Measuring and Explaining Management Practices Across Firms and Countries

Preliminary: Do not cite, do not quote.

Nick Bloom*and John Van Reenen*

*** Centre for Economic Performance, London School of Economics and CEPR*

July 2005

Abstract

We use an innovative survey tool to collect *management practice* data from 731 medium sized manufacturing firms in Europe and the US. We find these are strongly associated with better firm performance in terms of productivity, profitability, Tobin's Q, and sales growth. We also find a surprisingly large dispersion of management practices across firms with a long tail of extremely badly managed firms. But this presents a dilemma – how can so many firms with apparently inferior management practices survive? We find that this is due to a combination of: (i) a lack of competition, with worse management practices in less competitive industries (possibly due to more limited selection effects); (ii) firm age, with older firms less well managed particularly after controlling for survivor effects; and (iii) regulations on firing and dismissal, with job-protection appearing to enable long-tenured managers to block management practice reforms.

JEL No. O32, O33

Keywords: management practices, productivity,

Acknowledgements: We would like to thank the Economic and Social Research Council and the Anglo-German Foundation for their substantial financial support. The Bundesbank and HM Treasury supported the development of the survey. Our partnership with John Dowdy, Stephen Dorgan and Tom Rippin has been particularly important in the development of the project. Helpful comments have been received from Tim Besley, Eric Bartelsman, Wendy Carlin, Rachel Griffith, Ed Lazear, David Metcalf, Andy Neely, Andrea Pratt, Steve Redding, Kathryn Shaw, Andrei Shleifer, Dan Sichel, John Sutton and participants at numerous seminars. The usual disclaimer applies.

I INTRODUCTION

Economists have long speculated on why such astounding differences in the productivity performance exist between firms and plants within countries, even within tightly defined sectors. For example, labour productivity varies dramatically even with the same four or five digit industries and these differences are often highly persistent over time (Baily et al. (1992), Bartelsman and Dhrymes (1998) and Disney, Haskel and Heden (2003)).

The focus of much applied economic research has been in "chipping away" at these productivity differences through better measures of inputs (capital, materials, skills, etc.). Some parts of the literature have attempted to see how much of the residual can be accounted for by explicit measures of technology such as Research and Development patents or computerisation (e.g. Griliches, 1980, Stiroh, 2002). But technology is only one part of the story and a substantial unexplained productivity differential still remains, which panel data econometricians often label as the fixed effects of "managerial quality" (see, for example, Mundlak (1961) and Bailey et al. (1992)).

While the popular press and Business Schools place huge stress on the importance of good management, economists have until recently had relatively little to say about management practices per se. A major problem has been the absence of good quality data on managerial practices that is measured in a consistent way across countries and firms. One of the purposes of this paper is to present a survey instrument for the measurement of managerial practices. We collect original data using this survey instrument on a sample of about 730 medium sized manufacturing firms in the US, UK, France and Germany. After matching this data with information on firm accounts we are able to directly address the association between managerial practices and firm performance.

Our work relates to the recent contribution of Bertrand and Schoar (2003) which emphasises the importance of managers in firm performance. They focus on the impact of changing Chief Executive Officers (CEOs) and Chief Financial Officers (CFOs) in large quoted U.S. firms, which will tend to reflect the impact of management *styles* and *strategies*. Our work, with its emphasis measuring the *practices* of middle management, complements Bertrand and Schoar (2003) by looking at firm practices as revealed by the typical middle manager[1]. We see practices as more than the attributes of the top managers: they are part of the organisational structure and behaviour of the firm, typically evolving slowly over time even as CEOs and CFOs come and go.

We start by analysing the raw survey data and observe a surprisingly large spread in management practices across firms. Using multiple surveys of the same firm by different interviewers we calibrate our measurement error and show that this can only account for about a quarter of the distribution in management practices, with the remaining three quarters due to a wide underlying distribution of practices. Most notably, using our measure, we see that a large number of firms are extremely badly managed with ineffective monitoring, targets and incentives.

[1] In a sub-sample of 15 companies we piloted questions on the hierarchical structure of the firm and found the average number of levels to the shop floor was 6.3 for the CEO versus 3.4 for the plant managers (our target management group) placing them centrally within the organisation.

We then present evidence that better managerial practices are significantly associated with higher productivity and other indicators of firm performance, even after accounting for a host of measurement and econometric issues. This is true both in the Anglo-Saxon countries investigated (the UK and the US) and the Continental European countries investigated (France and Germany); suggesting our characterization of good management practice is not intrinsically Anglo-Saxon biased. Across the sample management practices account for a significant proportion of the variance in TFP between firms and between countries (about 10-20%), and we note this may actually be substantially greater than estimated due to the downward bias in our coefficients from measurement error.

This raises the question of why there is such a variation in management practices across firms? We present three explanations:

1. Product market competition plays a key role in determining the level of management practice, with higher competition likely to increase the exit rate of badly managed firms so improving average management practices. We find some evidence for an additional "effort" effect of competition in forcing managers to work harder, although this appears relatively less important.

2. Older firms, controlling for selection effects, have poorer management practices. This is consistent with the idea that new entrants find it easier to adopt the better management practices of the era they were founded than their older counterparts, who face organisational adjustment costs.

3. Stronger labour-market regulation significantly impedes good management practice, particularly in firms with longer tenured employees. This suggests that regulation impedes the adoption of new management practices

The layout of the paper is as follows. Section II discussed why management practices could vary, section III discusses measuring management practices the management data, section IV the model and the results, section V the distribution of management practice and section VI considers the evidence possible causes for the variations in management. Some concluding comments are in section VII. More details of the data, models and results can be found in the Appendices.

II WHY SHOULD MANAGEMENT PRACTICES VARY?

Why do poorly managed firms co-exist with well-run firms in the same product market? In a competitive marketplace one would expect to see the inefficiently run firms driven out of the industry[2].

[2] For examples of empirical evidence on competition and productivity across industries see *inter alia* Nickell (1996) or Syverson (2004b).

There are at least three groups of theories that could explain the paradox. First and foremost, firms may operate in environments with different degrees of product market competition – this enables poorer managed firms to survive in equilibrium. Second, even if the market is competitive there are important dynamics that may allow inefficient firms to survive, at least for some period of time. Thirdly and most simply, there are differential costs of good management driven for example, by government imposed regulatory constraints over the "right to manage". We consider each of these theories and examine their empirical predictions.

II.A The degree of product market competition

Moving away from perfect competition means that inefficient firms can survive in the marketplace even in the long-run. But the exact theoretical relationship between competition and management is complex. Crudely, one could consider two views of management practices: selection of the well managed or contracting for managerial effort.

Selection of the well managed

Entrepreneurs found firms with distinctive cultures that are deeply embedded and hard to change over time. Entrepreneurs do not know exactly how well the particular type of firm will perform until they enter a market and compete with other firms. We call this "selection of the well managed". Tough product market competition will accelerate this selection by vigorously eliminating firms with poor management practices, so that surviving firms will on average have higher managerial quality. Less competitive product markets will be characterised by on average worse management. So higher competition will be associated with better average management practices. Syverson (2004a) focuses on productivity and offers supportive evidence of these predictions in his analysis of the US cement industry, finding that tougher competition is associated with higher average productivity with a lower variation.

Contracting for managerial effort

Firms can influence management practices through a variety of mechanisms. This could be, for example, committing to a particular remuneration contract in a principal-agent setting in order to elicit greater managerial effort, or investing a greater amount in improving management in an analogous way to a non-tournament model of cost reducing R&D. Such investment could, for example, take the form of hiring the best managers. We call these effects "contracting for managerial effort".

The key question we will investigate is: what is the impact of increasing product market competition on management best practice? In Appendix E we set up a simple Bertrand differentiated product model to show some of the forces at play. We allow firms to choose contracts with managers after they have entered the market, but before their marginal costs are revealed. Marginal costs are an outcome of managers' (unobservable) efforts and a cost shock. We assume that the distribution of cost shocks is not so large that any firms exit the market (this is in order to switch off any selection effects and focus on the effort effect). "Investing in managerial effort" is essentially choosing a higher powered incentive contract that will elicit more effort (better managerial practices) but at the cost of giving away more of the firm's profits to the manager.

For a given number of firms an increase in competition (again indexed by a decrease in product substitutability) has an ambiguous effect on managerial effort. On the one hand higher competition should increase firm incentives to promote managerial effort because any unit cost reduction will have a larger effect on market share. On the other hand, rents are lower when competition in higher, so the profit increase from any increase in market share is less valuable. However, when we allow entry to be endogenous there is fall in the number of firms who choose to enter the market because profits are lower. In a free entry long-run equilibrium firms will be larger on average. This means they have a greater desire to cut marginal costs through higher managerial effort. In the context of this simple model (which follows Raith, 2003), once we allow for endogenous market structure an increase in product market competition unambiguously increases management effort[3].

Although we have discussed this in a principal-agent context the same intuition follows if we consider a model of non-tournament process R&D. This can be regarded as an investment in cost-reducing management practices prior to competing on prices. Increases in competition will have the same impact on the incentive to make such investments as it would have on the incentives to increase managerial effort in the principal-agent set-up. Both are cost-reducing investments so will increase with product market competition (at least under the assumptions of the differentiated product model).

The result that increased product market competition (through higher product substitutability) should improve incentives for managerial practices (though cost reducing investments) are reasonably robust, but not completely general. Vives (2004) shows that providing the market for varieties does not shrink the result goes through under Cournot competition as well as the Bertrand competition considered in Appendix E for a variety of assumptions over the form of utility. The conditions for Cournot are more exacting, but will hold so long as output reaction functions are downward sloping, which is the standard case.

II.B Dynamics and the age of the firm

Even in models of perfectly competitive product markets, dynamic effects may mean that poorly managed firms can survive for a period of time. For example, in the Jovanovic (1982) model firms take time to learn about their own quality so even poorly managed firms will continue producing for some periods before they exit. In the Hopenhayn (1992) model firms have perfect information about their ability, but this ability evolves over time. Since produces pay a fixed-cost to enter they will optimally exit only if their abilities falls below some lower threshold, generating a spread of abilities in the market.

Empirically, researchers who have followed cohorts of plants show that the least productive tend to exit earlier on average. Consequently, as the cohort ages there is an increase in average productivity within the cohort (these dynamic selection effects are mainly played out in first five

[3] Schmidt (1997) allows bankruptcy costs in a principal agent model with Cournot competition. With risk neutrality, but a wealth constrained manager the fear of bankruptcy will increase the incentive of the manager to supply effort. Nevertheless the rent reducing effect of competition will still pertain and could be large enough to completely offset the fear of bankruptcy. It is allowing the endogeneity of entry which makes a substantial difference to the comparative statics.

to ten years according to Jensen et al (2001), see also Disney et al (2003)). This pattern is made more complex, however, by the fact that new firms will tend to begin operating with newer and presumably better practice management techniques relative to incumbents. This may be because older firms find it difficult to change their organisations in response to new conditions[4]. This will give rise to cohort (or 'vintage') effects where more recent cohorts of firms start off with a systematically higher mean level of good management practices than earlier cohorts.

The impact of these dynamic considerations is that in industries with lower product market competition, and therefore few selection pressures, we will observe in the cross section that older firms have systematically worse management practices than the younger firms. This is because older firms, founded in earlier time periods, may be using less sophisticated management practice techniques on average. In a more competitive industry the cross sectional pattern between management quality and competition will be more hump-shaped. For the younger firms selection effects are very strong (in the first 5 or 10 years) and the younger firms will initially have lower management scores on average than their slightly older rivals. However, eventually the cohort effects are likely to dominate the selection effects and there will emerge a clear negative relationship between company age and management best practices even in these more competitive industries.

To evaluate these we set up a very simple simulation model combining selection effects and cohort effects[5]. This models a large fixed population of firms with a 2% annual rate of entry and exit. The entrants draw their managerial ability from a normal distribution with a yearly upward trend of 1% of the standard deviation. Exit occurs based on an imperfect signal of management ability, comprised of a 50% weight on managerial ability and a 50% weight on an equal standard deviation white noise. Thus, the new entrants are drawn from an upwardly trending distribution generating a cohort effect, while every period worse managed firms are more likely to exit generating a selection effect. For this cohort effect to exist it is only important that the new entrants improve their management practices at a *relatively* faster rate than the incumbents. So while incumbents may learn and embody some of the latest managerial practices, they do this at a slower rate than the new entrants.

Figure 1 plots average management practice scores against log firm-age, depicting a clear hump shaped relationship. For the first fifteen years management practices improve on average as the selection effects dominate. After this initial period, however, most of the badly managed firms have been eliminated and the cohort effect dominates, driven by worse management practice scores in the remaining upper-tail of firms. Figure 2 plots the same management practice against log firm-age but with the selection effects of competition turned off by removing any management signal from the exit process. This generates a clear downward sloping relationship as the cohort effects dominates in the absence of any selection mechanism removing poorly managed firms.

[4] See Ichniowski et al (1995, 1997) for example. In their work on 19 US steel finishing plants, where they find the youth of the plant is a significant predictor of HRM best practices, with older firms being impeded from adopting the latest HRM practices by internal organizational rigidity.

