Measuring and Explaining Management Practices Across Firms and Countries

Preliminary

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Abstract

We use an innovative survey tool to collect *management practice* data from 732 medium sized manufacturing firms in the US and Europe (France, Germany and the UK). Our measures of managerial best practice are strongly associated with superior firm performance in terms of productivity, profitability, Tobin's Q, sales growth and survival. We also find significant inter-country variation with US firms on average better managed than European firms, but a much greater intra-country variation with a long tail of extremely badly managed firms. This presents a dilemma – why do so many firms exist with apparently inferior management practices, and why does this vary so much across countries? We find this is due to a combination of: (i) low product market competition and (ii) family firms passing management control down to the eldest sons (*primo geniture*). European firms in our sample report facing lower levels of competition, and substantially higher levels of *primo geniture*. These two factors appear to account for around half of the long tail of badly managed firms and half of the average US-Europe gap in management performance.

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, labor productivity varies dramatically even with the same four or five digit industries and these differences are often highly persistent over time[1].

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 computerization (e.g. Griliches, 1979, 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" (e.g. Mundlak, 1961).

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. 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.

We start by evaluating this survey data. We first conduct internal validation by re-surveying firms to interview different managers using different interviewers in the same firms, and find a strong correlation between these two independently collected measures. We then conduct external validation by matching the data with information on firm accounts to investigate the association between our measure of managerial practices and firm performance. We find that "better" management practices are significantly associated with higher productivity, profitability, Tobin's Q, sales growth rates and firm-survival rates. This is true both in our English-speaking countries (the UK and the US) and the Continental European countries (France and Germany); suggesting our characterization of "good" management is not specific to Anglo-Saxon cultures.

We then turn to analysing the raw survey data and observe a surprisingly large spread in management practices across firms. Most notably we see that a large number of firms who are extremely badly managed with ineffective monitoring, targets and incentives. We also observe significant variations in management practices across our sample of countries, with US firms on average better managed than European firms.

This raises a question - why are there such variations in management practices across firms and countries when these are so strongly linked to firm performance? Two factors that appear to play an important role are product market competition and "family firms". First, higher levels of

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[1] For example, Baily et al. (1992), Bartelsman and Dhrymes (1998), Disney, Haskel and Heden (2003).

competition (measured using a variety of different proxies) is strongly and robustly associated with better management practices. This competition effect could arise through a number of channels, including by inducing greater managerial effort and/or the more rapid exit of badly managed firms. We find only small effects of competition on managerial hours, suggesting these are relatively unimportant with exit (or another mechanism[2]) playing the dominant role. Secondly, family-owned firms in which the CEO is chosen by *primo geniture* (the eldest male child) tend to be badly managed. Family *ownership* could have beneficial effects from the concentration of ownership as this may overcome some of the principal-agent problems associated with dispersed ownership. In our data we find family ownership combined with professional management (i.e. where the CEO is not a family member) has a mildly positive association with good managerial practices. The impact of family *ownership* and *management* is more ambiguous, however, with positive effects from reducing the principal-agent problem but negative effects due to more limited selection into managerial positions as well as the "Carnegie effect"[3]. We find for firms who select the CEO from all family members there is no significant net family *management* effect, but for firms who select the CEO based on *primo geniture* there is a very large negative impact on management.

The impact of competition and family firms is quantitatively important. Low competition and *primo geniture* family firms account for about half of the tail of poorly performing firms. Across countries competition and family firms also play a large role, accounting for as much as two-thirds of the gap in management practices between the US and Continental European and one third of the gap between the US and the UK. One reason is that European competition levels appear lower. Another reason is that *primo geniture* is much more common in France and the UK due to their Norman heritage, in which *primo geniture* was legally enforced to preserve concentrated land-holdings for military support. More recently European countries have also provided increasingly generous estate tax exemptions for family firms.

Our work relates to a number of stands in the literature. First, our findings are consistent with recent econometric work looking at the importance of product market competition in raising company productivity[4]. It has often been speculated that these productivity enhancing effects of competition work through improving mean management practices and our study provides support for this view. In economic history, Landes (1969) and Chandler (1994) claimed that the relative industrial decline of the UK and France in the early Twentieth Century was driven by their emphasis on family management, compared to the German and American approach of employing professional managers. Our results suggests this phenomena is still important almost a century later. A third related strand is the work on the impact of Human Resource Management[5] which also finds that management practices matter for firm performance. Finally, there is the recent contribution of Bertrand and Schoar (2003), who focus on the impact of changing Chief Executive Officers (CEOs) and Chief Financial Officers (CFOs) in very large quoted US firms.

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2 Other possible mechanisms include the a learning effect, whereby higher competition involving more firms within the same industry allows firms to learn superior management practices more quickly.

3 The "Carnegie effect" is named after the great philanthropist Andrew Carnegie who claimed that "*the parent who leaves his son enormous wealth generally deadens the talents and energies of the son, and tempts him to lead a less useful and less worthy life than he otherwise would*"

4 There are a very large number of papers here but examples of key contributions would be Syverson (2004a,b), Olley and Pakes (1996) and Nickell (1996)

5 For example, Ichinowski et al. (1995, 1997), Lazear (2000) and Black and Lynch (2001).

This will tend to reflect the impact of management *styles* and *strategies*, complementing our work emphasizing the *practices* of middle management.[6] We see management 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.

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 details the empirical model and the results. In section V we discuss the distribution of management practices and offer evidence on the causes for the variations in management. In section VI we pull this all together to try to explain management practices across firms and countries. Finally some concluding comments are offered 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[7]. There are at least two groups of theories that could explain the paradox. First, firms may operate in environments with different degrees of product market competition – this enables poorly managed firms to survive in equilibrium. Second, even if the market is competitive family involvement may generate the incentive and ability for sub-optimal management practices to persist. We consider these in turn.

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. Over time the less well managed firms will on average, be selected out and the well managed firms will be selected in. We call this "selection of the well managed". Tougher 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

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[6] 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.

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

characterised by worse management on average. 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 a higher average level of productivity with a lower dispersion of productivity as the less productive tail has been selected out.

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".[8]

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 is 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[9].

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

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[8] On a related theme Bertrand and Mullainathan (2003) find that weak *corporate governance* tends to be associated with lower managerial effort as proxied by corporate activity.

[9] 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 exist and this 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.

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 the Bertrand competition considered in Appendix E for a wide number of assumptions over the form of consumer 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 Family ownership and family management

Family firms are the typical form of ownership and management in the developing world and much of the developed world (La Porta, Lopez-de-Silanes and Schleifer, 1999). As Table 1 shows in our sample of medium-sized manufacturing firms (see section III for details) family involvement is common. In around thirty per cent of European firms and ten per cent of American firms the largest shareholding block is a family (defined as the second generation or beyond from the company's founder). This is similar in broad magnitude to the findings of La Porta et al. (1999), who report about 40% of medium sized firms were family-controled in Europe and about 10% were family-controled in the US.[10] Interestingly, we see in the second row that most of these firms have a family member as CEO, suggesting families are reluctant to let professional managers run their firms. In the third row we see in the UK and France around two thirds of these CEOs are chosen by *primo geniture* (succession to the eldest son) representing around 15% of the sample, while in Germany and the US this only occurs in about one third of the family firms representing only 3% of the sample. In rows 4 and 5 we look at founder firms – those companies were the largest current shareholder is the individual who founded the firm. We see that founder firms are also common in the UK and France, as well as in the US, although much less so in Germany - consistent with the fact that there are fewer young German firms.

[TABLE 1 ABOUT HERE]

One rationale for these differences in types of family involvement across countries is the historical traditions of Feudalism, particularly in the Norman societies of the UK and France. This appears to have persisted long after the Norman kingdoms collapsed, with *primo geniture* obligatory under English law until the Statute of Wills of 1540 and de facto in France until the introduction of the Napoleonic code in the early 1800s[11]. German traditions were based more on the Teutonic principle of *gavelkind* (equal division amongst all sons), while in the US *primo*

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[10] La Porta et al. (1999) define family "ownership" as controlling 20% or more of the equity, "medium sized" as those with common equity of just above $500m; and "family" as including founder owned. Including "founder" firms in our definition would increase "family" ownership to about 45% in Europe and 25% in the US, higher then their numbers, although our "medium sized" firms are smaller. The main points to note is that family firms are common in the OECD, pariticularly so in continental Europe.

[11] While Napoleonic inheritance code enforced the equal division of *property* it made no reference to companies. In fact, a common route to pass property on to a single heir in France is now to place this within a company.

