Firms' Sales Expectations and Marginal Propensity to Invest*

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Abstract

How do firms adjust their investment in response to sales shocks and what determines the response? Using a unique firm-level survey, we propose a novel approach to estimate UK firms' marginal propensity to invest (MPI) out of additional income: the forecast error of their sales growth expectations. Investment responds significantly to these sales surprises, with a 1 percentage point unexpected growth in sales translating into a 0.31 percentage point increase in capital expenditure. Firms that are more attentive to the state of the economy are more responsive, consistent with sales growth surprises providing firms with information about their demand. Sales growth surprises also cause firms to increase their prices, supporting this interpretation. We do not find evidence that these results are driven by financial frictions, uncertainty, or productivity shocks.

Keywords: Investment, survey data, corporate finance, financial frictions, learning
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1 Introduction

How does firms' investment react to changes in sales? This response determines how changes in aggregate conditions translate via sales to firms' investment. Investment is an important determinant of aggregate demand and the productive capacity of the economy, which makes this also a key question for policymakers. An intuitive way to quantify the impact of changes in sales on investment is the propensity of firms to invest out of unexpected sales realizations, or their marginal propensity to invest (MPI). Unfortunately, identifying how firms' sales affect their gross capital investment (CAPEX) is not straightforward. On the one hand, firms might invest more today to generate more sales tomorrow. In that case, investment causes sales. On the other hand, firms might invest more today because they sold more yesterday and have more cash. In that case, sales cause investment.

In this paper, we provide an extensive investigation of firms' MPI and its drivers by using a novel approach to identify firm-level sales shocks that overcomes this identification issue. We identify unexpected changes in firms' income using a representative survey of UK firms' expectations, the *Decision Maker Panel*. This survey allows us to identify firm-level sales growth surprises by constructing the forecast errors of firms' sales growth expectations, which we show are significantly correlated with firms' realised profitability. Importantly, these sales growth surprises are directly observable, fostering their construction without specific modeling assumptions and allowing us to provide novel evidence on the characteristics of firms' sales growth surprises and expectations.

We estimate the MPI as the change in investment induced by firms' own sales growth forecast errors. We find that a 1 percentage point higher than expected growth in sales translates into a 0.31 percentage point increase in investment over the subsequent 12 months. Consequently, there is a corresponding rise of 0.17 percentage points in the net asset stock. This response is significantly larger than found in previous studies (e.g. Hebous and Zimmermann, 2021; Martin-Baillon, 2021) because we can accurately control for the firm's information set. We also estimate the elasticity of firm-level price changes to sales growth surprises, where we find that an unexpected increase in sales growth by the same amount (1 percentage point) is associated with a 0.03 percentage point increase in prices over the subsequent 12 months.

We explore five potential mechanisms that could explain this positive pass-through from sales surprises to investment and prices: learning about unobserved demand, financial constraints, productivity shocks, micro vs. macro shocks, and changes in firm uncertainty. Our findings align most closely with the notion that firms learn about unobserved demand. In a standard model of firm decision-making under unobserved demand, unexpected sales realizations provide information about firms' actual demand. As a consequence, firms update their beliefs over time as they learn about their demand (as in Berman, Rebeyrol and Vicard, 2019). This learning process is reflected in their investment and price choices which, in this simple setting, can be shown to be linked to firms' expected sales.

We provide direct evidence for this learning-about-demand interpretation by showing that firms who are more attentive to their economic environment also respond more to sales growth surprises. This is because more attentive firms are able to extract more information from unexpected sales realisations. We measure attentiveness in two ways. First, we estimate a firm-level learning gain, which quantifies the weight that firms attach to forecast errors when updating their sales growth expectations. This allows us to measure how fast firms incorporate new information into their expectations. We find that firms with higher learning gains react more to sales growth surprises. Second, the DMP surveys firms' price-setting strategies: whether they adhere to a *time-dependent* approach, adjusting prices at regular intervals, or a *state-dependent* strategy, reacting to shifts in economic conditions. We estimate a significant MPI only for firms that follow state-dependent pricing. This is consistent with the assumption that state-dependent price-setters have to be more attentive to their economic environment. To do so, they pay more attention to unexpected sales realisations to learn about their economic environment which translates to higher estimated MPIs. Furthermore, we show that firms facing higher levels of uncertainty in their sales expectations are also more responsive, consistent with them obtaining more information from the surprise.

To corroborate this interpretation we explore the remaining four potential mechanisms, i.e. financial constraints, changes in firm uncertainty, productivity shocks, and differential responses to micro vs. macro shocks. We do not find support for these channels in the data which suggests that their role is small if anything.

We first explore the role of financial constraints, which can be an important factor shaping firm-level investment (Khan and Thomas, 2013) and increase firms' MPIs (Jeenas, 2023). Drawing on recent literature, we test for the role of financial constraints by estimating for heterogeneous MPIs along a number of commonly used proxies for financial constraints such as leverage, liquidity, interest burden, age, and size (Cloyne, Ferreira, Froemel and Surico, 2023; Gertler and Gilchrist, 1994; Ottonello and Winberry, 2020; Anderson and Cesa-Bianchi, 2020). We do not find significant heterogeneity in the estimated MPIs for any of these proxies. Taken together, these results suggest a limited scope for financial constraints to be driving our MPI measures.[1]

Second, we investigate the role of firm-level uncertainty about future sales growth for our results. Firm-level uncertainty could explain our results in two different ways: On the one hand, elevated firm-level uncertainty about sales growth might be the result of large forecast error realisations and might lead to larger subsequent forecast errors. That is, forecast errors might simply be a proxy for (or determinant of) changes in uncertainty (Altig et al. (2022), Yotzov et al. (2023)). In this case, firms could be adjusting their investment in response to a change in uncertainty instead of a sales growth surprise. On the other hand, the magnitude of firm-level uncertainty can shape how firms respond to these sales shocks. This effect can go either way, with the real-options channel –by triggering a wait-and-see effect– predicting a weaker response for high degrees of uncertainty, whereas firm-level learning predicting a stronger response. We find no evidence for the first effect because our MPI estimates remain unchanged when controlling for current and past uncertainty. However, when interacting firm-level uncertainty with sales growth surprises, we find that more uncertain firms react significantly to sales growth surprises. Firms that are more certain, on the other hand, do not react. This is consistent with more uncertain firms gaining more information from observing the current sales surprise and, thus, adjusting their investment more.

An alternative explanation for our results could be that firm-level sales growth surprises are a proxy for productivity shocks, which change the optimal size of the firm and thus affect

[1] Our results are consistent with Kaplan and Zingales (1997) who show how investment-cash flow sensitivities are a poor proxy of financial constraints, and with Ottonello and Winberry (2020) that find firms with low leverage responding more to monetary policy shocks than firms with high leverage.

firm investment. We find that this is not the case: when we explicitly control for changes in firm productivity, our baseline estimate is remarkably stable. Furthermore, the estimated response of prices to sales growth surprises corroborates the interpretation. If unexpected changes to sales growth were driven by changes in firm-level productivity, standard monopolistic pricing would, in fact, imply a negative rather than positive relationship between productivity shocks and price changes. This suggests that our MPI measure does not merely reflect a response to changes in productivity, but captures a distinct aspect of firm behaviour.

Finally, differential reactions of firms to micro and macro shocks, as in (Born et al., 2022), could affect our estimated MPIs. To test this we decompose sales growth surprises into a micro (i.e. firm-specific) and an aggregate (i.e. sector-specific) component. Our findings indicate that firms do not adjust their gross investment differently in reaction to micro or macroeconomic news.

Taken together, our results suggest that the investment response to sales growth surprises is not driven by financial frictions, firm-specific productivity shocks, or differential response to micro and macro shocks, but stem rather from a behavioral response where income shocks help firms learn about their demand, with more attentive firms extracting more information from unexpected income realisations.

Literature. Our paper is closely related to the empirical literature measuring the relationship between firms' capital investment and unexpected income shocks of various origin.

In a recent paper, Martin-Baillon (2021) applies the permanent/transitory shock decomposition developed in the consumption literature (Blundell, Pistaferri and Preston, 2008) to firms' income and estimates their investment response. In this case, the identification relies on correctly specifying firms' income processes to back out the transitory income shocks. In our case, as we have direct information on firms' expectations we can compute the unexpected component of sales growth realisation directly in the data without relying on a specific structure for firms' income processes.

Other contributions estimate the effects of income shocks due to macroeconomic policies. Cummins, Hassett and Hubbard (1994) study tax reforms, and more recently Hebous and

Zimmermann (2021) estimate an investment elasticity to federal spending using variation in federal procurement contracts in the US. Ottonello and Winberry (2020) among many others analyze how investment responds to monetary policy. Relative to this range of approaches, our main contribution is that we study how firms react to unexpected changes in income irrespective of the source of income variation. Recent research shows that firms react differently to, for example, micro and macro news (Born et al., 2022). Our measure likely captures both types of news. Furthermore, we provide a comprehensive analysis of potential factors that could explain firms' MPIs. As part of this investigation, we propose a novel methodology to identify firm-level income shocks that does not rely on a model and yields more frequent income shocks than, e.g., tax reforms, which also have a larger magnitude than monetary policy shocks. The resulting MPI estimates are relatively large compared to the existing literature. We show that this is partially due to the fact that we can accurately control form firms' information set and expectations. This leads to larger estimates relative to the existing literature and highlights the importance of capturing firms' expectations.

Our paper is also closely connected to a few recent studies that use firms' sales expectations to understand firm behaviour. Barrero (2022) establishes evidence on U.S. managers' belief biases to show that sales forecast errors are positively correlated with contemporaneous hiring decisions. We extend the evidence about sales growth surprises and additionally document the relationship between sales growth surprises and contemporaneous profits as well as subsequent sales growth. In contrast with this work, we do not find evidence that U.K. firms over- or under-extrapolate. Furthermore, by focusing on firms' realized investment and price response to sales growth surprises we extend the analysis of Barrero (2022) beyond hiring plans. Bachmann, Carstensen, Lautenbacher and Schneider (2021) study the dynamics of sales uncertainty in a panel of German manufacturing firms, documenting a positive relationship between the magnitude of firms' sales growth forecast errors and their uncertainty about subsequent sales growth. Lastly, Boutros et al. (2020) report similar results based on a sample of forecasts by Chief Financial Officers of S&P 500 companies. Relative to these papers, our focus instead is on firms' investment decisions in response to unexpected sales growth. And, while we confirm the connection between sales forecast errors and subsequent sales growth in the latter two, this channel does not explain our main result.

We also relate to the literature on measuring firm-level uncertainty and its interaction with firms' decision-making. A number of contributions have documented using aggregate and micro-level data that uncertainty can lower the level of economic activity. (Bloom, 2009). More specifically, higher uncertainty at the firm level can lower investment due to irreversibility, and weaken its responsiveness of investment to demand shocks (e.g. monetary policy) through a real options channel (Bloom, Bond and Van Reenen, 2007; Lakdawala and Moreland, 2022; Bloom et al., 2022). Recent work involving DMP data constructs subjective uncertainty measures to track economic uncertainty during the Covid-19 pandemic (Altig et al., 2020) and finds that increased uncertainty contributed significantly to the negative impact of Brexit on UK firms (Bloom et al., 2019). Our results suggest that while uncertainty is not the main driver of our MPI estimate, firms with higher subjective uncertainty have a higher MPI, consistent with them having a larger informational gain from sales surprises.

Outline. The remainder of the paper is structured as follows: Section 2 describes the data. Section 3 describes our identification and presents stylised facts of sales growth surprises. Section 4 presents the empirical approach and the results of our empirical analysis. Section 5 discusses the main interpretation of our results and explores alternative explanations. Section 6 concludes.

2 Data

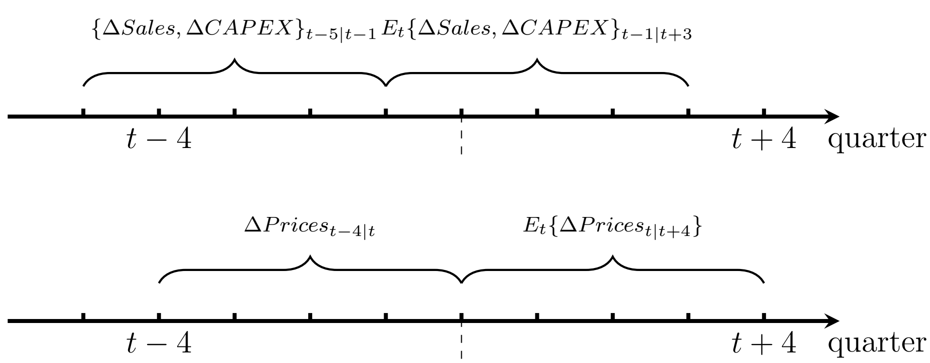
This section provides an overview of the two primary data sources used. Sales, pricing, and capital expenditures variables (both realized and expected) are obtained from the Decision Maker Panel (DMP), while balance sheet data is sourced from Bureau van Dijk (BvD).

