Exploiting Management To Raise Productivity

Remarks by Steven J. Davis

Bank of Portugal Conference in Honour of José Silva Lopes
Lisbon, 14 December 2015
Introduction

Labor productivity in Portugal is slightly more than half of French and German levels. This simple comparison underscores the enormous room for improvement.

My remarks today focus on one potential source of higher productivity: better management practices. As I will show, management practices vary greatly across countries and businesses, and better practices correlate closely with higher productivity.

Of course, correlation is not causality. That leads to some key questions:
• Do better management practices actually raise productivity?
• If so, how?
• And, how can we foster better management to raise productivity?

I will discuss two recent studies that throw some light on these questions. I will also argue that product market competition promotes good management practices and high productivity. If time permits, I will touch briefly on the role of business education in diffusing good management practices.

These issues are subtle and challenging, and they remain at the forefront of research. So you should treat my remarks as an interim report, rather than a full and final set of answers. That said, we – meaning the economics profession – have learned a great deal about these issues in recent years. In closing, I will gather some lessons for policy makers and citizens who want to raise productivity.
I. Measuring (Certain) Management Practices

Based on Bloom and Van Reenen (2007) and Bloom, Sadun and Van Reenen (2015)
World Management Survey (WMS)

15,400 phone interviews of plant managers in 35 countries. Manufacturing firms with 50 to 5,000 workers, random sampling of firms within country, largest plant of firm.

Includes 410 Interviews of Manufacturing Plants in Portugal

This map does not reflect all WMS waves.
How Does the Survey Work?

45-minute phone interview of plant manager, designed to create a scorecard for 18 practices that pertain to management practices in three broad areas:

**Monitoring:** How well does the company track its own activities and use the information to improve processes?

**Target Setting:** Does the company set targets, track outcomes, and respond appropriately when the two are inconsistent?

**Incentives and People Management:** Does the company promote and reward employees based on performance and systematically seek to hire and keep the best employees?
How Does the Survey Work?

• Double-blind interview technique:
  – Interviewers not informed in advance about performance of firms in the sample.
  – Managers don’t know they are being scored, and don’t see the management practices scorecard.
  – Managers told they are being “interviewed about management practices for a piece of work”

• Open-ended questions: For example, inquiry of monitoring practices starts with “Tell me how you monitor your production process” rather than “Do you monitor your production process daily? [yes/no]?”
**How Does the Survey Work?**

**Scoring example:**

Interviewer asks an open-ended question, e.g.:

> “How does the promotion system work?”

Based on the plant manager’s response to this and follow-up questions, interviewer assigns a score on a 5-point scale (omitting scores 2 and 4 for brevity):

<table>
<thead>
<tr>
<th>Score</th>
<th>(1) People are promoted primarily on the basis of tenure, irrespective of performance (ability &amp; effort)</th>
<th>(3) People are promoted primarily upon the basis of performance</th>
<th>(5) We actively identify, develop and promote our top performers</th>
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<td>5</td>
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</tbody>
</table>
How Does the Survey Work?

• Random sampling of mfg. firms with 50 to 5,000 workers. Interview manager of firm’s largest plant.


• 15,400 interviews, with 3,000 repeat panel interviews.

• Financial and economic performance measures from other sources.

• Response rate of 44%. Little correlation of response with independently obtained performance measures.

• See Bloom and Van Reenen (2007) and Bloom, Sadun and Van Reenen (2015) for more information.
II. Better Management Practices Are Strongly Associated With Greater Productivity And Higher Real Incomes

Based on Bloom, Sadun And Van Reenen (2015)
Management Practice Scores and Real GDP Per Capita

**Note:** Using management scores from 15,454 interviews in the World Management Survey. Management practices are scored on a 1 to 5 scale for 18 question, averaged over questions for the firm and then across firms for the country. GDP data on a PPP basis for 2013 from the IMF World Economic Outlook.

**Source:** Bloom, Sadun and Van Reenen (2015) = BSVR (2015)
Other Key Patterns in the WMS

• Firm performance rises with management scores in all countries → results not due to an “anglo-saxon” slant on what makes for “good” management.

• Monotonic positive relationship between firm-level performance and management scores → suggests basic management practices are “good” broadly.
  – Analysis in BSVR (2015) reinforces this conclusion.

• Multinationals have stronger management practices in all 35 countries.

• Wide dispersion of management scores in all countries.

