PRODUCTIVITY AND INNOVATION PROGRAMME

John Van Reenen (LSE)
CEP Conference
May 20th 2013
QUESTION: What are causes of productivity & growth?

1. Policies to restore growth
2. Management & organization
3. Technological innovation
4. Inclusive Growth
   - Environment (“green growth”)
   - Inequality
POLICIES TO RESTORE GROWTH

• UK Productivity Gap longstanding problem, but since crisis big falls in GDP per worker
• LSE Growth Commission (Pessao, Bagaria, Valero)
• IFS/CEP Working Group on Jobs & Productivity Puzzle
• Austerity debate (Bagaria & NIESR)
• Eurozone crisis (Garicano)
• Finance (Roland, Bell)
MANAGEMENT AND FIRM ORGANIZATION

• Understanding heterogeneity critical
  – Theory of firm & cross-country success (Bloom & Sadun: next presentation)
  – Creating a data infrastructure (Lemos, Scur, Homkes WMS survey work); MOPs, MOI
  – Human Capital (Feng & Valero)
  – Experiments (India, China, EBRD, Growth Accelerator?)
  – Regulations (Lelarge, Garicano)
  – Public Sector (e.g. hospitals with Cooper & Seiler; JobCentres with Bagaria & Petrongolo)
TECHNOLOGICAL INNOVATION

• Spillovers
  – Methodology for identifying multi-dimensional
• Role of trade, especially from China
  – Draca empirics; Romer theory
• Intellectual Property
  – Schankerman
• Finance & governance (Aghion, Zingales)
• Military (Draca, Moretti, Steinwender)
INCLUSIVE GROWTH

• **Environment** (Martin)
  – Climate Change
  – Directed Technical Change
  – Policies to combat
    • ETS
    • Technology policies

• **Inequality**
  – Wages at the top & Role of Finance (Bell)
  – Trade (Pessao)
  – Regional Policy (Polat, Overman, Martin)
  – Assortative Mating (Machin)
  – Firm & worker heterogeneity (e.g. Rent-sharing)
MANAGEMENT AS A TECHNOLOGY?

Nick Bloom (Stanford), Raffaella Sadun (HBS) & John Van Reenen (LSE)
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MANAGEMENT AS A TECHNOLOGY?

Nick Bloom (Stanford), Raffaella Sadun (HBS) & John Van Reenen (LSE)
MOTIVATION

• Evidence of extensive firms & plant productivity heterogeneity in last 10-20 years

• Finding has influenced many fields: trade (e.g. Melitz, 2003), labor (e.g. Card, Heining & Kline, 2013), macro (Hsieh & Klenow, 2009), IO (e.g. Syverson, 2004), etc.

• This paper:
  – Productivity heterogeneity related to certain core management practices
  – Some management practices like a technology, not simply different contingent styles (“Management as Design”)

• Caveat: we are not looking at “strategic” management issues like leadership, M&A, advertising, innovation, etc.
PRODUCTIVITY DISPERSION

- Large cross sectional dispersion within countries
  - Within US SIC4, plant labor productivity $90^{th}-10^{th} \approx 4x$ (TFP $\approx 2x$). Syverson (2004, 2011).
  - Persistent Productivity Differences
  - Also find big productivity variation outside US, typically larger (Crisuolo & Martin for UK)

- **Is it all measurement problems? NO**
  - Robust to different methods of TFP estimation (Solow residual, Olley-Pakes, 1996; Blundell-Bond, 2000; Ackerberg et al, 2007)
  - Using plant-specific prices (Foster et al, 2009)
  - Other measures of firm performance (e.g. profitability, size, management quality, etc.) show wide variation
FIRM HETEROGENEITY HAS LONG BEEN RECOGNIZED

“...we have the phenomenon in every community and in every trade, in whatever state of the market, of some employers realizing no profits at all, while others are making fair profits; others, again, large profits; others, still, colossal profits.”

Francis Walker (Quarterly Journal of Economics, ‘87)
FIRM HETEROGENEITY HAS LONG BEEN RECOGNIZED

common in every community and in whatever state of the market, of some employers realizing no profits at all, while others are making large profits; others, still, colossal

Francis Walker (Quarterly Journal of Economics, 1887)
REASONS FOR FIRM HETEROGENEITY

• **TFP Heterogeneity due to “hard technologies”**
  – R&D, patents, diffusion of ICT (information and communication technologies), etc.