2.1 The Decision Maker Panel

The DMP is a comprehensive and representative online survey of UK businesses, jointly initiated by the Bank of England, the University of Nottingham, and Stanford University. Each month, this panel survey recruits new participants by phone, targeting businesses with a minimum of 10 employees. With a monthly response rate of approximately 3,000 firms, representing about 5% of UK private sector employment, the DMP is one of the largest monthly business surveys in Europe. The survey offers robust coverage across various industries, firm sizes, and regions in the UK, encompassing both public and private firms.

Since 2016Q3, the DMP surveys firms' expectations for one year-ahead gross investment (CAPEX) as well as sales growth and own price growth.[2] In the first stage, firms are asked about the expected realisation of each variable in the lowest, low, medium, high, and highest scenario (see Appendix A for the exact questions). Subsequently, firms are tasked with assigning probabilities to each of these scenarios. These probabilities allow us gauge firms' confidence in these predictions. The expected value is then calculated using a weighted average of these scenarios, where the weights are the subjective probabilities assigned to each scenario. Additionally, the DMP surveys firms' realised investment, sales and own price growth over the preceeding year. Table B.1 provides summary statistics of firms' survey responses.

Figure 1: Reference Periods for Survey Questions in Time t



As depicted in Figure 1, the DMP applies different reference periods for questions about CAPEX and sales on the one hand, and questions about prices on the other hand. For CAPEX, the period t survey asks about the *level* of firms' investment in period $t-1$. Firms are then asked about the realised (expected) level of CAPEX four quarters before (after)

[2]The survey employs a three-panel rotation system, wherein new participants are randomly assigned to one of three panels (A, B, or C). In any given month, each panel receives a third of the total questions, ensuring that over a quarter, all firms encounter the entire set of questions. This rotation method not only maintains a short survey for respondents but also ensures a consistent monthly influx of data.

that reference quarter, i.e. $t-5$ ($t+3$). The growth rate of CAPEX is then computed using these respective levels.[3] For prices, the period t survey asks about the *growth* of firms' own prices using period t as reference period. That is, the survey asks firms about their realised (expected) own price growth between period t and fours quarters before (after) that reference quarter, i.e. $t-4$ ($t+4$). Sales-related questions align with CAPEX in timing, using the previous quarter $t-1$ as reference period. Unlike the CAPEX-related questions, sales-related questions focus on firms' sales growth instead of levels.

At a given survey date, price and sales as well as investment questions have a different reference period. This implies that the survey date for a given reference period also differs. For instance, firms' sales expectations for the period between t and $t+4$ are surveyed in $t+1$ whereas price expectations for the same period are surveyed in t. Expectations for prices thus reflect a different information set from that of sales and investment. This means that we cannot consistently deflate sales expectations with own price expectations and necessitates the use of nominal variables. Furthermore, measuring the unexpected income change in terms of quantities rather than pounds would also complicate the interpretation of the resulting estimate as a marginal propensity to invest out of unexpected income.

The survey drops all responses in which firms did not provide answers for all five scenarios or the order of scenarios is reversed. Furthermore, it drops observations in which the probabilities assigned to these five scenarios do not add up to 100%. Additionally, we drop observations in the utilities, finance and insurance, real estate, public, as well other services (such as Greenpeace) sectors as common in the literature.[4]

[3] In the DMP, the growth rate of CAPEX is computed using the same approach as in Davis, Haltiwanger and Schuh (1998), i.e. by normalising the change in CAPEX between $t-1$ and $t+3$ using the average CAPEX between $t-1$ and $t+3$. This weighted growth rate measure is preferable to standard growth rate measures (i.e. $\Delta\log(\text{CAPEX}_{i,t})$) because it does not get arbitrarily large when one of the elements approaches zero and does not produce missing observations when a firm does not invest in a given quarter. Furthermore, as Baumeister and Hamilton (2023) point out, this growth rate resembles a first-order Taylor approximation of $\Delta\log(\text{CAPEX}_{i,t})$ at the midpoint between the two elements. The approximation is almost exact as long as $\text{CAPEX}_{i,t}$ and $\text{CAPEX}_{i,t-1}$ do not differ by more than a factor of two.

[4] We omit these sectors from our analysis due to their distinct business models. For instance, high leverage is commonly observed in financial firms, whereas in a typical non-financial firm, it often signifies financial distress.

2.2 Balance Sheet Data

Firms in the UK are obligated to submit their annual accounts to Companies House, a government entity. These annual records are accessible through Bureau van Dijk (BvD) which compiles about 1.5 million distinct company accounts annually. Since BvD is a live database we use archived data sampled at a six-monthly frequency, ensuring that we gather information in the initial form it appeared in BvD database (see Bahaj, Foulis and Pinter, 2020). Importantly, balance sheet data provided by the BvD can be merged with DMP data through a shared firm identifier. This allows us to compute relevant balance sheet information (i.e., leverage, net liquidity, interest burdens, profitability), as well as firms' age and productivity growth. Table B.3 displays the summary statistics of these measures.

3 Sales Growth Surprises

In this section, we discuss our methodology for identifying sales growth surprises and examine the characteristics of these identified surprises.

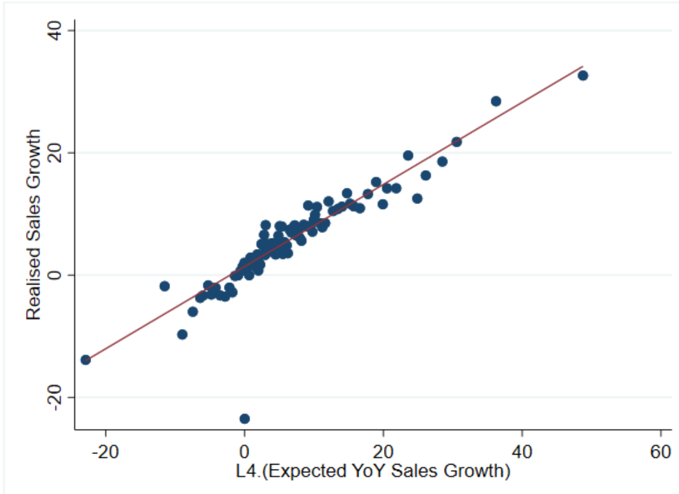
As illustrated in Figure 2, firms' sales growth expectations reported in the DMP are highly correlated with their respective realisations ($\rho = 0.72$). Despite this high correlation, firms' sales expectations can explain relatively little variation of sales realisations ($R^2 = 0.13$), indicating that firms frequently make large forecast errors.

We use these forecast errors to identify shocks to firms' incomes. For completeness, define sales growth surprises as the difference between a) firm i's realised sales growth between $t-4$ and t as reported in period $t+1$ and b) firm i's sales growth expectations for the same 4-quarter window as reported in period $t-3$:

$$FE_{i,t-3}(\Delta \text{Sales}_{i,t-4|t}) = \Delta \text{Sales}_{i,t-4|t} - E_{i,t-3}\Delta \text{Sales}_{i,t-4|t} \tag{1}$$

These identified sales growth shocks combine three attractive features. First, they are directly observable in the data and do not require assumptions about the firms' income process. Second, these shocks are both frequent and sizeable, setting them apart from other aggregate

Figure 2: Sales Expectations and Realisations



Note: This figure plots the bins of sales expectations & subsequent sales realisations along with a linear regression line which has a slope of $\rho = 0.72$ ($\sigma = 0.03$, $R^2 = 0.13$).

and firm-level shocks used in the literature. Third, the exposure to sales growth surprises is equal across firms, unlike the exposure to aggregate shocks like monetary policy. In the remainder of this section, we discuss properties of these sales growth surprises and present stylised facts.

Table 1: Summary Statistics

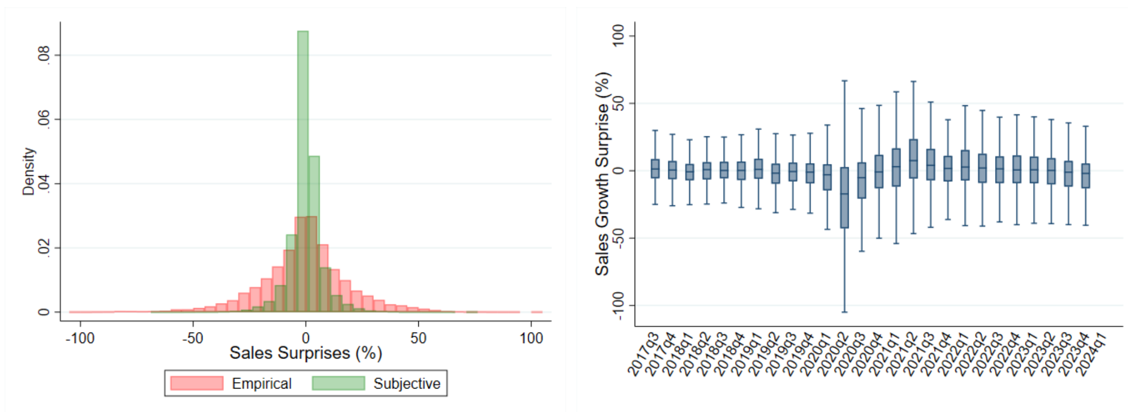
	N	Mean	s.d.	p10	p50	p90
$\mathbb{E}_{t+1}\Delta\text{Sales}_{t\|t+4}$	53,983	7.32	10.76	-3.00	5.00	21.45
$\sigma(\Delta\text{Sales}_{t\|t+4})$	53,983	5.90	4.49	1.49	4.66	12.77
$\Delta\text{Sales}_{t-4\|t}$	55,993	6.62	20.89	-19.00	5.00	34.00
$\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	21,768	-0.72	20.39	-24.79	-0.20	23.00

1. Firms' expectations are unbiased but overprecise. Table 1 shows that forecast errors are zero on average. That is, firms are not systematically under- or overoptimistic.[5] However, firms underestimate the volatility of sales growth, i.e. their sales expectations are overprecise. This is illustrated by the difference between subjective sales growth uncertainty $\mathbb{E}_{t+1}(\sigma(\Delta\text{Sales}_{t|t+4}))$ and the volatility of realised sales growth $\Delta Sales_{t-4|t}$ in Table 1. This difference is further illustrated in Panel A of Figure 3, which plots the histogram of subjective vs. realised forecast errors. Both observations are consistent with Bachmann et al. (2021)

[5]This result still holds when correcting the standard error of the average forecast error by clustering on the firm as well as on the industry and quarter level.

and Barrero (2022) who use the forecast errors of firms' sales expectations in Germany and the U.S., respectively.

Figure 3: Distribution of Sales Growth Surprises



(a) Histogram of Sales Growth Surprises

(b) Cyclicality of Sales Surprises

Note: Panel a of this figure plots the histogram of realised sales growth surprises (red) along with a hypothetical distribution of sales growth forecast errors (green) that follows firms' subjective probability distributions (i.e. a histogram of sales growth surprises obtained by taking independent draws from firms' subjective probability distributions). Panel b of this figure includes the box plot depicting the median sales growth surprises in each quarter along with the interquartile range as well as the minimum and maximum points of the distribution that omits outliers (values that are 1.5*IQR above the upper quartile/below the lower quartile).

2. Firms do not make persistent forecast errors. Firms' forecast errors for year-on-year sales growth are not correlated with the forecast error for the same window in the previous year, i.e. forecast errors are not correlated within firm over time as Column (1) of Table B.4 shows. Presumably this is because firms do not under- or overextrapolate from past sales realisations so that sales forecast errors are not significantly related to past sales growth (expectations) as Columns (2)-(3) show. In this, our findings differ from Barrero (2022).

3. Firms' forecasts get better over time. Column (4) of Table B.4 shows that the magnitude of forecast errors decays over time, indicating that firms improve their forecasts. Similarly, Figure B.1 shows that the magnitude of firms' forecast errors decreases with age even after controlling for aggregate conditions, but this decay reaches a limit at an age of about 60 years.

4. Firms under-react to news. Table B.5 shows that firms' forecast revisions are positively related to subsequent forecast errors, indicating that firms under-react to news. In this, our findings differ from Altig et al. (2022), who find evidence for over-reaction among U.S. firms.[6] Decomposing this forecast revision into a industry-specific and an idiosyncratic component by regressing it on quarter × industry dummies furthermore shows that firms primarily under-react to idiosyncratic news. The estimated coefficient on industry-specific news is negative but insignificant, which suggests that firms adjust their expectations correctly to these macro news. In this, our findings depart from Born et al. (2022) who find evidence for an under-reaction of own price growth expectations to macro news by German firms.

5. Forecast errors are cyclical but largely idiosyncratic. Panel B of Figure 3 illustrates the cyclical behaviour of forecast errors: with the onset of the Covid-19 pandemic, the share of firms experiencing positive forecast errors drops sharply before recovering in 2021. Similarly, the dispersion of forecast errors spikes around the onset of the Covid-19 pandemic and remains elevated compared to pre-pandemic periods. However, even in 2020Q2 a substantial share of firms reported higher sales growth than they expected before the pandemic and in all periods the interquartile range of sales growth surprises includes zero. This indicates the largely idiosyncratic nature of sales growth surprises.

