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Do Well Managed Firms Make Better Forecasts?
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ABSTRACT

We link a new UK management survey covering 8,000 firms to panel data on productivity in manufacturing and services. There is a large variation in management practices, which are highly correlated with productivity, profitability and size. Uniquely, the survey collects firms' micro forecasts of their own sales and also macro forecasts of GDP. We find that better managed firms make more accurate micro and macro forecasts, even after controlling for their size, age, industry and many other factors. We also show better managed firms appear aware that their forecasts are more accurate, with lower subjective uncertainty around central values. These stylized facts suggest that one reason for the superior performance of better managed firms is that they knowingly make more accurate forecasts, enabling them to make superior operational and strategic choices.

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1. Introduction

"The sagacious business man represents the other extreme; he is constantly forecasting. Many great corporations, banks, and investment trusts today maintain statistical departments largely for the purpose of gauging the future developments of business. The carefully calculated forecasts made by these and independent services tend to reduce the element of risk, and to aid intelligent speculation." *Irving Fisher (1930)*

Economic success and the managerial ability to accurately forecast future conditions may be strongly related, as sadly illustrated by Fisher himself, who lost his fortune after the 1929 stock market crash. It is likely this anecdote generalises: errors in estimates about future economic conditions will lead firms to make many inferior decisions such as mis-timed investments or lost sales opportunities.[2]

In this paper, we test this idea directly by taking data from the new Management and Expectations Survey (hereafter, MES) that we designed and was executed by the UK Office for National Statistics (ONS). We document a new set of empirical facts on the relationship between firm performance and management practices, looking not just at forecasts and outcomes at the level of the firm, but also at their forecasting ability over macroeconomic variables such as GDP. The major novelty of this paper is in the measurement of a firm's ability to forecast future outcomes (both macro objects like GDP and micro objects such as its own turnover) that have a bearing on their ability to make good business decisions. By exploiting cross-sectional differences in the accuracy of forecasting both macro- and micro-level

[2] It has been known that judgement errors in estimates of business cases are pervasive among firms but not recognized well by business managers (Kahneman, Rosenfield, Gandhi, and Blaser, 2016).

outcomes, we robustly isolate the role of management capabilities in driving performance differences across firms. Combined with quantitative management scores, and a battery of additional firm-level control variables obtained from ONS micro-data (both MES and other productivity related surveys such as the Annual Business Survey (ABS)), we show that management capabilities matter a lot for firms' forecasting and business performance.

The MES is the largest ever survey on management capabilities in the UK covering both manufacturing and non-manufacturing firms, with its survey design adapted from the established format of the World Management Survey (WMS).[3] Moreover, the MES collects expectations data at the business level, building on the US Management and Organizational Practices Survey (MOPS) and the Atlanta Fed Survey of Business Uncertainty (SBU).[4] The MES survey attempts to measure three aspects of firms' management practices: (1) *monitoring* - how well does the firm monitor its operations and use this information for continuous improvement (e.g. effectively collecting and using key performance indicators)? (2) *targets* - are the firm's targets stretching, tracked and appropriately reviewed? (3) *incentives* - is the firm promoting and rewarding employees based on performance, managing employee under-performance, making careful hiring decisions and providing adequate training opportunities? Based on the response to each question, we retrieve the management score for each firm using an identical methodology to the US MOPS, which facilitates international comparisons.

The MES survey reference year was 2016, but also collected firm-level expectations of turnover, expenditure, investment and employment growth for 2017 and 2018. In particular, the survey asked respondents to report their 2018 expectations using a 5-point bin, assigning a

[3] See Scur et al (2021) on the WMS and also https://worldmanagementsurvey.org/

[4] See Buffington et al. (2017) on the US MOPS and Altig et al. (2020) on the SBU.

probability to each bin, for each of the four firm-level indicators. It also asks businesses to predict economy wide GDP growth 2017-18 using similar bins to the Bank of England's survey of external forecasters. This allows us to evaluate business forecasts against professional forecasters.

By combining a quantitative measure of management with direct expectations data of firms about both macro- and micro-outcomes, we obtain a set of robust stylized facts:

1) Management practices vary substantially across firms – the 10^{th} percentile of firms lacks robust monitoring or feedback processes, has limited performance incentives or employee training, while the 90^{th} percentile are as well managed as leading firms internationally.
2) Management practices are strongly associated with superior firm performance – better managed firms have higher productivity, higher profitability, size, and a greater likelihood of exporting.
3) Management scores are higher in foreign-owned multinational firms and are lower in family-owned and family-run firms.
4) Better managed firms are able to make much more accurate forecasts about macro GDP growth *and* their own micro sales growth.
5) Firms with high management scores are also aware their micro and macro forecasts are more accurate in that they have lower subjective uncertainty in their predictions.

This suggests one driver of the superior performance of well managed firms could be they are better at forecasting, and being aware of this enables them to make better business decisions and rapidly optimize operational and strategic actions.

1.1 Related literature

This paper shows that management matters for forecast quality at the firm level, highlighting the importance of firm expectations data combined with data on management practices. While large-scale data on firm expectations have been virtually non-existent until recently, there are increasingly more projects that break with this tradition by collecting direct expectations data to study firm performance as in Bloom et al. (2020) and Altig et al. (2020).[5] Our paper is unique in that we combine direct expectations with large-scale data on management practices so that (1) quantitative management scores are available for each firm, (2) our sample includes many small and large firms, and (3) both GDP and firm level turnover growth forecasts are available. By combining forecasting data with management practice data we provide new evidence that pinpoints the role of management practices in driving forecast accuracy and firm performance. Furthermore, taking advantage of firm forecasts for a common macroeconomic object helps control for idiosyncratic components that may contaminate microeconomic forecasts of firm-specific growth (Tanaka et al. (2020)).[6]

Our paper also builds on recent studies that measure firm expectations directly[7]. We closely follow Bloom et al. (2020) and Altig et al. (2020) by asking firms to provide five-point subjective probability distributions of forecasts. Similar efforts, albeit with less detailed information being asked in their surveys, to collect data on subjective distributions of firm

[5] The seminal works by Coibion and Gorodnichenko (2012), Coibion and Gorodnichenko (2015), and Coibion et al. (2018) conducted a diagnostic study on how agents form expectations and how they respond to shocks.

[6] They show that forecast accuracy is positively correlated with profitability of firms using data on large firms GDP forecasts. Smaller forecast errors about turnover, for instance, may reflect that managers are better at forecasting their own outcomes but it could also be the case that it is just easier to predict turnover because they are stable, reflecting idiosyncratic business conditions rather than differences in manager's forecasting accuracy.

[7] Other papers that study micro-level expectations include Gennaioli et al. (2016) Bachmann and Elstner (2015), Bachmann et al. (2017), Coibion et al. (2020), and Boneva et al. (2020), among others.

forecasts include Bachmann et al. (2018), Guiso and Parigi (1999), Bontempi et al. (2010), and Morikawa (2016).

Our paper relies on large-scale data on management practices, which is scant in the empirical literature on management and firm performance (see, Bloom et al. (2011) for additional references). Our methodology is adapted from US MOPS to structure the survey and obtain quantitative scores of management practices; though, ours is the largest survey on management capabilities in the UK and, unlike the US MOPS, covers both manufacturing and non-manufacturing sectors.

In the following sections, we describe the survey design and the sampling process (Section 2), followed by in-depth description of our analysis on the variation in management practices across firms and the characteristics that appear to "drive" them (Section 3). We then discuss the relationship between firm performance and management (Section 4). Section 5 focuses on the relationship between management practices and firm forecasts. We conclude in Section 6.

2. Survey Design and Sample

2.1 Survey Questions

The MES was conducted by the ONS, in partnership with the Economic Statistics Centre of Excellence (ESCoE). It was sent to 25,006 firms and covered both the production and services industries. It was a voluntary survey of firms with ten or more employees, with the same frame as the Annual Business Survey (ABS) for 2016, allowing us to match to data on value added,

employment, output and investment.[8] The sample was drawn through random sampling, stratified by employment size groups, industries and regions. It was stratified by (1) three employment size groups (10 to 49, 50 to 249 and 250 or more), (2) industries in sections B to S, (3) regions, including the nine NUTS1 English regions, Wales and Scotland.[9]

In the MES survey, there are 36 multiple choice questions drawn mostly from the 2015 US MOPS (Buffington et al, 2017). Sections B-D (12 questions) ask management practices. Section E (4 questions) asks decentralization practices. Section F (4 questions) asks business characteristics. Section G (10 questions) asks firm-level forecasts about micro-level outcomes (turnover, intermediate consumption, capital expenditure, and hiring) as well as GDP. Section H (6 questions) asks feedback about the survey.

Focusing on the management questions (sections B-D), these ask about practices around monitoring, targets, incentives. For example, Section B asks how many key performance indicators are used and how frequently employees are evaluated against key performance indicators. Section C asks whether targets are set, and if so, how easy or difficult it is to achieve targets and it also asks who is aware of targets. Section D is about incentives asking how much each employee's performance and ability are reflected in performance bonuses or promotion. Each question is accompanied by a list of options from which respondents chose options closest to the practices within their firms. For each question, scores were awarded to each option on a

[8] Employment is defined as the total number of employees registered on the payroll and working proprietors. Further details on the Annual Business Survey (ABS) can be found in the ABS Quality and Methodology Information report and the ABS Technical Report.

[9] Sections included in the sample are, B: Mining and quarrying; C: Manufacturing, D: Electricity, gas, steam and air conditioning supply; E: Water supply; sewerage, waste management and remediation activities; F: Construction; G: Wholesale and retail trade; repair of motor vehicles and motorcycles; H: Transportation and storage; I: Accommodation and food service activities; J: Information and communication; L: Real estate activities; M: Professional, scientific and technical activities; N: Administrative and support service activities; P: Education; Q: Human health and social work activities; R: Arts, entertainment and recreation; S: Other service activities.

scale of 0 to 1, where 0 was the least and 1 the most structured management practice. An overall management score was derived as a simple average of a firm's score on all individual questions (so a firm scoring 1 overall had the most structured response to all 12 questions).

