AMERICANS DO I.T. BETTER: US MULTINATIONALS AND THE PRODUCTIVITY MIRACLE

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WEB APPENDIX

APPENDIX A: DATA

I UK Establishment level Data

A1 THE ANNUAL BUSINESS INQUIRY

The Annual Business Inquiry (ABI) is the major source of establishment level data in the UK. It underlies the construction of aggregate output and investment in the national accounts and is conducted by the Office of National Statistics (ONS) the UK equivalent of the US Census Bureau. The ABI is similar in structure and content to the US Longitudinal Research Database except that it covers non manufacturing as well as manufacturing. The recently constructed US Longitudinal Business Database covers non manufacturing but it does not have output or investment – items that are necessary to estimate production functions.

The ABI is a stratified random sample: sampling probabilities are higher for large establishments (e.g. 100 percent for all establishments with more than 250 employees). Each establishment has a unique "reporting unit reference number" (RUREF) which does not change when an establishment is taken over by a new firm. Data on the production sector (manufacturing, extraction and utilities) is in the ABI which has a long time series element (from 1980 and before in some cases). Data on the non production sector (services) is available for a much shorter time period (from 1997 onwards). The sample is large: in 1998 there are 28,765 plants in the production sector alone. The regression sample used in this paper consists of 11,064 establishments, of which 4,059 are classified in IT Intensive using industries.

The questionnaire sent out on the ABI is extensive and covers all the variables needed to estimate basic production functions. The response rates to the ABI are high because it is illegal not to return the forms to the Office of National Statistics. The ABI includes data on gross output, value added, employment, the wage bill, investment and "total materials" (this includes all purchased intermediate inputs – services, energy, material goods, etc.)[1]. Value added is gross output minus purchases. The construction of the IT and non IT capital stocks are described in the next section[2]. We condition on a sample that has positive values of all the factor inputs, so we drop establishments that have zero IT capital stocks.

A2 INFORMATION TECHNOLOGY DATASETS

Working closely with statisticians and data collectors at the ONS we combined five major IT surveys and matched this into the ABI establishment data using the common establishment code (RUREF). The main IT surveys include the Business Survey into Capitalized Items (BSCI), the Quarterly Inquiry into Capital

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[1] We examined whether breaking down intermediate inputs into bought in services ("service outsourcing") and goods made a difference. In particular we interacted the proportion of outsourced services with IT capital as in Abramovsky and Griffith (2007). Although this was significant in levels, it became insignificant when we included fixed effects.

[2] The ONS defines gross output as the sum of sales (turnover), net inventories (variation of total stocks), work of capital nature by own staff and insurance claims received.

Expenditure (QICE) and the Fixed Asset Register (FAR). We used information on hardware from the BSCI, QICE and FAR in the main part of the paper, one survey of computer use by workers (the E-Commerce Survey) and one software survey (ABI supplement). Of these, only the software survey was designed to cover exactly the same establishments as contained in the ABI survey, but because there is over-sampling of the larger establishments in all surveys the overlap is substantial, especially for the larger establishments. These surveys contain information on the value (in thousands of pounds) of software and hardware acquisitions and disposals. Once the stocks are built within each different survey, we combine them across surveys and, for hardware and software separately, we build across-survey stocks[3]. In the following paragraphs we first describe the different surveys; we then illustrate the details of the Perpetual Inventory Method used for the construction of the capital stocks and the procedure followed to build across-surveys variables.

A2.1 Data Sources

Quarterly Inquiry into Capital Expenditure (QICE). The QICE provides information on hardware and software investments from 2000Q1 until 2003Q4. The inquiry selects 32,000 establishments each quarter. Establishments with over 300 employees are selected every quarter. Businesses with fewer employees are selected for the inquiry randomly. Each quarter one fifth of the random sample is rotated out of the sample and a new fifth is rotated in. The quarterly data have been annualized in several alternative ways and we checked the robustness of the results across these methods. First, we extrapolated within year for establishments with missing quarters[4]. As a second alternative, we constructed an indicator that gives the number of non missing values that exist for each year and establishment and included this as an additional control in the regressions. Third, we dropped observations constructed from less than four full quarters. The results were robust across all three methods and the tables report results based on the first method. QICE contributed 80 percent of the IT hardware data in the final sample.

Business Survey into Capitalized Items (*BSCI).* The BSCI asks for detail of acquisitions and disposals of capital in more than 100 categories, including computer hardware and software. The survey is annual and runs between 1998 and 2003; we dropped the 1998 cross section due to concerns over reliability expressed by the data collectors. There is a 100 percent sampling frame for businesses with more than 750 employees and a stratified random sample of businesses with between 100 and 750 workers. The BSCI contributes about 1,500 to 2,000 observations for each year between 1999 and 2003. We use the SIC92 code 30020 defined as "Computers and other information processing equipment". Notes to this category specify "Microcomputers, printers, terminals, optical and magnetic readers (including operating systems and software bundled with microcomputer purchase)." BSCI contributed 17 percent of the IT hardware data in the final sample.

Fixed Asset Register (FAR). The FAR asks for the historic cost (gross book value) of the fixed assets held on the firms' asset register, broken down by the years of acquisition. The survey provides information on IT hardware assets only, and covers the years 1995 up to 2000. FAR contributed 3 percent of the IT hardware data in the final sample.

E-Commerce Survey. The E-Commerce Survey was conducted in 2001, 2002 and 2003 with around 2,500 establishments in each cross section. Unfortunately these were random cross-sections so the overlap between years is minimal (preventing us from performing serious panel data analysis). Plant managers were directly asked "What proportion of your employees uses a computer, workstation or terminal". To construct an estimate of the number of employees using IT we multiplied this proportion by the number of workers in the establishment. Although this is conceptually much cruder than the IT capital stock, it has the advantage that we do not have to rely so much on assumptions concerning the initial conditions. In Table 4 we discuss the results from this measure, showing very similar results to those obtained from using the IT capital measure.

Software questions in the Annual Business Inquiry (ABI). The ABI contains a question on software expenditures from 2000 onwards. There are approximately 20,000 non zero returned values for software investments in each

[3] We are careful to check for differences in coefficients due to the IT measures coming from different surveys. We could not reject the assumption that there were no significant differences in the IT coefficients arising from the fact that the IT stocks were built from different surveys.

[4] The extrapolation was done by simple averaging, but we also tried more sophisticated quarterly models taking into account the quarter surveyed. This made practically no difference.

year. We had some concerns about the accuracy of the establishment reports of software expenditure[5] so we focus in the main part of the paper on the IT hardware stocks.

A2.2 Estimation of IT capital stocks

We build stocks of IT capital applying the Perpetual Inventory Method to the IT investment data (and the non IT investment data) described above. The basic equation for IT capital is:

$$C_{it} = I_{it}^{c} + \left(1 - \delta^{c}\right)C_{it-1}$$

where I_t^c represents real investment in IT and δ_t^c is the depreciation rate. To construct real investment we deflate nominal investments using the economy-wide hedonic price indices for IT hardware provided by the National Institute of Economic and Social Research (which are based on Jorgensen's US price deflators). We rebased to the year 2000 for consistency with the other PPI deflators (see below). Non IT capital stock is built in an analogous way.

Zeros: Both the BSCI and the QICE code record missing values as zeros. While in the BSCI we are able to identify actual zero investments through a specific coding, for the QICE this is not possible. In the construction of the capital stocks we treated the zero investments observations as actual absence of IT investments. In the regressions we drop observations with zero IT capital stocks

Interpolations: In order to maximize the number of observations over which we could apply the Perpetual Inventory Method, we interpolated net investment observations for a single year of data if we observed investment the year before and the year afterwards. This affected only 2.8 percent of the observations in the regression sample and results are robust to dropping these observations.

Initial Conditions: In order to apply the Perpetual Inventory Method, we need to approximate a starting value to start the recursion. We construct establishment level capital stocks in the ARD by building two digit industry-specific IT Investment/Capital ratios using the NISEC02 industry level data-set provided by the National Institute of Economic and Social Research, which contains separate time-series data on IT capital stocks and runs up to 2001 (these are based on the input-output tables starting in 1975). We then use the ratio of the establishment's IT investment flow to the industry investment flow to impute the IT capital stock (i.e. we are assuming that the establishment's share of the IT capital stock in the industry is equal to the establishment's share of IT investment in the industry in the initial year). More precisely, we assume that for *t* = 0 only the initial establishment level IT capital stock C_{i0} is: $C_{i0} = (I_{it}^{C} / I_{jt}^{C})\mathrm{C}_{jt} \ \forall \ i \in j$ where *j* represents an industry so a *j* sub-script represents an industry total – i.e. I_{jt}^{C} is total industry IT investment and C_{jt} is the total IT capital stock in time *t.* We apply this approximation to determine our initial condition in the first year that the establishment appears in our sample. For greenfield sites this is not an issue as their capital stock is zero. After the first year, we simply apply the Perpetual Inventory Method.

Some of the establishments that we observe only for the first time may be investing systematically at a different rate from the industry average. To check whether our results were driven by the methodology used to build the initial conditions, we considered an alternative methodology based on employment weights to calculate the starting value, C_{i0}^{*} : $C_{i0}^{*} = (L_{it-1} / L_{jt-1})C_{jt-1}\left(1-\delta\right) + I_{it}^{C}$. So this is assuming that the establishment's share of the industry IT stock in the initial period is equal to the establishment's lagged share of employment.

