

PRODUCTIVITY AND INNOVATION PROGRAMME

John Van Reenen (LSE)

CEP Conference

May 20th 2013

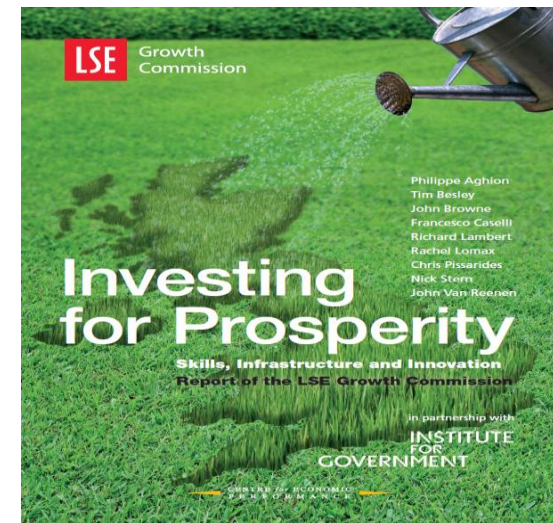


QUESTION: What are causes of productivity & growth?

- 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)**

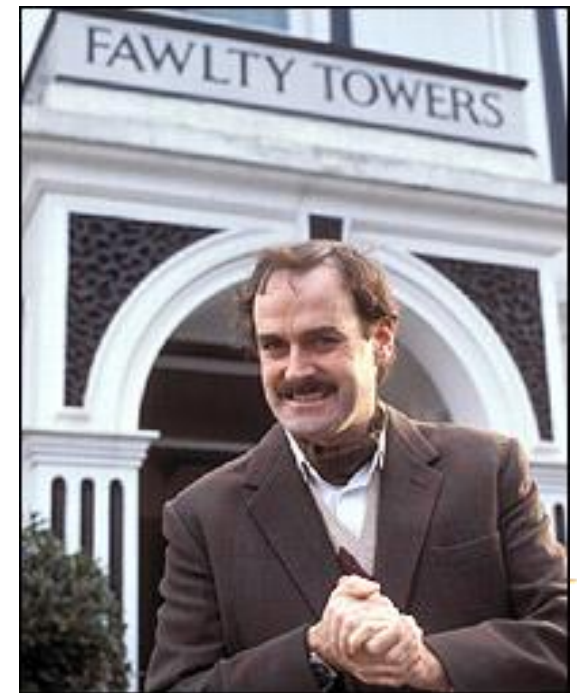
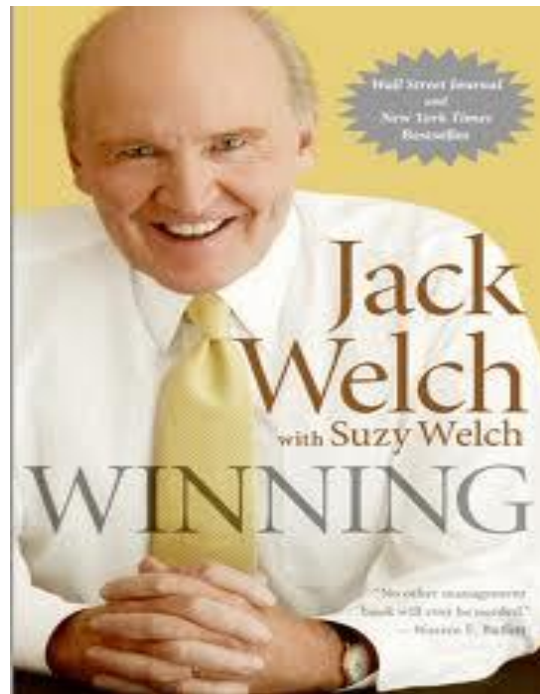
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MANAGEMENT AS A TECHNOLOGY?