• **These hard technologies matter a lot, but:**
  – After controlling for technology, still a big TFP residual
  – E.g. Productivity effects of ICT depend on firm management/organization (e.g. Bresnahan, Brynjolfsson and Hitt, 2002, QJE; Bloom, Sadun & Van Reenen, 2012, AER)

• **Heterogeneity of management practices?**
  – Econometric tradition that fixed effects in production function = managerial ability (Mundlak, 1961)
  – Business case studies
SUMMARY OF PAPER

• Productivity differences related to management
• A simple model of Management as Technology (MAT) implies:
  – Positive effect of management on performance
  – Reallocation of output/jobs to better managed firms
    • Especially strong in US
    • Especially strong when labor regulations flexible, trade costs low & during big downturns
  – Competition improves average management quality
• Management accounts for up to $\frac{1}{2}$ of between country TFP differences (e.g. 30% of US-Greece difference)
Measuring Management

Management Models

Data Description

Empirics
1) Developing management questions
   • Scorecard for 18 monitoring (e.g. lean), targets & people (e.g. pay, promotions, retention and hiring). ≈45 minute phone interview of manufacturing plant managers

2) Obtaining unbiased comparable responses ("Double-blind")
   • Interviewers do not know the company’s performance
   • Managers are not informed (in advance) they are scored
   • Run from LSE, with same training and country rotation

3) Getting firms to participate in the interview
   • Introduced as “Lean-manufacturing” interview, no financials
   • Official Endorsement: Bundesbank, Bank of England, RBI, etc.
   • Run by 100 MBA types (loud, assertive & business experience)
<table>
<thead>
<tr>
<th>Score</th>
<th>(1): Measures tracked do not indicate directly if overall business objectives are being met. Certain processes aren’t tracked at all</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(3): Most key performance indicators are tracked formally. Tracking is overseen by senior management</td>
</tr>
<tr>
<td></td>
<td>(5): Performance is continuously tracked and communicated, both formally and informally, to all staff using a range of visual management tools</td>
</tr>
</tbody>
</table>

**Note:** All 18 questions and over 50 examples in Bloom & Van Reenen (2007) & Appendix D

[http://worldmanagementssurvey.org/](http://worldmanagementssurvey.org/)
Plant locations from World Management Survey (~8,000 firms, 3 major waves: 2004, 2006, 2009; 20 countries)

Medium sized manufacturing firms (50-5,000 workers, median≈250)

Now extended to Retail, Hospitals, Schools, Universities, NFPs, etc.

Extension to nearer population surveys (e.g. US MOPs)
Measuring Management

Management Models

Data Description

Empirics
ECONOMIC PERSPECTIVES ON MANAGEMENT

- **Management as Design**
  - Organizational Economics (Gibbons and Roberts HOE, 2013) e.g. Personnel Economics
  - Contingent management School (Woodward, 1958)
  - Optimal “styles” of management

- **Management as a Technology (MAT)**
  - Management a part of firm’s TFP
  - Consider simple model based on Bartelsman, Scarpetta & Haltiwanger (2013, AER), GE with firm heterogeneity (in productivity and distortions) & imperfect competition
  - Various extensions
SIMPLE FORMAL MODEL OF MAT

Timing

1. Entrepreneurial entry decision with sunk cost, $c_e$
2. If enter draw permanent management quality ($A_i$) from a known distribution. Also a transitory management $\varepsilon_{it}$ shock each period.
   - Distortions like regulations & corruption modelled symmetrically: $\tau_i + \kappa_{it}$
3. Firm (i) exits or (ii) produces & pays a fixed overhead labor cost, $f$
4. Firm chooses capital (cost of capital is $R$)
5. i.i.d. shocks to management ($\varepsilon_{it}$) & distortions ($\kappa_{it}$)
6. Firms choose variable labor, $n$ (wage is $w$)
THREE MAIN PREDICTIONS WE EXAMINE

1. Firm **performance** (e.g. Size, TFPQ, TFPR, labor productivity/LPR) increases in management quality \((M_{it} = A_i \epsilon_{it})\). From FOC, etc.