Depreciation: For all IT capital we chose a depreciation rate of 36 percent. This choice is consistent with the analysis by methodology followed by the BEA which, in turn, derives from the study by Doms, Dunn, Oliner and Sichel (2004). In this study, the depreciation rate for computers is estimated at approximately 50 percent, this value including both obsolescence and revaluation effects. Since – as the BEA - we use real IT investments we have to use a lower depreciation rate to avoid double counting of the revaluation effect, included in the price deflators. Basu et al (2003) argue that the true geometric rate of depreciation should be, in fact, approximately 30 percent. The significance and the magnitude of the coefficient obtained for IT capital is not affected by the exact choice of the alternative depreciation rate.

Across-Survey Stocks: Following the steps described above, we obtain hardware and software stocks within each different survey. We then matched our constructed IT dataset with the ABI sample. In order to simplify the

[5] For example, many software values are imputed and the coding for the imputation does not make it clear how the imputation took place and for which establishments.

empirical analysis, we combined all the information of the different surveys constructing overall across-surveys IT stocks for both hardware and software. Our strategy is to use the BSCI measure as the most reliable observation (as recommended by the data collectors). We then build our synthetic measure using the QICE stocks if the BSCI observation is missing or equal to zero and the QICE is different from zero. We finally use the FAR if both QICE and BSCI are missing and/or equal to zero and the FAR is not.

In order to keep track of the possible measurement error introduced using this procedure, we introduce in all the IT regressions a dummy that identifies which survey the IT data came from. These dummies and their interactions with the IT coefficients are not significantly different from zero. A small portion of the firms included in our dataset responded to more than one survey. We use some of this overlapping sample to get a better understanding of the measurement error in the data. By comparing the reports from the same establishments we calculate that there is much more measurement error for software than for hardware, which is one reason why we focus on hardware. We did not find any evidence that the measurement error for IT capital was different for US firms than other firms.

A3 DEFINITION OF I.T. INTENSIVE USING INDUSTRIES

We focus on "IT intensive" sectors that are defined to be those that use IT intensively and are not producers of information or communication technologies. The definitions of IT usage and IT producers are based on O'Mahony and Van Ark (2003) who base their definitions on Kevin Stiroh (2002). They use US data to calculate the capital service flows and define IT use intensity as the ratio of IT capital services to total capital services. IT intensive using sectors are those where (a) the industries has above median IT capital service flows to total capital service flows and (b) the industry is not an IT producing industry. All industries are based on ISIC Revision 3. The industry definitions are detailed in Table A1.

A4 CLEANING

We used standard procedures to clean the ABI and the IT data. First, we dropped all observations with negative value added and/or capital stock. Secondly we dropped the top and bottom percentile of the distribution of the growth of employment and gross value added. Thirdly, we dropped top and bottom percentile of the distribution of total capital stock per employee and gross value added per employee. This step of the cleaning procedure was performed on the overall ABI sample. We applied a similar cleaning procedure also to our across surveys IT variables. We dropped the top and bottom percentiles of the ratio of the IT capital (and expenditure) relative to gross value added[6].

A5 DEFINITION OF FOREIGN OWNERSHIP AND UK MULTINATIONALS

The country of ownership of a foreign firm operating in the UK is provided in the ABI and is based on information from Dun and Bradstreet's Global "Who Owns Whom" database. Dun and Bradstreet define the nationality of an establishment by the country of residence of the global ultimate parent, i.e. the topmost company of a world-wide hierarchical relationship identified "bottom-to-top" using any company which owns more than 50 percent of the control (voting stock, ownership shares) of another business entity. UK Multinationals are identified via the matching of the ABI with the Annual Foreign Direct Investment (AFDI) register made by Criscuolo and Martin (2009). The AFDI identifies the population of UK firms which are engaging in or receiving foreign direct investment (FDI)[7]. Each establishment in the ABI that is owned by a firm which appears in the AFDI register can consequently be defined as a multinational. UK multinationals are thus UK-owned firms which appear in the AFDI.

A6 TAKEOVERS

The identification of takeovers consists of three basic steps. First, for all the available years (1980-2003 for manufacturing and 1997-2003 for services) we use all the raw ABI data (including "non selected" establishments where we know employment but not output or capital). We thus create a register file that allows us to keep track of the whole history of each firm, and exploit the uniqueness of the reporting unit reference number (RUREF) to correct for obvious reporting problems (i.e. establishments that disappear in one year, and appear again after some time). Second, for each establishment we keep track of changes in the foreign ownership information and the enterprise group reference number (this is a collection of RUREFs owned by a single group) to identify foreign and domestic takeovers[8]. Third, to control for measurement error in the takeover identification, we drop from the sample some ambiguous establishment observations: (a) establishments that are subject to more than three takeovers during their history; (b) for the establishments with two or three takeovers, we dropped observations where a time period could be simultaneously as "pre" and "post" takeover. We use up to three years prior to the takeovers in the "pre-takeover" regressions and up to three years after the takeover in the "post takeover" regressions. The year when the takeover occurred is dropped because it is unclear when in the year the establishment switched.

We have three types of takeover: by a US multinational, by a non US multinational and by a domestic firm. When a US multinational takes over an establishment already owned by another US multinational this does not represent a change in its status, even though it is coded as a US takeover. Consequently we excluded from the sample all takeovers where an establishment did not change multinational ownership status (i.e. we dropped US takeovers of US firms, non US multinationals takeovers of non US multinational firms and domestic takeovers

[6] The results of the regression are qualitatively similar if the IT data are cleaned using the ratio of investments per employee or stocks per employee.

[7] The working definition of Foreign Direct Investment for this purpose is that the investment must give the investing firm a significant amount of control over the recipient firm. The ONS considers this to be the case if the investment gives the investor a share of at least ten per cent of the recipient firm's capital.

[8] Foreign takeovers are observed if a firm experiences a change in the foreign ownership marker. Domestic takeovers are observed if a UK firm changes its enterprise reference number.

of purely domestic firms). This is quite a conservative approach. Bloom, Sadun and Van Reenen (2007) present results where we do not drop these establishments and show qualitatively similar results.

A7 DESCRIPTIVE STATISTICS

Panel A of Table A2 gives some descriptive statistics for our key variables. Note that median employment in the establishment is 238 which are larger than the ABI median because the IT surveys tend to focus on the larger establishments. Average IT stock is just over £1m ($1.5m) and value added per worker is just under £40,000 ($60,000). On average labor costs account for 30 percent of revenues and materials costs account for 57 percent. IT capital services are 1 percent of revenues and non IT capital services is estimated at 12 percent of revenues (both at rental prices).

Panel B of Table A2 breaks down mean values of the IT capital - output ratio and ln(IT capital) by ownership type and whether or not the sector is IT intensive. US multinationals have a higher IT capital-output ratio than non US multinationals in all sectors, especially so in IT intensive sectors. The levels of IT capital show much higher values for US establishments than non US multinationals (especially in the IT intensive sectors).

A8 SAMPLE SELECTION ISSUES FOR THE UK ESTABLISHMENT DATA

First, note that the ABI/IT sample has larger than average establishments primarily because the IT surveys we use deliberately chose a sampling frame that puts higher weight on establishments with greater employment (even more so than the ABI itself) since the intention was to use the survey for national statistics. For example, the QICE survey gives us 80 percent of all observations in our IT dataset. This was sent to all establishments with over 300 employees, but a randomized smaller number of smaller establishments in size bands. This is a selection on an observable known sampling weight, so this should not cause bias.

To investigate any potential bias we examined the probability of response by establishments belonging to US multinationals vs. those belonging to non US multinationals. Although the structure of the IT samples means that larger plants are more likely to be in our sample, the issue is where US multinationals are more likely to respond than non US multinationals. In other words is the bias “balanced”? Table A3 shows that the bias does seem to be balanced. Looking at the sample as a whole, column (1) shows that 53.1 percent of US multinational establishments in the ABI are in the IT sample compared to 52.7 percent of non US multinationals in column (2), a remarkably similar proportion, By contrast, only 13.5 percent of domestic establishments are contained in our sample. The lower response rate and the differential correlation with covariates suggests that domestic plants are not a good control group for multinationals. However, the similar response rates and correlation with observables suggests that US and non US multinationals are selected to a similar degree, which are the two groups we are comparing. Further, the domestic firms in our sample are the larger, more successful establishments, a bias which works against the finding that multinationals are more productive than non multinationals.

Column (1) of Table A3 examines all US multinationals in the ABI. The outcome variable is a dummy for 1 if the establishment is included in the IT sample and zero otherwise. A 10 percent increase in plant size is associated with an increases the probability of being in the sample by 1.53 percentage points. Column (2) shows that the equivalent test for the full ABI sample of non US multinationals. The results imply that a 10 percent increase in size is associated with an increase in the probability of being in the sample by 1.49 percentage points. A test of the difference in these coefficients on size across the two samples in column (1) and (2) shows that there is no significant difference (a p-value of 0.611). By contrast, column (3) shows that employment has a smaller effect for the domestic plants (a 10 percent increase in is associated with an increases the probability of being in the sample by only 1 percentage point).

The next three columns of Table A3 repeat the analysis for the IT intensive sample with similar results: (i) US response rates are 51 percent compared to 49 percent for non US multinationals, (ii) the size coefficient is 0.18 vs. 0.17 and (iii) the p-value of this difference is 0.985. The final three columns do the same for the non IT intensive sample.

