ISSN 2042-2695

CENTRE *for* ECONOMIC PERFORMANCE

CEP Discussion Paper No 1036

December 2010

Does Competition Raise Productivity Through Improving Management Quality?

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"Does Competition Raise Productivity Through Improving Management Practices?" Van Reenen, John. International Journal of Industrial Organization Vol. 29, No. 3 (2011): 306-317.

DOI: 10.1016/j.ijindorg.2011.02.001

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Abstract
A classic question in industrial organization is whether competition raises productivity and if so, through what mechanism? I discuss recent empirical evidence from both large-scale databases and specific industries which suggests that tougher competition does indeed raise productivity and one of the main mechanisms is through improving management practices. To establish this, I report on new research seeking to quantify management. I relate this to theoretical perspectives on the economics of competition and management, arguing that management should be seen at least in part as a transferable technology. A range of recent econometric studies suggest that (i) competition increases management quality and (ii) improved management quality boosts productivity.

JEL Classifications: L2, M2, O32, O33
Keywords: management, productivity, organization

This paper was produced as part of the Centre's Productivity and Innovation Programme. The Centre for Economic Performance is financed by the Economic and Social Research Council.

Acknowledgements
This was written as a keynote address for the 2010 EARIE conference in Istanbul. I would like to thank participants in the conference for several helpful comments. I would also like to thank the Economic and Social Research Council for their financial support through the Centre for Economic Performance. The work draws substantially on work with Nick Bloom. It also draws on joint work with Daron Acemoglu, Philippe Aghion, Eve Caroli, Luis Garicano, Christos Genakos, Claire Lelarge, Ralf Martin, Raffaella Sadun and Fabrizio Zilibotti.

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Published by
Centre for Economic Performance
London School of Economics and Political Science
Houghton Street
London WC2A 2AE

1. Introduction

Adam Smith wrote “Monopoly .... is a great enemy to good management” (*Wealth of Nations* Book 1, XI(1) 148, 1776) and most economists feel in their bones that this is correct. Despite this intuition, establishing that competition raises management quality has proven exceedingly hard. This is for at least three reasons. First, robust quantitative data on management practices is hard to come by, so applied IO economists have tended to rely on productivity as an empirical proxy. Second, finding compelling “experiments” that exogenously increase competition independently of management (or productivity) is hard. Finally, the impact of increased competition on incentives to improve management is ambiguous, so this issue cannot be resolved theoretically and one must rely instead on good data and credible identification schemes.

Fortunately, there has been significant progress on these issues in recent years and this paper reports on the current state of affairs. In brief, I believe that we have much more compelling evidence that competition does indeed raise productivity and a major mechanism for this is through changing management practices.

The paper is structured as follows. First, in order to establish this argument, I report in Section2 on the finding of what I consider a first order fact of economics: the astounding persistent productivity differences between organizations even within narrow sectors. I show how these have an important influence on aggregate productivity growth and aggregate cross-country differences in material wellbeing.

Section 3 describes various theoretical models of management and argues that management should be viewed, at least in part, as a transferable technology. Section 4 sketches some new approaches to measuring management practices. I then address the issue of the causal effect of competition on management and productivity from a theoretical (Section 5) and empirical (Section 6) perspective. Section 7 describes recent econometric studies on the effects of management on productivity and Section 8 concludes.

2. Heterogeneity in productivity and management across countries and firms: Descriptive evidence

2.1 Productivity patterns at the country level

In terms of aggregate growth, Solow's finding that a large fraction of the growth of the US economy was due to growth in residual total factor productivity (TFP) rather than the accumulation of factor inputs such as labor or capital has now been replicated in numerous countries. In growth theory TFP is generated by the creation and diffusion of "hard" technological innovations such as electricity, the electric combustion engine, hybrid corn, beta blockers and information and communication technologies (ICT). With the advent of better micro-economic data on plant productivity, Bailey, Hulten and Campbell (1992) argued that about half of aggregate US productivity growth was due to the reallocation of output among plants rather than simply increases in productivity of ongoing incumbent plants. Thus, the idea of a representative plant or firm increasing its productivity can be very misleading as a description of the creative destruction at play in the wider economy with much aggregate TFP growth coming from inefficient low productivity establishments shrinking and exiting the economy in conjunction with more productive plants growing[1]. There are methodological challenges in aggregating correctly plant level estimates of productivity to the aggregate Solow residual. Petrin and Levinsohn (2010) propose a more accurate way to decompose aggregate productivity into improvements in technical efficiency and reallocation. When applied to US manufacturing data in Petrin, White and Reiter (2010) they find that reallocation is even more important than Bailey et al (1992) originally suggested.

More recently, what was found in the time series for one country also appears to be true in the cross section across nations. Figure 1 shows the correlation between GDP per capita and TFP for a large number of countries. It is clear that those countries with high TFP are also the countries with high GDP per capita, suggesting that TFP is critical for understanding cross-country success[2]. But this aggregate TFP difference is also strongly influenced by how different economies allocate output to plants of heterogeneous productivity levels. For example, Figure 2 shows the estimated productivity distribution of the manufacturing sectors in the US and India from Hsieh and Klenow (2007). Compared to the US, India appears to have a much longer "left tail" of low productivity plants. This suggests that there is something about the structure of the Indian economy that is more forgiving of low productivity firms than in the US. A large number of possible explanations present themselves that

[1] Bartelsman, Haltiwanger and Scarpetta (2008) show that the speed of reallocation is much stronger in some countries (like the US) than others. There is also significant sectoral variation. For example, Foster, Krizan and Haltiwanger (2006), show that reallocation between stores accounts for almost all aggregate productivity growth in the US retail sector.

[2] The analogue of time series "productivity accounting" (dividing growth into the accumulation of factor inputs and TFP) is "development accounting" which decomposes cross-country GDP per capita into TFP and factor intensities. Caselli (2005) shows that cross-country TFP is the main cause of cross-country income per capita differences as suggested by Figure 1.

we will later examine such as competitive intensity in the product market, labor regulations, distortions due to corruption and tax, etc.

What these lines of research show is that productivity dispersion at the micro-economic level is fundamental to understanding the macro-economic patterns. But this only pushes the question one level deeper: what causes firm heterogeneity?

2.2 Firm Heterogeneity

Research on firm heterogeneity has a long history in social science. Systematic empirical analysis first focused on the firm size distribution measured by employment, sales or assets. Most famously, Gibrat (1931), characterized the size distribution as approximately log normal and sought to explain this with reference to simple statistical models of growth (i.e. Gibrat's Law that firm growth is independent of size). In recent decades access to large scale (frequently near population) databases in the government (e.g. the Longitudinal Business Database of US establishments) and private sector (e.g. Bureau Van Dijk's Orbis database of firm accounts) has enabled researchers to look more directly at firm productivity. The growing availability of plant-level data from the US Census Bureau and other nations combined with rapid increases in computer power (allowing much cheaper storage and ability to analyze such databases) has facilitated this development. Bartelsman, Haltiwanger and Scarpetta (2008) offer many examples of the cross country micro-datasets now being used for productivity analysis.

One of the robust facts emerging from these analyses is the very high degree of heterogeneity between business units (see Bartelsman and Doms, 2000). For example, Syverson (2004a) analyzes labor productivity (output per worker) in US manufacturing establishments in the 1997 Economic Census and shows that on average, a plant at the 90^{th} percentile of the productivity distribution is over four times as productive as a plant at the 10^{th} percentile in the same four digit sector. Similarly, Criscuolo, Haskel and Martin (2003) show that in the UK in 2000 there is a five-fold difference in productivity between these deciles.

What could explain these differences in productivity, and how can they persist in a competitive industry? One explanation is that if we accounted properly for the different inputs in the production function there would be little residual productivity differences[3]. It is certainly true that moving from

[3] This is analogous to the historical debate in the macro time series of productivity between Solow, who claimed that TFP was a large component of aggregate growth and Jorgenson who claimed that there was little role for TFP when all inputs

labor productivity to total factor productivity (TFP) reduces the scale of the difference. For example, in Syverson (2004a) the 90-10 productivity difference falls from a factor of 4 to a factor of 1.9, but it does not disappear.