2. Average management quality is higher when **competition** is higher. From cut-off, \(S_i\).

3. **Covariance** (re-allocation) between firm size & management quality; (e.g. OP term \(\text{cov}(M, n)\)) is higher when distortions \((\text{var}(\tau_i + \kappa_{it}))\) are lower.
   - Across countries (e.g. US vs. Southern EU)
   - Policies (e.g. high vs. low trade barriers; high vs. low labor regulation)
Measuring Management

Management Models

Data Description

Empirics
MANAGEMENT PRACTICE SCORES ACROSS COUNTRIES

Note: Unweighted averages taken across all firms within each country; 9,995 obs
Note: Bars are the histogram of the actual density. Scores from 9,995 management interviews across 20 countries.
DECOMPOSING THE RELATIVE MANAGERIAL DEFICIT BETWEEN COUNTRY $j$ AND THE US ECONOMY

\[ M^k - M^{US} = (OP^k - OP^{US}) + (\bar{M}^k - \bar{M}^{US}) \]

- Difference in aggregate share-weighted Management scores
- Difference in reallocation (between firm)
- Difference in unweighted Means (within firm)
Fig 6: Management Scores & Reallocation Across Countries Relative to the US Level

Notes: Total weighted mean management deficit with the US is the number on top of bar. This is decomposed into (i) reallocation effect (OP, blue bar) and (ii) unweighted average management scores (sd=1, red bar). Domestic firms, scores corrected for sampling bias.

Similar ranking to Bartelsman, Haltiwanger & Scarpetta (2013)
FIG 6: MANAGEMENT SCORES & REALLOCATION ACROSS COUNTRIES RELATIVE TO THE US LEVEL

Notes: Total weighted mean management deficit with the US is the number on top of bar. This is decomposed into (i) reallocation effect (OP, blue bar) and (ii) unweighted average management scores (sd=1, red bar). Domestic firms, scores corrected for sampling bias.

Similar ranking to Bartelsman, Haltiwanger & Scarpetta (2013, AER) sub-sample
<table>
<thead>
<tr>
<th>Country</th>
<th>Share-Weighted Average Management Deficit with US</th>
<th>TFP GAP with US</th>
<th>Proportion of TFP Gap due to Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sweden</td>
<td>-0.25</td>
<td>32.2</td>
<td>7.8%</td>
</tr>
<tr>
<td>Japan</td>
<td>-0.35</td>
<td>33.6</td>
<td>10.4%</td>
</tr>
<tr>
<td>Canada</td>
<td>-0.50</td>
<td>22.3</td>
<td>22.4%</td>
</tr>
<tr>
<td>Great Britain</td>
<td>-0.74</td>
<td>20.3</td>
<td>36.5%</td>
</tr>
<tr>
<td>Italy</td>
<td>-0.81</td>
<td>17.2</td>
<td>47.7%</td>
</tr>
<tr>
<td>France</td>
<td>-0.82</td>
<td>25.3</td>
<td>38.7%</td>
</tr>
<tr>
<td>Brazil</td>
<td>-0.98</td>
<td>59.6</td>
<td>16.9%</td>
</tr>
<tr>
<td>China</td>
<td>-1.01</td>
<td>78.3</td>
<td>14.9%</td>
</tr>
<tr>
<td>Argentina</td>
<td>-1.17</td>
<td>57.3</td>
<td>20.6%</td>
</tr>
<tr>
<td>Portugal</td>
<td>-1.18</td>
<td>24.9</td>
<td>48.2%</td>
</tr>
<tr>
<td>Greece</td>
<td>-1.65</td>
<td>51.0</td>
<td>32.4%</td>
</tr>
<tr>
<td>Unweighted av.</td>
<td></td>
<td>25%</td>
<td></td>
</tr>
</tbody>
</table>

Assume one sd increase in management increases TFP by 10%
Measuring Management

Management Models

Data Description

Empirics
Empirics

- Management effect on Performance
- Management and Reallocation
- Management and Competition
- Extensions
# TABLE 3: FIRM PERFORMANCE IS CORRELATED WITH MANAGEMENT SCORE