The reason why larger establishments respond is due to the sampling frame, no non random response conditional on being selected to be in the sampling frame. To show this we use the full ABI survey and selected all establishments with more than 100 employees. We estimated a model where the dependent variable is unity if an establishment answered the QICE survey and zero otherwise. There was no indication that the larger establishments (or more capital intensive establishments) were disproportionately likely to respond as the coefficient on size is insignificant in the multinational samples. Similar results were obtained for the BSCI.

We conclude that there is no evidence that the differences between US multinational and non US multinationals could be driven by sample selection issues.

II. European Firm-level Panel

As noted in the text this is constructed from three main data sources: the CEP Management Survey, the Harte-Hanks IT database and the Amadeus database. Descriptive statistics are contained in Table A2 Panel C.

A9 CEP MANAGEMENT SURVEY

In the summer of 2006 we used a team of 51 MBA-type students to collect data on management practices on 4,003 firms in 12 countries (see Bloom, Sadun and Van Reenen, 2009, for a full description). Following the methodology in Bloom and Van Reenen (2007) we used a survey grid of 18 questions which relate to key aspects of workplace management. Four of these questions relate to "people" management and these are the questions we have focused on in the paper. The questions are open rather than tick box and the interviewers are trained to probe with follow up questions in order to ascertain what is actually going on in the firm. Table A4 gives an example of the questions we used to probe managers and the overall grid. They relate to the promotion system, the fixing/firing of poor performers, the rewarding of high performers and the incentives and importance given to attracting and retaining talented workers. Each question is scored on a scale of 1 ("worst practice") to 5 ("best practice") and our basic composite measure z-scores each individual question, averages across the four questions and then z-scores this average[9]. For example, on the promotion question a low score indicates that employees are promoted solely on the basis of tenure, whereas a high score reflects firms who promote on the basis of effort and ability. The other management practice data we collected related to shop-floor operations (lean manufacturing techniques), monitoring (tracking and reviewing of individual and factory performance) and targets (the breadth, realism and interconnection of goals).

Although high scores on these practices are *a priori* likely to be related to higher productivity, we do not need to take a stance in this paper on whether a high score necessarily corresponds to something which will be in and of itself beneficial to productivity. The scores simply reveal whether the firm devotes much effort to promoting, rewarding and retaining its most talented workers and we investigate whether such practices are complementary with IT capital.

We use a "double blind" method where the interviewees did not know that they were being scored. This is to avoid the well known sample bias arising from the psychological reflex to give an answer that the interviewee thinks the interviewer wants to hear. The other part of the double-blind methodology is that the interviewers did not know anything about the firm's 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 270 employees) would not be known by name and are rarely reported in the business media.

The survey is targeted at plant managers in firms randomly drawn from the population of all public and private firms with between 100 and 5000 employees in the manufacturing sector. The interviews took an average of 50 minutes with the interviewers running an average of 78.5 interviews each, over a median of 3 countries, allowing us to remove interviewer fixed effects. In our France, Germany, Italy, Poland, Portugal, Sweden and UK sample we had a response rate of 49.5 percent and the response rate was uncorrelated with firm performance[10]. We also collected detailed information on the interview process including the interview duration, date, time of day, day of the week, and self-assessed reliability score, plus information on the interviewees' tenure in the company, tenure in the post, seniority and gender. We run robustness tests including these plus interviewer fixed-effects as 'noise-controls' to help control for any potential measurement error, and found that the results are extremely similar to those reported here.

A10 HARTE HANKS IT DATA

We use an establishment level IT data panel taken from the European Ci Technology Database (CiDB) produced by the international marketing and information company Harte-Hanks (H-H). H-H is a multinational that collects IT data primarily for the purpose of selling on to large producers and suppliers of IT. The fact that H-H sells this data on to major firms like IBM and Cisco exerts a strong market discipline on the data quality. Major

[9] We investigated other weighting schemes such as factor analysis which gave similar results to those reported here.

[10] The high response rate was achieved by a number of steps. First, we obtained 22 letters of endorsement from Governments, Central Banks and Employers Federations across the 12 countries. Second, the survey is confidential and does not discuss financial data (which we can obtain from AMADEUS). Third, we called the survey "*a piece of work*", since the word "*survey*" typically leads to switchboard rejections. Finally, we rewarded interviewers for high response rates, so they persisted in chasing firms for interviews, contacting them 5.2 times each on average.

discrepancies in the data are likely to be rapidly picked up when H-H customers' sales force placed calls using the survey data. Because of this H-H conducts extensive internal random quality checks on its own data, enabling them to ensure high levels of data accuracy.

The H-H data has been collected annually for over 160,000 establishments across 14 European countries since the mid-1990s. They target all firms with 100 or more employees, obtaining about a 45 percent success rate in their global sampling frame (54.5 percent for the sample with accounting and CEP management survey data from France, Germany, Italy, Poland, Portugal, Sweden and the UK, as used in Table 6 column (1)). Response rates do not seem to be systematically related to performance. The data for Europe is collected via one call centre in Dublin, so that all variables are defined on an identical basis across countries. In this paper we use the data only for the firms we matched to those we collected management data on in the France, Germany, Italy, Poland, Portugal, Sweden and the UK[11]. The papers by Bresnahan et al (2002) and Brynjolfsson and Hitt (2003) have also previously used the US H-H data, matching the US data to some of the larger firms in Compustat (all publicly listed).

The H-H survey contains detailed hardware, equipment and software information at the establishment level. We focus on using computers per worker as our key measure of IT intensity because this is available for all the establishments and is measured in a comparable way across time and countries. This computers per worker measure of IT has also been used by other papers in the micro-literature on technological change (see, for example, Beaudry, Doms and Lewis, 2006) and is highly correlated with other measures of IT use like the firm's total IT capital stock per worker[12].

A11 BVD AMADEUS ACCOUNTING DATA

Bureau Van Dijk (BVD) is a private sector supplier of the AMADEUS database. This contains company-level data on private and public firms from all over Europe. The data are taken from company registries so, in principle, cover the entire population of incorporated firms. Unlike the US, most European countries insist that basic firm accounts are lodged centrally even for unlisted firms (e.g. there are about 2.1m firms per year in UK Company House in the Amadeus data). BVD obtains these accounts data in electronic form and sells it as the Amadeus database. Reporting is generally good for firms with over 100 employees, but legal requirements on reporting every data item do vary from country to country (for example there are many missing values on capital in Germany for smaller firms).

For the management survey our sampling frame was taken from Amadeus so we have some data for all seven European countries – France, Germany, Italy, Poland, Portugal, Sweden and the UK (1,828 firms). We lose 1000 firms because we need to match this to H-H which is also a random sample, and 108 firms due to jumps or multi-matches or missing values in the accounting or H-H data. We match to H-H by name cross checking the information on size, address and industry.

An additional problem is that H-H surveys establishments within the firm, so do not always cover 100 percent of all workers in the firm. We aggregate across establishments using employment weights to form an estimate of the firm-level number of computers per worker. We use this coverage ratio to weight the regressions. We also include a fifth order polynomial expansion of this coverage ratio as a "noise" control in the regression. The sample mean of coverage is 73 percent, reflecting the fact in most firms all the workers are covered by the H-H survey. All results are robust to dropping the 12 percent of observations with less than 25 percent coverage.

A12 SAMPLE SELECTION ISSUES FOR THE EUROPEAN FIRM PANEL

The European firm panel combines three datasets:

<u>(I) Accounting data from BVD</u>: This is the population of firms that Bureau Van Dijk (BVD) typically obtain from each countries' national registry of companies (e.g. Companies House in the UK). Hence, as a firm population there is no response bias. Comparing the employment coverage in this database to the Census databases does, as expected, show a very close correspondence (see Bloom, Sadun and Van Reenen (2009)).

[11] In Bloom, Draca and Van Reenen (2011) we use the full 14 country data-set on all establishments to analyze the impact of Chinese trade-competition on European firms. There is an extensive description of the data in that paper.

[12] For example, in our establishment level data a regression of ln(IT capital stock per employee) on the ln(proportion of employees using computers) gives a coefficient of 0.63.

(II) CEP Management data: Our sampling frame for the Management survey was firms with between 100 to 5,000 employees whose primary industry was in manufacturing derived from the BVD database. Within this sample Table A5 shows that response rates appear uncorrelated with everything except firm size. In column (1) we report that ownership status is not correlated with response rates. In column (2) we show firm size is statistically significant in survey response, although the magnitude of this is not that large - doubling a firm's size is associated with only a 4.9 percent higher probability of being surveyed (4.9=0.035*log(2)/0.495). In column (3) we include both size and ownership status and show that ownership status remains insignificant. Finally, in column (4) we also include a measure of labor productivity and show survey response is uncorrelated with this.

(III) Harte-Hanks (H-H) data: The H-H survey aims to sample all incorporated firms with over 100 employees. Their sampling frame is also based on the same BVD dataset, but they contacted all firms rather than a random sample as in the CEP management survey. We investigate their sampling bias in Table A6, using the subset of firms also in the CEP Management sample. In Table A6 we find that larger firms were more likely to respond to the H-H survey, but that there is no differential response rates of multinationals compared to domestic firms. In Column (1) we show statistically that ownership is uncorrelated with response rates. In column (2) we see that firm size is significantly correlated with response rates with a coefficient of 0.123 on ln(employment). This means that a doubling of firm size is associated with a 15.6 percent higher probability of responding (15.6 percent = 0.123*ln(2) /0.545). In column (4) we also include our measure of people management and find this is insignificant in explaining sample response for the H-H survey. In column (5) we also add in productivity, again finding this insignificant.