These differences show up clearly even for quite homogeneous goods. An early example is Salter (1960) who studied the British pig iron industry between 1911 and 1926. He showed that the best practice factory produced nearly twice as many tons per hour as the average factory.

A major problem in measuring productivity is the fact that researchers rarely observe plant level prices, so an industry price deflator is usually used. Consequently, measured TFP typically includes an element of the firm-specific price-cost margin (e.g. Klette and Griliches, 1996). Foster, Haltiwanger and Syverson (2009) study 11 seven-digit homogeneous goods (including block ice, white pan bread, cardboard boxes and carbon black) where they have access to plant specific output (and input) prices. They find that conventionally measured revenue based TFP ("TFPR") numbers actually *understate* the degree of true productivity dispersion ("TFPQ") especially for newer firms as the more productive firms typically have lower prices and are relatively larger[4].

Higher TFP is positively related to firm size, growth and survival probabilities. Bartelsman and Dhrymes (1998, Table A.7) show that over a five year period around one third of plants stay in their productivity quintile. This suggests that productivity differences are not purely transitory, but partially persist.

In summary, there is a substantial body of evidence of persistent firm-level heterogeneity in firm productivity (and other dimensions of performance) in narrow industries in many countries and time periods. Differential observable inputs, heterogeneous prices and idiosyncratic stochastic shocks are not able to adequately account for the remarkable dispersion of productivity. So what could account for this? One long suggested factor is management practices, with authors going back at least to Walker (1887) suggesting that management practices play an essential role in explaining differences in performance across firms.

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were properly measured (see Griliches, 1996). A similar debate is active in "levels accounting" of cross-country TFP (e.g. Caselli, 2005).

[4] Foster et al (2009) show that measured revenue TFP will in general be correlated with true TFP but also with the firm specific price shocks. Hsieh and Klenow (2007) detail a model where heterogeneous TFPQ produces no difference in TFPR because the more productive firms grow larger and have lower prices, thus equalizing TFPR. In their model intra-industry variation in TFPR is due to distortions as firms face different input prices.

3. Theory

3.1 Do "hard technologies" solely explain productivity differences?

For econometricians, believing that management is a cause of productivity heterogeneity may be natural. Since at least Mundlak (1961) the fixed effect in panel data estimates of production functions (i.e. permanent unobserved TFP that is correlated with factor inputs) has been labelled "management quality". In the next section I will consider approaches which try and measure this directly instead of just treating it as a nuisance parameter in the estimation.

The focus of economics in attempting to understand productivity differences has been to look at how the creation and diffusion of technological innovations could be the driving factor behind the variation. Endogenous growth theory has focused on R&D and empirical economists have continued in this vein examining the relationship between TFP and innovation as proxied by R&D, patents and/or more direct proxies for innovation[5] and diffusion (such as ICT). Much has been learned from this body of work and there is much more robust evidence of the causal importance of "hard" technology for productivity growth[6]. Such estimates are important for both shedding light on theory and innovation policy.

There are at least two major problems, however, in focusing on these aspects of technical change as the causes of productivity. First, even after controlling for a wide range of observable measures of technology a large residual still remains. A response to this is that these differences still reflect some unmeasured "hard technology" differences which, if we measured them correctly would be properly accounted for. But an alternative view is that we need to widen our definition of "technology" to incorporate managerial and organizational aspects of the firm.

A second problem is that many recent studies of the impact of new technologies on productivity have stressed that the impact of technologies such as ICT varies widely across firms and countries. In particular, it appears that ICT has systematically a much larger effect on the productivity of firms who have complementary organizational structures which enable the technology to be more efficiently exploited. In their case studies of ICT in retail banking, for example, Autor et al (2003) and Hunter et

[5] Examples would include the UK SPRU dataset (e.g. Van Reenen, 1996) or the European Community Innovation Survey.
[6] Zvi Griliches pioneered work in this area which motivated the work of the NBER productivity group from the 1980s onwards. A representative collection would be Griliches (1998). For an example of recent work looking at the causal effect of R&D on productivity (and spillovers) using R&D tax policy as a natural experiment see Bloom, Schankerman and Van Reenen (2010).

al (2001) found that banks who failed to re-organize the physical and social relations within the workplace reaped little reward. More systematically, Bresnahan, Brynjolfsson and Hitt (2002) found that decentralized organizations tended to enjoy a higher productivity pay-off from IT. Similarly, Bloom, Sadun and Van Reenen (2007) found that IT productivity was higher for firms with better people management practices. Since these were much more prevalent in US firms (even those US multinational subsidiaries located in Europe), such firms obtained faster productivity growth when IT prices fell very rapidly as they did in the post 1995 period. The authors argue that about half of the faster productivity growth in the US relative to Europe over this period could be ascribed to these different US people management practices interacted with the exogenous fall in IT prices.

Both these reasons suggest that it is worth directly considering management practices as proximate factors in raising productivity. In addition, there is a huge body of case study work in management science which anecdotally suggests a major role for management.

3.2 What causes variation in management practices?

There are at least four perspectives on management. First, there is the cynical view that all management is just fads or fashions and should be ignored by serious economists (except with regard to why such fashions should ever be adopted and command a price premium over their own advice). There is certainly a large amount of snake oil masquerading as scholarship as any browse around the business section of an airport bookshelf will reveal. But given the large amounts of money paid for by such management advice by profit-oriented firms and by prospective MBA students, it is worth considering the view that management may actually matter.

A second perspective is that management should be considered as a factor of production no different from any other. As such the study of management is the same as the supply and demand for any other investment good (e.g. human capital). There is certainly something to be said for this view and investment in management has aspects of other capital goods. Yet, as was recognised by Kaldor (1934) among others, there is an aspect of a firm which is authority - an irreducible decision making aspect of how the firm is organized that is hard to reduce to the standard approach to considering factor choices.

We focus on two alternative paradigms. The third perspective has been the dominant one in economics in recent years, which is broadly organizational economics (a sub-set of this in labor economics would be the now classic approach of Personnel Economics). We label this the “design” approach. The view

here is that the management practices we observe are optimised by a firm, so that variations in management simply reflect variations in the firm's environment.

We contrast the design approach with a final perspective that is becoming more common which we label the "managerial technology" approach. This has become more popular in diverse fields of economics, such as trade, public, labor and macro, but above all in Industrial Organization. In this view some aspects of management could be considered at least partially as a technology or "best practice" in the jargon. Adopting these forms of management would improve productivity in a typical firm. This leads on naturally to the question of why all firms have not adopted such practices. We discuss this below, but one immediate explanation is that all technologies have some diffusion curve whereby not all firms immediately adopt them. Informational constraints (and other factors we discuss below) could be an explanation for the slow diffusion of major managerial innovations. Indeed, many empirical IO contributions have examined the spread of lean or flexible manufacturing exactly through this lens (e.g. Van Biesebroeck, 2003, 2007; Keane and Feinberg, 2008).

The Design and Technology perspectives are not mutually exclusive, of course. As economists, we believe that there is always some element of maximization. The managerial technology perspective highlights, however, that some firms are constrained by being less productive than others. We believe that this is an important empirical phenomenon which can explain many puzzling facts and requires integration into the dominant design paradigm. We overview both perspectives and refer readers who want more depth to the surveys in Gibbons and Waldman (1999), Malcomson (1999), Prendergast (1999), Lazear (1999) and especially Lazear and Oyer (2009) which summarizes the most recent theory and some more recent empirical evidence.

3.3 The Design perspective

The economics of contracts (see Bolton and Dewatripont, 2005, for an overview) and the economics of organizations (see Gibbons and Roberts, 2009) have made huge strides in recent decades. The design perspective borrows three key economic principles. First, firms and workers are rational maximizing agents (profits and utility respectively). Secondly, it is assumed that labor and product markets must reach some sort of price-quantity equilibrium, which provides some discipline for the models. Finally, the stress is very much on private efficiency with an emphasis on why some employment practices which may look to be perplexing and inefficient on the surface (e.g. mandatory retirement and huge pay disparities for CEOs) may actually be (at least privately) optimal.

