0.340

Aggregate Productivity

	No friction	With friction
Mean income growth	0.015	0.015
Log real income difference	0.000	-0.162

- Note: In counterfactuals, entry rate held fixed
- More severe contracting frictions $\implies$ lower entry (impact on welfare not obvious)

Conclusion

- One response to weak contract enforcement is to use relational contracts
- Static benefits, but less switching
  - $\Rightarrow$ Slower firm dynamics
  - $\Rightarrow$ Cost penalty builds up over time
    - Not switching in past $\implies$ large impact on current aggregate productivity
- Dynamic costs of bad enforcement are $\sim$3 times the size of static costs

Appendix

Number of Buyers is Good Predictor of Exit

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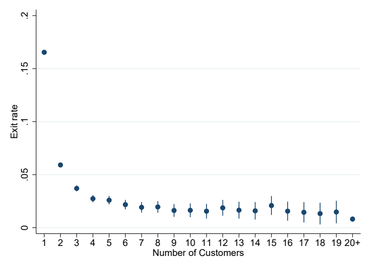

	Dependent variable: P(exit)			
	(1)	(2)	(3)	(4)
Constant	0.0878** (0.00039)	0.0879** (0.00038)	0.0878** (0.00038)	0.0879** (0.00038)
Fixed Effects	Year	Year, #Buyers	Year, Sales vingtiles	Year, #Buyers, Sales vingtiles
R^2	0.0293	0.0889	0.0976	0.112
Observations	501828	501431	501828	501431

Standard errors in parentheses, clustered at the industry-region level.
$^+$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Determinants of Firm Growth Volatility

	Data (Pakistan)					Simulation				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\overline{\log(\text{Sales})}$	-0.138		-0.092	-0.105	-0.103	-0.3021		-0.2424	-0.2259	-0.2256
	(0.0018)		(0.0025)	(0.0022)	(0.0022)	(0.0007)		(0.0009)	(0.0008)	(0.0008)
$\overline{\log(\text{Buyers})}$		-0.217	-0.111				-0.4962	-0.1845		
		(0.0031)	(0.0042)				(0.0014)	(0.0018)		
$\overline{\log(\text{HHI})}$				0.152	0.202				0.3179	0.4224
				(0.0055)	(0.0067)				(0.0017)	(0.0112)
$\overline{\log(\text{HHI (weighted)})}$					-0.051					-0.1058
					(0.0037)					(0.0112)
Fixed Effects										
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Statistics										
R^2	0.263	0.244	0.286	0.287	0.289	0.7667	0.7393	0.7713	0.781	0.781
R^2-within	0.197	0.175	0.221	0.223	0.225	0.2674	0.1814	0.282	0.3123	0.3124
Observations	23,034	23,034	23,034	23,034	22,552	538,784	538,784	538,784	538,784	538,784

Standard errors in parentheses. The dependent variable is the log standard deviation of $\log \text{sales}_{t+1} - \log \text{sales}_t$.

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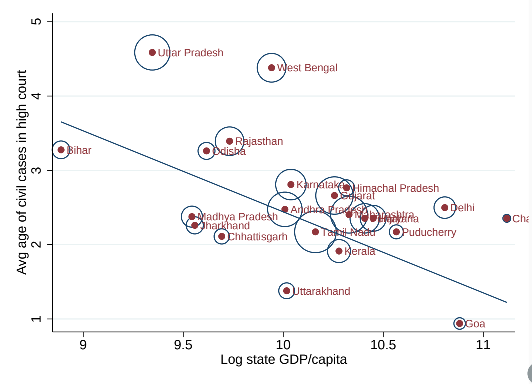
Slow Courts

- Contract disputes between buyers and sellers
- District courts can de-facto be bypassed, cases would be filed in high courts
- Court quality measure: average age of pending civil cases in high court



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Mean Reversion: Pakistan

	Dependent variable: Change in log Sales		
	(1)	(2)	(3)
$\log \text{Sales}_{t-1}$	-0.146**	-0.163**	-0.163**
	(0.0051)	(0.010)	(0.011)
$\log \text{Sales}_{t-1} \times$ Age civ. cases $\times$ relspec		0.0114^{+}	0.0128*
		(0.0060)	(0.0062)
Firm $\times$ 2-digit Industry FE	Yes	Yes	Yes
District FE	Yes	Yes	
Year FE	Yes	Yes	
Age FE			Yes
Industry $\times$ District $\times$ Year FE			Yes
R^2	0.218	0.218	0.249
Observations	205351	205254	201931

Standard errors in parentheses, clustered at the district $\times$ industry level.