• Many poorly managed firms, especially in middle and lower income countries.
WMS Management Practice Scores and Firm Performance

Note: Raw means of firm-level performance metrics, clockwise: log(employees), log(sales/employees), total factor productivity (sample normalized to zero), 5-year growth rates of employment, return on capital employed (ROCE) and Tobin’s Q. Values only shown where appropriate, for example, stock value only for publicly listed firms and ROCE only for firms with accounting data.

Management Practice Scores Across Firms by Country

Firm level average management scores, 1 (worst practice) to 5 (best practice)

Note: Bars are the histogram of the actual density. 15,454 surveys
Does management cause performance differences between firms and countries?

Massive literature of case-studies and surveys but no consensus

Syverson (2011, JEL) “no potential driving factor of productivity has seen a higher ratio of speculation to empirical study”.
Two Recent Studies

   – A field experiment involving free, intensive management consulting to large textile plants near Mumbai with 70 to 500 employees and average annual sales of US$ 7 million.

III. Experimental Study Of Indian Textile Plants
Large textile plants near Mumbai, randomized into treatment (improved management) & control groups: **14 treated plants and 6 control plants**
How Did the Study Work?

• **Diagnostic visits** (15 days over four weeks) by consulting teams to the 20 experimental plants covered by the study.

• **Purpose:** Evaluate 38 management practices in 5 broad areas:
  
  – **Factory Operations:** maintenance, breakdown records, floor layout, …
  
  – **Quality Control:** recording and analyzing defects and quality problems, formalizing defect reduction, …
  
  – **Inventory:** Sorting, labeling, daily monitoring, optimal inventory levels, tracking of information on computers, …
  
  – **Human Resources Management:** Job descriptions, performance-based incentives, …
  
  – **Sales and Orders:** Tracking production at the order level, prioritizing orders, pricing to order-level costs, …
How Did the Study Work?

• **Implementation Phase:** Additional visits to the 14 treatment plants for another four months (3 or 4 days per week).

• **Goal:** Based on diagnostics, introduce key management practices at treatment plants, try to persuade management to adopt them, and assist with adoption.

• **Measurement:** Track plant-level outcomes daily or weekly:
  – Productivity (output per worker)
  – Defect rates
  – Inventory levels and spoilage/loss
  – Energy use

• **How Much Consulting?** An average of 781 hours for 14 treatment plants and 273 hours for 6 control plants.
Inventory Control: Before
After Organizing and racking inventory lets plants reduce stock, cut spoilage and speed up retrieval.

Stock is organized, labeled, and entered into the computer with details of the type, age and location.
Factory operations: **Before**
Factory operations: After
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### WARP PATTERN

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<td>5-A</td>
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**Bolt** Dust

26 Dec 100 5001
Before
Mending recorded only to cross-check against customers’ claims for rebates

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<td>2000</td>
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S. Morden 314 E. 12th St. W. 916-555-1234
After mending recorded daily in a standard format, so it can analyzed by loom, shift, design & weaver.
After Factory information
Simple management improvements increased productivity by 20% within 1 year

Weeks after the start of the management experiment

Productivity (output per worker)

Control plants

Treatment plants

Start of Diagnostic

Start of Implementation

End of Implementation
How? Many factors. One source of productivity gain was a sharp reduction in defect rates.
Some Lessons

• Management practices are improvable
• Better management practices raise productivity – a lot in this setting!
• Cost-Benefit test: Average profitability gain of $300K (first year); $75K average intervention cost, $200K at market prices
• $20K cost per non-treatment plant
• Smaller improvements at untreated plants of firms with a treated plant.
• Owners initially skeptical about value of changes in management practices.
Caveats and Questions

• Can sizable productivity gains be achieved with less intensive treatments and lower quality consulting inputs?
• External validity: How much does this study tell us about potential gains from improved management practices in other settings and more developed economies?
• Karlan et al. (2012) review other experimental studies of management practice interventions, mostly on micro enterprises. Results are mixed.
Why do badly managed firms survive (in India)?

Weak Contracting Regime/Low Trust
- When delegation involves high risk of theft, good managers cannot exercise wide span of control
- Some evidence: textile firm size is much more correlated with # of male family members of working age than management practice scores

Limited Information: Firms unaware of good management practices, don’t believe they matter enough (“not worth it”), or can’t distinguish good management consultants/educators from quacks.
Why do badly managed firms survive (in India)?