The key feature of the design approach is that the management practices we observe are chosen by firms to maximize profits in an environment that departs from perfectly competitive spot markets. For example, unlike the standard Personnel Management texts, Organizational Economics leads to sharper predictions and generalizations: it is not the case that "every workplace is fundamentally different". However, the design approach puts the reason for heterogeneity in the adoption of different practices as mainly due to the different environments firms face – say in the industry's technology, rather than inefficiencies. The managerial technology view, described next, sees a large role for inefficiencies.

3.4 The managerial technology perspective

The large dispersion in firm productivity discussed in Section 2 motivates an alternative perspective that some types of management (or bundles of management practices) are better than others for firms in the same environment. There are three types of these best practices. First, there are some practices that have always been better throughout time and space (e.g. not promoting gross incompetents to senior positions) or collecting some information before making decisions. Second, there may be genuine managerial innovations (Taylor's Scientific Management; Lean Manufacturing; Demming's Quality movement, etc.) in the same way there are technological innovations. There are likely to be arguments over the extent to which an innovation is real technical progress or just a fad or fashion. It is worth recalling that this debate historically occurred for many of the "hard" technological innovations which we now take for granted such as computers and the Internet. Thirdly, many practices may have become optimal due to changes in the economic environment over time, as the design perspective highlights. Incentive pay may be an example of this: piece rates declined dramatically in the late 19th Century, but incentive pay appears to be making somewhat of a comeback. Lemieux et al (2009) suggest that this may be due to advances in ICT – companies like SAP make it much easier to measure output in a timely and robust fashion, making effective incentive pay schemes easier to design[7]. In these circumstances, some firms may be faster than others in switching to the new best practice. The differential speed of adjustment to the new equilibrium can be due to information differences, complementarities and agency issues.

3.4.1 Non-transferable management practices

We can divide the management as a technology perspective into two types: nontransferable and transferable. The former is more conventional than the latter, so we start here first. All theories have to tackle the essential question of why all firms do not adopt the management practice if it is profitable?

[7] Hard technological advances have also facilitated managerial innovations such as Just in Time. Keane and Feinberg (2007) stress the importance of these improved logistics for the growth of intra-firm trade between the US and Canada.

Imperfect Competition

The large-scale productivity dispersion described in Section 2 posed serious challenges to the representative firm approach. It has always been germane to Industrial Organization, but there has been a wholesale re-evaluation of theoretical approaches in several fields. For example, in international trade the dominant paradigm has already started to shift towards heterogeneous firm models. This is due to the increasing weight of empirical evidence documenting the persistent heterogeneity in firm export patterns (exporters tend to be larger and more productive). Melitz (2003) follows Hopenhayn (1992) in assuming that firms do not know their productivity before they pay a sunk cost to enter an industry, but when they enter they receive a draw from a known distribution. Productivity does not change over time and firms optimize subject to their constraint of having high or low productivity. Firms who draw a very low level of productivity will immediately exit as there is some fixed cost of production they cannot profitably cover. Those who produce will have a mixture of productivity levels, however. A natural interpretation of this set-up is that entrepreneurs found firms with a distinct managerial culture which is imprinted on them until they exit, so some firms are permanently "better" or "worse" managed. Over time, the low productivity firms are selected out and the better ones survive and prosper. There is some stochastic element to this, however, so in the steady state there will always be some dispersion of productivity.

Imperfect competition is one obvious ingredient for these models. With imperfect competition firms can have differential efficiency and still survive in equilibrium. With perfect competition inefficient firms should be rapidly driven out of the market as the more efficient firms undercut them on price. In Syverson (2004b), for example, there is horizontal product differentiation based on transport costs so firms have local market power. He shows theoretically and empirically that increases in competition will increase average productivity by reducing the mass of less productive plants in an area.

Perfect Competition: Management as talent

The classic contribution here is the Lucas (1978) span of control model that has been built on by many subsequent authors. In the Lucas model managerial/entrepreneurial talent is the ability to organize workers together in a way that enhances all of their productivity. Managerial talent is heterogeneous in the population with the most able managers increasing worker productivity by more. Managers leverage their ability by founding firms employing larger numbers of workers so the most talented manager will run the largest firms. What limits the best manager from taking over the entire economy is managerial overload causing decreasing returns to scale and a finite span of control. So in

equilibrium the best managers will have the largest span of controls and we have a theory of the distribution of firm size which perfectly reflects the differences in underlying managerial talent. Since individuals can also be employed as workers, what determines the number of managers (compared to workers) is the marginal person who is indifferent between being a manager or a worker.

Managerial talent will show up as TFP (if properly measured) because two firms with the same inputs will produce more output with the better manager. Thus, this is a theory of TFP dispersion as well as firm size.

Although there are clear differences, many of the predictions of this perfect competition span of control model are similar to those from imperfect competition models (see Hsieh and Klenow, 2007, for example, of how similar predictions on the size and productivity distribution can be derived).

A common feature of both imperfect and perfect competition models is that management is partially like a technology, so there are distinctly good (and bad) practices that would raise (or lower) productivity. But under both sets of theories, however, management does not change in a fundamental sense. Managerial talent cannot be transferred between firms in the basic Melitz model. Although firm productivity is perfectly transferable across workers and plants in the same firm (even when located in another country in Helpman, Melitz and Yeaple, 2004) when a firm dies, so does its knowledge on raising productivity. In the Lucas (1978) model talent does not transfer between individuals, so the only way that management quality is transferred between firms is when managers move across companies.

3.4.2 Transferable management practices

An alternative view is that management is partially transferable even without labor mobility or the entrance of a new firm. A natural context for such models is that there are genuine managerial innovations. In this view, Toyota's production system of lean manufacturing was a genuinely new idea that would have raised productivity in other car manufacturers such as GM or Chrysler had they come up with the Toyota system or adopted earlier. The fact that adoption was not immediate for all the beneficiaries should not come as a huge surprise as "hard" technological innovations are also adopted slowly and with a considerable lag by other firms. Indeed, seen in this perspective all the diffusion models that are well studied by economies (e.g. see the survey by Hall, 2003, Skinner and Staiger 2007, or Foster and Rosenzweig, 1996) become relevant to understanding the spread of management practices.

Although, in principle, this slow adoption could be down to differences in the environment, there is much evidence that the diffusion curve also has other influences such as informational constraints. Other potential explanations would include competition, human capital, adjustment costs, incentives and institutions. These are all in a standard economic rational choice framework, but of course behavioral considerations such as overconfidence or procrastination could also be at play (see Bloom and Van Reenen, 2010, for a discussion of these.

3.5 Economic theories of management: Summary

In the Design approach firms at every point are choosing their optimal set of management practices and no firm is more efficient than another based on these. In management science, "contingency theory" (e.g. Woodward, 1958) is akin to this. Any coherent theory of management has firms choosing different practices in different environments, so there will always be some element of contingency. For example, Bloom and Van Reenen (2007) show that firms appear to specialize more in investing in "people management" (practices over promotion, rewards, hiring and firing) when they operate in a more skill-intensive industry. If we examine the relative scores by country for monitoring and target setting practices compared to people management, the US, India and China have the largest *relative* advantage in people management, and Japan, Sweden and Germany the largest *relative* advantage in monitoring and target setting management. The systematic difference in the relative scores of different types of management across countries also suggests that there may be some specialization in areas of comparative advantage, perhaps due to labor market regulation. Figure 6 shows some evidence for this. The cross country differences in people management are related to the degree of labor market regulation (lightly regulated countries such as the US and Canada do better than heavily regulated countries such as France, Brazil and Greece).

The interesting question is whether there really are any "universals", i.e. some practices that would be unambiguously better for the majority of firms? If this is so, why are they not adopting them? The answer to this question is identical to that of the adoption of any new technology – there are costs to adoption in the form of information, incentives, regulatory constraints, externalities, etc. These will vary somewhat by time and place and we turn to some of these factors next.

4. Measuring management

Progress in understanding the role of management has been severely limited by the absence of high firm-level quality data[8]. Recently, Bloom and Van Reenen (2007) developed a survey tool that can in principle be used to directly quantify management practices across firms, sectors and countries. Fundamentally, the aim is to measure the overall managerial quality of the firm by benchmarking it against a series of global best practices (see next section for a discussion of what these mean).