5 The Matlab code is available on http://cep.lse.ac.uk/matlabcode

II.C Regulatory costs on managers

If firms can influence managerial practices they will weigh up the benefits and the costs of making such changes (Corrada, Hulten and Sichel, 2004, consider extending the standard production function to allow for variety of investments in "organisational capital"). We have discussed how the benefits of making changes will depend on the degree of product market competition and the form of the production function (which itself may differ across industries). The costs of good managerial practices may vary for a number of reasons (including firm age), but one important exogenous source of variation is government regulation. High firing costs, for example, will make it difficult to remove underperforming middle managers who may form coalitions to block change. Since regulations differ substantially across the countries in our sample (e.g. Botero et al (2004)), this is an important potential driver of management practices. Furthermore we would expect the costs of job regulation to be most binding on firms with longer tenured managers who have acquired more job rights, so there will be within country variation in the effects of these regulations.

III MEASURING MANAGEMENT PRACTICES

To investigate these issues we first have to construct a robust measure of management practices overcoming three hurdles: scoring management practices; collecting accurate responses; and obtaining interviews with managers. We discuss these in turn:

III.A Scoring Management Practices

To measure management requires codifying the concept of good and bad management into a measure applicable to different firms within the manufacturing sector. We used a practice evaluation tool developed by a leading international management consultancy firm which defines and scores from 1 (worst practice) to 5 (best practice) 18 of the key management practices which appear to matter to industrials firms.

The questions in the survey order, the scoring system and three anonymous responses per question are provided in Appendix A1. These questions can be grouped into four areas: *operations* (3 questions), *monitoring* (5 questions), *targets* (5 questions) and, *incentives* (5 questions). The operations management section focuses on the introduction of lean manufacturing techniques, the documentation of processes improvements and the rationale behind introductions of improvements. The monitoring section focuses on the tracking of performance of individuals, reviewing performance (e.g. through regular appraisals and job plans), and consequence management (e.g. making sure that plans are kept and appropriate sanctions and rewards are in place). The targets section examines the type of targets (whether goals are simply financial or operational or more holistic), the realism of the targets (stretching, unrealistic or non-binding), the transparency of targets (simple or complex) and the range and interconnection of targets (e.g. whether they are given consistently throughout the organisation). Finally incentives includes promotion criteria, pay and bonuses, and fixing or firing bad performers, where best practice is deemed to be an approach that gives strong rewards for those with both ability and effort. A subset of the incentives, targets and operations questions have

similarities with those used in studies on HRM practices, such as Ichinowski, Shaw and Prenushi (1997) and Black and Lynch (2002).

Since the scaling may vary across questions in the econometric estimations we convert the scores (from the 1 to 5 scale) to z-scores by normalizing by question to mean zero and standard deviation one. In our main econometric specifications we take the unweighted average across all z-scores as our primary measure of managerial practices, but we also experiment with other weightings schemes based on factor analysis approaches.

There is scope for legitimate disagreement over whether all of these measures really constitute "good practice". So an important way to examine the externality validity of the measures is to examine whether they are correlated with data on firm performance constructed from company accounts and the stock market. We also examine whether the relationship between management practices and productivity is weaker in the Continental European nations to check for "Anglo-Saxon" bias.

III.B Collecting Accurate Responses

With this management practice evaluation tool we can, in principle, provide some quantification of firms' management practices. However, an important issue is the extent to which we can obtain unbiased responses to these questions from firms. In particular, will respondents provide accurate responses? As is well known in the surveying literature (see, for example, Bertrand and Mullainathan, 2001) respondents answers are typically biased by their scoring grid with responses anchored towards those they expect the interviewer thinks is "correct". In addition interviewers may themselves have pre-conceptions about the performance of the firms they are interviewing and bias their scores based on their ex-ante perceptions. More generally, a range of background characteristics, potentially correlated with good and bad managers, may generate some kinds of systematic bias in the survey data.

To try and address these issues we took a range of steps to obtain highly accurate data.

1. The interviewer process was data was 'double-blind'. Participating managers were not told they were being scored during the interviews. The interview was introduced as a piece of research work which would take around one hour to discuss manufacturing and other management practices within their firm. Furthermore, interviewers did not know the firm's financials or performance in advance. This was achieved by selecting medium sized manufacturing firms and by providing only firm names and contact details to the interviewers (but no financial details). The interviewers were specially trained graduate students from top European and US business schools, with a median age of 29 and 5 years prior business experience in the manufacturing sector[6].

2. The survey was executed by telephone using a 'funnelling' interviewing technique, supported by as many responses as necessary to open questions (i.e. "can you tell me how you promote your employees"), rather than closed questions (i.e. "do you promote your employees on tenure [yes/no]?"), to get an accurate assessment of the firm's typical

[6] Thanks to the interview team of Johannes Banner, Michael Bevan, Mehdi Boussebaa, Dinesh Cheryan, Alberic de Solere, Manish Mahajan, Simone Martin, Himanshu Pande, Jayesh Patel and Marcus Thielking.

practices. This enabled scoring to be based on the interviewer's evaluation of the actual firm practices, rather than the firm's aspirations, the manager's perceptions or the interviewer's impressions. If an interviewer could not score a question it was left blank, with the firm average taken over the remaining questions[7].

3. The survey instrument was targeted at plant managers, who are typically senior enough to have an overview of management practices but not so senior as to be detached from day-to-day operations.

4. A detailed set of information was also collected on the interview process itself (number and type of prior contacts before obtaining the interviews, duration, local time-of-day, date and day-of-the week), on the manager (seniority, nationality, company and job tenure, internal and external employment experience, and location), and from the interviewer (individual, UK time-of-day and subjective reliability score). Some of these survey controls are significantly informative about the management score (see Appendix C and Table C1)[8], and when we use these as controls for interview noise in our econometric evaluations the coefficient on the management score typically increased.

III.C Obtaining Interviews with Managers

The interview process takes around one hour per interview and is targeted at relatively senior managers within the firm. Overall we obtained a high response rate of 54% coverage rate. This was achieved through a number of steps.

1. The interview was introduced as "Research" without any discussion of the firm's financial position or its company accounts, making it relatively uncontroversial for managers to participate. Interviewers did not discuss financials in the interviews both to maximise the participation of firms and also to ensure our interviewers were truly "blind" on the firm's financial position.

2. Questions were ordered to lead with the least controversial (shop-floor management) and finish with the most controversial (pay, promotions and firings).

3. Interviewers performance was monitored, as was the proportion of interviews achieved so they were persistent in chasing firms (the median number of contacts each interviewer had per interview was 6.4) Since the questions are about practices within the firm any plant managers can respond, so there are potentially several managers per firm who could be contacted[9].

---

[7] The average number of un-scored questions per firm was 1.3%, with no firm included in the sample if more than three questions were un-scored.

[8] In particular we found the scores were significantly higher: for senior managers, later in the week and earlier in the day. That is to say scores were highest, on average, for senior managers on a Friday morning and lowest for junior managers on a Monday afternoon. By including information on these characteristics in our analysis we explicitly controlled for these types of interview bias.

9 We found no significant correlation between the number, type and time-span of contacts before an interview is conducted and the management score. This suggests while different managers may respond differently to the

4. The endorsement of the Board of Directors of the Bundesbank (in Germany) and the Permanent Secretary of HM Treasury (in the UK) helped demonstrate to managers this was an important non-commercial exercise with official support.

III.D Sampling Frame and Additional Data

Since our aim is to compare across countries we decided to focus on the manufacturing sector where productivity is easier to measure than in the non-manufacturing sector. We also focused on medium sized firms selecting a sample where employment ranged between 50 and 10,000 workers (with a median of 700). Very small firms have little publicly available data. Very large firms are likely to be more heterogeneous across plants and so it would be more difficult to get a picture of managerial performance in the firm from one or two interviews. We drew a sampling frame from each country to be representative of medium sized manufacturing firms and then randomly chose the order of which firms to contact (see Appendix B for details). We also excluded any clients of our partnering consultancy firm from our sampling frame[10].

In addition to the standard information on management practices, we also collected information – primarily from a separate questionnaire to the Human Resource department - on the average characteristics of workers and managers in the firm such as gender, age, proportion with college degree, average hours, holidays, sickness, occupational breakdown and a range of questions on the organisational structure of the firm and the work-life balance. The details of this questionnaire are provided in Appendix A2.

Quantitative information on firm sales, employment, capital, materials etc. came from the company accounts and proxy statements, while industry level data came from the OECD. The details are provided in Appendix B.

Comparing the responding firms with those in the sampling frame we found no evidence that the responders were systematically different on any of the performance measures to the non-responders. They were also statistically similar on all the other observables in our dataset. The only exception was on size where our firms were slightly larger than average than those in the sampling frame.

III.E Evaluating and Controlling for Measurement Error

The data potentially suffers from several types of measurement error that are likely to downwardly bias our coefficients on management. First, we could have measurement error in the management practice scores obtained using our survey tool. To quantify this we performed repeat interviews on 64 firms, contacting different managers in the firm, typically at different plants, using different interviewers. To the extent that our management measure is truly picking up general firm level management practices these two scores should be correlated, while to the extent the measure is driven by noise the measures should be independent.

---

interview proposition this does not appear to be directly correlated with their responses or the average management practices of the firm.

[10] This removed 33 firms out of our sampling frame of 1353 firms

Figure 3 plots the 64 average firm level scores from the first interview against the second interviews, from which we can see they are highly correlated (0.734). Furthermore, there is no obvious (or statistically significant) relationship between the degree of measurement error and the absolute score. That is to say high and low scores appear to be as well measured as average scores, and firms that have high (or low) scores on the first interview tend to have high (or low) scores on the second interview. Thus, firms that score below 2 or above 4 appear to be genuinely badly or well managed rather than extreme draws of sampling measurement error.

Analysing the measurement error in more detail (see Appendix C) we find that the question level measures are noisier, with 42% of the variation in the scores due to measurement error, compared to the average firm's scores with 25% of the variation due to measurement error. This improved signal-noise ratio in the firm level measure – which is our primary management proxy - is due to the partial averaging out of measurement errors across questions.

The second type of measurement error concerns the fact that our management practices cover only a subset of all management practices which drive performance. For example, our interviews did not contain any questions on management strategy. However, so long as firms' capabilities across all management practices are positively correlated - which they are significantly within the 18 practices examined - then our measure based on a subset of practices will provide a proxy of the firm's true management capabilities. Again, however, this suggests that the coefficients we estimate on management are probably biased towards zero due to attenuation bias.

IV MANAGEMENT PRACTICES AND FIRM PERFORMANCE

Before we investigate the reasons for the spread of management practices across firms it is worth evaluating whether these practices can account for any variation in performance. While it is not possible to identify any *causal* relationship between our management practice measures and firm performance, a significant relationship would indicate our management scores are measuring something that is important to the operation of firms.

IV.A Econometric Modelling

Consider the basic production function

$$y_{it}^c = \alpha^c{}_l l_{it}^c + \alpha^c{}_k k_{it}^c + \alpha^c{}_m m_{it}^c + \beta^c MNG_i^c + \gamma^c{}' x_{it}^c + u_{it}^c \qquad (1)$$

where Y = sales, L = labour, K = capital and M= materials of firm i at time t in country c (note that we allow all firms to have country specific parameters on the inputs), and lower case letters denote natural logarithms $y = \ln(Y)$, etc. The x's are a number of other controls that will affect productivity such as workforce characteristics (e.g. human capital, age), firm characteristics (e.g. firm age) and industry characteristics (generally proxied by a complete set of 3-digit SIC industry controls).

The crucial variable for us is management practices denoted *MNG*. Our basic measure takes z-scores of each of the 18 individual management dimensions examined and then averages over the

variables to get *MNG*. We experimented with a number of other approaches including using the primary factor from factor-analysis and using the raw average management scores and found very similar results. We also looked for complementarities between the different types of management practices and found some weak support for this.

The most straightforward approach to estimating equation (1) is to run a within-groups estimation including a large set of possible controls in a first step, and then project the fixed effects on the management scores in a separate second step. This is analogous to the approach of Black and Lynch (2001) that followed a similar two step approach in their analysis of workplace practices and productivity. We use data from 1998-2004 to average out the variables that we do observe over time, allowing the firm level standard errors to be clustered. Alternatively, we can exploit the fact that we have panel data on our firms to estimate over a longer period (1994-2004), and attempt to deal with the endogeneity of the time varying inputs (capital, labour and materials). To do this we experiment with two alternative estimation approaches - System GMM and the Olley Pakes estimator[11]. Again, using these estimates of the production function parameters we construct firm specific efficiency/TFP measures which we then relate in a second stage to management practices and other time invariant firm characteristics.

Before turning to our results we highlight one important issue regarding the relationship between management practices and firm performance. Due to the cross-sectional nature of our data we can not identify the *causal* relationship between management practices and firm performance, and there are a number of reasons to be concerned about the potential for feedback. Negative feedback could occur – biasing our coefficient towards zero – if more productive firms use their rents to avoid implementing managerial "best practices" which are generally higher effort. Positive feedback could occur if well managed firms attract higher ability workers, and this is not controlled for by our human capital measures. So to reiterate our objective in these estimations is purely to confirm that our management practices measures are significantly *correlated* with firm performance measures, indicating they do indeed measure something that is meaningfully related to firm operations.