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geniture was abolished after the Revolution with almost completely equal treatment by birth order and gender by the middle of the 20th century (Menchik, 1980). A second potential rationale for these differences is the structure of estate taxation, which for a typical medium sized firm worth $10m or more, contains no substantial family firm exemptions in the US, but gives about a 33%, 60% and 100% exemption in France, Germany and the UK respectively.[12]

The theoretical implications of family ownership depend on the extent of involvement in management. Family ownership *per se* may have advantages over dispersed ownership because the (concentrated) ownership structure may lead to closer monitoring of managers (e.g. Berle and Means, 1932)[13]. Where capital markets are imperfect founders may be unable to sell off the firm easily to outside investors and prefer to keep ownership in the family (Caselli and Gennaioli, 2002). Furthermore, when minority investor rights are not well protected, it may be difficult to diversify ownership.

Even though a firm is family owned, outside professional managers can be apointed to run the firm as is common in the US and Germany. Combining family ownership with family management has several potential costs. Selecting managers from among the pool of family members will lower the average human capital of the managerial cadre as there is effectively less competition for senior positions in running the firm. Furthermore, the knowledge that family members will receive management positions in future may generate a "Carnegie effect" of reducing their investment in human capital earlier in life. These selection and Cargenie effects are likely to be much more negative for *primo geniture* family firms in which the eldest son is destined to control the firm from birth. On the other hand, principal-agent problems may be mitigated from combining ownership and control. Family manged firms may be in less fear of CEOs stealing from the firm, for example. There may also be investment in firm-specific human capital if the owners' children expect to inhereit the family firm. So ultimately the impact of family firms on management quality is an empirical matter.

Of course family-owned firms should have strong incentives to optimally balance off these factors before deciding on using family or external managers. But family-owned firms may choose family management even though this is sub-optimal for performance because family members receive "amenity potential" from managing the family firm, which often bears the family name and has been managed by several previous generations (Bukhart et al, 1998). In this case the family may accept lower economic returns from their management in return for the private utility of management. Indeed, the desire to retain family management may also be a reason for the refusal of family owners to sell equity stakes in the company to outsiders.

The small body of evidence on inherited family firms suggests that family *ownership* has a mixed effect on firm performance, but family *management* has a substantially negative effect (see Perez-

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[12] For political economy reasons these generous estate taxes could have arisen endogenously from the power blocs of politically connected family firms. The German Cabinet also proposed in July 2005 a 100% exemption for family firms. Of course estate-tax can be reduced by tax planning, but this usually involves advanced planning, financial costs and some loss of control.

[13] Bennedsen et al. (2005) list a range of additional potential benefits (and costs) of family ownership, although these are likely to be less important than those discussed in the main text. The benefits include working harder due to higher levels of shame from failure, trust and loyalty of key stakeholders, and business knowledge from having grown up close to the firm. The costs include potential conflicts between business norms and family traditions.

Gonzalez, 2005). Our approach in this paper is to examine more directly the impact of family firms on management practices rather than look at firm performance measures (which are indirect indicators of management quality). Although there may be some endogeneity problems with the family firms "effect" on management, these selection effects seem to cause OLS estimates to *underestimate* the damage of family involvement in management. This is because empirically family firms are more likely to involve professional managers when the firm has suffered a negative shock (see Bennedsen et al. 2005).[14]

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) eighteen of the key management practices which appear to matter most to industrial firms.

In Appendix A we detail the questions in the same order as they appeared in the survey, describe the scoring system and provide three anonymous responses per question. 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 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 estimation we convert the scores (from the 1 to 5 scale) to z-scores by normalizing by question to mean zero and standard

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[14] Bennedsen et al. 2005 construct a large dataset of 6,000 Danish firms, including information on the gender of the first born child, which they use to instrument for firms remaining under family management after a succession.

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 analytic 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 any "Anglo-Saxon" bias in our management scores.

III.B Collecting Accurate Responses

With this 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, 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 accurate data.

First, the survey was conducted by telephone using a 'funnelling' interviewing technique, asking 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]?"). The questioning continued using open questions for each dimension, based as much as possible on examples, until the interviewer could make an accurate assessment of the firm's typical practices. Participating managers were not shown the scoring grid or involved in the scoring system. 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.[15]

Second, the interviewers did not know anything about the firm's financial information or performance in advance of the interview. 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). These smaller firms would not be known by name and are rarely reported in the business media. The interviewers were specially trained graduate students from top European and US business schools, with a median age of twenty eight and five years prior business experience in the manufacturing sector[16].

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[15] If an interviewer could not score a question it was left blank, with the firm average taken over the remaining questions 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.

[16] 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.

Third, 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 of the enterprise.

Fourth, 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 (gender, seniority, nationality, company and job tenure, internal and external employment experience, and location), and on the interviewer (we can include individual interviewer-fixed effects, 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)[17], 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 took around one hour on average, and was run from the London School of Economics. Overall we obtained a high response rate of 54% coverage rate, which was achieved through four steps.

First, the interview was introduced as "a piece of work"[18] 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.

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

Third, 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[19].

Fourth, the endorsement of the Bundesbank (in Germany) and the Treasury (in the UK) helped demonstrate to managers this was an important non-commercial exercise with official support.

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[17] 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.

[18] We quickly discovered that using words like "survey", "research" or "analysis" should be avoided as these are used by telephone switchboards to screen out market research calls.

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

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 as a whole from one or two plant 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[20].

In addition to the standard information on management practices, we also ran two other surveys. First, we collected information from a separate telephone survey on 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 organizational structure of the firm and the work-life balance. The details of this questionnaire are provided in Appendix A2. Second, we collected information from company accounts, public data sources and another separate telephone survey on family ownership, management and succession procedures, typically answered by the CEO or his office. The details of this questionnaire are provided in Appendix A3.

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 the association of management with firm performance. 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 company-wide management practices these two scores should be correlated, while to the extent the measure is driven by noise the measures should be independent.

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[20] This removed 33 firms out of our sampling frame of 1,353 firms

Figure 1 plots the average firm level scores from the first interview against the second interviews, from which we can see they are highly correlated (correlation 0.734 with p-value 0.000). 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 eighteen 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 in the production function 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

$$y_{it}^c = \alpha^c{}_l l_{it}^c + \alpha_k^c k_{it}^c + \alpha_m^c m_{it}^c + \beta^c MNG_i^c + \gamma^c{}' x_{it}^c + u_{it}^c \tag{1}$$

where Y = sales, L = labor, 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 three digit industry dummies).

The crucial variable for us is management practices denoted *MNG*. Our basic measure takes z-scores of each of the eighteen individual management questions 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 simply run OLS in the cross section (or on the panel) and assume that all the correlated heterogeneity is captured by the control variables. Since we have panel data, however, an alternative is to implement a two step method where we estimate the production function in stage one and then estimate the "permanent" component of total factor productivity (i.e. the fixed effect). We then project the permanent component of productivity on the management scores in a separate second step. This is the approach of Black and Lynch (2001) that followed a similar two step approach in their analysis of workplace practices and productivity. We estimate the production function in a variety of ways. The simplest method is within groups – including a full set of firm dummies. We compare this to "System GMM" (see Blundell and Bond, 2000) approach that also allows for the endogeneity of the time varying inputs (capital, labor and materials). Finally we implement the Olley Pakes (1996) estimator.[21] This allows the unobserved firm-specific efficiency effect to follow a first-order Markov process. 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 2 investigates the association between firm productivity and management practices using a range of alternative econometric methods for panel data (1994-2004)[22]. Column (1) simply reports a levels OLS specification without controlling for correlated unobserved heterogeneity or endogeneity. We include country and industry dummies to controls for country and industry dummies; controls for hours, education, firm age, size and listing status; and a set of interview

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[21] See Arellano and Bond (1991) and Blundell and Bond (1998) on System GMM estimation, and Olley and Pakes (1996) on their estimation strategy.
[22] The exact number of observations depends on estimation technique. For Olley-Pakes we need at least one period for lags and must drop all observations with non-positive values of investment. For System GMM we lose two lags to construct instruments, and need to condition on firms having at least four continuous years of data.

"noise controls" to mitigate biases across interviewers and types of interviewees.[23] It is clear that the average management score is positively and significantly correlated with higher total factor productivity.

In the other columns in Table 2 the management score (along with the other time invariant controls) are all absorbed into the fixed effects when we estimate the production function. We can recover the estmates of the fixed effects fron the production function, however, and project these on to the management score (and the other controls). These are reported in the lower parts of the relevant column. Although the point estimates on the input coefficients differs to some degree depending on whether we estimate by Within Groups (Column (2)), Olley-Pakes (column (3)) or System GMM (column (4)) the management scores are always positively and significantly correlated with the "permanent" component of firm-specific TFP.

[TABLE 2 ABOUT HERE]

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 (5) by re-running the two stage estimation using French and German companies only and again found a large a highly significant coefficient on management. Indeed, column (6) shows that the management association with productivity is, if anything, weaker in the US and UK than in Continental Europe[24].

