The Network Origins of Firm Dynamics

Contracting Frictions and Dynamism with Long-Term Relationships

Johannes Boehm [1] Ezra Oberfield [2] Ruairidh South [3] Mazhar Waseem [4]

IFC / PEDL / STEG Workshop on Targeting Development Finance

19 June 2025

[1]Geneva Graduate Institute [2]Cornell [3]Princeton [4]Manchester

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

Empirical evidence that contracting frictions increase relationship stickiness:

- Johnson, McMillan, Woodruff (2002): firms in Eastern Europe less likely to try out new suppliers
- Monarch (2020): US importing relationships with Chinese firms: relationships last longer for rel-spec goods

What is the role of relationships in firm dynamics and allocative efficiency?
What are the dynamic allocative impacts of improving contracting institutions?

Empirical Results

Data: Indian Annual Survey of Industries and Pakistani VAT Data (firm-to-firm sales)

Contracting frictions: output is relationship-specific (Rauch, 1999) AND firm located in region with slow/congested courts

Main findings: when contracting frictions are present

- firm-to-firm relationships last longer ▸ table
- lower standard deviation of firm growth rates ▸ table
- lower exit probability ▸ table
- Weaker mean reversion in firm size ▸ table
- lower skewness in firm size distribution (“fewer large firms”) ▸ table

Sales growth decomposition: 3/4 of variation in firm sales growth is due to extensive margin changes in buyers (new buyers, losing buyers)

Model and Quantification

Model of firms dynamics:

- Cobb-Douglas production in intermediate input(s) and labor
- Single shock process: arrival of new potential supplier
- Buyer decides whether to switch from existing supplier to new supplier (no recall)
- When log of firm costs follow a random walk with identically distributed increments, decision becomes easy to characterize
- Closed-form expression for per-capita income along the BGP:

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

- Contracting frictions appear like a reduction in effective arrival rate of new suppliers ϕ ($\Rightarrow$ stickier relationships)

Calibrate to Indian and Pakistani moments. (relationship duration $\leftrightarrow$ court congestion)

Counterfactual: reducing court congestion

Reduce court congestion from slowest state in India (avg. age of pending cases: 4 years) to fastest state (1 year)
$\Rightarrow$ change relationship durations for rel-spec goods as implied by regression (0.25y per addl' year in age of pending cases)

Improves correlation between firm cost and firm size:

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

Table 1: Correlation of Log Cost and Log Size

Improvement in aggregate productivity: $\approx$ 15%

Discussion

Discussion

Common view in growth/development literature (e.g. Acemoglu-Robinson 2008):

Property rights matter more for development than contract enforcement, because one can find informal ways (relational contracts) to resolve hold-ups

But: such long-term relationships may slow down the growth of young & productive firms
$\Rightarrow$ You need to look at this in GE. Our paper provides a quantification of this channel.

More generally: framework to evaluate dynamism

- relationship churning
- sales growth volatility
- exit

In the perspective of this model, dynamism is a good thing

In the perspective of this model, there are some firms that are too small relative to what would be implied by their productivity.

- These firms are more likely to grow. Firms with too high sales compared to long-run level will shrink. Mean reversion in sales.
- The speed at which this happens is determined by the matching friction; contracting frictions here look like a matching friction

A potential strategy for investors could be to try to identify firms that have relatively high productivity compared to sales

- Such firms are more likely to grow
- Younger firms are more likely to satisfy this criterion (see also Foster et al., 2008)
- Don't look at recent sales growth (there's mean-reversion)
- But: young firms with several periods of consecutive high growth are likely to keep growing (evidence on "gazelles/rockets")
- # buyers growth is more informative about latent cost/productivity than sales growth

Of course this would only take the private returns into account.

▸ Gazelles

Broader discussion: evaluating impacts of entry/tech chg/public interventions

Ex-ante evaluation:

- Neoclassical models typically require good understanding of production function. Allows separation of costs and markups ($\rightarrow$ inefficiency)
- In my view under-appreciated: estimates of economies of scale: internal/external, plant/firm/local/industry/country-level etc
- Firm-to-firm data (and trade data) can provide demand shocks that allow identification of these

Ex-post evaluation:

- Standard causal inference techniques

How can we assess the market-level impact of investments that facilitate inter-firm transactions?

- Trade models

How can we identify cases of a market failure that requires public sector intervention to make profitable private sector investment viable?

