DISCUSSION PAPER SERIES

No. 5581

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LABOUR ECONOMICS

Centre for Economic Policy Research

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Available online at: **www.cepr.org/pubs/dps/DP5581.asp**

ISSN 0265-8003

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Discussion Paper No. 5581
March 2006

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ABSTRACT

Measuring and Explaining Management Practices Across Firms and Countries*

We use an innovative survey tool to collect *management practice* data from 732 medium sized manufacturing firms in the US, France, Germany and the UK. These measures of managerial practice are strongly associated with firm-level productivity, profitability, Tobin's Q, sales growth and survival rates. Management practices also display significant cross-country differences with US firms on average better managed than European firms, and significant within-country differences with a long tail of extremely badly managed firms. We find that poor management practices are more prevalent when (a) product market competition is weak and/or when (b) family-owned firms pass management control down to the eldest sons (*primo geniture*). European firms report lower levels of competition, while French and British firms also report substantially higher levels of *primo geniture* due to the influence of Norman legal origin and generous estate duty for family firms. We calculate that product market competition and family firms account for about half of the long tail of badly managed firms and up to two thirds of the American advantage over Europe in management practices.

JEL Classification: L2, M2, O32 and O33
Keywords: competition, family firms, management practices and productivity

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*We would like to thank the Economic and Social Research Council, the Anglo-German Foundation and the Advanced Institute for Management for their substantial financial support. We received no funding from the global management consultancy firm we worked with in developing the survey tool. Our partnership with John Dowdy, Stephen Dorgan and Tom Rippin has been particularly important in the development of the project. The Bundesbank and HM Treasury supported the development of the survey. Helpful comments have been received from Philippe Aghion, George Baker, Eric Bartelsman, Efraim Benmelech, Marianne Bertrand, Tim Besley, David Card, Wendy Carlin, Francesco Caselli, Dennis Carlton, Ken Chay, Nancy Dean Beaulieu, Avner Grief, Richard Freeman, Rachel Griffith, Bronwyn Hall, John Haltiwanger, Larry Katz, Ed Lazear, Phillip Leslie, Alex Mas, Eva Meyersson Milgrom, Kevin Murphy, Andy Neely, Tom Nicholas, Paul Oyer, Francisco Perez-Gonzalez, Michael Greenstone, Andrea Pratt, Steve Redding, Antoinette Schoar, Kathryn Shaw, Andrei Shleifer, Dan Sichel, Jeremy Stein, Belen Villalonga, Birger Wernerfelt, Gavin Wright, and Luigi Zingales, and participants at numerous seminars.

Submitted 18 February 2006

I. INTRODUCTION

Economists have long speculated on why such astounding differences in the productivity performance exist between firms and plants within countries, even within narrowly defined sectors. For example, labor productivity varies dramatically even with the same five digit industry 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 or Information and Communication Technologies[2]. 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 have long-stressed the importance of good management, empirical economists had relatively little to say about management practices. A major problem has been the absence of high quality data 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 732 medium sized manufacturing firms in the US, UK, France and Germany.

We start by evaluating the quality of this survey data. We first conduct internal validation by re-surveying firms to interview different managers in different plants 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 and stock market values 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 in both our English-speaking countries (the UK and the US) and the Continental European countries (France and Germany), which suggests that our characterization of "good" management is not specific to Anglo-Saxon cultures.

We then turn to analyzing the raw survey data and observe a surprisingly large spread in management practices across firms (see Figure 1). Most notably, we see a large number of firms who appear to be 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.

[FIGURE 1 ABOUT HERE]

This raises an important question – what could rationalize such variations in management practices? We start by considering two pure classes of theories: the "optimal choice of management practices"

[1] For example, Baily, Hulten and Campbell (1992), Bartelsman and Dhrymes (1998), Disney, Haskel and Heden (2003), Foster, Haltiwanger and Syverson (2005).
[2] For example, see Griliches (1979) on R&D and Stiroh (2004) on information technology.

whereby management practices are a choice variable determined by the firm; and the "managerial inefficiency" model whereby management simply reflects differences in efficiency with "worse" management practices predicted to be associated with lower profitability. We find some evidence for both models.

We then investigate what determines the variation in these management practices across firms and countries. The two factors that appear to play an important role are product market competition and family firms. First, higher levels of competition (measured using a variety of different proxies such as trade openness) are strongly and robustly associated with better management practices. This competition effect could arise through a number of channels, including the more rapid exit of badly managed firms and/or the inducement of greater managerial effort.[3] Secondly, family-owned firms in which the Chief Executive Officer (CEO) is chosen by *primo geniture* (the eldest male child) tend to be very 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".[4] We find that companies who select the CEO from all family members are no worse managed than other firms, but those who select the CEO based on *primo geniture* are very poorly managed.

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 France and one third of the gap between the US and the UK. One reason is that European competition levels are lower than in the US. 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, Britain and other European countries have also provided generous estate tax exemptions for family firms.

Our work relates to a number of strands in the literature. First, our findings are consistent with recent econometric work looking at the importance of product market competition in increasing productivity.[5] It has often been speculated that these productivity-enhancing effects of competition work through improving average management practices and our study provides support for this view. Second, economic historians such as Landes (1969) and Chandler (1994) have 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.[6] Our results suggest this phenomenon is still important almost a century

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

[4] The "Carnegie effect" is named after the great philanthropist Andrew Carnegie who claimed, "*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"*. See also Holtz-Eakin et al. (1993).

[5] There are a very large number of papers in this area but examples of key contributions would be Syverson (2004a,b), Olley and Pakes (1996) and Nickell (1996)

[6] See also the recent literature on family firms and performance, for example Morck et al. (2005), Bertrand et al (2005), Perez-Gonzalez (2005), and Villalonga and Amit (2005).

later. A third related strand is the work on the impact of Human Resource Management (HRM)[7] that also finds that these management practices are linked to firm performance. Finally, there is the recent contribution of Bertrand and Schoar (2003), who focus on the impact of changing CEOs and CFOs in very large quoted US firms. This will tend to reflect the impact of management *styles* and *strategies*, complementing our work emphasizing the *practices* of middle management.[8] We see management practices as more than the attributes of the top managers: they are part of the organizational structure and behavior 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, and 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. MODELS OF MANAGEMENT PRACTICES

We consider two classes of theories of why good management practices will vary across firms. We will later show evidence that both appear important, but consider the pure form of each theory to generate clear predictions we can take to the data. We characterize the first set of models as the "optimal choice of management practices" and the second set of models as "managerial inefficiency".

IIA. Optimal choice of management practices

A conventional economic approach is to consider management as a choice variable for the firm. Improving management practices may be a costly activity and the firm will weigh these costs against the future expected benefits. There is nothing inefficient about "worse" management practices: firms have simply chosen the optimal level. For example, middle managers may prefer to trade-off lower levels of effort and monitoring by the corporate head quarters in return for a lower compensation package. This perspective covers a large range of models from those where firms can perfectly control managerial inputs just as surely as any other factor of production to models where firms can influence managerial effort indirectly through contract choice.

Consider a basic parameterization of this type of model. Define M as an indicator of overall management practices which is an increasing function of two individual practices, $M = h(M_1,M_2)$, where M_1 and M_2 could be thought of respectively as human capital management (performance based promotions etc.) and fixed capital management (shop floor operations etc.). For simplicity we ignore all other factors of production. We then write the production function in the following CES form:

[7] For example, Bartel et al (2005), Ichinowski et al. (1997), Lazear (2000) and Black and Lynch (2001).

[8] In a sub-sample of 59 companies we piloted questions on the hierarchical structure of the firm and found the average number of levels to the shop floor was 5.03 for the CEO versus 2.78 for the plant managers (our target management group) placing them centrally within the organization.

$$Y = \left[\left(B_1 M_1\right)^{\frac{\sigma-1}{\sigma}} + \left(B_2 M_2\right)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \quad (1)$$

where σ is the elasticity of substitution is (which we assume is greater than unity) and B_1>0 and B_2>0 are parameters. Profits are written as:

$$\Pi = PY - W'X - \rho_1 M_1 - \rho_2 M_2 \quad (2)$$

where P is the price of output, W is the unit cost vector for inputs X and ρ_j is the unit cost of managerial practice M_j.

The first order conditions for management practice j are then

$$\ln M_j = (\sigma - 1)\ln\left(\varphi(X)\right) + \ln(Y) - \sigma \ln\left(\frac{\rho_j}{P}\right) + (\sigma - 1)\ln B_j \quad (3)$$

From (3) we can see that each individual practice is also decreasing in the cost of the practice and increasing in the technological parameter (B_j). Combining the first order conditions for the two types of management practices gives the relative demand for management practices:

$$\ln\left(\frac{M_1}{M_2}\right) = -\sigma \ln\left(\frac{\rho_1}{\rho_2}\right) + (\sigma - 1)\ln\left(\frac{B_1}{B_2}\right) \quad (4)$$

Unsurprisingly, the relative demand for the practices is decreasing in the relative costs and increasing in the relative benefits. Prices and technologies of the management practices are not observable but are likely to be systematically different by industry. For example, if M_1 represents a human capital focused practices and M_2 represents a fixed capital practices we would expect B_1/B_2 to be larger in the more highly skilled sectors. This is something that we examine empirically correlating the relative use of different types of management practices with proxies for the relative importance of skills.

II.B Managerial inefficiency

An alternative view of the variation in management practices is that it simply reflects differences in efficiency. A representation of this process is that there are exogenous differences in management quality between firms and these are not openly traded on markets – examples include Lucas (1978) and Mundlak's (1961) fixed effects. In this set-up, we could consider a production function of the form:

$$Y = A(M)F(X) \quad (5)$$

where A(M) represents total factor productivity which is increasing in management and the X are a vector of conventional inputs such as labour, capital and materials with F(.) is increasing in X. As with the previous model, an obvious empirical implication of (5) is the productivity is increasing in the quality of management practices.

The associated profits are:

$$\Pi = PA(M)F(X) - W'X \tag{6}$$

A possible distinction between the two pure forms of the models is the relationship between management practices and profits: if poor management were purely an optimal choice with no exogenous efficiency differences between firms, then badly managed firms should be no less profitable than well-managed firms. If instead poor management causes lower efficiency (A), then better management should be associated with higher profitability. Accounting profits may differ from true economic profits, however, so we also consider the relationship between stock market values and management. In a dynamic setting, under the managerial efficiency view firms with bad management should also be more likely to exit the market and to grow more slowly. We also examine these predictions, paying attention to the issue of the endogeneity.

II.C Management and Product Market Competition

Both optimal choice and efficiency models also have implications for the relationship between product market competition and management.

The most obvious effect of competition on management is through a Darwinian selection process in the "management inefficiency" model. Higher product market competition will drive inefficient firms out of the market and allocate greater market share to the more efficient firms. Syverson (2004a,b) 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 efficient tail of firms have been selected out.[9] Therefore, we expect a better average level and more compressed spread of management practices in environments that are more competitive.

Natural variation in management practices will arise in equilibrium if entrepreneurs found firms with distinctive cultures that are deeply embedded and hard to change. They do not know exactly how well their firm will perform until they enter a market and compete with other firms. Over time, they learn about the quality and suitability of their management practices and decide whether to continue operating in the market (Jovanovic, 1982). A more general model would allow best management practice to be stochastically evolving over time with firms continually innovating, generating a spread even across long-lived incumbents (e.g. Klette and Kortum, 2004).

[9] An alternative specification is perfect competition between incumbents within markets but a fixed cost of entry, such at Hopenhayn (1992). In his specification lower costs of entry also supports a higher average level and a lower dispersion of productivity.

Under the "optimal choice" approach there are models where higher competition could increase the incentives to provide greater managerial effort (or higher investments in quality). 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. "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 (indexed in the model 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[10].

The result that increased product market competition should improve incentives for managerial practices are reasonably robust, but not completely general. Vives (2005) 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.

The empirical prediction that we take to the data is that tougher competition should clearly be related to better management in the managerial inefficiency model. The relationship is more ambiguous in some optimal choice models, but is also likely to be positive.

II.D Family ownership and family management

The managerial inefficiency model has implications for the relationship between management and family firms, since these provide a potential rationale for the continued existence of badly managed firms. Family ownership can shield inefficient firms from competition if the owners are prepared to accept a below market rate of return to capital because of the amenity value attached to having the family's name associated with the company.

There has been much recent work on the efficiency of family firms. Family firms are the typical form of ownership and management in the developing world and much of the developed world[11]. 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

[10] 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 that makes a substantial difference to the comparative statics in the model in Appendix E.

[11] La Porta, Lopez-de-Silanes and Shleifer (1999) and Morck, Wolfenzon and Yeung (2005).