We also investigated the impact of the weighting across individual questions through factor analysis. Undertaking factor analysis 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. Re-estimating column (2) we found that in the second step TFP equation that this "good management" factor score had a coefficient of 0.038 with a standard error of 0.012. 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) and the level of organisational devolvement[25], suggesting a slightly different pattern of management practices across firms with different levels of human capital.

Table D1 in Appendix D provides further robustness checks on the management score using alternative measures of firm performance. In column (1) we report the production function estimation, 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

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[23] 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.

[24] We also experimented with allowing country specific coefficients on all the factor inputs (see Appendix D) and allowing the coefficients to be different in every two digit industry (with similar results).

[25] In the survey we also collected two questions on organizational structure (see Appendix A2) taken from Bresnahan et al. (2002).

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. 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 report simply the cross section (instead of using the panel with clustered firm standard errors). In column (4) we add in company average wages to the column (2) specification to control for unobserved worker quality and still find that the management coefficient is positive and significant. In column (5) 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 (see Betrand and Schoar, 2003). 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 (6) we estimate a Tobin's Q specification, which again includes the same production function set of controls, and find a significant positive coefficient. In column (7) we estimate the relationship between the average annual growth rate of sales (1994-2004) and management practices, again with the same set of controls, and find a positive and significant coefficient on management. Finally, in column (8) of Table D1 we estimate the relationship between exit in the twelve months after the survey and management practices. Over this period 18 firms exited, equivalent to about 2.5% of the sample, making it hard to accurately identify an exit effect due. However, these firms were so much worse managed that the implied marginal effects of management in the probit equation is large and statistically significant. Thus, firms who were worse managed in mid-2004 were subsequently more likely to exit by mid-2005.

Overall then, there is substantial external validation that the measures of management we use are positively and significantly associated with better firm performance.

V. ACCOUNTING FOR THE DISTRIBUTION OF MANAGEMENT PRACTICES

V.A 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 2 shows the distribution of the average management scores per firm across all eighteen 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 2% of the overall variation in firms' average management scores is across countries, 42% is across countries by three-digit industry, and the remaining 56% 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 address in the next sub-section is how do these firms survive?

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 gaps between the US, Continental Europe (France and Germany) and the 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.[26]

The presence of the US at the top of the ranking is consistent with anecdotal evidence from other surveys.[27] One might suspect this was due to an "Anglo-Saxon" bias which is why in the previous section we had to confront the scores with data on productivity to show that they are correlated with real outcomes within countries (see Table 2). 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 fixed-capital intensive and operational management)[28].

V.B Management practices and product market competition

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 4 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 as the average across the entire firm level database (excluding each firm itself)[29]. 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 three digit 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"[30].

[TABLE 3 ABOUT HERE]

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[26] We also find that the 21 US multinational subsidiaries in our dataset are significantly better managed (average 3.74) than either the 405 domestic European firms (average 3.11) or the 16 non-US multinational subsidiaries (average 3.12).

[27] 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 samples are drawn only from the consulting groups' clients so suffer from serious selection bias.

[28] 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.

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

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

In column (1) we see the Lerner index of competition measure is positive and strongly significant after controlling for country dummies, 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. The firm controls include firm size, firm age, listing status, skills controls and consolidation status[31]. Even after conditioning on these additional covariates we find that the 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 specifications, 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.

The magnitude of the competition effect is of economic as well as statistical significance. For example in column (6) increasing the number of competitors from "few" to "many" is associated with a management z-score increase of 0.145 or a raw management score increase of about 0.16.[32] As discussed in the section VI this competition effect also accounts for a substantial proportion of the tail of badly performing firms and also the management gap between the US and Europe.

These are associations, of course, as we have no instrumental variable for competition. But it is likely that any endogeneity will cause us to *underestimate* the importance of product market competition on management. For example, in columns (1) and (2) an exogenous positive shock that raises managerial quality in an industry is likely to increase profitability and therefore the measured Lerner index (indeed, Appendix Table D shows a positive corrleation between management and contemporaneous firm level profitability). This will make it *harder* for us to identify any positive impact of product market competition on management[33].

One issue in interpreting this competition effect as discussed in section III is that it potentially works through two mechanisms: (i) increasing management scores through greater managerial effort; and (ii) greater competition increasing the *relative* exit rate of badly managed firms versus well managed firms. In Table 5 we examine the *effort effect* of competition directly and find that this is typically insignificant and so probably weak. In columns (1) to (2) we regress managerial hours worked – our proxy for managerial effort[34] - on the Lerner index and find an insignificant

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[31] We also experimented with many other controls (results available on request). Union density was negative but insignificant. Average worker age was negative and significant until we included firm age which drove worker age to insignificance. The proportion of females was also insignificant.

[32] The difference in the raw management score between the 75th and 25th percentiles of the distribution is 1.06. The ratio of the standard-deviations of the firm-level management scores to the z-scores is 1.098.

[33] Similarly, better management will improve exports and reduce the degree of imports and probably mean that the firm pulls away from other competitors and feels less threatened. These will all generate a bias towards zero on the competition indicators in Table 3.

[34] 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.

relationship with mixed signs. In columns (3) and (4) we look at managerial hours worked and important penetration, finding again 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% level without industry and firm controls (column 5), but only significant at the 17% once these more general controls are included. This suggests that competition may play a small positive role in increasingly managerial effort, although this is not large enough to register at standard significance levels in our data. This is consistent with the somewhat ambiguous theoretical relationship discussed in section IIA.

[TABLE 4 ABOUT HERE]

V.C Management practices and family firms

In table 6 we investigate the impact of hereditary family ownership on firms management scores (see Table 1 for descriptive statistics on types of ownership and control by the family). Column (1) starts by regressing management scores against an indicator of the family as the single largest owner (defined on total family holdings[35]) plus the standard set of control variables. We see that family ownership *per se* is not bad for firm performance, with a negative but insignificant coefficient. In column (2) we regress management practices against an indicator of family ownership and family management (defined by the CEO being a family member), and find the coefficient becomes more negative but again is not significantly different from zero. In column (3) we include an indicator that the firm is family owned, family managed with the CEO succession determined by *primo geniture* - that is they explicitly stated this position passed to the eldest son. For these firms we see a strongly negative and significant coefficient, suggesting the sub-set of family firms who adopted *primo geniture* succession are substantially worse managed. Finally, in column (4) we include all three indicators and see that it is the *primo geniture* family firms that are driving the negative coefficients on family ownership and management. In fact, family ownership per se has a positive and weakly significant association with good management. It is the combination of family ownership and *primo geniture* family management that appear to damage performance.

[TABLE 5 ABOUT HERE]

One interpretation is that being a *primo geniture* company directly causes this inferior performance in family firms due to the types of selection and "Carnegie effects" discussed in section II. Another interpretation is that *primo geniture* is an indicator of firms being more generally backward. Looking at the individual management practices we do see that family firms are particularly bad at shop-floor operations and monitoring – which are typically related to more modern manufacturing practices – and relatively less bad at targets and monitoring.[36] However,

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[35] We also looked at the breakdown of individual family holdings (e.g. if two brothers owned half the equity each), but could not find any significant impact of the relative or absolute differences in holdings of the first and second largest family shareholders. One reason may be that complete data was hard to obtain for European firms.

[36] The point-estimate (standard-errors) for the column (3) specification for individual management components are: Shopfloor -0.341 (0.147); Monitoring -0.345 (0.116); Targets -0.229 (0.115); and Incentives -0.231 (0.099).

that these firms are significantly worse managed than both all other firms and also all other family firms, even after controlling for firm size, age and listing status, suggests this phenomena is different from simply family involvement or firm vintage alone.

V.D Management Scores and Management Ability

Another 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 (college degree and MBA proportion) 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 average wages 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 (Table D1). Finally, CEO pay (a proxy for top-managerial ability) is only very weakly and insignificantly correlated with our management score[37]. So while managerial ability may account for some of the variation in management practices across firms, this is unlikely to 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.

VI. EXPLAINING MANAGEMENT PRACTICES ACROSS FIRMS AND COUNTRIES: QUANTIFICATION

We turn to quantifying the role of competition and *primo geniture* family firms in accounting for management practices.

VI.A Explaining the Tail of Badly Managed Firms

One of the dilemmas in the raw data is the substantial fraction of firms that appear to be adopting surprisingly bad management practices, with scores of 2 or less. These firms have only basic shop-floor management, very limited monitoring of processes or people, ineffective and

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[37] For example, regressing log(CEO 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 we obtain 0.000 (0.060). Note that although CEO pay includes bonuses it does not include share options.

inappropriate targets, and poor incentives and firing mechanisms. And our calibration of the measurement error suggests these firms can not be entirely explained by sampling noise.