6. Sales growth surprises are associated with changes in contemporaneous profits. The DMP does not survey firms' profit expectations so that we cannot compute profit surprises. Nonetheless, Table 2 shows that sales growth surprises are significantly correlated with firms' profits & profitability: a 1pp sales growth surprise is associated with a contemporaneous 0.51pp growth in profits (EBITDA) and a 0.04 higher profitability (EBITDA-to-assets).[7]

7. Forecast errors predict a non-linear change in subsequent sales growth (expectations). Column (1) of Table 3 shows that firms, on average, revise their sales expectations downwards in response to a positive sales growth surprise.[8] However, this average response masks significant heterogeneity in responses to negative and positive sales growth surprises, as Column (2) shows (see Figure B.2 for a visualization of this non-linearity). Firms expect

[6] Altig et al. (2022) measure this with the correlation of forecast errors with the preceeding forecast revision, like we do, but define this as a test for under- or overextrapolation

[7] All estimates in Table 2 are based on the same sample of firms as in Table 4, Column (1), but relying only on periods in which firms filed their balance sheet information.

[8] We control for firms' price growth expectations for a potential price response in a regression of sales growth expectations on sales forecast errors.

Table 2: Sales Surprises and Balance Sheet Data

	(1) ΔEBITDA$_{t-4\|t}$ (BvD) b/se	(2) ΔProfitability$_{t-4\|t}$ (BvD) b/se
$FE_{t-3}(\Delta Sales_{t-4\|t})$	0.51***	0.04**
	(0.14)	(0.02)
$\Delta Price_{t-4\|t}$	1.49**	0.24***
	(0.75)	(0.08)
N	711	796

Note: This table reports the contemporaneous relationship between the growth rate of EBITDA & EBITDA-to-Assets (reported in BvD) and sales growth surprises. All estimates in Table are based on the same sample of firms as in Table 4, Column (1), but rely only on periods in which firms filed their balance sheet information. Standard errors in Columns (2) and (3) clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

sales growth to rebound quickly following a negative sales surprise. In contrast, positive sales surprises do not lead to a reversal of sales growth expectations.[9] Furthermore, columns (3) and (4) of Table 3 indicate that firms' adjustment of sales expectations aligns very well with the realised subsequent change in sales growth. These results are thus also consistent with positive surprises leading to a more persistent effect on the level of sales.

[9]Table B.6 shows that this effect continues to holds further out, consistent with firms expecting sales to mean-revert following negative surprises whereas positive surprises do not lead to a change in sales growth expectations after two years.

Table 3: Sales Surprises and Future Sales

	(1) $\mathbb{E}_{t+1}\Delta\text{Sales}_{t\|t+4}$ b/se	(2) $\mathbb{E}_{t+1}\Delta\text{Sales}_{t\|t+4}$ b/se	(3) $\Delta\text{Sales}_{t\|t+4}$ b/se	(4) $\Delta\text{Sales}_{t\|t+4}$ b/se
$\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	-0.10***		-0.08**	
	(0.02)		(0.03)	
$\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})^{-}$		-0.44***		-0.38***
		(0.06)		(0.07)
$\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})^{+}$		0.06**		0.02
		(0.03)		(0.05)
$\mathbb{E}_{t}(\Delta\text{Price}_{t\|t+4})$	0.46***	0.43***	0.44***	0.41***
	(0.09)	(0.09)	(0.15)	(0.15)
Negative = Positive (p-value)		0.00		0.00
N	4,263	4,263	3,701	3,701

Note: This table reports the relationship between sales expectations (Columns (1) and (2)) and realisations (Columns (3) and (4)) and the preceding sales forecast errors (split between positive and negative realisations in Columns (2) and (4)) in the sample used to estimate model (2). Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

4 Empirical Results

Having documented the informational content of our identified sales growth surprises for contemporaneous profits and subsequent sales growth, we now estimate how firms respond to these sales growth surprises. We focus on estimating the marginal propensity to invest in Section 4.1. We provide additional evidence on the response of prices in Section 4.2.

4.1 The Average MPI

We estimate the MPI as the realised change of firm i's gross investment between t and $t+4$ as a function of the unexpected realisation of sales growth in previous year, i.e. the forecast error between $t-4$ and t. That is, we estimate the MPI as the coefficient $\hat{\beta}$ using

$$\begin{aligned}\Delta\text{CAPEX}_{i,t|t+4} = \alpha + \beta FE_{i,t-3}(\Delta\text{Sales}_{i,t-4|t}) + \gamma_1 \Delta\text{Prices}_{i,t-4|t} \\ + \gamma_2 \Delta\text{CAPEX}_{i,t-4|t} + \gamma_3 E_{i,t+1}(\Delta\text{Sales}_{i,t|t+4}) + u_{i,t},\end{aligned} \tag{2}$$

The set of controls includes realised price growth to account for the endogenous part of the forecast error. This eliminates the component of the sales surprise that is caused by firms adjusting their prices during the forecast horizon. For example, if firms experience higher sales growth than expected in period $t-3$ because they raised prices in $t-2$ by more than originally planned, the forecast error realisation would no longer be unexpected. Furthermore, controlling for realised price growth partials out any supply driven source of the forecast error, allowing us to interpret $\hat{\beta}$ as the response to demand driven sales surprises. To the extent that firms contemporaneously observe sales growth different than expected in period $t-3$ and adjust investment or prices before period t, the estimated MPI $\hat{\beta}$ would constitute a lower bound of the response to demand induced sales shocks. We further control for past investment growth to account for lumpiness in investment. We do not include firm fixed effects on top of lagged investment to avoid biasing our results.[10] Finally, we control for expected future sales growth to control for potential heterogeneity in the persistence of sales growth surprises across firms.[11] This partials out the immediate effect of sales growth surprises on firms' expectations.

To assess the robustness of our MPI measure we estimate three alternative versions of model (2): First, given that our main sample includes the COVID years, a potential concern is that our estimates of MPIs are driven by the unprecedented nature of the COVID shock. To address this concern, we estimate (2) on a restricted sample in which we drop the sales realisations during the initial COVID quarters (2020Q2 and 2020Q3), excluding the variation in our main explanatory variable induced by the pandemic. Second, we also augment the specification in Equation (2) with industry × quarter fixed effects to control for aggregate shocks.[12] Finally, to avoid the possibility that firms' forecasts of tail scenarios might be bias-

[10]As noted by Nickell (1981), the inclusion of individual fixed-effects when controlling for lagged dependent variables introduces a mechanical correlation between regressors and the error term that would bias the estimate of all covariates. This is a consequence of the within-estimator as the average of the lagged dependent variable will be correlated with the average of the error term even if the errors are not autocorrelated.

[11]In Table C.11 we show that the shocks identified via sales growth surprises do not exhibit any heterogeneous persistence across firms even when conditioning on firms' attentiveness types.

[12]Here, industry refers to 12 high level sectors: agriculture & forestry & fishing, mining & quarrying, manufacturing, construction, wholesale & retail, transport & storage, accommodation & food, information & Communication, professional & scientific & technical activities, administrative & support service activities, health, as well as arts & entertainment & recreation.

ing our MPI estimate, we run the estimation using an alternative measure of sales surprises based on firms' median forecasts rather than their probability weighted ones.

Table 4: Average MPI

	(1) $\Delta\text{CAPEX}_{t\|t+4}$ b/se	(2) $\Delta\text{CAPEX}_{t\|t+4}$ b/se	(3) $\Delta\text{CAPEX}_{t\|t+4}$ b/se	(4) $\Delta\text{CAPEX}_{t\|t+4}$ b/se
$\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.31***	0.41***	0.28***	
	(0.08)	(0.09)	(0.09)	
$\text{FE}_{t-3}(\text{med}(\Delta\text{Sales}_{t-4\|t}))$				0.30***
				(0.08)
$\mathbb{E}_{t+1}(\Delta\text{Sales}_{t\|t+4})$	1.01***	0.90***	0.70***	
	(0.11)	(0.15)	(0.12)	
$\mathbb{E}_{t+1}(\text{med}(\Delta\text{Sales}_{t\|t+4}))$				1.12***
				(0.12)
$\Delta\text{CAPEX}_{t-4\|t}$	-0.25***	-0.24***	-0.25***	-0.25***
	(0.02)	(0.02)	(0.02)	(0.02)
$\Delta\text{Price}_{t-4\|t}$	-0.13	0.03	-0.63*	-0.15
	(0.38)	(0.38)	(0.38)	(0.38)
Covid	Yes	No	Yes	Yes
FE	No	No	Quarter x Ind.	No
N	4,312	3,918	4,290	4,312

Note: Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. $\text{E}_{t+1}(\text{med}(\Delta\text{Sales}_{t|t+4}))$ refers to the forecast of sales growth in the median scenario whereas $\text{FE}_{t-3}(\text{med}(\Delta\text{Sales}_{t-4|t}))$ refers to the forecast error for sales growth in the median scenario.

Results. We report the main estimates for the average MPI in Table 4. Column (1) shows our preferred measure estimated on the full sample of firms, including the COVID quarters.[13] Our estimate indicates that, on average, a 1 percentage point unexpected growth in sales translates to a 0.31 percentage point increase in gross investment. More concretely, if a (hypothetical) firm expected to sell £100 worth of goods and planned to invest £10 happens to actually sell £110 (a 10% surprise), it will increase investment by £3.10 from £10 to £13.10 over the following year.

[13]This setup requires survey responses in time $t-3$ (sales growth expectations), t (realised price growth), $t+1$ (realised sales and investment growth), and $t+5$ (realised investment growth). Taking into account these leads and lags, the effective sample of sales growth surprises spans 2017q3 - 2023q2, with data on realised investment covering the period 2018q3 - 2024q2.

The estimated MPI is remarkably robust across different specifications, as shown in Columns (2) to (4) of Table 4. Excluding the COVID quarters increases our MPI estimate to 0.41 (Column (2)), while including quarter $\times$ industry fixed effects to control for aggregate shocks marginally reduces the point estimate to 0.27 (Column (3)). Reassuringly, Column (4) shows that measuring sales surprises using firms' median forecasts rather than their probability weighted ones delivers exactly the same estimate as in the baseline specification. None of these alternative estimates deviates significantly from our baseline specification.

The remaining coefficient estimates have the expected sign and are similarly stable across specifications. Gross investment is significantly positively correlated with sales growth expectations, indicating firms increase their productive capacity when expecting higher sales. Gross investment is negatively correlated with its lagged realisation, reflecting the lumpy nature of capital investments at the firm level.

Comparison with the literature The two papers closest to ours are Martin-Baillon (2021) and Hebous and Zimmermann (2021), who estimate the investment response of public U.S. firms to sales shocks to lie between $10 - 15\%$, between a third and a half of our estimate. A significant part of this difference comes from the fact that we can accurately capture firms' information sets and expectations. That is, sales shocks change firms' sales growth expectations. We estimate this effect to be negative (see Table 3). This negative association implies that positive sales growth surprises depress firms' expectations of future sales growth, subsequently dampening investment. Therefore, not controlling for sales growth expectations leads to a smaller estimated investment elasticity because the estimated elasticity is a composite of the direct response and expectation adjustment. In our case, the estimated elasticity drops from 0.31 to 0.21 if we omit the expected sales growth control (see Table C.1). This underscores the importance of precisely capturing firms' expectations. The remaining difference is likely attributed to variations in shock identification methods and sample set, particularly the inclusion of privately owned firms.

Sensitivity. To corroborate our results, we re-estimate our baseline specification (2) but replace gross investment realisations surveyed in the DMP as dependent variable with balance sheet data on realised net investment from annual balance sheet accounts. In particular, in Table C.2 we consider three different measures of investment: the growth rate of tangible assets, the growth rate of fixed assets, and the growth rate of intangible assets. The results in Columns (1) and (2) indicate that sales growth surprises not only lead to an in increase in gross investment, but also lead to a significant increase in the net fixed (tangible) asset stock: a 1pp. sales growth surprises increases the fixed (tangible) capital stock by 0.17pp. (0.16pp.). Finally, Column (3) indicates that sales growth surprises do not lead to changes in the intangible asset stock. Furthermore, an unexpected increase in sales growth also leads to a significant increase of the investment rate (see Table C.3): An unexpected 1pp. increase in sales growth increases investment relative to total tangible assets (total sales) by 0.16% (0.04%). Taken together, these results indicate that the estimated MPI reflects neither replacement investment due to utilization-dependent depreciation rates nor inventory building. The latter would also be at odds with the phrasing of the survey question.

Table C.4 shows the effect of sales growth surprises on investment growth over a medium-term horizon: The response of investment growth between $t+4$ and $t+8$ to a sales growth surprise between $t-4$ and t is negative and marginally significant. This indicates that investment growth shows some tendency to mean revert but the level of investment appears to remain elevated also in the medium term.[14]

Furthermore, the average estimated MPI appears to be largely driven by large, positive sales growth surprises, whereas medium sized or large negative surprises do not lead to significant investment responses (see Table C.5). This asymmetry is consistent with a differential pass-through of surprises to sales growth (expectations) which we showed in Section 3 (stylised fact #7). Negative surprises are followed by a quick rebound in sales growth expectations and subsequent sales growth, so firms do not adjust their investment downward in anticipation of this rebound. In contrast, we do not see such reversal in the case of positive surprises and firms thus scale up production to meet this increased demand.[15]

[14] A back of the envelope calculation suggests that investment is $(1+0.0032)(1-0.0017) = 0.15\%$ higher in $t+8$ than in t.