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 forty per cent of medium sized firms were family-owned in Europe and about ten per cent were family-owned in the US.[12] Interestingly, we see in the second row that many 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 fifteen per cent of the total sample. In Germany and the US this only occurs in about one third of the family firms representing only three per cent of the sample. In rows 4 and 5, we look at founder firms – those companies where 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.

[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.[13] German traditions were based more on the Teutonic principle of *gavelkind* (equal division amongst all sons); while in the US, *primo geniture* was abolished after the Revolution with 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%, 50% and 100% exemption in France, Germany and the UK respectively.[14]

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)[15]. Under imperfect capital markets, founders will find it difficult to sell off the firm to outside investors (Caselli and Gennaioli, 2002). Furthermore, when minority investor rights are not well protected, it may be difficult to diversify ownership.

[12] 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 firms. 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, particularly so in Continental Europe.

[13] While Napoleonic inheritance code enforced the equal division of *property*, it was more flexible with companies. In fact, a common route to pass property on to a single heir in France is to place this within a company. In England *primo geniture* is also still common, with for example, the 2005 Oxford English Dictionary stating that it is "*still prevailing in most places in a modified form*".

[14] For political economy reasons these generous estate taxes could have arisen endogenously from the power blocs of politically connected 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.

[15] 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.

Even though a firm is family owned, outside professional managers can be appointed 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 less competition for senior positions. 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 Carnegie 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. There may also be investment in firm-specific human capital if the owners' children expect to inherit the family firm. So ultimately, the impact of family firms on management practices 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. However, family-owned firms may choose family management even though this is sub-optimal for company 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 managerial control. 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 evidence on inherited family firms suggests that family *ownership* has a mixed effect on firm profitability, but family *management* has a substantially negative effect[16]. Our approach in this paper is to examine directly the impact of family firms on management practices rather than only look at firm performance measures. 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).[17]

Family firms can account for why "exogenously inefficient" firms can persist even in competitive markets: family owners are prepared to take a below market return on capital because of the amenity value of having the family name attached to the company. It is hard to understand why there should be any systematic relationship between family firms and managerial practices under the pure "optimal choice" model.[18]

[16] See for example Perez-Gonzalez (2005), and Villalonga and Amit (2005).

[17] 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 as an instrumental variable to predict whether firms remaining under family management after a succession.

[18] One version of the optimal choice hypothesis is that firms could offer contracts with lower wages and worse management (e.g. less risk of firing, lower effort). This compensating differential would vary depending on the firm's technology and environment. Possibly, *primo geniture* firms may prefer offering these types of contracts, although it is hard to see why firms in the same industry, same size and age would differ dramatically in this respect purely because of their family status.

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 issues 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 across the manufacturing sector. This is a hard task as good management is tough to define, and is often contingent on a firm's environment. Our initial hypothesis was that while some management practices are too contingent to be evaluated as "good" to "bad", others can potentially be defined in these terms, and it is these practices we tried to focus on in the survey.

To do this we used a practice evaluation tool developed by a leading international management consultancy firm. In order to prevent any perception of bias with our study we chose to receive no financial support from this firm.

The practice evaluation tool defines and scores from one (worst practice) to five (best practice) across eighteen key management practices used by industrial firms. In Appendix A (Table A1) we detail the practices and the questions in the same order as they appeared in the survey, describe the scoring system and provide three anonymous responses per question. These practices can be grouped into four areas: *operations* (3 practices), *monitoring* (5 practices), *targets* (5 practices) and *incentives* (5 practices). 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 organization). Finally, the incentives section includes promotion criteria (e.g. purely tenure based or including an element linked to individual performance), pay and bonuses, and fixing or firing bad performers, where best practice is deemed the approach that gives strong rewards for those with both ability and effort. A subset of the practices has similarities with those used in studies on HRM practices.

Since the scaling may vary across practices in the econometric estimation, we convert the scores (from the 1 to 5 scale) to z-scores by normalizing by practice to mean zero and standard deviation one. In our main econometric specifications, we take the unweighted average across all z-scores as our primary measure of overall managerial practice, 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". Therefore, 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 our 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) a respondent's answer to survey questions is typically biased by the scoring grid, anchored towards those answers that 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 to address these issues we took a range of steps to obtain accurate data when we administered the survey in the summer of 2004.

First, the survey was conducted by telephone without telling the managers they were being scored.[19] This enabled scoring to be based on the interviewer's evaluation of the firm's actual practices, rather than their aspirations, the manager's perceptions or the interviewer's impressions.[20] To run this "blind" scoring we used 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]?"). These questions target actual practices and examples, with the discussion continuing until the interviewer can make an accurate assessment of the firm's typical practices. For each dimension, the first question is broad with detailed follow-up questions to fine-tune the scoring. For example, in dimension (1) *Modern manufacturing introduction* the initial question is "Can you tell me about your manufacturing process" and is followed up by questions like "How do you manage your inventory levels".[21]

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 (the median size was 700 employees) 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

[19] This survey tool has been passed by Stanford's Human Subjects Committee. The deception involved was deemed acceptable because it is: (i) necessary to get unbiased responses; (ii) minimized to the management practice questions and is temporary (we send managers debriefing packs afterwards); and (iii) presents no risk as the data is confidential.

[20] 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.

[21] Minimizing inventory levels is one of the key components of modern manufacturing.

and five years prior business experience in the manufacturing sector[22]. All interviews were conducted in the manager's native language.

Third, each interviewer ran over 50 interviews on average, allowing us to remove interviewer fixed effects from all empirical specifications. This helps to address concerns over inconsistent interpretation of categorical responses (see Manski, 2004), standardizing the scoring system.

Fourth, 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.

Fifth, we collected a detailed set of information 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)[23], 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 about fifty minutes on average, and was run from the London School of Economics. Overall, we obtained a relatively high response rate of 54%, which was achieved through four steps. First, the interview was introduced as "a piece of work"[24] without 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 maximize the participation of firms and 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 operations 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 made in setting up the interview was 6.4). The questions are also about practices within the firm so any plant managers can respond, so there are potentially several managers per firm who could be contacted[25]. Fourth, the written endorsement of the Bundesbank (in Germany) and the Treasury (in the UK), and a scheduled presentation to the Banque de France, helped demonstrate to managers this was an important exercise with official support.

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[22] 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.

[23] In particular, we found the scores were significantly higher for senior managers, when interviews were conducted later in the week and/or 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.

[24] Words like "survey" or "research" should be avoided as these are used by switchboards to block market research calls.

[25] 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[26].

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 a 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 A3. Second, we collected information from public data sources and another telephone survey in summer 2005 on family ownership, management and succession procedures, typically answered by the CEO or his office. The details of this questionnaire are provided in Appendix A4.

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 bias the association of firm performance with management towards zero. 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.

Figure 2 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

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

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 two or above four appear to be genuinely badly or well managed rather than extreme draws of sampling measurement error.

[FIGURE 2 ABOUT HERE]

Analyzing 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 that drive performance. For example, our interviews did not contain any questions on management strategy (such as merger and acquisition 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 are correlated with firm performance. The purpose of this exercise is not to directly identify a causal relationship between our management practice measures and firm performance. It is rather an external validity test of the survey measurement tool to check that the scores are not just "cheap talk" but are actually correlated with quantitative measures of firm performance from independent data sources on company accounts, survival rates and market value.

IV.A Econometric Modeling

Consider the basic firm production function

$$y_{it}^c = \alpha_l^c l_{it}^c + \alpha_k^c k_{it}^c + \alpha_n^c n_{it}^c + \beta^c M_i^c + \gamma^c \mathbf{z}_{it}^c + u_{it}^c \quad (7)$$

where Y = deflated sales, L = labor, K = capital and N = intermediate inputs (materials) of firm i at time t in country c (note that we generally allow country specific parameters on the inputs) and lower case letters denote natural logarithms $y = \ln(Y)$, etc. The z's are a number of other controls that will affect productivity such as workforce characteristics[27] (the proportion of workers with a degree, the proportion with MBAs and the average hours worked), firm characteristics (firm age, whether the firm is listed), a complete set of three digit industry dummies and country dummies.

[27] We experimented with a wide range of workforce characteristics such as gender, worker age and unionization. We only found human capital to be statistically significant after controlling for firm characteristics.

The crucial variable for us is management practices denoted *M*. Our basic measure takes z-scores of each of the eighteen individual management questions and then averages over the variables to get *M*. 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.

The most straightforward approach to estimating equation (7) is to simply run OLS in the cross section (or on the panel with standard errors clustered by company) 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 of TFP). We then project the permanent component of productivity on the management scores in a separate second step. This is the approach Black and Lynch (2001) followed in a similar two-step analysis of workplace practices and productivity. We estimate the production function in a variety of ways. The simplest method is within groups – i.e. 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.[28] 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 that we then relate in a second stage to management practices and other time invariant firm characteristics.

IV.B Econometric Results

Table 2 investigates the association between firm performance and management practices. Column (1) simply reports a levels OLS specification including only labor, country and time dummies as additional controls. The management score is strongly positively and significantly associated with higher labor productivity. The second column includes capital and materials, and this almost halves the management coefficient[29]. In column (3), we include our general controls of industry dummies, average hours worked, education, firm age, and listing status. This reduces the management coefficient slightly more, but it remains significant. Finally, in column (4) we include a set of interview "noise controls" to mitigate biases across interviewers and types of interviewees.[30] This actually increases the management coefficient, as we would expect if we were stripping out some of the measurement error in the management score. Overall, the first four columns suggest that the average management score is positively and significantly correlated with total factor productivity.

[TABLE 2 ABOUT HERE]

In Appendix D, we present more econometrically sophisticated production function estimates based on the "two step" method discussed above where we recover the long-run component of TFP and

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

[29] If one of the mechanisms through which better management improves productivity is by increasing investment in capital, we may be being too conservative by conditioning on capital.

[30] 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 that we use in our main regressions.

project this on the management score and other covariates.[31] We estimate the permanent component either by within groups, System GMM or Olley-Pakes. The results are as strong, if not stronger, than those presented here for the simple OLS regressions. Whether estimated by GMM, Olley-Pakes or within groups, management practices are always positively and significantly associated with the longer run component of TFP.

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 for Continental Europe. We empirically tested this by including interactions of the management term with country dummies – we could not reject that the hypothesis that the coefficients on management were equal across countries[32].

In addition to the overall management score, we looked at the role that individual questions play. Re-running column (4) of Table 2 we find that twelve of the question z-scores are individually significant at the five per cent level, two are individually significant at the 10% level and four appear insignificant[33]. The average question-level point estimate is 0.018 – less than half the pooled average of 0.042 - reflecting the higher question level measurement error (see Appendix C). We also calculated the average score separately for the four groups of management practices and entered them one at a time into the production function. The point estimates (standard errors) were as follows: operations 0.032 (0.011), monitoring 0.025 (0.011), targets 0.033 (0.011) and incentives 0.036 (0.013).[34]

We also considered whether the management measure was simply proxying for better technology in the firm. Although technology measures such as Research and Development (R&D) and computer use are only available for sub-samples of the dataset, we did not find that the management coefficient fell by very much in the production function when we include explicit measures of technology, as these are not strongly correlated with good management[35].

The final four columns of Table 2 examine four other measures of firm performance. In column (5) we use an alternative performance measure which is return on capital employed (ROCE), a

[31] 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 include dynamics. We condition on firms having at least four continuous years of data.

[32] For example, we generated a dummy for the two Continental European countries and interacting this with the management score. When entered as an additional variable in the column (4) specification the coefficient was 0.024 with a standard error of 0.028. In Table D the final two columns split the sample into different regions (Continental Europe and Anglo-American). We find that the coefficients on management are, if anything, larger in France and Germany than in the UK or US (although this difference is not statistically significant).

[33] This suggests that not all eighteen of the individual management practices are associated with better performance. We could of course construct a "refined" management measure by averaging over the individually significant questions, but this becomes too close to crude data mining.

[34] Details of the regressions appear in Appendix Table A2. We also examined specifications with multiple questions or different groupings, but statistically the simple average was the best representation of the data. Part of the problem is that it is hard to reliably identify clusters of practices in the presence of measurement error. We show how sub-sets of management practices vary systematically in sub-section IV.C below.

[35] In the context of the specification in Table 2 column (4) for the 219 firms where we observe PCs per employee the management coefficient is 0.069 with standard error of 0.041 (the coefficient on PCs was 0.051 with a standard error of 0.024). This compares to a management coefficient of 0.073 with a standard error of 0.042 on the same sample when PCs are not included. For the sample of 216 firms where we have R&D information the coefficient on management is 0.046 with a standard error of 0.017 in the specification with R&D and 0.050 with a standard error of 0.017 in the specification without R&D.

profitability measure used by financial analysts and managers to benchmark firm performance (see Bertrand and Schoar, 2003). The significant and positive coefficient in the ROCE equation, which also includes the same set of controls as in column (4), confirms the basic productivity results. In column (6), we estimate a Tobin's Q specification (the ratio of the market value of the firm to its book value), which again includes the same set of controls as in the production function. We also find a significant and positive coefficient on management. In column (7), we estimate the relationship between exit in the twelve months after the survey and management practices. Over this period, eight firms went bankrupt, for whom the implied marginal effects of management in the probit equation are large and statistically significant. In column (8), we estimate the relationship between the average annual growth rate of sales and management practices and find a positive and significant coefficient on management.