- Some non-excludable goods (roads, security), but also excludable goods/services when prices are not chosen correctly (e.g. energy)
- With quantity constraints (e.g. energy supply), perhaps better to focus on reliable

Full slide deck

This paper

1. Motivational evidence from India/Pakistan, that contracting frictions increase relationship stickiness and reduce dynamism
2. Quantitative model with firm dynamics built on firm-to-firm trade
    - Contracting frictions induce relational contracting which leads to more stickiness in firm-to-firm relationships
    - Productive firms are chosen less often as suppliers $\Rightarrow$ aggregate productivity loss
3. Calibrate multi-sector version of model to Indian/Pakistani setting
    - Compare firm dynamics in model to data
    - See how firm dynamics change with contracting frictions (in model & data)
4. Perform counterfactuals where we reduce contracting frictions
    - Reduces dynamic losses from misallocation
    - Dynamic losses $\approx$ 3x static losses (Boehm-Oberfield, 2020)

Data

- **Indian Annual Survey of Industries**, 1989/90-2014/15 (with gaps)
  - Plant-level panel survey of manufacturing plants
  - Sales/purchases by 5-digit outputs and inputs
- Supplement with **Pakistan Value Added Tax** data 2011-2019
  - Monthly Firm-to-Firm sales transactions, aggregated to annual level
  - 4-digit industry codes

Data

- **Indian Annual Survey of Industries**, 1989/90-2014/15 (with gaps)
  - Plant-level panel survey of manufacturing plants
  - Sales/purchases by 5-digit outputs and inputs
- Supplement with **Pakistan Value Added Tax** data 2011-2019
  - Monthly Firm-to-Firm sales transactions, aggregated to annual level
  - 4-digit industry codes

Contracting frictions in output market present when:

firms output is relationship-specific AND firm located in region with poor contract enforcement

- **Relationship-specificity:** Rauch '99, by 5-digit product (India), 4-digit industry (Pak.)
- **Poor contr. enforecement:** Avg. age of pending cases in states (India), districts (Pak.) For India, also use age of court as IV (Boehm & Oberfield, 2020)

Contracting friction in output markets ⇒ longer relationships (Pak) Back

	Dependent variable: Length of Relationship (in Years)				
	(1)	(2)	(3)	(4)	(5)
Age of pending cases (S) × RelSpec_S	0.206*		0.172*		
	(0.086)		(0.076)		
Age of pending cases (B) × RelSpec_S		0.187*	0.146*		
		(0.083)	(0.071)		
Age of pending cases (Min(B,S)) × RelSpec_S				0.296**	0.301**
				(0.038)	(0.039)
B × S 4-digit Industry FE	Yes	Yes	Yes	Yes	Yes
B District FE	Yes	Yes	Yes	Yes	
S District FE	Yes	Yes	Yes	Yes	
S District × S 4-digit Industry FE					Yes
B District × B 4-digit Industry FE					Yes
R^2	0.119	0.119	0.119	0.120	0.162
Observations	1628710	1628182	1627686	1629206	1627434

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 sales 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 (by age, year, state and industry) annualized sales growth in each state-industry cell

Data from ASI, India Back

Contracting frictions in output markets ⇒ lower exit rates (across all size bins)

	Dependent variable: P(exit)		
	(1)	(2)	(3)
Q1 Dummy	0.0739**		
	(0.0018)		
Q2 Dummy	0.0253**	-0.0510**	-0.0493**
	(0.0016)	(0.0042)	(0.0046)
Q3 Dummy	0.0131**	-0.0611**	-0.0636**
	(0.00091)	(0.0046)	(0.0053)
Q4 Dummy	0.00789**	-0.0715**	-0.0770**
	(0.00062)	(0.0045)	(0.0053)
Q1 × Relspec × AvgAgeCourts		-0.00621**	-0.00552*
		(0.0024)	(0.0023)
Q2 × Relspec × AvgAgeCourts		-0.00384*	-0.00422**
		(0.0015)	(0.0015)
Q3 × Relspec × AvgAgeCourts		-0.00469**	-0.00367**
		(0.0013)	(0.0011)
Q4 × Relspec × AvgAgeCourts		-0.00162	
		(0.0014)	
4-digit Industry × Year FE		Yes	Yes
District × Year FE			Yes
4-digit Industry × District FE			Yes
R^2	0.0522	0.0536	0.0764
Observations	407189	300384	299802