IV.B Econometric Results

Table 1 investigates the association between management practices and firm productivity using a range of alternative econometric methods. Column (1) estimates a within-groups estimator (top section of the column (1), and then uses the estimated fixed-effects in a second-step cross-sectional regression on our management practice scores (base of column (1)) and finds a significant and positive correlation of TFP with management. The Olley Pakes specification is estimated in the top section of column (2), for which TFP (averaged over the sample for a given firm) is positively and significantly correlated with our management measure (base of column (2)). In column (3) we run a System GMM specification, and again taking the predicted fixed effects find this is also significantly related to management[12].

[11] See Arellano and Bond (1991) and Blundell and Bond (1998) on System GMM estimation, and Olley and Pakes (1996) on their estimation strategy.

[12] Across these specifications the precise coefficients on capital, labor and materials of course change due to the different identification assumptions. These three estimators are presented here to show the robustness of the relationship between management and productivity to any particular estimation approach.

We were concerned that the definition of "good management" may be biased towards an Anglo-Saxon view of the management world. Some may regard such business practices as suitable for the 'free markets' of Britain and America, but less suitable to those of Continental Europe. We empirically tested this in column (4) by re-running the two stage estimation using French and German companies only and again found a large a highly significant coefficient on management.

Finally, we investigated the impact of the weighting across individual questions through factor analysis. Undertaking factor revealed there appeared to be one dominant factor that loaded heavily on all our questions – which could be labelled "good management" – which accounted for 49% of the variation. In column (5) we re-estimate our second step on this dominant factor and find a similar large and significant positive coefficient. The only other notable factor, which accounted for a further 7% of the variation, could be labelled as "incentives minus operations", which had a positive loading on incentives and a negative loading on shop-floor and performance monitoring. This factor was uncorrelated with any productivity measures, although interestingly it was significantly positively correlated with our skills measures (degrees and MBAs), suggesting a slightly different pattern of management practices across different firm skill levels.

Table D1 in Appendix D provides further robustness checks on the management score using alternative measures of firm performance. In column (1) we directly estimate management practices in a production function, finding a positive and significant coefficient. In column (2) we add in a range of controls including: factor coefficients interacted with country dummies to allow for the coefficients on the conventional inputs to vary across countries due to differences in their accounting measurement; country and industry dummies to controls for country and industry fixed effects; a number of extended controls for hours, education, firm age, size and listing status; and a set of interview controls to control for any biases across interviewers and types of interviewees[13]. Including these controls moderately reduces the size and increases the standard error on the management coefficient, although the impact is not great and management is still highly significant. In column (3) we add in an extra control for average wages within the firm and find again the management coefficient is positive and significant. In column (4) we use an alternative performance measure which is return on capital employed (ROCE), a profitability measure used by financial analysts and managers to benchmark firm performance. The significant and positive coefficient in the ROCE equation, which also includes the same set of controls as in column (2) confirms the basic productivity results. In column (5) we estimate a Tobin's Q specification, which again includes the full production function controls, and find a significant positive coefficient. Finally in column (6) we estimate the relationship between growth rates of sales and management practices, again with a full set of controls, and find a positive significant coefficient.

[13] In Table C1 in the Appendix we detail these noise controls with column (1) reporting the results from regressing management on the full set of noise controls and column (2) the results from regressing management on our selected set of (informative) noise controls which we use in our main regressions.

V THE DISTRIBUTION OF MANAGEMENT PRACTICES

Having confirmed that our management measures are significantly related to firm performance we now proceed to examine the management scores directly. Figure 4 shows the distribution of the average management scores per firm across all 18 questions, plotted by country in raw form (not in z-score form). It is clear that there is a huge amount of heterogeneity within each country with firms spread across most of the distribution. About 3% of the overall variation in firms' average management scores is across countries, 21% is across 3-digit SIC industries and the remaining 76% is within country and industry. This spread is particularly wide when considered against the fact that a score of 1 indicates industry worst practice and 5 industry best practices. So, for example, firms scoring 2 or less have only basic shop-floor management, very limited monitoring of processes or people, ineffective and inappropriate targets, and poor incentives and firing mechanisms. Thus, one of the central questions we focus on in section V is why do these firms exist?

Looking across countries the US has on average the highest scores (3.37), Germany is second (3.32), France third (3.13) and the UK last (3.08), with the gap between the US and UK statistically significant at the 5% level. We were concerned that some of this may simply be driven by differences in the sampling size distribution, but these figures are robust to controls for size and public ownership.

The presence of the US at the top of the ranking is consistent with anecdotal evidence from other surveys[14]. One might suspect this was due to an "Anglo-Saxon" bias. This is why we had to confront the scores with data on productivity to show that they are correlated with real outcomes within countries. Furthermore, the position of the UK as the country with the lowest average management scores indicates that the survey instrument is not intrinsically Anglo-Saxon biased. Table A1 in Appendix A provides more details behind these cross-country comparisons, and reveals a *relative* US strength in monitoring and incentives (more human-capital management) versus a German and French strength in shop-floor and monitoring (more physical-capital and operational management)[15].

VI THE CAUSES OF MANAGEMENT PRACTICE VARIATIONS

The evidence presented in section IV demonstrated that good management practices are significantly related to firm performance, while the evidence in section V demonstrated a wide distribution in management practices. But this raises the question of why so many firms appear to

[14] For example, Proudfoot (2003) regularly reports that US firms were least hindered by poor management practices (36%) compared to Australia, France, Germany, Spain, South Africa and the UK. Unfortunately, these are only from the consulting groups' clients so are unlikely to be representative.

[15] In the survey we also collected two questions on organizational structure (see Appendix A2) taken from Bresnahan et al. (2002). We found in France and German firms were significantly more hierarchical (gave managers more power relative to workers) in pace and task allocation compared to the UK and particularly the US.

be deploying sub-optimal practices? In this section we explore the role of three factors which may help to explain the tail of poorly managed firms.

VI.A Management Practices, Product Market Competition and Firm Age

A common argument is that variations in management practice result from the differences in product market competition, either because of selection effects and/or because of variations in the incentives to supply effort. Table 2 attempts to investigate this by examining the relationship between product market competition and management. We use three broad measures of competition following Nickell (1996) and Aghion et al. (2005). The first is the country by 3-digit SIC industry Lerner index of competition, which is (1 – profits/sales), calculated at the average across the entire firm level database (excluding each firm itself)[16]. This is constructed for the period 1995-1999 to remove any potential contemporaneous feedback. The second measure is the degree of import penetration in the country by 3-digit SIC industry measured as the share of total inputs over domestic production. Again, this is constructed for the period 1995-1999 to remove any potential contemporaneous feedback. The third measure of competition is the survey question on the number of competitors a firm faces (see Appendix A2), valued 0 for "non competitors", 1 for "less than 5 competitors", and 2 for "5 or more competitors"[17].

In column (1) we see the Lerner index of competition measure is positive and strongly significant after controlling for simple country levels effects, providing evidence for a positive role for competition in improving management practices. In column (2) we re-estimate the same specification but now include a full set of industry, firm and noise controls, and again find that higher competition is significantly correlated with better current management. Thus more competitive country-industry pairings contain firms which are on-average significantly better managed. In columns (3) and (4) we run two similar specifications on lagged import penetration as a trade competition measure and again find a significant and positive effect. Finally, in columns (5) and (6), we run two further similar specification, but this time using firms own self reported measure of the number of competitors they face, and again find a positive and significant effect: the more rivals a firm perceives it faces, the better managed it appears to be.

One issue in interpreting this competition effect as discussed in section III is that it potentially works through two mechanisms:

1. Greater competition increases the *relative* exit rate of badly managed firms versus well managed firms, and so will increase the average managerial practices of the survivors;
2. Increasing management scores through greater managerial effort.

To investigate these different mechanisms we start by running a non-parametric kernel regression to look for evidence of a selection effect.

In Figure 5 we plot the cross-sectional relationship between management practices and firm age for two sub-samples: (i) firms in low competition industries (below the 33rd percentile of the country-demeaned Lerner index); and (ii) firms in medium/high competition industries (above

[16] Note that in constructing this we draw on firms in the population database, not just those who participated in the survey.

17 This question has been used by inter alia Nickell (1996) and Stewart (1990).

the 33rd percentile of the country-demeaned Lerner index)[18]. For the low competition sample there is clear evidence of younger firms employing better management practices, while for the higher competition sample there is a humped shape relationship with an initially improving then subsequently deteriorating average management practices as firms' age. Figure 6 contains a similar plot but with the competition split determined instead by import penetration (above/below the 33rd percentile of the country-demeaned Import penetration ratio).

These results appear to be consistent with a selection effect of competition and technological evolution in management best-practices discussed in section IIB. When firms are young in competitive industries, the selection effect dominates with the worst managed firms rapidly exiting, so average management practices improve as the cohort ages. But once the worst managed firms have exited the selection effect begins to slow down and the vintage effect begins to dominate, with the age-management relationship flattening and then turning negative. In uncompetitive industries we should expect to see little selection effect and a dominant vintage effect, exactly as shown in Figures 5 and 6.

Table 3 estimates a linear-regression version of these sample splits showing these age-management relationship differ significantly according to the level of competition. In column (1) a straight regression of management practices on log firm-age demonstrates a significant negative coefficient, suggesting older firms use on average use worse management practices[19]. In column (2) we include the competition measure finding as before a positive competition effect. In column (3) we add an interaction of (country-demeaned) age and competition, finding a significant positive interaction term, and in column (4) we add in a full set of controls yielding a similar positive interaction term. The interpretation of these terms is that age is negatively related to management practices, but this is significantly less negative at high levels of competition since age provides a stronger signal of survival and hence good management practices. That is, old firms in highly competitive industries are much more likely to be well managed than in uncompetitive industries as they have survived a long period of tougher market selection.

Table 4 appears to suggest that the *effort effect* of competition and management practices is probably positive, but relatively less important. In columns (1) to (2) we regress managerial hours worked – our proxy for managerial effort[20] - on the Lerner index and find a positive but not significant relationship. In columns (3) and (4) look at managerial hours worked and important penetration, finding mixed signs and no significant relationship. Finally in columns (5) and (6) we use the number of reported competitors and find a positive relationship, which is significant at the 5% without industry and firm controls (column 5), but only significant at the 14% once these more general controls are included. This suggests that competition plays may play a positive role in increasingly managerial effort, although this effect is not large enough to register at standard significance levels in our data. This is not inconsistent with the somewhat ambiguous

18 The country level means are removed from the Lerner index to control for differences in accounting definitions across countries. Similar results are obtained by splitting around the 50th percentile of the country-demeaned Lerner.

19 The fact that older firms are on average more productive (i.e. see Jensen at al. 2001) suggests offsetting improvement in other un-measured factors.

20 Of course total managerial effort is the multiplication of total hours worked times the "intensity" of work. While we do not observe the "intensity" of work it seems reasonable to assume that harder working managers would increase effort along both margins, so that any relationship between competition and effort should be apparent in the managerial hours data.

theoretical relationship discussed in section IIA, and suggests the first impact of competition is via selection effects rather than effort effects.

VI.B Management Practices and Job Regulation

In a number of countries the business press has long argued that government regulations impede the ability of managers to effectively run their firms. One potential impact of regulations, in particular labour regulation, is that these could impede the adoption of superior management practices.

To look into this Table 5 starts in column (1) by running a very basic estimation of management practices on the extent of labour regulations regarding dismissals, as reported by Botero *et al.* (2004). We find that countries with tougher labour regulation (France and to a lesser extent Germany) are worse managed on average than countries with weak regulation (the US and to a lesser extent the UK). Of course a wide range of other factors varies across countries. To further investigate the impact of job regulation we interacted country-specific regulation with variations across firms in the tenure of workers as a proxy for the impact of these regulations, enabling an identification of within country-industry effects. In column (2) we estimate the interaction effect of job-regulation and average managerial tenure. Since we have included country and industry dummies the direct impact of labour-regulation is not identified but we can see the interaction effect with tenure is negative and significant. In columns (3) we re-run this specification including the full set of controls and find this interaction remains negative and significant. Thus, we find in firms where the bite of dismissal costs should be highest – those with long tenured managers – the impact of these types of dismissal costs is greatest. This suggests that strong labour regulation may inhibit the adoption of superior management practices.

VI.C Management Scores and Management Ability

One interpretation for the variation in managerial practices across firms is that our management score proxies for the underlying ability of managers (and employees) in the firm with well managed firms simply those containing a large-fraction of high ability managers. Under this view our proxies of human capital do not control for this unobserved ability. Even under this interpretation it is, of course, interesting that higher product market competition increases demand for high ability managers.

However, there are several findings that cause us to doubt that the management scores we measure are simply a cipher for employee ability. First, assuming employees are paid their marginal product, we would not expect to observe the positive correlation between good management practices, profits and market value discussed earlier (see Appendix D). Second, we also find that controlling for the total wage bill has very little effect on the size of the management coefficient in the production functions, suggesting that the management score is not simply a proxy for unobserved employee ability. Finally, CEO remuneration (a proxy for top-managerial ability) is only very weakly correlated with our management score[21]. So while

[21] For example, regressing log(management pay) on firm size, public/private status, country dummies, industry dummies, and the management score, we find the coefficient (s.e.) on the management score is 0.001 (0.051). If we dropped all other covariates then 0.000 (0.060). Note that although CEO remuneration includes bonuses it does not include share options.

managerial ability may account for some of the variation in management practices across firms, this can not explain all the observed variation. Our interpretation is that managerial practices are embedded in the organizational capital of the firm, and this explains the higher productivity and profitability of well managed firms. This organizational capital is greater than the sum of the parts of abilities and skills of the current employees.