Section G of MES focuses on expectations. It asks each firm to forecast the growth rate of real GDP in 2018, with the question reproduced in Figure 1. The questionnaire has seven growth bins which were taken from a Bank of England survey question sent to professional forecasters so we could evaluate firms' forecasts to professionals. We obtain expected GDP growth in 2018 as a weighted average of the seven bins taking their mid-points and twice the mid-point distance out for the end bins. [10]

We also asked firms to make forecasts about themselves (Figure 2). It asks a point forecast of 2017 total turnover, input costs, investment and hiring. It also asks firms to provide five-point subjective probability distributions of forecasts about the 2018 values of the same variables. Firms are given a blank "five-bin" scale and asked to fill five scenarios about their own future outcomes alongside probabilities. Granting them this degree of freedom is important because firm-level outcomes are widely dispersed across firms; pre-fixed bins are ill-suited for this situation because the range of outcomes requires a large number of bins, or very coarsely defined bins. From the subjective probability distributions, we retrieve both a firm's mean expectations for 2017 and 2018, and for 2018 a measure of subjective uncertainty. Comparing their expectations and realized outcomes we also obtain forecast errors for 2017 and 2018 (the difference between the firms' expectations and their eventual realized outcomes).

[10] The bins (points used for expectations) are: -4% or less (-5%), -3% to -2% (-2.5%), -1% (-1%), 0% (0%), 1% (1%), 2% to 3 % (2.5%) and 4% or more (5%).

The MES was dispatched in July 2017, about one year after the referendum in June 2016 on whether to leave the EU. There was considerable uncertainty about whether Brexit would actually occur, and if so when and what form it would take. After several rounds of negotiations with the EU side, Brexit was delayed. These facts resulted in high-level uncertainty and made it difficult for UK firms to make accurate forecasts about future economic conditions both in macro and micro levels.

2.2 Descriptive Statistics

The MES survey was a voluntary survey on a sample of 25,006 firms and the total response rate was 38.7%. 56.5% did not respond and 4.8% elected to opt out of the voluntary survey.[11] For our analysis, we impose more restrictions so that firms in the sample have no more than two question non-responses out of the 12 management practice questions. We further ensure that firms in the sample have positive employment, leaving us with an analysis sample of 7,756 firms with management scores. A set of descriptive statistics are in Table 1. Some firms have missing values for a few control variables (e.g. share of non-managers with a college degree).[12]

Panel A of Table 1 focuses on the sample we use for examining the drivers of management and its association with performance. The performance measures such as employment and productivity (value added per worker) are taken from the 2016 ABS. Firm employment size is 69 at the median and 283 at the mean. The average firm age is 17 years old, about 40% (24%) of managers (non-managers) have degrees, 42% of firms are family owned and run, 13% are

[11] See, for more information on the response rates and firm characteristics, https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/labourproductivity/articles/experimentaldataonthemanagementpracticesofmanufacturingbusinessesingreatbritain/2018-04-06.

[12] To keep the sample size stable across columns of the regression tables, for each question we generate a dummy variable equal to one for missing values (and zero otherwise), set the missing values equal to the mean and add the vector of these missing dummies to the regressions. Results are essentially unchanged if we condition on the sample of firms with all non-missing variables.

foreign owned and 36% export. Firms have an average management score of 0.59 with a standard deviation of 0.2.

Panel B of Table 1 looks at the expectations sample separating these into macro forecasts (the first three rows), micro forecasts and uncertainty measures. Firms were pessimistic about macro growth 2017-18, with an average prediction of 0.1%, even though the out-turn was 1.4%. The forecast error is the (absolute) difference between the firm's estimates and the actual out-turn which unsurprisingly gives a mean and median error of about 1.4%.

We can also compare firm estimates to those of professional forecasters in the Bank of England's Survey. Figure 3 gives the distributions showing that businesses were somewhat more pessimistic than professional forecasters.[13] Firm forecasts on GDP are skewed left in that firms assign a higher percentage of likelihood that real GDP growth is -1% or less (bin 1) and -1% to 1% (bin 2), relative to the average forecasts among professional forecasters. On the other hand, firms assign a lower percentage of likelihood that real GDP growth is 1% to 3% (bin 3) and 3% or more (bin 4) than the average forecasts among professional forecasters. Our "disagreement" measure is the absolute value of difference between each firm's forecast for GDP growth and the average forecasts in the Bank of England's survey of external forecasters. Unsurprisingly (since the mean of forecasters was close to the actual out-turn), the disagreement variable mean is quite similar to the forecast error (1.3%).

[13] To facilitate comparison, we convert the original seven bins into four bins: (1) -1% or less, (2) -1% to 1%, (3) 1% to 3%, (4) 3% or more.

The next block of descriptives in Table 1 Panel B are forecasts of firm level outcomes. For the 2016-17 period, the median firm was reasonable accurate with a forecast turnover growth of 4.6% compared to an outcome of 4.7%. The large standard deviation indicates a wide degree of variation, however. If we instead look at the absolute forecast error, the median is 6%. This suggests the substantial difficulties many firms face in accurately assessing their end year growth, even in the middle of the year (when half the data has been realized). We then construct the same statistics for the 2016-18 forecasts. As one might expect, firms found even more difficulty in forecasting this far out; the median forecast was for 4.6% growth over the whole period compared to an actual out-turn of 9%, suggesting the same pessimism as the macro forecast. It is worth noting the survey was conducted in the year after the Brexit vote which generated substantial policy uncertainty. Again, the absolute forecast error is large with a median of 11%.

Comparing the macro and micro forecasts, it appears to be more difficult to forecast their own turnover than GDP. For instance, the median of GDP forecast errors is 1.4%, whereas it is 11% for firm turnover forecasts.

The final block of descriptives in Panel B is on forecast uncertainty. We measure this as:

$$Uncertainty_i = \sqrt{\Sigma_j \left(Growth_{ij} - \overline{Growth_i}\right)^2 * Likelihood_{ij}},$$

where $Growth_{ij}$ is the firm *i*'s forecast in bin *j*, $\overline{Growth_i}$ is the sample average of the firm *i*'s forecasts over these bins, and $Likelihood_{ij}$ is the likelihood that firm *i* attached to bin *j*.

It is clear that the forecast distribution is more dispersed about turnover than about GDP: 0.4% vs. 1.7% at the mean. This is broadly consistent with those of Bloom et al. (2019), who estimate the size of uncertainty for both aggregate and idiosyncratic TFP and show micro-uncertainty is about five times larger than macro-uncertainty. Moreover, we show that micro-uncertainty is

larger than macro-uncertainty and robust to the choice of measures in that either we use forecast errors (ex-post measure of uncertainty) or dispersion of forecasts (ex-ante measure of uncertainty).

Figure 4 presents three binscatters with some basic sense checks of the data. Panel A shows that firms with higher GDP forecast uncertainty have greater GDP forecasting errors on average. Panel B shows a similar relationship for turnover, with firms with higher turnover uncertainty providing forecasts with greater average absolute error. Panel C shows that firms' GDP and turnover uncertainty are positively correlated, so the factors that lead to better or worse macro and micro forecasting confidence are common across firms.

In what follows, we will analyze the factors that might explain the accuracy and confidence with which firms are making their macro and micro-economic forecasts. A common theme emerges that firms with more structured management practices make more certain and more accurate forecasts and as a consequence, better business decisions.

3. Drivers of Management Practices

Management practice differs significantly across and within countries (Bloom and Van Reenen, 2007). We first look at the cross-sectional dispersion of management scores, then examine how firm-level characteristics are related to management practices. Figure 5 displays the kernel density plot of the management scores within three broad size classes of firms (10-49; 50-249 and 250 plus employees). There is wide variation in all three groups, consistent with evidence from other studies. The mean and median of the distribution increases with firm size, suggesting that larger firms have higher scores. There is also a hint of larger dispersion amongst smaller firms. Table 2 investigates this relationship across six broad industries using four size

bins. The final row reproduces the result that mean management scores rises monotonically as firm size bins get larger, and this is generally true across all sectors. There is some variation in mean management scores across sectors with the construction industry particularly low (0.43) and business services particularly high (0.53).

Table 3 reports how management scores are correlated with various characteristics. Measuring firm size by log employment, column (1) corroborates the statistical significance of Figure 5 and Table 2. Column (2) then includes fixed effects for two-digit industry and location (11 regions) and "Other Controls" (dummies for the month when the survey was returned; time spent on the survey, dummies for reporting accuracy[14] and a multi-site dummy). The size coefficient hardly changes (from 0.063 to 0.061) and remains highly significant. Column (3) includes ownership/governance dummies. Foreign-owned firms have significantly higher management scores and family-run firms have significantly lower scores. Family-owned firms who are run by professional outside managers are no worse than other firms.

To dig deeper into the family firm effects, columns (5) through (7) of Table 3 re-run the specification of column (4), but split the by the size bands of Figure 5. The coefficient on family owned and run is monotonically decreasing with firm size. It suggests that being family-run is not a disadvantage for smaller firms; being family run presents a severe management disadvantage for larger firms. By contrast, foreign ownership is positively associated with better management throughout the size distribution, with its effect particularly large for smaller firms. Turning to the other variables, the skills of both managers and non-managers are significantly positively correlated with higher management scores across all columns. Older

[14] This is measured by the disparity between turnover reported in ABS 2016 and as declared in the MES 2016.

firms have significantly lower management scores, but only in the smallest size category. This suggests that although there may be a cohort effect, with more recent firms adopting modern management practices, competitive selection effects offset this for firms with over 50 employees.[15]

4. Management and Firm Performance

It is well understood that productivity varies substantially across firms and establishments (e.g. Syverson, 2011). We now study the relationship between firm performance indicators and management practices. Columns (1) through (7) of Table 4 use labor productivity (log gross value added per worker) as the dependent variable. Column (1) is a simple bivariate regression and shows a strong and significant positive relationship between productivity and management score. This implies that a one standard deviation increases in the management score (0.196) is associated with a 0.166 log point increase in productivity.[16] Column (2) adds in the industry, location and other basic controls from Table 3. Columns (3) and (4) then include the log capital-labor ratio[17], log employment and other controls (age, skills, ownership). Even with all these variables included simultaneously in column (4) the coefficient on management is still large at 0.724 and statistically significant. Looking at the coefficients on the other variables, the output elasticity with respect to capital is low at 0.13 and we obtain somewhat decreasing returns to scale as indicated by the negative coefficient on labour inputs. As with management, family

[15] It is only among the smaller firms who are able to "hang on" (possibly because they operate in product niches, somewhat shielded from competition), that the cohort effect dominates the selection effect.