APPENDIX B: MODELS OF MANAGERIAL PRACTICES

In this section we look at our model more formally. In the first sub-section we present the basic model. In the short-run we consider fixed management practices (*O*) and in the long-run we allow them to vary. In the second sub-section we consider some extensions to the model allowing for the in-between case where there are costs of adjustment.

I. Basic Set-Up

The model is very simple and has three key features. First, IT and people management (*O*) are complements. Second, the US has a lower cost of people management. Third, when a multinational takes over a plant it is able to transfer its management after one period when it pays a fixed "disruption" which is independent of the plant's initial level of *O*. Using this model we consider what happens during a period of rapidly falling IT prices. This model generates predictions that are consistent with the micro and macro stylized facts we observe in the data:

1. US firms will have higher levels of *O*
2. US firms will have a higher observed elasticity of output respect to *C*
3. As IT prices fall US labor productivity growth will initially exceed that of the EU

Consider two representative firms, one in the US and one in the EU. To keep things as simple as possible we assume that all parameters are common in the two regions, except that the US has a lower "price" (ρ^O) for people management practices (*O*). This could arise for a wide variety of reasons such as lighter labor market regulations in the US, for example. The firms produce output (*Q*) by combining IT (*C*) inputs, labor inputs (*L*) and "people management" inputs with all other inputs (non IT capital, *K*, and materials, *M*) assumed to be zero for simplicity. Define the production relationship as:

$$Q = AO^{\alpha^O} C^{\alpha^C + \sigma O} L^{\alpha^L - \sigma O} \qquad \text{(B1)}$$

This specification of the production function is a simple way of capturing the notion that IT and management are complementary when $\sigma > 0$. This implies that the IT per worker ratio is increasing in the level of *O*. If *O* is quasi-fixed, when IT prices unexpectedly fall the firm with the largest initial stock of *O* stands to gain the most because it will obtain a higher marginal return from increasing the IT to labor ratio.

We should consider (B1) as a revenue function with monopolistic competition and iso-elastic demand so $\alpha^O + \alpha^L + \alpha^C < 1$. Note that it is not necessarily the case that $\alpha^O > 0$. In some industries higher levels of people management may not be beneficial for output ($\alpha^O = 0$).

Since this is a non standard production function (we think of it as an approximation to a more flexible form such as a translog), we have to be careful in ensuring that it is concave.

We assume that

$$0 \le \alpha^{L} - \sigma O \le 1 \qquad \text{(B2)}$$

and

$$0 \le \alpha^{C} + \sigma O \le 1 \qquad \text{(B3)}$$

We first consider the case where is *O* is fixed (short-run). We then consider a variety of cases where we allow management practices to vary. We consider the very long-run where *O* is perfectly flexible, then consider two intermediate cases where *O* can be changed (i) only by entry/exit and takeover and (ii) by paying a convex adjustment cost.

II. Fixed Management (O)

Flow profits are:

$$\Pi = Q - WL - \rho^{C}C - \rho^{0}O \qquad \text{(B4)}$$

where *W* is the wage rate, ρ^{O} is the rental price of people management and ρ^{C} is the rental price of IT capital. The first order conditions (FOC) for IT and labor are:

$$\alpha^{C}\frac{Q}{C} + \sigma\frac{OQ}{C} = \rho^{C} \qquad \text{(B5)}$$

$$\alpha^{L}\frac{Q}{L} - \sigma\frac{OQ}{L} = W \qquad \text{(B6)}$$

Combining these first order conditions we obtain:

$$\ln\left(\frac{C}{L}\right) = \ln\left(\frac{W}{\rho^{C}}\right) + \ln\left(\frac{\alpha^{C} + \sigma O}{\alpha^{L} - \sigma O}\right) \qquad \text{(B7)}$$

Consequently, IT intensity is increasing in people management:

$$\frac{\partial \ln(C/L)}{\partial O} = \left(\frac{\sigma}{\alpha^{C} + \sigma O}\right) + \left(\frac{\sigma}{\alpha^{L} - \sigma O}\right) > 0 \qquad \text{(B8)}$$

This establishes that observed *C/L* will tend to be higher for firms with higher *O*. Interestingly this implies that the rate of growth of IT intensity should be the same for high and low *O* firms (if *O* is fixed). This is consistent with what we observe in the data (US and EU growth rates of IT capital were similar after 1995).

What happens when IT prices unexpectedly decline? Consider expressing the production function in terms of output per worker. We get an increase of the IT to capital ratio *(C/L)* and from the production function this will lead to high labor productivity. Importantly, this increase will be greater the larger is the initial level of *O*

$$(q - l) = \sigma[(c - l) * O)] + \alpha^{C}(c - l) + \alpha^{O}(o - l) + a + (\alpha^{C} + \alpha^{L} + \alpha^{O} - 1)l \qquad \text{(B9)}$$

III Variable Management (O)

We consider three cases for variable *O*. First, in sub-section B1 we consider the long-run fully flexible case. Second, in sub-section B2 we consider the case where *O* changes through takeover. Third, in sub-section B3 we consider the case where firms can change through paying adjustment costs.

B1 PERFECTLY FLEXIBLE *O*

We begin with the "long-run" case of perfectly flexible *O*. To ensure that the second order condition ($\frac{\partial^2 Q}{\partial O^2} < 0$) with respect to *O* holds we assume the following condition:

$$-\left(\frac{2\alpha^O}{\sigma O} + \ln\left(\frac{\alpha^C + \sigma O}{\alpha^L - \sigma O}\right)\right) < \ln\left(\frac{W}{\rho^C}\right) < \ln\left(\frac{\alpha^L - \sigma O}{\alpha^C + \sigma O}\right) \quad \text{(B10)}$$

This ensures concavity of the production function. The first order condition for *O* is well defined as:

$$\alpha^O \frac{Q}{O} + \sigma Q \ln\left(\frac{C}{L}\right) = \rho^O \quad \text{(B11)}$$

We can substitute the first order conditions for labor and capital into the first order condition for *O* to derive a function that implicitly defines *O* as:

$$\lambda(O) = Ae^Z[\alpha^O O^{\alpha^O - 1} + \sigma O^{\alpha^0} \ \ln(W/\rho^C)] - \rho^O \ = 0 \quad \text{(B12)}$$

Where:

$$Z = -\sigma O \ln\left(\frac{\rho^C}{W}\left(\frac{\alpha^L + \sigma O}{\alpha^C - \sigma O}\right)\right) +$$

$$\frac{(\alpha^C + \alpha^L)[a + \ln O + \sigma O \ln(W/\rho^C)] - \alpha^C \ln \rho^C - \alpha^L \ln W + \alpha^L (1 + 2\sigma)\ln(\alpha^C + \sigma O) + \alpha^C (1 - 2\sigma)\ln(\alpha^L - \sigma O)}{1 - \alpha^L - \alpha^C}$$

We can consider the comparative statics using the implicit function theorem

$$\frac{\partial O}{\partial x} = -\frac{\partial \lambda / \partial x}{\partial \lambda / \partial O}$$

This generates long-run optimal levels for the three endogenous variables (O*, C*, L*) as a function of the exogenous factor prices $\rho = \{\rho^C, \rho^O, W\}$, and technological parameters, $\theta = \{\alpha^C, \alpha^O, \alpha^L)$.

$$O^*(\rho^C, \rho^O, W; \theta),\ C^*(\rho^C, \rho^O, W; \theta),\ L^*(\rho^C, \rho^O, W; \theta)$$

From this we can get our basic predictions:

1. $\left(\frac{\partial O^*}{\partial \rho^O}\right) < 0$. So if ρ^O (the price of *O*) is higher in the EU than US then $\overline{O}^{US} > \overline{O}^{EU}$.

2. $\left(\frac{\partial C^*}{\partial \rho^C}\right) < 0$. As IT prices fall firms will increase their level of IT inputs.

3. $\left(\frac{\partial O^*}{\partial \rho^C}\right) < 0$. As IT prices fall more O is accumulated if $\ln\left(\frac{W}{\rho^C}\right) > -\left(\frac{1-\alpha^L-\alpha^C}{\alpha^C+\sigma O}\right)$. Note that a sufficient (but not necessary) condition for this is W > ρ^C . To see this note that

$$\frac{\partial \lambda}{\partial \rho^C} = Ae^Z \alpha^O O^{\alpha_O - 1} \frac{\partial Z}{\partial \rho^C} - \sigma A e^Z O^{\alpha_O} \left[\frac{1}{\rho^C} - \ln\left(\frac{W}{\rho^C}\right) \frac{\partial Z}{\partial \rho^C} \right] \quad \text{(B13)}$$

The first term on the right hand side of $\frac{\partial \lambda}{\partial \rho^C}$ is negative since $\frac{\partial Z}{\partial \rho^C} = \frac{-(\alpha^C+\sigma O)}{\rho^C(1-\alpha^L-\alpha^C)}$ < 0. The second term will also be negative if W > ρ^C. If W < ρ^C, we also require that $\ln\left(\frac{W}{\rho^C}\right) > -\left(\frac{1-\alpha^L-\alpha^C}{\alpha^C+\sigma O}\right)$.

