Productivity and Reallocation

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What Is Productivity?

Productivity: How much output a producer or set of producers obtains from each unit of inputs

Many specific metrics, but all are essentially a ratio of output to inputs

$$\text{Productivity} = \frac{Output}{Inputs}$$

- (Read: Efficiency)
- (Read: Profitability)

Productivity Dispersion is Everywhere

There are very large productivity differences across producers, even within narrowly defined industries

Researchers have found this in every country, industry, and time period they've looked

Productivity Dispersion is Everywhere

What does “narrowly defined” mean?

- Saw blade manufacturing
- Ready-mixed concrete
- Retail office supply stores
- Business accounting services
- Hospitals

Productivity Dispersion is Everywhere

What do “large productivity differences” mean?

- Typical 90-10 percentile total factor productivity ratio within 4-digit industries in U.S. mfg. is 2-to-1 or *higher*

What this implies:

- Line up industry producers from least to most productive; the 90th percentile producer obtains *twice* as much output from the *same measured inputs* (capital, labor, energy, materials) as the 10th percentile producer

Not just U.S. manufacturers

- China mfg.: 3-to-1 ratio; India: 5-to-1; Business services: 2.5-to-1

Productivity Is Persistent

High-productivity businesses this year are likely to be next year as well

Low-productivity businesses are likely to stay that way, too…

- Unless they shut down, which they are much more likely to do

Productivity Is Literally a Matter of Survival for Businesses

Higher productivity is tied to “good news” about business prospects

- More likely to survive
- Faster future growth

This correlation between productivity and growth/survival is the heart of the reallocation mechanism that is the focus of today’s lecture—we will return to that

But while we’re at it:

- Productivity is also good for workers (higher wages)
- Productivity is also good for consumers (lower quality-adjusted prices)

So What Determines Productivity?

Two broad sets of factors:

1. Things that, at least in concept, are within a businesses' control—"levers"
2. Aspects of the operating environment—"external factors"
    - These things influence the reallocation mechanism

“Levers”

1. Managerial practices/talent
2. Higher-quality labor and capital
    a. IT and R&D
3. Learning-by-doing
4. Product innovation
5. Firm structure decisions

External Factors

1. Productivity spillovers
2. Regulatory environment
3. Competition—both intra-market and through trade
4. Input market flexibility

#3 and #4 are key elements of the productivity and reallocation story (#1 and #2 can have secondary effects)

Productivity and Allocation

Suppose two companies with different productivity levels operate in a perfectly competitive market

- Call company with higher productivity Company 1
- Higher productivity means fewer inputs are required per unit, so Company 1 has a lower marginal cost curve than Company 2
- Under perfect competition, each company produces until MC = Price
- So Company 1 sells more output than Company 2
  - The market allocates more activity to the higher-productivity company
- Same logic applies for any number of companies with different productivity levels

Productivity and Allocation (with Market Power)

What about markets where companies have market power?

- For the same demand, again, higher-productivity companies will be larger

Productivity and RE-Allocation

These examples are static, but in dynamic settings the same logic applies

- Markets will *tend to* shift activity toward higher-productivity producers
- Might not happen instantaneously
- If producers themselves are experiencing productivity changes, market will react to that, though again probably not instantaneously

Productivity and Size in Hospitals

Big performance differences among hospitals

But many think healthcare sector market is messed up, with little reason activity should respond to performance

We use Medicare data to test

- Measure hospitals' performance at treating heart attacks, congestive heart failure, pneumonia, and hip/knee replacements
- See whether better hospitals are larger (allocation test) and grow faster (reallocation test)

Productivity and Size in Hospitals

- Are better hospitals larger (allocation)?

$$\ln(N_h) = \beta_0^s + \beta_1^s q_h + \gamma_M^s + \varepsilon_h^s$$

- If so, $\beta_1^s > 0$

- Do better hospitals grow faster (reallocation)?

$$\Delta_h = \beta_0^d + \beta_1^d q_h + \gamma_M^d + \varepsilon_h^d$$

- If so, $\beta_1^d > 0$

Allocation Results

	AMI	CHF	Pneumonia	Hip/Knee
Survival	17.50 (1.00)	15.36 (1.32)	5.14 (0.78)	
Readmission	-9.16 (1.62)	-10.35 (1.78)	0.50 (1.58)	-21.04 (2.03)
Process of care score	0.319 (0.026)	0.332 (0.016)	0.211 (0.015)	
Patient survey score	-0.321 (0.052)	-0.252 (0.038)	-0.210 (0.030)	-0.057 (0.051)

