Firm expectations about production and prices: Facts, determinants, and effects*

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Abstract

This chapter revisits survey evidence about firm expectations, with a particular focus on firms' production and prices. We aim at synthesizing the evidence established on the basis of various firm surveys from different countries. We complement our discussion of existing work with new evidence based on the ifo Survey of German firms. This allows us, first, to put together five stylized facts regarding firm expectations and expectation errors. In addition, we present new evidence regarding the stickiness of firm expectations. Second, we use the same data set to revisit key results regarding the formation of firm expectations. Firm expectations react strongly to firm-specific developments, whereas aggregate variables are less important. Third, we summarize the evidence on how firm expectations drive firm decisions.

Keywords: Firm expectations, survey data, expectation errors, expectation formation, firm decisions, production, prices
JEL-Codes: D84, E71, D21

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1 Introduction

In this chapter, we review recent work which uses survey data to analyze firm expectations—with a particular focus on firms' production and price expectations. These matter a great deal for actual firm decisions. To see this, consider the responses to a brief survey among German firms about their production and pricing decisions. As illustrated by Figure 1.1, firm-specific developments are as important for these decisions as the developments of the aggregate economy and a firm's market segment (see also Freuding et al. 2021). At the same time, forecasting their own variables is potentially hard for firms and perhaps even harder than forecasting the aggregate economy (Bloom et al. 2021).[1]

We revisit the evidence based on various surveys from different countries. Because the existing literature on the issue is still in a somewhat early stage, we complement our discussion of existing work with new evidence based on the ifo Survey of German firms. The ifo Survey is one of the oldest and largest surveys of firms currently available. It is based on a firm survey which has been conducted since 1949 and whose design has since then been adopted by other surveys as well (Becker and Wohlrabe 2008). We provide details about this survey and introduce basic concepts in Section 2.[2]

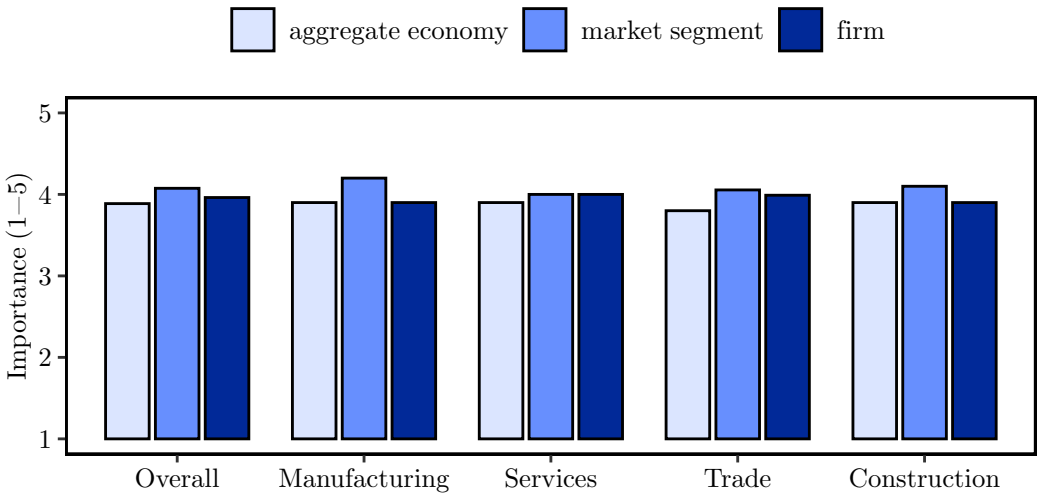
In Section 3, we use the ifo Survey to establish—on the basis of a common data set—five stylized facts which emerge robustly across various studies and surveys. First, firms' expectation errors are unconditionally unbiased, that is, mostly not significantly different from zero. Second, survey responses are informative in that they outperform static and adaptive expectations in terms of forecasting firm-specific developments. Third, larger and older firms tend to do even better in terms of forecasting. Fourth, we find that firms make predictable forecast errors. Past information about firms' own variables, in particular, predict expectation errors. Fifth, the dispersion and volatility of expectations and expectation errors is countercyclical, in line with the notion that uncertainty increases during recessions. In addition to those stylized facts, we present a sixth observation which has not been made in the survey literature so far: firm expectations are sticky, that is, they are adjusted only infrequently.

In the second part of the chapter, we seek to shed light on both, expectation formation (Section 4) and the effects of expectations on firm actions (Section 5). We stick to our strategy and revisit for our sample results established in earlier work. As we do so, we focus on the main results in the literature but also offer some additional findings. A first important result concerning the expectation-formation process is that firm-specific variables account for

[1] Chapters 7 and 14 consider inflation expectations of households and firms, respectively.

[2] The ifo Survey is also one of the surveys discussed in greater detail in Chapter 2 'Firm surveys'.

Figure 1.1: What matters for firm decisions?



Notes: responses to special question in the October 2020 wave of the ifo survey of German firms. "How important are the following domains for your production and/or pricing decisions?", with answer scale 1 to 5. Categories: recent developments in the aggregate economy, the firm's market segment, and within the firm. No. of responses: 1,666. Left bars show results for all firms, the other blocks results for specific sectors.

almost all the variation in firm expectations regarding their own output and prices. Next, we consider the responsiveness of firm expectations to news. Here we discuss some recent results which pertain mostly to professional forecasters (Coibion and Gorodnichenko 2015; Bordalo et al. 2020, and Chapter 3 'Surveys of Professionals'). As a noteworthy exception, Born et al. (2021) study the response of firms' forecast errors about their own variables to forecast revisions (news): firms tend to overreact to firm-specific news, but underreact to news about the aggregate economy.

Eventually, we care about firm expectations to the extent that they matter for actual outcomes—an issue we revisit last, following earlier work by Enders et al. (2021a). Here two results are key. First, firm expectations about future production significantly impact current production and pricing decisions. Second, this also holds for expectations that turn out to be incorrect from an ex-post point of view. This suggests that expectations not only operate as a transmission channel of news but also as a genuine source of shocks. There is also evidence that expectations are key for firms' investment decisions.

Before getting started, we note that rather than relying on surveys, one may measure expectations or, relatedly, confidence through proxies extracted from observable behavior (e.g., Malmendier and Tate 2005a,b; Hirshleifer et al. 2012). Also, in our analysis, we treat firms and firm expectations as the primitives and abstract from within-firm dynamics and management practices and personality traits of CEOs (e.g., Bloom and Reenen 2007; Kaplan et al. 2012).

2 Surveying firm expectations

By now there is a sizeable number of firm surveys which collect direct evidence on firm expectations about their own variables, such as production and prices. In what follows we provide an overview. We then zoom in on the ifo Business Expectations Panel (BEP), which we will use throughout the chapter to replicate the most importing findings in the literature and to generate some new results based on a single data set.

2.1 Background

Several surveys were initiated in the 1950s–1970s in order to provide early and additional information about the current state of the (national or regional) economy when official statistics were incomplete and available with a considerable lag only (INSEE 2007; Nerb and Sauer 2020; Bank of Japan 2020; Trebing and Fenske 2018).[3] In these surveys, firms are typically asked only qualitative questions. They may respond that they expect, say, prices or production to increase, stay the same, or decrease, likewise for their business situation or related variables.[4]

Questions regarding realized values are typically structured analogously to those about expectations. For instance, firms report if production had risen, fallen, or stayed the same. Nerb and Sauer (2020) document that this format was adopted in order to increase the return rate of the survey. Moreover, the format is considered adequate because the surveys feature several questions which require subjective evaluations. Responding qualitatively to questions about, say, the current business situation or the adequateness of inventories, allows firms to weigh different aspects depending on current circumstances in a flexible manner. These types of questions also constitute the so-called 'Judgement' part of the Tankan Survey (Bank of Japan 2020).[5] Rosewell (1987) adds, referring to the CBI Industrial Trends Survey, that the qualitative format increases chances that senior management answers the questionnaires (which is confirmed in Glynn 1969) and that questions about actual outcomes and expectations can be easily asked in the same context. By aggregating answers regarding current and expected firm-specific variables (most often by forming balances of positive and negative answers), the surveys turn out to have a high predictive value for sector-wide or even national economic developments, see Abberger and Wohlrabe (2006), Henzel and Rast (2013), and Lehmann (2020) for the ifo Survey, Trebing and Fenske (2018) for the Manufacturing Business

[3] See also Chapter 1 'Firms surveys', for further details on individual firm surveys.

[4] See Table A.2 in the online appendix for examples of qualitative questions from the ifo Survey. Note that throughout this chapter, material in the online appendix will be marked with an "A." prefix.

[5] The predecessor of the Tankan started in 1951, following the methodology of the ifo Survey (Bank of Japan 2022).

Outlook Survey of the Philadelphia Fed, and Glynn (1969) for capital expenditure elicited in the CBI Industrial Trends Survey. Note that this result lends credibility to the choice of aggregating qualitative answers by calculating balances of positive and negative answers.

The large potential of business surveys for rigorous empirical analysis became more apparent over time (see, e.g., Nerb 1987; Seiler and Wohlrabe 2013, for the ifo Survey).[6] To increase the scope further still, quantitative questions have been added in several surveys.[7] In this case, respondents are asked to provide a specific number or to choose from predefined ranges when responding to questions about, say, expected sales growth. Providing predefined ranges to elicit point estimates involves potential pitfalls, as the provision of ranges may have a bearing on the elicited answers (Schwarz et al. 1985). Even more recently, following Bloom (2009) and others, business-cycle research highlighted the role of uncertainty for economic developments and, as a consequence, several firm surveys now ask for probability distributions in addition to point forecasts to measure uncertainty.[8] Specifically, survey participants are asked to assign probabilities to either several bins that cover predefined ranges for the future realizations of the variable of interest (e.g., Business Inflation Expectations Survey) or to freely selected bins (Survey of Business Uncertainty, SBU).[9] However, in order to evaluate the answers to these questions additional assumptions need to be made regarding, for instance, probability-mass distribution inside the bins or the underlying models (formal or not) used by survey participants (Krüger and Pavlova 2020; Glas and Hartmann 2021).[10]

We provide an overview of existing firm surveys in Table 2.1, Panels (a) and (b). Here we focus on those surveys that are available for economic research on firm expectations about firms' own variables.[11]

[6]This is not necessarily true for the underlying micro data, that is, the individual responses. They were often, after aggregation, not kept for later use.