Overall then, there is substantial external validation that the measures of management we use are positively and significantly associated with better firm performance. Interestingly, the association is not simply with productivity but also with profitability (and market value, survival and growth). This would be naturally predicted by the managerial inefficiency model, but is not predicted from the pure "optimal choice of management model". We must be cautious in interpreting this as strong positive support for the former model, however, as Table 2 simply presents associations and there are endogeneity issues (see sub-section V.E below). Nevertheless, at the very least these results offer some external validation of the survey tool implying that we are not simply measuring statistical noise.

IV.C Contingent management

In this sub-section we examine some of the empirical predictions of the "optimal choice" model of management and produce some supportive evidence. In this model, the importance of different practices for firm performance will be contingent on a firm's environment. For example, firms in a high-skill industry may find good human-capital management practices relatively more important than those in a low-skill industry[36].

First, we investigated the impact of the weighting across individual questions through factor analysis. There appeared to be one dominant factor that loaded heavily on all our questions – which could be labeled "good management" – which accounted for 49% of the variation[37]. The only other notable factor, which accounted for a further 7% of the variation, could be labeled as "human capital relative to fixed capital", which had a positive loading on most of the human capital oriented questions and a negative loading on the fixed capital/operations type questions. This factor was uncorrelated with any productivity measures, although interestingly it was significantly positively correlated with our skills measures (e.g. the proportion of employees with college degrees) and the level of organizational devolvement[38], suggesting a slightly different pattern of relative management practices across firms with different levels of human capital.

[36] See also Athey and Stern (1998)

[37] Re-estimating the production functions of Table 2 column (4), we found that this "good management" factor score had a coefficient of 0.029 with a standard error of 0.009.

[38] In the survey we also collected two questions on organizational structure (see Appendix Table A3) taken from Bresnahan et al. (2002).

We examine this issue more explicitly in Table 3 where we find robust evidence that firms and industries with higher skills – as proxied by college degrees or average wages – have significantly better *relative* human-capital management practices. Column (1) regresses the average score of the three explicitly human-capital ("HC") focused questions (13, 17 and 18) on the percentage of employees with a degree (in logs), and finds a large positive coefficient of 0.220. By comparison, column (2) runs the same regression but uses the average score of the three most fixed capital ("FC") focused questions (1, 2 and 4) as the dependent variable. In this column we also find a significantly positive association but with a much smaller coefficient of 0.100. Column (3) uses the difference between the human capital focused and fixed capital focused management practices as the dependent variable and shows that this measure of "relative intensity of human-capital management practices" ("HC-FC") is significantly higher in highly skilled firms. Column (4) includes the general controls that weaken the correlation but it remains significant at the 10 per cent level. Hence, while higher skilled firms have better overall management practices, they are particularly good at the most human-capital focused management practices. Columns (5) to (8) run similar regressions on firm average wages (rather than college degrees) as a measure of skills. We find a similar pattern of more human-capital focused management practices in higher waged firms. Finally, column (9) uses a three-digit industry level measure of skills instead of a firm-specific measure, the proportion of employees with a college degree in the US. We also find that this is positively correlated with the relative intensity of human-capital management practices. Overall, this table is consistent with the "optimal choice model of management practices" in which firms tailor their practices to their competitive environment.

[TABLE 3 ABOUT HERE]

IV.D Firm performance-related measurement bias

A criticism of our "external validity" test of looking at production functions is that for psychological reasons managers will respond "optimistically" in firms who are doing well even if the true state of management practices is poor[39]. We call this firm performance-related measurement bias. Note that this is different from the reverse causality issue that states that management practices genuinely improve in response to a shock that raises productivity (see section V.E below for a discussion of this issues and an instrumentation strategy that attempts to deal with it).

There are several considerations mitigating the problem of firm performance-related measurement bias in our study. First, the survey is deliberately designed to try to avoid this kind of bias by using a "double-blind" methodology based on open questions, with the managers unaware they are being scored. So to the extent that managers talk about actual practices in their firms this should help to reduce this measurement bias.

Second, as we shall show below in section V.B, firms in more competitive industries – defined in terms of lower historical average rents – are on average *better* managed. Therefore, at the industry level the correlation between management practices and historic average profitability goes in the reverse direction to that implied by this measurement bias story.

Third, psychological evidence (e.g., Schwarz and Strack, 1999) suggests that recent improvements in a subject's condition are more likely to have an impact on survey responses than the absolute

[39] We thank Bengt Holmstrom for emphasizing this issue.

level of a condition. Therefore, if there were a large performance-related bias in the management scores we would expect this to show up in the fact that recent improvements in firm productivity (relative to comparators) have a big impact on managerial responses. In fact, when we regress management scores against lagged productivity *growth* rates there is no significant correlation. For example, a regression of management scores against the productivity growth rates over the previous year generated a coefficient (standard error) of 0.001 (0.002).[40]

Finally, the Appendices report a further battery of robustness tests on this issue. Not all individual questions are significantly correlated with performance, as shown in Appendix Table A2. Therefore, to the extent this bias is a serious phenomenon it only seems to afflict certain questions. One reason of course may be that some questions are more or less subject to bias because they are more or less "objective". To investigate this further Appendix Table D2 runs some robustness tests on the management performance results by using a management measure based on the four questions which are arguable the most objective (column 1), and the four questions which are arguably the least objective (column 2).[41] Comparing these two columns demonstrates that the coefficients on these two sub-sets of questions, however, are not significantly different. In columns (3) to (8) in Appendix Table D2 we report the results from running the production function estimation on three other survey measures – a self-scored "work-life balance" indicator and two self-scored "organizational devolvement" indicators - which should also be afflicted by the measurement bias story. However, as can be seen from columns (3) to (8) these measures are not significantly correlated with productivity, suggesting that the questions are not all reflections of a "warm glow" surrounding a firm who is performing well.

Hence, in conclusion while there is undoubtedly scope for firm performance related measurement bias in the survey; we do not find evidence that this is a major problem in our results.

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 1 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 one indicates industry worst practice and five industry best practices. Therefore, for example, firms scoring two or less have only basic shop-floor management, very

[40] We also tested this management and productivity growth relationship over longer periods in a Table 2 Column (4) specification – such as the last 5 years and the last 3 years – and found equally insignificant results. The positive correlation of management with productivity levels and sales growth but not with productivity growth is consistent with a simple dynamic selection model. Management (and therefore productivity levels) is fixed over time and the market gradually allocates more sales to the more productive firms.

[41] Appendix Table A2 reports the individual coefficients for every question so any other grouping of the questions by an alternative categorization of "objectivity" can also be analyzed.

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 are statistically significant at the 5% level. The UK-US gap also appears persistent over time. The Marshall Plan productivity mission of 1947 reported that "*efficient management was the most significant factor in the American advantage [over the UK]*" (Dunning, 1958, p. 120). We were concerned that some of the apparent cross-country differences in management scores may simply be driven by differences in the sampling size distribution, but these figures are robust to controls for size and public ownership.[42]

The presence of the US at the top of the ranking is consistent with anecdotal evidence from other surveys.[43] It also reflects the productivity rankings from other studies comparing the four nations (the US is top and the UK bottom). One might suspect this was due to an "Anglo-Saxon" bias that is why in the previous section we had to confront the scores with data on productivity to show that the management scores 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 A2 in Appendix A provides more details behind these cross-country comparisons, and reveals a *relative* US strength in targets and incentives (more people management) versus a German and French strength in shop floor and monitoring (more operations management)[44].

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 (see our model in Appendix E). 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 measure is the degree of import penetration in the country by three-digit industry measured as the share of total imports over domestic production. This is constructed for the period 1995-1999 to remove any potential contemporaneous feedback[45]. The second is the country by three digit industry Lerner index of competition, which is (1 – profits/sales), calculated as the average across the entire firm level database (excluding each firm itself)[46]. Again, this is constructed for the period 1995-1999 to

[42] We also find that the 21 US multinational subsidiaries located in Europe 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). So American firms also manage to transport their management practices to their overseas subsidiaries.

[43] 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.

[44] We also 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.

[45] Melitz (2003) and other have suggested this measure of trade exposure should truncate the lower part of the productivity distribution. We have also looked at (Imports+Exports)/production as an alternative indicator of trade exposure with similar results to those reported here.

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

remove any potential contemporaneous feedback. The third measure of competition is the survey question on the number of competitors a firm faces (see Appendix A3), valued zero for "non competitors", one for "less than 5 competitors", and two for "5 or more competitors"[47].

[TABLE 4 ABOUT HERE]

In column (1), we see that better management scores are positively and significantly associated with greater import penetration. In column (2), we re-estimate the same specification but now include a full set of controls, and again find that higher lagged trade competition is significantly correlated with better management. The firm controls include firm size, firm age, listing status, skills and consolidation status.[48] Even after conditioning on these additional covariates, we find that the more competitive country-industry pairings contain firms that are on average significantly better managed. In columns (3) and (4), we run two similar specifications on lagged Lerner index of competition as an alternative competition measure and again find a significant and positive effect. In columns (5) and (6), we run two further similar specifications, but this time using managers' own self reported measure of the number of competitors they face, and again we find a positive and significant association: the more rivals a firm perceives it faces the better managed it appears to be. The final two columns include all three competition measures simultaneously. Although the statistical significance and marginal effects are typically a bit lower, the same pattern of results persists. Tougher product market competition is associated with significantly better management practices[49].

The magnitude of the competition effect on average management scores 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 0.160.[50] As discussed in the section VI this competition effect accounts for a substantial proportion of the tail of badly performing firms and the management gap between the US and Europe.

These are conditional correlations, of course, as we have no instrumental variable for competition. However, it is likely that any endogeneity bias will cause us to *underestimate* the importance of product market competition on management. For example, in columns (3) and (4) an exogenous positive shock that raises managerial quality in an industry is likely to increase profitability and therefore the measured Lerner index (indeed, Table 2 showed a positive correlation between management and individual firm level profitability). This will make it *harder* for us to identify any positive impact of product market competition on management[51].

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

[48] We also experimented with many other controls (results available on request). Union density was negatively correlated with management scores, but insignificant. Although there was a significant negative correlation between management scores and average worker age in simple specifications, this disappeared when we controlled for firm age (older workers are more likely to be matched with older firms). The proportion of females was insignificant.

[49] We also looked for a relationship between the level of competition and the spread of management practices (Syverson, 2004a, b), but could not find any significant relationship. One reason may be our current sample is too small to test for differences in the second moment of management across sub-samples.

[50] 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.

[51] Similarly, better management will improve exports, 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 4.

One issue in interpreting this competition effect is that it potentially works through two mechanisms (see Section II): (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. Using the managerial hours worked as a basic proxy for effort, we find an insignificant relationship between tougher competition and longer hours[52] Of course managerial hours is a very imperfect proxy for managerial effort, as managers may supply more effort by a greater "intensity" of work rather than longer hours. Still, it does suggest that the margin of impact of competition is not on the length of the working day or week.

V.C Management practices and family firms

In Table 5, 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[53]) plus the standard set of control variables. We see that family ownership *per se* does not seem to be associated with depressed 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 that the policy of the firm has been to pass this position 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* successions are substantially worse managed. In column (4) we drop the general controls and show that the family firm correlation is much stronger in the unconditional regressions. In column (5) 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. The final column drops the founder firms from the sample so that external ownership is the pure baseline, which makes little difference to the results. Taking Table 5 as a whole it seems that the combination of family ownership and *primo geniture* family management significantly damages company performance.

[TABLE 5 ABOUT HERE]

One interpretation of this result is that being a *primo geniture* company directly causes 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, suggesting the persistence of "old-fashioned" management techniques. While this is possible we do nevertheless find that *primo geniture* family firms are significantly worse managed even after including controls for firm age, average employee age and CEO age.[54] It is also difficult

[52] For example, the coefficient (standard deviation) of managerial hours on import penetration, the Lerner index and the number of competitors is 1.033 (0.881), -2.498 (6.657) and 0.847 (0.612) respectively based on an identical specification to Table 4 column (2), except with managerial hours as the dependent variable instead of the management score.

[53] 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 on this was hard to obtain for European firms.