[16] Alternatively, increasing the management score from the 10th to the 90th percentile (0.509 as show in base of Table 4) is associated with a 0.43 log point increase in productivity.

[17] For our capital stock series, we apply the perpetual inventory method, starting from the firm's initial level of capital stock to generate a subsequent series of capital stock using the firm-level investment data from the ABS (2008-2016) and industry-level deflators. We use a capital depreciation rate of 12%. Initial capital stock is calculated by assuming that the firm is in steady state, so the initial investment rate is divided by the depreciation rate plus the steady state growth rate (assumed to be a three year moving average of the GDP growth rate).

firms have lower productivity and multinationals higher productivity. Older firms appear more productive, consistent with selection effects: older firms are those who have managed to survive competitive market pressures.

Columns (5) through (7) of Table 4 split by employment size. Management scores have positive and significant coefficients across all size bands, and the magnitude is not significantly different for large firms than smaller ones. We switch the dependent variable to profit per employee in column (8) and an exporting dummy in column (9).[18] The management score has a positive and significant coefficient on both of these alternative measures of success.

5. Forecast Accuracy, Uncertainty and Management

We turn to examine the relationship between management practices and forecast accuracy. In this section, we restrict our sample to satisfy three criteria for "good responses". Firstly, firms must complete at least two bins (see Figures 1 and 2) with full information. Secondly, the values answered for five scenarios about their own future outcomes must be weakly increasing from the lowest to the highest bin. Finally, the sum of percentage likelihoods in these bins must be within range of 90% to 110%. The share of the firms in our sample which satisfy these criteria is 88% and is comparable to that in the US MOPS (85% in Bloom et al. (2020)).[19]

[18] We define profit as gross value added minus labor costs. Exporting is a dummy indicating if a firm exports any goods or services outside the UK, and zero otherwise.

[19] Firms that can return good responses have certain characteristics. In Table A1, we regress good response dummies on various firm characteristics. In general, good responses are from firms with good management practice and a large fraction of managers with a college degree. These findings are also consistent with those in the US MOPS.

5.1 Forecasting *macro-level* outcomes: GDP forecasts by well-managed firms are more accurate

Figure 6 shows the relationship between GDP forecast errors and three firm characteristics – management, productivity and profitability. The horizontal axis in each panel has absolute GDP forecast error grouped into 40 equal-sized bins. The vertical axis of Panel A shows the mean values of management scores in each bin. There is a clear negative relationship indicating that better managed firms make lower GDP forecast errors. Panel B uses productivity instead of management and Panel C uses profitability, which also show negative gradients (consistent with Tanaka et al. (2020)), although the relationship is noisier.[20]

We address this issue in Table 5, where we go beyond these bivariate correlations and control for many other factors. Column (1) reports the result of regressing a measure of forecast errors on the management score, confirming the statistical significance of the relationship in Panel A of Figure 6. Column (2) adds in industry dummies, location dummies and the standard other controls. Firms with more structured management practice still make significantly smaller forecast errors. In column (1), the coefficient of -0.358 implies that an increase in management scores from the 10^{th} to 90^{th} percentile (0.509) is associated with a fall in the absolute value GDP growth forecast errors of 0.18 percentage points, or 13% of the mean of the dependent variable (1.411 as shown in the base of the column). Columns (3) to (5) show the conditional correlations of GDP forecast error with firm size, foreign ownership and family firms and column (6) presents the full regression of management with all these variables as well as age

[20] We also show in the Appendix Tables A2 and A3 that firms with higher manager scores are more optimistic about GDP and turnover growth respectively future. This is consistent with their higher accuracy as firms on average were 1.4% too pessimistic.

and skills. Although the management coefficient falls to -0.171, it remains significant. The only other significant variable in the saturated model is employment: larger firms make significantly better GDP forecasts.

As a robustness test, we compare GDP forecasts of firms to those of professional forecasters in the Bank of England's survey of external forecasters as another way to evaluate the reasonableness of firms' forecasts. We show the results of a regression of $Disagreement_i$ (between the firm and the mean of professional forecasters) on firm characteristics in column (7) of Table 5. The coefficient on management score is negative and significant, and similar in magnitude to column (6), indicating that forecasts of better-managed firms align better with those of external forecasters. This may indicate that large firms with structured management practices either have similar information and analytical ability to external forecasters, or that they simply pay more attention to reports in the public domain of such forecasts.

5.2 Forecasting *micro-level* outcomes: turnover forecasts by well-managed firms are more accurate

We now turn to explore the relationship between firms' forecasts about their own growth and their characteristics. Our measure of forecast errors is the absolute value of the difference between expected and actual turnover growth rate. In the survey, we asked turnover forecasts for two different horizons: one for 2017 and one for 2018. We thus obtained forecast errors for 2017 and 2018, respectively. Taking the average of two forecast errors, we use it as a measure of forecast accuracy and study its relationship with management capabilities.[21] Note that the number of observations analyzed in this section is smaller compared to those in the previous

[21] Technically, we inverse weight the regressions by number of usable responses per firm, so that each firm only count for one observation even though it may have an outturn in 2017 and 2018.

sections because we need to observe the same firm over two years to obtain realizations and calculate the actual growth rate of turnover.[22]

Figure 7 illustrates the relationship between forecast accuracy with the same firm characteristics of Figure 6. As with GDP forecast errors, better managed firms (as well as those with higher productivity and profits) make significantly more accurate forecasts about their own sales. There appears to be more outliers, however, with some very large errors of 100% or more (even after winsorizing at the top and bottom percentiles). To investigate whether the relationship is driven by outliers, Figure A1 shows what happens if we drop all observations with a forecast error of 50% of greater (Panel A) or 25% or greater (panel B). The negative relationship between management and forecast error still seems to hold up even when we drop large parts of the sample.

Table 6 uses forecast accuracy about firm-level turnover as the dependent variable. Turnover forecast errors are significantly smaller for better-managed firms as shown in column (1). The coefficient of -6.108 implies that shifting management scores from the 10^{th} to 90^{th} percentile (0.509) is associated with a fall in the absolute value of the forecast error of 3.11 percentage points. This is 20% of the mean of the dependent variable – a substantial effect. The magnitude of the management coefficient remains large at -4.236 in column (2) after including for industry, location and standard controls. Column (3) shows that the firm's turnover volatility[23] in the past five years is associated with a greater forecasting error as one might expect. Column (4) shows that larger firms also make less forecasting errors. Column (5) presents the saturated

[22] We exclude firms reporting zero turnover in both MES and ABS from the analysis.

[23] Volatility is measured as the five year standard deviation of the firm's annual change in log(turnover).

model with all these controls as well as the others from Table 5.[24] The management coefficient remains negative, significant and large at -5.068.[25]

5.3 Comparing forecasts about GDP and turnover: well-managed businesses manage uncertainty better

As noted in Section 2, we construct a measure of uncertainty over the firm's macro and micro forecast. Column (1) of Table 7 reports how subjective uncertainty is significantly and negatively correlated with management. An increase in the score from the 10^{th} to 90^{th} percentile is associated with a 0.43 log point decrease in uncertainty (25% of the mean of the dependent variable). This relationship remains significant when the usual control variables are added in columns (2) and (3), although the coefficient drops from -0.845 to -0.196.[26] Columns (4) through (8) use subjective uncertainty on other dimensions, specifically employment, intermediate consumption, capital expenditure and GDP. These show that better managed firms have lower subjective uncertainty.

The weakest statistical uncertainty-management relationship is with GDP uncertainty. While management scores are negatively and significantly correlated with GDP uncertainty in column (7) the management coefficient is insignificant in the saturated model of column (8). It is tempting to conclude that well-managed firms are better at forecasting their own outcomes

[24] The only real surprise in this column is that the family run firm variable has a negative and significant coefficient. They seem to make more accurate forecasts about their own future even though their make poorer forecasts about the macro economy. This might be because they operate in much more stable and less risky environments – and take less chances themselves (see Sraer and Thesmar, 2007).

[25] In both Tables 5 and 6, the management score remains significant even after controlling for productivity and profitability from Figures 6 and 7. The results are also robust to trimming on outliers as in Figure A1.

[26] As in Table 6, we exclude firms reporting zero turnover in both MES and ABS from the analysis.

(which are presumably most relevant for their performance) than GDP. However, the magnitudes are not so different. Using our usual experiment of increasing management by 0.509 implies that turnover uncertainty is reduced by 6.2% of the mean in column (3) compared to 4.9% of the mean in the equivalent GDP uncertainty of column (8). Hence, the economic significance is similar.[27]

6. Conclusions

This paper reports results from the MES, the largest management survey in the UK linked to firm panel data on productivity. We document that: (i) there is a large variation in UK management practices; (ii) productivity, profitability and size are significantly higher in firms with more structured management, and (iii) that structured management is systematically greater in firms that are foreign owned and more skilled, and lower in firms that are family owned or run.

In terms of expectations, we compare firm's forecasts of one year ahead growth to actual outcomes observed in the years following the survey. We are able to show that firms with higher management scores are significantly more accurate in their forecasts about macro-economic growth (GDP) and their own growth (turnover). This statement is true even after controlling for many factors correlated with management. Large and more productive firms are also better at forecasting, for example, and these features are correlated with management. However, even after conditioning on these firm characteristics (as well as ownership, age, industry and location), well managed firms are significantly better forecasters. Moreover, they

[27] The shrinkage of the management coefficients between columns (2) and (3) is similar to that between columns (7) and (8).

are more confident forecasters having less subjective uncertainty over their forecasts than other firms.