VII CONCLUSIONS

We use an innovative survey tool to collect *management practice* data from 731 medium sized manufacturing firms in Europe (UK, France and Germany) and the US. We find these are strongly associated with better firm performance in terms of productivity, profitability, Tobin's Q, and sales growth. We also find a surprisingly large dispersion of management practices across firms with a long tail of poorly managed firms. This presents a dilemma - why do so many firms continue to exist with apparently inferior management practices? We find that this is due, in part, to a combination of: (i) product market competition, with greater competition stimulating the deployment of improved management practices; (ii) firm age, with younger market entrants utilising better management techniques; and (iii) labour market regulations.

A range of potential extensions to this work are planned, including running a second survey wave on around 2,000 firm in 2006 to follow up these 731 firms to examine the time profile of management practices; extend the survey to other countries; survey multiple plants in a few hundred firms to examine plant vs. firms effects; and gather more detailed organisational structure data. In terms of the current sample we hope to follow this over time and examine the role of managerial practices in market exit (bankruptcy, take-over and going private).

BIBLIOGRAPHY

Aghion, P., Bloom, N., Blundell, R., Griffith, R., and Howitt, P., (2002) "Competition and Innovation: An inverted U relationship", forthcoming Quarterly Journal of Economics.

Arellano, M. and Bond, S. (1991), "Some tests of specification for panel data: Monte Carlo evidence and an application to employment functions", Review of Economic Studies, 58, pp. 277-297

Baily, M., Hulten, C. and Campbell, D. (1992), "Productivity dynamics in manufacturing plants", Brookings Papers on Economics Activity, pp 187-267.

Bartelsman, E. and Dhrymes, P. (1998), "Productivity Dynamics: US Manufacturing plants, 1972-1986", Journal of Productivity Analysis, 9, pp5-34.

Bartlelsman, E. and Doms, P. (2000), "Understanding Productivity: Lessons from Longitudinal Microdata", Journal of Economic Literature, 38,3, 569-594.

Bartelsman, E., Becker, R. and Gray, W. (2000), "The NBER Manufacturing Productivity Database", NBER.

Bertrand, M. and Schoar, A. (2003), "Managing with Style: The Effect of Managers on Firm Policies", Quarterly Journal of Economics, pp.1169-1208.

Bertrand, M. and Mullainathan, S. (2001), "Do people mean what they say? Implications for subjective survey data", American Economic Review Papers and Proceedings, 91(2), May 2001: 67-72.

Bertrand, M. and Mullainathan, S. (2003), "Enjoying the quiet life? Corporate Governance and Managerial Preferences", *Journal of Political Economy,* 111(5), pp 1043-1075.

Black, S. and Lynch, L. (2001), "How to Compete: The Impact of Workplace Practices and Information Technology on Productivity", Review of Economics and Statistics, 83(3), pp. 434-445.

Blundell, Richard and Bond, Stephen (1998) "Initial Conditions and Moment Restrictions in dynamic panel data models" Journal of Econometrics

Blundell, Richard and Bond, Stephen (2000) "GMM estimation with persistent panel data: an application to production functions." Econometric Reviews, 321-340

Bresnahan, T., Brynjolfsson, E. and Hitt, L. (2002), "Information Technology, Workplace Organisation and the Demand for Skilled Labour: Firm-level Evidence", Quarterly Journal of Economics, pp.339-376.

Botero, J., Djankov, R., La Porta, R., Lopez-de-Silanes, F., and Shleifer, A. (2004) "The regulation of labor", *Quarterly Journal of Economics,* November

Caballero, R. and Hammour, L. (1994), "The cleansing effects of recessions", American Economic Review, 84(5), 1350-1368.

Caroli, E. and Van Reenen, J. (2001), "Skill-biased Organisational change? Evidence from a panel of British and French establishments", the Quarterly Journal of Economics, vol. 116(4), 1449-1492,

Corrada, C. Hulten, C. And Sichel, D. (2004) "Measuring Capital and technology: An expanded framework" Federal Reserve Bank Discussion Paper 2004/65

Disney, R. Haskel, J. and Heden, Y. (2003), "Restructuring and Productivity Growth", Economic Journal, July 2003.

Foster, L., Haltiwanger, J. and Kirzan, C. (2000), "Aggregate productivity growth: lessons from microeconomic evidence", NBER WP

Hopenhayn, H. (1992) "Exit, Entry and Firm Dynamics in Long Run equilibrium" Econometrica, 60: 1127-1150

Ichinowski, C., and Shaw, K. (1995), "Old dogs and new tricks: determinants of the adoption of productivity-enhancing work practices", Brookings Papers: Microeconomics: 1-65

Ichinowski, C., Shaw, K. and Prenushi, G. (1997), "The Effects of Human Resource Management: A Study of Steel Finishing Lines", American Economic Review, pp.291-313

Jensen, J, McGuckin, Stiroh, K. (2001), "The impact of vintage and survival on productivity: evidence from cohorts of U.S. manufacturing plants", Review of Economics and Statistics, vol.83, pp323-332

Jovanovic, Boyan (1982) "Selection and the evolution of Industry" Econometrica, 50, 649-70

Lazear, Edward (2000) "Performance pay and productivity", American Economic Review, 1346-1361.

Lucas, R. (1978) "On the Size distribution of business firms" Bell Journal of Economics, 9, 2, 508-523

Melitz, Mark (2003) "The impact of trade on Intra-industry reallocations and Aggregate Industry Productivity" Econometrica, 71, 1695-1725

Mundlak, Y. (1961), "Empirical Production Function Free of Management Bias, "Journal of Farm Economics 43(1): 44-56

Nickell, S, Nicolitsas, D. and Patterson, M. (1997), "Does doing badly encourage management innovation", Oxford Bulletin of Economics and Statistics

Nickell, S. (1996) "Competition and Corporate Performance", Journal of Political Economy, 104, 724-746.

O'Mahoney, M. and De Boer, W. (2002), "Britain's Relative Productivity Performance: Updates to 1999" mimeo, National Institute of Economic and Social Research

Olley, S and Pakes, A. (1996), "The dynamics of productivity in the telecommunications industry", Econometrica, 64: 1263-97.

Proudfoot Consulting (2003) "Missing Millions: How Companies mismanage their most valuable resource"

Raith, M. (2003) "Competition, Risk and Managerial Incentives" American Economic Review, 93, 1424-1436

Rajan, R. and Wulf, J. (2004), "The flattening firm: evidence from panel data on the changing nature of corporate hierarchies", GSB Chicago mimeo.

Roberts, J. (2004), "The Modern Firm: Organizational Design for Performance and Growth", forthcoming Oxford University Press, 2003

Salop, Steve (1979) "Monopolistic Competition with Outside Goods" Bell Journal of Economics 10, 141-156

Schmidt, K. (1997) "Managerial Incentives and Product Market Competition" Review of Economic Studies 64(2) 191-213

Stewart, M (1990), "Union wage differentials, product market influences and the division of rents", Economic Journal, 100, 1122-1137.

Stiroh, Kevin, 2002, "Information Technology and the U.S. Productivity Revival: What Do the Industry Data Say?", *American Economic Review*, 92(5), December, 1559-1576

Syverson, Chad (2004a) "Market Structure and Productivity: A concrete example" Journal of Political Economy, 112, 6, 1181-1222

Syverson, Chad (2004b) "Product substitutability and Productivity Dispersion" Review of Economics and Statistics, 86, 534-50

Figure 1: Management practices and age, with competition - simulation

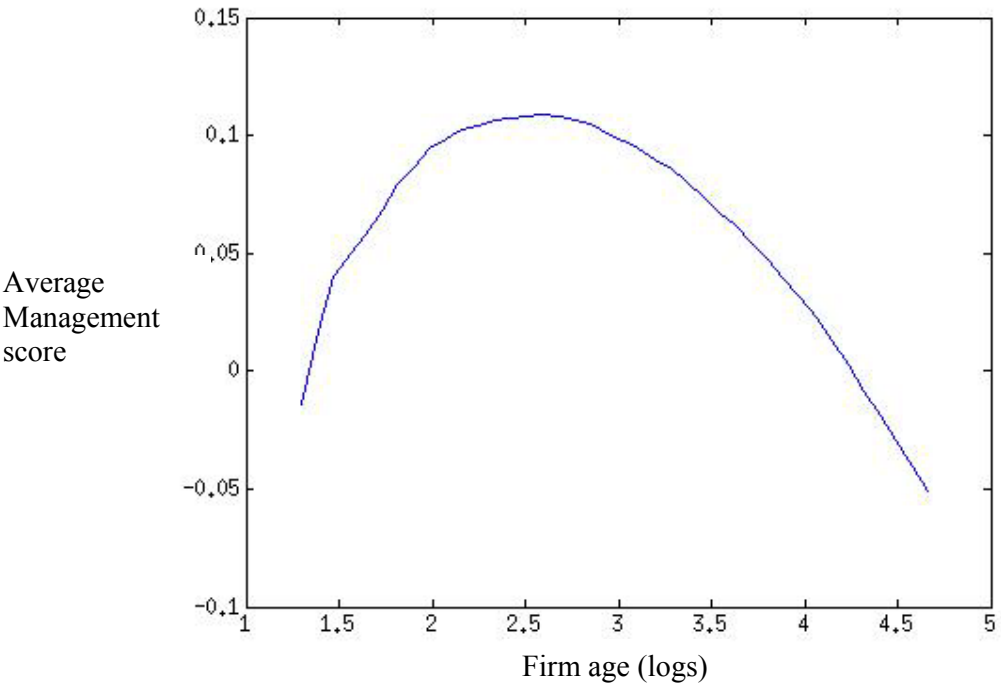
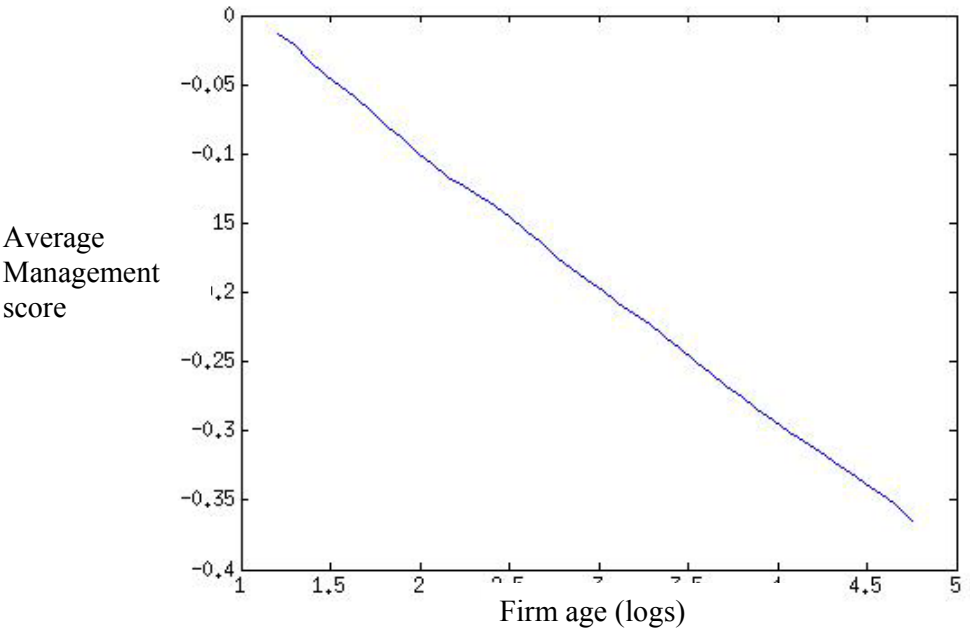
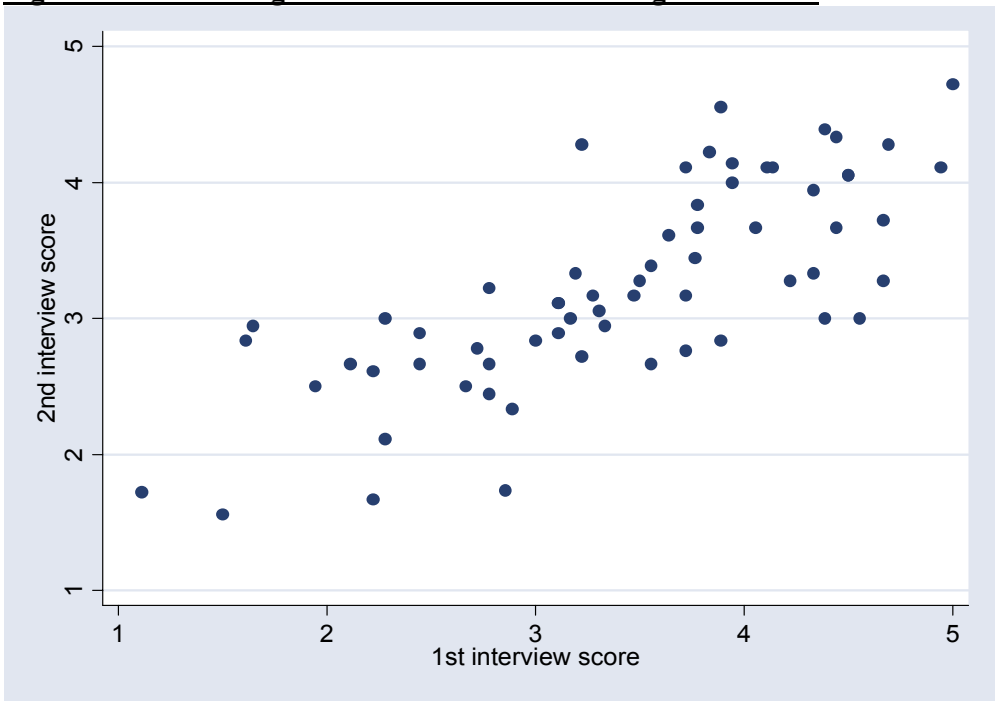