[54] Another interpretation on the poor management of family firms is that they operate less formally due to a lower return from "bureaucracy" (Novaes and Zingales, 2004). The point-estimate (standard errors) for the column (3) specification

to see why France and the UK should exogenously have a greater number of old-fashioned firms than Germany or the US (given our controls for industrial structure, age and size). By contrast, the common Norman legal origin of the France and the UK offers a direct historical reason for the persistence of *primo geniture*.

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 (such as the proportion of employees with college degrees and the proportion with MBAs) do not control for this unobserved ability. Even under this interpretation it is, of course, interesting that lower product market competition and *primo geniture* increases the incidence of poor quality managers.

However, several findings 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 and profits and market value discussed earlier (see Table 2) as this would be "priced out" in the market. 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[55]. Finally, CEO pay (a proxy for top-managerial ability) is not correlated with our management score once we control for firm size[56]. Therefore, 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 deeply 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.

V.E Instrumental variable estimates of management practices in the production function

Returning to the production functions estimates in the previous section, we noted that it was not possible to regard the coefficient on management as a causal effect of management on firm performance. Our estimated effects of the "true effect" of management on productivity could be biased upwards or downwards due to reverse causality. For example, positive feedback could occur if higher productivity enabled cash-constrained to invest more resources in improving managerial

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for individual management components are: Shop floor operations -0.341 (0.147); Monitoring -0.345 (0.116); Targets -0.229 (0.115); and Incentives -0.231 (0.099). So while there is some evidence for this in the particularly low monitoring scores for family firms, they still score significantly badly on other management components like shop floor operations and incentives, which are not obviously linked to more formalized management styles.

[55] When we include the ln(average wage of the firm) and its interactions with country dummies in a specification identical to that of column (4) in Table 2, the management coefficient is 0.051 with a standard error of 0.017. This compares to a management coefficient of 0.059 with a standard error of 0.017 without the wage terms on the same sample (we only have 2,612 observations for this regression compared to the 5,350 in Table 2 because wage data is not reported for some of the firms in the sample). The wage terms are positive and significant.

[56] For example, regressing log(CEO pay) on firm size, public/private status, country dummies, industry dummies, and the management score, we find the coefficient (standard error) on the management score is 0.001 (0.051). Note that although CEO pay includes bonuses it does not include share options.

practices. This would bias our coefficient on management upwards. Negative feedback could occur if higher productivity allows managers to reduce their input of effort.[57] This would bias the coefficient on management downwards.

[TABLE 6 ABOUT HERE]

We present results in Table 6 using product market competition and/or family ownership as instrumental variables for management practices. For this to be valid we need to not only assume that our measures of product market competition and ownership are exogenous (as in Table 6) but also that the mechanism by which competition (and ownership) impacts on productivity is solely through improving managerial practices. Essentially, we are assuming the model in Appendix E is correct, and based on these admittedly strong identification assumptions the instrumental variable strategy identifies the causal effect of management on performance.

Table 6 contains the results of using competition and/or family management to instrument management practices in the production function. The baseline is column (1) which repeats the simple OLS productivity equations including management on the right hand side[58]. Columns (2), (3) and (4) then present production function results confirming that competition and family *primo geniture* are important determinants of firm level productivity, matching their role in determining management practices. Column (5) then estimates a production function in which management is instrumented using the import penetration and family *primo geniture* management, generating a management coefficient which significantly positive and over five-fold larger in magnitude than the OLS coefficient. As noted in Section IV, this is likely to be due to heavy measurement error in our definition of "good" management and/or negative feedback from firm performance to managerial effort. As can be seen from the bottom of column (5) these instruments are not rejected by the Hansen-Sargan test of instrument validity. Columns (6) and (7) then present robustness results instrumenting management using just competition and then just family management individually. These also suggest downward bias from the OLS estimates

The coefficients in the production function estimates are of quantitative as well as statistical significance. Although we cannot clearly attribute causality to the management scores on productivity, a movement from the lower to the upper quartile of management scores between firms (0.971 points) is associated with an increase in TFP of between 3.2% and 7.5% under OLS and 21.6% under IV. Empirically the difference in TFP between the lower quartile and upper quartile of our firms is 31.9%. In a purely accounting sense, therefore, management scores explain between 10% and 23% of the inter-quartile range of productivity under OLS and about 66% under IV[59].

[57] Higher scoring practices involve more time and effort from managers on a range of the monitoring and target practices, plus potentially more difficult decisions in incentive practices over hiring, firing, pay and promotions.

[58] This is identical to column (1) in Table D1.

[59] We take the OLS coefficients in Table 2 to be between 0.032 and 0.075; we use the IV coefficient of Table 6 column (5). The TFP calculations are the within-group residuals from Table D1 column (s). An equivalent calculation for the 90-10 implies that management accounts for up to 22% under OLS and 64% under I.V.

VI. EXPLAINING MANAGEMENT PRACTICES ACROSS FIRMS AND COUNTRIES: QUANTIFICATION

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

VI.A Explaining the Tail of Badly Managed Firms

One of the interesting features of the raw data is the substantial fraction of firms that appear to have surprisingly bad management practices, with scores of two or less. These firms have only basic shop-floor management, very limited monitoring of processes or people, ineffective and inappropriate targets, and poor incentives and firing mechanisms. In addition, our calibration of the measurement error suggests these firms cannot be entirely explained by sampling noise. Interestingly most of the differences across countries highlighted in Figure 1 are due to the left tail[60] - the low UK and French average management scores are primarily due to their long tail of badly managed firms.

To investigate the extent to which 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[61] 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 per cent of firms scoring two or less, compared to 2.7 per cent of firms in the high competition no *primo-geniture* sample.[62] Given that 6.5 per cent of all firms in the sample scored 2 or less, controlling for competition and *primo geniture* succession appears to remove over half of the tail of very badly managed firms.[63]

[FIGURES 3 AND 4 ABOUT HERE]

[60] We ran a Kolmogorov-Smirnov test of the equality of management score distributions between the US and Germany versus the UK and France and found this is rejected (p-value=0.002) on the whole sample. If we test equality of this distribution for management scores above 2 this is not rejected (p-value=0.391). After truncating at 2 the coefficients on the country dummies (standard errors) in a Table 7 Column (1) specification with a US-baseline fall to -0.015 (0.060) for Germany, -0.012 (0.078) for France and -0.128 (0.070) for the UK, so that the US-French gap is eliminated and the US-UK gap falls by more than half.

[61] Defined by firms reporting "few" or "no" competitors. We use this measure to analyze cross-country competition because it is consistently measured across the sample. The Lerner index and import penetration measures may 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.

[62] This split is also true in the US and European sub samples. In the US 5.2% of firms, score 2 or less in the low competition and/or *primo geniture* group while 0.6% score two 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 geniture* group.

[63] Competition explains around two-thirds of this reduction in the tail, with conditioning on "many" competitors alone taking the share of firms scoring two or less from 6.9% (in the whole sample) down to 4.2%.

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

In Table 7, we attempt to account for the variations in management practices across countries. In column (1), we regress management on dummy variables for Germany, France and the UK (with the US as the omitted as baseline category). We find that French and UK firms are significantly worse managed than US firms on average, with a gap of 0.202 and 0.276 respectively, while German firms are worse managed but not significantly so with a smaller gap of 0.045. In column (2), we include a dummy for a *primo geniture* family firm whose coefficient is negative and significant at the 5% level as expected. The coefficient on the UK and French dummy variables drop substantially by around 0.09, reflecting the extensive presence of family firms with traditional *primo geniture* progression rules.[64] In column (3), we condition on our measure of the number of competitors faced by the firm. Consistent with the earlier results of the competition variables 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 marginally lower in the UK than in the US. By contrast the coefficients for France and Germany drop by about 0.04, because the level of competition is reported to be lower by French or German companies than by US firms.[65] Together competition and family firm status accounts for around two-thirds (62% = 100*(.202-.077)/.202) of the gap between the US and France and one-third (32% = 100*(.276-.188))/.276) of the gap between the US and the UK. In column (4), we add one final control, which is the proportion of employees with a college degree, and find that this accounts for much of the remaining UK and French gap with the US.

[TABLE 7 ABOUT HERE]

Although we were expecting the competition results, the role of family firms is more surprising. The finding matches up with an earlier economic history literature of Landes (1967) and Chandler (1994), who claim 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.[66] 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 third generation…[and] the weakness of British enterprise reflected their combination of amateurism and complacency"*
>
> [p. 563]

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

[64] Controlling for firm size and public/private mix does not notably change these results with the respective coefficients for Germany, France and the UK in column (1) -0.081, -0.183 and -0.276; in column (2) -0.051, -0.075 and -0.200; in column (3) -0.042, -0.127 and -0.251; and in column (4) 0.010, -0.028 and -0.126.

[65] 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.

[66] Nicholas (1999) provides supporting evidence for the UK, showing that over this period individuals who inherited family firms accumulated less lifetime wealth than either firm founders or professional managers.

And extrapolating from the 20 per cent of firms under family ownership in 2004 to the majority share they would have accounted for in the early Twentieth Century suggests they could have played the dominant cross-country role in that period as suggested by Landes and Chandler.

VII. CONCLUSIONS

In this paper 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 American firms on average much better managed than European firms. There is, however a much larger variation between firms within countries with a long tail of extremely badly managed firms. This heterogeneity is consistent with what we know from the productivity distribution between firms and plants. 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 that 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 than American firms. France and the UK also display substantially higher levels of *primo geniture* probably due to their Norman legal origin and traditions and the more generous exemption from the estate taxation regime. Product market competition and family firms alone appear to account for around half of the long tail of badly managed firms and between two thirds (France) and one-third (UK) of the European management gap with the US.

A possible criticism of our research design is that we have focused on managerial practices from the employer perspective rather than the worker perspective. Do these "tough" management practices come at the expense of work intensification and a breakdown of reciprocity and job satisfaction in the workplace? Although we did not interview workers directly regarding managerial practices, we doubt that we would get a radically different picture from such information. In a companion paper (Bloom, Kretschmer and Van Reenen, 2006) we show that our overall management score is strongly positively correlated with many pro-worker features of firms such as more generous childcare subsidies and better work-life balance indicators. Although these indicators have no association with productivity conditional on management, it suggests that workers may actually prefer working in well-run firms to badly run firms.

A range of potential extensions to this work is planned, including running a second survey wave in 2006. It is important to follow up these firms in order to examine the extent to which management practice evolves over time. This will enable us to examine whether competition is working simply through selection or if there is 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. We are also developing this survey

methodology to measure the organizational structure and characteristics of firms, attempting to empirically test the long line of organizational theories of the firm.