To investigate whether low competition and *primo geniture* family firms can account for this tail of badly run firms we split the sample based on these measures. Figure 3 plots the management histogram for all firms reporting low competition[38] and/or *primo geniture* family succession, accounting for 415 firms. Figure 4 plots the management histogram for the remaining high-competition and no *primo geniture* succession, accounting for the remaining 307 firms. Comparing these two graphs it is clear that the tail of badly managed firms is substantially larger in the low competition and *primo geniture* sample, with 8.9% of firms scoring 2 or less, compared to 2.7% of firms in the high competition no *primo-geniture* sample.[39] Given that 6.5% of all firms in the sample scored 2 or less, controlling for competition and *primo geniture* succession appears to remove over 50% of the tail of very badly managed firms.[40]

VI.B Explaining the Cross-Country Variation in Management Scores

In table 6 we attempt to account for the variations in management practices across countries. In column (1) we regress management on a Continental Europe indicator (France or Germany[41]) and a UK indicator, with the US as baseline. We find that Continental European and UK firms are significantly worse managed than US firms on average, with a gap of 0.118 and 0.277 respectively. In column (2) we condition on our measure of the number of competitors faced by the firm. Consistent with the earlier results this enters the regression with a positive and significant coefficient. The coefficient on the UK dummy drops slightly as the degree of competition is only slightly lower in the UK than in the US. By contrast the coefficient on the Continental European countries drops by a third and is now insignificant at the 10% level. This is because competition levels are reported to be much higher for US firms than French or German firms.[42] In column (3) we include a dummy for *primo geniture* family firms which is negative and significant at the 5% level as expected. The country dummies drop further. Together, competition and family firm status have accounted for over two thirds (68% = 100*(.118-.037)/.118) of the gap between the US and Continental Europe and one third (33% = 100*(.277-.186))/.277) of the US gap with the UK. In column (4) we further add an extra set of "compositional" controls for size, industry, age and public listing status. Interestingly, we find larger firms are significantly better run, consistent with Lucas's (1978) model of the optimal spread of managerial talent. There is no longer discernible difference in management scores between the US and Continental Europe. There remains a UK-US gap (significant at the 10%

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[38] Defined by firms reporting "few" or "no" competitors. We use this measure to analyse cross-country competition because it is consistently measured across the sample. The Lerner index and import penetration measures will vary with accounting standards and country size respectively. In the regression results we controlled for this with country dummies and identify from within country variations, but in this section we want to look across countries.

[39] This split is also true in the US and European subsamples. In the US 5.2% of firms score 2 or less in the low competition and/or *primo geniture* group while 0.6% score 2 or less in the high competition non *primo geniture* group. In Europe 11.2% of firms score 2 or less in the low competition and/or *primo geniture* group while 5.3% score 2 or less in the high competition non *primo genitur* group.

[40] Competition explains around 2/3 of this reduction in the tail, with conditiong on "many" competitors alone taking the share of firms scoring 2 or less from 6.9% (in the whole sample) down to 4.2%.

[41] We cannot reject the restriction that the French and German dummies are equal (p-value = 0.077)

[42] In the descriptive statistics of Table B1 the index of competition is 2.56 for the US, 2.52 for the UK, 2.35 for Germany and 2.32 for France.

level) and we suspect this is due to differences in human capital between the two countries. Including two human capital measures (the proportion of employees with college degrees and the proportion of employees with MBAs[43]) reduces the coeffecient on the UK dummy to -0.119 with a standard error of 0.104.

[TABLE 6 ABOUT HERE]

Although we were expecting the competition results, the role of family firms is more surprising. The finding matches up with the Economic History literature of Landes (1967) and Chandler (1994), who claims that hereditary family management was probably the primary the reason for the industrial decline of the UK and France relative to the US and Germany around the early 1900s. For example, Landes (1967) states that:

> *"The Britain of the late 19th Century basked complacently in the sunset of economic hegemony. Now it was the turn of the 3rd generation…[and] the weakness of British enterprise reflected their combination of amateurism and complacency"*

Landes (1967), pp. 563

> *"Before the war the model [French] enterprise was family-owned and operated, security-orientated rather than risk-taking, technologically conservative and economically inefficient"*

Landes (1967), pp. 528.

The results in Table 6 suggest family firms – at least in our sample of medium sized manufacturing firms - are still a factor in explaining cross country management practices 100 years later. And extrapolating from the 20% of firms under family ownership in 2004 to the majority share they would have accounted for in the early 1900s suggests they could have played the dominant cross-country role in that period as suggested by Landes and Chandler.

VII. CONCLUSIONS

We use an innovative survey tool to collect *management practice* data from 732 medium sized manufacturing firms in Europe and the US. The methodology described here combines traditional survey tools used by economists with the more in-depth case study interview techniques recommended by management specialists. We believe that it will be a useful part of the empirical toolkit to be used by economists interested in the internal organization of firms. Rather than simply label unobserved heterogeneity "fixed effects" we have explicitly developed indicators of managerial best practice.

In our application we find these measures of better management practice are strongly associated with superior firm performance in terms of productivity, profitability, Tobin's Q, sales growth and survival. We also find significant country variation with US firms on average better managed than European firms, and an even larger firm variation with a long tail of extremely badly

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[43] The two variables are both positive and jointly significant with a p-value of 0.001.

managed firms. Why do so many firms exist with apparently inferior management practices, and why does this vary so much across countries? We find this is due to a combination of: (i) low product market competition which appears to allow poor management practices to persist, and (ii) family firms passing management control down by *primo geniture*. European firms in our sample report facing lower levels of competition, and display substantially higher levels of *primo geniture* than American firms apparently due to their Feudal heritage. These two factors alone appear to account for around half of the long tail of badly managed firms and between two thirds (France/Germany) and one-third (UK) of the European management gap with the US.

A range of potential extensions to this work are planned, including running a second survey wave on in 2006. It is important to follow up these firms in order to examine the extent to which management practice evolve over time. This will enable us to examine whether competition is working simply through selection or is there learning of better managerial techniques by incumbent firms. The methodology of quantifying management is general enough to be applied (with modifications) to other countries and other sectors, including the public sector.
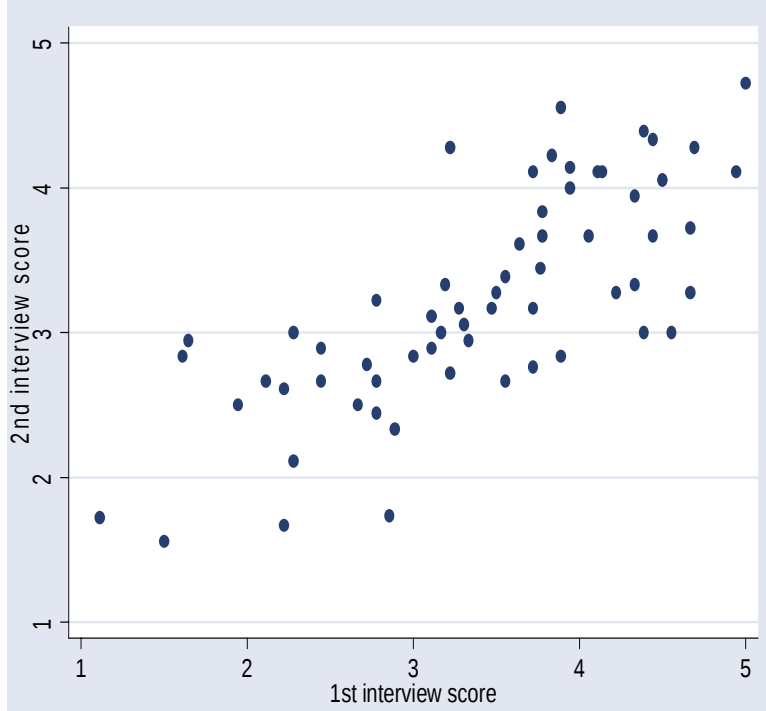
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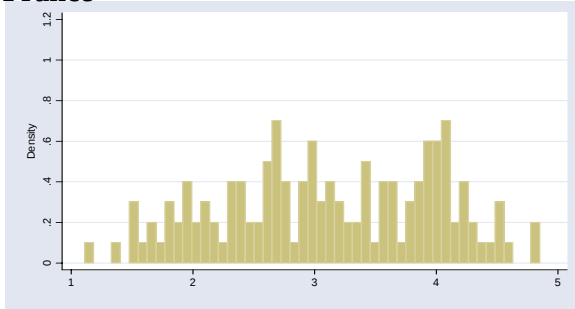
Figure 1: First management score on second management score
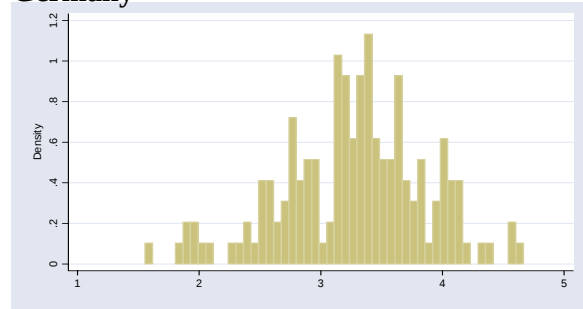
Note: Scores from 64 repeat interviews on the same firm with different managers and different interviewers.