[7]For instance, the ifo Survey and the CBI Industrial Trends Survey introduced quantitative questions in 2005 and 2008, respectively. There is some evidence that using qualitative (elicited via visual analog scales) and quantitative expectation data yields similar results (Enders et al. 2021a). Similarly, we stress that the facts established in Section 3 hold for qualitative and quantitative data. Nevertheless, a systematic investigation of differences induced by choosing qualitative or quantitative answer possibilities, e.g., by randomizing this choice, seems fruitful.

[8]See Chapter 2 'Household Surveys and probabilistic questions', for the use of probabilistic questions in household surveys.

[9]Bloom et al. (2020) analyze business expectations that are surveyed as part of the Census Bureau's Management and Organizational Practices Survey. For selected years, it elicits point estimates for current-year outcomes and five-point probability distributions for the next. Bloom et al. (2020) find that 85% of respondents provide logically sensible responses to the five-point distribution questions, suggesting that most managers can form and express detailed subjective probability distributions.

[10]See also Chapter 3 'Surveys of professionals', for issues relating to constructing measures of disagreement and uncertainty in the context of surveys of professionals.

[11]We only consider those surveys that include questions about firm expectations about their own variables and whose firm-level answers are generally provided to researchers. These criteria eliminate a moderate number of firm surveys.

Table 2.1: Surveys with firm expectations about firm-specific developments

(a) General information

Name	Country	Expectation Variables	From	Freq.	Format	Maintained by
ifo Business Climate Survey	Germany	output, prices, employment, business situation	1949	m	ql, qt 2005+ d 2013+	ifo
Tankan Survey	Japan	sales, exports, profits, investment	1951	q	ql, qt	METI
CBI Industrial Trends Survey	UK	wages, sales prices, employment, unit costs, , new orders	1958	q	ql, qt 2008+	Confederation of British Industry
Monthly Outlook Survey in Industry	France	sales, prices, employment	1962	m	ql, qt	INSEE
Survey of Industrial Trends	Australia	output, employment, prices, stocks, overtime	1966	m	ql	Australian Chamber of Commerce
Survey of Production Forecasts	Japan	production	1971	m	qt	METI
Survey on Industrial and Service Firms	Italy	investment, production, turnover, prices, costs	1972	a	qt	Banca d'Italia
ifo Investment Survey	Germany	investment	1973	s	qt	ifo
Basic Survey on Overseas Business Activities	Japan	sales	1995	a	qt	METI
CFO Survey	US	revenue, wages, unit costs, employment	1996	q	qt	FRB Richmond and FRB Atlanta
Survey on Inflation and Growth Expectations	Italy	economic situation, prices, demand, investment, empl.	1999	q	ql, qt	Banca d'Italia
Business Outlook Survey	Japan	sales, operating profits	2004	q	qt	Ministry of Finance of Japan
Monitoraggio Economia e Territorio Survey	Italy	sales, prices	2008	a	ql, qt	MET Research Center
Management and Organizational Practices Survey	US	production, capital expenditures, employment, costs	2010	5a	ql	U.S. Census Bureau
Business Inflation Expectations Survey	US	unit costs	2011	m	qt, d	FRB Atlanta
Survey of Business Uncertainty	US	employment, sales, capital expenditures (investment rate)	2014	m	d	FRB Atlanta
Bundesbank Online Panel - Firms	Germany	employment, sales, inputs, finances, inventories	2020	i	ql, qt, d	Bundesbank

Notes: Frequencies (Freq.) are monthly (m), quarterly (q), semi-annually (s), annually (a), every 5 years (5a), and irregular (i). Formats are qualitative (ql), quantitative (qt), and distributional (d). METI is the Ministry of Economy, Trade, and Industry in Japan. Surveys ordered by their inception date, although the quality and scope of the initial waves may be much reduced (if they are available at all) relative to subsequent waves, e.g., data from the ifo Business Climate Survey is available for research since 1980. Only those surveys are listed whose firm-level data about firms' expectations about own variables are generally provided to researchers. For this reason, the surveys of some central banks and regional Federal Reserve Banks (mostly <250 participants/month) are not included, e.g., the Business Outlook Surveys run by the Bank of Canada and the FRB Philadelphia. Similarly, the Joint Harmonised EU Programme of Business and Consumer Surveys consists of a number of national surveys but does not provide firm-level data.

(b) Additional information

Name	Selected Literature	Sectors	Resp.*	Firm Size	Documentation
ifo Business Climate Survey	Nerlove (1983), Kawasaki and Zimmermann (1986), Bachmann et al. (2013), Bachmann and Elstner (2015), Massenot and Pettinicchi (2018), Enders et al. (2019), Enders et al. (2021a), Born et al. (2021)	man	2,000	nr	bit.ly/doc-ifo
Tankan Survey	Morikawa (2016)	nr	11,000	20m.+ yen	bit.ly/doc-tankan
CBI Industrial Trends Survey	Bennett (1984), McIntosh et al. (1989), Thomas (1995), Lui et al. (2010), Boneva et al. (2020)	man	500	nr	bit.ly/doc-cbi
Monthly Outlook Survey in Industry	König et al. (1981), Nerlove (1983), Andrade et al. (2021)	man, extr	1,600	20+ empl	bit.ly/doc-mos-ind
Survey of Industrial Trends	Smith and McAleer (1995)	man	250	nr	bit.ly/doc-sit
Survey of Production Forecasts	Morikawa (2019)	man			bit.ly/doc-spf
Survey on Industrial and Service Firms	Guiso and Parigi (1999), Ma et al. (2020)	man, con, serv	5,000	20+ empl	bit.ly/doc-sisf
ifo Investment Survey	Bachmann et al. (2017)	man, trade	2,000	nr	bit.ly/doc-ifo
Basic Survey on Overseas Business Activities	Chen et al. (2020)	nr	8,700	mult.nat.	bit.ly/doc-bsoba
CFO Survey	Gennaioli et al. (2015)	nr	1,00	nr	bit.ly/doc-cfos
Survey on Inflation and Growth Expectations	Coibion et al. (2020)	ind, serv	1,000	50+ empl	bit.ly/doc-sige
Business Outlook Survey	Chen et al. (2021)	nr	11,500	nr	bit.ly/doc-bos
Monitoraggio Economia e Territorio Survey	Balduzzi et al. (2020)	man	25,000	nr	bit.ly/doc-met
Management and Organizational Practices Survey	Bloom et al. (2020)	man	37,000	nr	bit.ly/doc-mops
Business Inflation Expectations Survey	Meyer et al. (2021a)	nr	300	nr	bit.ly/doc-bies
Survey of Business Uncertainty	Altig et al. (2020b), Barrero (2021)	nr	1,300	nr	bit.ly/doc-sbu
Bundesbank Online Panel - Firms	Balleer et al. (2020)	nr	10,000	nr	bit.ly/doc-bopf

Notes: *Resp. refers to current respondents per wave. The ifo Business Climate Survey was initially launched for the manufacturing sector. Similar surveys were later added for the construction, trade, services, and insurance sectors. Sector refers to sectoral coverage: not restricted (nr), manufacturing (man), extraction (extr), construction (con), non-financials private services (serv), industry (ind), and trade. Firm size gives restrictions on target firms: not restricted (nr), minimum number of employees (empl), mult.nat. (multinationals). The Tankan Survey targets firms with capital of at least 20 million Yen (Bank of Japan 2020).

2.2 Example: The ifo Business Expectations Panel

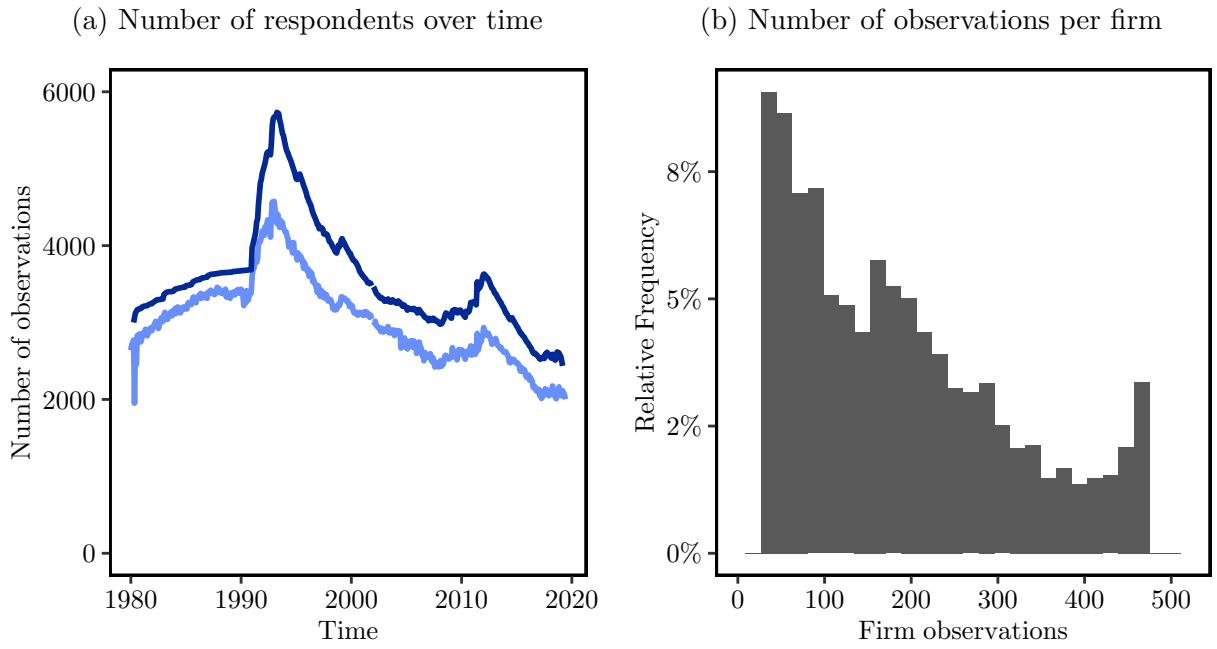
Below we survey the existing literature on firm expectations and, in doing so, we replicate the most important findings on the basis of a single data set. Because of its large coverage in terms of firms, firm-specific variables, and its time dimension, we choose the Business Expectations Panel of the LMU-ifo Economics and Business Data Center (BEP or ifo Survey from now on). It is based on the ifo Business Climate Survey, one of the oldest firm surveys in existence. Specifically, the BEP combines survey data from the Business Climate Survey and balance sheet data from the Amadeus and Hoppenstedt databases (EBDC-BEP 2019). Because the wording of the questions and possible answers differs somewhat across sectors, we focus on firms in the manufacturing sector for our analysis, the sector with the largest number of firms and the longest time dimension. Since the BEP combines annual balance-sheet data with the monthly survey data, we use the most recent balance-sheet data at a given point in time to avoid using information that is not yet available when firms report expectations. The BEP starts in January 1980; the last observation available to us is for June 2019. The survey questions (regarding prices, production, etc.) refer to a specific product.[12]