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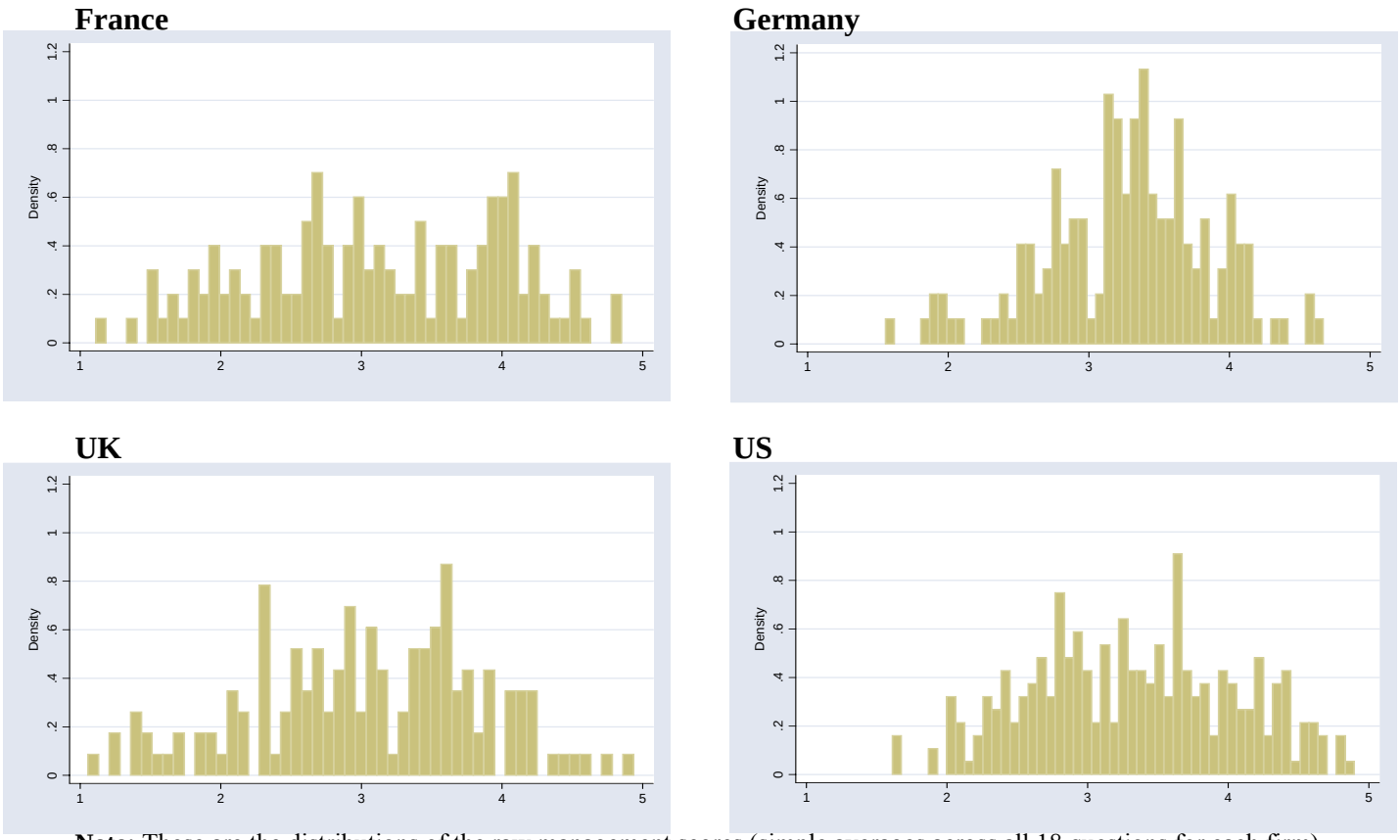
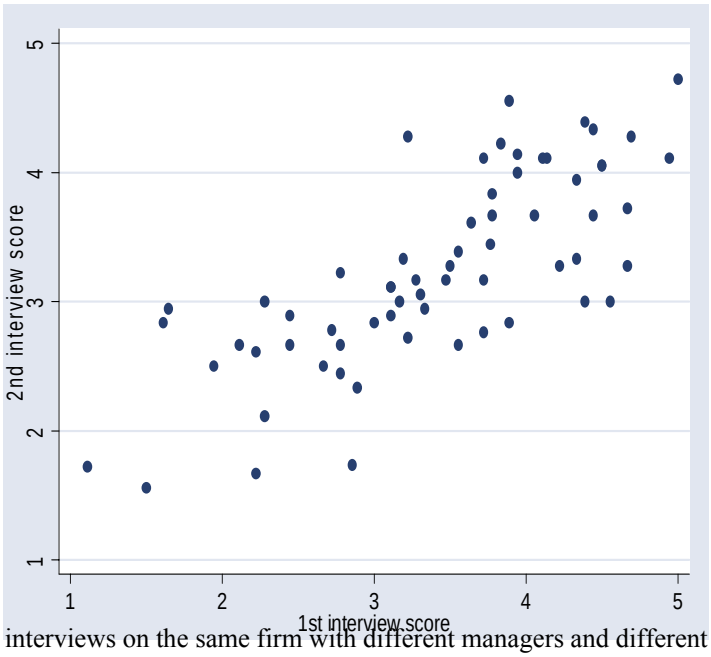
Figure 1: Distribution of management scores by country



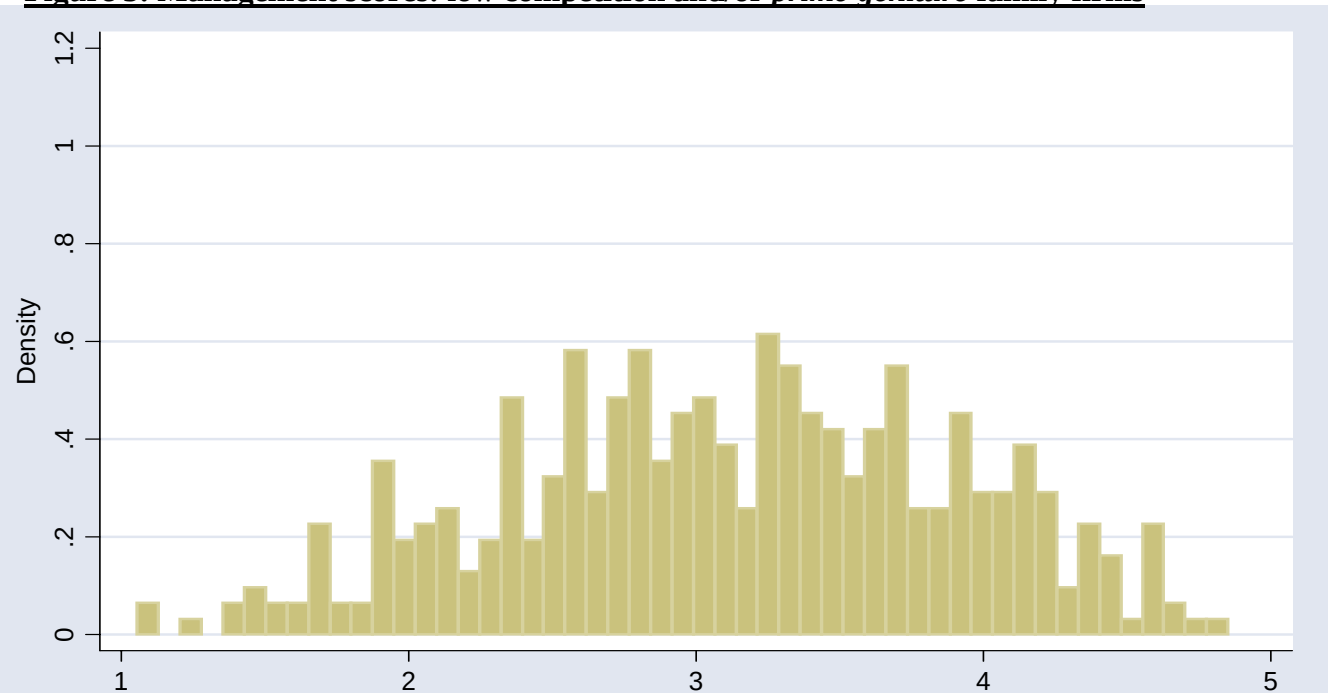
Note: These are the distributions of the raw management scores (simple averages across all 18 questions for each firm). 1 indicates worst practice, 5 indicates best practice. There are 135 French observations, 156 German observations, 151 UK observations and 290 US observations.

Figure 2: First management score on second management score



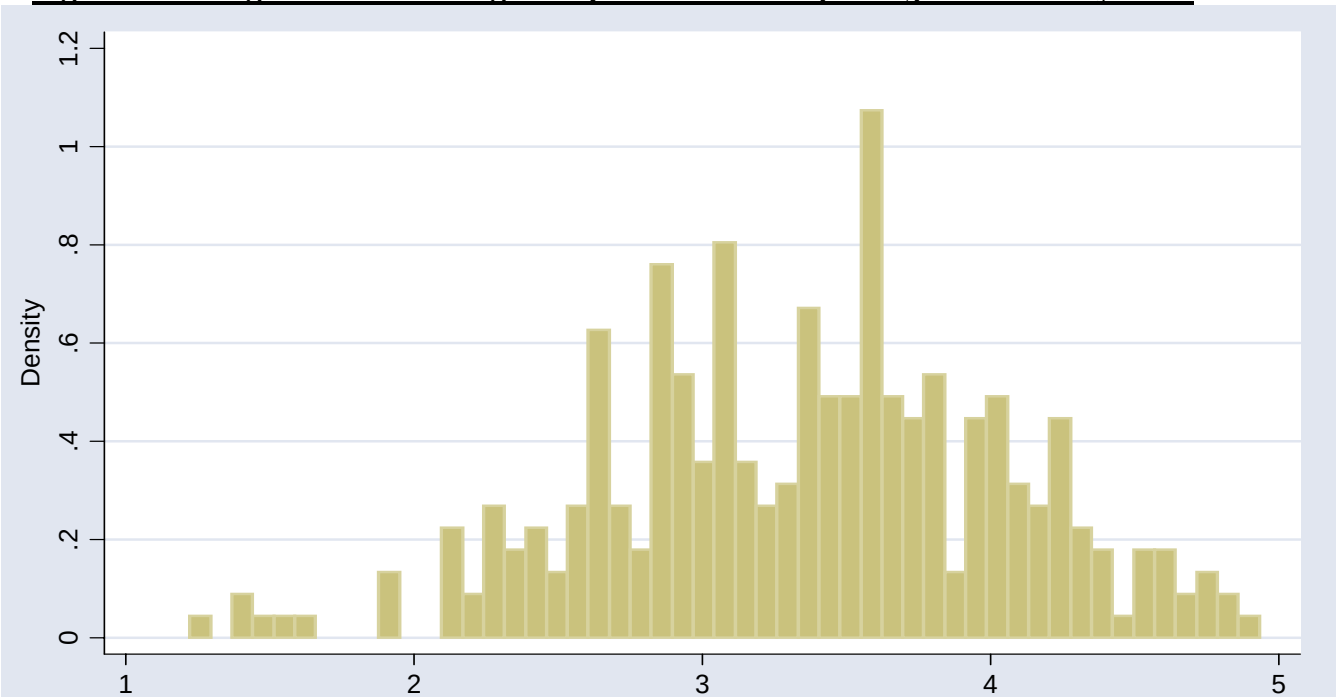
Note: Scores from 64 repeat interviews on the same firm with different managers and different interviewers. Simple scores averaged across the eighteen raw management scores.

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 two or less. 1 indicates worst practice, 5 indicates best practice

Figure 4: Management scores: high competition and non *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 two or less. 1 indicates worst practice, 5 indicates best practice

TABLE 1: HEREDITARY FAMILY FIRM INVOLVEMENT BY COUNTRY

%	France	Germany	UK	US
Family largest shareholder	32	30	30	10
Family largest shareholder and family CEO	22	12	23	7
Family largest shareholder, family CEO and *primo geniture*	14	3	15	3
Founder largest shareholder	18	5	14	18
Founder largest shareholder and CEO	10	2	12	11
Number of firms	137	156	152	290

NOTES: These mean values are taken from our sample of 732 firms. Family shareholding is combined across all family members. Family involvement is defined as second-generation family or beyond. Primo geniture defined by a positive answer to the question **"How was the management of the firm passed down: was it to the eldest son or by some other way?"** (see Table A3). Alternatives to primo-geniture in frequency order are younger sons, son in-laws, daughters, brothers, wives and nephews. "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 are those with additionally a family member as the CEO; "Family largest shareholder, family CEO and primo geniture" who additionally the CEO was selected as the eldest male child upon succession. See Appendix B for more details on construction of the variables.

TABLE 2: ESTIMATES OF FIRM PERFORMANCE EQUATIONS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation Method	**OLS**	**OLS**	**OLS**	**OLS**	**OLS**	**OLS**	**Probit**	**OLS**
Firms	**All**	**All**	**All**	**All**	**All**	**Quoted**	**All**	**All**
Dependent variable	**Ln (Y) $_{it}$ sales**	**Ln (Y) $_{it}$ sales**	**Ln (Y) $_{it}$ sales**	**Ln (Y) $_{it}$ sales**	**ROCE profitability**	**Ln(Tobin's Av. Q)**	**Exit (by death)**	**Sales Growth**
Management z-score	0.075	0.039	0.032	0.042	2.534	0.270	-0.225	0.018
	(0.024)	(0.012)	(0.011)	(0.012)	(0.686)	(0.073)	[0.024]	(0.006)
ln (L) $_{it}$ labor	1.081	0.522	0.535	0.526	1.372	0.299	0.263	-0.020
	(0.034)	(0.036)	(0.033)	(0.032)	(1.724)	(0.187)	[0.024]	(0.014)
Ln(K) $_{it}$ capital		0.186	0.147	0.146	-1.765	-0.588	-0.178	0.009
		(0.029)	(0.025)	(0.025)	(1.351)	(0.169)	[0.056]	(0.012)
ln (N) $_{it,}$ materials		0.301	0.306	0.304	0.946	0.210	-0.095	0.007
		(0.037)	(0.025)	(0.024)	(1.011)	(0.108)	[0.202]	(0.009)
General Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Noise Controls	No	No	No	Yes	Yes	Yes	Yes	Yes
Firms	709	709	709	709	690	374	709	702
Observations	5,350	5,350	5,350	5,350	5,089	2,635	709	4,777

NOTES: All columns estimated by OLS except column (7) which is estimated by probit Maximum Likelihood. In all columns (except 7), standard errors are in parentheses under coefficient estimates and allow for arbitrary heteroskedacity and correlation (i.e. clustered by firm). In column (7), we report the p-value in square brackets below the marginal effects of each variable on the percentage increase in the probability of exit (between 2004 and 2005). The coefficients on capital, materials and labor are allowed to be different across countries and consolidation status (UK is base). "**General controls**" comprise of firm-level controls for ln(average 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 industry dummies and four country dummies interacted with a full set of time dummies. **"Noise controls"** are those in the final column of Table C1 (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). Data runs between 1994 and 2004 except in column (7).