Impediments to Competition:
• Entry barriers (e.g., remnants of Raj licensing)
• Expansion barriers (onerous regs on large firms)
• Barriers to international trade and multinationals
• Poor infrastructure, limiting the extent of the market and the power of competitive forces

Education: Low average level of managerial skills

Financing: Good firms with good managers cannot obtain financing (on reasonable terms)

Cronyism: Political connections and ability to navigate regulatory system, not managerial quality, determine “winners” and losers
IV. Quasi-Experimental Study Of U.S. Private Equity Buyouts
Private Equity Buyouts

• Controlling equity stakes in target firms by professionally managed partnerships (PE)
  – PE group exercises significant oversight until “exit.”
  – Most PE buyouts in the U.S. are highly leveraged.
  – Most involve family-owned or other private firms.
  – Some involve a change in management, some do not.

• We focus on mature and later-stage target firms – i.e., excluding VC-backed firms.

• Short-hand: “Leveraged buyouts,” “LBOs,” or “buyouts.”
Rough calculation: More than 7% of private sector jobs came under control of private equity (via buyouts) at some point from 1998 to 2007.
Private Equity Buyouts: A Politically Charged Issue

“`leveraged buy-outs’ leave the company saddled with debt and interest payments, its workers are laid off, and its assets are sold, ... benefiting neither workers nor the real economy.”

Empirical Method

1. Compare U.S. PE targets to controls defined in terms of industry, size, age, and multi-unit status
   - 2,265 target firms, operating 103,671 establishments in buyout years from 1980 to 2003.
   - Matched to universe of firms and establishments in the United States → millions of annual observations on control firms and establishments.
   - Follow targets and controls before and after buyout.

2. Quantify productivity (TFP) effects. Isolate TFP changes within production units and the effects of reallocation across units.
What Do We Find for Jobs?

1. Target firms destroy and create more new jobs post buyout relative to controls.
   - Sum of extra job gains and losses (over two years) = 14% of initial employment
     - Computed as gross establishment-level job gains and losses, then aggregated to firm level
     - Nearly half of extra job reallocation reflects organic changes, and the rest reflects greater A&D activity by target firms
     - The acceleration of job reallocation after buyout holds across industries and types of PE buyouts.
   - Net job loss is modest: about 1% of initial employment over two years at targets relative to controls
     - But larger net job losses in Retail and Services, and ≈0 net effect on jobs in Manufacturing.
What Do We Find for Productivity?

2. PE buyouts raise TFP growth (Manufacturing)

– Total factor productivity (TFP) growth rises by 2 percentage points at target firms relative to controls over the first two years post buyout. The baseline TFP growth of controls is -0.4 percent.

– Three-quarters of the TFP growth effect works through plant entry and exit margins:
  
  • PE-owned firms are 50% more likely to close low-TFP plants (“low” = bottom tercile of own-industry TFP distribution)
  
  • PE-owned firms are twice as likely to open new plants in the top third of the TFP distribution
  
  • On average, new plants opened by PE-owned firms are 25% more productive than those opened by control firms
  
  • In short, job creation and destruction at PE targets is better directed to raise firm-level TFP
Some Lessons

• Productivity gains in our study reflect reallocation from low-TFP to high-TFP plants within target firms, as compared to control firms.

• This result points to better management skills and/or better incentives around investment and plant selection decisions at PE-owned firms.

• This source of productivity gains is completely unlike the source of gains in the Indian textile study.
Caveats and Questions

- Some studies also find operational improvements in continuing units
  - See, for example, Cohn and Towery (2013) and Bernstein and Sheen (2014).
  - A focus of some of my work underway.
- Some studies find an important PE role in relaxing financing constraints at targets
- Some evidence that PE raises profitability of target firms by lowering their taxes. (US tax code treats debt more favorably than equity financing.) See Kaplan (1989).
Caveats and Questions

• External validity:
  • PE business model differs across countries.
  • Some studies (outside US) find that PE buyouts help already-efficient firms grow faster by relaxing financing constraints

• PE-induced “Creative destruction” elicits strong political resistance

• Buyouts are expensive – they involve intensive use of highly-priced inputs

• Better ways to achieve the benefits of an active market for corporate control?
V. The Role Of Competition

“Monopoly, besides, is a great enemy to good management... [Universal] competition ... forces everybody to have recourse to [good management] for the sake of self-defence.”