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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 90th-10th $\approx 4x$ (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; Akerberg 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)

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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

BLOOM - VAN REENEN (2007) SURVEY METHODOLOGY

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

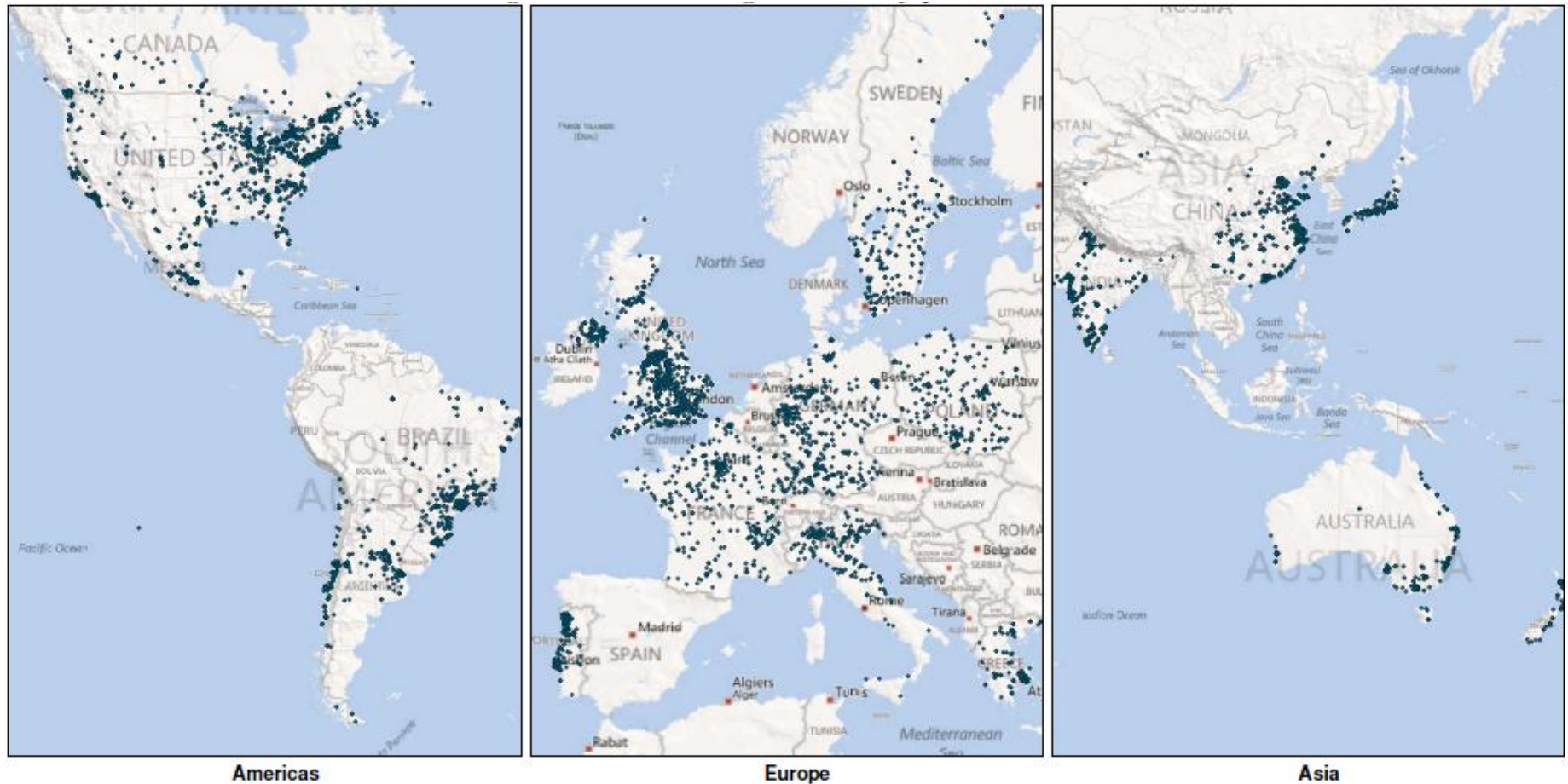
- Introduced as “Lean-manufacturing” interview, no financials
- Official Endorsement: Bundesbank, Bank of England, RBI, etc.
- Run by 100 MBA types (loud, assertive & business experience)

MONITORING – e.g. “HOW IS PERFORMANCE TRACKED?”