Figure 2: Distribution of management scores by country
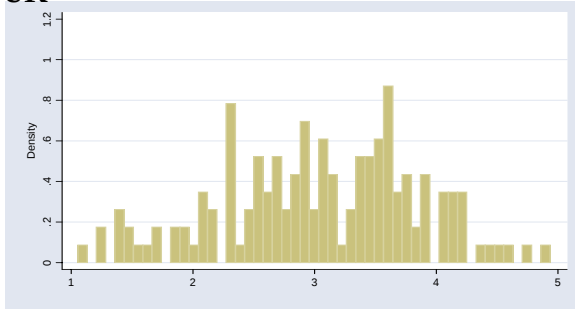
France
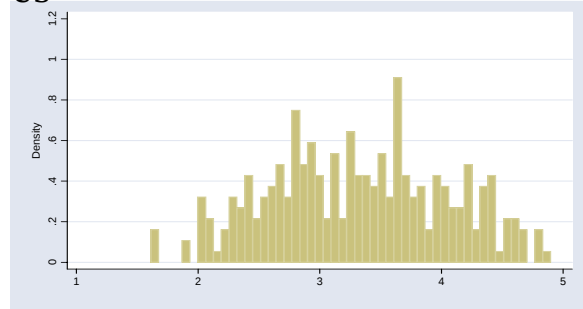
Germany

UK
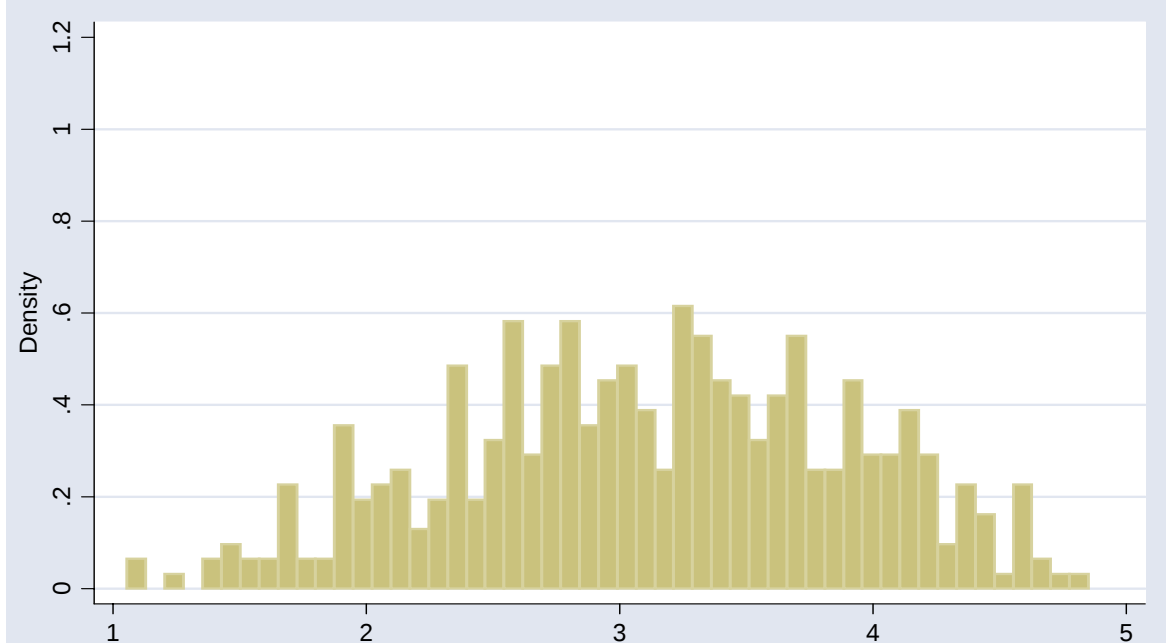
US
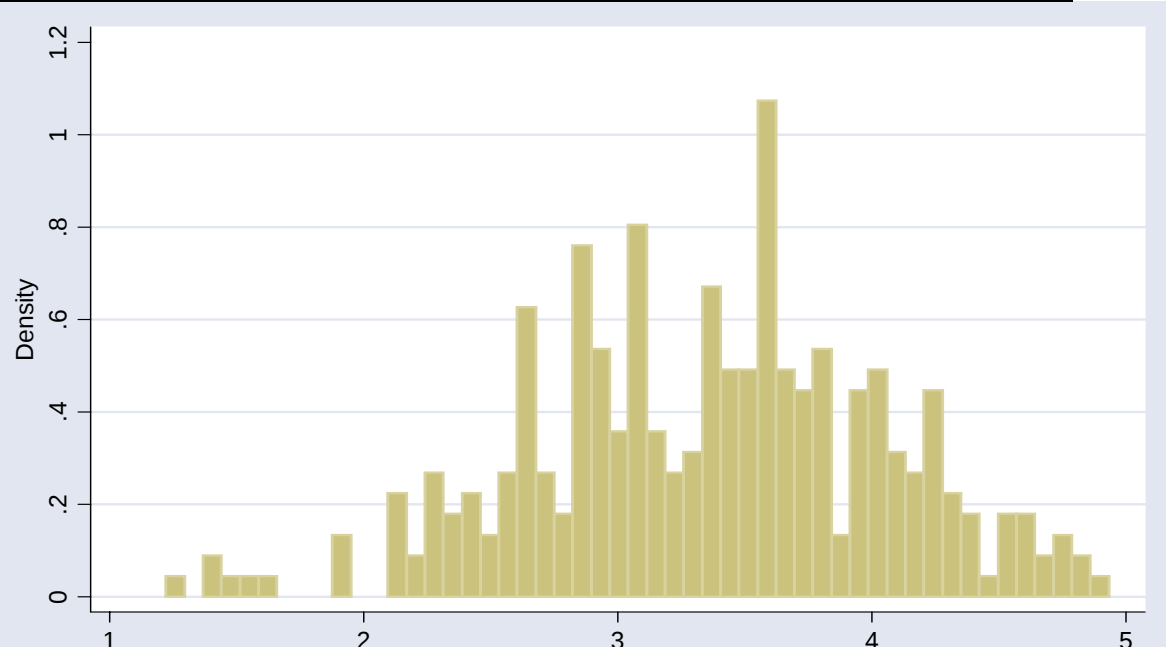
Note: These are the distributions of the raw management scores (simple averages across all 18 questions). There are 137 French observations, 156 German observations, 152 UK observations and 290 US observations,

Figure 3: Management scores, low competition and/or *primo geniture* family firms

Notes: Average management scores for the 415 firms which: (i) report facing "few" or "no" competitors, and/or (ii) have a family (2nd generation or more) as the largest shareholder with a family CEO chosen by *primo geniture*. Split by country is France (95), Germany (101), UK (85) and the US (134). Overall 8.9% of the sample score 2 or less.

Figure 4: Management scores, high competition and no *primo geniture* family firms

Notes: Average management scores for the 307 firms which report facing "many" competitors, and do not have a family (2nd generation or more) as the largest shareholder with a family CEO chosen by *primo geniture*. Split by country is France (34), Germany (51), UK (66) and the US (156). Overall 2.7% of the sample score 2 or less.

TABLE 1: HEREDITARY FAMILY FIRM INVOLVEMENT BY COUNTRY

%	France	Germany	UK	US
Family largest shareholder	28	31	30	10
Family largest shareholder and family CEO	18	11	23	7
Family largest shareholder, family CEO and *primo geniture*	13	3	15	3
Founder largest shareholder	24	4	14	18
Founder largest shareholder and CEO	18	1	12	11

NOTES: Family shareholding is combined across all family members. Family involvement is defined as 2nd generation family or beyond. Alternatives to *primo-geniture* in frequency order are: younger sons, son in-laws, daughters, brothers, wives & nephews. Founder is defined as the person that set up the firm.