Adam Smith, *The Wealth of Nations*, Book 1, Chapter 11.
Product Market Competition And Management Quality

Greater competition improves management quality through several channels, including:

1. Selection on the Exit Margin: Lower prices in competitive markets make it harder for poorly managed firms to cover costs and survive.
   • Olley and Pakes (1996, telecom deregulation) and Syverson (2004, cross-market comparisons in ready-mix concrete) find strong evidence for this effect.
   • There is also much evidence that trade cost reductions induce exit of the least-productive firms and plants. High-quality studies include Pavcnik (2002) for Chile and Bernard et al. (2006) for the USA.
2. **Reallocation (among continuing units):** Greater competition encourages the flow of inputs to more productive, presumably better managed, firms. This reallocation effect raises industry productivity. Evidence:

- Trade cost reductions spur reallocation to more productive plants (e.g., Pavcnik, 2002, Eslava et al., 2004, Bernard et al., 2006, and Bloom et al., 2011).
- Highly competitive big-box retail chains with superior management practices (Wal-Mart, Target) displaced less efficient independents, bringing large productivity gains in US retail (Foster et al., 2006).
Product Market Competition And Management Quality

- A (legal) U.S. sugar cartel led to large misallocations, lowering industry productivity (Schmitz, 2012).
- Studies for several countries find that industries with greater product substitutability exhibit less between-establishment productivity dispersion, consistent with the implications of the selection and reallocation effects of competition. See Syverson (2011).
- BSVR (2015) find that countries differ greatly in how well they allocate production to the best-managed firms, echoing related findings about the role of factor misallocation as a major source of productivity differences across countries (e.g., Bartlesman et al., 2009, Hsieh and Klenow, 2009, Kalemli & Sorensen, 2012).
3. **Incentives:** Greater competition (in the form of more product substitutability) increases the sensitivity of a firm’s profits to its productivity, raising the return to investments in good management practices. Competition can also improve management by taming agency conflicts. Greater competition can also weaken the incentives to improve management practices under plausible conditions, as discussed in the additional slides. So the incentive effects of competition on managerial quality is an empirical issue.
Empirically, the incentive effects of greater competition on management quality and productivity are predominantly positive. Examples:

- More competition, in the form of exogenously greater local hospital numbers, yields better management quality and patient outcomes in the U.K. health care sector (Bloom et al., 2015)
- Intensified competitive pressures in the North American iron ore industry led to dramatic productivity gains by prompting reforms in work practices (Schmitz, 2005)
Product Market Competition And Management Quality

• Greater import competition upon China’s accession to the WTO led to better management practices and higher TFP in (surviving) European firms, as well as higher patent rates and more R&D (Bloom, Draca and Van Reenen, 2011).

• Plants with more (self-reported) competitors have higher management scores in the WMS (BSVR, 2015). This result is not limited to plants near the exit margin, suggesting it is not simply a selection effect.
Product Market Competition And Management Quality

The following studies find competition-induced productivity gains within continuing units, consistent with the view that competition provides incentives to improve managerial practices. These studies do not identify the precise channels through which competition spurred productivity gains. Better management is likely only one channel in play.

- Trade cost reductions led to plant-level productivity gains in U.S. manufacturing (Bernard et al., 2006).
- FDI liberalization and tariff reductions in India led to plant-level productivity gains (Sivadasan, 2009).
- Trade liberalization in Chile led to plant-level productivity gains (Pavcnik, 2002).
Product Market Competition And Management Quality

- Regulatory reforms that intensified competition led to operating efficiency gains in European airlines (Ng and Seabright, 2001) and U.S. electricity generation (Markiewicz et al., 2007)
- More competitive environments are associated with higher productivity and production growth in U.K. manufacturing industries (Nickell 1996).
VI. The Role of Business Education
1. Individuals (and employers) pay handsome sums and forego considerable income to attend business schools in countries around the world.
   - This fact indicates that business schools impart useful management skills.
   - Networking benefits are also important, and they are distinct from instruction in management skills.
   - “Signaling” is an implausible interpretation of the business school phenomenon, in view of the large costs involved. Out-of-pocket costs plus foregone income exceed $250K for students who attend leading U.S. business schools. Surely, there are cheaper ways to signal.
2. The Indian textile study testifies to the usefulness of education about basic management practices.

3. The study of U.S. private equity buyouts points indirectly to the usefulness of business education. PE firms routinely recruit from leading business schools.

4. Looking across firms in the WMS, and conditional on many potential confounders, BSVR (2015) find:
   • Management scores rise in the percent of college-educated managers at the firm.
   • Management scores are higher for plants located closer to universities and business schools.
VII. Fostering Better Management to Raise Productivity: Six Lessons
Six Lessons

1. **(Efficient) Rule of Law:** Competent, impartial judges and cost-effective enforcement enable owners to appoint good managers and let the best managers and best-managed firms exercise a wide span of control.