[15] Capital irreversibility as in Cooper and Haltiwanger (2006) can also contribute to this differential response.

Note again that these results are obtained from nominal variables due to the difference in information sets underpinning firms' sales and price expectations. However, the results are largely unchanged even when we ignore the difference in information sets and use real variables instead (see Table C.6). To deflate firms' sales growth expectations (realisations) we use their own price growth expectations (realisations) and we deflate realised investment using the CPI.

Table C.7 shows that the estimated MPI does not differ significantly between firms in the manufacturing & construction industries and firms in the services industries.[16]

These results are also also robust to controlling for i) how long a given firm has been taking part in the survey, ii) whether the survey questions are answered by a given firm's CEO, CFO, or other personnel,[17] and iii) the legal form of the company (see Table C.8). Finally, we test whether our results change when weighting observations using employment weights and when using the sales growth surprise as an instrumental variables for realised sales growth instead of adding it directly to the estimated model. Table C.9 shows that in neither case the results change significantly.

4.2 The Price Response (MPMP)

In addition to the investment response, we also investigate how firms adjust their prices in response to unexpected changes in sales growth. For this, we use the same specification as in Section 4.1 but instead of investment growth we estimate the response of realised price growth between t and $t+4$ to a sales growth surprise. The estimated coefficient measures how much the unexpected change in sales growth induces a change in future prices, providing an estimate of firms' "marginal propensity to modify prices" (MPMP).

Results We report our baseline estimate in Table 5, Column (1). As for our MPI estimate, we control for the role of COVID, the possible influence of industry specific time trends

[16]We count the following industries as the service sector: wholesale & retail, transport & storage, accommodation & food, information & communication, professional & scientific & technical activities, administrative & support service activities, health, as well as arts & entertainment & recreation.

[17]For this control, we replace missing information on the survey respondent's position with the first / last available information.

Table 5: Average MPMP

	(1) $\Delta\text{Price}_{t\|t+4}$ b/se	(2) $\Delta\text{Price}_{t\|t+4}$ b/se	(3) $\Delta\text{Price}_{t\|t+4}$ b/se	(4) $\Delta\text{Price}_{t\|t+4}$ b/se
$\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.03***	0.03***	0.02***	
	(0.01)	(0.01)	(0.00)	
$\text{FE}_{t-3}(\text{med}(\Delta\text{Sales}_{t-4\|t}))$				0.03***
				(0.01)
$\mathbb{E}_{t+1}(\Delta\text{Sales}_{t\|t+4})$	0.07***	0.09***	0.05***	
	(0.01)	(0.01)	(0.01)	
$\mathbb{E}_{t+1}(\text{med}(\Delta\text{Sales}_{t\|t+4}))$				0.07***
				(0.01)
$\Delta\text{CAPEX}_{t-4\|t}$	0.00	-0.00	-0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
$\Delta\text{Price}_{t-4\|t}$	0.45***	0.44***	0.33***	0.45***
	(0.03)	(0.03)	(0.03)	(0.03)
Covid	Yes	No	Yes	Yes
FE	No	No	Quarter x Ind.	No
N	3,704	3,381	3,685	3,704

Note: Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. $\text{E}_{t+1}(\text{med}(\Delta\text{Sales}_{t|t+4}))$ refers to the forecast of sales growth in the median scenario whereas $\text{FE}_{t-3}(\text{med}(\Delta\text{Sales}_{t-4|t}))$ refers to the forecast error for sales growth in the median scenario.

and the regularity of firms' expectations by changing our estimation period, Column (2), including industry-quarter fixed effects, Column(3), and by using firms' median scenarios to construct the sales growth surprises, Column (4). As for the baseline MPI estimates, our measurement of firms' MPMP is very stable across the different specifications, indicating that a 1 percentage point higher than expected sales growth induces a 0.03 percentage point increase in prices, in the year following the realisation of the sales growth surprises. Note that the stable coefficient in column (3) despite the inclusion of quarter $\times$ sector fixed effects suggests that the price response is not driven by the pass-through of higher prices of suppliers that are subject to correlated sales surprises.

Sensitivity We conduct the same set of sensitivity analyses as for the CAPEX response. We find that prices do not react in the second year after the shock (Table C.5). Furthermore, we find that the price response is non-linear in the magnitude of the sales growth surprise: firms barely adjust their prices in response to large negative surprises. The biggest adjustment occurs after sales surprises around zero. Larger positive sales surprises also lead to a significant response, but smaller than for medium sized surprises (Table C.5). We find no difference in the responsiveness between sectors (Table C.7). Finally, the result is robust to controlling for survey features (Table C.8) and using employment weights in the regression (Table C.9).

5 Drivers

The average response to sales growth surprises can reflect a myriad of competing factors. In this section we discuss the main driver of our MPI measure: firms use unexpected sales growth realisations to learn about their demand. We also explore other dimensions of firm heterogeneity to rule out alternative explanations for the positive relationship between sales growth surprises and investment.

5.1 Attention

If firms use unexpected sales growth realisations to learn about their demand, we would expect more attentive firms to adjust their investment and prices by more than less attentive firms. The degree of attention to the state of the economy is of course an unobservable firm characteristic. However, the DMP provides us with two measures that can be used to proxy firm attentiveness: first, we utilise the DMP survey responses to estimate a firm specific learning gain. Second, the DMP directly asks whether firms follow a *state*- or *time*-dependent pricing strategy. Using these two measures, we show in this section that more attentive firms indeed respond more sales growth surprises. Importantly, this is consistent with our main result. Although we control for sales expectations in our baseline specification (2), which should capture the adjustment firms make following a sales surprise, we find that firms under-react to sales growth surprises and their expectations adjust only sluggishly (see stylised fact 4 and Table B.5).

5.1.1 Learning Gain

We use the degree to which firms adjust their expectations in response to forecast errors, i.e. their learning gain (Evans and Honkapohja, 2001), as a proxy for attentiveness. We estimate the firm specific learning gain as the parameter γ_i that links quarter-on-quarter revisions in sales growth expectations to forecast errors from the following firm-level regression

$$E_{t+1}(\Delta \text{Sales}_{i,t|t+4}) - E_t(\Delta \text{Sales}_{i,t-1|t+3}) = \alpha_i + \gamma_i \text{FE}_{i,t-3}(\Delta \text{Sales}_{i,t-4|t}) + \zeta_i \Delta \text{Prices}_{i,t-4|t} + \delta_i \Delta \text{E} \Delta \text{Prices}_{i,t-4|t} \quad (3)$$

We only keep estimates of $\gamma_i \in (-1, 1)$ that were estimated on a sample of 8 or more observations. With this regression setup we deviate from the learning literature in two ways. First, we control for realised price growth as in our baseline model to account for the endogenous part of the forecast error. Second, we control for the change of price growth expectations because, upon realisation of the forecast error, firms jointly adjust their price and sales growth expectations. Controlling for price growth expectations accounts for any heterogeneity in this adjustment. Figure 4 plots the distribution of estimated learning gains. The average and median gain is negative (consistent with the negative relationship between sales growth surprises and subsequent sales growth documented in Table 3) with large outliers.[18]

To investigate whether firms' with different degrees of attentiveness respond differently to sales growth surprises, we create a dummy variable $D_{i,\tau}$ indicating whether $\gamma_i \in (-1, -1/5)$, $\gamma_i \in (-1/5, 1/5)$, or $\gamma_i \in (1/5, 1)$.[19] Table C.10 reports summary statistics of firms by the magnitude of their respective learning gain. We add this interaction term to Equation 2 to estimate different MPIs for firms with different learning gains. In particular, we estimate:

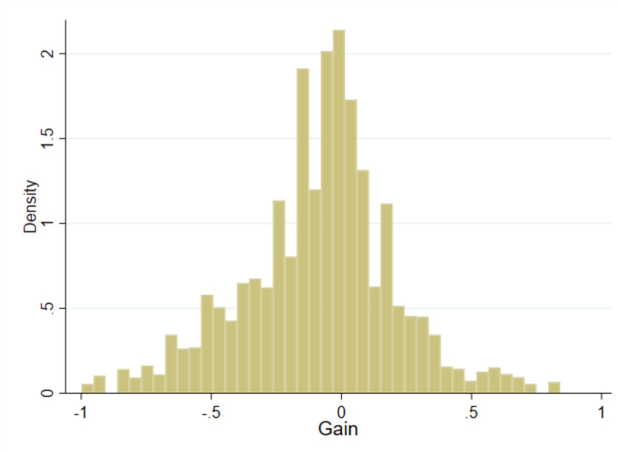
$$\Delta \text{CAPEX}_{i,t|t+4} = \alpha + \sum_{\tau} \left(\beta_\tau FE_{i,t-3}(\Delta \text{Sales}_{i,t-4|t}) \times D_{i,\tau} + \zeta_\tau D_{i,\tau} \right) + \gamma_1 \Delta \text{Prices}_{i,t-4|t} + \gamma_2 \Delta \text{CAPEX}_{i,t-4|t} + \gamma_3 E_{i,t+1}(\Delta \text{Sales}_{i,t|t+4}) + u_{i,t}, \quad (4)$$

[18] The size of the learning gain is not related significantly with the magnitude of the forecast errors.

[19] Figure C.1 shows that the distribution of realised sales growth surprises is very similar for the three groups: All three distributions are centered around zero, but the distribution of sales growth surprises for firms with larger learning gains has more mass around the center.

The coefficients β_τ estimate how the MPI varies across the firm distribution. This specification, has the advantage that it does not impose linearity on the interaction. Instead, it offers a non-parametric way of estimating the heterogeneous responses to sales growth surprises by different firm characteristics.

Figure 4: Histogram of Learning Gains



Note: This figure displays the histogram of firm-level learning gains estimated from model (3), restricting the estimated gains to lie in $\gamma_i \in (-1, 1)$.

Table 6 presents the results. We find that firms with large, positive learning gains, i.e. those that revise their expectations more in response to forecast errors, adjust their investment by more in response to sales growth surprises than firms with a small or large, negative learning gain. This difference is statistically significant. For completeness, Column (2) reports the estimated price response to sales growth surprises for the three types of firms. Here, we do not find any statistically significant heterogeneity for different levels of firm attentiveness.[20]

5.1.2 Price setting type

As an alternative measure of attention we estimate whether firms' differ along their price-setting strategy. The DMP reports whether firms follow a *state*- or *time*- dependent pricing strategy.[21] Firms are asked whether they reset their prices in regular intervals, i.e. a time-

[20] These results remain unchanged when also interacting sales growth surprises with the size of the learning gain to account for a potentially heterogeneous updating of expectations between the three groups.

[21] This categorization is self reported in the DMP and was surveyed between 2023m2 - 2023m4 as well as 2024m2 - 2024m3. We assume that that the price-setting strategy it time-invariant. If, following a rational (in-)attention logic, some firms switched from a time-dependent to a state-dependent price setting strategy

Table 6: Does Attentiveness Matter?

	(1) $\Delta\text{CAPEX}_{t\|t+4}$ b/se	(2) $\Delta\text{Price}_{t\|t+4}$ b/se
$\gamma_i \in (-1, -1/5) \times \text{ FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.19	0.05***
	(0.20)	(0.01)
$\gamma_i \in (-1/5, 1/5) \times \text{ FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.20	0.03***
	(0.15)	(0.01)
$\gamma_i \in (1/5, 1) \times \text{ FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.82**	0.01
	(0.33)	(0.02)
$\mathbb{E}_{t+1}(\Delta\text{Sales}_{t\|t+4})$	1.01***	0.08***
	(0.17)	(0.01)
$\Delta\text{CAPEX}_{t-4\|t}$	-0.27***	-0.00
	(0.02)	(0.00)
$\Delta\text{Price}_{t-4\|t}$	-0.05	0.44***
	(0.51)	(0.03)
Low = Medium (p-value)	0.95	0.10
Medium = High (p-value)	0.08	0.39
Low = High (p-value)	0.09	0.08
N	2,763	2,593

Note: This table reports the results from estimating model (4), controlling for dummies for the respective interaction terms (omitted for brevity). The firm-level learning gain is estimated using model (3). Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. See Tables B.7 & B.8 for the respective median value of the firm characteristic and median sales growth surprises for each group.

dependent strategy, or in response to changes in economic conditions, i.e. a state-dependent strategy. Firms that follow a state-dependent pricing strategy have to pay more attention to the state of their activities. As a consequence, they should react more to sales growth surprises as for these firms unexpected realisations of the state should contain a larger signal about the state of the economy relative to time-dependent pricing firms. Table C.12 reports summary statistics of firms by their respective price-setting strategy.

Table 7 reports the estimates of MPIs for firms that follow either a state-dependent or a time-dependent pricing strategy. As shown in Column (1), the response of CAPEX for sales growth surprises is strongly positive and significant only for firms that are state-dependent

during the high inflation period of 2022-2024, this would imply that we underestimate the difference between the two types of firms because we wrongly classify firms as state-dependent price setters, i.e. attentive, even during the low inflation part of the sample.

and therefore are structurally more versed in responding to changes in their economic environment. For these firms, a 1 percentage point higher than expected growth in sales translates to a 0.53 percentage point increase in gross investment.