Reallocation Results

	AMI	CHF	Pneumonia	Hip/Knee
Survival	1.533 (0.379)	0.774 (0.501)	1.220 (0.354)	
Readmission	-1.428 (0.611)	-2.300 (0.651)	-1.138 (0.679)	-1.112 (0.836)
Process of care score	0.048 (0.010)	0.043 (0.009)	0.026 (0.009)	
Patient survey score	-0.065 (0.015)	-0.003 (0.011)	0.007 (0.011)	0.037 (0.022)

Reallocation in the U.S. Steel Industry

Collard-Wexler and De Loecker (2015) look at within-industry reallocation in the U.S. steel industry over 1963 and 2002

Background: Industry saw huge drops in employment but much smaller drops in output—hence productivity growth

Shock to the system: diffusion of minimill technology and slowdown in integrated mills

Minimills much smaller scale but also have higher (about 8-10%) productivity levels

Reallocation in the U.S. Steel Industry

Focusing within producers of each technology:

- Most of total productivity growth among minimills came from individual plants becoming more efficient
- But about half among integrated mills came from reallocation away from less productive and toward more productive plants

If we include reallocation *across* technologies, reallocation accounts for about 2/3 of aggregate productivity growth

Minimills increased productivity in steel both by displacing less efficient vertical mills and forcing the remaining mills to raise their productivity levels

- Some evidence this included product upgrading among integrated mills

Competition and Productivity: Two Mechanisms

Competition can drive productivity improvements through a combination of two mechanisms

- Existing businesses spurred to be more efficient
- Reallocation: inefficient shrink or go out of business, efficient enter and grow
  - A sort of Darwinian survival mechanism

Both mechanisms matter, but their relative importance varies across industries

That is, reallocation doesn’t just exist or not exist; its magnitude can vary

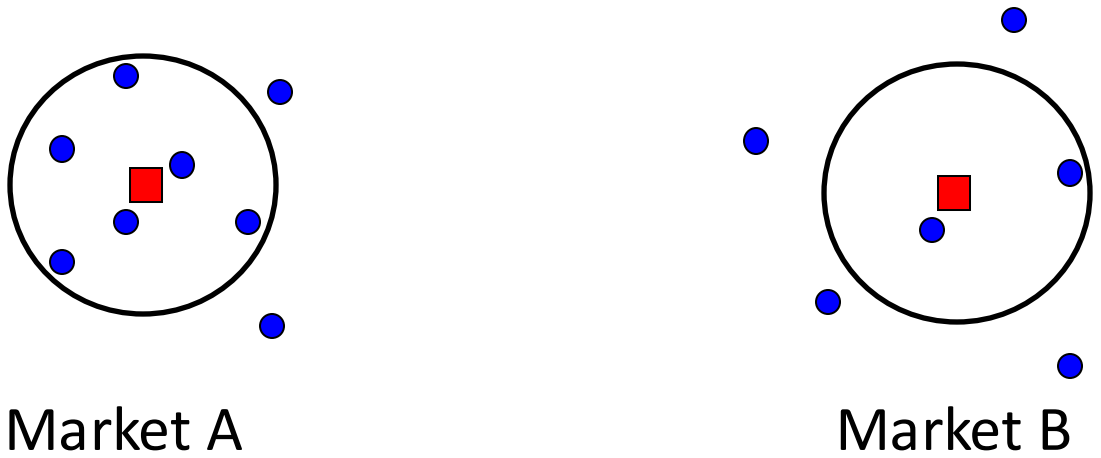
Competition and Productivity: Ready-Mixed Concrete

Concrete is concrete, so what limits competition?

- Transport costs

Markets where producers are located close together offer more options for customers