2. **Competitive Product Markets:** Competition selects against poorly managed firms, intensifies incentives to improve management quality, and increases the market share of the best-managed firms. Policy levers include:
   - Business licensing and zoning rules
   - Other regulations that inhibit/facilitate entry and expansion
   - Trade policies

3. **Transport Infrastructure:** Efficient transport systems promote competition and good management.
4. **Flexible Factor Markets**: Let labor and capital migrate to the best-managed firms, and let firms adopt efficient work practices. Policies that inhibit or misdirect the flow of workers, jobs and capital undermine the potential benefits of competitive product markets.

5. **Corporate Control**: An effective market for CC helps to displace or upgrade low-quality management and to spread good management practices.

6. **Education**: Raising the average level of management quality is also important:
   - Business schools
   - Multinationals (e.g., via openness to FDI)
   - Business groups that diffuse best practices
* “Flexible factor markets” involve a complex set of economic and policy issues that I won’t try to unpack today. That would require another speech. Here, I simply want to note that efforts to foster better management practices (and to achieve higher productivity as a result) are likely to yield greater benefits when (a) factor inputs are free to migrate to their best uses, and (b) firms are free to organize work practices efficiently.
Additional Slides –
Not for Prepared Remarks
Additional Slides Pertaining to The World Management Survey
Management Practice Scores and Firm Performance
Sample: All WMS firms with reliable performance data

Source: BSVR (2015)

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General controls: Yes, No
Firm FE: No, No, No, No, No
Observations: 12146, 10900, 12578, 11291, 6572

Note: OLS estimation using the combined management-accounting panel data from 2004 to 2014. Standard errors in parentheses, with clustering by firm. *** denotes 1%, ** denotes 5%, and * denotes 10% significance. “Management” is the firm’s normalized z-score of management (the average of the z-scores across all 18 questions, normalized to then have itself a mean of 0 and standard-deviation of 1). “Profitability” is “Return on Capital Employed” (ROCE) and “5 year Sales growth” is the difference between current and 5-year lagged logged sales. “Tobin’s Q” is the firm’s ratio of (stock-market equity plus book value of debt) to its book value, available for publicly listed firms only. “General controls” are firm-level controls for average hours worked and the proportion of employees with college degrees (from the survey) plus a set of survey noise controls: interviewer dummies, the seniority and tenure of the manager who responded, the time, duration and day of the week of the interview, and an indicator of the reliability of the information as coded by the interviewer.
Figure 13: Management and Multinationals

Note: Show the management scores for the 15,454 interviews across the countries in the WMS survey. Management is scored on a 1 to 5 basis for 18 questions. Competition from a self-reported question “How many competitors do you face?”

<table>
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<tbody>
<tr>
<td>United States</td>
<td>3.2</td>
</tr>
<tr>
<td>Japan</td>
<td>3.0</td>
</tr>
<tr>
<td>Germany</td>
<td>2.8</td>
</tr>
<tr>
<td>Sweden</td>
<td>2.6</td>
</tr>
<tr>
<td>Canada</td>
<td>2.5</td>
</tr>
<tr>
<td>Great Britain</td>
<td>2.4</td>
</tr>
<tr>
<td>France</td>
<td>2.3</td>
</tr>
<tr>
<td>Italy</td>
<td>2.2</td>
</tr>
<tr>
<td>Australia</td>
<td>2.1</td>
</tr>
<tr>
<td>Singapore</td>
<td>2.0</td>
</tr>
<tr>
<td>Mexico</td>
<td>1.9</td>
</tr>
<tr>
<td>Poland</td>
<td>1.8</td>
</tr>
<tr>
<td>Portugal</td>
<td>1.7</td>
</tr>
<tr>
<td>New Zealand</td>
<td>1.6</td>
</tr>
<tr>
<td>Turkey</td>
<td>1.5</td>
</tr>
<tr>
<td>China</td>
<td>1.4</td>
</tr>
<tr>
<td>Chile</td>
<td>1.3</td>
</tr>
<tr>
<td>Greece</td>
<td>1.2</td>
</tr>
<tr>
<td>Spain</td>
<td>1.1</td>
</tr>
<tr>
<td>India</td>
<td>1.0</td>
</tr>
<tr>
<td>Brazil</td>
<td>0.9</td>
</tr>
<tr>
<td>Colombia</td>
<td>0.8</td>
</tr>
<tr>
<td>Vietnam</td>
<td>0.7</td>
</tr>
<tr>
<td>Argentina</td>
<td>0.6</td>
</tr>
<tr>
<td>Northern Ireland</td>
<td>0.5</td>
</tr>
<tr>
<td>Myanmar</td>
<td>0.4</td>
</tr>
<tr>
<td>Republic of Ireland</td>
<td>0.3</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Source: BSVR (2015)
Management Scores and Self-Reported Competition in WMS