In the following, we produce a set of descriptive statistics for the BEP sample. Panel (a) of Figure 2.1 displays the actual number of responses per month (light blue line) and the target observations (dark blue line), i.e., the number of firms that are in principle in the survey during a given month but did not return the questionnaire, over time. The difference between the two is usually small, that is, the average monthly response rate of 85% is quite high.[13] Furthermore, the median firm responds in 92% of the months they are in the panel. The ifo institute enlarged the panel significantly at various points in time, for example, after the German reunification in 1990. The right panel of Figure 2.1 shows the number of responses per firm. While there are many firms that participate only a few times in the survey, there is still a relatively high number of firms that answer the survey more than 100 and up to almost 500 times.

[12]Some firms, hence, respond to several questionnaires each month. In our sample, however, this is the case for less than 10% of firms. In our analysis below, we refer to the individual observation as a "firm" in order to ease the exposition.

[13]Firms do not receive any compensation for participating in the survey, except the aggregate and sectoral results of the survey itself. Andrade et al. (2021) report a response rate of 60% for the quarterly INSEE survey. Banca d'Italia (2019) indicate a response rate of 40%-50% for its Survey of Inflation and Growth Expectations, similar to the monthly response rate of 45% for the SBU (FRB Atlanta 2021). Note, however, that our reported response rate refers to firms which have already answered at least once. Out of all firms that were contacted in mid 2021 for the first time, around 2/3 returned at least two surveys. For the SBU, around 1/3 of firms responded at least once after the initial contact (FRB Atlanta 2021).

Figure 2.1: BEP observations across both panel dimensions



Notes: observations of the ifo Business Expectations Panel (BEP) across time and firms. Left panel: number of actual (light blue) and target observations (dark blue). The number of actual observations is the number of firms that respond in a given month. Target observations equal the number of firms that are in the survey during a given month. Due to the harmonization of survey periods introduced by the European Union, no survey was conducted in December 2001. We set the value to missing in this plot.

3 Stylized facts

The literature has established a number of facts about firm expectations—they emerge consistently across surveys and for both qualitative and quantitative measures. In this section, we offer a synthesis of these facts with a focus on firms' expectations (and expectation errors) about their own production and prices. We consolidate five facts that we illustrate using one consistent, mostly qualitative data set: the ifo Business Expectations Panel (BEP), introduced in the previous section. Afterwards, we present a new, sixth fact that—to the best of our knowledge—has not been documented in the literature so far.

Given that we not only look at firm expectations but also at expectation errors, we first have to define expectation errors. There are different ways to do this for qualitative business surveys. However, Table A.1 and the discussion in Section A.1 show that these yield very similar outcomes for the ifo Survey. In what follows, we employ the widely-used definition of Bachmann et al. (2013). It is based on firms' reported realized monthly changes $x^i_{t+j,1}$ of production or prices over a 3-month period, $x^i_{t,3} = \sum_{j=1}^{h} x^i_{t+j,1}$, and their 3-months ahead

expectations, $x^i_{t,3|t}$.[14] The expectation error is then defined as

$$e^i_{t,3} = \begin{cases} 0 & \text{if } \operatorname{sgn}(x^i_{t,3}) = \operatorname{sgn}(x^i_{t,3|t}) \\ \frac{1}{3}(x^i_{t,3} - x^i_{t,3|t}) & \text{else} \end{cases} \tag{1}$$

When the sign of the summed-up realizations is equal to the expectation, no error is assigned. In all other cases, the error is equal to the sum of the realizations minus the expectation, standardized by the forecasting horizon $h = 3$.

Fact 1 - Unbiasedness. *Unconditionally, firms' expectation errors are small and almost always insignificant.*

This fact emerges robustly from a number of studies. Evaluating a quantitative supplement to the ifo Business Climate Survey, Bachmann and Elstner (2015) find that more than two-thirds of firms in their sample of German manufacturing firms do not systematically over- or underpredict their production growth one quarter ahead. Using qualitative and quantitative questions from the same survey, Massenot and Pettinicchi (2018) also find that, on average, firms do not make unconditional expectations errors about their business situation. Altig et al. (2020b) and Barrero (2021) again find little evidence of an unconditional bias in expected firm-level sales growth rates, using qualitative and quantitative data from the Survey of Business Uncertainty. Chen et al. (2020) document for a panel of Japanese firms small quantitative forecast errors on average. Andrade et al. (2021), in turn, show in a quantitative French firm survey that there is a strong positive relationship between firms' anticipated and ex-post price changes. To illustrate Fact 1 further, Table 3.1 reports average expectation errors of individual firms for production, Panel (a), and prices, Panel (b), based on the BEP. For the full sample and across various classification schemes, we find robustly that the median forecast error is close to zero and the share of insignificant expectations errors is consistently above 75 percent. Table A.3 provides additional sectoral evidence in support of Fact 1.

Fact 2 - Information content. *Firm expectations outperform static and adaptive expectations.*

Firm expectations have significant information content because they help predicting future developments. To see this formally, we compute the root mean squared expectation error (RMSE), based on the actual expectations reported in the BEP, and compare it to two alternative models of expectation formation. The first assumes *adaptive* expectations: here,

[14] See Table A.2 for the exact wording in the ifo Survey.

Table 3.1: Average unconditional expectation errors

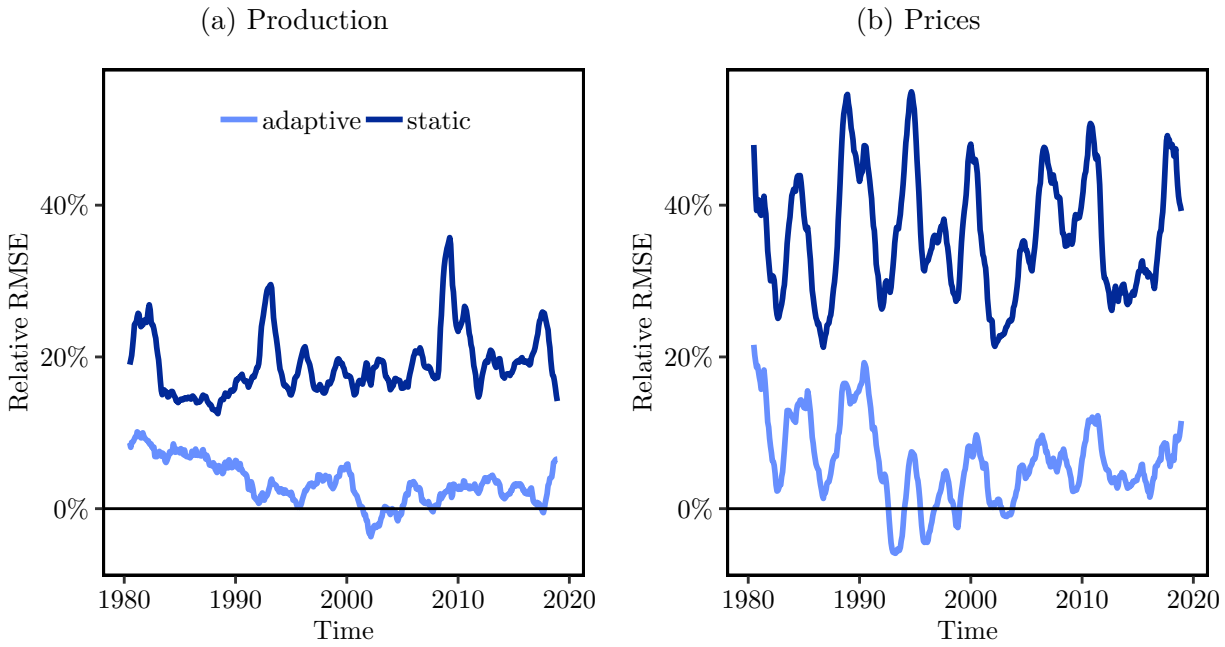
		Production			Prices		
Grouped by	Group	N	Median	% insig.	N	Median	% insig.
Overall		5122	-0.0183	77.59	5074	-0.0097	79.96
Number of Employees	Fewer than 50	801	-0.0128	76.40	779	-0.0056	81.51
	50-199	881	-0.0143	76.73	865	-0.0078	81.73
	200-499	410	-0.0097	81.22	410	-0.0048	84.88
	500-999	131	-0.0324	78.63	129	-0.0013	77.52
	More than 1000	95	-0.0041	77.89	93	-0.0051	75.27
Employees (Quartile)	First Quartile	566	-0.0115	77.56	548	-0.0048	81.02
	Second Quartile	588	-0.0172	76.19	578	-0.0085	82.87
	Third Quartile	582	-0.0154	77.15	569	-0.0076	81.20
	Fourth Quartile	582	-0.0097	79.38	581	-0.0039	81.76
Sales (Quartile)	First Quartile	566	-0.0191	74.56	546	-0.0046	82.97
	Second Quartile	576	-0.0147	77.08	557	-0.0071	81.33
	Third Quartile	562	-0.0169	80.25	564	-0.0058	82.27
	Fourth Quartile	571	-0.0159	78.98	574	-0.0063	79.27
Total Assets (Quartile)	First Quartile	672	-0.0159	75.60	652	-0.0070	82.82
	Second Quartile	673	-0.0113	77.86	655	-0.0065	81.07
	Third Quartile	666	-0.0193	78.53	668	-0.0079	83.98
	Fourth Quartile	676	-0.0153	79.29	677	-0.0056	79.03
Location	Eastern Germany	527	-0.0215	79.70	497	-0.0040	89.13
	Western Germany	1050	-0.0123	79.81	1052	-0.0041	82.60

Notes: firm-level average expectation errors (computed by regressing a firm's expectation error on a constant); table entries provide number of firms in each subgroup (N), the median of their average expectation errors (Median) and share of insignificant average expectation errors (% insig.), based on Newey-West standard errors. When grouping by location, we only consider firms that joined the ifo Survey after the German reunification.

we simply carry forward as expectation the most recent realization (increase, no change, decrease) of either production or prices. The second model assumes *static* expectations: here we simply assume that no further change for either production or prices is expected. Figure 3.1 compares the RMSE of the benchmark models to reported production and price expectations. It shows that for almost all months, the benchmark models are less precise, that is, have larger RMSEs, than the reported expectations.