Bloom and Van Reenen (2007) use an interview-based evaluation tool that defines and scores from one ("worst practice") to five ("best practice") eighteen basic management practices. This evaluation tool was developed by an international consulting firm to target practices they believed were associated with better performance, covering three broad areas:

(1) Monitoring: how well do companies track what goes on inside their firms, and use this for continuous improvement? For example, is product quality regularly monitored so that any production defects are quickly addressed rather than left to damage large volumes of output.
(2) Target setting: do companies set the right targets, track the right outcomes and take appropriate action if the two are incongruent? For example, are individual production targets callibrated to be stretching but achievable, rather than incredibly easy or impossibly hard.
(3) People: are companies promoting and rewarding employees based on ability and effort, and systematically trying to hire and keep their best employees? For example, are employees that perform well, work hard and display high ability promoted faster than employees who under-perform, are lazy and appear incompetent.

The management survey tool excludes practices whose performance impact clearly depends on individual firms circumstance – for example, setting lower prices or M&A activity.

To obtain accurate responses from firms, they interview production plant managers using a 'double-blind' technique. One part of this double-blind technique is that managers are not told they are being scored or shown the scoring grid. They are only told they are being "interviewed about management practices for a research project". To run this blind scoring, open questions were used since these do not tend to lead respondents to a particular answer. For example, the first monitoring question starts by asking "tell me how you monitor your production process" rather than a closed question such as "do

[8] Bertrand and Schoar (2006) show that there is substantial variation in "management styles" (e.g. in M&A activity) that are correlated with management characteristics. For example, older managers that have experienced the Great Depression tend to be more cautious than younger managers with MBA training on the tax advantages of debt leverage. Although this goes beyond TFP, management styles are still identified with the residual fixed effects in their analysis.

you monitor your production daily (yes/no)". Interviewers also probed for examples to support assertions. The other side of the double-blind technique is interviewers are not told in advance anything about the firm's performance to avoid prejuduice. They are only provided with the company name, telephone number and industry. Since the survey covers medium-sized firms (defined as those employing between 100 and 10,000 workers) these would not be usually known *ex ante* by the interviewers. The survey was targeted at plant managers, who are senior enough to have an overview of management practices but not so senior as to be detached from day-to-day operations. The sample response rate was 45% and this was uncorrelated with measures of firm performance.

One way to summarize firm-specific quality is to z-score each individual question and take an average across all eighteen questions.[9] This management practice score is strongly correlated with firm performance (total factor productivity, profitability, growth rates, and Tobin's Q and survival rates) as well as firm size. These performance data were taken from independently collected company accounts and imply that the managers' responses contained real information. Figure 3 shows the correlation between the management score and labor productivity, for example. Firms with higher management scores tend to have higher sales per worker relative to the industry and country average. These correlations should by no means be taken as causal but do suggest that the management data contains useful information. We examine the identification issues in detail in Section 5 below. Other research shows that better management is also associated with more energy efficient production (Bloom, Genakos, Martin and Sadun, 2008), better patient outcomes in hospitals (Bloom, Propper, Seiler and Van Reenen, 2009) and improved work-life balance indicators (Bloom, Kretschmer and Van Reenen, 2009).

The bar chart in Figure 4 plots the average management practice scores across countries from the interviews. The US has the highest average management practice scores, with Germany, Japan and Sweden below, followed by a block of mid-European countries (e.g. France, Italy, the UK and Poland) and Australia, with Southern Europe and developing countries Brazil, China, Greece and India at the bottom. In one sense this cross-country ranking is not surprising since it approximates the cross-country distribution of productivity (recall Figure 1).

The between country variation in average management scores are swamped by the within country variation. Figure 5 plots out the histogram of management scores across firms for each country in our

[9] Another is to take the principal factor component. This provides an extremely similar result to the average z-score since these are correlated at 0.997.

sample. As with productivity there is huge variation in management practices with many badly managed firms in all countries, even those with high average scores. An interesting feature of Figure 5 is that the US appears to have little or no left tail of very badly managed firms (say scores less than 2). In fact, a large fraction of the cross country differences in Figure 4 can be accounted for by whether a country has a thick or thin left tail of badly managed firms. This immediately suggests that one factor causing cross country differences in productivity is the strength of the forces of selection which aggressively weed out badly managed firms in countries like the US to a much greater extent than in India. This would be consistent with the productivity data shown in Figure 2. We return to the role of product market competition in explaining these differences in Section 4.

There are alternative approaches to measuring management or more generally attempts to measure "intangible capital" or "organizational capital" (Prescott and Visscher, 1980). First, one could try and infer these as residuals using relatively weak conditions (variants of TFP) or more tightly specified structures (e.g. Atkeson and Kehoe, 2005). Secondly, one can use past expenditures to build up intangible stocks exactly as would be done for tangible capital (e.g. through the perpetual inventory method). This is frequently done for R&D and advertising, but it is far harder to accomplish for management as there is no clear data on such expenditures[10]. Third, more conventional paper and pen surveys can be used with "closed" questions (e.g. Black and Lynch, 2001). There are a large number of these for individual countries, but very few that are comparable across international boundaries.

5. The effect of competition on management and productivity: Theory

There are many mechanisms through which competition can affect management and productivity. It is convenient to divide mechanisms into a "between firm" and "within firm" effect. The former are better understood than the latter.

5.1 Between firm effects

We can illustrate this with a simple model used by Holmes and Schmitz (2010) which is close to the Melitz (2003) model. The set-up of the model is as follows. Consider an industry where Firms can enter at two possible locations: $j = \{1,2\}$. The demand at location j is $Q^j = S^j d(p^j)$ where S^j = population at j , and p^j is price so $d(p^j)$ can be thought of as per capita demand. Transportation costs,

[10] See Corrado, Hulten and Sichel (2006) at the macro level.

are T and D^j is a tariff (or duty). At each location there are a set of potential entrants who face fixed cost of entry F^j (an exogenous engineering set-up cost) plus E^j, an entry tax (that could be firm-specific). Entrants differ in post-entry productivity/management by taking a draw from a known distribution, but they do not know their idiosyncratic productivity (A_i) pre-entry. The Production function is $y_i = A_i f(n_i^j)$ where n = units of labor.

Assume that production is simultaneous move Cournot and normalize the wage rate = 1. The competitive environment e, denoting equilibrium levels under alternative parameters of {D,E}. Let $B^{j,e}$ is the set of firms who choose to enter and let $n_i^{j,e}$ and $y_i^{j,e} = A_i^{j,e} f(n_i^{j,e})$ denote the equilibrium employment and output of a given entering firm.

Under these conditions, we can define the aggregate productivity in the industry in environment e as total industry output in both locations divided by total industry input:

$$Productivity^e = \frac{\sum_{i \in B^{1,e}} A_i^{1,e} f(n_i^{1,e}) + \sum_{i \in B^{2,e}} A_i^{2,e} f(n_i^{2,e})}{\sum_{i \in B^{1,e}} (n_i^{1,e} + F_i^{1,e}) + \sum_{i \in B^{2,e}} (n_i^{2,e} + F_i^{2,e}) + q_{ship}^e T^e} \quad (1)$$

Where q_{ship}^e is the total volume of shipments between locations in environment e that incurs the transportation cost T^e. Note that included inputs are labor, set-up costs and transportation costs (which are technological) but not entry taxes and tariffs (which are policies).

Changes in the competitive environment can influence productivity through three mechanisms: reallocation, scale and within firm changes.

Reallocation is the most straightforward to understand. Consider a reduction in tariffs as the indicator of an increase in competitive intensity. The more efficient firms in one location will displace the less efficient firms both in its own location and in the other location. This will mean that aggregate productivity rises through the reallocation effect discussed in Section 2. Effectively the productivity cut-off for survival in the industry has increased meaning that there will be fewer, more highly productive firms.

Second, there is a scale effect. Suppose that all firms have the same marginal cost and fixed cost of entry. If on account of a change in the competitive environment, one firm produces the same amount as two previous firms; all else equal industry productivity will increase. This is because one fixed cost expenditure replaces two fixed cost expenditures in the denominator of equation (1). This scale effect is well known from the inefficient entry literature (e.g. Mankiw and Whinston, 1986)

Third, there may be a change in productivity "within firms" from a change in competition as incentives to invest in productivity enhancing activities like management may change. The model is silent over the within firm effect as it has no explicit model of how management can endogenously change within a firm.