If better management enables superior predictions of growth, then firms are more likely to be making optimal decisions over the appropriate composition of factor inputs (as well as other more strategic decisions). To put it simply, better managed firms make better forecasts and as a consequence better business decisions. The higher productivity and profitability of well managed firms may rest, at least in part, over this better allocation of factors, a micro-level equivalent of the macro-level findings in Hsieh and Klenow (2009). This is a hypothesis we intend to pursue in future work.

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Table 1: Descriptive statistics

Variables	Number of observations	Mean	Median	Standard deviation
Panel A: Management				
Management score	7756	0.586	0.627	0.196
Employment at 2016 IDBR	7756	282.606	69	1070.225
Age	7756	16.695	21	7.418
Log GVA per worker	7346	3.648	3.707	1.059
Share of managers with a college degree	7496	0.397	0.350	0.347
Share of non-managers with a college degree	7109	0.236	0.100	0.269
Family owned but not run	7717	0.112	0	0.315
Family owned and run	7717	0.425	0	0.494
Foreign owned	7756	0.132	0	0.338
Profit per worker	7756	26.756	10.295	63.900
Exporting likelihood	7756	0.355	0.000	0.479
Panel B: Expectations (shown as percentage)				
Macro forecasts				
Expected GDP growth 2017-18	7756	0.096	0.000	1.047
Absolute GDP forecast error 2018	7756	1.410	1.398	0.918
Absolute GDP disagreement	7756	1.301	1.263	0.900
Micro forecasts				
Turnover growth forecast 2016-17	7563	5.236	4.597	17.343
Realized turnover growth 2016-17	4959	5.443	4.710	34.072
Turnover forecast errors 2016-17	4853	0.174	-0.029	27.499
Turnover growth forecast 2016-18	7621	-7.573	4.580	57.861
Realized turnover growth 2016-18	3398	10.366	9.014	40.180
Turnover forecast errors 2016-18	3353	-14.266	-2.916	59.454
Absolute turnover forecast errors 2016-17	4853	14.229	5.965	27.611
Absolute turnover forecast errors 2016-18	3353	31.044	11.395	54.020
Average absolute turnover forecast error (2017 and 2018 pooled)	5140	21.164	8.596	35.902
Uncertainty				
GDP uncertainty 2018	6705	0.439	0.541	0.425
Turnover uncertainty	6923	1.698	1.757	0.864

Notes: These are descriptives from the data (MES and ABS). Details in text. Panel A is the cleaned sample for management analysis. Profit per worker is winsorized with top and bottom 1%. Panel B focuses on subsample which has expectations information. To construct micro forecast errors we need realized outcomes from the ABS which is why the samples are smaller. All variables in Panel B are winsorized at the top and bottom 1% of the distribution. Uncertainty measures are in logarithm.

Table 2: Management scores by broad industry

	Employment: 10-49		Employment: 50-99		Employment: 100-249		Employment: 250+		All	
	Mean	Share	Mean	Share	Mean	Share	Mean	Share	Mean	Share
Manufacturing	0.47	7.10	0.58	3.75	0.64	3.08	0.71	4.09	0.58	18.02
Construction	0.43	5.89	0.56	1.71	0.63	0.99	0.67	1.16	0.50	9.76
Retail, distribution, hotels and restaurants	0.49	9.45	0.62	3.30	0.64	2.40	0.73	5.83	0.60	20.98
Transport, storage and communication	0.52	3.38	0.57	1.47	0.64	1.16	0.72	2.09	0.60	8.10
Business services	0.53	6.58	0.63	2.58	0.62	2.99	0.68	5.27	0.61	17.42
Real estate and others	0.49	8.34	0.59	4.05	0.62	3.73	0.68	9.61	0.60	25.72
Total	0.49	40.70	0.60	16.84	0.63	14.33	0.69	28.13	0.59	100

Note: Mean shows the average management score for the firms in the industry and employment size categories. Share describes the share of firms in the industry and employment size categories out of the full sample.

Table 3: "Drivers" of Management Scores

Dependent Variable:	**Management Score**						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample:	All	All	All	All	Employment 10-49	Employment 50-249	Employment 250+
Log employment	0.063***	0.061***	0.055***	0.057***	0.108***	0.043***	0.022***
	(0.0014)	(0.0017)	(0.0018)	(0.0018)	(0.0079)	(0.0071)	(0.0039)
Family owned but not run			-0.009	-0.004	-0.012	-0.001	-0.007
			(0.0065)	(0.0065)	(0.0129)	(0.0107)	(0.0094)
Family owned and run			-0.025***	-0.015***	0.007	-0.020**	-0.042***
			(0.0050)	(0.0050)	(0.0089)	(0.0083)	(0.0087)
Foreign owned			0.053***	0.046***	0.093***	0.046***	0.025***
			(0.0054)	(0.0054)	(0.0144)	(0.0093)	(0.0071)
Log age				-0.016***	-0.036***	-0.010	0.002
				(0.0031)	(0.0050)	(0.0065)	(0.0040)
Share of managers with a college degree				0.061***	0.063***	0.063***	0.028*
				(0.0079)	(0.0127)	(0.0137)	(0.0141)
Share of non-managers with a college degree				0.058***	0.071***	0.050***	0.031*
				(0.0103)	(0.0165)	(0.0181)	(0.0172)
Industry Dummies	No	Yes	Yes	Yes	Yes	Yes	Yes
Location Dummies	No	Yes	Yes	Yes	Yes	Yes	Yes
Other Controls	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7756	7756	7756	7756	3160	2421	2175
R^2	0.212	0.307	0.319	0.341	0.272	0.246	0.243

Note: Estimation by OLS with robust standard errors in parentheses. Management score is the unweighted average of the score for each of the 12 questions, with scores on a scale of 0 to 1 for each question, where 0 was the least and 1 the most structured management practice. Firm employment is from the ABS in 2016. "Foreign Owned" is a dummy for whether the firm is an affiliate of a non-UK firm. "Family owned and run" is a firm owned by a family and run by a family member; "Family owned but not run" is a dummy for a firm which is family owned but whose CEO is a non-family member (a firm which is not owned by a family is the omitted base) from MES. Age is the dated from the date of incorporation from the ABS. Share of managers with a college degree and share of non-managers with a college degree is from MES. Industry dummies are two-digit, location dummies are the 9 NUTS1 regions and "Other Controls" includes dummies for the month when the survey was returned, time spent on the survey, multi-site dummy and reporting accuracy indicator (difference between 2016 employment as reported in ABS and MES). * p < 0.10, ** p < 0.05, *** p < 0.01.

Table 4: Firm Performance (Productivity, Profits and Exports) and Management Score

Dependent variable:	**Log (Gross Value Added per worker)**							**Profit Per Worker**	**Export**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sample:	All	All	All	All	Employment 10-49	Employment 50-249	Employment 250+	All	All
Management score	0.845***	0.846***	0.790***	0.724***	0.754***	0.670***	0.661***	18.878***	0.125***
	(0.0662)	(0.0640)	(0.0680)	(0.0693)	(0.1041)	(0.1227)	(0.1883)	(4.2240)	(0.0264)
Log employment			-0.102***	-0.101***	-0.062	-0.201***	-0.035	-5.271***	0.009**
			(0.0117)	(0.0117)	(0.0415)	(0.0449)	(0.0271)	(0.7429)	(0.0046)
Log capital per worker			0.131***	0.128***	0.130***	0.120***	0.165***	6.303***	0.021***
			(0.0076)	(0.0075)	(0.0125)	(0.0124)	(0.0173)	(0.5479)	(0.0026)
Log age			0.063***	0.064***	0.097***	0.078**	0.013	-0.963	0.030***
			(0.0193)	(0.0191)	(0.0309)	(0.0366)	(0.0332)	(1.1449)	(0.0065)
Family owned but not run			-0.076**	-0.066*	-0.079	0.004	-0.041	-2.202	-0.033**
			(0.0359)	(0.0357)	(0.0686)	(0.0582)	(0.0683)	(2.4556)	(0.0154)
Family owned and run			-0.119***	-0.102***	-0.065	-0.114***	-0.112**	-3.738**	-0.056***
			(0.0257)	(0.0255)	(0.0440)	(0.0436)	(0.0499)	(1.7122)	(0.0111)
Foreign owned			0.186***	0.171***	0.356***	0.226***	0.029	9.742***	0.113***
			(0.0354)	(0.0354)	(0.0959)	(0.0604)	(0.0529)	(2.9841)	(0.0163)
Share of managers with a college degree				0.082*	0.036	0.133*	0.128	0.029	0.058***
				(0.0425)	(0.0616)	(0.0776)	(0.0908)	(2.5105)	(0.0165)
Share of non-managers with a college degree				0.286***	0.343***	0.154	0.263**	6.516	0.092***
				(0.0630)	(0.0972)	(0.1141)	(0.1253)	(4.0643)	(0.0236)
Industry Dummies	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Location Dummies	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other Controls	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Difference in management scores between 10 and 90 percentiles	0.509	0.509	0.509	0.509	0.509	0.509	0.509	0.509	0.509
Observations	7346	7346	7346	7346	3023	2305	2018	7756	7756
R^2	0.025	0.334	0.390	0.395	0.378	0.460	0.513	0.195	0.414

Note: Estimation by OLS with robust standard errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. Dependent variable is log gross value added per worker in columns (1) - (7); profits per worker, winsorized with top and bottom 1%, in column (8) and an exporting dummy in column (9). Employment and capital constructed from the ABS. "Foreign Owned" is a dummy for whether the firm is an affiliate of a non-UK firm. "Family owned and run" is a firm owned by a family and run by a family member; "Family owned but not run" is a dummy for a firm which is family owned but whose CEO is a non-family member (a firm which is not owned by a family is the omitted base). Age is the dated from the date of incorporation. Industry dummies are two-digit, location dummies are the 9 NUTS1 regions and "Other Controls" includes dummies for the month when the survey was returned, time spent on survey, a multi-site dummy and reporting accuracy indicator. See Table 1 notes and text for more details.