This observation is consistent with earlier work. Kawasaki and Zimmermann (1986) also find that ifo Survey-based qualitative price expectations beat adaptive expectations. Using the Confederation of Australian Industries (CAI)/Westpac Survey of Industrial Trends, Smith and McAleer (1995) also document the high information content of qualitative survey expectations about firms' output, prices, employment, stocks, and overtime relative to static expectations, and relative to a number of univariate/multivariate time-series models. Using quantitative survey questions, Chen et al. (2020) show for Japanese firms that a large majority

Figure 3.1: Performance of firm expectations relative to benchmark models



Notes: relative RMSE for production, Panel (a), and price expectations, Panel (b), both for adaptive (light blue line) and static expectations (dark blue line). Values above (below) zero mean that the respective benchmark model does not (does) beat the actual survey-based expectations. All series are plotted as moving averages over the previous and the next six months. All values expressed in percent.

of firms do not just use their realized sales to forecast next periods sales.

Fact 3 - Experience. *Larger and older firms are better at forecasting their own variables.*

While firm expectations generally reflect meaningful information (Facts 1 and 2), this is even more the case as firms get older and/or larger: experience, according to Fact 3, matters for the accuracy of firm expectations about their own variables. Massenot and Pettinicchi (2018), for instance, show, based on qualitative and quantitative questions in the ifo Survey, that older and larger firms make smaller expectation errors. Bachmann and Elstner (2015) for German firms in the ifo Business Climate Survey and Morikawa (2019) for Japanese firms in the Survey of Production Forecast document that larger firms make smaller quantitative expectation errors, presumably because they are able to spend more resources on forecasting than smaller firms. Experience also matters: Triebs and Tumlinson (2013) find that firms located in eastern Germany did worse, relative to their western peers, in predicting business conditions early after German reunification, but improved their forecasting performance over time. Similarly, Chen et al. (2020) show for a panel of Japanese firms that forecast precision increases with age. Related, there is also evidence that better-managed firms make smaller forecasting errors (Bloom et al. 2021).

Table 3.2: Experience and expectation errors

(a) Experience by age

	Production				Prices			
Decade	MSE_{old}	MSE_{young}	Difference	p-value	MSE_{old}	MSE_{young}	Difference	p-value
1980-89	0.1058	0.1121	-0.0064	0.00	0.0447	0.0498	-0.0051	0.00
1990-99	0.1185	0.1343	-0.0158	0.00	0.0533	0.0556	-0.0022	0.01
2000-09	0.1415	0.1405	0.0010	0.53	0.0674	0.0637	0.0037	0.00
2010-19	0.1303	0.1414	-0.0110	0.00	0.0607	0.0658	-0.0051	0.01

(b) Experience by size

		Production			Prices		
Grouped by	Group	N	Mean	Median	N	Mean	Median
Overall		5122	0.1278	0.1170	5074	0.0594	0.0372
Number of Employees	Fewer than 50	801	0.1319	0.1197	779	0.0617	0.0363
	50-199	881	0.1299	0.1217	865	0.0615	0.0386
	200-499	410	0.1233	0.1184	410	0.0556	0.0358
	500-999	131	0.1209	0.1052	129	0.0500	0.0372
	More than 1000	95	0.1088	0.0988	93	0.0615	0.0422
Employees (Quartile)	First Quartile	566	0.1312	0.1165	548	0.0622	0.0370
	Second Quartile	588	0.1323	0.1262	578	0.0579	0.0359
	Third Quartile	582	0.1302	0.1216	569	0.0645	0.0406
	Fourth Quartile	582	0.1187	0.1078	581	0.0549	0.0363
Sales (Quartile)	First Quartile	566	0.1348	0.1220	546	0.0587	0.0360
	Second Quartile	576	0.1326	0.1248	557	0.0655	0.0391
	Third Quartile	562	0.1240	0.1147	564	0.0558	0.0375
	Fourth Quartile	571	0.1199	0.1074	574	0.0615	0.0355
Total Assets (Quartile)	First Quartile	672	0.1310	0.1197	652	0.0611	0.0375
	Second Quartile	673	0.1326	0.1209	655	0.0624	0.0375
	Third Quartile	666	0.1284	0.1187	668	0.0589	0.0370
	Fourth Quartile	676	0.1188	0.1082	677	0.0586	0.0361

Notes: Panel (a) shows the difference of mean squared expectation errors (MSE) between young and old firms. At the time of being surveyed, a firm is considered young when it was founded at most 10 years ago. For each decade, we pool observations by age and estimate the difference in the MSE between old and young firms. Panel (b) shows firm-level mean and median squared expectation errors; table entries provide summary statistics for different firm sizes. We measure size in terms of the absolute number of employees, as well as firms' location in the distributions of employees, sales, and total assets. N denotes the number of firms in each group.

We complement the existing work with new evidence based on the BEP and present it in Table 3.2. Panel (a) shows that mean squared expectation errors (MSEs) tend to be smaller for older firms and consistently so across decades. One exception are the 2000s: here older firms did worse. This result may be caused by the global financial crisis and deserves some future research. Panel (b) of Table 3.2 reports firm-level mean and median SEs for different firm sizes. In line with the literature, we observe that larger firms tend to make smaller MSEs.

Fact 4 - Predictability. *Firms make predictable expectation errors.*

Under rational expectations (RE), expectation errors should not be predictable on the basis of information that is available at the time when expectations are formed. The RE hypothesis can be framed in a regression setup as

$$e^i_{t,h} = x^i_t \beta + v^i_t \ , \tag{2}$$

where the forecast error $e^i_{t,h}$, at horizon $h = 3$ in our case, is the dependent variable and x^i_t contains candidate predictors. The β-coefficients should not be different from zero under the null of RE.[15] We estimate the equation using the observations for the BEP and report results in Table A.8. While macroeconomic variables turn out to be mostly insignificant as predictors, many firm-specific variables—such as the order backlog, changes in demand, or past expectations—help in predicting expectation errors for production and prices. Overall, about 17 percent of the variance in expectations errors can be explained in our regressions.

Consistent with our results, Massenot and Pettinicchi (2018) find that firms extrapolate from past experience too much and end up making predictable expectation errors. Similarly, Barrero (2021), using distributional questions from the Survey of Business Uncertainty (SBU), documents that firm managers over-extrapolate: their forecasts are too optimistic after positive shocks and too pessimistic after negative shocks. Ma et al. (2020) analyze expectation errors of Italian firms about their sales and detect significant auto-correlation. Boneva et al. (2020) show that UK firms tend to have rational expectations of quantity variables, such as their own employment and new orders, but deviate from rational expectations when it comes to prices, wages, and unit costs. Hence, Fact 4.

At first sight, this fact is hard to reconcile with Fact 1. Note, however, that while Fact 1 is about the unconditional accuracy of expectations, Fact 4 shows that forecast errors are predictable conditional on specific information. As such, the two facts are not contradictory

[15] An alternative test for rationality is based on the regression $x^i_{t,h} = \beta_0 + \beta_1 x^i_{t,h|t} + v^i_t$, where $\beta_0 = 0$ and $\beta_1 = 1$ under the null of RE. This test is discussed in Chapter 3 'Surveys of Professionals'.

but raise challenges that need to be addressed in future research. At an empirical level, a more systematic investigation into the two facts seems warranted. At a conceptual level, one may explore models of learning and/or limited attention which can rationalize the patterns in the data.

Fact 5 - Countercyclical second moments. *The dispersion and volatility of expectations and expectation errors are countercyclical.*

This fact has been observed for a variety of survey-based measures (e.g., Bachmann et al. 2013, 2017, 2019; Enders et al. 2019; Morikawa 2016, 2019), based both on qualitative and quantitative survey questions. As before we corroborate these findings. While Panel (a) of Table 3.3 lists dispersion and volatility measures, Panel (b) reports their time-series properties based on BEP data. The first subpanel shows correlation coefficients between the measures for production (left) and prices (right). The correlation is generally quite high, in particular for the error-based measures.

The countercyclicality of the dispersion and volatility measures can be read off the second subpanel where we report correlation coefficients vis-à-vis monthly measures of economic activity: the growth rates of industrial production, hours worked, and employment. Across the board, the signs of the correlation coefficients are negative and mostly significantly so. We also regress the measures on recession dummies—as dated by the German Council of Economic Experts—and again find a significant increase in dispersion and volatility in economic downturns. Especially so in the Great Recession of 2008/09, where our measures increase by between 8.3 and 25 percent.