Table 7: Does the Price Setting Type Matter?

	(1)	(2)
	$\Delta\text{CAPEX}_{t\|t+4}$	$\Delta\text{Price}_{t\|t+4}$
	b/se	b/se
Time-dep. Pricing × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.16	0.03***
	(0.16)	(0.01)
State-dep. Pricing × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.52***	0.05***
	(0.15)	(0.01)
$\mathbb{E}_{t+1}(\Delta\text{Sales}_{t\|t+4})$	1.08***	0.07***
	(0.14)	(0.01)
$\Delta\text{CAPEX}_{t-4\|t}$	-0.26***	0.00
	(0.02)	(0.00)
$\Delta\text{Price}_{t-4\|t}$	-0.05	0.39***
	(0.41)	(0.03)
Time-dep. = State-dep. (p-value)	0.061	0.141
N	2,580	2,303

Note: This table reports the results from estimating model (4), controlling for dummies for the respective interaction terms (omitted for brevity). Time-dependent pricing refers to firms that reset their price in regular intervals, whereas state-dependent Pricing refers to firms who reset their prices depending on the state of their business. Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Column (2) reports the estimated price response to sales growth surprises for both types of firms. As for CAPEX, state-dependent pricing firms exhibit a stronger response to sales growth surprises than time-dependent ones. Specifically, for more attentive, state-dependent firms a 1 percentage point higher than expected sales growth generates a 0.05 percentage point increase in prices.[22] Importantly, the price response is calculated four-quarters after the realisation of the sales growth surprise, an horizon over which the vast majority of time-dependent pricing firms also resets prices. This implies that the significant response of prices for time-dependent firms is likely the cumulative effect of all additional shocks that these firms experience in between their price setting schedules.

[22]These results remain unchanged when also interacting sales growth surprises with the price-setting type dummy to account for a potentially heterogeneous updating of expectations between the two groups.

Figure C.1 shows that the distribution of realised sales growth surprises is very similar for both types of price-setters: Both distributions are centered around zero, but the distribution of sales growth surprises for state-dependent price-setters has less mass around the center and is slightly more skewed towards the left. We have shown in Table C.5 that firms react to large, positive sales growth surprises in particular. Given that these occur relatively more frequently to time-dependent price setters than to state dependent-price setters, the stronger response of state-dependent price setters is even more striking.

5.2 Alternative Explanations

In this section, we explore four alternative drivers behind our results. First, we examine financial frictions as a potential driver of the observed MPI. Second, we investigate the dynamics of uncertainty as a fundamental determinant of firms' sales growth surprises. Third, we analyze the link between sales growth surprises and idiosyncratic productivity shocks. Finally, we assess whether firms respond differently to micro and macro shocks.

5.2.1 Financial Constraints

An alternative explanation for the presence of a positive MPI on average is that financially constrained firms use unexpected income to invest because they cannot obtain these funds externally, resulting in a positive correlation between sales surprises and gross investments. If financial constraints were the main driver of firms' investment responses, we would expect larger MPIs for firms that face more severe financial constraints. Therefore, we test the role of financial constraints by estimating MPIs (using Equation 4) across different firm characteristics - specifically age, size and balance sheet measures of firms' financial positions - that have been frequently used as proxies for financial constraints (see Gertler and Gilchrist, 1994; Ottonello and Winberry, 2020; Anderson and Cesa-Bianchi, 2020; Jeenas, 2023).

Balance sheet measures. We begin our analysis by testing whether MPIs exhibit significant heterogeneity across various balance sheet measures that are used in the literature to proxy firms' financial positions. We focus on three indicators: leverage, net liquidity, and the interest burden (the ratio of interest expenditure to sales).[23] Table B.7 reports the median firm characteristic for each tercile.

Table 8: The Role of Financial Constraints - Balance Sheet Measures

	(1) $\Delta CAPEX_{t\|t+4}$ b/se	(2) $\Delta CAPEX_{t\|t+4}$ b/se	(3) $\Delta CAPEX_{t\|t+4}$ b/se
Low Leverage × $FE_{t-3}(\Delta Sales_{t-4\|t})$	0.39**		
	(0.18)		
Medium Leverage × $FE_{t-3}(\Delta Sales_{t-4\|t})$	0.44***		
	(0.15)		
High Leverage × $FE_{t-3}(\Delta Sales_{t-4\|t})$	0.18		
	(0.15)		
Low Liquidity × $FE_{t-3}(\Delta Sales_{t-4\|t})$		0.38**	
		(0.17)	
Medium Liquidity × $FE_{t-3}(\Delta Sales_{t-4\|t})$		0.30**	
		(0.14)	
High Liquidity × $FE_{t-3}(\Delta Sales_{t-4\|t})$		0.31**	
		(0.15)	
Low Int. Burden × $FE_{t-3}(\Delta Sales_{t-4\|t})$			0.51**
			(0.21)
Medium Int. Burden × $FE_{t-3}(\Delta Sales_{t-4\|t})$			0.50***
			(0.17)
High Int. Burden × $FE_{t-3}(\Delta Sales_{t-4\|t})$			0.31
			(0.19)
1st = 2nd (p-value)	0.82	0.74	0.97
2nd = 3rd (p-value)	0.26	0.94	0.39
N	3,833	3,783	2,876

Note: This table reports the results from estimating model (4), controlling for realised CAPEX growth, realised price growth, expected sales growth, and dummies for the respective interaction terms (omitted for brevity). Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. See Tables B.7 & B.8 for the respective median value of the firm characteristic and median sales growth surprises for each group.

Table 8 reports the main coefficients of interest. Following the previous literature (i.e. Ottonello and Winberry, 2020; Anderson and Cesa-Bianchi, 2020) that identifies leverage as the primary proxy for financial constraints, we begin our analysis by focusing on this metric. Accordingly, Column (1) presents MPIs for different terciles of the leverage distribution. The results show how MPIs are significant only for firms with low and medium leverage, although it is not possible to statistically distinguish the responses across the leverage terciles.

[23]For each of these variables we assign firms to terciles of the respective distribution in each quarter based on their latest available balance sheet information to. This implies that the respective balance sheet variable can be up to 3 quarters old.

Column (2), instead, reports MPIs for different terciles of liquidity. Interestingly, unexpected sales realisations do not transmit differently to gross investment for firms with different liquidity position. The measured MPIs are remarkably stable for all terciles of the liquidity distribution, indicating that 1 percentage point higher than expected sales growth induces approximately 0.3 percentage points more investment for both firms in the top and bottom terciles of the liquidity distribution.

Finally, Column (3) shows MPI estimates across different terciles of the interest burden distribution. Firms with a high interest burden should benefit more from the windfall generated by higher than expected sales growth. However, we cannot reject the hypothesis that the estimated MPIs differ significantly across different terciles of the interest burden distribution.

Age and size. To complement the previous analysis, we also test whether MPIs exhibit any significant heterogeneity across age (Cloyne et al., 2023) and size (Gertler and Gilchrist, 1994). Intuitively, as firms become larger and older, they become less financially constrained on average. Therefore, if financial constraints were a significant driver of MPIs, we would expect a smaller investment response for larger and older firms.[24]

Table C.13 reports the interaction terms between the sales growth surprises and the three categories of firm age, Column (1), and size in Column (2). In both cases, the coefficients indicate that firms in the middle of the distribution respond strongest to sales growth surprises. However, for none of the three groups we can reject the null hypothesis that they react significantly different from the other groups. As an extension, we also interact firm age and size, grouping firms into four categories: young and small, young and medium & large, old and small, old and medium/large. Table C.14 shows that, if anything, larger and older firms react more strongly to sales growth surprises.

Profitability. Finally, we investigate profitability as an indicator of firms' financial constrainedness. This hypothesis implies that highly profitable firms face less severe constraints

[24]We classify firms as young if they are less than 10 years old, medium if they are between 10 and 20 years old, and old if they are more than 20 years old. We classify firms as small if they have fewer than 50 employees, medium if they have between 50 and 249 employees, and large if they have 250 or more employees (see Table B.8 for summary statistics of the sales growth surprises for each group).

in investment decisions compared to their less profitable counterparts, as they have more internal funds available to finance their investment needs. For this, more profitable firms, characterised by higher margins, and those with elevated markups compared to the industry average, should exhibit less sensitivity to sales growth surprises. However, we find that firms with higher margins and higher markups (relative to the industry average) tend to adjust their investment more strongly in response to sales growth surprises, as shown in Table C.15 and C.16.[25] This is consistent with the idea that market power provides a strong incentive to pay attention to the evolution of firms' own demand.

Taken together, these results indicate that the role of financial constraints in shaping firms' marginal propensity to invest is, if anything, small. Furthermore, if the estimated marginal propensity to invest would predominantly reflect the role of financial constraints, we would not expect a significant response of prices.

5.2.2 Uncertainty

The structure of the DMP questions allows us to construct a measure of (subjective) uncertainty at the firm-level: Firms participating in the survey are asked to report a distribution for their sales expectations with corresponding probability weights. Our measure of sales uncertainty is the standard deviation of their expected sales growth.[26]

This allows us to test two hypotheses: First, it might be the case that sales growth surprises lead to higher uncertainty about future sales growth (i.e. higher uncertainty in $t+1$), which would affect firm investment via the real options channel. In other words, sales growth surprises might affect investment because they proxy changes in uncertainty. To test this, we include sales uncertainty and its four-periods lag in Equation (2). Second, if firms extract information about the state of their demand functions from the realisation of sales growth

[25] To compute relative mark-ups, we use the expression for the markup $\mu_{it} = \theta^v_{it} \frac{P_{it} Q_{it}}{P^V_{it} V_{it}}$ of De Loecker, Eeckhout and Unger (2020) where θ^v_{it} is the industry-specific output elasticity, and $\frac{P_{it} Q_{it}}{P^V_{it} V_{it}}$ the revenue share of the variable input. Taking logs and demeaning this expression on the industry-quarter level eliminates the industry-specific constant and thus returns the markup of the firm relative to its respective industry. We compute $\frac{P_{it} Q_{it}}{P^V_{it} V_{it}}$ as the sales-to-cost-of-goods-sold ratio.

[26] We construct our measure of subjective uncertainty as in Altig et al. (2022). Altig et al. (2020) and Bloom et al. (2019) also construct these subjective uncertainty measures using the DMP.

surprises, we should expect a positive relationship between MPIs and the level of uncertainty about firms' sales forecasts. In other words, firms that are more uncertain about their future sales should extract a large signal from different sales realisations. To test this, we estimate Equation (4), interacting sales growth surprises with dummies indicating the terciles of the firm-level uncertainty distribution in the DMP sample.

Table 9 displays the respective results. Column (1) shows that controlling for sales uncertainty hardly changes our baseline estimate suggesting that sales growth surprises affect investment not just because they change sales growth uncertainty. In Column (2) we test whether firms that are more uncertain about their future sales do react more to unexpected sales growth realisations. The coefficients are significant only for firms in the middle and top terciles of the uncertainty distribution. Here, we cannot fully reject the hypothesis that firms with high uncertainty react differently than firms with low uncertainty although the p-value is close to usual significance thresholds.

As a robustness check, we use the span between the highest and lowest sales realisations expected by firms as a measure of subjective uncertainty (as in Bachmann et al. (2021)). Column (1) of Table C.17 shows that the estimated average MPI remains unchanged. However, we cannot reject the null hypothesis that firms across terciles of the uncertainty distribution react equally to the sales growth surprise.

5.2.3 Productivity

Another potential channel that would generate a positive relationship between sales growth surprises and investments are firm-level productivity shocks. As firm productivity improves unexpectedly, firms can sell more goods at the same price. As a consequence, firms optimally respond by increasing their factor demands, thus increasing their gross investment.

To test this channel we augment our baseline specification (Equation (2)) with controls for changes in firm-level total factor productivity (TFP) and labour productivity.[27] If the effect

[27] Assuming a Cobb-Douglas production function and using the UK labour share estimates, we can measure firm-level TFP as

$$ln(\text{TFP}_{i,t}) = ln(\text{GVA}_{i,t}) - 0.63 * ln(\text{Labour Costs}_{i,t}) - 0.37 ln(\text{Fixed Assets}_{i,t})$$

Table 9: The Role of Sales Uncertainty

	(1) $\Delta\text{CAPEX}_{t\|t+4}$ b/se	(2) $\Delta\text{CAPEX}_{t\|t+4}$ b/se
$\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.31***	
	(0.08)	
Low Uncertainty × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$		0.00
		(0.17)
Medium Uncertainty × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$		0.34**
		(0.13)
High Uncertainty × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$		0.41***
		(0.13)
Sales Uncertainty	0.40	
	(0.46)	
L4.Sales Uncertainty	-0.28	
	(0.41)	
1st = 2nd (p-value)		0.12
2nd = 3rd (p-value)		0.68
1st = 3rd (p-value)		0.07
N	4,312	4,312

Note: This table reports the results from estimating models (2) (Column (1)) as well (4) (Column (2)), controlling for realised CAPEX growth, realised price growth, expected sales growth, and dummies for the respective interaction terms (omitted for brevity). $\mathbb{E}_{t+1}(\sigma_{\Delta\text{sales}_{t,t+4}})$ refers to the firm-level standard deviation of expected sales growth at the time of the forecast error realisation. Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. See Tables B.7 & B.8 for the respective median value of the firm characteristic and median sales growth surprises for each group.

of sales surprise on CAPEX were only due to these firm specific productivity shocks, adding them as controls should render the coefficient on the sales growth surprises insignificant.