Table 5: GDP Forecast Errors and Management Score

Dependent Variable:	**Absolute GDP Forecast Error**						**GDP Disagreement**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Management score	-0.358***	-0.293***				-0.171**	-0.154**
	(0.0609)	(0.0673)				(0.0738)	(0.0725)
Log employment			-0.066***			-0.054***	-0.055***
			(0.0103)			(0.0115)	(0.0113)
Foreign owned				-0.040		0.035	0.036
				(0.0338)		(0.0365)	(0.0358)
Family owned but not run					0.066*	0.047	0.049
					(0.0391)	(0.0395)	(0.0388)
Family owned and run					0.073***	0.031	0.033
					(0.0269)	(0.0295)	(0.0289)
Log age						0.018	0.016
						(0.0175)	(0.0171)
Share of managers with a college degree						-0.030	-0.027
						(0.0474)	(0.0465)
Share of non-managers with a college degree						0.087	0.088
						(0.0641)	(0.0627)
Industry Dummies	No	Yes	Yes	Yes	Yes	Yes	Yes
Location Dummies	No	Yes	Yes	Yes	Yes	Yes	Yes
Other Controls	No	Yes	Yes	Yes	Yes	Yes	Yes
Mean of dep. var.	1.411	1.411	1.411	1.411	1.411	1.411	1.304
Observations	7134	7134	7134	7134	7134	7134	7134
R^2	0.005	0.055	0.058	0.053	0.054	0.060	0.061

Note: Estimation by OLS with robust standard errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. The dependent variable in columns (1) to (6), is the absolute value of the difference between expected (in MES 2016) and actual real GDP growth rate 2017-18. In column (7), the dependent variable is the measure of GDP disagreement between firms and Bank of England's external forecasters (see text). Employment and capital constructed from the ABS. "Foreign Owned" is a dummy for whether the firm is an affiliate of a non-UK firm. "Family owned and run" is a firm owned by a family and run by a family member; "Family owned but not run" is a dummy for a firm which is family owned but whose CEO is a non-family member (a firm which is not owned by a family is the omitted base). Age is the dated from the date of incorporation. Industry dummies are two-digit, location dummies are the 9 NUTS1 regions and "Other Controls" includes dummies for the month when the survey was returned, time spent on survey, a multi-site dummy and reporting accuracy indicator. See Table 1 notes and text for more details.

Table 6: Forecast Error in Firm's Estimate of its Future Turnover and Management Score

Dependent Variable:	**Absolute Forecast Error in Firm's Estimate of its Future Turnover**				
	(1)	(2)	(3)	(4)	(5)
Management score	-6.108***	-4.236*			-5.068**
	(1.9132)	(2.1735)			(2.3997)
Five-year turnover volatility			14.037***		13.876***
			(3.5425)		(3.5326)
Log employment				-0.670*	-0.037
				(0.3658)	(0.4654)
Foreign owned					0.825
					(0.9641)
Family owned but not run					-0.382
					(1.1090)
Family owned and run					-1.624**
					(0.8131)
Log age					-1.540**
					(0.6323)
Share of managers with a college degree					0.787
					(1.4730)
Share of non-managers with a college degree					3.959*
					(2.2128)
Industry Dummies	No	Yes	Yes	Yes	Yes
Location Dummies	No	Yes	Yes	Yes	Yes
Other Controls	No	Yes	Yes	Yes	Yes
Mean of dep. var.	15.213	15.213	15.213	15.213	15.213
Observations	4676	4676	4676	4676	4676
R^2	0.002	0.150	0.160	0.150	0.167

Note: Estimation by OLS with robust standard errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. The dependent variable is the average of the absolute value of the difference between actual and expected growth rates. We do this for 2016-2017 and also 2016-2018 (and re-weight the regression if the firm error is available in both years so that each firm is only counted once). We exclude firms reporting zero turnover in both MES and ABS from the analysis. Employment is from the ABS. "Foreign Owned" is a dummy for whether the firm is an affiliate of a non-UK firm. "Family owned and run" is a firm owned by a family and run by a family member; "Family owned but not run" is a dummy for a firm which is family owned but whose CEO is a non-family member (a firm which is not owned by a family is the omitted base). Age is the dated from the date of incorporation. Industry dummies are two-digit, location dummies are the 9 NUTS1 regions and "Other Controls" includes dummies for the month when the survey was returned, time spent on survey, a multi-site dummy and reporting accuracy indicator. See Table 1 notes and text for more details.

Table 7: Uncertainty Over Forecasts and Management Scores

Dependent Variable	(1) Turnover Uncertainty	(2) Turnover Uncertainty	(3) Turnover Uncertainty	(4) Employment Uncertainty	(5) Intermediate Consumption Uncertainty	(6) Capital Expenditure Uncertainty	(7) GDP Uncertainty	(8) GDP Uncertainty
Management score	-0.845***	-0.541***	-0.196***	-0.200***	-0.103***	-0.162***	-0.169***	-0.042
	(0.0549)	(0.0570)	(0.0620)	(0.0103)	(0.0110)	(0.0138)	(0.0280)	(0.0341)
Log employment			-0.125***	-0.287***	-0.152**	-0.194**		-0.015***
			(0.0104)	(0.0603)	(0.0670)	(0.0857)		(0.0056)
Foreign owned			-0.028	-0.125***	-0.097***	-0.052**		0.014
			(0.0335)	(0.0147)	(0.0164)	(0.0208)		(0.0178)
Family owned but not run			0.082**	-0.094***	-0.009	-0.162***		0.024
			(0.0330)	(0.0321)	(0.0355)	(0.0448)		(0.0184)
Family owned and run			0.141***	0.097***	0.075**	0.071*		0.061***
			(0.0240)	(0.0312)	(0.0361)	(0.0427)		(0.0133)
Log age			-0.096***	0.095***	0.153***	0.060*		-0.026***
			(0.0149)	(0.0233)	(0.0259)	(0.0327)		(0.0081)
Share of managers with a college degree			-0.009	-0.031	0.030	-0.037		0.000
			(0.0395)	(0.0370)	(0.0427)	(0.0518)		(0.0213)
Share of non-managers with a college degree			0.058	-0.029	0.080	-0.173**		-0.013
			(0.0549)	(0.0487)	(0.0586)	(0.0701)		(0.0289)
Industry Dummies	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Location Dummies	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Other Controls	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Mean of dep. var.	1.695	1.695	1.695	1.619	1.591	2.828	0.439	0.439
Observations	6833	6833	6833	6628	6816	5890	6705	6705
R^2	0.035	0.194	0.232	0.278	0.186	0.151	0.006	0.062

Note: Estimation by OLS with robust standard errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. The dependent variable is the log subjective uncertainty regarding the forecast over turnover in columns (1)-(3), over employment, intermediates and capital expenditure in the next three columns and over GDP in the final column (see text for details). For turnover uncertainty, we exclude firms reporting zero turnover in both MES and ABS from the analysis. Employment is from the ABS. "Foreign Owned" is a dummy for whether the firm is an affiliate of a non-UK firm. "Family owned and run" is a firm owned by a family and run by a family member; "Family owned but not run" is a dummy for a firm which is family owned but whose CEO is a non-family member (a firm which is not owned by a family is the omitted base). Age is the dated from the date of incorporation. Industry dummies are two-digit, location dummies are the 9 NUTS1 regions and "Other Controls" includes dummies for the month when the survey was returned, time spent on survey, a multi-site dummy and reporting accuracy indicator. See Table 1 notes and text for more details.

Figure 1: MES Questionnaire on Macro Growth Expectations

30. Please indicate what likelihood you would attach to the possible 2018 rates of UK economic growth (real growth rate of Gross Domestic Product) below.
Gross Domestic Product (GDP) is the main measure of the size of the UK economy, based on the value of goods and services produced during a given period.

UK Economic Growth in 2018		Percentage likelihood (values in this column should sum to 100)
Strong decline	-4% or less	2 % 1138
Moderate decline	-2% to -3%	5 % 1139
Slight decline	-1%	10 % 1140
No change	0%	30 % 1141
Slight increase	1%	40 % 1142
Moderate increase	2% to 3%	10 % 1143
Strong increase	4% or more	3 % 1144
	Total	100 %

Notes: This is the macro growth expectations question from the MES.

Figure 2: MES Questionnaire on Micro Growth Expectations

The example below will help you to complete questions 22, 24, and 26

Example A:
Jane Smith is filling out this survey for Business A. In 2016, Business A had approximately £4,500,000 in turnover, with a forecast of £4,750,000 in 2017.

For calendar years 2016 and 2017, what are the approximate values of turnover, including exports and other receipts within this business? If applicable exclude freight charges, excise taxes and value added tax.