Score	(1): Measures tracked do not indicate directly if overall business objectives are being met. Certain processes aren't tracked at all	(3): Most key performance indicators are tracked formally. Tracking is overseen by senior management	(5): Performance is continuously tracked and communicated, both formally and informally, to all staff using a range of visual management tools
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Note: All 18 questions and over 50 examples in Bloom & Van Reenen (2007) & Appendix D

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)

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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 ε_{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 (ε_{it}) & distortions (κ_{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 ($M_{it} = A_i \varepsilon_{it}$). From FOC, etc.
2. Average management quality is higher when **competition** is higher. From cut-off, S_i .
3. **Covariance** (reallocation) 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)

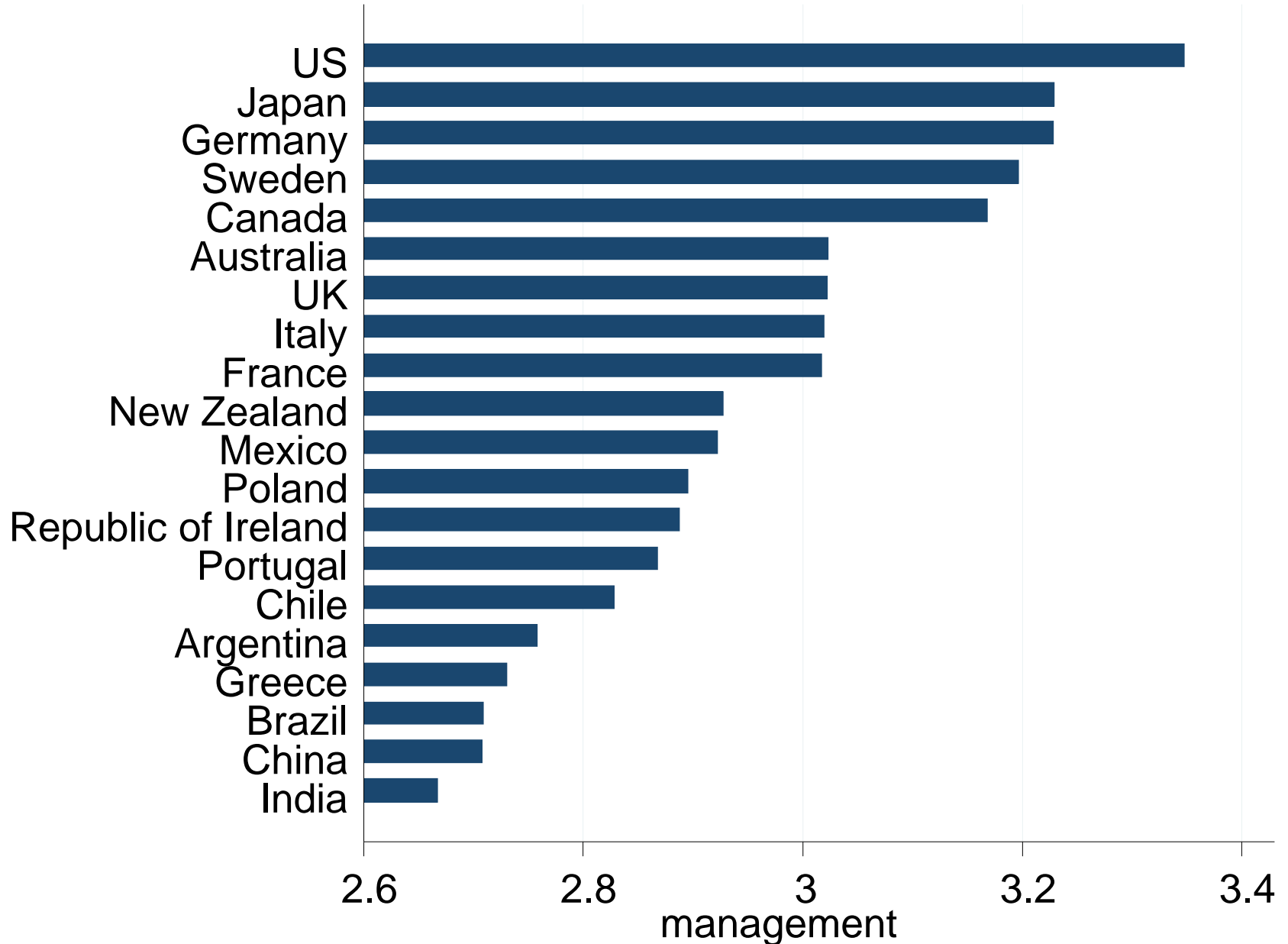
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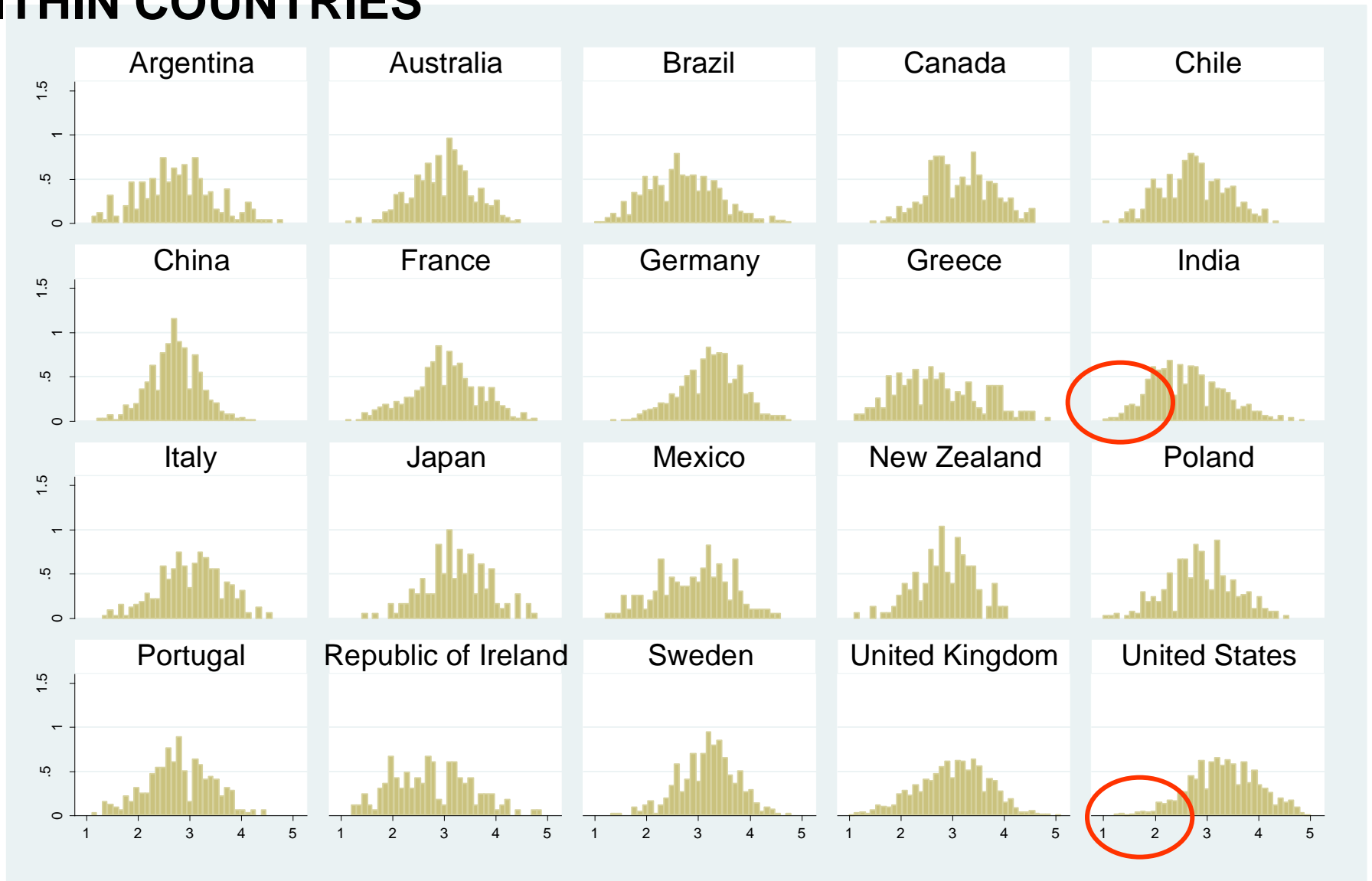
Empirics