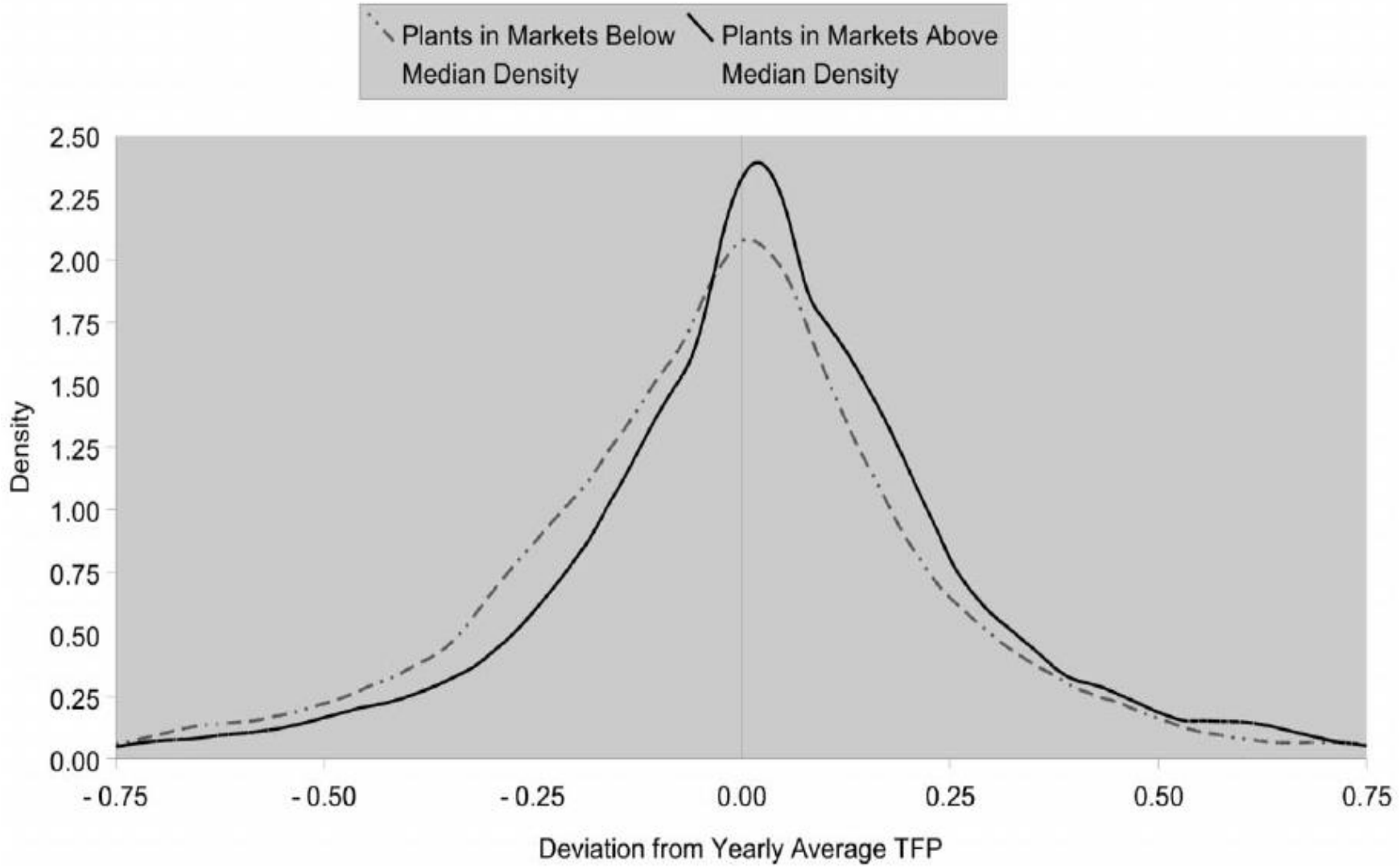
- It's harder to be inefficient and survive in such markets
- Competitiveness determined by construction density



Market A

Market B

Competition and Productivity: Ready-Mixed Concrete



Competition and Productivity

One way to think theoretically about why competition increases reallocation is that it tends to flatten companies' marginal revenue curves

- If marginal revenue curves flatten, the quantity difference caused by any given cost difference becomes larger
- I.e., market shares and size are more sensitive to costs, creating a larger reward for productivity