Now consider an increase in competition as indexed by a fall in tariffs (or transportation costs). Efficient firms in one location are more likely to also move into the other location as it is cheaper to ship goods. This will increase the overall degree of competition and put downward pressure on price-cost margins. This in turn will reduce the number of firms in each region by weeding out the less efficient firms. This change in the equilibrium will obviously raise industry productivity through the reallocation effect: the more efficient firms have larger output and there will be fewer less productive firms. But there will also be a positive scale effect on productivity, as there are fewer firms in aggregate.

So in this set-up there is a clear intuition of how competition improves aggregate productivity through a selection and scale effect[11].

5.2 Within firm effects

Effort to improve managerial practices may also increase through incentive effects on incumbent firms. Schmidt (1997) formalizes the intuition that tougher competition will bring the interests of the managerial agent more into line with the firm's owners. In his model, managers have borrowing constraints so lose wealth when their firm goes bankrupt. High levels of competition increase bankruptcy risk and increase managerial effort.

Theoretically, however, the effects of competition on management is ambiguous from a design perspective. The analysis in Vives (2008) is very useful as he shows that management incentives can

[11] See Holmes and Schmitz (2010) for more theoretical discussion of other policy changes.

be considerd in some respects as an investment in non-tournament R&D. The firm pays a fixed cost of investing in a management system that lowers marginal costs as improved management increases productivity of all factors. Consider again an increase in consumer price sensitivity as an index of product market competition. The “stakes” are now higher: through greater managerial effort a firm can reduce marginal costs and this will have a larger effect on relative market share or relative profitability than when competition is lower. On the other hand, higher competition means that profits are lower in the industry, so any given performance contract will generate lower expected benefits because, for a given effort level, the profit related part of pay will be lower. This is the standard "Schumpeterian" reason for expecting lower innovative effort in high competition industries, and is an ever-present counterbalance to the pro-management forces of competition.

Vives (2008) shows that there are other factors at play when we allow endogenous entry and exit even for symmetric firms. In general, the average firm will be larger in equilibrium as the more intense competition induces exit, and larger firms enjoy economies of scale in management (they spread the fixed costs of management over a larger sales base). Thus, allowing for entry will tend to strengthen the positive effect of competition, as firms will be larger in equilibrium.

Despite this relatively clear message, it is worth emphasising that the offsetting Schumpeterian effect remains. Even in the short-run case, although the stakes are higher profit margins are still lower. For any given level of effort, the rewards to the manager (a share of the firm’s profits) will be lower for Schumpeterian reasons. Thus, we cannot unambiguously sign the effects of the competition on managerial effort (this intuition is also apparent in Raith, 2002, which Vives builds upon).

This discussion finds its analogue in the closely related literature on innovation and competition where the ambiguity has long been recognised. For example, the “raising the stakes” mechanism is closely akin to Arrow’s (1962) displacement effect: a monopolist is less likely to innovate because he does not want to cannibalize his own rents. Aghion et al (2005) argue that this can lead to an inverted “U” between competition and innovation where at low levels of competition the displacement (or “escape competition”) effect dominates, but at high levels of competition the Schumpeterian effect dominates.

5.3 Summary

The upshot of this discussion is that although some theories may help in pointing towards situations where competition might have a stronger effect on management or productivity, it is only going to be a very rough guide. To make progress we need to turn to empirical evidence.

6. The effects of competition on management and productivity: Empirical evidence

6.1 Competition and management

What about the empirical evidence? The evidence from Figure 5 suggested that management practices were better in the US where competitive selection forces are stronger than in developing countries and Southern Europe. More formally, we can look at the conditional correlation between the management score and indicators of competitive intensity. Whether measured by trade openness, the industry inverse Lerner Index or simply the number of perceived rivals competition is robustly and positively associated with higher management practice scores (Bloom and Van Reenen, 2007). Importantly, this relationship is robust to controlling for firm fixed effects (Bloom, Genakos, Sadun and Van Reenen, 2009) - increases in competition are associated with increases in management scores. Note that the obvious endogeneity bias here is to underestimate the importance of competition as better managed firms are likely to have higher profit margins, lower import penetration ratios and drive out their rivals, thus lowering conventional measures of competition.

A problem with these estimates is that there could still be ommitted variables, so reserachers have sought quasi-experiments that increase competiitve factors. For example, Bloom, Propper, Seiler and Van Reenen (2009) use political competition as an instrumental variable to account for unusually high numbers of hospitals in some areas of the country in the UK public healthcare system (hospitals are rarely closed down in politically marginal constituencies). They find that the positive effects of competition grow stronger when endogeneity is taken explicitly into account[12].

6.2 Competition and productivity

There is a much larger literature here. Early studies focused on cross sectional correlations which generally lead to ambiguous results. In the 1990s, panel data became more widely available and researchers were able to look in more detail at changes in competitive measures over time and track through changes in productivity. Nickell (1996) is a well-known study which found that increases in competition were followed some years later by increases in total factor productivity across a large

[12] Consistent with these general results on the positive association of competition on explicit measures of HR management, there is other evidence which also gets closer to causal effects when focusing explicitly on incentive pay. Guadalupe and Cunat (2009a) show that the pay-performance sensitivity for US CEOs is stronger when import competition is stronger (as measured by tariffs). Guadalupe and Cunat (2009b) show a similar result using US banking deregulation as an exogenous shift to competition. And in Guadalupe and Cunat (2005) they also find that the correlation between pay and firm performance (for UK workers and executives) strengthens with competition using the exchange rate appreciation in 1996 which differentially affected traded and non-traded sectors.

number of UK manufacturing firms. A criticism of studies following Nickell is that the measures of competition can have an ambiguous interpretation. For example, an increase in competition caused by tariff reductions in the model of Section 6.1 would *reduce* the number of firms and *increase* concentration, causing his empirical proxies to move in the wrong direction.

In the light of this concern, researchers have tried to identify more clearly exogenous changes to competition arising from quasi-experiments often focusing on single industries (the Bloom, Propper, Seiler and Van Reenen, 2009, study is in this spirit). For example, Syverson (2004b) shows TFP (and size) is very dispersed in the US ready mix concrete industry. Interestingly, the mean level of productivity was higher in more competitive markets (as indicated by a measure of spatial demand density) and this seemed to be mainly due to a lower mass in the left tail in the more competitive sector.

Perhaps the most common form of a competition shock is from trade liberalization. There are many studies looking at changes in plant productivity across the manufacturing sector as a whole. Pavcnik (2002) is one of the best known, focusing on Chile's liberalization. She found a large increase in aggregate productivity with about half due to reallocation and the remainder because of within plant effects. Other studies exploiting trade changes would include Trefler (2004), Goldberg et al (2008), de Loecker (2007), Dunne, Klimek and Schmitz (2008), Bustos (2007), Eslava et al (2009), Bloom, Draca and Van Reenen (2009) and Teshima (2008).

Another identification strategy is to examine deregulation of different sectors. Olley and Pakes (1996) examined the telecommunication equipment supply industry[13] finding substantial increases in productivity, especially through reallocation. Fabrizio, Rose and Wolfram (2007) examine deregulation of the electricity generation sector, also identifying substantial improvements in efficiency.

There is also an emerging literature examining discrete historical episodes of changes in the competitive environment. Holmes and Schmitz (2001), for example, look at the impact of the railroads on freight transport by water. They show evidence that the coming of the railroads in the 19th Century led to significant productivity improvements in water transport. The management of labor in ports,

[13] There is also a significant effect of such policy changes on the productivity of incumbent firms. Modelling the changing incentives to invest in productivity enhancing activities, such as R&D, is more difficult in heterogeneous firm models, but some recent progress has been made (e.g. Aw, Roberts and Xu, 2008).

such as New Orleans, for example, was poor with slow movement of goods and restrictive union rules. This seems like a classic example of competition raising productivity through changing work organization. Schmitz (2005) and Dunne et al (2008) look at two incidences of increased trade-based competition: the threat of Brazilians in the US iron ore industry in the early 1980s and imports from developing countries for the US cement industry. Bloom, Draca and Van Reenen (2009) use China's entry into the WTO in December 2001 to examine the impact on the European textile and apparel industries where quotas against China where lifted. All these trade-related events increased TFP dramatically.