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Ln(sales)</th>
<th>Ln(sales)</th>
<th>Ln(employment)</th>
<th>Profitability ROCE</th>
<th>5yr Sales growth</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimation</td>
<td>OLS</td>
<td>Fixed Effects</td>
<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
</tr>
<tr>
<td>Firm sample</td>
<td>All</td>
<td>2+ surveys</td>
<td>All</td>
<td>All</td>
<td>Quoted</td>
<td>All</td>
</tr>
<tr>
<td>Management</td>
<td>0.158***</td>
<td>0.030**</td>
<td>0.287***</td>
<td>0.911**</td>
<td>0.049***</td>
<td>-0.007**</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.015)</td>
<td>(0.021)</td>
<td>(0.368)</td>
<td>(0.014)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Ln(employees)</td>
<td>0.658***</td>
<td>0.375***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.026)</td>
<td>(0.112)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln(capital)</td>
<td>0.293***</td>
<td>0.243***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.021)</td>
<td>(0.090)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firms</td>
<td>2,925</td>
<td>1,340</td>
<td>2,925</td>
<td>2,925</td>
<td>2,925</td>
<td>7,532</td>
</tr>
<tr>
<td>Observations</td>
<td>7,035</td>
<td>5,450</td>
<td>7,035</td>
<td>7,035</td>
<td>7,035</td>
<td>7,532</td>
</tr>
</tbody>
</table>

**Notes:** Regressions includes controls for country, SIC3 & year, dummies. Firm-age, skills, noise controls etc. SE clustered by firm.
PRODUCTIVITY IMPROVEMENTS IN RCT ON ADOPTION OF MANAGEMENT PRACTICES

Notes: Weekly average total factor productivity for the 14 treatment plants which adopted modern management practices for quality, inventory and production efficiency and the 6 control plants. All plants make cotton fabric near Mumbai, India, with between 100 and 1000 employees. Values normalized so both series have an average of 100 prior to the start of the intervention. Confidence intervals bootstrapped over firms. Source: Bloom, Eifert Mahajan, McKenzie, Roberts (2013).
Empirics

- Management effect on Performance
- Management and Reallocation
- Management and Competition
- Extensions
EXAMINING THE ROLE OF REALLOCATION

\[ Y_{ijk} = \alpha M_{ijk} + \beta (M \ast \text{REALLOCATION})_{ijk} \]
\[ + \gamma \text{REALLOCATION}_{ijk} + u_{ijk} \]

- \( Y_{ijk} = \) SIZE (or GROWTH) for firm \( i \) in industry \( j \) country \( k \)

- \( \text{REALLOCATION} = \) strength of reallocation forces in firm’s environment (expect \( \beta > 0 \))
  - Set of country dummies, with US as base
  - Explicit policy variables (e.g. country labor regulation indices) & industry*country policies (e.g. trade barriers)
  - Shocks like Great Recession 2008-09 (also have industry*country variation)
<table>
<thead>
<tr>
<th>Management (US base)</th>
<th>179.2***</th>
<th>194.1***</th>
<th>353.1***</th>
</tr>
</thead>
<tbody>
<tr>
<td>MNG*Argentina</td>
<td></td>
<td></td>
<td>-273.1**</td>
</tr>
<tr>
<td>MNG*Australia</td>
<td></td>
<td>194.1***</td>
<td>-259.8*</td>
</tr>
<tr>
<td>MNG*Brazil</td>
<td></td>
<td></td>
<td>-210.1*</td>
</tr>
<tr>
<td>MNG*Canada</td>
<td></td>
<td></td>
<td>-170.3</td>
</tr>
<tr>
<td>MNG*Chile</td>
<td></td>
<td></td>
<td>-167.9</td>
</tr>
<tr>
<td>MNG*China</td>
<td></td>
<td></td>
<td>-95.7</td>
</tr>
<tr>
<td>MNG*France</td>
<td></td>
<td></td>
<td>-497.6**</td>
</tr>
<tr>
<td>MNG*Germany</td>
<td></td>
<td></td>
<td>-18.7</td>
</tr>
<tr>
<td>MNG*Greece</td>
<td></td>
<td>-352.1***</td>
<td></td>
</tr>
<tr>
<td>MNG*India</td>
<td></td>
<td></td>
<td>-148.6</td>
</tr>
<tr>
<td>MNG*Ireland</td>
<td></td>
<td></td>
<td>-257.9**</td>
</tr>
<tr>
<td>MNG*Italy</td>
<td></td>
<td></td>
<td>-288.7***</td>
</tr>
<tr>
<td>MNG*Mexico</td>
<td></td>
<td></td>
<td>-243.3*</td>
</tr>
<tr>
<td>MNG*NZ</td>
<td></td>
<td></td>
<td>-376.9*</td>
</tr>
<tr>
<td>MNG*Japan</td>
<td></td>
<td></td>
<td>-301.4**</td>
</tr>
<tr>
<td>MNG*Poland</td>
<td></td>
<td></td>
<td>-305.2***</td>
</tr>
<tr>
<td>MNG*Portugal</td>
<td></td>
<td></td>
<td>-306.1***</td>
</tr>
<tr>
<td>MNG*Sweden</td>
<td></td>
<td></td>
<td>-213.0</td>
</tr>
<tr>
<td>MNG*UK</td>
<td></td>
<td></td>
<td>-107.4</td>
</tr>
</tbody>
</table>