TABLE 2: PRODUCTION FUNCTION ESTIMATIONS

	(1)	(2)	(3)	(4)	(5)	(6)
Estimation Method	OLS LEVELS	WITHIN GROUPS	OLLEY PAKES	GMM-SYS	WITHIN GROUPS	WITHIN GROUPS
Countries	All	All	All	All	France and Germany	US and UK
Dependent variable	Ln (Y) $_{it}$	Ln (Y) $_{it}$	Ln (Y) $_{it}$	Ln (Y) $_{it}$	Ln (Y) $_{it}$	Ln (Y) $_{it}$
	sales	sales	sales	sales	sales	sales
ln (L) $_{it}$	0.498	0.543	0.417	0.444	0.416	0.566
labor	(0.020)	(0.024)	(0.020)	(0.113)	(0.055)	(0.026)
Ln(K) $_{it}$	0.123	0.058	0.147	0.113	0.077	0.055
capital	(0.013)	(0.017)	(0.040)	(0.049)	(0.031)	(0.019)
ln (Materials) $_{it,}$	0.368	0.325	0.431	0.359	0.439	0.305
materials	(0.019)	(0.024)	(0.023)	(0.043)	(0.048)	(0.025)
Management z-score	0.041 (0.013)					
Firms	709	709	709	709	270	439
Observations	5,350	5,350	3,606	3,674	1,393	3,957
Dependent variable		TFP	TFP	TFP	TFP	TFP
Management z-score		0.079 (0.017)	0.041 (0.018)	0.071 (0.017)	0.103 (0.042)	0.060 (0.20)
Observations		709	709	709	270	439
SC(2) p-value				0.181		
SARGAN p-value				0.160		
COMFAC p-value				0.000		

NOTES: In all columns standard errors are in parentheses under coefficient estimates and allow for arbitrary heterskedacitiy and correlation (i.e. clustered by firm). Column (1) is estimated by OLS levels and we also include "**full controls**" comprising of "firm" controls for ln(hours worked), ln(firm age), a dummy for being listed, a dummy for being consolidated the share of workforce with degrees, the share of workforce with MBAs, 108 three digit dummies and four country dummies. Full controls also includes the **"noise controls"** of column (2) Table A2 (17 interviewer dummies, the seniority, gender, tenure and number of countries worked in of the manager who responded, the day of the week the interview was conducted, the time of the day the interview was conducted , the duration of the interviews and an indicator of the reliability of the information as coded by the interviewer). All other columns report two stage results where, in the first stage fixed effects are included and in production function. In the second stage the estimated fixed effects ("TFP") is regressed against the management z-score and the basic controls. Columns (2), (5) and (6) are estimated by within groups. Column (3) implements a version of the Olley-Pakes (1996) technique. We use a third order series approximation for φ(.). Standard errors are bootstrapped with 100 replications. After calculating the parameters of labor 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 the basic controls and noise controls (stage 2). Column (4) 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, labor and materials. Instruments for the levels equation are lagged differenced t-1 on sales, capital, labor 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..

TABLE 3: MANAGEMENT AND PRODUCT MARKET COMPETITION

	(1)	(2)	(3)	(4)	(5)	(6)
Estimation Method	OLS	OLS	OLS	OLS	OLS	OLS
Dependent variable	Management z-score	Management z-score	Management z-score	Management z-score	Management z-score	Management z-score
Lerner index of competition (5-year lagged)	1.515 (0.683)	1.318 (0.637)				
Import penetration (5-year lagged)			0.144 (0.040)	0.156 (0.084)		
Number of competitors					0.142 (0.051)	0.145 (0.049)
Firms	726	727	732	732	732	732
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 four country dummies. **"Full controls"** includes a full set of 108 three digit industry dummies, ln(firm size), ln(firm age), a dummy for being listed, the share of workforce with degrees, the share of workforce with MBAs, a dummy for being consolidated, and the "noise controls of column (2) in Table A2 (17 interviewer dummies, the seniority, gender, tenure and number of countries worked in of the manager who responded, the day of the week the interview was conducted, the time of the day the interview was conducted, the duration of the interviews 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 4: MANAGEMENT, PRODUCT MARKET COMPETITION AND EFFORT

	(1)	(2)	(3)	(4)	(5)	(6)
Estimation Method	OLS	OLS	OLS	OLS	OLS	OLS
Dependent variable (Mean = 45.2)	Managerial hours	Managerial hours	Managerial hours	Managerial hours	Managerial hours	Managerial hours
Lerner index of competition (5-year lagged)	4.530 (4.397)	-2.498 (6.657)				
Import penetration (5-year lagged)			-0.106 (0.458)	1.033 (0.881)		
Number of competitors					1.197 (0.479)	0.847 (0.612)
Firms	554	554	560	560	560	560
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 four country dummies. **"Full controls"** includes a full set of 108 three digit industry dummies, ln(firm size), ln(firm age), a dummy for being listed, the share of workforce with degrees, the share of workforce with MBAs, a dummy for being consolidated, and the "noise controls of column (2) in Table A2 (17 interviewer dummies, the seniority, gender, tenure and number of countries worked in of the manager who responded, the day of the week the interview was conducted, the time of the day the interview was conducted, the duration of the interviews 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 5: MANAGEMENT AND FAMILY FIRMS

	(1)	(2)	(3)	(4)	(5)	(6)
Estimation Method	**OLS**	**OLS**	**OLS**	**OLS**	**OLS**	**OLS**
Sample	**All**	**All**	**All**	**All**	**All**	**Family & External Owners**
Dependent variable	**Management z-score**	**Management z-score**	**Management z-score**	**Management z-score**	**Management z-score**	**Management z-score**
Family largest shareholder	-0.029 (0.094)				0.304 (0.166)	0.164 (0.166)
Family largest shareholder and family CEO		-0.100 (0.078)			-0.175 (0.188)	-0.075 (0.186)
Family largest shareholder, family CEO and *primo geniture*			-0.281 (0.097)	-0.556 (0.097)	-0.382 (0.128)	-0.331 (0.134)
Firms	732	732	732	732	732	597
Country controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry controls	Yes	Yes	Yes	No	Yes	Yes
Full Controls	Yes	Yes	Yes	No	Yes	Yes

NOTES: Coefficients from OLS regressions with standard errors in parentheses (robust to arbitrary heteroskedasticity); single cross section. In columns (1) to (5) the complete sample is used, in column (6) only family firms plus firms with external largest shareholders and professional managers are used. "Country and industry controls" includes four country and 108 three-digit industriy dummies. "Full controls" includes ln(firm size), ln(firm age), a dummy for being listed, share of workforce with degrees, share of workforce with MBAs, a dummy for being consolidated, and the "noise controls of column (2) in Table A2 (17 interviewer dummies, the seniority, gender, tenure and number of countries worked in of the manager who responded, the day of the week the interview was conducted, the time of the day the interview was conducted, the duration of the interviews and an indicator of the reliability of the information as coded by the interviewer).

TABLE 6: ACCOUNTING FOR MANAGEMENT PRACTICES ACROSS COUNTRIES

	(1)	(2)	(3)	(4)
Estimation Method	OLS	OLS	OLS	OLS
Dependent variable	Management raw score	Management raw score	Management raw score	Management raw score
Country is the US	Baseline	Baseline	Baseline	Baseline
Country is France or Germany	-0.118 (0.061)	-0.081 (0.061)	-0.037 (0.061)	0.020 (0.090)
Country is the UK	-0.277 (0.078)	-0.267 (0.079)	-0.186 (0.077)	-0.171 (0.100)
Number of competitors		0.165 (0.053)	0.149 (0.052)	0.160 (0.037)
Family ownership (>50%), family CEO and *primo geniture*			-0.621 (0.100)	-0.424 (0.114)
Firm size (log employees)				0.103 (0.025)
Public quoted				-0.094 (0.087)
Firm age (log age)				-0.033 (0.034)
Firms	732	732	732	732
Industry controls	No	No	No	Yes

NOTES: Coefficients from OLS regressions with standard errors in parentheses (robust to arbitrary heteroskedasticity); single cross section. "**Industry controls**" include 108 three digit industries dummies.

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

NOTES: Standard errors of each question's average response are reported below in brackets. Calculated from full sample of 732 firms for which management information is available. Management z-scores used in the calculations.

APPENDIX A2: 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]

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]

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 A3: FAMILY INVOLVEMENT DATA GUIDE

Run subsequently to the management survey and collected from company accounts, public sources and telephones interviews primarily conducted with the CEO or his office.