Other examples include the effect of the entry of Wal-Mart (e.g. Matsa, 2009) on retail productivity such as stock-outs and the ending of cartels (e.g. the US sugar manufacturing industry described in Bridgman et al, 2009).

The common feature of all these quasi-experiments was increases in TFP through the within firm dimension as well as the between firm reallocation mechanism. Although harder to identify, the *mechanisms* stressed by the authors were changes in both "hard" technologies but also through management practices. This emerging literature is suggestive of an important role for competition in raising productivity through managerial change.

7. The effects of management practices on productivity

Do variations in variations in management practices play a role in driving differences in and productivity? We find that the answer is "probably, yes", although the empirical basis for this which we survey in detail is surprisingly weak given the importance of the topic. In fact, as Syverson (2010**)** notes in discussing management as a driver of productivity "*no potential driving factor of productivity has seen a higher ratio of speculation to empirical study*".

There are a huge number of studies here and we survey them in some detail in Bloom and Van Reenen (2010b). Here is our five point summary:

1. First, high quality studies generally show that there is a positive effect on productivity of incentive pay, both individual bonuses and (more surprisingly) group bonuses. This seems true across many sectors, including the public sector (see, for example, the Prentice et al, 2007 survey).

2. Second, in addition to a pure incentives effect, there is usually also an important selection effect generating higher productivity – productivity increases because high ability workers are attracted to organizations offering higher powered incentives.
3. Third, the introduction of new forms of incentive pay is generally more effective when combined with other "complementary" factors. There are complements within the bundles of management practices (e.g. team work and group bonuses), and between some management practices and other firm characteristics (e.g. people management and information technology).
4. Fourth, there are many examples of perverse incentives, for example, when rewards are tied to specific periods of time so that workers manipulate commissions to hit quarterly targets.
5. Fifth, incentive pay schemes tend to be associated with greater dispersion of productivity as the effects are stronger on the more able workers, and this is stronger than the selection effect (which pushes towards reduced dispersion)

Several randomized control trials of management interventions are currently in the field. Perhaps the most compelling is Bloom, Eifert, Mahajan, McKenzie and Roberts (2010). They randomize management practices delivered by a major international consultancy firm to 20 plants in large (300 person) textile firms in Mumbai, India. The Control firms get one month of diagnostic (about 200 hours of help) and then monthly monitoring (about 20 hours a month). Treatment firms get one month of diagnostic, four months of intervention (about 800 hours of help) and then monthly monitoring. They collect weekly data for all plants from 2008 to 2010.

The authors find large increases in the adoption of 32 management practices (which include those discussed in the Bloom and Van Reenen, 2007, survey). Productivity also improved dramatically - quality improved, inventories are much lower and operational efficiency far greater. The authors estimate that adopting these practices increased productivity by 10% and profits by around $200,000 per year. The work is still in the field, so an important question is whether these gains persist over time. But on face value, this looks like a major increase in productivity stimulated by a management intervention.

A complication of this study and others that focus on management as the mechanism underlying productivity increases is that management practices affect not just Hick neutral change but also interact with other factor inputs. The traditional approach of consigning management (and other efficiency enhancing activities) to a residual is problematic when managerial capital is not separable from other factor inputs. Measurement of management allows researchers to investigate this non-neutrality

directly (through allowing for interaction terms for example[14]). It also relates to the econometric literature allowing for non-separable error terms and reinforces the point that taking management seriously implies that one needs to think much harder about identification of production functions.

8. Conclusions

This paper has been a whirlwind tour of some of the new findings that seek to address a classic economic question: does competition raise productivity and if so, what is the mechanism? I have argued that competition does increase productivity and a main mechanism is through improved management practices. Our view is that management should be seen partly as a transferable technology and that competition fosters the adoption of better management practices through both selecting out the badly managed firms (reallocation) and giving incumbent firms stronger incentives to improve their management practices. We have argued that this perspective is supported by a range of new evidence both from new ways of measuring management and from more robust forms of identifying the causal impact of competition changes on productivity outcomes.

The literature here is still in its infancy and there are many important lines of research to be investigated. First, in terms of measurement there is huge room for improving the way we quantify management and organizational practices in firms. The methods described in Section 4 only look at a small number of aspects of the firm and there is ample room to expand the set of design issues that have been explored in the theory literature (e.g. decentralization, span of control, etc.). Also, the methods are skill labor intensive, so finding ways to reduce the costs through using more conventional survey techniques is important. Second, the number of studies with clean identification of large shifts in competition is still too small and more work needs to be done in looking for such changes and examining their consequences, rather than simply relying on an assumed model of industry behaviour. Third, the theoretical perspective of management as a transferable technology needs to be developed further and we need to think more about what are the testable implications that could distinguish this paradigm from the other perspectives on the economics of management. Finally, if the consensus is emerging that competition does have an effect on within firm incentives to upgrade productivity and management, we need to know why? Which theoretical mechanisms are at play and where will the forces be stronger? This has obvious implications for public policy.

[14] See for example, Bloom, Sadun and Van Reenen (2007) who stress this in relation to the effects of IT capital on productivity.