However, as shown in Table 10, controlling for the change in either firm specific TFP or labor productivity does not significantly change the estimate of the MPI, and in both cases the productivity measures remain insignificant. If firms' sales growth surprises were predominantly a proxy for productivity shocks, we would instead expect the coefficient on the sales growth surprises to turn insignificant.

---

and labour productivity as

$$ln(\text{Labour Productivity}_{i,t}) = ln\frac{\text{GVA}_{i,t}}{\text{\# of Employees}_{i,t}}$$

where gross value added (GVA) is the sum of operating profits and labour costs. All values are deflated using the GVA deflator.

Table 10: The Role of Productivity

	(1) $\Delta \text{CAPEX}_{t\|t+4}$ b/se	(2) $\Delta \text{CAPEX}_{t\|t+4}$ b/se
$\text{FE}_{t-3}(\Delta \text{Sales}_{t-4\|t})$	0.43***	0.41***
	(0.11)	(0.11)
$\Delta \text{TFP}_{t-4\|t}$	6.62	
	(7.27)	
$\Delta \text{Labour Prod.}_{t-4\|t}$		7.32
		(7.00)
Covid	Yes	Yes
FE	No	No
N	2,801	2,823

Note: This table reports the results from estimating model (2), controlling for realised CAPEX growth, realised price growth, expected sales growth (omitted for brevity). For details on the computation of productivity, see Footnote 27. Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

On top of this, it is unlikely that sales growth surprises simply proxy for productivity shocks because that would be at odds with the positive response of prices to sales growth surprises: if firms' sales growth surprises would predominantly capture productivity shocks, we would expect a price response with a different sign. In a standard setting in which firms' enjoy some constant degree of market power and prices are relatively flexible, a positive productivity shock would in fact decrease firms' marginal costs, leading to a decrease in prices rather than an increase. We take this as evidence that our measure of sales surprises is not capturing firm specific productivity shocks.

5.2.4 Micro vs Macro Shocks

In our baseline specification we are agnostic about the source of the sales growth surprises. In light of recent evidence by Born et al. (2022), we also test whether firms react differently to micro and macro shocks. To do so, we first decompose sales growth surprises into a micro and a macro component by regressing them on industry $\times$ quarter dummies. We interpret the fitted values (residuals) of this regression as macro (micro) shocks. To investigate the potentially heterogeneous response, we standardise the two respective shocks and include them separately in our baseline model (2). The results in Table C.18 indicate that firms do not adjust their gross investment in a way that is statically significantly different in response to micro or macro news.[28] However, firms increase their prices significantly more in response to sales growth surprises that are driven by macro shocks compared to sales growth surprises driven micro shocks.

6 Conclusion

In this paper, we introduce a novel approach to calculate the Marginal Propensity to Invest (MPI) of UK firms, leveraging unique firm-level data from the Decision Maker Panel survey and firm balance sheet data from Bureau van Dijk. Our methodology constructs income shocks by utilizing survey-based sales forecast errors in a panel of UK firms, allowing for a detailed analysis of MPI dynamics. Our analysis reveals a significantly positive relationship between unexpected sales growth and gross investment, indicating that firms adjust their investment in response to changes in demand conditions. We find that approximately one-third of an unexpected increase in sales is translated into investments, a magnitude greater than previously observed in literature. Our results suggest a behavioral response, where firms adjust investments based on learning from income shocks, particularly more attentive firms. We find limited support in the data for alternative explanations, such as financial constraints, productivity, and uncertainty. Additionally, we estimate the price response to income shocks, finding a significant increase in prices following unexpected sales growth. Our analysis contributes to understanding how fluctuations in firms' income affect their investment decisions. Our results also provide valuable insights into the UK economic landscape by shedding light on the behavioral aspects of UK firms' investment strategies.

[28] Decomposing the sales growth surprises into idiosyncratic and narrower two-digits sectors (instead of one-digit) indicates that firms appear to react more to the narrower industry component than the idiosyncratic one. However, it is unclear how the narrower industry definition is able to distinguish between macro and micro news versus other potential channels, like strategic complementarities in response to aggregate shocks.

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APPENDIX

A Questions

To illustrate the survey questions asked in the DMP, we list the respective questions asked for investment, sales, and prices in 2016q4.

A.1 Investment

Looking backwards, firms were asked about their investment (in thousand £) in the previous quarter and the corresponding quarter one year before. Realised investment growth is then computed as the growth rate between these two values.

> "In the last quarter (July - September 2016), what was the approximate sterling value of your CAPITAL EXPENDITURE (in £, THOUSANDS)?"

> "Looking back over the past year, what was the approximate sterling value of your CAPITAL EXPENDITURE in the same quarter a year ago (July - September 2015) (in £, THOUSANDS)?"

Looking forward, firms were asked about their investment (in thousand £) 3 quarters ahead in 5 different scenarios and the corresponding probabilities. Expected investment growth is then computed as the growth rate between the probability weighted level of investment three quarters ahead and last quarter's investment.

> "Looking a year ahead from the last quarter (July - September 2016), what would be the approximate sterling value of CAPITAL EXPENDITURE you expect for the same quarter (July – September 2017) in each of the following scenarios?" (with five scenarios provided; i) lowest, ii) low, iii) middle, iv) high, v) highest)

> "Please assign a percentage likelihood (probability) to the amounts of CAPITAL EXPENDITURE you entered."

A.2 Sales

Looking backward, firms were asked about the growth of their sales revenue between the previous quarter and the corresponding quarter one year before.

> "Looking back over the past year from the third quarter of 2016 (July - September), by what % amount has your SALES REVENUE changed since the same quarter a year ago (July - September 2015)?"

Looking forward, firms were asked about the growth rate of their sales between the previous quarter and the quarter 3 periods ahead in 5 different scenarios and the corresponding probabilities. Expected sales growth is then computed as the probability weighted sales growth.

> "Looking a year ahead from the last quarter (July - September 2016), by what % amount do you expect your SALES REVENUE to have changed in each of the following scenarios?" (with five scenarios provided; i) lowest, ii) low, iii) middle, iv) high, v) highest)"
>
> "Please assign a percentage likelihood (probability) to the % changes in SALES REVENUE you entered (values should sum to 100%)."

A.3 Prices

Looking backward, firms were asked about the growth of their average prices between the current month and the corresponding month one year before.

> "Looking back, from 12 months ago to now, what was the approximate % change in the AVERAGE PRICE you charge, considering all products and services?"

Looking forward, firms were asked about the growth of their average prices between the current month and the month one year ahead in 5 different scenarios and the corresponding probabilities. Expected price growth is then computed as the probability weighted price growth.

> "Looking ahead, from now to 12 months from now, what approximate % change in your AVERAGE PRICE would you assign to each of the following scenarios?" (with five scenarios: lowest, low, middle, high, highest provided)
>
> " Please assign a percentage likelihood (probability) to the % changes in your AVERAGE PRICES you entered."

B Data

Table B.1: Summary Statistics - DMP

	N	Mean	s.d.	p10	p50	p90
$\mathbb{E}_{t+1}\Delta\text{Sales}_{t\|t+4}$	53,983	7.32	10.76	-3.00	5.00	21.45
$\Delta\text{Sales}_{t-4\|t}$	55,993	6.62	20.89	-19.00	5.00	34.00
$\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	21,768	-0.72	20.39	-24.79	-0.20	23.00
$\sigma(\Delta\text{Sales}_{t\|t+4})$	53,983	5.90	4.49	1.49	4.66	12.77
$\mathbb{E}_{t}\Delta\text{Price}_{t\|t+4}$	44,649	3.49	3.27	0.00	2.90	7.75
$\Delta\text{Price}_{t-4\|t}$	46,127	3.93	4.63	0.00	3.00	10.00
$\mathbb{E}_{t+1}\Delta\text{CAPEX}_{t\|t+4}$	48,341	10.58	81.09	-101.53	4.08	132.20
$\Delta\text{CAPEX}_{t-4\|t}$	46,498	3.94	88.40	-127.27	0.00	133.33
Learning Gain γ_i	12,004	-0.09	0.29	-0.48	-0.06	0.25

Table B.2: Summary Statistics - DMP, Main Estimation Sample

	N	Mean	s.d.	p10	p50	p90
$\mathbb{E}_{t+1}\Delta\text{Sales}_{t\|t+4}$	4,312	6.17	10.50	-3.50	4.57	18.75
$\Delta\text{Sales}_{t-4\|t}$	4,312	6.58	19.38	-16.00	5.00	30.30
$\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	4,312	0.71	18.30	-20.10	0.30	23.10
$\sigma(\Delta\text{Sales}_{t-4\|t})$	4,312	5.31	3.85	1.55	4.43	10.37
$\mathbb{E}_{t}\Delta\text{Price}_{t\|t+4}$	4,263	3.17	3.02	0.00	2.65	6.97
$\Delta\text{Price}_{t-4\|t}$	4,312	3.52	4.35	0.00	2.60	9.00
$\mathbb{E}_{t+1}\Delta\text{CAPEX}_{t\|t+4}$	4,278	9.06	78.78	-98.68	3.06	125.58
$\Delta\text{CAPEX}_{t-4\|t}$	4,312	4.78	89.30	-126.69	0.00	133.33
γ_i	2,763	-0.10	0.29	-0.51	-0.07	0.23

Note: This table reports the summary statistics of variables in the DMP survey that are in our main estimation sample.

Table B.3: Summary Statistics - BvD

	N	Mean	s.d.	p10	p50	p90
Age	18,315	29.00	23.09	8.00	22.00	59.00
Employees	21,103	748.48	7930.81	17.00	94.00	664.00
Total Assets	21,823	8.2e+05	2.7e+07	1798.10	11998.00	1.6e+05
Leverage	20,978	50.46	31.22	11.80	47.48	89.79
Liquidity	20,899	-2061.96	2.3e+05	-12.10	22.64	64.29
Interest Burden	13,360	2.23	6.95	0.02	0.39	4.29
Δ_4 ln(Labour Productivity)	10,098	0.00	0.45	-0.35	0.00	0.36
Δ_4 ln(TFP)	9,999	-0.01	0.42	-0.39	0.00	0.34

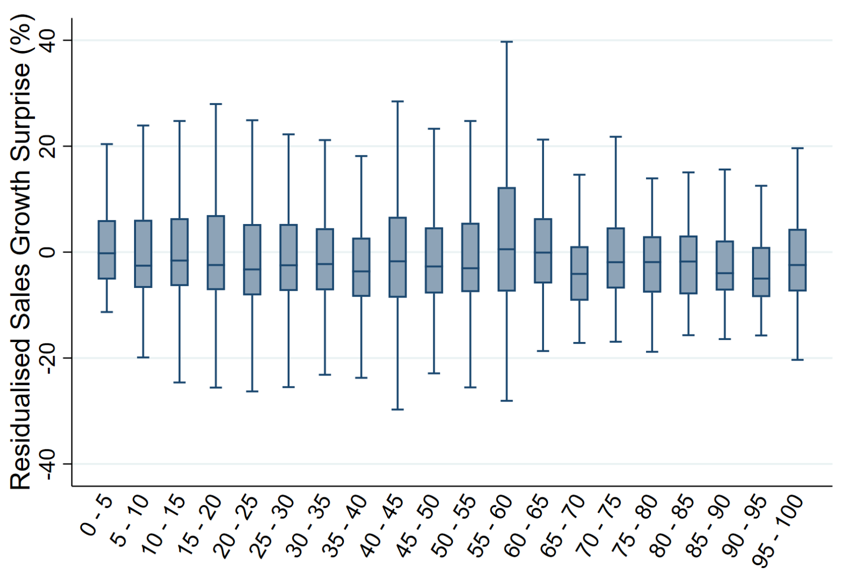
Note: This table reports the summary statistics of variables obtained from BvD for the years 2016-2022. All variables (except age) are winsorised by reporting quarter at the 5^th and 95^th percentile. Net liquidity is computed as the ratio of liquid assets minus short-term obligations to total assets. Interest burden is computed as the ratio of interest payments to total sales. For details on the computation of productivity, see Footnote 27.