Figure 2: Management practices and age, without competition - simulation



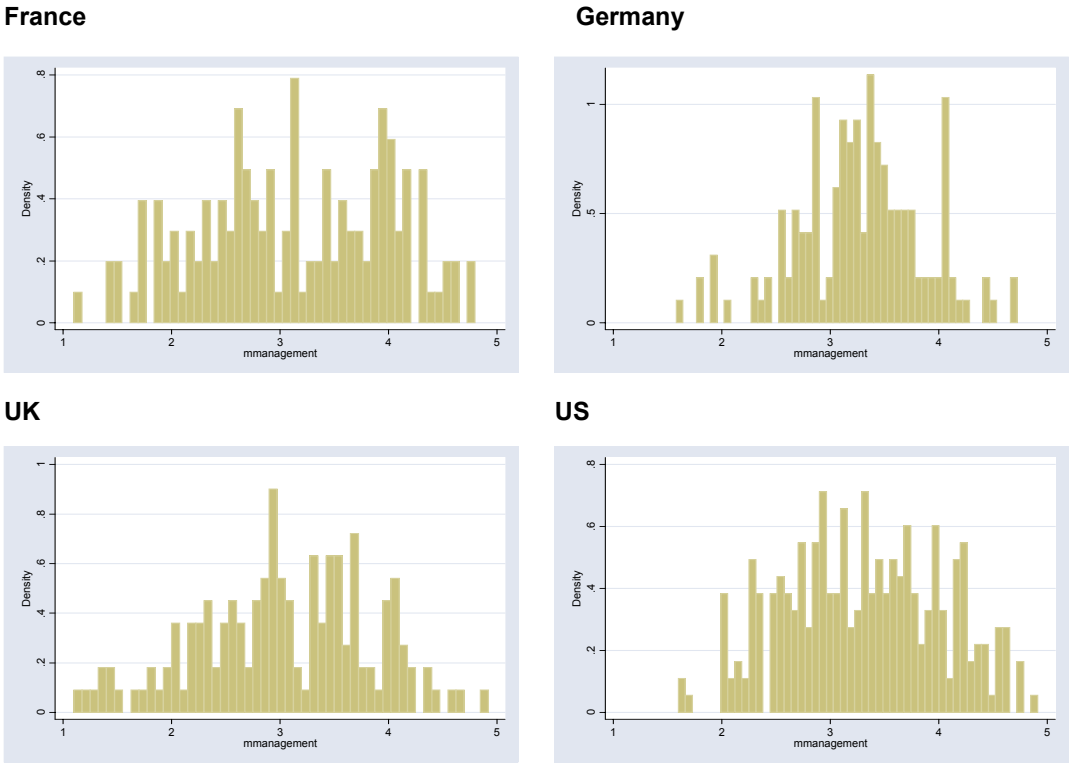
Notes: Figure 1 is from a simulation results from modelling a large fixed population of firms with a 2% annual rate of entry and exit. The exit occurs based on a noisy signal of management ability. The entrants are drawn from a normal distribution with an upwardly trending mean. Thus, every period worse managed firms are more likely to exit generating a selection effect over time, while the new entrants are drawn from an upwardly trending distribution generating a cohort effect. In Figure 2 the competitive selection effects are switched off.

Figure 3: First management score on second management score



Note: These are the scores from two interviews on the same firm but with different managers and different interviewers.

Figure 4: Distribution of management scores by country



Note: These are the distributions of the raw management scores (simple averages across all 18 questions).

Figure 5: Management practices, firm age and competition (Lerner Index)

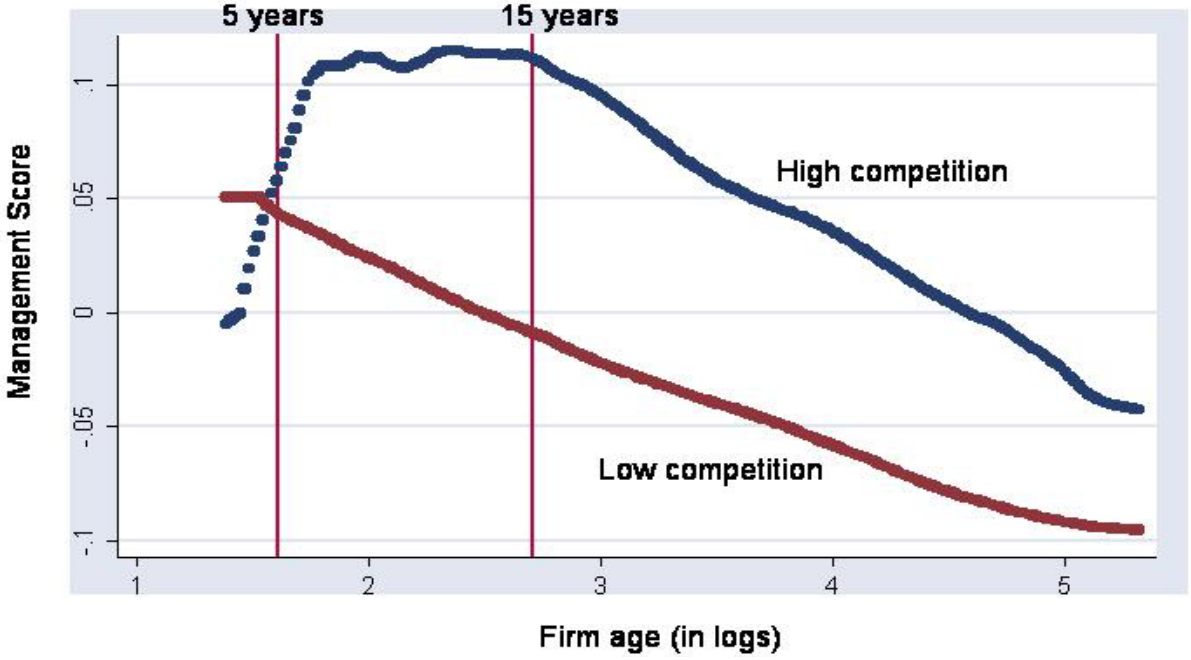
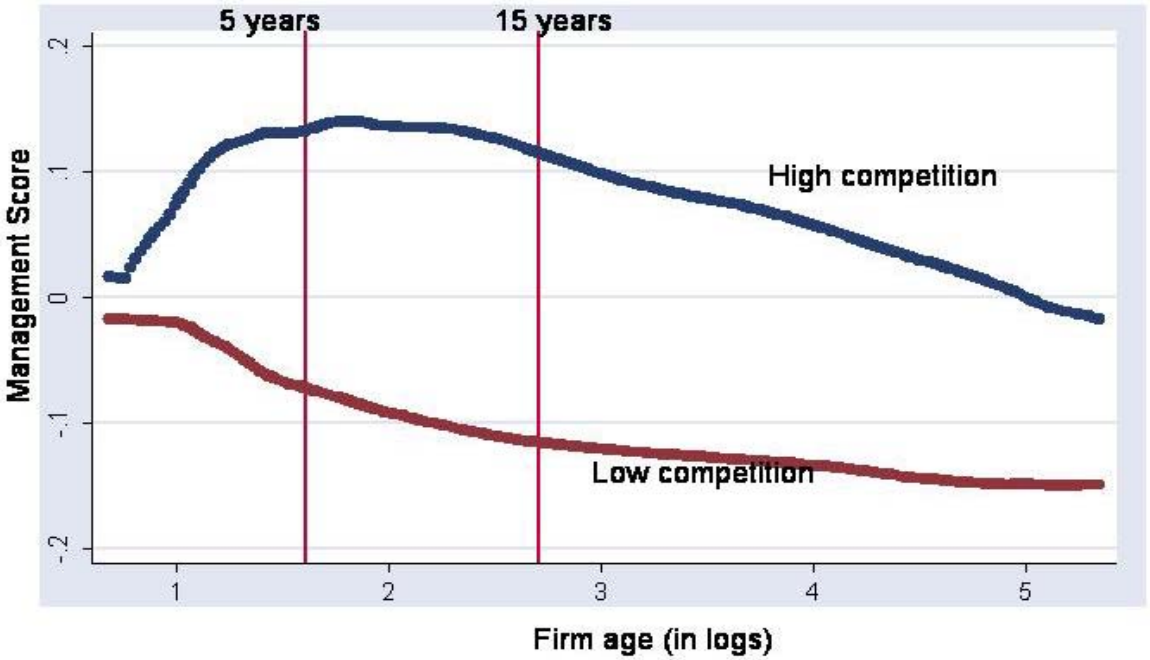


Figure 6: Management practices, firm age and competition (Import Penetration)



Note: These are results from a non-parametric kernel regression of the mean management score against firm ln(age). This is performed separately for firms in high competition sectors vs. low competition sectors (bottom third of the Lerner Index distribution in Figure 5 and bottom third of the import penetration distribution in Figure 6).

TABLE 1: PRODUCTION FUNCTION ESTIMATIONS

	(1)	(2)	(3)	(4)	(5)
Estimation Method	**WITHIN GROUPS**	**OLLEY PAKES**	**GMM-SYS**	**WITHIN GROUPS**	**WITHIN GROUPS**
Countries	**All**	**All**	**All**	**France and Germany**	**All**
Dependent variable	**Ln (Y) $_{it}$** sales	**Ln (Y) $_{it}$** sales	**Ln (Y) $_{it}$** sales	**Ln (Y) $_{it}$** sales	**Ln (Y) $_{it}$** sales
ln (L) $_{it}$ labour	0.493	0.501	0.519	0.559	0.493
	(0.030)	(0.050)	(0.085)	(0.038)	(0.030)
Ln(K) $_{it}$ capital	0.128	0.111	0.085	0.107	0.128
	(0.023)	(0.030)	(0.041)	(0.026)	(0.023)
ln (Materials) $_{it,}$ materials	0.304	0.383	0.320	0.203	0.304
	(0.018)	(0.038)	(0.043)	(0.015)	(0.018)
Firms	718	718	718	287	718
Observations	3,797	3,703	3,466	1,373	3,797
Dependent variable	TFP	TFP	TFP	TFP	TFP
Management score	0.088	0.080	0.104	0.177	
	(0.015)	(0.018)	(0.018)	(0.030)	
Management principal component factor					0.063
					(0.011)
Observations	718	718	718	287	622
SC(2) p-value			0.582		
SARGAN p-value			0.002		
COMFAC p-value			0.082		

NOTES: In all columns labour, capital and materials are interacted with country dummies and consolidated status to allow flexible coefficient across countries and type of account. The baseline is UK consolidated in Columns (1), (2), (3) and (5), and German consolidated in Column (4). Columns (1), (4) and (5) implement an OLS estimator with fixed-effects (stage 1), and then regresses these in cross-section against the management z-scores (stage 2). Column (2) implements a version of the Olley-Pakes (1996) technique. We use a fifth order series approximation for $\varphi(.)$ in stage 1. Standard errors are bootstrapped with 100 replications. After calculating the parameters of labour and materials (stage 1a) and capital (stage 1b) we calculate the efficiency term/TFP. This is used as a dependent variable in the lower panel and regressed on management and its noise controls (stage 2). Column (3) implements the Blundell-Bond (1998) GMM-SYS technique (stage 1). Instruments for the differenced equation are lagged levels t-2 to t-3 on sales, capital, labour and materials. Instruments for the levels equation are lagged differenced t-1 on sales, capital, labour and materials. SC(2) is an LM test of second order correlation of the differenced residuals (see Arellano and Bond, 1991) and SARGAN is the Sargan-Hansen test of over-identification (distributed χ^2 under the Null). We impose the COMFAC restrictions by Minimum Distance (see Blundell and Bond, 2000) and test this by a χ^2 test of the COMFAC restrictions. We use the estimated coefficients to calculate TFP which is used as the dependent variable in the lower panel and regressed on management and the noise controls (stage 2). The management principal component factor is only available for firms with all 18 questions completed, resulting in a smaller sample size of 622 firms.