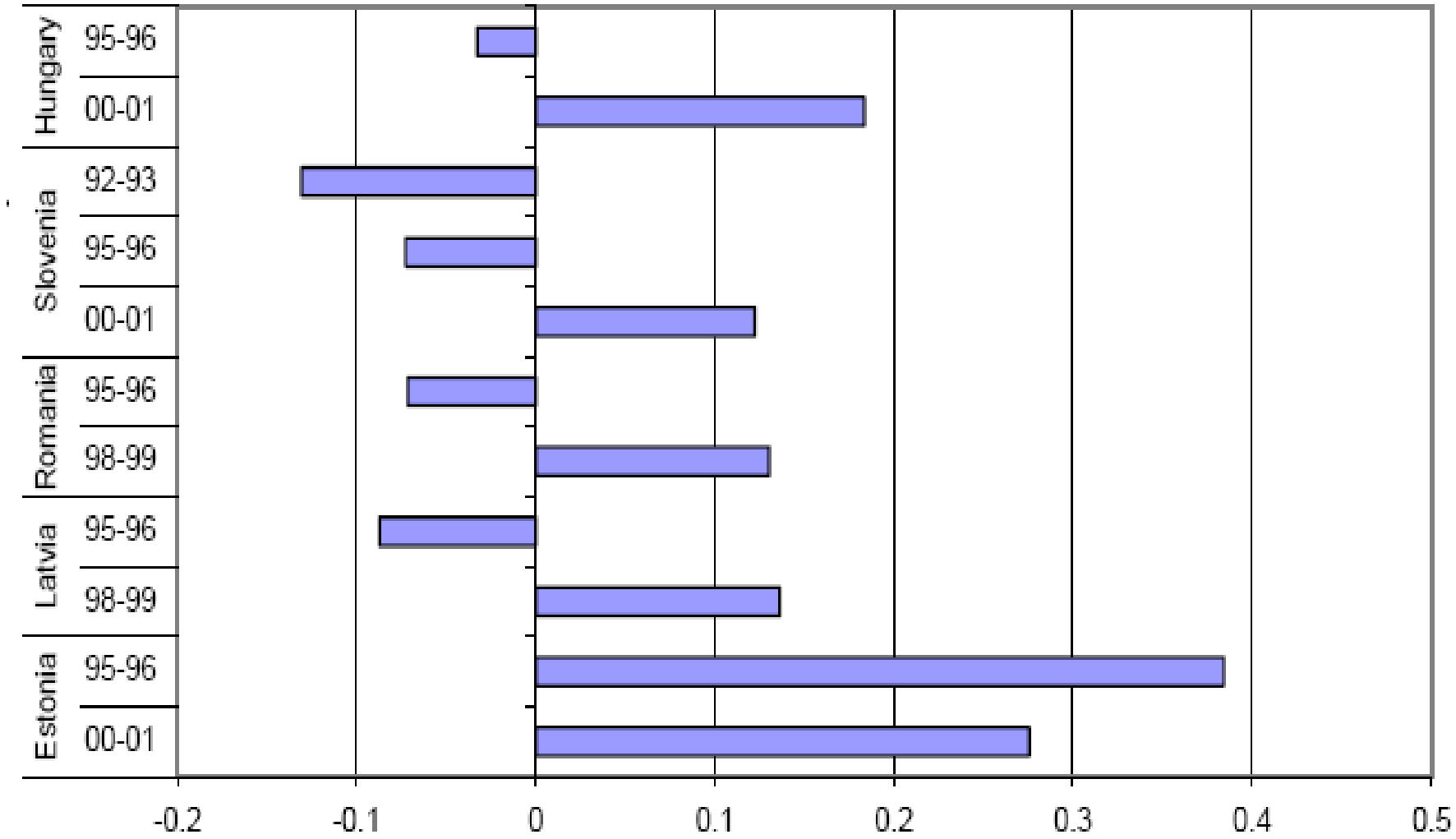
Productivity and Factor Market Flexibility

Productivity growth through reallocation also relies on the ability of the market to move productive factors (inputs) toward higher-productivity producers

- Labor mkt. flexibility—workers can move to more efficient operations
- Capital mkt. flexibility—capital flows to efficiency

Productivity and Market Flexibility: Eastern Europe

Correlation between Productivity and Market Share



Productivity and Factor Market Flexibility: Indian Textiles

Bloom, Eifert, Mahajan, McKenzie, and Roberts (2013):

Sample of cotton textile manufacturers in Mumbai

Found that the best single predictor of firm size was not productivity

Instead, it was owner's number of close male relatives

What does this say about factor allocation processes in this market?

Productivity and Factor Market Flexibility: Indian Textiles

Product market and factor market flexibility are complements in raising productivity

All the product market competition/substitutability/etc in the world won't matter if factor markets are totally stuck

Similarly, having frictionless factor markets won't matter if product markets are gummed up

Recap

Two facts imply reallocation can increase industry- and economy-wide productivity:

1. Large dispersion in productivity across producers, even in narrowly defined markets
2. Productivity is correlated with growth and survival

Reallocation can work regardless of sources of productivity differences

Many things can influence how well reallocation works

- Flexibility (e.g. competition) in product markets
- Flexibility (e.g. competition) in input markets
- These are complements