Table B.4: Predictability of Sales Growth Surprises

	(1) $\text{FE}_{t+1}\Delta\text{Sales}_{t\|t+4}$ b/se	(2) $\text{FE}_{t+1}\Delta\text{Sales}_{t\|t+4}$ b/se	(3) $\text{FE}_{t+1}\Delta\text{Sales}_{t\|t+4}$ b/se	(4) $(\|\text{FE}_{t+1}\Delta\text{Sales}_{t\|t+4}\|)$ b/se
$\Delta\text{Sales}_{t-4\|t}$	-0.02			
	(0.02)			
$\text{L4.}\mathbb{E}_{t+1}\Delta\text{Sales}_{t\|t+4}$		-0.09*		
		(0.05)		
$\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$			-0.00	
			(0.02)	
$(\|\text{FE}_{t-3}\Delta\text{Sales}_{t-4\|t}\|)$				0.18***
				(0.03)
N	3,746	3,746	3,746	3,746

Note: This table reports the relationship between sales forecast errors and the preceding realised sales growth (Column (1)), sales forecast error (Column (2)), and absolute sales forecast error (Column (3)) in the sample used to estimate model (2). Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Figure B.1: Absolut Sales Growth Surprises and Age



Note: This box plot displays the distribution of sales growth surprises by age after controlling for quarter × sector fixed effects.

Table B.5: Forecast Revisions and Sales Growth Surprises

	(1)	(2)
	$\text{FE}_{t+1}\Delta\text{Sales}_{t\|t+4}$	$\text{FE}_{t+1}\Delta\text{Sales}_{t\|t+4}$
	b/se	b/se
$\text{E}_{t+1}\Delta\text{Sales}_{t\|t+4} - \text{E}_t\Delta\text{Sales}_{t-1\|t-3}$	0.28***	
	(0.04)	
Micro News		3.41***
		(0.52)
Macro & Industry News		-0.57
		(0.74)
Micro = Macro (p-value)		0.00
N	3,320	3,320

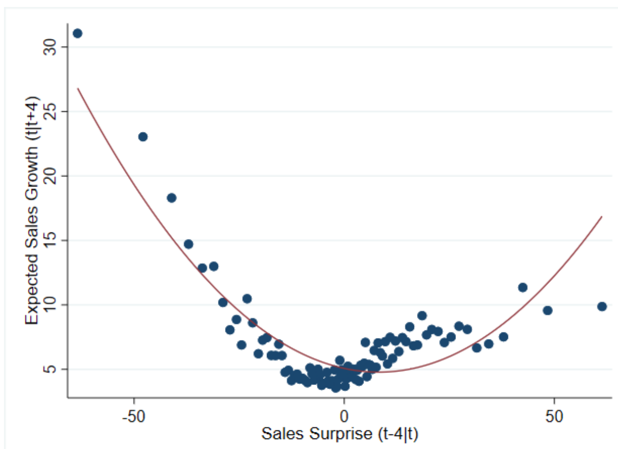
Note: This table reports the relationship between sales forecast errors and the preceding sales growth (Column (1)), sales forecast revision (Column (2)), and sales forecast revision decomposed into a common component within sector and an idiosyncratic one (Column (3)) (2). Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table B.6: Long-run Effects of Sales Surprises

	(1) $\mathbb{E}_{t+1}\Delta\text{Sales}_{t\|t+4}$ b/se	(2) $\mathbb{E}_{t+5}\Delta\text{Sales}_{t+4\|t+8}$ b/se
$\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})^{-}$	-0.44***	-0.14***
	(0.06)	(0.02)
$\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})^{+}$	0.07***	-0.01
	(0.03)	(0.02)
Negative = Positive (p-value)	0.00	0.00
N	4,312	3,770

Note: This table reports the relationship between positive and negative sales forecast errors and the subsequent expectations for sales growth over the period $(t, t+4)$ as well as $(t+4, t+8)$ (Column (2)) in the sample used to estimate model (2). Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Figure B.2: Sales Growth Surprises and Expectation Revisions



Note: This figure displays the binned distribution of sales growth surprises and subsequent sales growth expectations.

Table B.7: Group Median of Sample Splits

	Median 1^{st} Group	Median 2^{nd} Group	Median 3^{rd} Group
Age	7	15	33
Employees	26	99	439
Leverage	18.67	47.06	79.73
Net Liquidity	-1.39	23.14	55.30
Interest Burden	.08	.64	4.36
Uncertainty	2.05	4.71	10.07
Gain	-.38	-.02	.32

Note: This table reports the median value for each respective variable used in the dummy interactions terms of model (4).

Table B.8: Summary of Sales Growth Surprise by Sample Split

	1^{st} Group	2^{nd} Group	3^{rd} Group
Age	-2.13	-0.96	-0.38
	(21.27)	(20.03)	(20.32)
Employees	-1.55	-0.74	0.06
	(22.67)	(20.36)	(17.58)
Leverage	-1.39	-0.40	-0.59
	(21.06)	(20.85)	(21.39)
Liquidity	-1.31	-0.46	-0.89
	(21.14)	(20.92)	(21.41)
Interest Burden	1.09	0.41	-2.61
	(19.96)	(19.54)	(21.48)
Gain	-1.55	0.74	1.19
	(18.86)	(19.05)	(17.53)
Sales Uncertainty	0.72	-0.08	-1.76
	(13.64)	(18.54)	(25.83)

Note: This table reports the mean sales growth surprise for each respective variable category used in the dummy interactions terms of model (4). Standard errors in parenthesis.

C Further Results

C.1 Main Results: Sensitivity and Extensions

Table C.1: Average MPI - Not Controlling for Expectations

	(1) $\Delta \text{CAPEX}_{t\|t+4}$ b/se	(2) $\Delta \text{CAPEX}_{t\|t+4}$ b/se	(3) $\Delta \text{CAPEX}_{t\|t+4}$ b/se	(4) $\Delta \text{CAPEX}_{t\|t+4}$ b/se
$\text{FE}_{t-3}(\Delta \text{Sales}_{t-4\|t})$	0.21**	0.38***	0.22**	
	(0.10)	(0.09)	(0.09)	
$\text{FE}_{t-3}(med\Delta \text{Sales}_{t-4\|t})$				0.21**
				(0.10)
$\Delta \text{CAPEX}_{t-4\|t}$	-0.25***	-0.24***	-0.25***	-0.25***
	(0.02)	(0.02)	(0.02)	(0.02)
$\Delta \text{Price}_{t-4\|t}$	0.01	0.19	-0.52	0.00
	(0.38)	(0.39)	(0.38)	(0.38)
Covid	Yes	No	Yes	Yes
FE	No	No	Quarter x Ind.	No
N	4,312	3,918	4,290	4,312

Note: This table reports the results from estimating model (2) omitting the sales growth expectations control. Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table C.2: Average MPI - Balance Sheet Data

	(1) $\Delta \text{Fix. Assets}_{t\|t+4}$ b/se	(2) $\Delta \text{Tang. Assets}_{t\|t+4}$ b/se	(3) $\Delta \text{Intan. Assets}_{t\|t+4}$ b/se
$\text{FE}_{t-3}(\Delta \text{Sales}_{t-4\|t})$	0.17***	0.16**	0.06
	(0.05)	(0.07)	(0.17)
$\mathbb{E}_{t+1}(\Delta \text{Sales}_{t\|t+4})$	0.27***	0.28***	0.60***
	(0.08)	(0.10)	(0.19)
$\Delta \text{Price}_{t-4\|t}$	0.25	0.16	-0.73
	(0.32)	(0.49)	(0.80)
$\Delta \text{Fix. Assets}_{t-4\|t}$	0.03		
	(0.04)		
$\Delta \text{Tang. Assets}_{t-4\|t}$		0.00	
		(0.02)	
$\Delta \text{Intan. Assets}_{t-4\|t}$			0.07*
			(0.04)
Covid	Yes	Yes	Yes
FE	No	No	No
N	1,291	1,246	536

Note: This table reports the results from estimating model (2), replacing the growth rate of CAPEX (as reported in the DMP) as dependent variables with the growth rate of the fixed asset stock (Column (1)), the tangible asset stock (Column (2)), and the intangible asset stock (Column (3)) as reported in BvD. Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table C.3: Average MPI - Balance Sheet Data

	(1) Invest./Assets$_{t+4}$ b/se	(2) Invest./Sales$_{t+4}$ b/se
$FE_{t-3}(\Delta Sales_{t-4\|t})$	0.16***	0.04***
	(0.05)	(0.02)
$\mathbb{E}_{t+1}(\Delta Sales_{t\|t+4})$	0.28***	0.05**
	(0.08)	(0.02)
$\Delta Price_{t-4\|t}$	0.30	-0.02
	(0.30)	(0.11)
Invest./Assets$_t$	0.05	
	(0.04)	
Invest./Sales$_t$		0.16**
		(0.07)
Covid	Yes	Yes
FE	No	No
N	1,291	1,273

Note: This table reports the results from estimating model (2), replacing the growth rate of CAPEX (as reported in the DMP) as dependent variables with the change in tangible assets relative to the lagged total tangible asset stock (Column (1)) and lagged total sales (Column (2)) as reported in BvD. Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table C.4: Average MPI - Medium-term Response

	(1) $\Delta CAPEX_{t+4\|t+8}$ b/se	(2) $\Delta Prices_{t+4\|t+8}$ b/se
$FE_{t-3}(\Delta Sales_{t-4\|t})$	-0.20*	0.00
	(0.10)	(0.01)
$\mathbb{E}_{t+1}(\Delta Sales_{t\|t+4})$	-0.16	0.06***
	(0.20)	(0.01)
$\Delta CAPEX_{t-4\|t}$	0.02	-0.00**
	(0.03)	(0.00)
$\Delta Price_{t-4\|t}$	-0.44	-0.01
	(0.70)	(0.05)
Covid	Yes	Yes
FE	No	No
N	2,036	2,457

Note: This table reports the results from estimating model (2), using two-year ahead investment & price growth as dependent variable. Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table C.5: Magnitude of Sales Surprises

	(1) $\Delta \text{CAPEX}_{t\|t+4}$ b/se	(2) $\Delta \text{Price}_{t\|t+4}$ b/se
Lower Tercile of $\text{FE}_{t-3}(\Delta \text{Sales}_{t-4\|t})$	-0.26	0.02*
	(0.20)	(0.01)
Medium Tercile of $\text{FE}_{t-3}(\Delta \text{Sales}_{t-4\|t})$	0.57	0.16***
	(0.62)	(0.02)
Upper Tercile of $\text{FE}_{t-3}(\Delta \text{Sales}_{t-4\|t})$	0.69***	0.07***
	(0.19)	(0.01)
$\mathbb{E}_{t+1}(\Delta \text{Sales}_{t\|t+4})$	0.88***	0.06***
	(0.12)	(0.01)
$\Delta \text{CAPEX}_{t-4\|t}$	-0.25***	-0.00
	(0.02)	(0.00)
$\Delta \text{Price}_{t-4\|t}$	-0.11	0.44***
	(0.37)	(0.03)
Small = Medium (p-value)	0.22	0.00
Medium = Large (p-value)	0.85	0.00
Small = Large (p-value)	0.00	0.00
N	4,312	3,704

Note: This table reports the results from estimating model (2), interacting sales growth surprises with dummies indicating in which tercile of the distribution the sales growth surprises falls. Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table C.6: Average MPI - Quantity Surprises

	(1) ΔReal CAPEX$_{t\|t+4}$ b/se	(2) ΔPrice$_{t\|t+4}$ b/se
FE$_{t-3}$(ΔQuantity$_{t-4\|t}$)	0.35***	0.03***
	(0.12)	(0.01)
$\mathbb{E}_{t+1}$(ΔQuantity$_{t\|t+4}$)	1.13***	0.03***
	(0.14)	(0.01)
ΔReal CAPEX$_{t-4\|t}$	-0.28***	0.00
	(0.02)	(0.00)
ΔPrice$_{t-4\|t}$	-0.28	0.48***
	(0.62)	(0.03)
Covid	Yes	Yes
FE	No	No
N	2,314	2,729

Note: This table reports the results from estimating model (2), deflating CAPEX growth using the CPI and deflating sales growth (expectations) with the firm's own price growth (expectations). Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table C.7: Response by Sector

	(1) ΔCAPEX$_{t\|t+4}$ b/se	(2) ΔPrice$_{t\|t+4}$ b/se
Manufacturing & Construction × FE$_{t-3}$(ΔSales$_{t-4\|t}$)	0.23**	0.04***
	(0.11)	(0.01)
Services × FE$_{t-3}$(ΔSales$_{t-4\|t}$)	0.34***	0.03***
	(0.12)	(0.01)
$\mathbb{E}_{t+1}$(ΔSales$_{t\|t+4}$)	1.00***	0.07***
	(0.12)	(0.01)
ΔCAPEX$_{t-4\|t}$	-0.25***	0.00
	(0.02)	(0.00)
ΔPrice$_{t-4\|t}$	-0.12	0.45***
	(0.38)	(0.03)
Manufactiong & Construction = Services (p-value)	0.49	0.69
N	4,249	3,651

Note: This table reports the results from estimating model (4), controlling for dummies for the respective interaction term (omitted for brevity). Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table C.8: Average MPI - Controlling for Survey Features