(Data from Pakistan) Back

Much of the variation in sales growth is explained by extensive margin changes

Table 3: Sales growth decomposition

	Contribution of extensive magin changes to firm sales volatility, by time aggregation								
	Quarterly			Annual			Biennial		
Order	All	Small	Large	All	Small	Large	All	Small	Large
0	0.744	0.752	0.731	0.792	0.813	0.734	0.832	0.858	0.788
1	0.741	0.748	0.73	0.79	0.814	0.731	0.839	0.867	0.794
2	0.736	0.745	0.725	0.787	0.813	0.725	0.842	0.871	0.796

Table shows coefficient in regression of EXT^k on g, where:

$$g_i = \frac{\text{Sales}_{i,t+1} - \text{Sales}_{i,t}}{(\text{Sales}_{i,t+1} + \text{Sales}_{i,t})/2}$$

$$EXT_i^0 = \frac{\sum_{\in B_{i,t+1}^{\text{new}}} \text{Sales}_{i,t+1} - \sum_{\in B_{i,t}^{\text{old}}} \text{Sales}_{i,t}}{(\text{Sales}_{i,t+1} + \text{Sales}_{i,t})/2}, \qquad EXT^{k+1} = \sum_{n=0}^{k} \Omega^n EXT^0$$

Model: Single Industry

- Growing industry with many firms. Two types of firms: manufacturers, retailers
- Each firm produces using labor and one input:

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

- Single shocks process: new potential buyer-supplier matches arrive via Poisson process
  - Each new potential match: random supplier s, random match-specific productivity z_{bs}
  - Buyer's decision: switch or not
- Large number of retailers
  - Same production function & supplier arrival process as manufacturers
  - Sell output to household (but not to other manufacturers or retailers)
    - Manufacturers 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 manufacturers and retailers
- 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 proportionally 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 (log) cost is 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

  What makes this work?
  - 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

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

where $z_0, z_1, z_2, \dots$ 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

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

$\implies$ 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 endogenous exit (Hopenhayn/Luttmer) $\implies$ would give mean reversion in costs
  - 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 manufacturers 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

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

$\rightarrow$ 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

Calibrate multi-sector version of model

- Firm b in industry ω

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

- Calibrate to Indian data on 5-digit industries (# firms, industry cost shares $\alpha_{\omega\omega'}$)
- Some industries produce relationship specific goods (relevant for frictions later)

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	$\beta + 1$		

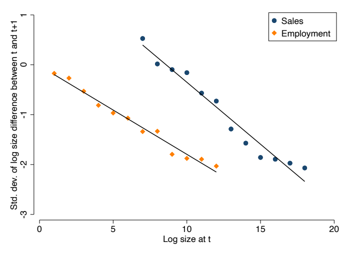
Properties of the Model

One shock, many subtle firm dynamics patterns

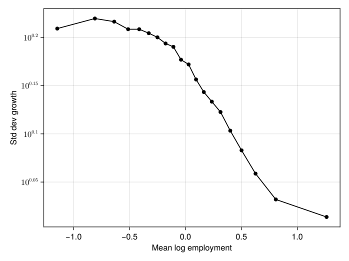
- Firm size depends on how many customers, how large those customers are, which depends on how many customers they have
- Prospects for growth depend on cost: Lower cost $\implies$ attract customers more quickly
  - Potential customers more likely to switch
- Changes in size from both downstream and upstream shocks
  - Downstream: Gain or lose customers, customers grow or shrink...
  - Upstream: Get better supplier: household buys more from downstream retailers

Standard Deviation of Growth Rates by Size

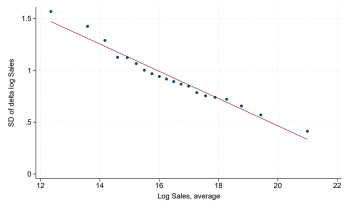
Data (US, Factset):



Simulation:



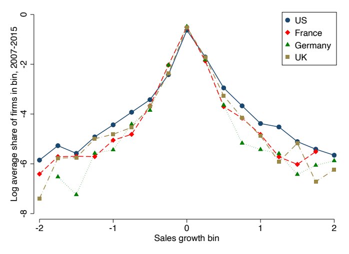
Data (Pakistan):