CEO characteristics

CEO is a family member	[yes/no]
CEO family generation	continuous
CEO age	continuous
CEO tenure	continuous
CEO worked at another company previously	[yes/no]
CEO has a university degree	[yes/no]
CEO shares name with the firm	[yes/no]
CEO also Chairman	[yes/no]

Chairman characteristics

Chairman is a family member	[yes/no]
Chairman family generation	continuous
Chairman age	continuous
Chairman tenure	continuous
Chairman shares name with the firm	[yes/no]

Other directors

Number of other family directors	continuous
Total number of directors	continuous

Family ownership

% of family ownership	continuous
% largest family shareholder	continuous
% second largest family shareholder	continuous
% largest outside shareholder	continuous
Type of large outside shareholder	[institution/state/manager/private individual/other]

Handover data

Number of siblings (of current CEO)	continuous
How is management of the firm passed down: is it to the eldest son or by some other way?	text
Year of last handover	continuous

APPENDIX B: DATA

Sampling Frame Construction
Our sampling frame was based on the Amadeus dataset for Europe (UK, France and Germany) and the Compustat dataset for the USA. These all have information on company accounting data. We chose firms whose principal 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 the consultancy firm we worked with from the sampling frame (33 out of 1,353 firms).

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, labor and capital. Fortunately, there are a much larger proportion of firms are listed on the stock exchange in the US than in Europe so we are able to go substantially down the size distribution using Compustat. Nevertheless, the US firms in our sample are slightly larger than those of the other countries, so we are always careful to control for size in the analyses. Furthermore, when estimating production functions we can allow all coefficients to be different on labor, 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 Amadeus (France, Germany and the UK) 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.

<u>CEO Pay and Age:</u> 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[44]. 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.

<u>Company Shareholdings</u>: This was manually extracted from the Bloomberg online data service for the 10 largest shareholders and the 10 largest insider shareholders.

<u>Dates of Incorporation:</u> For UK, French and German companies this is provided by Amadeus datasets. For the US this was obtained from Dunn and Bradstreet.

<u>Family ownership data</u>

The ownership data, directors data, shareholder information and family generation was collected from company SEC fillings (particularly the DEF14a), company databases (Compustat and ICARUS in the US, AMADEUS in the UK, France and Germany), company websites, and *The International Directory of Company Histories* (St. James Press) and *Moody's Manuals* (Moody's Investor Service). When this data was missing or ambiguous this was supplemented with information from the family firm telephone survey, which was run on around 300 firms in the sample who were (or potentially were) family owned.[45] This allowed us to separate firms into the three family firm categories: "*Family largest shareholder*" firms defined as those with a single family (combined across all family members, whom are all second generation or beyond) as the largest shareholder; "*Family largest shareholder and family CEO*" firms as those with additionally a family member as the CEO; "*Family largest shareholder, family CEO and primo geniture*" who additionally the CEO selected as the eldest male child upon succession.

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).

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

[45] Many thanks to Kevin Krabbenhoeft, Timo Hiller and Mohamed Moharram for the data collection and family firm surveys.

TABLE B1 DESCRIPTIVE STATISTICS

	All	France	Germany	UK	US
Number of firms, #	732	135	156	151	290
Management (mean z score)	-0.001	-0.084	0.032	-0.150	0.097
Employment (mean)	1,984	1,213	1,816	1,735	2,569
Labor share of output,%	26.4	23.5	28.2	27.2	28.0
Return of Capital Employed (ROCE), %	15.2	11.9	9.10	11.6	21.19
Tobin's Q	1.71	1.16	1.86	2.01	0.88
Nominal sales growth rate, %	6.0	5.4	3.8	6.8	7.2
Unconsolidated, %	24.3	77.0	37.2	0	10.6
Age of firm (years)	53.4	38.6	86.8	44.7	48.4
Listed firm,%	57.2	16.1	41.0	285	100
Multinational subsidiary, %	5.1	8.9	7.1	9.3	0
Share workforce with degrees, %	21.2	15.5	14.3	14.0	31.0
Share workforce with an MBA, %	1.36	0.23	0.09	1.28	2.73
Sickness, days/year	6.80	8.16	8.51	6.21	5.01
Hours, hours per week	40.7	35.6	38.6	40.8	44.1
Holidays, days per year	22.7	32.2	29.7	26.9	12.4
Union density, %	19.9	9.7	41.4	25.3	9.4
Number of competitors index, 1="none", 2="a few", 3="many"	2.47	2.32	2.35	2.53	2.56
Lerner index, 2000-2003, excluding the firm itself	0.055	0.040	0.071	0.040	0.060
Openness (export + imports) / output	0.713	0.688	0.732	0.796	0.415

Notes: Data descriptives calculated on the full sample of 732 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 $\beta_q = \dfrac{\sigma_m^2 + \sigma_p^2}{\sigma_m^2 + \sigma_p^2 + \sigma_u^2 + \sigma_e^2}$, from applying the standard result on the attenuation bias due to measurement error. The average coefficient[46] 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 $\beta_q = \dfrac{\sigma_m^2}{\sigma_m^2 + \sigma_u^2}$. 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%).

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[46] 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: CONTROLS FOR MEASUREMENT ERROR

Dependent variable is Management z-score

Explanatory Variable	Definition	Mean	Coefficient (s.e.)	Coefficient (s.e.)
Male	Respondent is male	0.982	-0.277 (0.128)	-0.298 (0.127)
Seniority	The position of manager in the organisation (1 to 5)	3.08	0.074 (0.026)	0.073 (0.026)
Tenure in this post	Years with current job title	4.88	-0.011 (0.007)	-0.009 (0.006)
Tenure in the company	Years with the company	11.7	0.002 (0.004)	
Countries	Total number of countries worked in over last ten years	1.19	0.085 (0.048)	0.092 (0.043)
Organisations	Total number of organisations worked in over last ten years	1.66	-0.009 (0.032)	
Manager is foreign	Manager was born outside the country s/he works	0.032	-0.048 (0.142)	
Ever worked in USA	The manager has worked in the USA at some point	0.425	0.103 (0.152)	
Location of manager	Manager based on site (rather than in corporate HQ)	0.778	0.011 (0.063)	
Tuesday	Day of the week that interview was conducted, (Monday base)	0.181	0.011 (0.062)	0.016 (0.086)
Wednesday	Day of the week that interview was conducted, (Monday base)	0.280	0.017 (0.084)	0.014 (0.080)
Thursday	Day of the week that interview was conducted, (Monday base)	0.195	0.183 (0.088)	0.176 (0.088)
Friday	Day of the week that interview was conducted, (Monday base)	0.165	0.059 (0.090)	0.054 (0.090)
Local time for manager	The time of the day (24 hour clock) interview conducted	12.45	-0.023 (0.010)	-0.022 (0.010)
Days from start of project	Count of days since start of the project	39	0.001 (0.001)	
Duration of interview	The length of the interview with manager (in minutes)	46.0	0.008 (0.003)	0.007 (0.003)
Number of contacts	Number of telephone calls to arrange the interview	5.73	0.007 (0.006)	
Reliability score	Interviewer's subjective ranking of interview reliability (1 to 5)	4.15	0.326 (0.034)	0.327 (0.033)
17 Interviewer Dummies			F(15,699)=3.05 p-value=0.000	F(15,699)=3.46 p-value=0.000

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; 732 observations

APPENDIX D: ALTERNATIVE PERFORMANCE ESTIMATES

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation Method	OLS	OLS	OLS	OLS	OLS	OLS	OLS	Probit
Dependent variable	Ln (Sales)	Ln (Sales)	Ln (Sales)	Ln (Sales)	ROCE	Ln (Tobin's Q)	Ave sales growth	Exit
Companies	All	All	All	With wage data	All	Quoted	All	All
Management z-score	0.049	0.041	0.060	0.048	2.532	0.266	0.016	-0.544
	(0.013)	(0.013)	(0.019)	(0.017)	(0.694)	(0.075)	(0.006)	[0.001]
ln (L) $_{it}$ labor	0.444	0.519	0.501	0.597	2.262	-0.209	-0.022	0.241
	(0.022)	(0.034)	(0.049)	(0.029)	(1.202)	(0.109)	(0.011)	[0.218]
Ln(K) $_{it}$ capital	0.142	0.141	0.131	0.084	0.398	-0.029	0.024	-0.021
	(0.013)	(0.025)	(0.035)	(0.020)	(0.899)	(0.086)	(0.008)	[0.880]
ln (Materials) $_{it,}$ materials	0.404	0.323	0.345	0.293	-0.920	0.130	-0.010	-0.107
	(0.021)	(0.029)	(0.037)	(0.023)	(0.723)	(0.050)	(0.007)	[0.427]
Ln (Wages) $_{it}$ average wages				0.735				
				(0.052)				
Firms	709	709	709	430	690	374	706	709
Observations	5350	5350	709	2672	5089	2635	706	709
Factor coefficients interacted with country dummies	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*No*
Country dummies	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Industry dummies	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*No*
Basic Controls	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Extended controls	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*No*
Interviewer controls	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*No*

NOTES: Coefficients from OLS with standard errors (in parentheses) robust to arbitrary heteroskedasticity and autocorrelation through clustering by firm, run over the period 1994-2004 except column (3) which uses the most recent year and column (7) which uses averages across all years. Coefficients from Probit marginal effects with p-values in square brackets. "Factor coefficients interacted with industry dummies" allows labor, capital, materials (and a dummy for subsidiary status) to be interacted with country dummies. UK is the baseline; "Industry and country dummies" includes 4 country and 108 SIC 3-digit dummies; "Basic controls" includes firm size, firm age and a dummy for public listing; "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, the proportion with an MBA, and a dummy for consolidation status; "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.