TABLE 2: MANAGEMENT AND PRODUCT MARKET COMPETITION

	(1)	(2)	(3)	(4)	(5)	(6)
Estimation Method	**OLS**	**OLS**	**OLS**	**OLS**	**OLS**	**OLS**
Dependent variable	**Management**	**Management**	**Management**	**Management**	**Management**	**Management**
Lerner index of competition (5-year lagged)	1.496	1.378				
	(0.664)	(0.664)				
Import penetration (5-year lagged)			0.138	0.192		
			(0.041)	(0.082)		
Number of competitors					0.132	0.161
					(0.045)	(0.051)
Firms	727	727	733	733	733	733
Observations	727	727	733	733	733	733
Country controls	Yes	Yes	Yes	Yes	Yes	Yes
Full controls	No	Yes	No	Yes	No	Yes

NOTES: Coefficients from OLS regressions with standard errors in parentheses (robust to arbitrary heteroskedasticity and clustered by country * industry pair); single cross section. "**Country controls**" includes 4 country controls. **"Full controls"** includes a full set of 108 SIC 3-digit industry controls, firm size, a dummy for being listed, being consolidated, a separate dummy variable for all the selected controls in column (2) table A2: each interviewer (17), the seniority and tenure of the manager who responded, the day of the week the interview was conducted, the time of the day the interview was conducted and an indicator of the reliability of the information as coded by the interviewer; "**Lerner index of competition**" constructed, as in Aghion et al. (2005) , as the mean of (1 - profit/sales) in the entire database (excluding the firm itself) for every country industry pair. "**Import Penetration"** = ln(Import/Production) in every country industry pair. Average over 1995-1999 used. "**Number of competitors"** constructed from the response to the survey question on number of competitors, and is coded as 0 for "*none*" (1% of responses), 1 for "*less than 5*" (51% of responses), and 2 for "*5 or more*" (48% of responses).

TABLE 3: MANAGEMENT, PRODUCT MARKET COMPETITION AND FIRM-AGE

	(1)	(2)	(3)	(4)
Estimation Method	**OLS**	**OLS**	**OLS**	**OLS**
Dependent variable	**Management**	**Management**	**Management**	**Management**
Firm age (in logs)	-0.094	-0.087	-0.084	-0.052
	(0.027)	(0.032)	(0.027)	(0.027)
Lerner index of competition (5-year lagged)		1.350	1.443	1.585
		(0.669)	(0.627)	(0.705)
Firm age (in logs) × Lerner index of competition (5-year lagged)			0.900	1.244
			(0.496)	(0.638)
Joint test of age terms (p-value)			0.001	0.002
Joint test of competition terms (p-value)			0.003	0.037
Firms	727	727	727	727
Observations	727	727	727	727
Country controls	*Yes*	*Yes*	*Yes*	*Yes*
Full controls	*No*	*No*	*No*	*Yes*

NOTES: Coefficients from OLS regressions with standard errors in parentheses (robust to arbitrary heteroskedasticity and clustered by country * industry pair); single cross section. "**Country controls**" includes 4 country controls. Firm age and Lerner index terms have country averages removed in the levels and interaction terms. **"Full controls"** includes a full set of 108 SIC 3-digit industry controls, firm size, a dummy for being listed, being consolidated, a separate dummy variable for all the selected controls in column (2) table A2: each interviewer (17), the seniority and tenure of the manager who responded, the day of the week the interview was conducted, the time of the day the interview was conducted and an indicator of the reliability of the information as coded by the interviewer; **"Firm age"** is years since incorporation. "**Lerner index of competition**" constructed, as in Aghion et al. (2005) , as the mean of (1 - profit/sales) in the entire database (excluding the firm itself) for every country industry pair.

TABLE 4: MANAGEMENT, PRODUCT MARKET COMPETITION AND EFFORT

	(1)	(2)	(3)	(4)	(5)	(6)
Estimation Method	**OLS**	**OLS**	**OLS**	**OLS**	**OLS**	**OLS**
Dependent variable	**Managerial hours**	**Managerial hours**	**Managerial hours**	**Managerial hours**	**Managerial hours**	**Managerial hours**
Lerner index of competition (5-year lagged)	6.660	1.809				
	(4.128)	(5.869)				
Import penetration (5-year lagged)			-0.230	1.082		
			(0.444)	(0.948)		
Number of competitors					1.155	0.935
					(0.509)	(0.623)
Firms	549	549	555	555	555	555
Observations	549	549	555	555	555	555
Country controls	Yes	Yes	Yes	Yes	Yes	Yes
Full controls	No	Yes	No	Yes	No	Yes

NOTES: Coefficients from OLS regressions with standard errors in parentheses (robust to arbitrary heteroskedasticity and clustered by country * industry pair); single cross section. "**Country controls**" includes 4 country controls. **"Full controls"** includes a full set of 108 SIC 3-digit industry controls, firm size, a dummy for being listed and being consolidated; "**Lerner index of competition**" constructed, as in Aghion et al. (2005) , as the mean of (1 - profit/sales) in the entire database (excluding the firm itself) for every country industry pair. "**Import Penetration"** = ln(Import/Production) in every country industry pair. Average over 1995-1999 used. "**Number of competitors"** constructed from the response to the survey question on number of competitors, and is coded as 0 for "*none*" (1% of responses), 1 for "*less than 5*" (51% of responses), and 2 for "*5 or more*" (48% of responses).

TABLE 5: MANAGEMENT AND EMPLOYMENT REGULATION

	(1)	(2)	(3)
Estimation Method	**OLS**	**OLS**	**OLS**
Dependent variable	**Management**	**Management**	**Management**
Job Regulation	-0.151		
	(0.062)		
Job Regulation tenure of manager		-0.016	-0.017
		(0.008)	(0.005)
Tenure of manager		0.011	0.012
		(0.006)	(0.004)
Firms	656	656	656
Observations	656	656	656
Country and industry controls	No	Yes	Yes
Full Controls	No	No	Yes

NOTES: Coefficients from OLS regressions with standard errors in parentheses (robust to arbitrary heteroskedasticity); single cross section. "**Job Regulation**" is the average legal index of "cost of firing workers" and "dismissal procedures" from Botero et al. (2004). "**Tenure of manager**" is the tenure of the interviewed manager (usually the plant manager). "**Country and industry controls**" includes 4 country and 108 SIC 3-digit industries controls. **"Full controls"** includes a full set of 108 Sic 3-digit industry controls, group and firm size, a dummy for being listed, being consolidated, a separate dummy variable for all the selected controls in column (2) table A2: each interviewer (17), the seniority and tenure of the manager who responded, the day of the week the interview was conducted, the time of the day the interview was conducted and an indicator of the reliability of the information as coded by the interviewer.

APPENDIX A: MANAGEMENT PRACTICE INTERVIEW GUIDE AND ANONYMIZED EXAMPLE RESPONSES

Note: Any score from 1 to 5 can be given, but the scoring guide and examples are only provided for scores of 1, 3 and 5.

		Score 1	Score 3	Score 5
1	**Modern manufacturing, introduction**	Other than JIT delivery from suppliers few modern manufacturing techniques have been introduced, (or have been introduced in an ad-hoc manner)	Some aspects of modern manufacturing techniques have been introduced, through informal/isolated change programmes	All major aspects of modern manufacturing have been introduced (Just-in-time, autonomation, flexible manpower, support systems, attitudes and behaviour) in a formal way
	Example:	A UK firm orders in bulk and stores the material on average 6 months before use. The business focuses on quality and not reduction of lead time or costs. Absolutely no modern manufacturing techniques had been introduced.	A supplier to the army is undergoing a full lean transformation. For 20 years the company was a specialty supplier to the army, but now they have had to identify other competencies forcing them to compete with lean manufacturers. They have begun adopting specific lean techniques and plan to use full lean by the end of next year.	A US firm has formally introduced all major elements of modern production. It reconfigured the factory floor based on value stream mapping and 5-S principles, broke production into cells, eliminated stockrooms, implemented Kanban, and adopted Takt time analyses to organize work flow.
2	**Modern manufacturing, rationale**	Modern manufacturing techniques were introduced because others were using them.	Modern manufacturing techniques were introduced to reduce costs	Modern manufacturing techniques were introduced to enable us to meet our business objectives (including costs)
	Example:	A German firm introduced modern techniques because all its competitors were using these techniques. The business decision had been taken to imitate the competition.	A French firm introduced modern manufacturing methods primarily to reduce costs.	A US firm implemented lean techniques because the COO had worked with them before and knew that they would enable the business to reduce costs, while competing with cheaper imports through improved quality, flexible production, greater innovation and JIT delivery.

3	**Process problem documentation**	No, process improvements are made when problems occur.	Improvements are made in 1 week workshops involving all staff, to improve performance in their area of the plant	Exposing problems in a structured way is integral to individuals' responsibilities and resolution occurs as a part of normal business processes rather than by extraordinary effort/teams
	Example:	A US firm has no formal or informal mechanism in place for either process documentation or improvement. The manager admitted that production takes place in an environment where nothing has been done to encourage or support process innovation.	A US firm takes suggestions via an anonymous box, they then review these each week in their section meeting and decide any that they would like to proceed with.	The employees of a German firm constantly analyse the production process as part of their normal duty. They film critical production steps to analyse areas more thoroughly. Every problem is registered in a special database that monitors critical processes and each issue must be reviewed and signed off by a manager.
4	**Performance tracking**	Measures tracked do not indicate directly if overall business objectives are being met. Tracking is an ad-hoc process (certain processes aren't tracked at all)	Most key performance indicators are tracked formally. Tracking is overseen by senior management.	Performance is continuously tracked and communicated, both formally and informally, to all staff using a range of visual management tools.
	Example:	A manager of a US firm tracks a range of measures when he does not think that output is sufficient. He last requested these reports about 8 months ago and had them printed for a week until output increased again.	At a US firm every product is bar-coded and performance indicators are tracked throughout the production process; however, this information is not communicated to workers	A US firm has screens in view of every line. These screens are used to display progress to daily target and other performance indicators. The manager meets with the shop floor every morning to discuss the day past and the one ahead and uses monthly company meetings to present a larger view of the goals to date and strategic direction of the business to employees. He even stamps napkins with key performance achievements to ensure everyone is aware of a target that has been hit.
5	**Performance review**	Performance is reviewed infrequently or in an un-meaningful way e.g. only success or failure is noted.	Performance is reviewed periodically with both successes and failures identified. Results are communicated to senior management. No clear follow-up plan is adopted.	Performance is continually reviewed, based on indicators tracked. All aspects are followed up ensure continuous improvement. Results are communicated to all staff

	Example:	A manager of a US firm relies heavily on his gut feel of the business. He will review costs when he thinks they have too much or too little in the stores shed. He admits that as he is very busy so such a review can be quite infrequent. He also mentioned that staffs feel like he is going on a hunt to find a problem, so he has now made a point of highlighting anything good that he finds too.	A UK firm uses daily production meetings to compare performance to plan. However, clear action plans are infrequently developed based on these production results.	A French firm tracks all performance numbers real time (amount, quality etc). These numbers are continuously matched to the plan on a shift-by-shift basis. Every employee can access these figures on workstations on the shop floor. If scheduled numbers are not met, action for improvement is taken immediately.
6	**Performance dialogue**	The right data or information for a constructive discussion is often not present or conversations overly focus on data that is not meaningful. Clear agenda is not known and purpose is not stated explicitly	Review conversations are held with the appropriate data and information present. Objectives of meetings are clear to all participating and a clear agenda is present. Conversations do not, as a matter of course, drive to the root causes of the problems.	Regular review/performance conversations focus on problem solving and addressing root causes. Purpose, agenda and follow-up steps are clear to all. Meetings are an opportunity for constructive feedback and coaching.
	Example:	A US firm doesn't conduct staff reviews. It was just "not the philosophy of the company" to do that. The company was very successful during the last decade and therefore didn't feel the need to review their performance.	A UK firm focuses on key areas to discuss each week. This ensures that key areas of the business receive consistent management attention and everyone comes prepared. Once the discussion takes place of what is happening they move to the next topic. However, meetings are more of an opportunity for everyone to stay abreast of current issues rather than problem solve.	A German firm meets weekly to discuss performance with workers and management (plus daily team meetings run by the supervisors). Participants come from different departments (shop floor, sales, R&D, procurement) to discuss the previous week performance and to identify areas to improve. They focus on the root cause of problems and agree topics to be followed up the next week, allocating all tasks to individual participants.
7	**Consequence management**	Failure to achieve agreed objectives does not carry any consequences	Failure to achieve agreed results is tolerated for a period before action is taken.	A failure to achieve agreed targets drives retraining in identified areas of weakness or moving individuals to where their skills are appropriate