B2. MANAGEMENT (*O*) CAN CHANGE ONLY BY TAKEOVER (ENTRY/EXIT)

Some models assume that management is fixed for a given firm and can only change with entry/exit. We consider a related model where *O* changes by takeover (but allow *O* to be different across firms of different nationalities). Consider a model where a firm that takes over another firm can raise its management practices to the level of the predator, but has to pay a one period fixed cost, F, in order to do this (disruption costs associated with re-organizing the managerial structures). This captures the idea that re-organizing is easier to do via M&A activity than internally.

When IT prices fall, firms will want to increase *O*, call this new optimal level O*. Other firms with higher levels of *O* will seek to takeover the low *O* firms. Consider what happens when a higher *O* firm takes over a low *O* firm. The acquired firm will see (after one period) its *O* rise. Post-restructuring, the coefficient on IT in the production function will be higher because of this higher *O*. The firm's IT capital will also increase because the marginal value of IT is higher because of the higher *O*.

During the period of restructuring the predictions are more ambiguous. Assume the disruption cost depends on the size of the acquired firm, F = fQ. During the re-organization period the firm will bear the cost of lost output due to disruption so this will tend to lower productivity. However, if there are adjustment costs to IT (see below) then the firm may accumulate more IT assets in rational anticipation of higher *O* in subsequent periods: this will tend to raise labor productivity. In any case, the gains in labor productivity stemming from the increase in the productivity-IT correlation will not be apparent immediately after the takeover, but will occur with a lag.

In terms of the endogeneity of takeovers consider a domestic plant with management, O^{DOM} , being considered by two multinationals, US and EU. The differential costs of organization in the US and EU mean that on average:

$$O^{US} > O^{EU} > O^{DOM}$$

For firms with "low *O*" (defined as having an optimal level of *O* is greater than O^{EU}) the US firm will tend to select these firms. Both EU and US firms will place a positive value on taking over the plant so long as the disruption cost is less than the increased value of the firm arising from transferring across management practices. The US firm has an advantage over the EU firm, however, because it is able to raise *O* to a higher level (its optimal level in fact if $O^{US} \geq O^*$) whilst bearing the same disruption costs as the EU firm. Consequently, we may expect to see US firms selecting the worse performing European plants (with particularly low *O*).

B3 ADJUSTMENT COSTS IN MANAGEMENT (*O*)

More generally, management practices can change for a given firm, but this will be a costly process. In Bloom et al (2007) we consider in detail this more complex model. In short, this makes the analysis more complex so the model must be numerically simulated. But it does not change the key results and intuitions from the above model.

One way to model this is to define $g(\Delta O)$ as the adjustment cost function where Δ is the first difference operator (e.g. $\Delta O_t = O_t - O_{t-1}$). We assume that the management adjustment cost term $g(\Delta O)$ has a quadratic component and a fixed disruption component and is borne as a financial cost. This is parameterized as

$$g(\Delta O) = \omega_m(\Delta O)^2 + \eta PQ|\Delta O \neq 0|$$

where m = {EU,US}. Bloom, Sadun and Van Reenen (2007) consider a case where $\omega_{EU} = \omega_{US}$ and the more realistic case that $\omega_{EU} > \omega_{US}$. They show how the main intuition in the basic model goes through, but one needs to use numerical methods to show the transitional dynamics of firms in the two economies.

IV. Implications for Total Factor Productivity

We have focused our model on understanding the dynamics of labor productivity as this has had the clearest difference between the US and EU at the macro level. But there also appears to be some difference in TFP. Our baseline model even with quadratic managerial adjustment costs does not predict an acceleration in measured TFP, because the observed factor share of ICT capital in revenues will still give the correct weight in TFP calculations (i.e. it will be equal to $\alpha^C + \sigma$). If we allowed for adjustment costs in IT capital, however, this would lead to a measured increase in TFP in the US compared to Europe, at least after an initial acceleration in the fall of IT prices (see Bloom et al, 2007, Appendix B).

Basu et al (2003) are able to generate an increase in the observed TFP following an increase in IT capital in a simpler model. Their set-up is similar to ours with complementarity between IT and *O* (modelled as a CES nested in a Cobb-Douglas between the aggregate *G(C,O)* factor, labor, non IT capital and materials). Investment in *O* is in the form of lost output, so in the initial stages of a sharp fall in IT prices measured TFP falls as firms rapidly accumulate IT and *O* and measured output is "too low". In subsequent periods after the *O* stock has been built, however, output is correctly measured, but the *O* capital input is underestimated so TFP is overestimated. Since the US invested in IT more quickly this could explain the faster measured US TFP growth post 1995.

This is elegant and also fits the facts, but it does not explain why the US started to adjust before the EU. Our model suggests that this is because the US already had a higher level of *O* prior to the acceleration in the decline of IT prices in the mid 1990s: this is why labor productivity growth picked up faster in the US for a similar rate of increase of IT capital growth in both regions. It may be, in addition, that costs of adjustment are lower in the US and this could explain why the US "moved first" both in Basu et al's model and in our extended model.

APPENDIX C: ADDITIONAL RESULTS

Table C1 contains alternative econometric estimates of the production function allowing for endogenous factor inputs. The structural model of firm behaviour underlying the Olley-Pakes (1996) approach is not consistent with simply including interactions, so instead we estimate the production function separately for the three ownership types separately: US multinationals in column (1), non US multinationals in column (2) and UK domestic firms in column (3). For the same reason we do not normalize the outputs and inputs by labor in this table. Note that the extension of Olley and Pakes to two observable state variables that are influenced by the firm (the IT and non IT capital stock) is straightforward (see Ackerberg et al, 2008). We have two investment equations (for IT and non IT) that we could invert to control for the unobserved productivity shocks, ω_{it}. We found similar results for either and the results below use non IT capital. To be precise, assuming strict monotonicity, we invert the non IT investment equation, $i_{it}^K = i_t^K(c_{it}, k_{it}, \omega_{it})$ to solve for $\omega_{it} = \omega_t(c_{it}, k_{it}, i_{it}^K)$ [13]. This enters the unknown function $\phi_{it} = \phi(\alpha^K k_{it} + \alpha^C c_{it} + \omega_t(c_{it}, k_{it}, i_{it}^K))$ which is included in the first step when we estimate the coefficients on the variable factor inputs.

The key empirical finding is that IT coefficient is twice as large for US multinationals as it is for non US multinationals (0.0758 vs. 0.0343), which is consistent with our earlier findings[14].

[13] The only difference from standard Olley-Pakes is that non IT investment is a function of IT capital stock as well as non IT capital stock and the unobserved productivity term.

[14] As with the main results we experimented with including four digit industry output following Klette and Griliches (1996) to allow for monopolistic competition. Again, there was some evidence of imperfect competition with larger mark-ups for US multinationals, but this did not affect the finding that the IT coefficient for US multinationals was again double the magnitude of that on non US multinationals (0.077 vs. 0.035).

Column (4) presents results for the System GMM estimator of Blundell and Bond (1998). Note that if the Markov Process determining the evolution of unobserved productivity shock in Olley and Pakes can be represented by an AR(1) process, the Olley-Pakes set-up becomes a special case of Blundell and Bond (2000). It is a special case because, the Blundell Bond set-up allows for fixed effects and endogeneity of the capital inputs (capital is weakly exogenous in Olley-Pakes). A practical disadvantage of Blundell and Bond is that it requires at least four continuous time series observations to exploit all the moment conditions which results in a smaller sample size for estimation purposes.

The results of column (4) of Table A4 are consistent with those observed in the rest of the paper. The interaction of IT with the US is positive and significant at the 5 percent level. This is significantly different from the IT coefficient on non US multinationals at the 10 percent level (in the short-run and the long-run). The LM and Sargan-Hansen tests are consistent with the validity of the instrument set.

Note that the specification is not identical to Blundell and Bond (2000) but actually follows Nickell (1996). We also experimented with including the full set of lagged right hand variables as in Blundell and Bond (2000) but found that the common factor restrictions were rejected. This was because almost all the other lags were insignificant. The only lagged factor input that appeared to be significant was materials. When lagged materials is also included in the regression the US IT coefficient remained significantly higher than the non US IT coefficient at the 10 percent level (see column (5) of Table C1).

Table C2 contains some additional results from the European firm-level panel. The first column includes our baseline results of Table 6 column (3) for comparison purposes. Column (2) is an equivalent specification except we use the z-score of the three shopfloor operations management questions instead of the people management scores. The interaction with IT is positive but insignificantly different from zero. The third column uses the 5 questions on monitoring which again produces a positive, but insignificant interaction. Column (4) does the same for the 5 target management questions with similar results. Finally in column (5) we use the z-score of all 18 management questions. In this case we do observe a weakly significant positive interaction (at the 10 percent level). The coefficient and significance levels are far lower than column (1), however, suggesting that it really is the people management practices that seem to matter.