MANAGEMENT PRACTICE SCORES ACROSS COUNTRIES



Note: Unweighted averages taken across all firms within each country; 9,995 obs

HUGE VARIATION IN MANAGEMENT SCORES ACROSS FIRMS WITHIN COUNTRIES



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

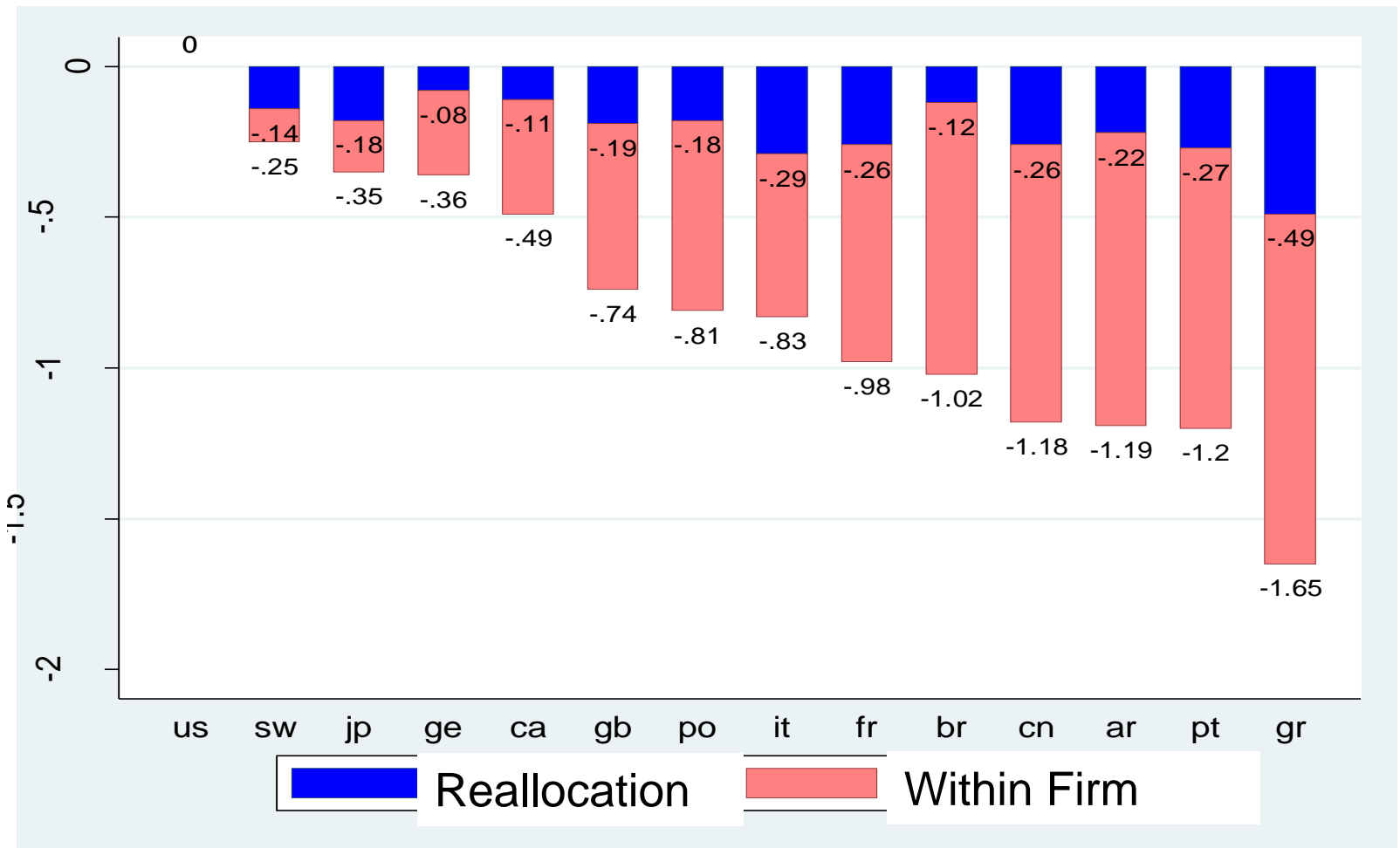
$$M^k - M^{US} = (OP^k - OP^{US}) + (\bar{M}^k - \bar{M}^{US})$$