Fact 6 - Stickiness. *Firm expectations are updated infrequently; updates for production and prices often happen at the same time and in the same direction.*

This fact has not been documented in the literature. This is surprising in light of influential work which models firms' sticky information, that is, infrequent updating as key friction for business cycle dynamics (Mankiw and Reis 2002). As a first pass towards assessing the stickiness of expectations in the BEP, we compute mean and median spells of expectations, that is, the number of consecutive months for which expectations remain unchanged. Panel (a) of Table 3.4 shows results, both for production (left) and prices (right). For the whole sample, expectations are quite sticky: we observe, for instance, that production expectations are not adjusted for more than 3 months on average. The panel also offers a breakdown into the stickiness of the three different response categories. Here, we observe the largest degree of stickiness for the "no change" category. Overall, price expectations tend to be more

Table 3.3: Dispersion and volatility measures

(a) Definitions

Domain	Measure	Definition
firm & time	Absolute forecast error	$\text{absfe}_{i,t} = abs(e^i_{t,h})$
	Rolling window standard deviation	$\text{stdef}_{i,t} = \sqrt{\frac{1}{3}\sum_{k\in\{-3,0,3\}}(e^i_{t+k,h} - \overline{e}^i_{t,h})^2}$
time	Forecast dispersion	$\text{fdisp}_t = \sqrt{\text{frac}^+_t + \text{frac}^-_t - (\text{frac}^+_t - \text{frac}^-_t)^2}$
	Forecast error dispersion	$\text{fedisp}_t = \sqrt{Var(e_{t,h,i\|t})}$
	Mean absolute forecast error	$\text{mae}_t = \frac{1}{n_t}\sum_i \text{absfe}_{i,t}$
	Avg. rolling window standard deviation	$\text{stdfe}_t = \frac{1}{n_t}\sum_i \text{stdef}_{i,t}$

(b) Business cycle properties

	Production				Prices			
Variable	fdisp	fedisp	mae	stdfe	fdisp	fedisp	mae	stdfe
Correlation within measures								
fdisp	1.00	0.69***	0.56***	0.58***	1.00	0.40***	0.60***	0.46***
fedisp		1.00	0.93***	0.73***		1.00	0.94***	0.88***
mae			1.00	0.82***			1.00	0.87***
stdfe				1.00				1.00
Correlation with aggregates								
Δ log Production	−0.12***	−0.04	−0.12***	−0.15***	0.06	−0.07	−0.07	−0.03
Δ log Hours	−0.02	−0.08*	−0.18***	−0.14***	−0.01	−0.03	−0.04	−0.03
Δ log Employment	−0.20***	−0.30***	−0.44***	−0.44***	−0.04	−0.21***	−0.22***	−0.20***
Recession Dummies								
Recession	0.019***	0.016**	0.043***	0.029***	0.024*	0.061***	0.114***	0.094***
Recession 2008/09	0.083***	0.084***	0.128***	0.140***	0.088***	0.154***	0.246***	0.243***

Notes: Panel (a): $e^i_{t,h}$ is the forecast error of Bachmann et al. (2013) defined in equation 1 and $\overline{e}^i_{t,h}$ is the average forecast error of the current value, its third lag, and its third lead. $\text{frac}^+_t = \sum_i \mathbf{1}(x^i_{t,h|t} = +1)/n_t$ and $\text{frac}^-_t = \sum_i \mathbf{1}(x^i_{t,h|t} = -1)/n_t$ are the shares of expected increases and decreases at time t. $fdisp_t$, $fedisp_t$, and mae_t based on Bachmann et al. (2013); $stdfe_t$ on Bachmann et al. (2019). Panel (b) shows Spearman rank correlation among dispersion measures first, Spearman rank correlation with aggregate business cycle measures second, and regression results using recession dummies third. After standardizing each time series by its non-recession mean, we report coefficients for a general recession dummy and a dummy for the 2008/09 recession. One, two, and three stars (*) correspond to significance at the 10, 5, and 1 percent significance levels.

Table 3.4: Stickiness of firm expectations

(a) Spell lengths

	Production			Prices		
Spell type	Share in %	Mean	Median	Share in %	Mean	Median
overall		3.38	2		4.85	2
decrease	24.73	2.17	1	18.25	2.21	1
no change	48.36	4.67	2	51.00	7.23	4
increase	26.91	2.15	1	30.74	2.45	2

(b) Conditional updating frequencies

	Production		Prices	
	Updating freq. conditional on	Value	Updating freq. conditional on	Value
Frequencies				
	Update in price exp.: yes	36.58%	Update in prod. exp.: yes	24.74%
	Update in price exp.: no	26.32%	Update in prod. exp.: no	16.91%
Difference				
in percentage points		10.26pp		8.83pp
in percent		38.98%		46.30%

(c) Conditional distribution of expectation updates

	Production			Prices		
P(Y=y|X=x)	Y = Prod. update | X= Price update			Y = Price update | X= Prod. updates		
y=	downwards	no update	upwards	downwards	no update	upwards
x= downwards	25.63	63.64	10.73	17.17	75.47	7.37
no update	13.35	73.68	12.97	8.51	83.09	8.40
upwards	11.05	63.19	25.76	7.36	75.05	17.58

Notes: Panel (a) shows summary statistics for spell length of qualitative expectations for prices and production. Given qualitative expectations (increase, no change, decrease) we calculate the lengths of sequences with identical expectations (spells). We compute their average and median length in months both across spell types (overall) and for each spell type separately. Panel (b) shows relative frequencies of expectation updates (changes in the reported qualitative expectations) for production (prices) conditional whether a firm reported update for price (production) expectations. Observations are pooled across time and firms. Panel (c) shows distribution of expectation updates for production conditional on price-expectation updates (left) and vice versa (right). Entries in the table are conditional probabilities of observing an update, as in the column labels, conditional on observing an update of the other variable, as in the row labels. Each row for production and prices sums to 100. Computation based on full ifo sample (manufacturing, 2002–2019)

sticky than production expectations. Panel (b) of Table 3.4 shows that firms in the BEP tend to update expectations across variables at the same time. Specifically, observing an update in price expectations increases the probability of observing an update (upwards or downwards) in production expectations by 10 percentage points or 39 percent. A production expectation update increases the probability of observing a price expectation update by 9

percentage points or 46 percent. This is consistent with the findings for firms' macroeconomic expectations discussed in Chapter 14. Calibrating sticky information models to capture the evidence put forward in Table 3.4 seems a promising venue for future research. Moreover, Panel (c) of Table 3.4 shows, that for the majority of cases, price and production expectations change in the same direction. In particular, if we observe a change in either production or price expectations, we find that the other variable is updated in the same direction at least twice as often as in the opposite direction. This pattern in the data suggests an important role for demand shocks for firm expectations and calls for further investigation.

4 Expectation formation

In this section, we turn to the expectation formation process of firms with a focus on recent survey evidence. This evidence often points to departures from the full information rational expectations (FIRE) benchmark. For instance, Fact 4 shows that firms make predictable forecast errors. At this point, however, there is no consensus about an alternative to FIRE. At a very basic level, there is a long tradition of noisy information models. Here, information processing is rational but information is incomplete. In the classic contributions by Lucas (1973), Woodford (2002), Sims (2003), or Maćkowiak and Wiederholt (2009), economic actors—and notably firms—process information and update expectations in a rational way. This goes some way to account for the evidence presented above. Likewise, more recent contributions emphasize that a (rational) focus on certain sectors/media distorts the information formation process (Chahrour et al. 2021; Kohlhas and Walther 2021). Other models, by contrast, allow for behavioral aspects in the expectation formation process (for instance, Shiller 2017; Bordalo et al. 2019), where, under certain conditions, behavioral models and incomplete information models give rise to equivalent equilibrium effects (Angeletos and Huo 2021).

In what follows, we seek to inform this discussion by first surveying the evidence on the determinants of expectations. In the second part of this section, we zoom in on the expectation formation process as we discuss recent evidence regarding the response of firms to news, both at the firm level and the aggregate level. As in the previous section, we revisit key findings on the basis of the BEP.

4.1 Determinants of expectations

We aim to provide a simple empirical characterization of the determinants of firm expectations. We first focus on the mean forecast (first moment). Afterwards, we also consider briefly the determinants of firm uncertainty (second moment).

4.1.1 Firm expectations

In terms of expectations, we focus, as before, on firm expectations about production and prices. To set the stage, we perform an analysis based on the ifo Survey which builds on earlier work by Enders et al. (2021a). Because firm answers regarding production and price expectations are qualitative in the ifo Survey, we estimate an ordered probit model. Specifically, using $j = \{-1, 0, 1\}$ to index the reported expectations $x^i_{t,h|t}$ about firms' prices or production, we estimate

$$\begin{aligned} Pr(x^i_{t,h|t} = j) &= Pr(a_{j-1} < x^{i*}_{t,h|t} \leq a_j) \\ &= \Phi(\alpha_j - X'_{it}\beta) - \Phi(\alpha_{j-1} - X'_{it}\beta) \ , \end{aligned} \tag{3}$$

where X_{it} contains the variables which may influence firm expectations, $x^{i*}_{t,h|t}$ is the latent variable, and α_{j-1} and α_j are threshold parameters. Since the set of potential variables is large, we consider different groups of variables and summarize their impact by focusing on the model fit, namely on the pseudo R^2 as defined by McFadden (1974).[16] In terms of explanatory variables X_{it}, we distinguish three sets of variables. The first set contains variables that describe a firm's own condition as reported in the survey, such as, for instance, the current state of business, orders, and capacity utilization. In addition, it includes lags of expected production and prices. It also contains interaction terms that we include on the basis of a log-likelihood test. The second set consists of firm fundamentals as reported in the most recent balance sheet, such as, for instance, the debt share. Here our selection of variables follows Enders et al. (2021a). A third set of variables contains macro variables as observable by firms in real time, notably the unemployment rate in the previous month as well as industrial production. Table A.5 provides a full list of variables for each of the three sets. In addition, we always include sector fixed effects and the average reported state of business, both on a two-digit level.