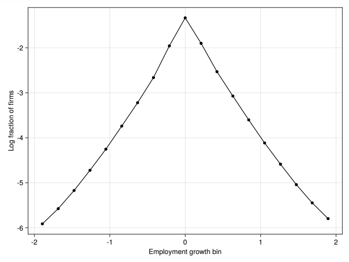
- Larger $\implies$ lower standard deviation of growth rates (Hymer and Pashigian, 1962)
  - Usual mechanism: Large firms composed of more subunits $\implies$ diversification
  - Here: Large firm tends to have more customers
- Declines more slowly than $\sqrt{\text{size}}$
  - Usual mechanism: correlation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

Distribution of Growth Rates has Fat Tails

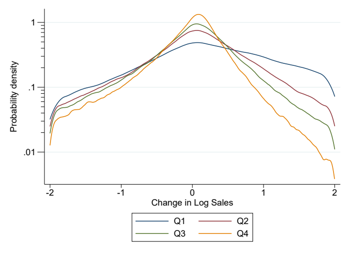
Data (Factset):



Simulation:

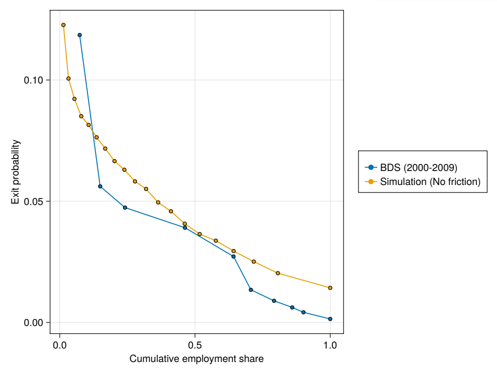


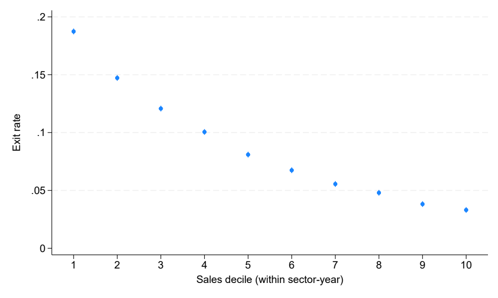
Data (Pakistan):



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

Exit rates decline with size





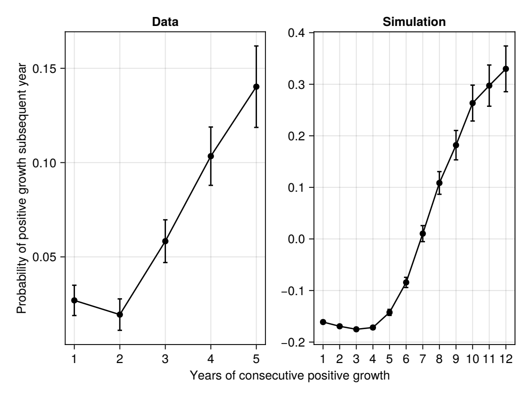
- Firms exit when they lose last customer
- Large firms can have one large customer
- Number of buyers is a good predictor of exit

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

- Luttmer (2011): Need “rockets” that eventually slow to explain why largest firms are not so old
- Sedlacek, 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



Back

Weak Enforcement and Relational Contracts

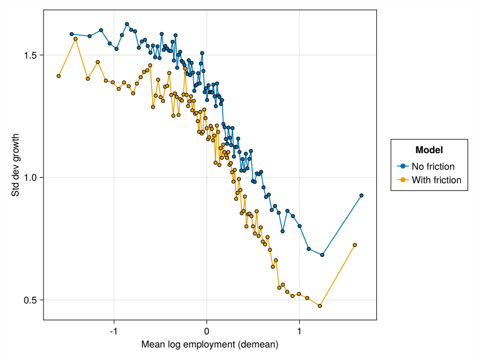
Weak Enforcement and Relational Contracts

- 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

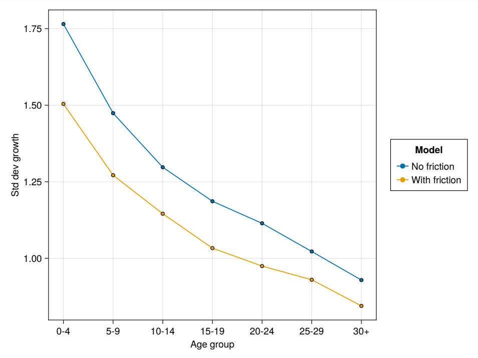
Quantitatively:

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

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



(a) Volatility by Size

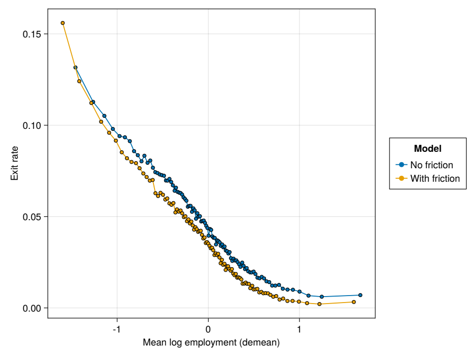


(b) Volatility by Age

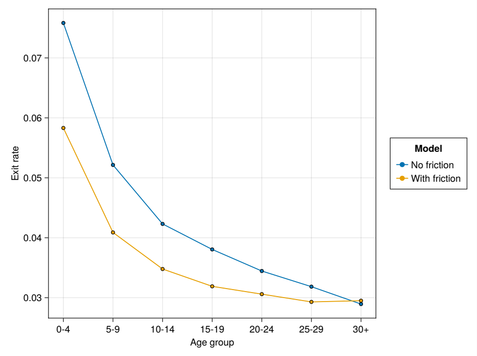
Lower arrival rate of shocks $\Rightarrow$ lower variance of growth rates

Empirical Evidence: see table at beginning of talk

Exit Rates: Frictions vs No Frictions (Model)



(c) Exit Rates By Size

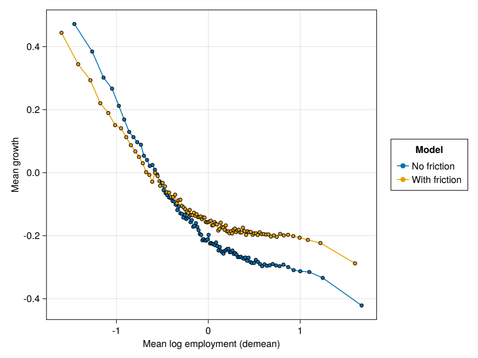


(d) Exit Rates by Age

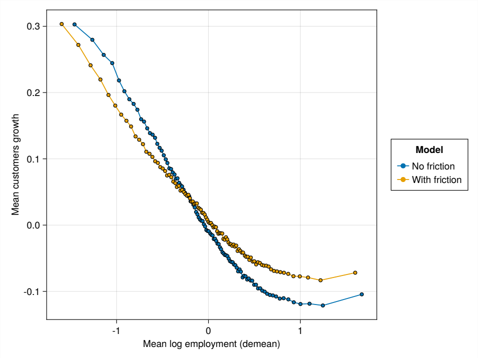
Lower arrival rate of shocks $\Rightarrow$ lower probability of losing last customer

Empirical Evidence: see table at beginning of talk

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

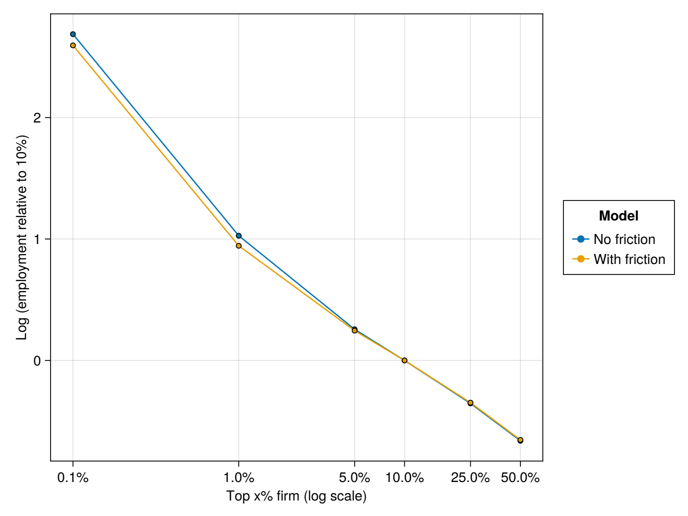
	Dependent variable: Change in log Sales					
	(1)	(2)	(3)	(4)	(5)	(6)
log Sales_{t-1}	-0.403**	-0.427**	-0.555**	-0.403**	-0.436**	-0.583**
	(0.011)	(0.025)	(0.037)	(0.012)	(0.028)	(0.038)
log $\text{Sales}_{t-1} \times$ Age civ. cases $\times$ relspec	0.00709^{+}	0.0206*	0.0249^{+}	0.00687	0.0256*	0.0405*
	(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 Back