For 2016 calendar year..... £ , , 4 , 5 0 0 , 0 0 0

Forecast for 2017 calendar year..... £ , , 4 , 7 5 0 , 0 0 0

The example below will help you to complete questions 23, 25, 27 and 29

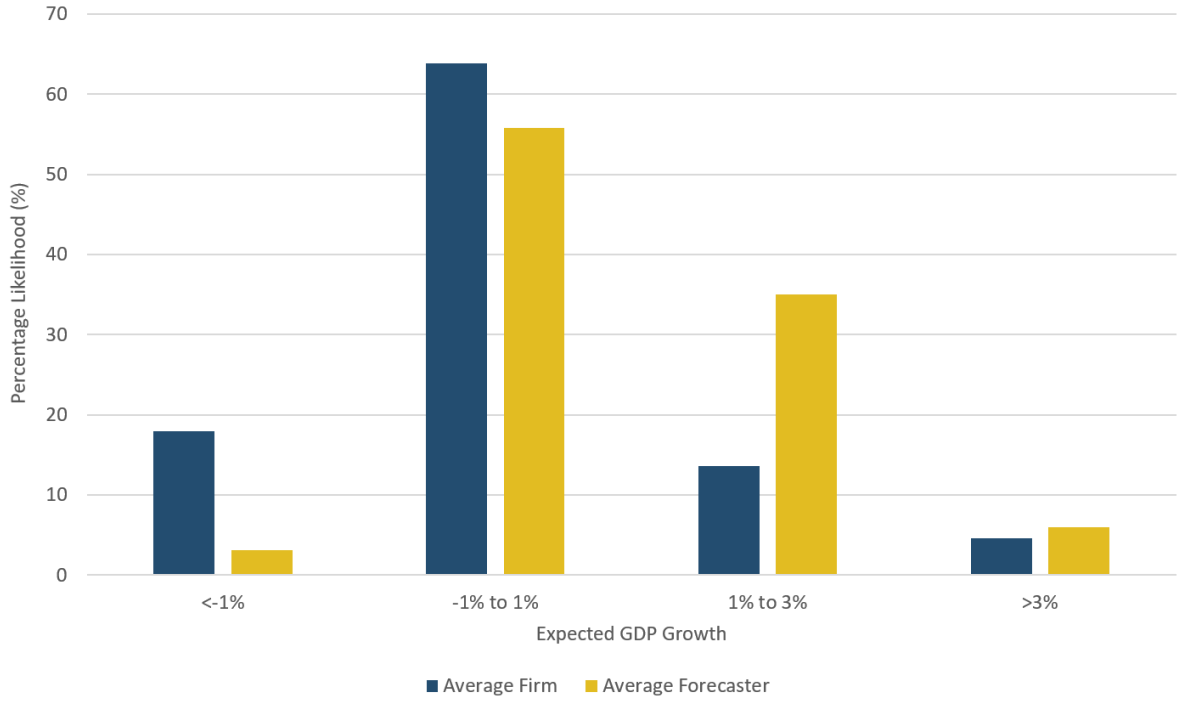
Example B:
Jane also knows that turnover at Business A is forecast to grow approximately an additional 5% in 2018, with predicted annual value of turnover of £5 million. However, Jane knows there is some uncertainty with that forecast and that the value of turnover next year could be more or less than £5 million depending on consumer demand, changes in prices, and other uncertainties in the market. Given this uncertainty, Jane estimates that turnover will be between £2.8 million and £7.5 million, and thinks the likelihood of each scenario is as shown in the table below.

Looking ahead to the 2018 calendar year, what is the approximate value of turnover you would anticipate for this business in the following scenarios, and what likelihood do you assign to each scenario?

2018 scenarios, from lowest to highest	Approximate turnover in 2018	Percentage likelihood (values in this column should sum to 100)
LOWEST	£ , , 2 , 8 0 0 , 0 0 0	5 %
LOW	£ , , 4 , 2 0 0 , 0 0 0	1 0 %
MEDIUM	£ , , 5 , 0 0 0 , 0 0 0	6 0 %
HIGH	£ , , 6 , 3 0 0 , 0 0 0	2 0 %
HIGHEST	£ , , 7 , 5 0 0 , 0 0 0	5 %
	Total	1 0 0 %

Notes: This is the micro growth expectations question from the MES.

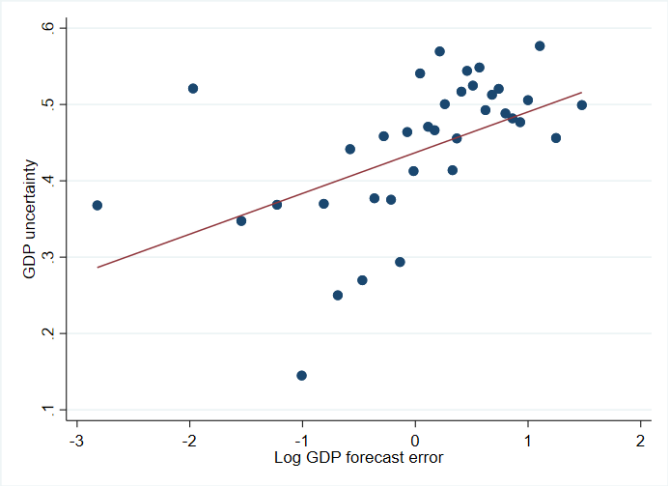
Figure 3: Businesses Forecasts compared to Professional Forecasters in the Bank of England Survey of External Forecasters



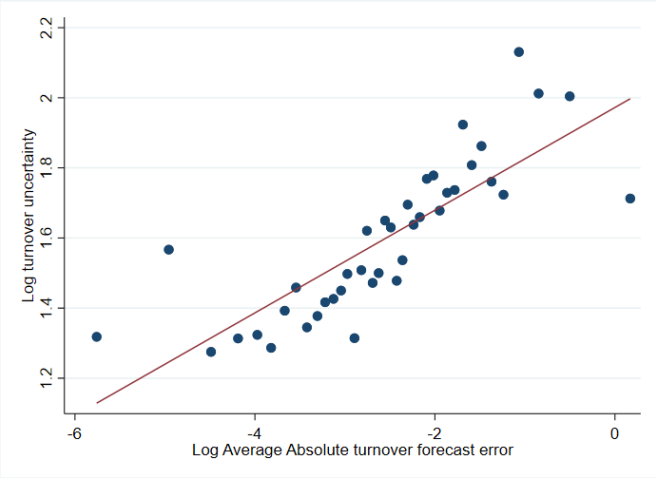
Notes: The dark blue bars are the histograms of MES respondents to the macro growth question (see Figure 1). We group the seven bins into four to match the approach of professional forecasters surveyed by the Bank of England (yellow bars).

Figure 4: Forecast Errors and Uncertainty

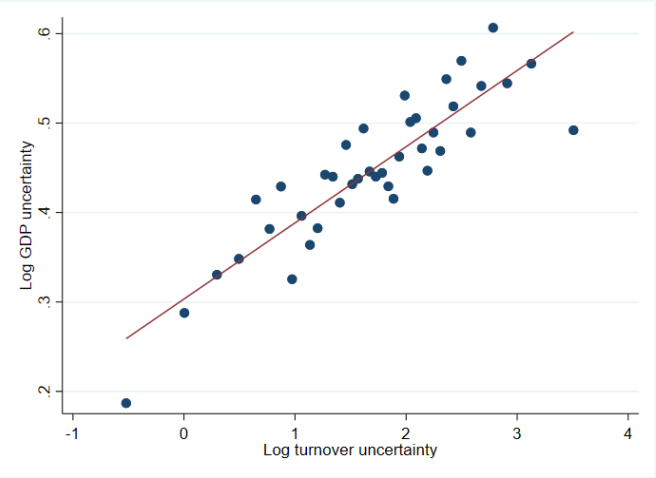
Panel A. GDP Forecast Errors and GDP Uncertainty



Panel B. Average Turnover Forecast Errors and Turnover Uncertainty

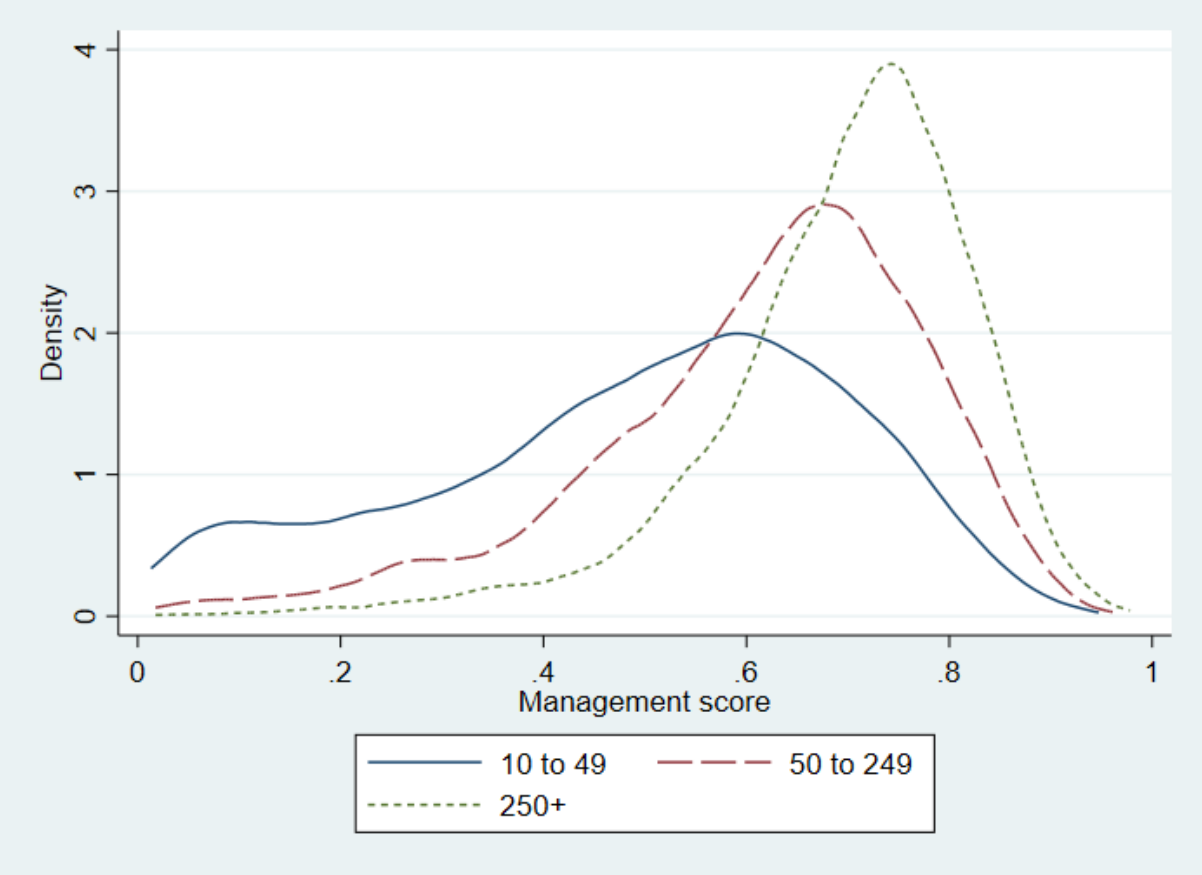


Panel C. GDP and Turnover Uncertainty



Note: Panel A shows the relationship between log GDP forecast errors and log GDP uncertainty, and Panel B has log average turnover forecast errors and log turnover uncertainty. Panel C shows the relationship between log GDP uncertainty and log turnover uncertainty. Vertical axes show the level of log uncertainty. The values on both axes are winsorized with top and bottom 1% and grouped into 40 equal-sized bins.