TABLE A1 – BREAKDOWN OF THE INDUSTRIAL SECTORS BY IT USAGE

<u>IT Intensive Sectors</u>

Manufacturing	***Services***
18 Wearing apparel, dressing and dyeing of fur	51 Wholesale trades
22 Printing and publishing	52 Retail trade
29 Machinery and equipment	71 Renting of machinery and equipment
31 Manufacture of Electrical Machinery and Apparatus n.e.c. excludes 313 (insulated wire)	73 Research and development
33 Precision and optical instruments, excluding 331 (scientific instruments)	
351 Building and repairing of ships and boats	
353 Aircraft and spacecraft	
352+359 Railroad equipment and transport equipment	
36-37 miscellaneous manufacturing and recycling	

<u>Other Sectors</u>

Manufacturing	***IT producing sector?***	***Services***	***IT producing sector?***
15-16 Food drink and tobacco	No	50 Sale, maintenance and repair of motor vehicles	No
17 Textiles	No	55 Hotels and catering	No
19 Leather and footwear	No	60 Inland transport	No
20 Wood	No	61 Water transport	No
21 Pulp and paper	No	62 Air transport	No
23 Mineral oil refining, coke and nuclear	No	63 Supporting transport services, travel agencies	No
24 Chemicals	No	64 Communications	Yes
25 Rubber and plastics	No	70 Real estate	No
26 Non metallic mineral products	No	72 Computer services and related activity	Yes
27 Basic metals	No	741-743 Professional business services	No
28 Fabricated metal products	No	749 Other business activities n.e.c.	No
30 Office machinery	Yes		
313 Insulated wire	Yes	***Other sectors***	
321 Electronic valves and tubes	Yes	10-14 Mining and quarrying	No
322 Telecom equipment	Yes	50-41 Utilities	No
323 Radio and TV receivers	Yes	45 Construction	No
331 Scientific instruments	Yes		
34 Motor vehicles	No		

Notes: See text for definitions. IT intensive sectors are those that have above median IT capital flows as a proportion of total capital flows (in the US) and are <u>not</u> IT producing sectors. These are taken directly from Stiroh's (2002) definitions.

TABLE A2 - DESCRIPTIVE STATISTICS

Panel A: All Establishments in UK Establishment Panel

Variable	Mnemonic	Mean	Median	Standard Deviation
Employment	L	811.098	238.000	4,052.766
Gross Output	Q	87,966.380	20,916.480	456,896.000
Value Added	VA	29,787.610	7,052.000	167,798.700
IT Capital	C	1,030.595	77.438	10,820.690
Value Added per worker	VA/L	40.429	29.530	55.192
Gross Output per worker	Q/L	124.745	86.034	136.555
Materials per worker	M/L	82.377	47.226	103.518
Non IT Capital per worker	K/L	85.275	48.563	112.535
IT Capital per worker	C/L	0.964	0.339	2.079
Share of Materials in revenue	M/PQ	0.572	0.602	0.229
Share of Labour Expenditures in revenue	WL/PQ	0.300	0.262	0.196
Share of Non IT Capital services in revenue	$\rho^K K/PQ$	0.825	0.642	0.864
Share of IT Capital services in revenue	$\rho^C C/PQ$	0.010	0.004	0.018
Multi-plant dummy (i.e. is establishment part of larger group?)		0.532	1.000	0.499

Panel B: Breakdown by Ownership Status and Sector in UK Establishment Panel

		IT Capital over value added (C/VA)			Ln(IT Capital)		
		All Sectors	IT Using Intensive Sectors	Other Sectors	All sectors	IT Using Intensive Sectors	Other Sectors
All firms	**Mean**	0.03	0.03	0.02	4.46	4.78	4.27
	St. Deviation	0.04	0.04	0.04	2.03	2.06	1.99
	Observations	7,121	2,703	4,418	7,121	2,703	4,418
US Multinationals	**Mean**	0.04	0.04	0.03	5.57	5.69	5.46
	St. Deviation	0.05	0.05	0.04	2.00	1.94	2.05
	Observations	569	260	309	569	260	309
Other Multinationals	**Mean**	0.03	0.03	0.03	5.18	5.34	5.07
	St. Deviation	0.04	0.04	0.04	1.96	1.99	1.93
	Observations	2,119	853	1,266	2,119	853	1,266
UK domestic	**Mean**	0.02	0.03	0.02	3.98	4.33	3.79
	St. Deviation	0.04	0.04	0.03	1.91	1.99	1.83
	Observations	4,433	1,590	2,843	4,433	1,590	2,843

Notes: The UK establishment panel consists of 7,121 establishments in 2001. All monetary amounts are in sterling in year 2001 prices. Total stocks are constructed as described in the Appendix. All variables in units of 1,000s except variables given in ratios and employment.

TABLE A2 - DESCRIPTIVE STATISTICS – CONT.

Panel C: European Firm Level Panel

		(1) Employment	(2) Sales per employee	(3) computers per employee	(4) percent employees with a degree	(5) People management (z-scores)
		Normalized to 100 for the country, 3-digit SIC and year average				Absolute value
US Multinationals	**Mean**	105.9	110.5	104.1	105.7	0.395
	St. Deviation	83.3	54.9	29.2	63.7	0.639
	Observations	125	125	51	144	175
Other Multinationals	**Mean**	104.5	107.2	99.5	102.7	0.092
	St. Deviation	77.7	42.2	38.1	60.9	0.674
	Observations	254	254	121	359	419
European domestic	**Mean**	97.1	95.2	99.5	97.3	-0.134
	St. Deviation	69.4	41.4	43.9	70.6	0.677
	Observations	650	650	292	869	1,040

Notes: The European firm level panel consists of 1,029 firms in 2001 (the smaller sample size in Table 6 is due to some missing values). All monetary amounts are in sterling in year 2001 prices. Total stocks are constructed as described in the Appendix. All variables in units of 1,000s except variables given in ratios and employment.

TABLE A3 - EXAMINING SELECTION BIAS FOR THE UK ESTABLISHMENT IT/ABI SAMPLE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Whole Sample			**IT Intensive Sample**			**Non IT Intensive Sample**		
Type of Establishment	**US Multinationals**	**Non US Multinationals**	**Domestic Firms**	**US Multinationals**	**Non US Multinationals**	**Domestic Firms**	**US Multinationals**	**Non US Multinationals**	**Domestic Firms**
Mean of dependent variable	**0.531**	**0.527**	**0.135**	**0.514**	**0.492**	**0.111**	**0.546**	**0.554**	**0.154**
Ln(Employment)	0.1526***	0.1493***	0.1007***	0.1845***	0.1668***	0.0939***	0.1183***	0.1348***	0.1042***
	(0.0092)	(0.0092)	(0.0011)	(0.0117)	(0.0059)	(0.0018)	(0.0143)	(0.0066)	(0.0015)
# Establishments	1,071	4,019	32,807	505	1,733	14,318	566	2,286	18,489

Notes: * significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent. The sample is all establishments in the ABI . The dependent variable is a dummy variable equal to 1 if an establishment was in our sample (and zero otherwise). Estimation is by OLS with robust standard errors in parentheses under coefficients. Three digit industry dummies included.

TABLE A4: THE PEOPLE MANAGEMENT SURVEY QUESTIONS

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. 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?

Scoring grid:	Score 1	Score 3	Score 5
	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

2. 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?

Scoring grid:	Score 1	Score 3	Score 5
	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

3. 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?

Scoring grid:	Score 1	Score 3	Score 5
	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

4. 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?

Scoring grid:	Score 1	Score 3	Score 5
	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

TABLE A5: INVESTIGATING SAMPLING BIAS IN THE CEP MANAGEMENT SURVEY

	(1)	(2)	(3)	(4)
Mean Dep. Var.	**0.495**	**0.495**	**0.495**	**0.495**
Sample	**All firms**	**All firms**	**All firms**	**All firms**
USA				
USA Ownership	0.0342 (0.0255)		0.0274 (0.0257)	0.0247 (0.0259)
MNE				
Non US multinational	0.0243 (0.0189)		0.0214 (0.0189)	0.0186 (0.0192)
ln(L)				
Labor		0.0354*** (0.0089)	0.0344*** (0.0089)	0.0338*** (0.0090)
ln(Q/L)				
Labor productivity				0.0105 (0.0120)
Firms	4,809	4,809	4,809	4,809
Joint test USA & MNE	0.226		0.353	0.457

Notes: * significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent. Sample are the manufacturing firms with between 100 and 5,000 employees contacted as part of the CEP management survey. The dependent variable in all columns is equal to unity if the firm was successfully interviewed in the CEP Management Survey (and zero otherwise). Data from France, Germany, Italy, Poland, Portugal, Sweden and the UK. The estimation method in all columns is OLS. Robust standard errors in brackets under coefficients in all columns. All columns include a full set of three-digit industry, country and interviewer dummies. "Joint test USA & MNE" is the p-value of the joint test of the significance of the coefficients on the two multinational ownership dummies.