	(1)	(2)
	$\Delta \text{CAPEX}_{t\|t+4}$	$\Delta \text{Price}_{t\|t+4}$
	b/se	b/se
$\text{FE}_{t-3}(\Delta \text{Sales}_{t-4\|t})$	0.22*	0.03***
	(0.12)	(0.01)
$\mathbb{E}_{t+1}(\Delta \text{Sales}_{t\|t+4})$	1.12***	0.05***
	(0.14)	(0.01)
$\Delta \text{CAPEX}_{t-4\|t}$	-0.26***	-0.00
	(0.02)	(0.00)
$\Delta \text{Price}_{t-4\|t}$	0.45	0.36***
	(0.68)	(0.05)
Duration of Survey Participation	6.55***	0.72***
	(1.60)	(0.09)
Response by CFO	2.65	-0.36
	(5.85)	(0.31)
Response by Other	0.15	-0.48
	(10.14)	(0.53)
Covid	Yes	Yes
FE	No	No
N	2,299	1,991

Note: This table reports the results from estimating model (2), controlling for additional survey features as well as dummies for the legal form for the firm (omitted for brevity). Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table C.9: Employment Weights and IV

	(1) $\Delta\text{CAPEX}_{t\|t+4}$ b/se	(2) $\Delta\text{CAPEX}_{t\|t+4}$ b/se	(3) $\Delta\text{Price}_{t\|t+4}$ b/se	(4) $\Delta\text{Price}_{t\|t+4}$ b/se
$\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.32**		0.03***	
	(0.14)		(0.01)	
$\Delta\text{Sales}_{t-4\|t}$		0.33***		0.04***
		(0.09)		(0.01)
$\mathbb{E}_{t+1}(\Delta\text{Sales}_{t\|t+4})$	1.05***	0.95***	0.04**	0.06***
	(0.27)	(0.12)	(0.02)	(0.01)
$\Delta\text{Price}_{t-4\|t}$	0.05	-0.23	0.50***	0.44***
	(1.06)	(0.38)	(0.06)	(0.03)
$\Delta\text{CAPEX}_{t-4\|t}$	-0.23***	-0.26***	-0.00*	-0.00
	(0.03)	(0.02)	(0.00)	(0.00)
Covid	Yes	Yes	Yes	Yes
FE	No	No	No	No
N	4001.00	4312.00	3473.00	3704.00
Weights	Yes	No	Yes	No
IV	No	Yes	No	Yes
F-statistic		70.82		107.17

Note: This table reports the results from estimating model (2) using employment weighs (columns (1) and (3)) and using the sales growth surprises as instrument for sales growth expectations (columns (2) and (4)). Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

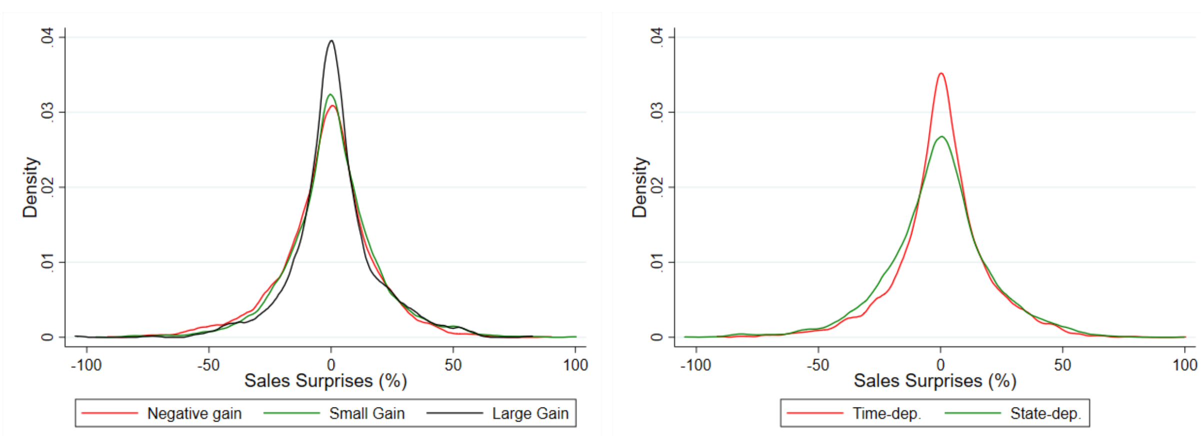
C.2 Drivers: Results and Extensions

Table C.10: Descriptive Statistics by Size of Learning Gain

	$\gamma \in (-1, -1/5)$	$\gamma \in (-1/5, 1/5)$	$\gamma \in (1/5, 1)$
Age	35.63	34.79	31.02
	(27.66)	(27.51)	(22.17)
Sales	94,576.26	240249.96	218544.41
	(639393.79)	(9.65e+06)	(1.37e+06)
Employees	533.00	512.82	368.66
	(1,221.19)	(1,321.66)	(817.77)
Sales Volatility	5.23	6.27	8.10
	(7.28)	(7.59)	(9.61)
Sales Uncertainty	5.40	4.97	5.07
	(2.65)	(3.07)	(2.89)
Manufacturing & Construction (%)	0.30	0.33	0.24
	(0.46)	(0.47)	(0.43)

Note: This table reports the mean summary statistic of firms by the magnitude of their respective learning gain. Standard errors of the respective value are reported in parenthesis.

Figure C.1: Density of Sales Growth Surprises by learning gain and price-setting type



(a) Magnitude of Learning Gain

(b) Price-setting Type

Note: Panel a of this figure plots the density of realised sales growth surprises for firms with large negative gains (red), small gains (green), and large positive gains (black). Panel b of this figure plots the density of realised sales growth surprises for time-dependent price setters (red) and state-dependent price-setters (green)

Table C.11: Persistence by Attentiveness

	(1) $\Delta\text{Sales}_{t\|t+4}$ b/se	(2) $\Delta\text{Sales}_{t\|t+4}$ b/se
$\gamma_i \in (-1, -1/5) \times$ $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	-0.03	
	(0.04)	
$\gamma_i \in (-1/5, 1/5) \times$ $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	-0.04	
	(0.03)	
$\gamma_i \in (1/5, 1) \times$ $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.06	
	(0.09)	
Time-dep. Pricing $\times$ $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$		-0.01
		(0.03)
State-dep. Pricing $\times$ $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$		0.00
		(0.04)
$\Delta\text{Price}_{t-4\|t}$	-0.13	-0.20*
	(0.10)	(0.10)
$\mathbb{E}_{t+1}(\Delta\text{Sales}_{t\|t+4})$	0.73***	0.63***
	(0.06)	(0.06)
Low gain = Medium gain (p-value)	0.81	
Medium gain = High gain (p-value)	0.27	
Low gain = High gain (p-value)	0.36	
Time-dep. = State-dep. (p-value)		0.85
N	2,567	2,303

Note: This table reports the results from estimating a version of model (4) for future sales growth controlling for realised price growth, expected sales growth, dummies for the respective interaction terms (omitted for brevity). The attentiveness measures are constructed as described in section 5.1. In particular, the firm-level learning gain is estimated using model (3). Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. See Tables B.7 & B.8 for the respective median value of the firm characteristic and median sales growth surprises for each group.

Table C.12: Descriptive Statistics by Price-setting Strategy

	Time-dep.	State-dep.
Age	30.84	32.50
	(24.57)	(25.11)
Sales	221800.70	190332.71
	(9.39e+06)	(7.39e+06)
Employees	478.36	376.44
	(3,005.85)	(1,505.74)
Sales Volatility	8.10	6.23
	(11.47)	(11.91)
Sales Uncertainty	5.45	6.33
	(3.67)	(3.88)
Manufacturing & Construction (%)	0.21	0.32
	(0.40)	(0.46)

Note: This table reports the mean summary statistic of firms by their respective price-setting strategy. Standard errors of the respective value are reported in parenthesis.

Table C.13: The Role of Financial Constraints - Age and Size

	(1) $\Delta\text{CAPEX}_{t\|t+4}$ b/se	(2) $\Delta\text{CAPEX}_{t\|t+4}$ b/se
Young × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.42	
	(0.35)	
Medium × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.31**	
	(0.15)	
Old × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.29***	
	(0.11)	
Small × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$		0.02
		(0.20)
Medium × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$		0.46***
		(0.12)
Large × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$		0.18
		(0.15)
1st = 2nd (p-value)	0.77	0.06
2nd = 3rd (p-value)	0.89	0.15
N	4,271	4,001

Note: This table reports the results from estimating model (4), controlling for realised CAPEX growth, realised price growth, expected sales growth, and dummies for the respective interaction terms (omitted for brevity). We classify firms as young if they are less than 10 years old, medium if they are between 10 and 20 years old, and old if they are more than 20 years old. We classify firms as small if they have fewer than 50 employees, medium if they have between 50 and 249 employees, and large if they have 250 or more employees. Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. See Tables B.7 & B.8 for the respective median value of the firm characteristic and median sales growth surprises for each group.

Table C.14: The Role of Financial Constraints - Interacting age and Size

	(1) $\Delta\text{CAPEX}_{t\|t+4}$ b/se
Young & Small × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	-0.27
	(0.47)
Small & Old × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.05
	(0.22)
Young & Medium/Large × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.46**
	(0.20)
Old & Medium/Large × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.35***
	(0.11)
Young & Small = Young (p-value)	0.54
Young & Medium/Large = Small & Old (p-value)	0.15
Young & Medium/Large = Old & Medium/Large (p-value)	0.64
N	4,149

Note: This table reports the results from estimating model (4), controlling for realised CAPEX growth, realised price growth, expected sales growth, and dummies for the respective interaction terms (omitted for brevity). We classify firms as young if they are less than 15 years old. We classify firms as small if they have fewer than 50 employees. Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. See Tables B.7 & B.8 for the respective median value of the firm characteristic and median sales growth surprises for each group.

Table C.15: Heterogeneity by Margins

	(1) $\Delta\text{CAPEX}_{t\|t+4}$ b/se	(2) $\Delta\text{Price}_{t\|t+4}$ b/se
Lower Tercile (Margin) × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.40**	0.04***
	(0.17)	(0.01)
Middle Tercile (Margin) × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.37*	0.03***
	(0.19)	(0.01)
Upper Tercile (Margin) × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.69***	0.05***
	(0.26)	(0.02)
Low = Medium (p-value)	0.89	0.41
Low = High (p-value)	0.35	0.45
N	2,471	2,133

Note: This table reports the results from estimating model (4), controlling for realised CAPEX growth, realised price growth, expected sales growth, and dummies for the respective interaction terms (omitted for brevity). Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table C.16: Heterogeneity by Markups

	(1) $\Delta\text{CAPEX}_{t\|t+4}$ b/se	(2) $\Delta\text{Price}_{t\|t+4}$ b/se
Lower Tercile (Markup) × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.08	0.04^{***}
	(0.18)	(0.01)
Middle Tercile (Markup) × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.38^{**}	0.03^{***}
	(0.19)	(0.01)
Upper Tercile (Markup) × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.49^{***}	0.04^{***}
	(0.18)	(0.01)
Low = Medium (p-value)	0.26	0.57
Low = High (p-value)	0.11	0.73
N	3,017	2,588

Note: This table reports the results from estimating model (4), controlling for realised CAPEX growth, realised price growth, expected sales growth, and dummies for the respective interaction terms (omitted for brevity). Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table C.17: The Role of Sales Uncertainty

	(1) $\Delta\text{CAPEX}_{t\|t+4}$ b/se	(2) $\Delta\text{CAPEX}_{t\|t+4}$ b/se
$\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$	0.31^{***}	
	(0.08)	
Low Span × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$		0.15
		(0.15)
Medium Span × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$		0.36^{**}
		(0.15)
High Span × $\text{FE}_{t-3}(\Delta\text{Sales}_{t-4\|t})$		0.35^{***}
		(0.12)
Sales Span	0.02	
	(0.12)	
L4.Sales Span	-0.03	
	(0.11)	
L4.Sales Span		
1st = 2nd (p-value)		0.31
2nd = 3rd (p-value)		0.92
1st = 3rd (p-value)		0.30
N	4,312	4,312

Note: This table reports the results from estimating models (2) (Columns (1) and (3)) as well (4) (Columns (2) and (4)), controlling for realised CAPEX growth, realised price growth, expected sales growth, and dummies for the respective interaction terms (omitted for brevity). Span refers to the difference in sales growth between the best and worst possible realisation. Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table C.18: Micro vs. Macro Surprises

	(1) $\Delta\text{CAPEX}_{t\|t+4}$ b/se	(2) $\Delta\text{Price}_{t\|t+4}$ b/se
Aggregate Component	2.56	1.21***
	(1.90)	(0.17)
Idiosyncratic Component	5.88***	0.40***
	(1.59)	(0.08)
$\mathbb{E}_{t+1}(\Delta\text{Sales}_{t\|t+4})$	1.01***	0.08***
	(0.11)	(0.01)
$\Delta\text{CAPEX}_{t-4\|t}$	-0.25***	-0.00
	(0.02)	(0.00)
$\Delta\text{Price}_{t-4\|t}$	-0.14	0.42***
	(0.37)	(0.03)
Micro = Macro (p-value)	0.12	0.00
N	4,312	3,704

Note: This table reports the results from estimating model (2),decomposing the sales forecast error into a macro & industry specific component as well as a firm specific component by regressing the forecast errors on quarter x industry dummies. Standard errors clustered on firm as well as quarter x industry level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.