Source: BSVR (2015)

**Note:** Show the management scores for the 15,454 interviews across the countries in the WMS survey. Management is scored on a 1 to 5 basis for 18 questions. Competition from a self-reported question “How many competitors do you face?”
Management and Education in the WMS

Note: Show the management scores for the 15,454 interviews across the countries in the WMS survey. Management is scored on a 1 to 5 basis for 18 questions. Education is based on the questions “What share of [non] managers has a degree”?

Source: BSVR (2015)
Note: Show the management scores for the 15,454 interviews across the countries in the WMS survey. Management is scored on a 1 to 5 basis for 18 questions. One ownership category called “Other” is omitted which contains 660 firms with a wide variety of ownership forms like employee coops, foundations, and unknown.

Source: BSVR (2015)
Management Quality and Plant-Level Performance In U.S. Manufacturing, Using a Different Source Of Data on Management Practice Scores
Figure 8: Management Practice Scores Across Plants (US Census sample)

Note: Shows performance metrics for establishments from a sample of 31,673 US establishments. For more details see “Management in America” by Bloom et al. (2013) [http://web.stanford.edu/~nbloom/MIA.pdf]
Additional Slides Pertaining to The Indian Textile Plant Study
Before treatment, 19% of manpower went to repairs

Large room full of repair workers (the day shift)

Workers spread cloth over lighted plates to spot defects

Defects are repaired by hand or cut out from cloth

Defects lead to about 5% of cloth being scrapped
After treatment, quality data collated and analyzed as part of new daily production meetings.

Plant managers meet with heads of departments for quality, inventory, weaving, maintenance, warping etc.
Daily performance boards were also put up, with incentive pay for employees based on this.
Spare parts were also organized, reducing downtime (parts can be found quickly)
Adoption of the 38 management practices over time

Share of 38 practices adopted

-10 -8 -6 -4 -2 0 2 4 6 8 10 12

Months after the start of the diagnostic phase

Treatment plants
Control plants
Non-experimental plants in treatment firms
Additional Slides Pertaining to The U.S. Private Equity Study
3. Private equity buyouts reduce annual Earnings per worker (EPW)

- EPW declines by about 4% at target firms relative to controls over two years post buyout.
- EPW effect works mainly through declines at continuing establishments, secondarily through a greater propensity of target firms to divest establishments with high EPW.
- PE firms are NOT more likely to close facilities with high EPW.
4. Large positive effects (on average) of PE buyouts on net operating margins:

- TFP results \(\rightarrow\) buyouts improve operating margins by about 2 percentage points over two years
- Earnings per worker results \(\rightarrow\) another 2 percentage point improvement in operating margins, assuming a 50% labor cost share

\(\rightarrow\) Operating margins rise by 4 percentage points
- Resulting profitability gains are magnified in their effect on earning per share by highly levered capital structures at buyout targets
Total Factor Productivity (TFP)

Total Factor Productivity (TFP) refers to the efficiency of production activity. It is measured as the “residual” after accounting for the contributions of measured capital, labor, materials and other inputs.

Given suitable data, TFP can be measured at any level of aggregation: production team, establishment, firm, industry or country.
Measuring Plant-Level TFP

\[ \ln TFP_{it} = \ln Q_{it} - \alpha_K \ln K_{it} - \alpha_L \ln L_{it} - \alpha_M \ln M_{it} \]

- Output = shipments + inventory change, deflated by industry-level price index
- Capital measured separately for equipment and structures by perpetual inventory methods
- Labor = total hours of all workers
- Energy and other materials measured and deflated separately
- Elasticities = cost shares in same year & industry (4-digit SIC or 6-digit NAICS)
### A. Plant Exit Probabilities in the First Two Years Post Buyout (Logistic Specification)

<table>
<thead>
<tr>
<th>Location in Own-Industry TFP Distribution as of the Buyout Year t</th>
<th>Probability of Plant Exit by Year t+2</th>
<th>P-value for Difference Between Targets and Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Targets</td>
<td>Controls</td>
<td></td>
</tr>
<tr>
<td>Bottom Tercile</td>
<td>0.143 (0.023)</td>
<td>0.091 (0.002)</td>
</tr>
<tr>
<td>Middle Tercile</td>
<td>0.112 (0.034)</td>
<td>0.062 (0.002)</td>
</tr>
<tr>
<td>Top Tercile</td>
<td>0.078 (0.015)</td>
<td>0.067 (0.002)</td>
</tr>
</tbody>
</table>