TABLE A6: INVESTIGATING SAMPLING BIAS IN THE HARTE-HANKS DATA

	(1)	(2)	(3)	(4)	(5)
Mean Dep. Var.	**0.545**	**0.545**	**0.545**	**0.545**	**0.545**
Sample	**All firms**	**All firms**	**All firms**	**All firms**	**All firms**
USA	-0.0468		-0.0659	-0.0613	-0.0582
USA Ownership	(0.0410)		(0.0406)	(0.0412)	(0.0415)
MNE	0.0328		0.0171	0.0189	0.0224
Non US multinational	(0.0280)		(0.0274)	(0.0275)	(0.0280)
ln(L)		0.1232***	0.1238***	0.1251***	0.1113***
Labor		(0.0144)	(0.0144)	(0.0146)	(0.0263)
People management				-0.0106	-0.0090
People management				(0.0173)	(0.0175)
ln(Q/L)					-0.0140
Labor productivity					(0.0221)
Firms	1,828	1,828	1,828	1,828	1,828
Joint test USA & MNE	0.176	0.159	0.186	0.184	0.184

Notes: * significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent. Sample is the CEP Management Survey matched accounting data used in Table 6. The dependent variable is equal to 1 if a firm was in the HH survey and zero otherwise. Data from France, Germany, Italy, Poland, Portugal, Sweden and the UK. The estimation method in all columns is OLS. Robust standard errors in brackets under coefficients in all columns. All columns include a full set of three digit industry dummies and country dummies. "Joint test USA & MNE" is the p-value of the joint test of the significance of the coefficients on the two multinational ownership dummies.

TABLE A7 – MAIN RESULTS CONTROLLING FOR INDUSTRY OUTPUT

	(1)	(2)	(3)
Dependent variable: Output per employee	**ln(Q/L)**	**ln(Q/L)**	**ln(Q/L)**
Sector	**IT Using Intensive Sectors**	**IT Using Intensive Sectors**	**IT Using Intensive Sectors**
ln(M/L) Materials per employee	0.5018*** (0.0279)	0.5008*** (0.0278)	0.5003*** (0.0274)
ln(K/L) Non IT Capital per employee	0.1056*** (0.0228)	0.1067*** (0.0229)	0.1063*** (0.0228)
ln(L) **Labor**	-0.1279*** (0.0319)	-0.1276*** (0.0317)	-0.1275*** (0.0317)
ln(C/L) **IT capital per employee**	0.0123** (0.0051)	0.0121** (0.0051)	0.0121** (0.0050)
USA **USA Ownership**	0.0451 (0.0366)	0.0440 (0.0366)	-0.3888** (0.1895)
MNE **Non US multinational**	0.0173 (0.0172)	0.0157 (0.0173)	-0.2622** (0.1177)
USA*ln(C/L) **USA ownership*IT capital per employee**	0.0368** (0.0144)	0.0366** (0.0144)	0.0367** (0.0146)
MNE*ln(C/L) **Non US multinational *IT capital per employee**	-0.0003 (0.0064)	-0.0002 (0.0063)	-0.0007 (0.0063)
ln(Industry Output) **Sum of industry output at the SIC4 level**		0.0179*** (0.0069)	0.0076 (0.0081)
USA*ln(Industry Output) **USA ownership*Sum of industry output at the SIC4 level**			0.0294** (0.0135)
MNE*ln(Industry Output) **Non US multinational *Sum of industry output at the SIC4 level**			0.0187** (0.0080)
Observations	7,784	7,784	7,784
Test USA*ln(C/L)=MNE*ln(C/L)	0.0094	0.0095	0.0096
Test USA*ln(Industry Output)=MNE*ln(Industry Output)			0.4043

Notes: * significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent. The dependent variable in all columns is the log of gross output per employee. The time period is 1995-2003. The estimation method in all columns is OLS. All columns include establishment level fixed effects. Standard errors in brackets under coefficients in all columns are clustered by establishment (i.e. robust to heteroskedasticity and autocorrelation of unknown form). All columns include a full set of three digit industry dummies interacted with a full set of time dummies and as additional controls: dummies for establishment age (interacted with a manufacturing dummy), region, multi-establishment group (interacted with ownership type) and a dummy for IT survey. See Table A1 for definition of IT using intensive sectors.

TABLE A8 - RESULTS ESTIMATED SEPARATELY BY TWO-DIGIT INDUSTRY

SIC2 Description	SIC2	IT intensive	IT producing	Coefficient on USA ownership*IT capital per employee	Standard error	Obs
Other Mining and Quarrying	14			-0.5074**	(0.2303)	80
Manufacture of Food Products and Beverages	15			0.0035	(0.0249)	1,110
Manufacture of Textiles	17			0.0085	(0.0606)	314
Manufacture of Wearing Apparel; Dressing and Dyeing of Fur	18	**yes**		0.2500**	(0.1036)	73
Manufacture of Wood And Products of Wood And Cork, Except Furniture; Manufacture of Articles of Straw and Plaiting Materials	20			0.9083***	(0.1477)	79
Manufacture of Pulp, Paper and Paper Products	21			-0.0087	(0.0162)	364
Publishing, Printing and Reproduction of Recorded Media	22	**yes**		0.0426	(0.0489)	635
Manufacture of Chemicals and Chemical Products	24			0.0056	(0.0227)	673
Manufacture of Rubber and Plastic Products	25			-0.0288	(0.0257)	660
Manufacture of Other Non metallic Mineral Products	26			-0.0437	(0.0404)	419
Manufacture of Basic Metals	27			-0.0217	(0.0248)	342
Manufacture of Fabricated Metal Products, Except Machinery and Equipment	28			-0.1076***	(0.0388)	558
Manufacture of Machinery and Equipment Not Elsewhere Classified	29	**yes**		-0.0164	(0.0208)	728
Manufacture of Office Machinery and Computers	30		**yes**	1.2138***	(0.3123)	116
Manufacture of Electrical Machinery and Apparatus Not Elsewhere Classified	31		**part**	-0.0309	(0.0431)	358
Manufacture of Radio, Television and Communication Equipment and Apparatus	32		**part**	-0.0080	(0.0331)	353
Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	33	**part**	**part**	0.1875**	(0.0727)	262
Manufacture of Motor Vehicles, Trailers and Semi-trailers	34		**yes**	0.0183	(0.0152)	479
Manufacture of Other Transport Equipment	35	**part**		-0.1380	(0.1192)	239
Manufacture of Furniture; Manufacturing Not Elsewhere Classified	36	**yes**		-0.0218	(0.0250)	265
Construction	45			-0.0938	(0.0576)	979

(ctd.)

TABLE A8 (CONTINUED) - RESULTS ESTIMATED SEPARATELY BY TWO-DIGIT INDUSTRY

SIC2 Description	SIC2	IT intensive	IT producing	Coefficient on USA ownership*IT capital per employee	Standard error	Obs
Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Automotive Fuel	50			0.1501	(0.0915)	540
Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles	51	yes		0.0228	(0.0197)	2,603
Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Personal and Household Goods	52	yes		0.0870***	(0.0192)	1,387
Hotels & restaurants	55			-0.0451	(0.0288)	995
Land Transport; Transport Via Pipelines	60			0.0107	(0.0223)	634
Water Transport	61			0.0000	(0.0000)	91
Air Transport	62			0.0000	(0.0000)	93
Supporting And Auxiliary Transport Activities; Activities Of Travel Agencies	63			0.1153**	(0.0516)	735
Post and Telecommunications	64		yes	-0.0479	(0.0560)	300
Activities Auxiliary to Financial Intermediation	67			0.0000	(0.0000)	97
Real Estate Activities	70			-0.1491**	(0.0713)	699
Renting of Machinery and Equipment Without Operator and of Personal and Household Goods	71	yes		0.2798**	(0.1139)	354
Computer and Related Activities	72		yes	0.1286	(0.0881)	599
Research and Development	73	yes		0.1692	(0.3102)	134
Other Business Activities	74		part	0.0752*	(0.0457)	2015
Sewage and Refuse Disposal, Sanitation and Similar Activities	90			0.0000	(0.0000)	139
Activities of Membership Organisations Not Elsewhere Classified	91			0.0000	(0.0000)	149
Recreational, Cultural and Sporting Activities	92			-0.0904	(0.1041)	775
Other Service Activities	93			0.0754	(0.0784)	144

Notes: * significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent. Each raw refers to a different regression. The dependent variable in all rows is the log of gross output per employee, and all the inputs included in Table 2 are included as controls. The time period is 1995-2003. The estimation method in all columns is OLS. All columns include establishment level fixed effects. Standard errors in brackets under coefficients in all columns are clustered by establishment (i.e. robust to heteroskedasticity and autocorrelation of unknown form). All columns include a full set of three digit industry dummies interacted with a full set of time dummies and as additional controls: dummies for establishment age (interacted with a manufacturing dummy), region, multi-establishment group (interacted with ownership type) and a dummy for IT survey. See Table A1 for definition of IT using intensive sectors.