TABLE 3: SKILL CONTINGENT MANAGEMENT PRACTICES

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Countries	**All**	**All**	**All**	**All**	**All**	**All**	**All**	**All**	**All**
Dependent variable	**Human Capital (HC) management**	**Fixed Capital (FC) management**	**HC-FC management**	**HC-FC management**	**HC-FC management**	**HC-FC management**	**HC-FC management**	**HC-FC management**	**HC–FC management**
Ln(proportion of employees with college degrees)	0.220	0.100	0.120	0.099					
	(0.039)	(0.043)	(0.043)	(0.057)					
Firm level									
Ln(firm average wages) $_{it}$					0.594	0.256	0.337	0.340	
					(0.120)	(0.130)	(0.122)	(0.168)	
Ln(proportion of employees with college degrees), three digit industry level									0.281
									(0.169)
General Controls	No	No	No	Yes	No	No	No	Yes	Yes
Industry Controls	No	No	No	Yes	No	No	No	Yes	No
Firms/industries	732	732	732	732	424	424	424	424	732

NOTES: All columns estimated by OLS with robust standard errors in parentheses (standard errors are clustered by industry in column (9)). A single cross section of data used. "HC management" is the average z-score of the three explicitly human capital focused questions (questions 13, 17 and 18 in Appendix Table A1). "FC management" is the average z-score of the 3 most fixed capital focused questions (1, 2 and 4 in Appendix Table A1). "HC-PC management" is the difference of these two averages. "**General controls**" comprises controls for ln(firm age), ln(average number of employees), a dummy for being listed and country dummies. "**Industry controls**" are a full set of three digit industry dummies. **"ln(proportion of employees with college degrees), three digit industry level"** is the average number of employees with a college level qualification (or higher) in the industry in the 1991 to 1998 US Current Population Survey (NBER MORG files). We use this measure in all four countries under the assumption that the relative skill intensity of industries is similar across countries. Column (9) is weighted by the number of observations on each industry in the CPS.

TABLE 4: MANAGEMENT AND PRODUCT MARKET COMPETITION

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation Method	**OLS**	**OLS**	**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**	**Management z-score**	**Management z-score**
Import penetration (5-year lagged)	0.144	0.157					0.123	0.174
	(0.040)	(0.078)					(0.041)	(0.080)
Lerner index of competition (5-year lagged)			1.516	1.318			1.203	1.376
			(0.682)	(0.588)			(0.619)	(0.569)
Number of competitors					0.143	0.144	0.125	0.123
					(0.051)	(0.045)	(0.045)	(0.045)
Firms	732	732	726	726	732	732	726	726
General controls	No	Yes	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 **"General controls"** includes a full set of 108 three digit industry dummies, four country 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 C1 (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); "**Import Penetration"** = ln(Import/Production) in every country*industry pair with the average over 1995-1999 used. "**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 (average over 1995-1999 used). "**Number of competitors"** constructed from the response to the survey question on number of competitors, and is coded as zero 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 and 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				0.304	0.154
	(0.094)				(0.166)	(0.176)
Family largest shareholder and family CEO		-0.100			-0.152	-0.011
		(0.078)			(0.186)	(0.195)
Family largest shareholder, family CEO and *primo geniture*			-0.329	-0.596	-0.450	-0.444
			(0.095)	(0.098)	(0.123)	(0.139)
Firms	732	732	732	732	732	497
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
General 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. "**General controls**" are 108 three-digit industry dummies, 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 C1 (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: INSTRUMENTING MANAGEMENT PRACTICES

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Countries	**All**	**All**	**All**	**All**	**All**	**All**	**All**
Estimation	**OLS**	**OLS**	**OLS**	**OLS**	**IV**	**IV**	**IV**
Dependent variable	**Ln (Y) $_{it}$ sales**	**Ln (Y) $_{it}$ sales**	**Ln (Y) $_{it}$ sales**	**Ln (Y) $_{it}$ sales**	**Ln (Y) $_{it}$ sales**	**Ln (Y) $_{it}$ sales**	**Ln (Y) $_{it}$ sales**
Management z-score	0.042 (0.012)				0.216 (0.094)	0.403 (0.282)	0.157 (0.097)
ln (L) $_{it}$ labor	0.526 (0.032)	0.507 (0.020)	0.502 (0.020)	0.504 (0.020)	0.512 (0.020)	0.519 (0.026)	0.511 (0.020)
Ln(K) $_{it}$ capital	0.146 (0.025)	0.126 (0.013)	0.129 (0.013)	0.127 (0.014)	0.107 (0.017)	0.085 (0.035)	0.111 (0.017)
ln (N) $_{it,}$ materials	0.304 (0.024)	0.358 (0.017)	0.358 (0.017)	0.360 (0.017)	0.357 (0.017)	0.357 (0.018)	0.358 (0.017)
Import penetration (5-year lagged)		0.089 (0.032)		0.088 (0.032)			
Family largest shareholder, family CEO and *primo geniture*			-0.060 (0.030)	-0.058 (0.030)			
Instrumental variables for Management					Imports, Family	Imports	Family
General Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hansen-Sargan test of over-identification (p-value)					0.520		
First stage F-test value [p-value]					20.79 [0.000]	4.33 [0.010]	28.38 [0.000]
Firms	709	709	709	709	709	709	709
Observations	5,350	5, 350	5,350	5,350	5,350	5,350	5,350

NOTES: In all columns, standard errors are in parentheses under coefficient estimates and allow for arbitrary heteroskedacity and correlation (i.e. clustered by firm). Columns (1) to (3) estimated by OLS levels. Column (4) estimated by IV, with the instrument set including all independent variables except management, plus "*Import penetration (5-year lagged)*" and "*Family largest shareholder, family CEO and primo geniture*". All columns include a set of **"general controls"** comprising of 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 interacted with a full set of time dummies. Controls also includes the **"**noise controls**"** of column (2) Table C1 (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). "**Import Penetration"** = ln(Imports/Production) in every country*industry pair (average over 1995-1999) is used as an explanatory variable in columns (2) and (4) and is in the instrument set in columns (5) and (6). **"Family largest shareholder, family CEO and primo geniture)"** and **"Family"** is a binary indicator for whether the family is the largest shareholder, and the family is CEO chosen by *primo geniture*. The same variable is used as an explanatory variable in columns (3) and (4) and as an instrumental variable in columns (5) and (7). Data runs 1994 through 2004.

TABLE 7: 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 Germany	-0.045	-0.036	-0.004	0.063
	(0.064)	(0.063)	(0.063)	(0.067)
Country is France	-0.202	-0.115	-0.077	-0.021
	(0.086)	(0.088)	(0.088)	(0.089)
Country is the UK	-0.276	-0.199	-0.188	-0.107
	(0.078)	(0.076)	(0.076)	(0.079)
Family largest shareholder, family CEO and *primo geniture*		-0.658	-0.648	-0.606
		(0.102)	(0.102)	(0.100)
Number of competitors			0.147	0.154
			(0.052)	(0.051)
Ln(Proportion of employees with degrees)				0.134
				(0.037)
Firms	732	732	732	732

NOTES: Coefficients from OLS regressions with standard errors in parentheses (robust to arbitrary heteroskedasticity); single cross section. **"Family largest shareholder, family CEO and primo geniture)"** and **"Family"** is a binary indicator for whether the family is the largest shareholder, and the family is CEO chosen by *primo geniture*. "**Number of competitors"** constructed from the response to the survey question on number of competitors, and is coded as zero for "*none*" (1% of responses), 1 for "*less than 5*" (51% of responses), and 2 for "*5 or more*" (48% of responses).

APPENDIX A: DETAILS OF THE SURVEY QUESTIONNAIRES

TABLE A1: MANAGEMENT PRACTICE INTERVIEW GUIDE AND EXAMPLE RESPONSES

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. Multiple questions are used for each dimension to improve scoring accuracy.

(1) Modern manufacturing, introduction

a) Can you describe the production process for me?
b) What kinds of lean (modern) manufacturing processes have you introduced? Can you give me specific examples?
c) How do you manage inventory levels? What is done to balance the line?

	Score 1	Score 3	Score 5
Scoring grid:	Other than Just-In-Time (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 programs	All major aspects of modern manufacturing have been introduced (Just-In-Time, autonomation, flexible manpower, support systems, attitudes and behaviour) in a formal way
Examples:	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 workflow [these are all forms of lean/modern manufacturing techniques].

(2) Modern manufacturing, rationale

a) Can you take through the rationale to introduce these processes?
b) What factors led to the adoption of these lean (modern) management practices?

	Score 1	Score 3	Score 5
Scoring grid:	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)
Examples:	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, competing with cheaper imports through improved quality, flexible production, greater innovation and JIT delivery.

(3) Process problem documentation

a) How would you go about improving the manufacturing process itself?
b) How do problems typically get exposed and fixed?
c) Talk me through the process for a recent problem.
d) Do the staff ever suggest process improvements?

	Score 1	Score 3	Score 5
Scoring grid:	No, process improvements are made when problems occur.	Improvements are made in one 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
Examples:	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

a) Tell me how you track production performance?
b) What kind of Key Performance Indicators (KPIs) would you use for performance tracking? How frequently are these measured? Who gets to see this KPI data?
c) If I were to walk through your factory could I tell how you were doing against your KPI's?

	Score 1	Score 3	Score 5
Scoring grid:	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.
Examples:	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

a) How do you review your Key Performance Indicators (KPIs)?
b) Tell me about a recent meeting
c) Who is involved in these meetings? Who gets to see the results of this review?

	Score 1	Score 3	Score 5
Scoring grid:	Performance is reviewed infrequently or in an un-meaningful way, e.g. only success or failure is noted.	Performance is reviewed periodically with 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
Examples:	A manager of a US firm relies heavily on his gut feel of the business. He will review costs when he thinks there is too much or too little in the stores. He admits he is busy so reviews are infrequent. He also mentioned staffs feel like he is going on a hunt to find a problem, so he has now made a point of highlighting anything good.	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

a) How are these meetings structured? Tell me about your most recent meeting.
b) During these meeting, how much useful data do you have?
c) How useful do you find problem solving meetings?
d) What type of feedback occurs in these meetings?

	Score 1	Score 3	Score 5
Scoring grid:	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.
Examples:	A US firm does not 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 did not feel the need to review their performance.	A UK firm focuses on key areas to discuss each week. This ensures they receive consistent management attention and everyone comes prepared. 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. Participants come from all departments (shop floor, sales, R&D, procurement etc.) to discuss the previous week performance and to identify areas to improve. They focus on the cause of problems and agree topics to be followed up the next week, allocating all tasks to individual participants.

(7) Consequence management

a) What happens if there is a part of the business (or a manager) who isn't achieving agreed upon results? Can you give me a recent example?
b) What kind of consequences would follow such an action?
c) Are there are any parts of the business (or managers) that seem to repeatedly fail to carry out agreed actions?

	Score 1	Score 3	Score 5
Scoring grid:	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
Examples:	At a French firm, no action is taken when objectives are not 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 behavior 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

a) What types of targets are set for the company? What are the goals for your plant?
b) Tell me about the financial and non-financial goals?
c) What does Company Head Quarters (CHQ) or their appropriate manager emphasize to you?

	Score 1	Score 3	Score 5
Scoring grid:	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 organization)	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.
Examples:	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 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 lunchtime 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) Target interconnection

a) What is the motivation behind your goals?
b) How are these goals cascaded down to the individual workers?
c) What are the goals of the top management team (do they even know what they are!)?
d) How are your targets linked to company performance and their goals?

	Score 1	Score 3	Score 5
Scoring grid:	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 communicated down to individuals	Corporate goals focus on shareholder value. They increase in specificity as they cascade through business units ultimately defining individual performance expectations.
Examples:	A family owned firm in France is only concerned about the net income for the year. They try to maximize 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 many areas labeled as "cost-centers" with an objective to cost-cut despite potentially disproportionately large negative impact on the other departments they serve.	For a US firm strategic planning begins with a bottom up approach that 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. Everyone has to know exactly how he or she contributes to the overall goals or else they will not understand how important the 10 hours they spend at work every day is to the business.

(10) Target time horizon

a) What kind of time scale are you looking at with your targets?
b) Which goals receive the most emphasis?
c) How are long term goals linked to short term goals?
d) Could you meet all your short-run goals but miss your long-run goals?