We estimate model (3) using all combinations of the three sets of variables and show results in Table 4.1. Results are clear cut. The survey responses account for a fairly large share of the variation in firm expectations, with a pseudo R^2 of 25 and 32 percent for production and prices, respectively. The contributions of balance-sheet fundamentals and macro variables, on the other hand, appear negligible. We should stress, however, that balance sheet data ("fundamentals") is available only at annual frequency and may therefore not matter much for changes in the short-term outlook of firms over the next three months. In addition to using the R^2 to judge the contribution of each group of variables, we also checked by how

[16] Formally, we consider: $R^2_{mf} = 1 - \ln L_M / \ln L_0$, where R^2_{mf} is the pseudo R^2, L_M is the likelihood of the model and L_0 is the likelihood of a constant-only model.

Table 4.1: Determinants of production and price expectations

	Production		Prices	
Variables	Observations	Pseudo-R^2	Observations	Pseudo-R^2
Survey	181,329	0.2523	181,276	0.3204
Fundamentals	271,498	0.0002	277,890	0.0001
Macro	337,028	0.0057	345,828	0.0074
Survey + Fundamentals	180,686	0.2524	180,633	0.3204
Survey + Macro	172,428	0.2524	172,374	0.3244
Fundamentals + Macro	254,624	0.0064	260,988	0.0075
Survey + Fundamentals + Macro	172,327	0.2525	171,731	0.3244

Notes: summary statistics for ordered probit models using expectations about a firm's own production and price as dependent variables. Explanatory variables are combinations of variables from the survey (business situation, orders, etc. with up to three lags and interaction terms), firm fundamentals from their balance sheet (debt share, financing coefficient) and macro variables (monthly growth rates of PPI, CPI, and IP and the unemployment rate, each with their publication lag). See Table A.5 for more details on the variables.

much the share of correctly predicted expectations increases when we include each group one-by-one. We find that the first set of variables helps to increase the performance of the model most strongly also in this case.

The result that firm-specific information, as reflected in survey responses, is a key determinant of firm expectations echos early work based on the ifo Survey in the 1950s. Pioneering work by Anderson et al. (1956a), Anderson et al. (1956b), and somewhat later by Anderson and Strigel (1960) showed that unexpected changes in demand lead to changes in firms' production and pricing plans. This early work already established that production plans are more responsive to surprise demand changes than price plans. For the latter, cost changes are important. More recently, Carlsson and Skans (2012) document an influence of both current and expected future marginal cost on firms' price-setting behavior, while Meyer et al. (2021a) find that firms' year-ahead unit-cost expectations covary strongly with year-ahead price expectations.[17] Massenot and Pettinicchi (2018), in turn, find for the ifo Survey that business expectations are responsive to past business developments. Similarly, Boneva et al. (2020) show for UK firms that past orders are important when it comes to accounting for price and wage expectations. Financial factors, too, matter for expectations: Balduzzi et al. (2020) study Italian firms during the Corona crisis and find that financially constrained firms expect to charge higher prices relative to their unconstrained counterparts.

Our results above suggest that firm-specific developments are considerably more important than macroeconomic developments when it comes to accounting for firm expectations. But there is also evidence that firm expectations are responsive to macroeconomic developments.

[17]The former use Swedish firm-level data and the latter the Atlanta Fed's Business Inflation Expectations Survey. Meyer et al. (2021a) also demonstrate that information treatments about aggregate inflation and policymakers' forecasts have a negligible effect on firms' unit-cost expectations.

Enders et al. (2019), for instance, find that firm expectations respond to monetary policy shocks. Similarly, Eminidou and Zachariadis (2022) document effects of monetary policy shocks on firm expectations for a panel of euro area countries. For this purpose, they rely on the Joint Harmonised EU Programme of Business and Consumer Surveys (BCS). Strasser (2013) uses the ifo Survey and investigates to what extent firms' export expectations respond to exchange-rate movements.

Several studies use survey data to explore the impact of the Covid-19 pandemic on firm expectations. Meyer et al. (2021b) rely on the Business Inflation Expectations Survey run by the Federal Reserve Bank of Atlanta. Balleer et al. (2020) and Deutsche Bundesbank (2021) look at German firms, using ifo data and the Bundesbank Online Panel - Firms, respectively. These studies find consistently that firms' price expectations have decreased in the early phase of the pandemic. In addition, there is evidence that lockdown measures matter for firm expectations. Buchheim et al. (2021), using ifo data for Germany, show that the announcement of nationwide school closures on March 13, 2020 in response to the first wave of Corona infections was followed by the largest change in business perceptions by far.

Finally, there is evidence that the developments of the sectors or regions in which firms operate influence their expectations. Andrade et al. (2021) stress the importance of industry-level shocks, as distinct from aggregate and firm-specific shocks, for both firm actions and expectations. Their analysis is based on a survey of French firms. Kukuvec and Oberhofer (2020) use input-output tables and establish on the basis of the BCS that firms' business expectations are also influenced by expectations of other firms, in particular of those located upstream. Dovern et al. (2020) find for the ifo Survey that firms extrapolate from local economic conditions to aggregate growth expectations.

4.1.2 Firm uncertainty

So far, we have focused on the determinants of the first moment of firm expectations, that is, the mean forecast. But firm surveys also shed light on the determinants of the second moment of firm expectations, that is, into firm-level uncertainty. Altig et al. (2020b) survey business executives about firm outcomes with a particular focus on business uncertainty. They find, among other things, that subjective uncertainty is higher when firms' have grown faster and when they have revised their growth expectations. Similarly, Bachmann et al. (2021), using data for German firms, show that firms' subjective uncertainty of future sales growth increases in the aftermath of unusual, in particular negative, growth experiences. In the cross section of firms, large and fast-growing firms display, for a given shock volatility, lower subjective uncertainty than unsuccessful ones.

Dovern et al. (2020) document a negative relationship between firms' uncertainty about

their own business outlook and expectations about GDP growth. There is also survey evidence that specific events raise uncertainty at the firm level, notably in the context of Brexit and Covid-19 (Bloom et al. 2019; Altig et al. 2020a). Finally, we note that measuring firm uncertainty remains challenging from a methodological point of view. Bachmann et al. (2020), for instance, find that a majority of firms use an interval of probabilities instead of a single number at least once in their sample period. The authors interpret this behavior as reflecting Knightian uncertainty.

4.2 Over- and underreaction to news

How do firms form expectations? In an influential study, Coibion and Gorodnichenko (2015) propose a simple diagnostic in order to shed light on the expectation-formation process. Specifically, using the Survey of Professional Forecasters (SPF), they regress the upcoming forecast error on the current forecast revision. It turns out that forecast revisions predict forecast errors in the same direction. An upward revision, say, is followed by an underprediction of the same variable—forecasters seem to underreact to news, as reflected in the revision. This finding is in line with rational expectations models featuring noisy information. Yet, it has given rise to an intensive debate about the expectation-formation process and motivated new explorations, both empirically and in terms of theory.

In their original contribution, Coibion and Gorodnichenko (2015) study the response of the average forecast error in the SPF to the average forecast revision in the SPF. Against this background, Bordalo et al. (2020) stress that results change—from underreaction to overreaction—once one studies the relationship between forecast errors and forecast revisions *at the level of individual forecasters*. Other work, some of which we discuss below, establishes that whether there is over- or underreaction depends on the nature of the news which forecasters receive. Most of the evidence to date, however, is based on the SPF.

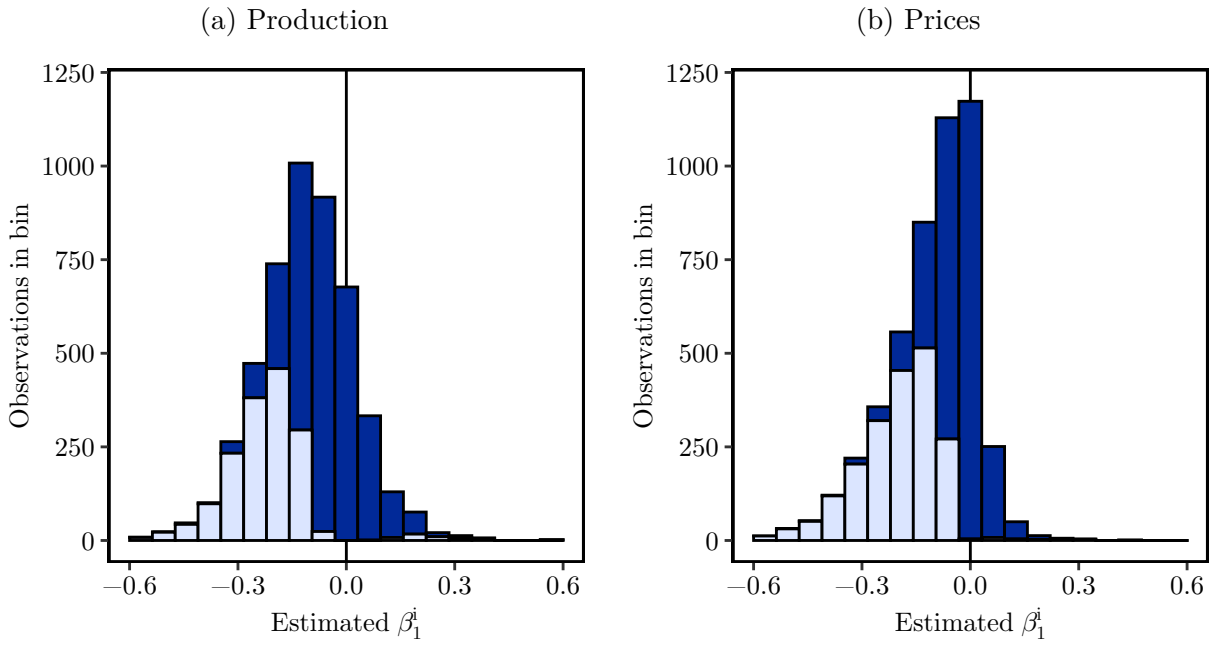
In what follows, we broaden the discussion and follow Born et al. (2021) in turning to firms' forecasts and their expectation formation process. We estimate a simplified version of their empirical model on our BEP sample:[18]

$$e^i_{t,h} = \beta^i_0 + \beta^i_1 FR^i_{t,h} + v^i_{t+h} \ , \tag{4}$$

where index i denotes a specific firm, $e^i_{t,h}$ is the forecast error (as defined in equation (1)), $FR^i_{t,h}$ is the forecast revision defined as $\text{sgn}(x^i_{t+h|t} - x^i_{t-1+h|t-1}) \in \{+1, 0, -1\}$, and v^i_{t+h} is a zero-mean error. A positive β^i_1-coefficient implies underreaction to the news that is reflected

[18] In the context of the qualitative ifo Survey data, there are a number of noteworthy conceptual issues and limitations that are discussed in Born et al. (2021).