### B. Plant Entry Probabilities in the First Two Years Post Buyout (Logistic Specification)

<table>
<thead>
<tr>
<th>Location in Own-Industry TFP Distribution in t+2, Two Years After Buyout</th>
<th>Probability that a Plant Operating in t+2 Entered in t+1 or t+2</th>
<th>P-value for Difference Between Targets and Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Targets</td>
<td>Controls</td>
<td></td>
</tr>
<tr>
<td>Bottom Tercile</td>
<td>0.056 (0.015)</td>
<td>0.121 (0.006)</td>
</tr>
<tr>
<td>Middle Tercile</td>
<td>0.071 (0.016)</td>
<td>0.078 (0.003)</td>
</tr>
<tr>
<td>Top Tercile</td>
<td>0.127 (0.029)</td>
<td>0.072 (0.003)</td>
</tr>
</tbody>
</table>

Logistic regressions with propensity weights to adjust for sampling.
Table 9: Productivity of Target and Control Plants, Buyouts in Manufacturing from 1980 to 2003

A. TFP In Buyout Year \( t \) by Plant Status in Year \( t+2 \)

<table>
<thead>
<tr>
<th>Plant Status</th>
<th>Targets</th>
<th>Controls</th>
<th>P-Value for Difference Between Targets and Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuers</td>
<td>0.016 ( (0.012) )</td>
<td>Omitted Group</td>
<td>0.180</td>
</tr>
<tr>
<td>Exits</td>
<td>-0.075 ( (0.035) )</td>
<td>-0.032 ( (0.008) )</td>
<td>0.232</td>
</tr>
<tr>
<td>Divestitures</td>
<td>-0.023 ( (0.027) )</td>
<td>-0.044 ( (0.007) )</td>
<td>0.462</td>
</tr>
<tr>
<td>R-Squared</td>
<td>0.538</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
- OLS regressions with propensity weights set to reciprocal of model-implied sample-inclusion probabilities
- Specifications include industry-year effects and firm size and age effects
- Sample of about 107,000 establishments, including 2,050 targets.
Table 9: Productivity of Target and Control Plants, Buyouts in Manufacturing from 1980 to 2003

<table>
<thead>
<tr>
<th>Plant Status</th>
<th>Targets</th>
<th>Controls</th>
<th>P-Value for Difference Between Targets and Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuers</td>
<td>0.020</td>
<td>Omitted Group</td>
<td>0.076</td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entrants</td>
<td>0.182</td>
<td>-0.039</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>(0.055)</td>
<td>(0.011)</td>
<td></td>
</tr>
<tr>
<td>Acquisitions</td>
<td>-0.010</td>
<td>-0.030</td>
<td>0.668</td>
</tr>
<tr>
<td></td>
<td>(0.047)</td>
<td>(0.007)</td>
<td></td>
</tr>
<tr>
<td>R-Squared</td>
<td>0.523</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Productivity of Target and Control Plants, Buyouts in Manufacturing from 1980 to 2003

Table 9

<table>
<thead>
<tr>
<th>Dependent Variable: Change in Plant-level Log TFP from Buyout Year $t$ to $t+2$</th>
<th>Targets</th>
<th>Controls</th>
<th>P-Value for Difference Between Targets and Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuers</td>
<td>0.001</td>
<td>Omitted Group</td>
<td>0.954</td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-Squared</td>
<td>0.071</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

No discernable difference between continuing target and control plants in post-buyout TFP growth.
Overall TFP Effect: Putting the Pieces Together

Consider the difference-in-difference $\Delta P_t - \Delta \tilde{P}_t$, where

$$\Delta P_t = \left[ S_{t+2}^C P_{t+2}^C - S_t^C P_t^C \right] + \left[ S_{t+2}^N P_{t+2}^N - S_t^X P_t^X \right] + \left[ S_{t+2}^A P_{t+2}^A - S_t^D P_t^D \right]$$

is the average two-year change in TFP among target firms, and

- $S$ denotes an employment share,
- $P$ denotes a TFP value
- $C, N, X, A$ and $D$ denote continuers, entrants, exits, acquisitions, and divestitures, respectively.