	Score 1	Score 3	Score 5
Scoring grid:	Top management's main focus is on short term targets	There are short and long-term goals for all levels of the organization. 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
Examples:	A UK firm has had several years of ongoing senior management changes – therefore senior managers are only focusing 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 senior managers know the long-term goals 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 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

a) How tough are your targets? Do you feel pushed by them?
b) On average, how often would you say that you meet your targets?
c) Are there any targets which are obviously too easy (will always be met) or too hard (will never be met)?
d) Do you feel that on targets that all groups receive the same degree of difficulty? Do some groups get easy targets?

	Score 1	Score 3	Score 5
Scoring grid:	Goals are either too easy or impossible to achieve; managers provide low 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
Examples:	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 has not stretched them enough. Each KPI is linked to the overall business plan.

(12) Performance clarity

a) What are your targets (i.e. do they know them exactly)? Tell me about them in full.
b) Does everyone know their targets? Does anyone complain that the targets are too complex?
c) How do people know about their own performance compared to other people's performance?

	Score 1	Score 3	Score 5
Scoring grid:	Performance measures are complex and not clearly understood. Individual performance is not made public	Performance measures are well defined and communicated; performance is public in all levels but comparisons are discouraged	Performance measures are well defined, strongly communicated and reinforced at all reviews; performance and rankings are made public to induce competition
Examples:	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 could not remember all the details.	A French firm does not 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

a) Do senior managers discuss attracting and developing talented people?
b) Do senior managers get any rewards for bringing in and keeping talented people in the company?
c) Can you tell me about the talented people you have developed within your team? Did you get any rewards for this?

	Score 1	Score 3	Score 5
Scoring grid:	Senior management **do not** communicate that attracting, retaining and developing talent throughout the organization is a top priority	Senior management believe and communicate that having top talent throughout the organization is a key way to win	Senior managers are evaluated and held accountable on the strength of the talent pool they actively build
Examples:	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

a) How does you appraisal system work? Tell me about the most recent round?
b) How does the bonus system work?
c) Are there any non-financial rewards for top-performers?
d) How does your reward system compare to your competitors?

	Score 1	Score 3	Score 5
Scoring grid:	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
Examples:	An East Germany firm pays its people equally and regardless of performance. The management said to us "there are no incentives to perform well in our company". Even the management is paid an hourly wage, with no bonus pay.	A German firm has an awards system based on three components: the individual's performance, shift performance, and overall company performance.	A US firm sets ambitious targets, rewarded through a combination of bonuses linked to performance, team 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

a) If you had a worker who could not do his job what would you do? Could you give me a recent example?
b) How long would underperformance be tolerated?
c) Do you find any workers who lead a sort of charmed life? Do some individuals always just manage to avoid being fixed/fired?

	Score 1	Score 3	Score 5
Scoring grid:	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
Examples:	A French firm had a supervisor who was regularly drinking alcohol at work but no action was taken to help him or move him. 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 three times that an individual underperformed before they can take serious action.	At a US firm, the manager fired four people during last couple of months due to underperformance. They continually investigate why and who are underperforming.

(16) Promoting high performers

a) Can you rise up the company rapidly if you are really good? Are there any examples you can think of?
b) What about poor performers – do they get promoted more slowly? Are there any examples you can think of?
c) How would you identify and develop (i.e. train) your star performers?
d) If two people both joined the company 5 years ago and one was much better than the other would he/she be promoted faster?

	Score 1	Score 3	Score 5
Scoring grid:	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
Examples:	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 based on his succession plans and development plans for individuals.

(17) Attracting human capital

a) What makes it distinctive to work at your company as opposed to your competitors?
b) If you were trying to sell your firm to me how would you do this (get them to try to do this)?
c) What don't people like about working in your firm?

	Score 1	Score 3	Score 5
Scoring grid:	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
Examples:	A manager of a firm in Germany could not give an example of a distinctive employee proposition and (when pushed) thinks the offer is 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

a) If you had a star performer who wanted to leave what would the company do?
b) Could you give me an example of a star performers being persuaded to stay after wanting to leave?
c) Could you give me an example of a star performer who left the company without anyone trying to keep them?

	Score 1	Score 3	Score 5
Scoring grid:	We do little to try to keep our top talent.	We usually work hard to keep our top talent.	We do whatever it takes to retain our top talent.
Examples:	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 does not think they can keep people if they want to work somewhere else. The company also will not 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 their reasons for leaving 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. If any of them signal an interest to leave the firm pulls in senior managers and even corporate Head Quarters 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 A2: QUESTION LEVEL AVERAGES BY COUNTRY

	Question number	Question type	Average Value by Country (US = 100)			Regression Coefficients
			(1)	(2)	(3)	(4)
Countries			**UK**	**Germany**	**France**	**All**
Modern manufacturing, introduction	1	Operations	90.0 (3.50)	86.4 (3.47)	101.3 (3.63)	0.019** (0.008)
Modern manufacturing, rationale	2	Operations	92.9 (3.35)	101.5 (3.32)	101 (3.47)	0.012 (0.008)
Process documentation	3	Operations	89.0 (3.51)	106.9 (3.49)	99 (3.64)	0.032*** (0.009)
Performance tracking	4	Monitoring	98.3 (3.19)	109.5 (3.17)	111 (3.32)	0.017** (0.008)
Performance review	5	Monitoring	94.7 (2.99)	110.2 (2.97)	104 (3.10)	0.018** (0.008)
Performance dialogue	6	Monitoring	93.0 (3.19)	103.3 (3.11)	99 (3.27)	0.017** (0.009)
Consequence management	7	Monitoring	96.5 (3.02)	108.7 (3.01)	94 (3.13)	0.017** (0.008)
Target breadth	8	Targets	91.1 (3.53)	93.3 (3.51)	94 (3.66)	0.024*** (0.008)
Target interconnection	9	Targets	93.7 (3.56)	97.3 (3.54)	78 (3.68)	0.025*** (0.008)
Target time horizon	10	Targets	91.9 (3.69)	98.6 (3.66)	92 (3.83)	0.021*** (0.009)
Targets are stretching	11	Targets	87.8 (3.34)	104.9 (3.32)	101 (3.45)	0.014* (0.008)
Performance clarity and comparability	12	Monitoring	93.7 (3.53)	80.7 (3.49)	83 (3.65)	0.009 (0.008)
Managing human capital	13	Targets	89.4 (3.94)	99.0 (3.92)	89 (4.08)	0.023** (0.008)
Rewarding high performance	14	Incentives	81.6 (3.42)	85.2 (3.42)	85 (3.55)	0.021** (0.009)
Removing poor performers	15	Incentives	89.4 (3.04)	92.5 (3.02)	83 (3.15)	0.012 (0.009)
Promoting high performers	16	Incentives	90.2 (2.86)	104.9 (2.85)	92 (2.97)	0.015* (0.009)
Attracting human capital	17	Incentives	90.4 (2.89)	95.1 (2.88)	85 (2.99)	0.029*** (0.009)
Retaining human capital	18	Incentives	93.6 (2.74)	97.7 (2.73)	97 (2.84)	0.006 (0.009)
Unweighted Average			91.5	98.7	93.8	0.018

NOTES: In columns (1) to (3) standard deviation of each question's average response are reported below in brackets. Calculated from full sample of 732 firms. Management z-scores used in these calculations. In column (4) results from 18 OLS estimations following exactly the same specification as column (4) Table 2 except estimated with each individual question z-score one-by-one rather than the average management z-score. So every cell in column (4) is from a different regression with 5,350 observations from 709 firms where: standard errors in parentheses allow for arbitrary heteroskedacity and correlation (clustered by firm), and regression includes "general controls" as detailed in Table 2. *** denotes that the variable is significant at the 1% level, ** denotes 5% significance and * denotes 10% significance.

APPENDIX A3: 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 (cross-check again accounts)	(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 (including overtime, excluding 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)

Work-life Balance: Perceptions

Question	Response choice (all employees)
Relative to other companies in your industry how much does your company emphasize work-life balance?	[much less / slightly less / the same / slightly more / much more]

Organizational 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 A4: 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]
Chairperson characteristics	
Chairperson is a family member	[yes/no]
Chairperson family generation	continuous
Chairperson age	continuous
Chairperson tenure	continuous
Chairperson 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 largest outside shareholder	[institution/state/manager/private individual/other]
Handover data	
Number of siblings (of current CEO)	continuous
How was the management of the firm passed down: was it to the eldest son or by some other way?	text
Year of last handover	continuous

APPENDIX B: DATA

The entire anonymized dataset with a full set of do-files generating all results in this paper will be made available on-line after publication of his paper.

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 and public listing in the analyses. Furthermore, when estimating production functions we allow all coefficients to be different on labor, capital, materials and consolidation status by country (see notes to Table 2).

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. By design, the firms in our sampling frame (over 50 workers) are past this 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-responders. French firms were slightly less likely to respond than firms in the other three countries were 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.

Company Shareholdings: This was manually extracted from the Bloomberg online data service for the ten largest shareholders and the ten largest insider shareholders.

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

Family ownership data

The ownership data, directors' data, shareholder information and family generation was collected from company SEC filings (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.[67] 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.

CEO Pay and Age: In the US, the S&P 1500 largest firms (which cover all sectors) are contained in Execucomp, which provided data for 106 largest of our US firms. For the remaining firms we manually downloaded the Def14a proxy statements from the SEC to extract the details of the CEO and CFO compensation package and age over the last three accounting years[68]. 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.

Industry level data

This comes from the OECD STAN database of industrial production. This is provided at the country ISIC Revision 3 level and is mapped into US SIC (1997) three (which is our common industry definition in all four countries). The measure of competition we use are "Import Penetration" = ln(Import/Production) in every country*industry pair (i.e. 4 countries and 108 industries implies up to 432 cells). We use the average over 1995-1999. "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 (average over 1995-1999 used).

A full set of descriptive statistics are in Table B1.

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

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

TABLE B1 DESCRIPTIVE STATISTICS

	All	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
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
Age of firm (years)	53.4	38.6	86.8	44.7	48.4
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
Number of competitors index, 1="none", 2="a few", 3="many"	2.47	2.32	2.35	2.52	2.56
Lerner index , excluding the firm itself in three digit industry	0.055	0.040	0.071	0.040	0.060
Trade Openness (imports/output) in three digit industry	0.31	0.33	0.32	0.42	0.24
Union density, %	19.9	9.7	41.4	25.3	9.4
Listed firm,%	57.2	16.1	41.0	28.5	100

Notes: Data descriptive 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 (i.e. question) 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 one. To determine these values of these components we exploit the information in the first and second interviews and the variance of question scores within and between firms.

At the question level the regression coefficient from the first on the second interview responses will take the value $\beta_q = \frac{\sigma_m^2 + \sigma_p^2}{\sigma_m^2 + \sigma_p^2 + \sigma_u^2 + \sigma_e^2}$, from applying the standard result on the attenuation bias due to measurement error. The average coefficient[69] from the first on second interviews and the second on first interviews is 0.578. At the firm level the regression coefficient of the first interview average scores on the second interview average scores will take the value $\beta_q = \frac{\sigma_m^2}{\sigma_m^2 + \sigma_u^2}$. The average coefficient from the first on second and second on first interviews is 0.752. Finally, decomposing the variance in question scores within and between firms provides values on $\sigma_m^2 + \sigma_u^2$ and $\sigma_p^2 + \sigma_e^2$ of 0.466 and 0.534.

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

[69] 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 below contains a list of interviewer, interview and interviewee characteristics as described in III.E. Column (1) reports the results of an OLS regression where the dependent variable is the average management z-score in the firm. The coefficient and standard errors of each of the variables are reported. Column (2) drops the least significant variables from the regression. We use these variables as "noise controls" in some of the regressions.

TABLE C1: CONTROLS FOR MEASUREMENT ERROR

Dependent variable is Management z-score				
			(1)	**(2)**
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 organization (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)
Organizations	Total number of organizations 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(16,699)=3.05 p-value=0.000	F(16,699)=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 three digit industry dummies included in the regression; 732 observations. Seniority scores defined by 1="Technician/Engineer", 2="Manufacturing/Production manager", 3="Plant/Factory manager", 4="VP/General manager" and 5="Director/CEO".

APPENDIX D: ADDITIONAL RESULTS

In this Appendix, we give some additional results that we refer to in the main text (Section IV.B), but did not have room to discuss in detail. In Table D1, we present alternative estimates of the production function. Column 1 simply reports the OLS levels regression that is comparable with column (4) of Table 2[70] .

In the rest of the table, we implement the two stage estimates described in Section 4 of the text. In the first stage, we estimate the production function:

$$y_{it} = \alpha_l l_{it} + \alpha_k k_{it} + \alpha_n n_{it} + \eta_i + u_{it} \quad \text{(D1)}$$

We recover our estimates of the fixed effects, η_i, and then in a second stage we project the fixed effects on the time invariant variables including the management score, *M*. The upper panel of Table D1 (Panel A) shows the "first stage" results of the production function. The lower panel (Panel B) shows the results of the "second stage" regression.