Figure 4.1: Response of forecast error to forecast revision



Notes: histograms of estimated β_1^i-coefficients in firm-level regressions for production and price expectations, see equation (4); sample restricted to firms that initially report no expected change. Coefficients outside of the 1 and 99 percent quantiles (pooled over all subfigures) are dropped. Dark blue is for estimates that are insignificant at the 5%-level, light blue is for significant estimates.

in the forecast revision. We estimate this equation separately for each firm, for both price and production expectations.[19]

Figure 4.1 shows the distribution of the estimates for β_1^i across firms for production and price expectations. The mass of firms is characterized by negative betas, of which 32 percent are significant for production and 41 percent for prices. The overall mean estimate for production is -0.112 and -0.107 for prices. The overall result is in line with Born et al. (2021) and clear cut: firms tend to overreact to news.[20] This is particularly noteworthy because, in our analysis, news and forecast errors pertain to firms' expectations about their own production and prices rather than the aggregate economy and rational expectations models with noisy information have a hard time rationalizing overreactions. A number of behavioral models have been put forward to account for overreaction in other contexts. Azeredo da Silveira and Woodford (2019), for instance, show that if memory is noisy, current realizations are extrapolated into the future disproportionally. Bordalo et al. (2020), instead,

[19]For a firm to be considered in the estimation we require it to provide us with at least 30 observations and a non-zero variance of forecast errors and forecast revisions, that is, a firm must have revised its expectation at least once.

[20]Figure A.1 shows that estimates for the intercept in equation (4) are generally well-behaved in the sense that they are scattered evenly around zero. Moreover, there is no systematic pattern which would suggest a specific relationship between the estimate for the slope and the intercept.

rely on diagnostic expectations to rationalize overreaction. Here, forecasters overweigh the probability of certain states in the light of recent signals.

Table A.6 shows that the coefficients are robustly below zero across different measures of firm size and location. The same holds if we consider distinct sectors. We conclude that overreaction of firm expectations to news is a robust and pervasive feature of the data, not driven by a particular group of firms.

Born et al. (2021) also estimate equation (4) on pooled data while allowing for firm and time-fixed effects. For this specification, the estimate of β_1^i is significantly negative as well. They further distinguish the response to "macro news" (measured by unexpected changes in the aggregate ifo index or manufacturing orders) from the response to firm-specific micro news (as reflected in the revision of a firms' own production expectation net of time-fixed effects) and still find that firms overreact to micro news, but also that they underreact to macro news.[21]

Born et al. (2021) rationalize their findings in a general equilibrium model that allows for noisy information and salience effects. The key feature of their model is that firms' own productivity is salient of aggregate technology to them—a phenomenon which gives rise to a 'false consensus' bias. In line with additional model predictions, firms with a larger 'salience bias' empirically display larger production and forecast-error volatility, as well as lower profits. These systematic differences demonstrate that the measured bias is not the result of random forecast fluctuations. Broer and Kohlhas (2021) put forward a related mechanism. They stress that what they call 'overrevision' of individual forecasts may mask both over- and underreactions to salient public signals, as documented for inflation expectations in the SPF.[22]

In sum, recent survey evidence shows that firm expectations are responsive to information. Firm-specific information turns out to be more important and impacts expectations more strongly than information about the aggregate economy. This finding emerges from a number of recent contributions and is confirmed once we estimate models (3) and (4) on our BEP sample. When it comes to the details of the expectation-formation process, the recent

[21] Similarly, Kučinskas and Peters (2021) document for professional forecasters that their inflation forecasts underreact to aggregate shocks but overreact to idiosyncratic shocks. Using the ifo Survey, Massenot and Pettinicchi (2018) regress, in turn, expectations and forecast errors on past changes of the business situation (rather than on forecast revisions). They find that the regression coefficient is positive and significant, and robustly so, across a number of specifications. They refer to this result as "over-extrapolation".

[22] They extend a model of noisy rational expectations by allowing forecasters to be overconfident about the precision of their own information. In this account, absolute overconfidence (perceiving own information as more informative than it actually is) makes forecasters overreact to private information while relative overconfidence (perceiving own information as more informative than information of others) makes forecasters underreact to public signals which, in turn, are understood to reflect the response of others to their own forecasts.

literature has put forward a number of promising alternatives to the FIRE benchmark. They go some way to account for the evidence. But further work is required for the profession to be able to settle on a new consensus model.

5 Firm expectations and firm decisions

One reason why we care about firm expectations is that they matter for firm decisions—at least according to theory. For the longest time, the link from economic expectations to actions has been taken for granted. At an empirical level, models featuring a key role for expectations that lay the foundation for, e.g., the New Keynesian Phillips curve, have been shown to describe the data reasonably well (e.g., Galí and Gertler 1999). There are also numerous purely empirical studies which suggest that, in general, expectations of economic agents are key for the business cycle (see, for instance, Beaudry and Portier 2006; Born et al. 2019; Enders et al. 2021b). These studies, however, do not directly rely on expectations data at the firm level. Only recently has the literature started to explore these data to study the effect of firm decisions on firm actions.

5.1 The effect of firm expectations

We revisit some of this work in what follows, with a particular focus on Enders et al. (2021a) since their analysis is also based on the BEP. The basic idea of the study is to compare the behavior of firms that report that they expect either an increase or a decrease of production to otherwise very similar firms that expect production to remain unchanged. Because the responses regarding expected production are qualitative, one may think of expectations as a kind of "treatment": firms may either expect an increase, no change, or a decrease. Of course, expectations are not literally assigned in a random way. By comparing firms that display the same fundamentals but different expectations, however, the assignment can be interpreted as random.

In terms of identification, two features of the ifo Survey are crucial. First, the survey features a fairly large set of control variables, including balance-sheet data and received orders of firms. One may thus approximate the set of fundamentals which matter for firm decisions fairly accurately. Second, the timing of survey responses is key: because the large majority of responses to the survey is filed early in the month, they represent expectations about future periods (namely, for the three months following the current one) at a time when production plans for the current month may be formed but actual demand has not yet been observed.[23]

[23] About 50% of firms answer within the first eight days and another 25% answer in the following week.

Enders et al. (2021a) investigate how production expectations impact both production and pricing decisions in the current month. In what follows, we modify the original analysis in three ways. First, for the matching exercise we use data from 1991–2019, that is, three more years of data. Second, to control for fundamentals we compute the propensity score, that is the likelihood, of a treatment for a given firm-month observation on the basis of model (3). In this way, we directly build on the estimates reported in Section 4, which allows for macroeconomic control variables, rather than for time-fixed effects as in Enders et al. We use the propensity score to match treated and untreated observations and, eventually, to compute the average treatment effect on the treated (ATT), both for production and pricing decisions. Third, we also report results for various subsets of firms.

Table 5.1 reports the results, separately for firms which report an "increase" and a "decrease" of production expectations. The top row shows the results for the full sample. We observe that expectations of a production increase impact current production and prices positively. Quantitatively our results are very similar to those reported by Enders et al. (2021a).[24] The effect of an expected production decrease on production and prices is negative and quantitatively comparable to that of an expected production increase. Table 5.1 also reports results for a detailed break-down for different subsets of firms that turn out to be quite similar.

Importantly, expectations may impact current decisions for two reasons. First, expectations may reflect *news* that are not yet incorporated into current fundamentals. According to this interpretation, firm expectations operate as a transmission channel through which future fundamentals impact current decisions. Second, expectations might be fundamentally unwarranted and as such are genuine *noise*. Enders et al. assess the distinct role of news and noise for firm decisions on the basis of forecast errors. Specifically, taking an ex-post perspective, they ask whether firms that expect a change in production behave differently vis-à-vis firms which correctly expect production to remain unchanged, once for firms whose expectations turn out to be correct and once for firms with, in hindsight, incorrect expectations. They find that the treatment effect is present for both correct and incorrect expectations. This finding suggests that expectations impact current firm decisions for both fundamental (news) and non-fundamental reasons (noise).

Other work has also looked into how firm expectations shape firm behavior based on survey evidence. Boneva et al. (2020) study a survey of UK firms and estimate Phillips-

These figures are calculated for those firms that answer the survey electronically, which is the majority by now.

[24]This positive effect may reflect a stronger tendency among treated firms to raise production and prices or a reduced tendency to lower production and prices, or both. As they disentangle the two effects, Enders et al. (2021a) find that the overall effect is dominated by the increased tendency to raise production and prices.