	Example:	At a French firm no action is taken when objectives aren't achieved. The President personally intervenes to warn employees but no stricter action is taken. Cutting payroll or making people redundant because of a lack of performance is very rarely done.	Management of a US firm reviews performance quarterly. That is the earliest they can react to any underperformance. They increase pressure on the employees if targets are not met.	A German firm takes action as soon as a weakness is identified. They have even employed a psychologist to improve behaviour within a difficult group. People receive ongoing training to improve performance. If this doesn't help they move them in other departments or even fire individuals if they repeatedly fail to meet agreed targets
8	**Target balance**	Goals are exclusively financial or operational	Goals include non-financial targets, which form part of the performance appraisal of top management only (they are not reinforced throughout the rest of organisation)	Goals are a balance of financial and non-financial targets. Senior managers believe the non-financial targets are often more inspiring and challenging than financials alone.
	Example:	At a UK firm performance targets are exclusively operational. Specifically volume is the only meaningful objective for managers, with no targeting of quality, flexibility or waste.	For a French firm strategic goals are very important. They focus on market share and try to hold their position in technology leadership. However, workers on the shop floor are not aware of those targets.	A US firm gives everyone a mix of operational and financial targets. They communicate financial targets to the shop floor in a way they found effective – for example telling workers they pack boxes to pay the overheads until lunch time and after lunch it is all profit for the business. If they are having a good day the boards immediately adjust and play the profit jingle to let the shop floor know that they are now working for profit. Everyone cheers when the jingle is played.
9	**Targets interconnection**	Goals are based purely on accounting figures (with no clear connection to shareholder value)	Corporate goals are based on shareholder value but are not clearly cascaded down to individuals	Corporate goals focus on shareholder value. They increase in specificity as they cascade through business units ultimately defining individual performance expectations.
	Example:	A family owned firm in France is only concerned about the net income for the year. They try to maximise income every year without focusing on any long term consequences.	A US firm bases its strategic corporate goals on enhancing shareholder value, but does not clearly communicate this to workers. Departments and individuals have little understanding of their connection to profitability or value with	For a US firm strategic planning begins with a bottom up approach which is then compared with the top down aims. Multifunctional teams meet every 6 months to track and plan deliverables for each area. This is then presented to the area head that then agrees or refines it and then communicates it down to his lowest level.

			many areas labeled as “cost-centers” with an objective to cost-cut despite potentially disproportionately large negative impact on the other departments they serve.	Everyone has to know exactly how they contribute to the overall goals or else they won’t understand how important the 10 hours they spend at work every day is to the business.
10	**Targets time horizon**	Top management's main focus is on short term targets	There are short and long term goals for all levels of the organisation. As they are set independently, they are not necessarily linked to each other	Long term goals are translated into specific short term targets so that short term targets become a "staircase" to reach long term goals
	Example:	A UK firm has had several years of ongoing senior management changes – therefore senior managers are only focussing on how the company is doing this month versus the next, believing that long-term targets will take care of themselves.	A US firm has both long and short term goals. The long term goals are known by the senior managers and the short term goals are the remit of the operational managers. Operations managers only occasionally see the longer term goals so are often unsure how they link with the short term goals.	A UK firm translates all their goals – even their 5 year strategic goals - into short term goals so that they can track their performance to them. They believe that it is only when you make someone accountable for delivery within a sensible timeframe that a long term objective will be met. They think it is more interesting for employees to have a mix of immediate and longer term goals.
11	**Targets are stretching**	Goals are either too easy or impossible to achieve; managers low-ball estimates to ensure easy goals	In most areas, top management pushes for aggressive goals based on solid economic rationale. There are a few "sacred cows" that are not held to the same rigorous standard	Goals are genuinely demanding for all divisions. They are grounded in solid, solid economic rationale
	Example:	A French firm uses easy targets to improve staff morale and encourage people. They find it difficult to set harder goals because people just give up and managers refuse to work people harder.	A chemicals firm has 2 divisions, producing special chemicals for very different markets (military, civil). Easier levels of targets are requested from the founding and more prestigious military division.	A manager of a UK firm insisted that he has to set aggressive and demanding goals for everyone – even security. If they hit all their targets he worries he hasn’t stretched them enough. Each KPI is linked to the overall business plan and for the business to stay in the UK everyone has to work hard to get their products out the door quickly.
12	**Performance clarity and**	Performance measures are complex and not clearly understood. Individual	Performance measures are well defined and communicated; performance is public	Performance measures are well defined, strongly communicated and reinforced at all reviews;

	comparability	performance is not made public	in all levels but comparisons are discouraged	performance and rankings are made public to induce competition
	Example:	A German firm measures performance per employee based on differential weighting across 12 factors, each with its own measurement formulas (e.g. individual versus average of the team, increase on prior performance, thresholds etc.). Employees complain the formula is too complex to understand, and even the plant manager couldn't remember all the details.	A French firm doesn't encourage simple individual performance measures as unions pressure them to avoid this. However, charts display the actual overall production process against the plan for teams on regular basis.	At a US firm self-directed teams set and monitor their own goals. These goals and their subsequent outcomes are posted throughout the company, encouraging competition in both target-setting and achievement. Individual members know where they are ranked which is communicated personally to them bi-annually. Quarterly company meetings seek to review performance and align targets.
13	**Managing human capital**	Senior management **do not** communicate that attracting, retaining and developing talent throughout the organisation is a top priority	Senior management believe and communicate that having top talent throughout the organisation is a key way to win	Senior managers are evaluated and held accountable on the strength of the talent pool they actively build
	Example:	A US firm does not actively train or develop its employees, and does not conduct performance appraisals or employee reviews. People are seen as a secondary input to the production.	A US firm strives to attract and retain talent throughout the organization, but does not hold managers individually accountable for the talent pool they build. The company actively cross-trains employees for development and challenges them through exposure to a variety of technologies.	A UK firm benchmarks human resources practices at leading firms. A cross-functional HR excellence committee develops policies and strategies to achieve company goals. Bi-monthly directors' meetings seek to identify training and development opportunities for talented performers.
14	**Rewarding high-performance**	People within our firm are rewarded equally irrespective of performance level	Our company has an evaluation system for the awarding of performance related rewards	We strive to outperform the competitors by providing ambitious stretch targets with clear performance related accountability and rewards
	Example:	An East Germany firm pays its people equally and regardless of performance. The management said to us that "there are	A German firm has an awards system based on three components: the individual's performance, shift	A US firms stretches employees by setting ambitious targets. They reward performance through a combination of bonuses linked to performance, team

		no incentives to perform well in our company". Even the management are paid an hourly wage, with no bonus pay.	performance, and overall company performance.	lunches cooked by management, family picnics, movie passes and dinner vouchers at nice local restaurants. They also motivate staff to try by giving awards for perfect attendance, best suggestion etc.
15	**Removing poor performers**	Poor performers are rarely removed from their positions	Suspected poor performers stay in a position for a few years before action is taken	We move poor performers out of the company or to less critical roles as soon as a weakness is identified
	Example:	A French firm had a supervisor who was regularly drinking alcohol at work but no action was taken to help him or move him to a less critical role. In fact no employee had ever been laid off in the factory. According to the plant manager HR kicked up a real fuss whenever management wanted to get rid of employees, and told managers their job was production not personnel.	For a German firm it is very hard to remove poor performers. The management has to prove at least 3 times that an individual underperformed before they can take serious action.	At a US firm the manager fired 4 people during last couple of months due to underperformance. They continually investigate why and who are underperforming.
16	**Promoting high performers**	People are promoted primarily upon the basis of tenure	People are promoted upon the basis of performance	We actively identify, develop and promote our top performers
	Example:	A UK firm promotes based on an individual's commitment to the company measured by experience. Hence almost all employees move up the firm in lock-step. Management was afraid to change this process because it would create bad-feeling among the older employees who were resistant to change.	A US firm has no formal training program. People learn on the job and are promoted based on their performance on the job.	At a UK firm each employee is given a red light (not performing), amber light (doing well and meeting targets) a green light (consistently meeting targets very high performer) and a blue light (high performer capable of promotion of up to two levels). Each manager is assessed every quarter on the basis of his succession plans and development plans for individuals.
17	**Attracting human capital (talent)**	Our competitors offer stronger reasons for talented people to join their companies	Our value proposition to those joining our company is comparable to those offered by others in the sector	We provide a unique value proposition to encourage talented people join our company above our competitors

	Example:	A manager of a firm in Germany could not give an example of a distinctive employee proposition and (when pushed) thinks the offer is probably worse than most of its competitors. He thought that people working at the firm "have drawn the short straw".	A US firm seeks to create a value proposition comparable to its competitors and other local companies by offering competitive pay, a family atmosphere, and a positive presence in the community.	A German firm offers a unique value proposition through development and training programs, family culture in the company and very flexible working hours. It also strives to reduce bureaucracy and seeks to push decision making down to the lowest levels possible to make workers feel empowered and valued.
18	**Retaining human capital (talent)**	We do little to try and keep our top talent.	We usually work hard to keep our top talent.	We do whatever it takes to retain our top talent.
	Example:	A German firm lets people leave the company if they want. They do nothing to keep those people since they think that it would make no sense to try to keep them. Management doesn't think they can keep people if they want to work somewhere else. The company also won't start salary negotiations to retain top talent.	If management of a French firm feels that people want to leave the company, they talk to them about the reasons and what the company could change to keep them. This could be more responsibilities or a better outlook for the future. Managers are supposed to "take-the-pulse" of employees to check satisfaction levels.	A US firm knows who its top performers are and if any of them signal an interest to leave it pulls in senior managers and even corporate HQ to talk to them and try and persuade them to stay. Occasionally they will increase salary rates if necessary and if they feel the individual is being underpaid relative to the market. Managers have a responsibility to try to keep all desirable staff.

TABLE A1: QUESTION LEVEL AVERAGES BY COUNTRY

	UK US=100	Germany US=100	France US=100
Modern manufacturing, introduction	90.0	86.4	101.3
	(3.50)	(3.47)	(3.63)
Modern manufacturing, rationale	92.9	101.5	101
	(3.35)	(3.32)	(3.47)
Process documentation	89.0	106.9	99
	(3.51)	(3.49)	(3.64)
Performance tracking	98.3	109.5	111
	(3.19)	(3.17)	(3.32)
Performance review	94.7	110.2	104
	(2.99)	(2.97)	(3.10)
Performance dialogue	93.0	103.3	99
	(3.19)	(3.11)	(3.27)
Consequence management	96.5	108.7	94
	(3.02)	(3.01)	(3.13)
Target breadth	91.1	93.3	94
	(3.53)	(3.51)	(3.66)
Target interconnection	93.7	97.3	78
	(3.56)	(3.54)	(3.68)
Target time horizon	91.9	98.6	92
	(3.69)	(3.66)	(3.83)
Targets are stretching	87.8	104.9	101
	(3.34)	(3.32)	(3.45)
Performance clarity and comparability	93.7	80.7	83
	(3.53)	(3.49)	(3.65)
Managing human capital	89.4	99.0	89
	(3.94)	(3.92)	(4.08)
Rewarding high performance	81.6	85.2	85
	(3.42)	(3.42)	(3.55)
Removing poor performers	89.4	92.5	83
	(3.04)	(3.02)	(3.15)
Promoting high performers	90.2	104.9	92
	(2.86)	(2.85)	(2.97)
Attracting human capital	90.4	95.1	85
	(2.89)	(2.88)	(2.99)
Retaining human capital	93.6	97.7	97
	(2.74)	(2.73)	(2.84)

NOTES: Standard errors of each question's average response are reported below in brackets. Calculated from full sample of 731 firms for which management information is available. Management z-scores used in the calculations.

APPENDIX A: HUMAN RESOURCES INTERVIEW GUIDE

Run in parallel as the management survey but targeted at the HR department

Workforce Characteristics

Data Field	Breakdown
Total number of employees	(all employees)
% with university degree	(all employees)
% with MBA	(all employees)
Average age of employees	(all employees)
% of employees	(managerial/non-managerial)
Average training days per year	(managerial/non-managerial)
Average hours worked per week (inc overtime, exc. breaks)	(managerial/non-managerial)
Average holidays per year	(all employees)
Weeks maternity leave	(all employees)
Weeks paternity leave	(all employees)
Average days sick-leave	(all employees)
% part-time	(managerial/non-managerial)
% female	(managerial/non-managerial)
% employees abroad	(all employees)
% union membership	(all employees)
Are unions recognized for wages bargaining [yes / no]	(all employees)

Organisational Characteristics

Question	Response choice (all employees)
Who decides the pace of work?	[exclusively workers / mostly workers / equally / mostly managers / exclusively managers]
Who decides how tasks should be allocated?	[exclusively workers / mostly workers/ equally / mostly managers / exclusively managers]
Do you use self-managing teams?	[v. heavily / heavily / moderately / slightly / none]

Work-life Balance: Perceptions

Question	Response choice (all employees)
Relative to other companies in your industry how much does your company emphasize work-life balance?	[much less / slightly less / the same / slightly more / much more]
Is it up to an individual employee (rather than the company) to balance their work/life balance?	[yes/no]

Work-Life Balance: Policies

Question	Response choice (managerial/non-managerial)
If an employee needed to take a day off at short due child-care problems or their child was sick how do they generally do this?	[Not allowed / Never Been Asked / Take as leave without pay / Take time off but make it up later / Take as annual leave / Take as sick leave]
What entitlements are there to the following	Breakdown
Working at home in normal working hours?	(managerial/non-managerial)
Switching from full-time to part-time work?	(managerial/non-managerial)
Job sharing schemes?	(managerial/non-managerial)
Workplace nursery or nursery linked to workplace?	(managerial/non-managerial)
Financial subsidy to help pay for childcare?	(managerial/non-managerial)
School time contracts only?	(managerial/non-managerial)

Market & firm questions:	Response choice
# of competitors	[none / less than 5 / 5 or more]
# hostile take-over bids in last three years	[none / one / more than one]
Average IT spend over the last 3 years	

Interviewer's assessment of the scoring reliability

1 to 5 scoring system calibrated according to:

1 = Interviewee did not have enough expertise for interview to be valuable; I have significant doubts about most of the management dimensions probed]

3 = Interviewee had reasonable expertise; on some dimensions I am unsure of scoring

5 = Interviewee had good expertise, I am confident that the score reflects management practices in this firm

APPENDIX B: DATA

Sampling Frame Construction

Our sampling frame was based on the Fame dataset for the UK, Amadeus dataset for Europe and the Compustat dataset for the USA. We chose firms whose principle industry was in manufacturing and who employed (on average between 2000 and 2003) no less than 50 employees and no more than 10,000 employees. We also removed any clients of partnering consultancy firm from the sampling frame (33 out of 1353 firms).