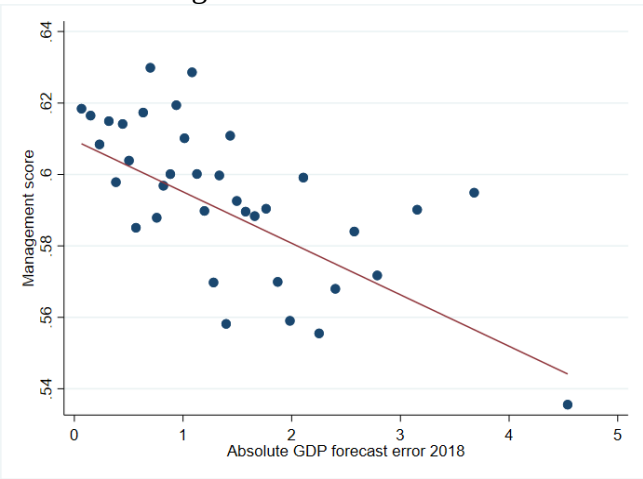
Figure 5: Firm size and the Management Score Distribution



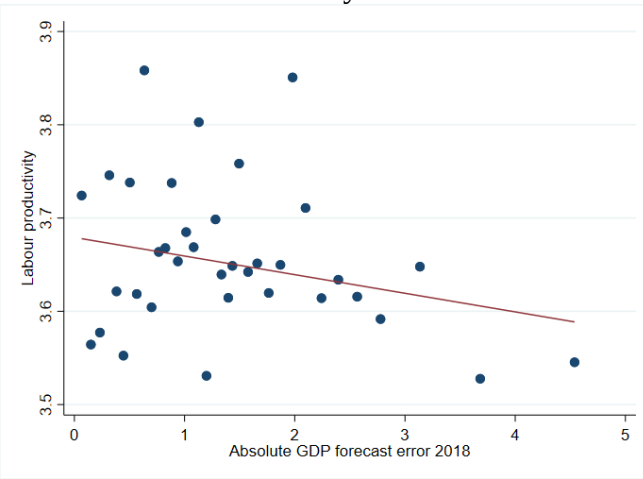
Note: Each curve corresponds to the kernel density of firms in each employment size category.

Figure 6: GDP Forecast Errors and Management, Productivity and Profits

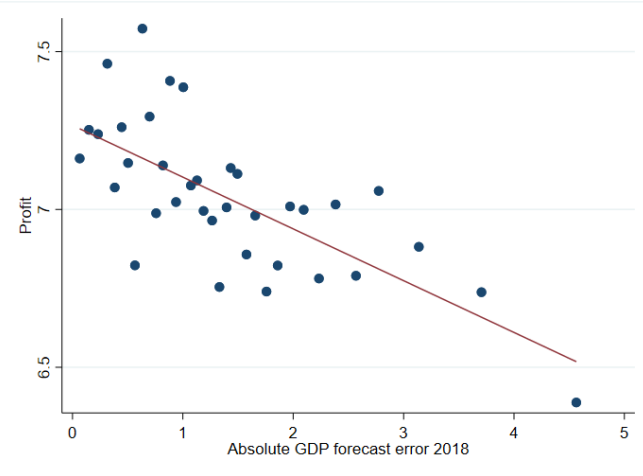
Panel A. Management Score



Panel B. Labor Productivity



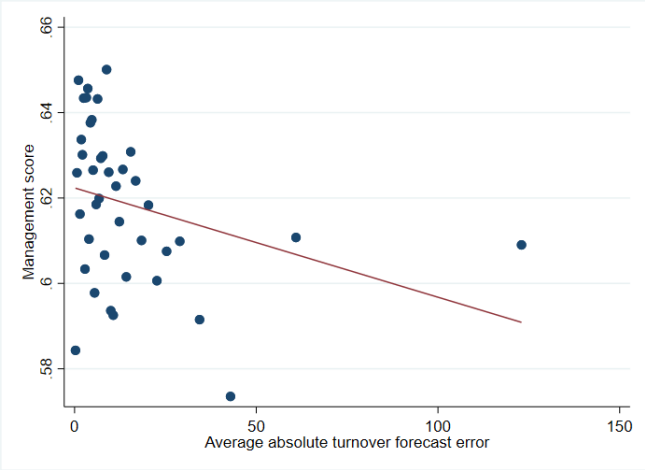
Panel C. Profit



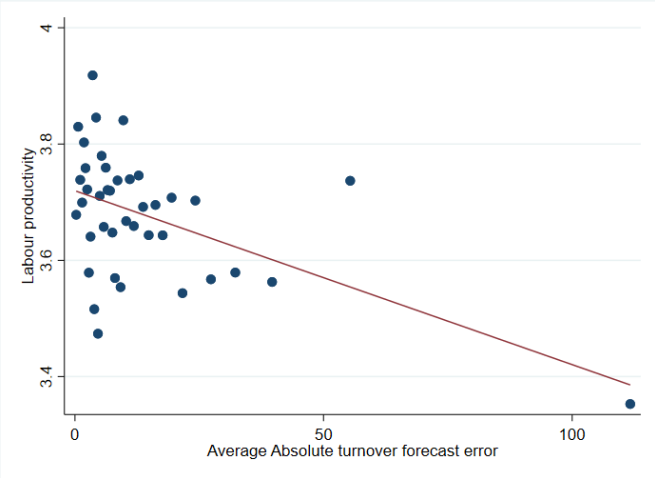
Note: Panel A shows the relationship between absolute GDP forecast errors and management score, Panel B GDP forecast errors and labor productivity, and Panel C GDP forecast errors and log profit. Horizontal axes show the value of forecast errors in absolute. The values are winsorized with top and bottom 1% and grouped into 40 equal-sized bins. Vertical axes are the mean values of management score, labor productivity and profit, respectively, in each panel.

Figure 7: Micro Turnover Forecast Errors and Management, Productivity and Profits

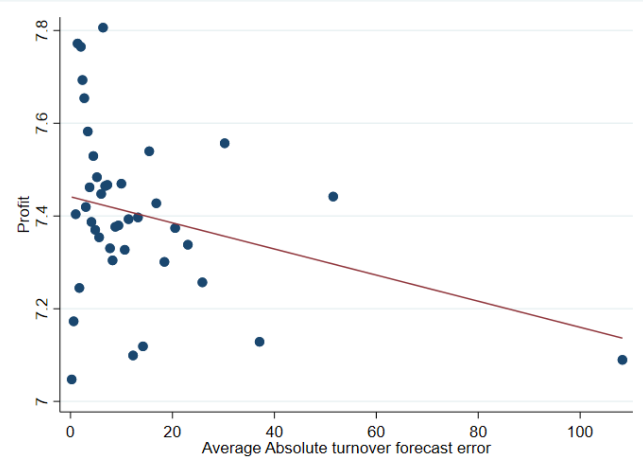
Panel A. Management Score



Panel B. Labor Productivity



Panel C. Profit



Note: Panel A shows the relationship between turnover forecast errors and management score, Panel B turnover forecast errors and labor productivity, and Panel C turnover forecast errors and log profit. Horizontal axes show the value of forecast errors in absolute. The values are winsorized with top and bottom 1% and grouped into 40 equal-sized bins. Vertical axes are the mean values of management score, labor productivity, and profit, respectively, in each panel.

Appendix

Table A1: Correlations Between "Good Response" Dummy and Control Variables

	(1) GDP	(2) GDP	(3) Turnover	(4) Turnover	(5) Intermediate Consumption	(6) Intermediate Consumption	(7) Capital Expenditure	(8) Capital Expenditure	(9) Employment	(10) Employment
Management score	0.089***	0.099***	0.109***	0.126***	0.117***	0.127***	0.328***	0.287***	0.246***	0.233***
	(0.0184)	(0.0202)	(0.0208)	(0.0218)	(0.0217)	(0.0236)	(0.0260)	(0.0295)	(0.0238)	(0.0261)
Log employment		-0.006*		-0.007**		-0.007**		0.004		0.003
		(0.0032)		(0.0034)		(0.0037)		(0.0047)		(0.0040)
Log age		0.002		0.004		0.004		0.011		-0.006
		(0.0048)		(0.0053)		(0.0058)		(0.0073)		(0.0059)
Foreign owned		-0.014		-0.040***		-0.039***		-0.046***		-0.064***
		(0.0096)		(0.0115)		(0.0121)		(0.0145)		(0.0129)
Family owned but not family run		0.007		0.010		0.015		0.015		0.007
		(0.0095)		(0.0109)		(0.0114)		(0.0148)		(0.0127)
Family owned and family run		-0.004		0.008		0.006		0.019		0.013
		(0.0074)		(0.0081)		(0.0089)		(0.0114)		(0.0096)
Log GVA per worker		-0.004		-0.006		-0.006		0.016***		0.003
		(0.0040)		(0.0040)		(0.0044)		(0.0058)		(0.0049)
Share of managers with a college degree		0.026**		0.021		0.046***		0.051***		0.045***
		(0.0118)		(0.0130)		(0.0139)		(0.0183)		(0.0162)
Share of non-managers with a college degree		-0.011		-0.004		-0.008		-0.008		-0.017
		(0.0159)		(0.0177)		(0.0189)		(0.0243)		(0.0216)
Industry Dummies	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Location Dummies	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Other Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Mean of dep. var.	0.920	0.920	0.892	0.892	0.879	0.879	0.786	0.786	0.856	0.856
Observations	7756	7756	7756	7756	7756	7756	7756	7756	7756	7756
R^2	0.004	0.184	0.005	0.224	0.005	0.188	0.024	0.178	0.019	0.177