APPENDIX E: CONTRACTS FOR MANAGERIAL EFFORT

To consider managerial effort and product market competition we will follow Raith (2003) and consider an oligopoly model with endogenous entry and allow firms to choose managerial contracts. In this set-up we can show that conditional on a given number of firms, an increase in product substitutability (i.e. higher product market competition) will, in general, have an ambiguous effect on managerial incentives. There is a positive (*"business stealing"*) effect on managerial effort from the fact that market share will be more sensitive to changes in managerial effort (changes in costs will have larger effects in more competitive industries. There is also, however, a negative (*"scale"*) effect on managerial incentives because each firm will be earning lower profits so any given increase in market share will have a smaller impact on profits (and therefore on managerial compensation) in a highly competitive industry compared to a less competitive industry.

Allowing the number and type of entrants to be endogenous, however, changes this conclusion. When product substitutability increases profits per firm fall for a given number of firms. Fewer firms will therefore choose to enter the market so average firm size increases. Because firms are larger the scale effect reinforces the business stealing effect so managerial incentives always improve following increases in product market competition arising from an increase in product substitutability.

0.1 Order of the Game

Consider the following five stage game

1. Entry

There are a large number of potential entrants who are considering paying a sunk cost s to enter an industry. Each firm consists of a risk neutral principal and a risk averse agent. A continuous number of n firms choose to enter. There is free entry and exit.

2. Costs and Contracts

Each firm i has constant marginal cost

$$c_i = \bar{c} - e_i - u_i \tag{1}$$

where e_i is managerial effort and u_i is the cost shock (unobserved managerial ability). Assume that u_i is distributed normally with mean zero and variance σ^2. This is only revealed after the firm has chosen to enter. The firm can only contract on c_i,

Each principal offers a linear contract to the agent with a total compensation of

$$w_i = s_i + b_i(\bar{c} - c_i) \tag{2}$$

where s_i is salary and b_i is a piece rate that will generate a bonus that depends on the observed cost reduction $(\bar{c} - c_i)$.

3. Effort Choice

All agents simultaneously choose (unobservable to the firm) effort levels. Each agent's utility is

$$-\exp(-r[w_i - \frac{1}{2}ke_i^2]) \tag{3}$$

where r is the constant absolute risk aversion. Given the normality of the cost shocks maximizing utility is equivalent to maximizing

$$s + b_i e_i - \frac{1}{2}rb_i^2\sigma^2 - \frac{k}{2}e_i^2 \tag{4}$$

Agents accept any contract that has expected utility above the reservation level that we normalize to zero.

4. Price Competition

After agents choose effort, the firm observes costs (which is private information to each firm). Firms then simultaneously choose price to maximize expected profit.

5. Demand

We use a Salop (1979) circular city model. The circle is populated by a continuum of consumers with a uniform density of m. Each consumer buys one unit (variety) of the good produced by one firm. If a consumer located at x purchases from firm i located at z_i he gets utility

$$U_i(x) = y + a - p_i - t(x - z_i)^2 \tag{5}$$

where y is income, a is utility of consuming the most preferred variety (x) and $t(x - z_i)^2$ is the disutility associated with consuming variety z instead.

0.2 Regularity assumptions

A. Upper Bound to the number of firms, $\overline{n} = am/F$.

B. $\sigma^2 < t^2/(3\overline{n}^4)$.

C. $2kt(1 + kr\sigma^2) > \overline{n}m$.

Conditions **A** and **B** ensures that one firm's cost is never so low it captures the entire market of its neighbor. This enables us to solve for a symmetric interior equilibrium. Condition **C** rules out escalation effects that imply as a market gets large firms may start investing in cost reducing investments that cause the number of entrants to fall.

0.3 Equilibrium

We solve the model through backward induction. At stage 4, a firm's optimal prices and profits are

$$p_i(c_i, E(p)) = \frac{t}{2n^2} + \frac{E(p) + c_i}{2} \tag{6}$$

$$\pi_i(c_i, E(p)) = \frac{nm}{4t}\left[E(p) - c_i + \frac{t}{n^2}\right]^2 \tag{7}$$

In a symmetric equilibrium, the expected price $E(p)$ must equal the expression in (6) for a firm whose costs equals its expected cost which leads to:

$$E(p) = E(c) + \frac{t}{n^2} \tag{8}$$

Substituting (8) into (6) and (7) means we can solve for the unique Nash equilibrium in prices

$$p_i(c_i, E(c)) = \frac{t}{n^2} + \frac{E(c) + c_i}{2}$$

Profits at equilibrium prices are

$$\pi_i(c_i, E(c)) = \frac{mt}{n}\left(\frac{1}{n} + \frac{n}{2t}[E(c) - c_i]\right)^2 \tag{9}$$

The agent maximizes utility with respect to effort and chooses $e_i = b_i/k$. One can then calculate the salary necessary to obtain an expected utility of zero. at the contracting stage a firm chooses a piece rate b to maximize expected profit net of agents total compensation. We then obtain at stage 2 the Nash Equilibrium in contract choices gives a piece rate of

$$b = \frac{m}{n(1 + kr\sigma^2)} \tag{10}$$

At Stage 1 firms will calculate the expected value of entering the industry net of set-up costs. Note that b is increasing in output (m/n) and decreasing in σ^2. The resulting expected profit net of the start-up costs of entry is:

$$V^e = \frac{mt}{n^3} + \frac{nm\sigma^2}{4t} - \frac{m^2}{2kn^2(1 + kr\sigma^2)} - F \tag{11}$$

0.4 Analysis

Short Run

What is the effect of increasing product market competition (i.e. a fall in t)? First, conditional on a given market structure differentiating (7) with respect to costs we obtain

$$\frac{\partial \pi_i(c_i, E(p))}{\partial c_i} = m\frac{[c_i - E(p)]n^2 - t}{2nt} \tag{12}$$

Notice that $c_i - E(p) < 0$, so this expression is negative. Notice that this expression is increasing in t and decreasing in $E(p)$.

The incentive to reduce costs $\frac{\partial \pi_i(c_i, E(p))}{\partial c_i}$ is changed in two ways when competition increases.

- *Business stealing Effect.* Equation (12) is increasing in transport costs for a given $E(p)$. In other words as transport costs fall (i.e. substitutability and competition increases) profits become more sensitive to costs (a given change in costs will have a more negative impact on profits at lower levels of transport costs). This will increase a firm's incentives to reduce costs through high powered incentive contracts so it will want to increase b.

- *Scale Effect.* But as t falls $E(p)$ will also fall. Lower expected prices will cause a fall in a firm's own prices, but not to the same extent (own prices also depend on own costs). This means that the firm will have less demand. Since the value of cutting costs is proportional to demand, piece rates also fall (see equation (10)).

In this model the two effects perfectly offset each other (aggregate demand is insensitive to price). In general, however, the effect of increased competition on incentives is ambiguous (e.g. Nickell, 1996, Schmidt, 1997).

Long run

Falling transport costs will reduce entry as there are less profits to be earned[1]. Since there are fewer firms they will all have greater individual demand. This means that there is a positive scale effect on incentives which reinforces the positive business stealing effect. To see this differentiate (11) with respect to the number of firms

$$\frac{m^2}{n^3}\left(\frac{m}{k(1+kr\sigma^2)}-\frac{2t}{n}\right)+m\left(\frac{\sigma^2}{4t}-\frac{t}{n^4}\right)$$

Both of these terms are negative because of assumptions **B** and **C** respectively. Consequently the value of entry is decreasing in n and increasing in t. Consequently a fall in transport costs will generate fewer firms in equilibrium. From (10) we know that b is increasing as the number of firms falls. This implies that each individual firm will induce greater managerial effort through setting a higher piece rate when product substitutability increases.

It can also be shown that a larger market size, m, will be associated with more firm entry but that average firm size will still rise (as competition has effectively increased). Since m/n is higher there will be a higher b and therefore more managerial effort in this case, too. On the other hand, lower barriers to entry increase competition but reduce scale. This will mean that marginal costs are higher (lower b induces less managerial effort) although welfare can still be shown to be higher as prices fall to offset this form increased competition.

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[1] Aggregate profits fall even though there is an offsetting "Demsetz" type effect arising from the fact that competitive markets allocate more production to the lower cost (and therefore more profitable) firms. Assumption B assures that the main effect of shrinking price cost margins for all is greater than this reallocation effect.