We believe that our sampling frame is reasonably representative of medium sized manufacturing firms. The European firms in Amadeus include both private and public firms whereas Compustat only includes publicly listed firms. There is no US database with privately listed firms with information on sales, labour and capital. Fortunately, there are a much larger number of US firms listed on the stock exchange than in Europe so we are able to go substantially down the size distribution with Compustat. Nevertheless, the US firms are slightly larger than those of the other countries, so we are always careful to control for size in our analyses. Furthermore our preferred specifications allow all coefficients to be different on labour, capital, materials and consolidation status by country.

Another concern is that we condition on firms where we have information on sales, employment and capital. These items are not compulsory for firms below certain size thresholds so disclosure is voluntary to some extent for the smaller firms. Luckily the firms in our sampling frame (over 50 workers) are past the threshold for voluntary disclosure (the only exception is for capital in Germany).

We achieved a response rate of 54% from the firms that we contacted: a very high success rate given the voluntary nature of participation. Respondents were not significantly more productive than non-respondents. French firms were slightly less likely to respond than firms in the other three countries and all respondents were significantly larger than non-respondents. Apart from these two factors, respondents seemed randomly spread around our sampling frame

Firm level data

Our firm accounting data on sales, employment, capital, profits, shareholder equity, long-term debt, market values (for quoted firms) and wages (where available) came from Fame (UK), Amadeus (France and Germany) and Compustat (US). For other data fields we did the following:

Materials: In France and Germany these are line items in the accounts. In the UK these were constructed by deducting the total wage bill from the cost of goods sold. In the US these were constructed following the method in Bresnahan et al. (2002). We start with costs of good sold (COGS) less depreciation (DP) less labor costs (XLR). For firms who do not report labor expenses expenditures we use average wages and benefits at the four-digit industry level (Bartelsman, Becker and Gray, 2000, until 1996 and then Census Average Production Worker Annual Payroll by 4-digit NAICS code) and multiply this by the firm's reported employment level. This constructed measure is highly correlated at the industry level with materials. Obviously there may be problems with this measure of materials (and therefore value added) which is why we check robustness to measures without materials.

CEO Pay and Age: In the US the S&P 1500 largest firms (which cover all sectors) are contained in Execucomp, which provided data for 106 largest of our US firms. For the remaining firms we manually downloaded the Def14a proxy statements from the SEC to extract the details of the CEO and CFO compensation package and age over the last three accounting years[22]. In the UK the highest paid director is a mandatory line item in the accounts and we took this as the CEO's salary. In France and Germany we have no data on executive pay.
Company Shareholdings: This was manually extracted from the Bloomberg online data service for the 10 largest shareholders and the 10 largest insider shareholders.
Dates of Incorporation: For UK, French and German companies this is provided by the Fame and Amadeus datasets. For the US this was obtained from Dunn and Bradstreet.
R&D: For the US firms this is provided in Compustat. For quoted European firms we obtained this from Datastream UK and Datastream Europe. For unquoted European firms we have no R&D data.

Industry level data
This comes from the OECD STAN database of industrial production. This is provided at the country ISIC Rev. 3 level and is mapped into US SIC (1997) 3 (which is our common industry definition in all four countries).

[22] Many thanks to Guy Clark, Jatin Gulati, Sejal Mehta and Rahul Rathi for the construction of this and the Bloomberg share-ownership data.

TABLE B1 DESCRIPTIVE STATISTICS

	All	UK	US	Germany	France
Number of firms, #	731	152	289	154	136
Management (mean z score)	0.009	-0.144	0.108	0.075	-0.077
Employment (mean)	1,964	1,750	2,476	1,880	1,215
Employment(median)	690	418	1,251	974	311
Material share of output, %	49.2	46.5	53.9	54.7	42.8
Labour share of output,%	26.5	27.9	29.5	28.0	22.9
Return of Capital Employed (ROCE), %	9.94	10.89	5.84	12.9	15.38
Tobin's Q	2.51	2.01	2.87	1.77	1.37
Nominal sales growth rate, %	11.1	5.1	7.9	4.9	8.1
Unconsolidated, %	.257	.094	0	.341	.804
Age of firm (years)	44.3	42.9	42.6	54.9	39.6
Listed firm,%	55.7	28.3	100	40.0	15.4
Multinational subsidiary, %	8.8	9.2	0	22.3	11.0
Share workforce with degrees, %	21.0	13.5	30.6	14.2	15.4
Share workforce with an MBA, %	1.00	0.97	1.89	0.07	0.20
Sickness, days/year	6.850	6.06	5.07	8.48	8.29
Hours, hours per week	40.5	40.2	44.0	38.6	35.6
Holidays, days per year	22.8	25.8	12.2	29.7	32.3
Union density, %	19.0	8.7	22.6	40.8	10.2
Number of competitors index, 1="none", 2="a few", 3="many"	2.28	2.37	2.26	2.25	2.16
Shareholder concentration, % held by top 10 shareholders	53.3	51.5	59.1	41.3	63.6
Insider shareholder concentration, % held by top 10 insider shareholders	10.6	10.8	8.8	27.9	n/a
Lerner index of competition, 2000-2003, excluding the firm itself	0.054	0.077	0.030	0.048	0.038
Openness (export + imports) / output	0.616	0.809	0.424	0.737	0.667

Notes: Data descriptives calculated on the full sample of 731 firms for which management information is available.

APPENDIX C: MEASUREMENT ERROR AND NOISE CONTROLS

Decomposing Variation and Measurement Error

We decompose the variation in the question level z-scores q_{ij} into four components $q_{ij} = m_i + p_{ij} + u_i + e_{ij}$ (where subscript *i* denotes firm and *j* denotes practice): the average firm management practice m_i; the practice specific deviations from the average firm management practice p_{ij} where $\sum p_{ij} = 0$; the average firm-level measure error u_i; and the practice specific deviation in measurement error from the firm average measurement error e_{ij} where $\sum e_{ij} = 0$.

Assuming that the practice deviations and measurement error deviations are i.i.d. within firms (although not across firms) we can decompose the variance in q_{ij} as $1 = \sigma_m^2 + \sigma_p^2 + \sigma_u^2 + \sigma_e^2$ using the fact that z-scores have a variance of 1. To determine these values of these components we exploit the information in the first and second interviews and the variance of question scores within and between firms.

At the question level the regression coefficient from the first on the second interview responses will take the value $\beta_q = \frac{\sigma_m^2 + \sigma_p^2}{\sigma_m^2 + \sigma_p^2 + \sigma_u^2 + \sigma_e^2}$, from applying the standard result on the attenuation bias due to measurement error. The average coefficient[23] from the first on second interviews and the second on first interviews is 0.578. At the firm level the regression coefficient of the first interview average scores on the second interview average scores will take the value $\beta_q = \frac{\sigma_m^2}{\sigma_m^2 + \sigma_u^2}$. The average coefficient from the first on second and second on first interviews is 0.752. Finally, decomposing the variance in question scores within and between firms provides values on $\sigma_m^2 + \sigma_u^2$ and $\sigma_p^2 + \sigma_e^2$ of 0.466 and 0.534.

Combining these three results together with the definition of the variances allows us to calculate $\sigma_m^2 = 0.350$, $\sigma_p^2 = 0.228$, $\sigma_u^2 = 0.116$, and $\sigma_e^2 = 0.306$. Thus, we estimate the ratio of variation from management practices to measurement error to be 58:42 at the question level. This ratio rises to 75:25 at the firm level due to the higher correlation of management practices than measurement error across questions within the firm. Interestingly the variation in these management practices is driven both by changes in firm average management practices (61%) and in firm specific practice capabilities (39%).

[23] The regression of the first interview questions on the second interview questions provides an estimate of the measurement error in the second interviews, while the regression of the second on first interview questions provides an estimate of the measurement error in the first interview. Taking the average coefficient from these two regressions provides a sample average of the measurement error.

TABLE C1: NOISE CONTROLS FOR MEASUREMENT ERROR IN THE MANAGEMENT INTERVIEW

Dependent variable is Management z-score

Explanatory Variable	Definition	Mean	Coefficient (s.e.)	Coefficient (s.e.)
			All Controls	**Selected Controls**
Male	Respondent is male	0.978	0.023	
			(0.200)	
Seniority	The position of manager in the organisation (1 to 5)	3.058	0.062	0.067
			(0.029)	(0.028)
Tenure in this post	Years with current job title	4.908	-0.011	
			(0.007)	
Tenure in the company	Years with the company	11.887	0.002	
			(0.004)	
Countries	Total number of countries worked in over last ten years	1.188	0.076	0.088
			(0.045)	(0.042)
Organisations	Total number of organisations worked in over last ten years			
Manager is foreign	Manager was born outside the country s/he works	0.026	0.241	
			(0.158)	
Ever worked in USA	The manager has worked in the USA at some point	0.425	0.142	
			(0.161)	
Respondent is from US	The manager was born in the USA	0.317	0.231	
			(0131)	
Location of manager	Manager based on site or in corporate HQ			
Tuesday	Day of the week that interview was conducted, (Monday base)	0.288	0.033	0.063
			(0.089)	(0.088)
Wednesday	Day of the week that interview was conducted, (Monday base)	0.199	0.051	0.038
			(0.082)	(0.080)
Thursday	Day of the week that interview was conducted, (Monday base)	0.159	0.230	0.211
			(0.087)	(0.086)
Friday	Day of the week that interview was conducted, (Monday base)	12.45	0.132	0.117
			(0.091)	(0.089)
Local time for manager	The time of the day (24 hour clock) interview conducted	12.45	-0.021	-0.023
			(0.010)	(0.010)
Local time for interviewer	The time of the day GMT (24 hour clock) interview conducted	14.28		
Days from start of project	Count of days since start of the project		0.003	0.003
			(0.001)	(0.001)
Duration of interview	The length of the interview with manager (in minutes)	46.00	0.008	0.008
			(0.003)	(0.003)
Number of contacts	Number of telephone calls to arrange the interview	5.714	0.003	
			(0.006)	

Reliability score	Interviewer's subjective ranking of interview reliability (1 to 5)	4.148	0.384 (0.036)	0.365 (0.036)
17 Interviewer Dummies			F(15,699)=2.37 p-value=0.003	F(15,699)=2.37 p-value=0.003

NOTES: Coefficients from OLS regressions with standard errors in parentheses (robust to arbitrary heteroskedasticity); single cross section; 3 country dummies and 108 sic 3-digit dummies included in the regression; 731 observations

APPENDIX D: ALTERNATIVE PERFORMANCE ESTIMATES

	(1)	(2)	(3)	(4)	(5)	(6)
Estimation Method	**OLS**	**OLS**	**OLS**	**OLS**	**OLS**	**OLS**
Dependent variable	**Ln (Sales)**	**Ln (Sales)**	**Ln (Sales)**	**ROCE**	**Ln (Tobin's Q)**	**Sales growth rate**
Companies	All	All	All with wage data	All	Quoted	All
Management	0.048	0.045	0.053	2.259	0.238	0.024
	(0.014)	(0.015)	(0.017)	(0.699)	(0.075)	(0.009)
ln (L) $_{it}$	0.470	0.502	0.479	1.679	0.345	-0.016
labour	(0.023)	(0.044)	(0.040)	(1.953)	(0.154)	(0.019)
Ln(K) $_{it}$	0.109	0.162	0.045	-0.801	-0.343	-0.002
capital	(0.015)	(0.027)	(0.018)	(1.522)	(0.161)	(0.015)
ln (Materials) $_{it,}$	0.399	0.332	0.464	0.081	0.000	0.009
materials	(0.022)	(0.036)	(0.040)	(1.287)	(0.110)	(0.015)
Ln (Wages)$_{it}$			0.539			
average wages			(0.046)			
Firms	717	717	448	717	374	717
Observations	3958	3958	2344	3685	2217	3955
Factor coefficients interacted with country dummies	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Industry dummies interacted with country dummies (72)	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Extended controls	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Interviewer controls	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*

NOTES: Coefficients from OLS regressions with standard errors in parentheses (robust to arbitrary heteroskedasticity and autocorrelation through clustering by firm); sample period 2000-2004. **"Factor coefficients interacted with industry dummies"** allows labour, capital, materials (and a dummy for subsidiary status) to be interacted with country dummies. UK is the baseline; **"Industry dummies interacted with country dummies"** interactions allows all 2 digit SIC dummies to vary with country; "**Extended controls**" include the average hours worked in the firm, the average days lost to sickness and holidays over the year, the proportion of the workforce with a college degree or equivalent, firm age, a dummy for consolidation status and a dummy for whether or not the firm has a stock market listing; **"Interviewer controls"** includes a separate dummy variable for all the selected controls in column (2) table A2: each interviewer (17), the seniority and tenure of the manager who responded, the day of the week the interview was conducted, the time of the day the interview was conducted and an indicator of the reliability of the information as coded by the interviewer.