Note: In all columns the dependent variable is a "good response" dummy (see text) for the relevant question. Estimation by OLS with robust standard errors in parentheses. Management score is the unweighted average of the score for each of the 12 questions, with scores on a scale of 0 to 1 for each question, where 0 was the least and 1 the most structured management practice. Firm employment is from the ABS in 2016. "Foreign Owned" is a dummy for whether the firm is an affiliate of a non-UK firm. "Family owned and run" is a firm owned by a family and run by a family member; "Family owned but not run" is a dummy for a firm which is family owned but whose CEO is a non-family member (a firm which is not owned by a family is the omitted base) from MES. Age is the dated from the date of incorporation from the ABS. Share of managers with a college degree and share of non-managers with a college degree is from MES. Industry dummies are two-digit, location dummies are the 9 NUTS1 regions and "Other Controls" includes dummies for the month when the survey was returned, time spent on the survey, multi-site dummy and reporting accuracy indicator (difference between 2016 employment as reported in ABS and MES). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A2: Management GDP Growth Forecasts

	Expected GDP Growth 2017-18					
	(1)	(2)	(3)	(4)	(5)	(6)
Management score	0.433***	0.371***				0.266***
	(0.0693)	(0.0766)				(0.0842)
Log employment			0.065***			0.049***
			(0.0117)			(0.0130)
Foreign owned				0.042		-0.032
				(0.0392)		(0.0419)
Family owned but not run					-0.047	-0.024
					(0.0452)	(0.0457)
Family owned and run					-0.060**	-0.011
					(0.0307)	(0.0337)
Log age						-0.022
						(0.0203)
Share of managers with a college degree						0.035
						(0.0546)
Share of non-managers with a college degree						-0.086
						(0.0738)
Industry Dummies	No	Yes	Yes	Yes	Yes	Yes
Location Dummies	No	Yes	Yes	Yes	Yes	Yes
Other Controls	No	Yes	Yes	Yes	Yes	Yes
Mean of dep. var.	0.105	0.105	0.105	0.105	0.105	0.105
Observations	7134	7134	7134	7134	7134	7134
R^2	0.006	0.051	0.052	0.048	0.048	0.055

Note: In all regressions the dependent variable is the expected real GDP growth. Estimation by OLS with robust standard errors in parentheses. Management score is the unweighted average of the score for each of the 12 questions, with scores on a scale of 0 to 1 for each question, where 0 was the least and 1 the most structured management practice. Firm employment is from the ABS in 2016. "Foreign Owned" is a dummy for whether the firm is an affiliate of a non-UK firm. "Family owned and run" is a firm owned by a family and run by a family member; "Family owned but not run" is a dummy for a firm which is family owned but whose CEO is a non-family member (a firm which is not owned by a family is the omitted base) from MES. Age is the dated from the date of incorporation from the ABS. Share of managers with a college degree and share of non-managers with a college degree is from MES. Industry dummies are two-digit, location dummies are the 9 NUTS1 regions and "Other Controls" includes dummies for the month when the survey was returned, time spent on the survey, multi-site dummy and reporting accuracy indicator (difference between 2016 employment as reported in ABS and MES). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A3: Management and Firm-level Turnover Growth forecast (2016-17).

	2017 Turnover Forecast					
	(1)	(2)	(3)	(4)	(5)	(6)
Management score	3.974***	6.128***				7.242***
	(1.1078)	(1.2325)				(1.3900)
Log employment			-0.223			-0.378*
			(0.1821)			(0.2124)
Foreign owned				-1.385**		-1.719**
				(0.6361)		(0.6979)
Family owned but not run					0.431	0.379
					(0.6938)	(0.6976)
Family owned and run					0.521	0.561
					(0.4988)	(0.5426)
Log age						-2.288***
						(0.3916)
Share of managers with a college degree						1.098
						(0.8204)
Share of non-managers with a college degree						0.198
						(1.2596)
Industry Dummies	No	Yes	Yes	Yes	Yes	Yes
Location Dummies	No	Yes	Yes	Yes	Yes	Yes
Other Controls	No	Yes	Yes	Yes	Yes	Yes
Mean of dep. var.	5.589	5.589	5.589	5.589	5.589	5.589
Observations	6833	6833	6833	6833	6833	6833
R^2	0.002	0.060	0.056	0.057	0.056	0.071

Note: The dependent variable is expected turnover in 2017. Estimation by OLS with robust standard errors in parentheses. We exclude firms reporting zero turnover in both MES and ABS from the analysis. Firm employment is from the ABS in 2016. "Foreign Owned" is a dummy for whether the firm is an affiliate of a non-UK firm. "Family owned and run" is a firm owned by a family and run by a family member; "Family owned but not run" is a dummy for a firm which is family owned but whose CEO is a non-family member (a firm which is not owned by a family is the omitted base) from MES. Age is the dated from the date of incorporation from the ABS. Share of managers with a college degree and share of non-managers with a college degree is from MES. Industry dummies are two-digit, location dummies are the 9 NUTS1 regions and "Other Controls" includes dummies for the month when the survey was returned, time spent on the survey, multi-site dummy and reporting accuracy indicator (difference between 2016 employment as reported in ABS and MES). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

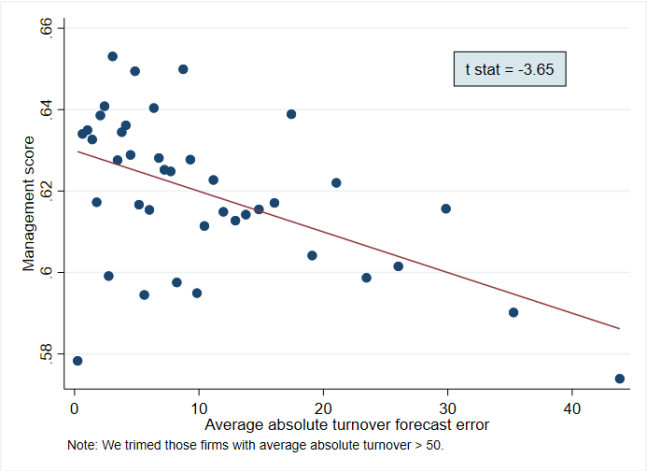
Table A4: Management and Firm-level Turnover Growth forecast (2016-18).

	2018 Turnover Forecast					
	(1)	(2)	(3)	(4)	(5)	(6)
Management score	11.678***	13.601***				14.823***
	(1.6498)	(1.8127)				(2.0760)
Log employment			0.160			-0.171
			(0.2624)			(0.3061)
Foreign owned				-2.675***		-3.744***
				(0.9297)		(1.0309)
Family owned but not run					0.012	0.060
					(1.0366)	(1.0386)
Family owned and run					0.922	1.337*
					(0.7013)	(0.7758)
Log age						-3.971***
						(0.5352)
Share of managers with a college degree						1.619
						(1.2502)
Share of non-managers with a college degree						0.774
						(1.7682)
Industry Dummies	No	Yes	Yes	Yes	Yes	Yes
Location Dummies	No	Yes	Yes	Yes	Yes	Yes
Other Controls	No	Yes	Yes	Yes	Yes	Yes
Mean of dep. var.	7.029	7.029	7.029	7.029	7.029	7.029
Observations	6833	6833	6833	6833	6833	6833
R^2	0.009	0.069	0.059	0.060	0.060	0.084

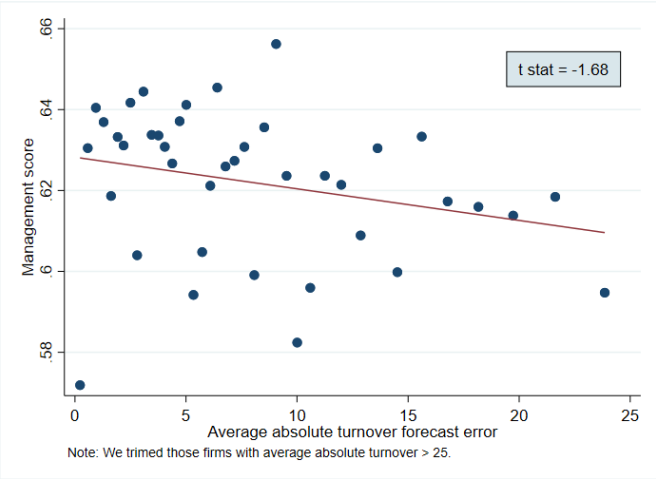
Note: The dependent variable is expected 2018 turnover. Employment from ABS in 2016. We exclude firms reporting zero turnover in both MES and ABS from the analysis. "Foreign Owned" is a dummy for whether the firm is an affiliate of a non-UK firm. "Family owned and run" is a firm owned by a family and run by a family member; "Family owned but not run" is a dummy for a firm which is family owned but whose CEO is a non-family member (a firm which is not owned by a family is the omitted base) from MES. Age is the dated from the date of incorporation from the ABS. Share of managers with a college degree and share of non-managers with a college degree is from MES. Industry dummies are two-digit, 9 NUTS1 location dummies and "Other Controls" includes dummy for month when survey returned, time spent on survey, multi-site dummy and reporting accuracy indicator* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses

Figure A1: Sensitivity of the Turnover Forecast Error and Management Score Relationship to Trimming Outliers

Panel A. Trim above 50



Panel B. Trim above 25



Note: Both panels show the relationship between turnover forecast errors and management scores. Panel A trims the sample with forecast errors equal or greater than 50% and Panel B trims the sample with forecast errors equal or greater than 25%. Horizontal axes show the level of the forecast error in absolute value. The values are winsorized with top and bottom 1% and grouped into 40 equal-sized bins. Vertical axes are the mean values of management score. The box in both panels shows t statistics.