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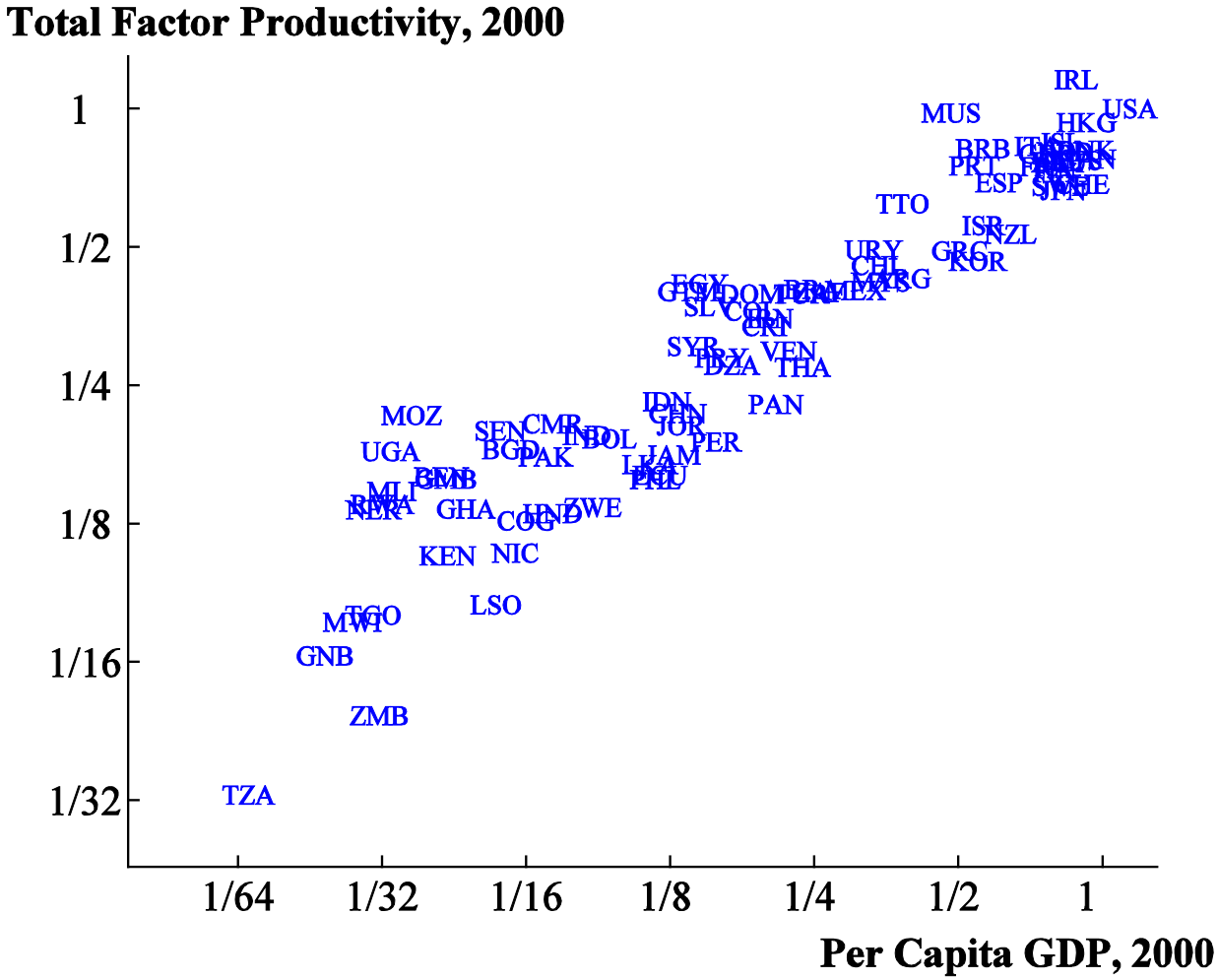
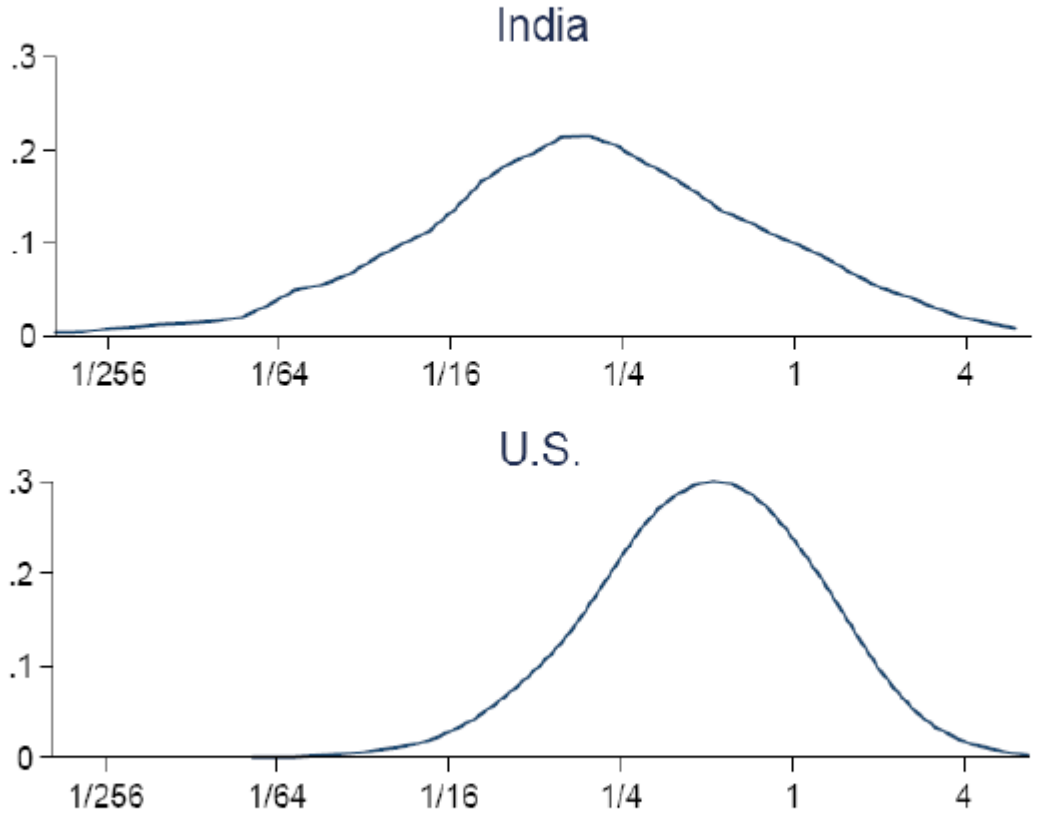
FIGURE1:
LARGE INCOME & TFP DIFFERENCES BETWEEN COUNTRIES



Source: Jones and Romer (2009). US=1

FIGURE 2

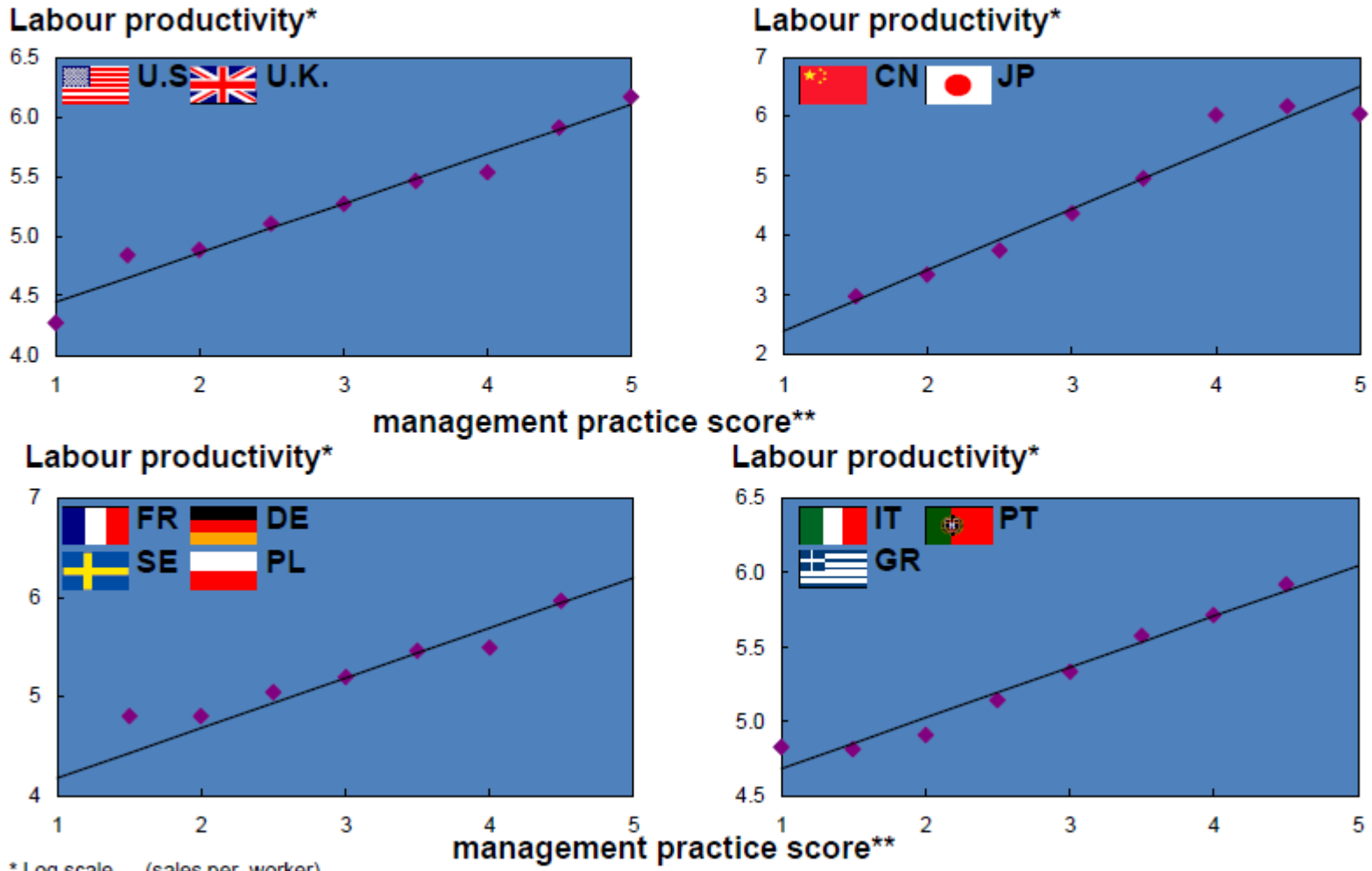
DISTRIBUTION OF PLANT TFP DIFFERENCES IN US VS. INDIA HIGHER US TFP DUE TO REALLOCATION - THINNER "TAIL" OF LESS PRODUCTIVE PLANTS