Difference in aggregate
share-weighted
Management scores

Difference in reallocation
(between firm)

Difference in unweighted
Means (within firm)

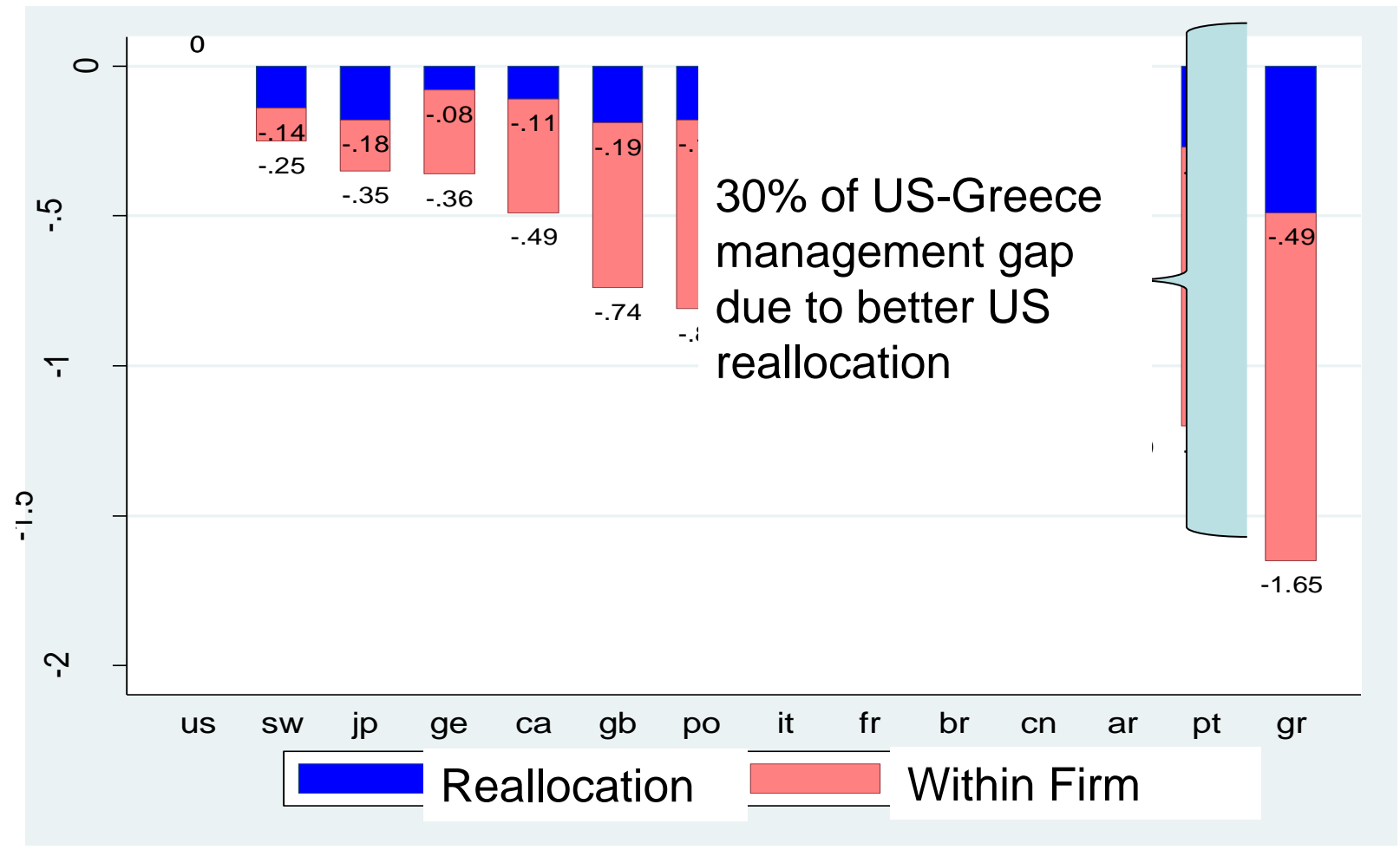
FIG 6: MANAGEMENT SCORES & REALLOCATION ACROSS COUNTRIES RELATIVE TO THE US LEVEL