**General Controls**

<table>
<thead>
<tr>
<th>No</th>
<th>Yes</th>
<th>Yes</th>
</tr>
</thead>
</table>

**Notes**: Dependent var is firm employment; 5,662 observations; domestic firms only.
Empirics

- Management effect on Performance
- Management and Reallocation
- Management and Competition
- Extensions
COMPETITION & MANAGEMENT

• Various ways that competition may influence management
  – **Selection**: badly run firms more likely to exit, so average management quality higher in a more competitive industry
  – **Effort**: forces badly run firms to try harder to survive (although Schumpeterian effects may counterbalance)

• No obvious relationship in Design perspective

• Using cross section & panel we can find a role for both mechanisms
## Competition and Management

3 competition proxies from Nickell (1996) & Aghion et al. (2005)

<table>
<thead>
<tr>
<th>Competition proxies</th>
<th>Dependent variable: Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Import penetration (lagged industry-country level)</td>
<td>0.081** (0.044)</td>
</tr>
<tr>
<td>1- Lerner Index(^1) (lagged industry-country level)</td>
<td>5.035** (2.146)</td>
</tr>
<tr>
<td># of competitors (Firm level)</td>
<td>0.115*** (0.023) 0.120** (0.052)</td>
</tr>
<tr>
<td>Observations</td>
<td>2,657 2,819 2,789 864</td>
</tr>
<tr>
<td>Firm fixed effects?</td>
<td>No No No Yes</td>
</tr>
<tr>
<td>Full controls(^2)</td>
<td>Yes Yes Yes Yes</td>
</tr>
</tbody>
</table>

Notes: “Full controls” includes 108 SIC-3 industry, country, firm-size, public and interview noise (interviewer, time, date & manager characteristic) controls, 2004-2006, UK, US, France and Germany only. Col (1) and (2) clustered SE by ind*cty, col (3) clustered by firm
IS COMPETITION EFFECT CAUSAL?

• Also use natural experiments to generate exogenous increases in competition

• Trade liberalization following China accession to WTO & subsequent phase out of MFA quotas in textiles & apparel industries in 2005. Bloom, Draca & Van Reenen (2013)
  — Strong first stage on Chinese imports into EU
  — Big improvement in management & productivity in more affected sectors

• Hospital competition in UK under Blair reforms (Bloom, Propper, Seiler & Van Reenen, 2013)
CONCLUSIONS

• Heterogeneity in firm productivity linked to management
  – ~25% of cross-country TFP gap (re allocation 1/3)

• Management as a “technology”
  – Management improves firm performance
  – Reallocation stronger in US
    • Linked to trade & labor regulations
    • Stronger in Great Recession
  – Competition improves average management quality

• Next Steps:
  – Management & managers (German IAB)
  – Dynamics & spillovers (US MOPs)
  – Other determinants of PPDs (co-ordination a la Gibbons and Henderson, 2012)
The traditional British Chat-Up

[Male manager speaking to an Australian female interviewer]

Production Manager: “Your accent is really cute and I love the way you talk. Do you fancy meeting up near the factory?”

Interviewer “Sorry, but I’m washing my hair every night for the next month….,”
Production Manager: “Are you a Brahmin?’

Interviewer “Yes, why do you ask?”

Production manager “And are you married?”

Interviewer “No?”

Production manager “Excellent, excellent, my son is looking for a bride and I think you could be perfect. I must contact your parents to discuss this”
The difficulties of defining ownership in Europe

*Production Manager:* “We’re owned by the Mafia”

*Interviewer:* “I think that’s the “Other” category………although I guess I could put you down as an “Italian multinational” ?”

Americans on geography

*Interviewer:* “How many production sites do you have abroad?

*Manager in Indiana, US:* “Well…we have one in Texas…”