Size Distribution: less fat tails with frictions

Model simulation:



Contracting frictions in output markets $\Rightarrow$ 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

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

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

Similar with Pakistan data ▸ Pakistan ▸ Back

Counterfactual: reduce contracting frictions

Reducing average age of pending court cases by 1 year

$\Rightarrow$ 0.26 years longer relationships on average (for rel-spec. industries)

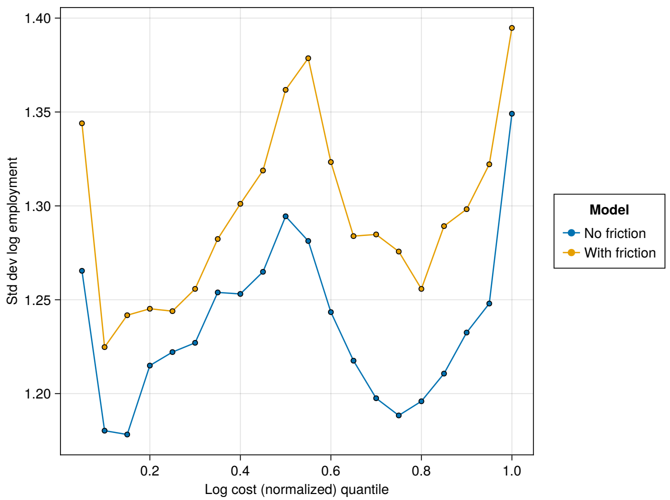
Counterfactual: change arrival rate of new suppliers κ (or ϕ) accordingly, to move from average age of pending cases of 4 years to 1 year

Reduces misallocation: firms with low cost get drawn as suppliers more often, large but unproductive firms shrink

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

Agg. productivity loss from dynamic misallocation $\approx$ 3x static loss (Boehm & Oberfield, 2020)

Reducing friction ⇒ reduce size dispersion within each cost quantile



Thank you!

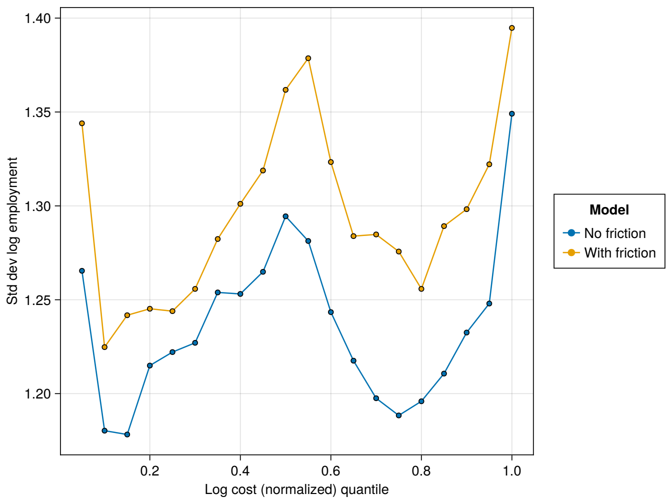
johannes.boehm@graduateinstitute.ch

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)

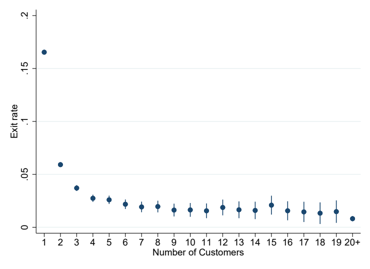
Conclusion

- 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

Back



	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

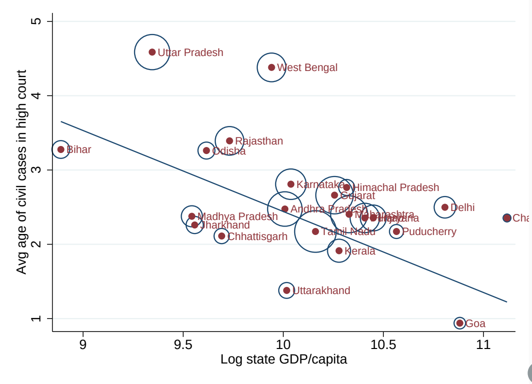
	Data (Pakistan)					Simulation				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\overline{\log(\text{Sales})}$	-0.138		-0.092	-0.105	-0.103	-0.3021		-0.2424	-0.2259	-0.2256
	(0.0018)		(0.0025)	(0.0022)	(0.0022)	(0.0007)		(0.0009)	(0.0008)	(0.0008)
$\overline{\log(\text{Buyers})}$		-0.217	-0.111				-0.4962	-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 $\log \text{sales}_{t+1} - \log \text{sales}_t$.