Source: Hsieh and Klenow (2009); US mean=1

FIGURE 3

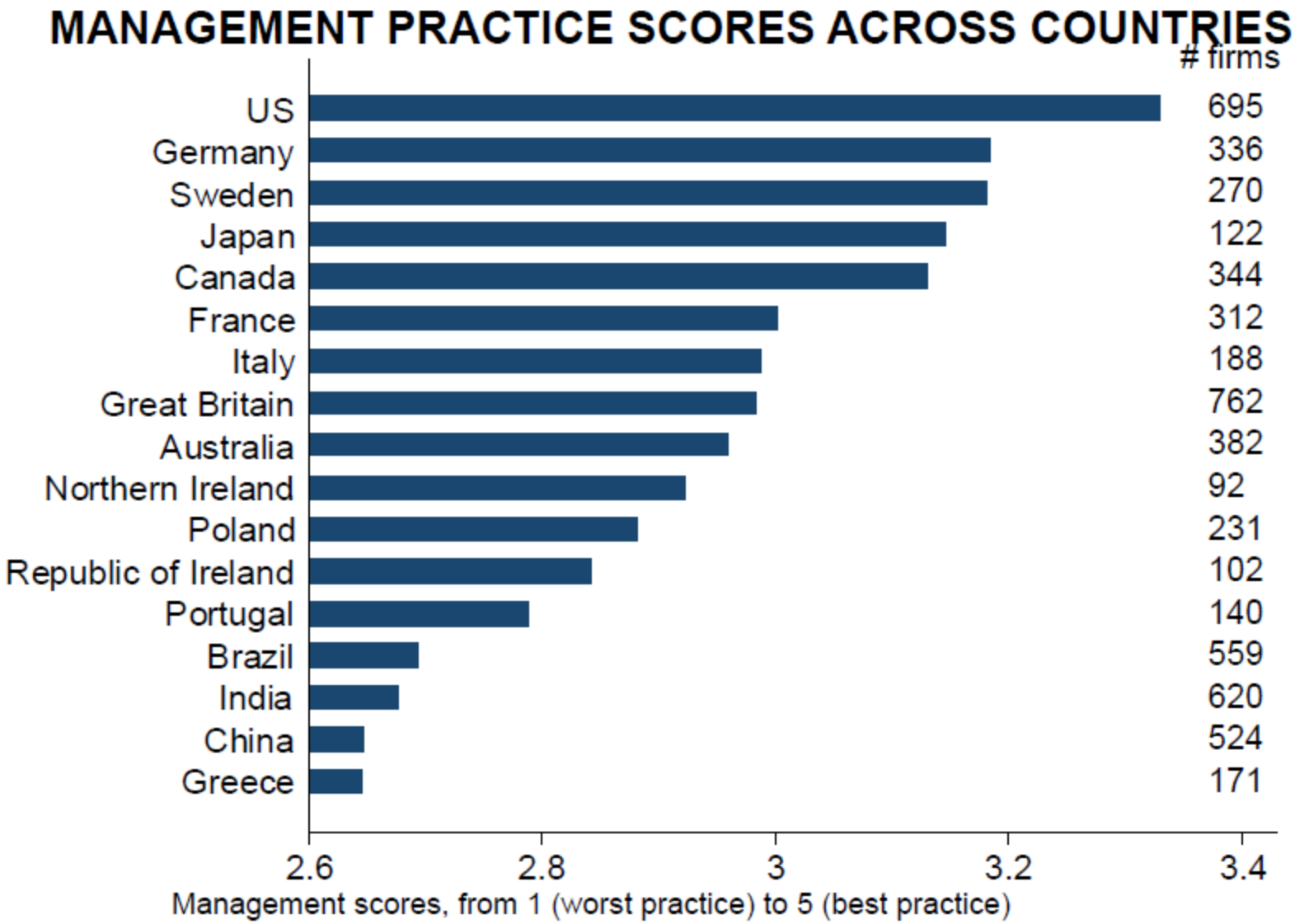
THE LINK BETWEEN PRODUCTIVITY AND MANAGEMENT HOLDS TRUE ACROSS DIFFERENT COUNTRIES



* Log scale (sales per worker)

** Firms are grouped in 0.5 increments of assessed management score

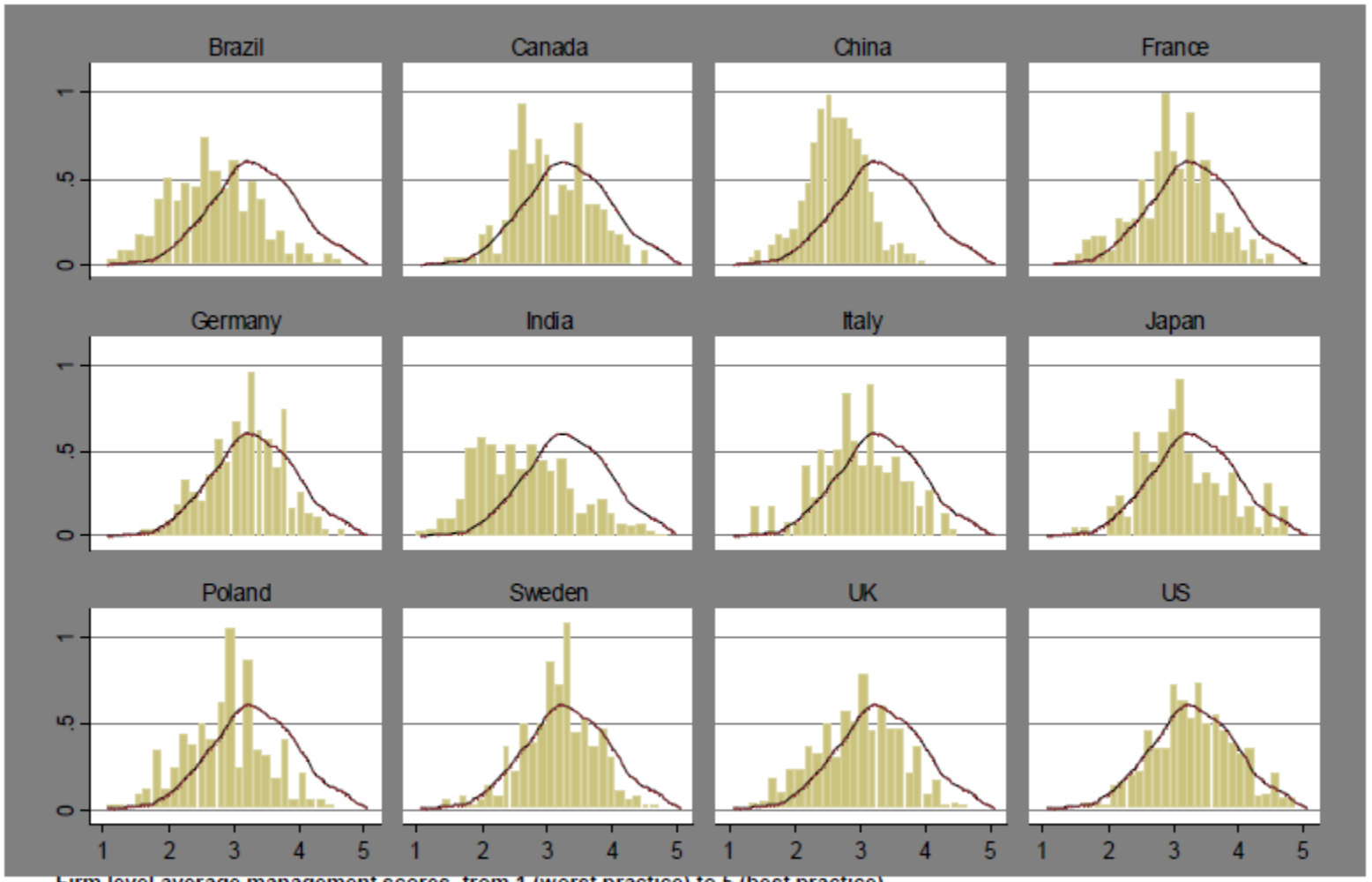
FIGURE 4



Note: Averages taken across all firms within each country. 5,850 observations in total. Firms per country in the right column
Source: Bloom, Genakos, Sadun and Van Reenen (2009)

FIGURE 5

MANAGEMENT PRACTICE SCORES ACROSS FIRMS



Note: The bars are the histogram of the actual density. The line is the kernel of the US density for comparison. Portugal , Ireland and Greece omitted for presentational reasons, http://www.nber.org/reporter/2008number4/bloom.html

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