Within groups estimates equation (D1) directly, GMM System follows Blundell Bond (2000) and allows the u_{it} to follow an AR (1) process, $u_{it} = \rho u_{it-1} + \varepsilon_{it}$, where ε_{it} is a serially uncorrelated error. We estimate a general dynamic model with a lagged dependent variable and lags of all the factor inputs:

$$y_{it} = \pi_1 l_{it} + \pi_2 l_{it-1} + \pi_3 k_{it} + \pi_4 k_{it-1} + \pi_5 n_{it} + \pi_6 n_{it-1} + \eta_i^* + \varepsilon_{it} \quad \text{(D2)}$$

We use the moment conditions suggested by Arellano-Bond (1991) and Blundell and Bond (1998) treating all factor inputs as endogenous. The underlying parameters of the production function in equation (D1) are recovered by imposing the Common Factor restrictions in equation (D2) by Minimum Distance. We can then estimate the fixed effects and proceed to the second step regression as before.

In Olley-Pakes (1996) the unobserved productivity term is allowed to evolve over time in a first order Markov process. In this case we estimate the efficiency term for each firm-year and then average this over the eleven years in our data.

Note that we have also experimented with estimating the results in Table D1 for just the 1999-2004 periods instead of the 1994-2004 period that lead to very similar results.

Column (2) of Table D1 presents the within group results where we have included a full set of firm fixed effects. Compared to OLS levels the coefficient on capital falls by over 50 per cent and the coefficient on labour rises. This is typical of within group estimates of production functions and is suggestive of attenuation bias in the capital stock measure that becomes

[70] The minor differences with Table 2 are because we impose the same coefficients on the factor inputs across countries in order to ease comparability with the other estimators – this makes practically no difference to the results on the management term.

exacerbated when moving from OLS to within groups. The Olley Pakes results are in column (3). The coefficient on capital is higher than in OLS levels and much higher than Within Groups. The labor coefficient, by contrast, is lower. This is reassuring, as we would generally expect OLS levels (column (1)) to generate an upwards bias in the labor coefficient and a downwards bias in the capital coefficient. The GMM System estimator in column (4) also generates a lower labor coefficient and higher capital coefficient than within groups[71].

We recover the estimates of the unobserved efficiency terms/fixed effects and project them against the management score and other variables in Panel B. In all three columns, there remains a significant and positive association of (total factor) productivity with our management score. The magnitude of this management coefficient ranges between 0.04 for Olley Pakes and 0.08 for Within Groups with GMM system in between (0.07). We conclude that using our simpler OLS methods of estimating the association of management and productivity in the main text is not misleading. If anything, we may be *underestimating* the importance of management.

The final two columns report the results of a simple test of splitting the sample completely into the Continental European observations (France and Germany in column (5)) and Anglo-American observations (US and UK in column (6)). This is a further test of whether our management variables are Anglo-Saxon biased and matter less for the "social markets" of France and Germany. We use the Within Groups estimates of column (2). The coefficient on the management is significant in both columns and is actually larger in Continental Europe than in the UK and US (although not significantly so). We therefore reject the hypothesis that our management practice measures are culturally biased against France and Germany (this is supported by the fact that one of the Anglo Saxon countries, Britain, has a lower average management score than Germany and France).

Table D2 presents extensions to the production functions where we try to control for "firm performance related measurement bias". These are discussed in the text in sib-section IV.D.

[71] The similarity of the capital coefficient in GMM System and OLS levels is surprising, but it may because of problems with the extra moment conditions for the levels equations in Blundell-Bond. Even though the Sargan Difference test fails to reject the null of instrument validity in column (4), it might have weak power to reject. We re-estimated the equation using only the differenced moments (Arellano-Bond, 1991). The results were similar to the other estimates. The coefficient (standard error) on capital was 0.174(0.064), on labor 0.361(0.054) and on materials 0.416(0.057).

TABLE D1: ALTERNATIVE ECONOMETRIC ESTIMATES OF THE PRODUCTION FUNCTION

	(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) $_{it}$ sales**	**Ln (Y) $_{it}$ sales**	**Ln (Y) $_{it}$ sales**	**Ln (Y) $_{it}$ sales**	**Ln (Y) $_{it}$ sales**	**Ln (Y) $_{it}$ sales**
Panel A						
Management z-score	0.041					
	(0.013)					
ln (L) $_{it}$ labor	0.507	0.543	0.426	0.456	0.416	0.565
	(0.019)	(0.022)	(0.022)	(0.064)	(0.049)	(0.025)
Ln(K) $_{it}$ capital	0.123	0.059	0.158	0.114	0.077	0.056
	(0.013)	(0.015)	(0.042)	(0.050)	(0.028)	(0.018)
ln (N) $_{it,}$ materials	0.358	0.325	0.412	0.353	0.439	0.305
	(0.017)	(0.022)	(0.026)	(0.046)	(0.043)	(0.024)
SC(1)p-value				0.000		
SC(2) p-value				0.195		
SARGAN p-value				0.153		
SARGAN-DIF p-value				0.332		
General Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,350	5,350	3,606	3,674	1,393	3,957
Panel B						
Dependent variable:		TFP	TFP	TFP	TFP	TFP
Management z-score		0.080	0.047	0.071	0.103	0.058
		(0.017)	(0.017)	(0.017)	(0.042)	(0.020)
General Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations		709	709	709	270	439

NOTES: In all columns, standard errors are in parentheses under coefficient estimates and allow for arbitrary heteroskedacity and correlation (i.e. clustered by firm). The data runs between 1994 and 2004. Column (1) is estimated by OLS levels and we also include "**general 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 industry dummies and four country dummies interacted with a full set of time dummies. The controls also include the "Noise controls" from the final column of Table C1 (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 individual effects are included in the production function and we report the estimated parameters on the factor inputs (**Panel A**). In the second stage the estimated firm-specific efficiency term/"TFP" is regressed against the management z-score and the general controls as described above. We report the coefficients and robust standard error for management in **Panel B**. 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 $\varphi(.)$, the non-parametric expansion of capital and investment. We also include a selection correction term following Olley and Pakes (1996). Standard errors are bootstrapped (clustered by firm) with 200 replications. After calculating the parameters of labor and materials (stage 1a) and capital (stage 1b), we calculate the efficiency term/TFP averaged by firm across all year. This is used as a dependent variable in the lower panel and regressed on management and the general controls (stage 2). Column (4) shows results from our implementation of the Blundell-Bond (1998) GMM system (GMM-SYS) estimator (stage 1). Instruments for the differenced equation are lagged levels t-2 to t-3 on ln(sales), ln(capital), ln(labor) and ln(materials). Instruments for the levels equation are lagged differenced t-1 on ln(sales), ln(capital), ln(labor) and ln(materials). Standard errors are the "one step robust" (i.e. allow for clustering by firm). SC(k) is the p-value of an LM(k) test of second order correlation of the differenced residuals (see Arellano and Bond, 1991). We find evidence of significant negative first order correlation, but no evidence of second order correlation, which is consistent with the validity of the instrumentation strategy. SARGAN is the p-value of a Sargan-Hansen test of over-identification (distributed χ^2 under the Null). SARGAN-DIF reports the p-value of a Sargan Difference test of the validity of the extra "Blundell-Bond moments" over the standard moments in Arellano and Bond (1991). We impose the COMFAC (Common Factor) restrictions by Minimum Distance (see Blundell and Bond, 2000).

TABLE D2: EVALUATING FIRM PERFORMANCE RELATED MEASUREMENT BIAS IN THE MANAGEMENT VARIABLE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable	**Ln(Y) $_{it}$** sales	**Ln(Y) $_{it}$** sales	**Ln(Y) $_{it}$** sales	**Ln(Y)$_{it}$** sales	**Ln(Y)$_{it}$** sales	**Ln(Y) $_{it}$** sales	**Ln(Y)$_{it}$** sales	**Ln(Y) $_{it}$** sales
ln (L) $_{it}$ labor	0.528	0.526	0.519	0.524	0.522	0.526	0.520	0.525
	(0.032)	(0.032)	(0.032)	(0.032)	(0.033)	(0.032)	(0.032)	(0.032)
Ln(K) $_{it}$ capital	0.143	0.149	0.156	0.148	0.155	0.147	0.155	0.147
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
ln (N) $_{it,}$ materials	0.304	0.303	0.304	0.304	0.303	0.304	0.303	0.304
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
Management z-score				0.040		0.041		0.041
				(0.012)		(0.012)		(0.012)
Management z-score, most objective questions	0.037							
	(0.011)							
Management z-score, least objective questions		0.032						
		(0.011)						
Work-life balance focus			0.014	0.011				
			(0.010)	(0.010)				
Organizational devolvement – pace					0.009	0.008		
					(0.008)	(0.008)		
Organizational devolvement – tasks							0.007	0.007
							(0.008)	(0.008)
Firms	709	709	709	709	709	709	709	709
Observations	5,350	5,350	5,350	5,350	5,350	5,350	5,350	5,350

NOTES: In all columns, standard errors are in parentheses under coefficient estimates and allow for arbitrary heteroskedacity and correlation (i.e. clustered by firm). All columns estimated by OLS levels and 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. The coefficients on capital, materials and labor are allowed to be different across countries and consolidation status (UK is base). Full controls also includes the **"noise controls"** of column (2) Table C1 (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). Management z-score, more "objective" questions is the average of questions 1, 3, 4 and 9, chosen as being arguably the most objective questions in the interview, while Management z-score, least "objective" questions is the average of questions 6, 12, 17 and 18, chosen as being arguably the least objective questions in the interview. Work-life balance focus is the z-score from the work-life balance question, "Relative to other companies in your industry how much does your company emphasize work-life balance?" [much less/slightly less/the same/slightly more/much more], graded on a 1 to 5 scale. Organizational devolvement - pace is the z-score from the question "Who decides the pace of work?" and Organizational devolvement – task is the z-score from the question "Who decides how tasks should be allocated?" both scored on a 1 to 5 scale [exclusively managers/mostly managers/equally/mostly workers/exclusively workers].

APPENDIX E: ENDOGENOUS MANAGERIAL EFFORT, HETEROGENEOUS MANAGEMENT ABILITY AND COMPETITION

To consider managerial practices and product market competition we will follow Raith (2003) and consider an oligopoly model with endogenous entry and allow firms to choose managerial contracts. If a firm chooses a "high powered" contract this will on average elicit greater managerial effort and therefore better management practices. The model allows for exogenous heterogeneity in managerial ability and optimal choice of contracts thereby combining both elements discussed in section II in the text. In this set-up we can show that conditional on a *given number of firms*, an increase in product substitutability (which is how we index higher product market competition) will, in general, have an ambiguous effect on managerial incentives. When competition increases 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. This is one of the standard "Schumpeterian" reasons for the negative impact of higher product market competition on innovation.

Allowing the number and type of entrants to be endogenous, however, changes this conclusion. The second "scale" effect noted above implies that when product substitutability increases, profits per firm fall for a given number of firms. Because of this fewer firms will therefore choose to enter the market so in the long-run 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.

E1. 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

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

where e_i is managerial effort, u_i is the cost shock (which we consider to be unobserved managerial ability) and $\overline{c}$ is a positive constant. Assume that u_i is distributed normally with mean zero and variance σ^2. The cost shock is only revealed after the firm has chosen to enter as managers are unsure of their ability ex ante. Effort is unobservable to the principal so the firm can only contract on c_i.

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

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

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

3. Effort Choice

All managers simultaneously choose effort levels. Each manager'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

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

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 principal observes costs (which is assumed to also be 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 she 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.

E2. Regularity assumptions

To make the analysis tractable and ensure an equilibrium be need to make some 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 the "escalation" effects of Sutton (1991) that imply as a market gets large firms may start investing in cost reducing investments that cause the number of entrants to fall.

E3. 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. This 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:

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

E4. 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 equation (12) is negative. Also 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 and this reduces the profits from any given increase in market share engendered by higher managerial effort. Since the value of cutting costs is proportional to demand, piece rates also fall as the firm will want to reduce b (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. Hart, 1983, 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

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

[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.

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.

E5. Conclusions

The purpose of this Appendix was to examine the relationship between product market competition and management in the context of a simple model that allows "optimal" choice of managerial practices (in this case managerial effort) when there is heterogeneity in managerial ability. It therefore combines elements of both of the "pure" models discussed in Section II of the main text.

We have shown in the context of this simple model that the intuition that tougher market competition will generally improve management practices (effort) in the long-run is correct. The relationship is, however, ambiguous in the short-run when the number of firms is fixed. This set-up can be generalized in various directions and the general finding of a positive impact of competition on managerial effort (or equivalently non-tournament process R&D) is reasonably robust (see Vives, 2005).