For example, $P_{t+2}^C$ is the average TFP among continuing target plants two years post buyout, where each plant’s TFP is expressed as a deviation from mean log TFP in the same industry-year cell. Define $\Delta \tilde{P}_t$ for controls firms analogously.
New Decomposition of TFP Changes

Now express the TFP terms as deviations about same-year TFP values for control continuers, cancel terms in $\Delta P_t - \Delta \tilde{P}_t$, and rearrange to obtain:

$$\Delta P_t - \Delta \tilde{P}_t = S_{t+2}^C \left( P_{t+2}^C - \tilde{P}_{t+2}^C \right) - S_t^C \left( P_t^C - \tilde{P}_t^C \right)$$

$$+ S_{t+2}^N \left( P_{t+2}^N - \tilde{P}_{t+2}^N \right) - S_t^N \left( \tilde{P}_{t+2}^N - \tilde{P}_{t+2}^C \right) - S_t^X \left( P_t^X - \tilde{P}_t^C \right) + \tilde{S}_t^X \left( \tilde{P}_t^X - \tilde{P}_t^C \right)$$

$$+ S_{t+2}^A \left( P_{t+2}^A - \tilde{P}_{t+2}^C \right) - \tilde{S}_{t+2} \left( \tilde{P}_{t+2}^A - \tilde{P}_{t+2}^C \right) - S_t^D \left( P_t^D - \tilde{P}_t^C \right) + \tilde{S}_t^D \left( \tilde{P}_t^D - \tilde{P}_t^C \right)$$

The “S” terms in this decomposition follow from the manufacturing analog to Table 6. The terms in parentheses can be read directly from the diff-in-diff estimates in Table 9.
Attractive Features of the TFP Change Decomposition

1. It shows how to combine diff-in-diff estimates of PE effects with a simple accounting relationship often used in research on firm-level productivity dynamics.

2. The decomposition sidesteps any need to compare TFP across industries or years – all productivity terms involve plant-level TFP deviations about same industry-year means.
## Overall Effects of Buyouts on TFP Growth

### Table 10. Impact of Private Equity Buyouts on Total Factor Productivity in the Manufacturing Sector, Buyouts from 1980 to 2003

Estimated Average Two-Year Post-Buyout Change in TFP at Target Firms Relative to Controls, Log Points

<table>
<thead>
<tr>
<th>TFP Log Change Differential</th>
<th>2.14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excluding Acquisitions &amp; Divestitures</td>
<td>2.01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Share of Total TFP Two-Year Change Differential By Margin of Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuing Establishments</td>
</tr>
<tr>
<td>Entry and Exit</td>
</tr>
<tr>
<td>Acquisitions and Divestitures</td>
</tr>
</tbody>
</table>

Baseline TFP growth for control continuers = -0.38
Buyout targets also divest establishments with high EPW (relative to control continuers), whereas controls do not.

Applying above decomposition to EPW results reveals that unit labor input costs decline by 4.0 log points for target firms (relative to control firms) over two years post buyout, mainly due to EPW reductions at continuing establishments and secondarily due to greater propensity to divest high EPW establishments.
Additional Slides Pertaining to The Effects of Competition on Management Quality
Product Market Competition, Incentives, And Management Quality

1. The textbook static theory of producer behavior implies that firms minimize costs regardless of product market competition → no scope for competition to alter managerial practices within firms and production units.

2. Some theories in the Schumpeterian mold imply that monopoly profits provide essential incentives for innovation, including innovations in managerial practices. These theories suggest that too much competition can retard improvements in managerial practices. See Vives (2008).
3. Similarly, Rodrik (1991) notes that trade liberalization can reduce the incentive of domestic firms to invest in cost-cutting efforts by reducing their market shares,

4. The broader relationship between competition and incentives to innovate (including incentives to improve management practices) is complex. See, e.g., Arrow (1962), Gilbert and Newberry (1982), Vives (2006), Holmes et al. (2012) and Schmitz (2012).
5. As discussed in Nickell (1996), competition sharpens managerial incentives for good performance in some models with agency conflicts between owners and managers, but weakens them in others.

6. Willig (1987) presents an agency model that captures the idea that competition raises the sensitivity of profits to managerial performance. A higher elasticity of product demand leads the principal (owner) to induce more effort from the agent (manager), raising productivity.
7. But a fall in demand has the opposite effect in Willig’s model. So “more” competition induces better managerial performance only if the higher demand elasticity effect dominates the demand reduction effect. See, also, Baggs and de Bettignies (2007).
References


Sivadasan, Jagadeesh. 2009. “Barriers to Entry and Productivity: Evidence from India,” The B.E. Journal of Economic Analysis & Policy, 9 no. 1 (September)