TABLE A9 - INDUSTRY RESULTS - AGGREGATION AT FIRM LEVEL - GLOBAL SIZE

	(1)	(2)	(3)	(4)	(5)
Dependent variable: Output per worker	**ln(Q/L)**	**ln(Q/L)**	**ln(Q/L)**	**ln(Q/L)**	**ln(Q/L)**
Sectors	**All IT Intensive Excluding Wholesale and Retail**	**Wholesale and Retail**	**IT Using Intensive Sectors**	**IT Using Intensive Sectors**	**IT Using Intensive Sectors**
Fixed effects	**YES**	**YES**	**YES**	**YES**	**YES**
Fixed effects level	**Establishment**	**Establishment**	**Establishment**	**Firm**	**Establishment**
USA*ln(C/L)	0.0347*	0.0413**	0.0368***	0.0456**	0.0434**
USA ownership*IT capital per employee	(0.0181)	(0.0208)	(0.0128)	(0.0183)	(0.0169)
MNE*ln(C/L)	-0.0024	0.0007	-0.0003	0.0016	0.0150
Non US multinational *IT capital per employee	(0.0072)	(0.0099)	(0.0059)	(0.0083)	(0.0104)
ln(C/L)	0.0102**	0.0149*	0.0123***	0.0148***	0.0220
IT capital per employee	(0.0046)	(0.0086)	(0.0045)	(0.0049)	(0.0440)
ln(M/L)	0.6381***	0.3832***	0.5018***	0.4791***	0.5729***
Materials per employee	(0.0358)	(0.0308)	(0.0245)	(0.0247)	(0.0472)
ln(K/L)	0.0575***	0.2213***	0.1056***	0.1461***	0.0519
Non IT Capital per employee	(0.0208)	(0.0600)	(0.0205)	(0.0182)	(0.0449)
ln(L)	-0.0916***	-0.0741	-0.1279***	-0.0310*	-0.0745
Labor	(0.0269)	(0.0642)	(0.0298)	(0.0163)	(0.0845)
USA	0.0473	0.0026	0.0451	-0.0252	-0.2215*
USA Ownership	(0.0579)	(0.0320)	(0.0281)	(0.0323)	(0.1324)
MNE	0.0396	-0.0066	0.0173	0.0168	-0.0535
Non US multinational	(0.0242)	(0.0191)	(0.0127)	(0.0196)	(0.0742)
Ln(Global Size)* ln(C/L)					-0.0015
Size of group * IT capital per employee					(0.0035)
Observations	3,938	3,846	7,784	6,972	2,205
Test USA*ln(C/L)=MNE*ln(C/L)	0.0563	0.0491	0.0036	0.0145	0.0951

Notes: * significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent. The dependent variable in all columns is the log of gross output per employee. The time period is 1995-2003. The estimation method in all columns is OLS.. All variables in Column (4) are aggregated at the firm year level. Columns (1), (2), (3) and (5) include establishment level fixed effects. Column (2) includes firm level fixed effects. Standard errors in brackets under coefficients in columns (1), (2) and (5) are clustered by establishment. Standard errors in brackets under coefficients in columns (3) and (4) are clustered by firm. Column (4) is weighted by the share of total firm employment which is part of the regression sample. Column (5) is the sub-sample where we can establish group size (=ln(turnover)) using AMADEUS data (this is time invariant). All columns include a full set of three digit industry dummies interacted with a full set of time dummies and as additional controls: dummies for establishment age (interacted with a manufacturing dummy), region, multi-establishment group (interacted with ownership type) and a dummy for IT survey. See Table A1 for definition of IT using intensive sectors.

TABLE C1 – GMM-SYS AND OLLEY-PAKES ESTIMATES OF THE PRODUCTION FUNCTION

	(1)	(2)	(3)	(4)	(5)
Sample	**US multinationals**	**Other multinationals**	**Domestic UK**	**All establishments**	**All establishments**
Estimation Method	**Olley-Pakes**	**Olley-Pakes**	**Olley-Pakes**	**GMM**	**GMM**
Sectors	IT Using Intensive	IT Using Intensive	IT Using Intensive	All	All
Dependent Variable	**Ln(Q)**	**Ln(Q)**	**Ln(Q)**	**Ln(Q)**	**Ln(Q)**
USA*ln(C_t) **USA Ownership*IT capital**				0.0524*** (0.0192)	0.0368** (0.0165)
MNE*ln(C_t) **Non US Multinational *IT capital**				0.0158 (0.0180)	0.0070 (0.0159)
ln(C_t) **IT Capital**	0.0774* (0.0409)	0.0351** (0.0170)	0.0471*** (0.0119)	0.0268* (0.0153)	0.0237* (0.0142)
ln(M_t) **Materials**	0.5825*** (0.0318)	0.6481*** (0.0188)	0.6283*** (0.0269)	0.2993*** (0.0539)	0.4423*** (0.0579)
ln(K_t) **Non IT Capital**	0.0674 (0.0640)	0.1000*** (0.0282)	0.1114*** (0.0268)	0.0774** (0.0320)	0.0686*** (0.0276)
ln(L_t) **Labor**	0.1920*** (0.0319)	0.2069*** (0.0140)	0.2142*** (0.0173)	0.179*** (0.0371)	0.1394*** (0.0360)
USA **USA Ownership**				-0.3540*** (0.1142)	-0.2630*** (0.0984)
MNE **Non US Multinational**				-0.0858 (0.1218)	-0.0339 (0.1075)
ln(Q_{t-1}) **Lagged Output**				0.4164*** (0.0830)	0.5321*** (0.0861)
ln(M_{t-1}) **Lagged Materials**					-0.2010*** (0.0636)
Observations	615	2,022	3,692	978	978
First order serial correlation, p value				0.000	0.000
Second order serial correlation, p value				0.707	0.572
Sargan-Hansen, p-value				0.943	0.972
Test USA*ln(C) = MNE*ln(C), p-value (short-run)				0.0926	0.1044
Test USA*ln(C)= MNE*ln(C), p-value (long-run)				0.0871	0.1077

Notes: * significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent. The dependent variable in all columns is the log of gross output. The time period is 1995-2003. All variables are expressed in deviations from the year-specific three digit industry mean. Columns (1)-(3) are estimated using Olley-Pakes (1996). We use a fourth order series expansion to approximate the φ(.) function (the first stage control function). Standard errors in Olley-Pakes are bootstrapped (clustered at the establishment level) with 200 replications. Columns (4) and (5) are estimated using System-GMM (Blundell and Bond, 1998). One step GMM results reported. In column (4) instruments are all establishment level factor inputs lagged t-2 and before (when available) in the differenced equation (i.e. m_{t-2}, l_{t-2} ,k_{t-2},$c_{t-2,}$ $q_{t-2,}$ $USA_{t-2,}$ $MNE_{t-2,}$ $(USA*c)_{t-2,}$ $(MNE*c)_{t-2}$,$q_{t-2,}$) and lagged differences in the levels equation (Δm_{t-1}, Δl_{t-1} , Δk_{t-1}, $\Delta c_{t-1,}$ $\Delta USA_{t-1,}$ $\Delta MNE_{t-1,}$ $\Delta(USA*c)_{t-1,}$ $\Delta(MNE*c)_{t-1,}$). Serial correlation tests are LM tests of the first differenced residuals (see Arellano and Bond, 1991). Sargan-Hansen Test of instrument validity is a test of the over-identification. "Test USA*ln(C) =MNE*ln(C)" is test of whether the coefficient on USA*ln(C) is significantly different from the coefficient on MNE*ln(C). Because we include a lagged dependent variable we include both a short-run and a long-run test where the latter takes the coefficient on the lagged dependent variable into account. All columns include age, region dummies and a dummy taking value one if the establishment belongs to a multi-firm enterprise group as additional controls.

TABLE C2 – EUROPEAN FIRM-LEVEL PANEL

Dependent Variable:	(1) Ln(Q/L)	(2) Ln(Q/L)	(3) Ln(Q/L)	(4) Ln(Q/L)	(5) Ln(Q/L)
People Management	0.0271				
	(0.0219)				
People Management*ln(C/L)	0.1451***				
	(0.0331)				
Operations Management		0.0189			
		(0.0171)			
Operations Management*ln(C/L)		0.0119			
		(0.0269)			
Monitoring Management			0.0255		
			(0.0159)		
Monitoring Management*ln(C/L)			0.0119		
			(0.024)		
Targets Management				0.0224	
				(0.0155)	
Target Management*ln(C/L)				0.0171	
				(0.0239)	
Overall Management					0.0261*
					(0.0156)
Overall Management*ln(C/L)					0.0409*
					(0.0236)
ln (K/L)	0.1782***	0.1825***	0.1797***	0.1794***	0.1802***
	(0.0276)	(0.0281)	(0.0284)	(0.0287)	(0.0284)
ln(L)	0.0421	0.0405	0.0399	0.0422	0.0414
	(0.0344)	(0.0367)	(0.0366)	(0.0363)	(0.0366)
ln(C/L)	0.1430***	0.1172***	0.1168***	0.1186***	0.1155***
	(0.0284)	(0.0288)	(0.0280)	(0.0289)	(0.0290)
ln(Degree)	0.0375**	0.0451**	0.0433**	0.0442**	0.0423**
	(0.0184)	(0.0183)	(0.0184)	(0.0184)	(0.0186)
USA	0.1111**	0.1364***	0.1308***	0.1329***	0.1247***
	(0.0446)	(0.0471)	(0.0473)	(0.0473)	(0.0460)
MNE	0.1604***	0.1554***	0.1545***	0.1549***	0.1590***
	(0.0355)	(0.0367)	(0.0360)	(0.0357)	(0.0359)
Observations	2,555	2,555	2,555	2,555	2,555
Firms	720	720	720	720	720

Notes: * significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent. The dependent variable in all columns is the log of sales per employee. The time period is 1999-2006, containing data from France, Germany, Italy, Poland, Portugal, Sweden and the UK. The estimation method in all columns is OLS. Standard errors in brackets under coefficients in all columns are clustered by firm (i.e. robust to heteroskedasticity and autocorrelation of unknown form). All columns include a full set of three digit industry dummies, country dummies interacted with a full set of time dummies and a public listing indicator. Columns weighted by the survey coverage rate in the Harte-Hanks data, plus include a fifth order series expansion for the coverage ratio to control for any potential survey bias.

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