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Skewness of Size Distribution: Pakistan

	Dependent variable: Skewness of log Sales		
	(1)	(2)	(3)
Relspec x Court Congestion	-0.914	-1.053^{+}	-1.465^{+}
	(0.593)	(0.562)	(0.831)
District FE	Yes	Yes	Yes
2-digit Industry FE	Yes	Yes	Yes
Statistic	25-75	25-90	50-90
R^2	0.424	0.598	0.547
Observations	935	688	688

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

$$\text{Skewness}_{s\omega} = \frac{\log(\text{Share of plants above } S_1) - \log(\text{Share of plants above } S_0)}{\log S_1 - \log S_0}$$

S_0 and S_1 are different quantiles of overall plant size distribution (25th, 50th, and 75th, 90th)

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Notes on Pakistan

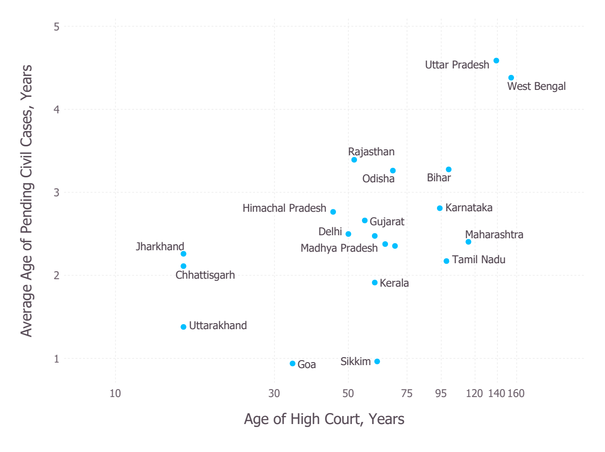
- 7 states, almost all economic activity is in two states, Sindh and Punjab
- All of our data is in district courts
- VAT data: Size threshold: varies across years. 2-3k per year - 15k per year
- Can still register for VAT
- Small firms effectively face sales tax
- Some sectors (notably agriculture, some services, companies owned by army) excluded from VAT
- For manufacturing, sum across firms of reported VA in data of firms represents 89% manufacturing VA as reported by National Accounts (for whole economy, much lower 30-40%)
- Currently use all transactions, whether reported by one or both parties. If parties disagree on value, use geometric mean of reported transactions
- Firms reports total sales separately from transactions For size, use declared sales of firm, not sum of transactions
- Remove invoice mills
- For firm: age (date registered), two digit industry codes (sometimes there is a

Endogeneity: IV

- Since independence: # judges based on state population

⇒ backlogs have accumulated over time

- But: new states have been created, with new high courts and clean slate



Aggregate Output along BGP

Output per capita along the BGP when $\beta \neq \varepsilon - 1$ is

$$\frac{Y_t}{L_t} = (1-\eta)^{\frac{\beta}{\varepsilon-1}} \left(\frac{\eta \chi_R}{\gamma} L_0\right)^{\frac{1}{\varepsilon-1}} \left[\frac{\Gamma\left(1 - \frac{\alpha}{\beta}(\varepsilon-1)\right)}{1 + \frac{\phi}{\gamma}\sum_{k=1}^{\infty} \frac{\varepsilon-1}{\varepsilon-1-\beta\alpha^{-k}}}\right]^{\frac{1}{\varepsilon-1}} \left[\frac{\kappa_0 \Gamma(1-\alpha)}{1 + \frac{\phi}{\gamma}\sum_{k=1}^{\infty} \frac{1}{1-\alpha^{-k}}}\right]^{\frac{\alpha}{1-\alpha}\frac{1}{\beta}} e^{\frac{\gamma}{\varepsilon-1}t}$$

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Weak Enforcement and Relational Contracts

- Contract specifies level of defectiveness $\delta \in [0, 1]$. Surplus maximized at $\delta = 0$.
  - Supplier can produce defective input. Saves in cost, but possibility output will be defective.
  - Claim can be enforced in court.
    - But delay in court reduces value of payment
    - Cost proportional to value of transaction

- Static Nash: Supplier makes defective input, court. Priced in, but static surplus $\downarrow$

- Relational contract
  - Supplier chooses $\delta = 0$
  - Buyer chooses lower arrival rate of new suppliers (observable to supplier, not court)
    - Backloads payoff, raises surplus of the relationship
  - Enforcement: Trigger strategies
    - If supplier does not customize, buyer does not reduce arrival of new suppliers
    - Punishment for defective inputs: **Relationship ends faster + enforcement in court**
    - If buyer does not reduce arrival rate, supplier stops customizing

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