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

TAB 8 – CONT. ABOUT 25% OF CROSS COUNTRY TFP GAP ACCOUNTED FOR BY MANAGEMENT

Country	Share-Weighted Average Management Deficit with US	TFP GAP with US	Proportion of TFP Gap due to Management
US	0		
Sweden	-0.25	32.2	7.8%
Japan	-0.35	33.6	10.4%
Canada	-0.50	22.3	22.4%
Great Britain	-0.74	20.3	36.5%
Italy	-0.81	17.2	47.7%
France	-0.82	25.3	38.7%
Brazil	-0.98	59.6	16.9%
China	-1.01	78.3	14.9%
Argentina	-1.17	57.3	20.6%
Portugal	-1.18	24.9	48.2%
Greece	-1.65	51.0	32.4%
Unweighted av.			25%

Assume one sd increase in management increases TFP by 10%

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Empirics

- **Management effect on Performance**
- Management and Reallocation
- Management and Competition
- Extensions

TABLE 3: FIRM PERFORMANCE IS CORRELATED WITH MANAGEMENT SCORE

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

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

$$Y_{ijk} = \alpha M_{ijk} + \beta (M * REALLOCATION)_{ijk} + \gamma REALLOCATION_{ijk} + u_{ijk}$$

- Y_{ijk} = *SIZE* (or *GROWTH*) for firm i in industry j country k
- *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 4: FIRM SIZE CORRELATED WITH MANAGEMENT MORE STRONGLY IN US THAN ELSEWHERE

Management (US base)	179.2***	194.1***	353.1***
MNG*Argentina			-273.1**
MNG*Australia			-259.8*
MNG*Brazil			-210.1*
MNG*Canada			-170.3
MNG*Chile			-167.9
MNG*China			-95.7
MNG*France			-497.6**
MNG*Germany			-18.7
MNG*Greece			-352.1***
MNG*India			-148.6
MNG*Ireland			-257.9**
MNG*Italy			-288.7***
MNG*Mexico			-243.3*
MNG*NZ			-376.9*
MNG*Japan			-301.4**
MNG*Poland			-305.2***
MNG*Portugal			-306.1***
MNG*Sweden			-213.0
MNG*UK			-107.4
General Controls	No	Yes	Yes

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)

Competition proxies	Dependent variable: Management			
Import penetration (lagged industry-country level)	0.081** (0.044)			
1- Lerner Index¹ (lagged industry-country level)		5.035** (2.146)		
# of competitors (Firm level)			0.115*** (0.023)	0.120** (0.052)
Observations	2,657	2,819	2,789	864
Firm fixed effects?	No	No	No	Yes
Full controls²	Yes	Yes	Yes	Yes

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 (reallocation 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)

MY FAVOURITE QUOTES:

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....”

MY FAVOURITE QUOTES:

The traditional Indian Chat-Up

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”

MY FAVOURITE QUOTES:

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...”