Back

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



Back

Mean Reversion: Pakistan

	Dependent variable: Change in log Sales		
	(1)	(2)	(3)
$\log \text{Sales}_{t-1}$	-0.310**	-0.347**	-0.359**
	(0.0053)	(0.018)	(0.022)
$\log \text{Sales}_{t-1} \times$ Age civ. cases $\times$ rel.spec.		0.0191*	0.0216*
		(0.0082)	(0.0095)
Firm $\times$ 4-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	0.368	0.370	0.432
Observations	214380	164552	154912

Standard errors clustered at the district $\times$ industry level. Conditions on $|\Delta \log \text{Sales}| < 1$.

Back

Skewness of Size Distribution: Pakistan

	Dependent variable: Skewness of log Sales		
	(1)	(2)	(3)
Avg age of civil cases × Rel. spec.	-1.627*	-2.347**	-2.603*
	(0.795)	(0.798)	(1.240)
District FE	Yes	Yes	Yes
4-digit Industry FE	Yes	Yes	Yes
Statistic	25-75	25-90	50-90
R^2	0.540	0.623	0.546
Observations	854	653	653

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

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

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

Back

Notes on Pakistan

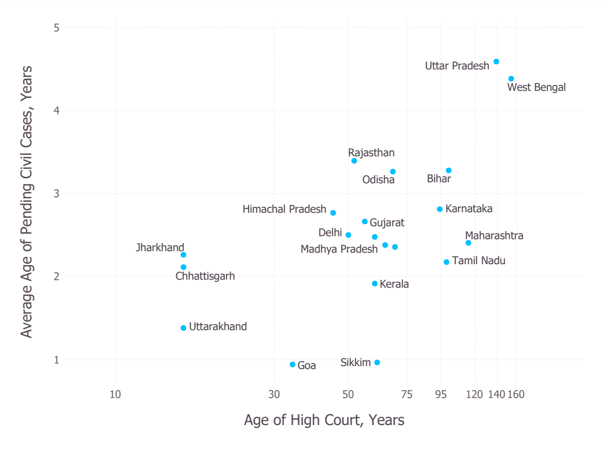
- 7 states, almost all economic activity is in two states, Sindh and Punjab
- All of our data is in district courts
- VAT data: Size threshold: varies across years. 2-3k per year - 15k per year
- Can still register for VAT
- Small firms effectively face sales tax
- Some sectors (notably agriculture, 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

$\Rightarrow$ 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

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

back

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

Back

Much of the variation in sales growth is explained by extensive margin changes

Table 5: Sales growth decomposition

	Contribution of extensive magin changes to firm sales volatility, by time aggregation								
	Quarterly			Annual			Biennial		
Order	All	Small	Large	All	Small	Large	All	Small	Large
0	0.744	0.752	0.731	0.792	0.813	0.734	0.832	0.858	0.788
1	0.741	0.748	0.73	0.79	0.814	0.731	0.839	0.867	0.794
2	0.736	0.745	0.725	0.787	0.813	0.725	0.842	0.871	0.796

Table shows coefficient in regression of EXT^k on g, where:

$$g_i = \frac{\text{Sales}_{i,t+1} - \text{Sales}_{i,t}}{\text{Sales}_{i,t+1} + \text{Sales}_{i,t}}$$

$$EXT_i^0 = \frac{\sum_{\in B_{i,t+1}^{\text{new}}} \text{Sales}_{i,t+1} - \sum_{\in B_{i,t}^{\text{old}}} \text{Sales}_{i,t}}{(\text{Sales}_{i,t+1} + \text{Sales}_{i,t})/2}, \qquad EXT_i^{k+1} = EXT_i^0 + \sum_{j \in B_{i,t}} \omega_{ij,t} EXT_j^k$$

Back