Table 5.1: Effects of increased and decreased production expectations

		Production		Prices	
Grouped by	Group	increase	decrease	increase	decrease
Full sample		0.152***	−0.193***	0.012***	−0.034***
Number of Employees	Fewer than 50	0.140***	−0.175***	0.025***	−0.040***
	50-199	0.154***	−0.207***	0.003	−0.029***
	200-499	0.183***	−0.149***	0.026**	−0.052***
	500-999	0.186***	−0.245***	−0.009	−0.048*
	More than 1000	0.150***	−0.242***	0.092***	0.006
Employees	First Quartile	0.162***	−0.160***	0.033***	−0.051***
	Second Quartile	0.143***	−0.179***	0.015	−0.017
	Third Quartile	0.140***	−0.229***	−0.005	−0.044***
	Fourth Quartile	0.177***	−0.176***	0.030***	−0.035***
Sales	First Quartile	0.159***	−0.159***	0.038***	−0.028**
	Second Quartile	0.128***	−0.191***	0.005	−0.038***
	Third Quartile	0.139***	−0.163***	−0.002	−0.053***
	Fourth Quartile	0.163***	−0.217***	0.013*	−0.024***
Total Assets	First Quartile	0.153***	−0.151***	0.034***	−0.034***
	Second Quartile	0.132***	−0.225***	0.007	−0.028***
	Third Quartile	0.160***	−0.169***	−0.001	−0.048***
	Fourth Quartile	0.159***	−0.211***	0.016**	−0.029***
Location	Eastern Germany	0.146***	−0.149***	−0.002	−0.025**
	Western Germany	0.144***	−0.183***	0.013**	−0.040***
Sector	Chemical	0.145***	−0.120***	0.011	−0.054***
	Electrical	0.157***	−0.184***	−0.005	−0.052***
	Food	0.154***	−0.224***	−0.002	0.037*
	Furniture	0.114***	−0.160***	−0.018	−0.039**
	Glass	0.122***	−0.192***	0.016	−0.024
	Leather	0.294***	−0.294***	−0.033	0.020
	Machine	0.174***	−0.231***	0.029***	−0.035***
	Metal	0.143***	−0.181***	0.030***	−0.043***
	Oil	0.166*	−0.241*	−0.014	−0.133
	Paper	0.133***	−0.152***	−0.006	−0.065***
	Rubber	0.116***	−0.193***	−0.018	0.015
	Textile	0.247***	−0.223***	0.096***	−0.038
	Vehicle	0.197***	−0.244***	0.004	−0.043*
	Wood	0.147***	−0.197***	0.050*	−0.025

Notes: treatment effect of increased and decreased production expectations. Independent of the sample split, all available observations are used for the matching. The treatment effect is then computed using all observations in a given group. Instead of including time-fixed effects, we use the macro variables introduced in Section 4. When grouping by location, we only consider firms that joined the ifo Survey after the German reunification. One, two, and three stars (*) correspond to significance at the 10, 5, and 1 percent significance levels, respectively.

curve relationships to capture the effect of firm expectations on firm decisions. Similar to the findings above, they also find an effect on firms' pricing decisions. Other papers have established a link between firm expectations and firms' investment decisions. Bachmann and Zorn (2020) do so on the basis of the ifo Investment Survey. Gennaioli et al. (2015), instead, rely on the Duke University Quarterly Survey of Chief Financial Officers. They stress, in particular, that while CFOs' expectations matter for investment decisions, these expectations cannot be easily accounted for by conventional variables. Ma et al. (2020) establish a relation between capital investment and sales forecasts using a business survey of Italian firms run by the Bank of Italy.

5.2 Firm-level uncertainty and firm decisions

In theory, not only the first moment of firm expectations matters for firm decisions. The second moment, that is, uncertainty, is important, too. In an influential study, Bloom (2009) emphasized the real option value of delaying an (irreversible) investment decision in the face of increased uncertainty. Whether this matters a lot for aggregate dynamics and the business cycle remains controversial (Bachmann and Bayer 2013, 2014; Bloom et al. 2018). A direct empirical assessment of the effect of uncertainty on firm decisions is thus called for in order to advance our understanding of how firm-level expectations influence firm decisions.

A study by Bachmann et al. (2013) uses the ifo Survey to construct empirical proxies for time-varying business-level uncertainty. They estimate a VAR model to identify uncertainty shocks and find that they induce a temporary contraction of aggregate production in the manufacturing sector as well as of employment and hours—consistent with the notion that uncertainty drives firm decisions. Also, they obtain similar results for the US based on the Business Outlook Survey maintained by the Federal Reserve Bank of Philadelphia. Bachmann et al. (2019), in turn, zoom in on the decisions at the firm level. They find that idiosyncratic firm-level volatility raises the probability of a decision to reset prices (upwards or downwards). This may reflect the fact that firms are exposed to larger shocks as uncertainty (volatility) increases and suggests that the "volatility effect" dominates the "wait-and-see" effect, according to which one would expect a reduced probability to adjust prices. They also establish a fall in the aggregate price level following a shock to average firm-specific volatility.[25] Lastly, we note that misperceptions of the extent of uncertainty may also impact firms' decisions. Ben-David et al. (2013) find for CFOs in the US that more "miscalibrated" (realized returns lie often outside the reported confidence intervals) managers invest more and tolerate higher leverage.

[25] See also Vavra (2014) for a model-based analysis of how volatility impacts pricing behavior.

In sum, recent evidence based on survey data suggests that firm expectations matter for firm decisions—as economic theory would suggest. Yet the evidence to date is limited and more research is called for, not least with a view towards assessing the importance of expectations—both its first and its second moment—for firm decisions from a quantitative view. It would be particularly desirable to compare the evidence against predictions from quantitative models which also allow for departures from FIRE in order to account simultaneously for the expectation-formation process (as discussed in Section 4 above) and the effect of expectations on firm decisions.

6 Conclusion

As more and more survey data on firms' expectations has become available, the literature has started to explore this data systematically from various angles over the last decade or so. In surveying this work, we have focused on firm expectations about firm-specific developments. We have identified a number of stylized facts and revisited a number of noteworthy insights into the expectation-formation process. Lastly, we have also discussed evidence which illustrates the importance of firm expectations for firm behavior.

More research on firm expectations is called for. The following items feature prominently on our non-exhaustive wish list. First, we need more evidence on firms' forecast errors. While they are not biased unconditionally (Fact 1), they are predictable conditional on some firm-specific variables (Fact 4). Models which account simultaneously for both observations would be important advances. Second, regarding the expectation-formation process of firms, we need to develop a better understanding of how often and how strongly firms update their expectations and what role behavioral features play in this process. Third, we are currently lacking a comprehensive theory which ties together the expectation-formation and decision process of firms. Any advances in these directions are highly welcome. Fourth, while we have made an effort to assemble observations from many countries and surveys, a systematic cross-country comparison of firm-level data on firm expectations is bound to deliver additional valuable insights. While there has been efforts to harmonize firm surveys in the EU, the firm-level data is not available on a common platform. Lastly, we also consider a systematic comparison of qualitative and quantitative survey responses a promising venue for future research.

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Online Appendix

Firm expectations about production and prices: Facts, determinants, and effects*

Benjamin Born, Zeno Enders, Gernot J. Müller, Knut Niemannn

A.1 Expectation errors

Table A.1: Definitions of qualitative expectation errors

Source	Agg. realization	Expectation error	Production		Prices	
	$x^i_{t,h} = f(\varsigma^i_{t,h})$	$e^i_{t,h} = f(x^i_{t,h}, x^i_{t,h\|t})$	μ	σ	μ	σ
Nerlove (1983)	$\text{sgn}(\varsigma^i_{t,h})$	$\text{sgn}(x^i_{t,h} - x^i_{t,h\|t})$	-0.05	0.65	-0.04	0.65
Bachmann et al. (2013)	$\varsigma^i_{t,h}$	0 if $\text{sgn}(x^i_{t,h}) = \text{sgn}(x^i_{t,h\|t})$ $\frac{1}{h}(x^i_{t,h} - x^i_{t,h\|t})$ else	-0.03	0.35	-0.02	0.24
Massenot and Pettinicchi (2018)	$\frac{1}{h}\varsigma^i_{t,h}$	$x^i_{t,h} - x^i_{t,h\|t}$	-0.04	0.53	-0.09	0.41

Notes: schemes for the computation of expectation errors from qualitative surveys like the BEP. Realizations for one month are denoted by $x^i_{t,1} \in \{-1, 0, +1\}$, expectations for h months ahead are denoted by $x^i_{t,h|t} \in \{-1, 0, +1\}$. To account for the difference in reference periods and the qualitative nature, schemes first aggregate monthly realizations over h months and then compare aggregate realizations to expectations. Aggregate realizations $x^i_{t,h}$ are based on the sum of monthly changes over h months $\varsigma^i_{t,h} = \sum_{j=1}^{h} x^i_{t+j,1}$. Nerlove (1983) and Kawasaki and Zimmermann (1986) set $x^i_{t,h}$ to missing when there are opposite signs in the sum. sgn denotes the sign function and returns 1,0, or -1. The last four columns report the mean (μ) and standard deviation (σ) for expectation errors in the BEP.

Table A.1 summarizes the main approaches of earlier work using the ifo Survey. The survey asks for the expected change of a variable (production, prices, business situation, etc.) in the next h months, compared to now. We therefore define as $x^i_{t,h|t}$ the expectation of firm i in month t regarding the change of the firm-specific variable x^i from month t to the period from month $t+1$ until $t+h$. It can take the values -1 (expected decrease), 0 (no expected change), or 1 (expected increase). The realized change—as reported by the firm—of variable x^i from month $t-1$ to month t is denoted by $x^i_{t,1}$. Aggregating changes over the h months in question yields $\varsigma^i_{t,h} = \sum_{j=1}^{h} x^i_{t+j,1}$. Different studies have used different ways how to define a forecast error $e^i_{t,h}$ based on transformations $x^i_{t,h} = f(\varsigma^i_{t,h})$ of $\varsigma^i_{t,h}$, where $x^i_{i,h}$ is the respective definition of the aggregate realization over the h months. Nerlove (1983) and

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Kawasaki and Zimmermann (1986) compare the sign of $\varsigma^i_{t,h}$ with that of the expectation $x^i_{t,h|t}$. In their definition, the firm has made no expectation error if the two signs align. Otherwise, there is a forecast error that can be positive or negative (-1 or 1). Bachmann et al. (2013) proceed in a slightly different way. They too assign no expectation error if the sign of the aggregate realization $\varsigma^i_{t,h}$ equals that of the expectation $x^i_{t,h|t}$. In case signs differ, however, they quantify the expectation error by assigning the monthly average of the difference between the aggregate realization $\varsigma^i_{t,h}$ and the expectation $x^i_{t,h|t}$. It can therefore take values between $\pm(h+1)/h$. Massenot and Pettinicchi (2018) define the expectation error as the difference between the monthly average of the aggregate realization $\varsigma^i_{t,h}/h$ and the expectation $x^i_{t,h|t}$, such that the error may take values between -2 and 2. Note that with this definition, the error is zero only if the realization of the change takes the expected value in each of the h months.

Yet, the mean and the standard deviation of the expectation errors for production and prices, based on the BEP, are fairly comparable across definition, see the right panels of Table A.1. Moreover, the empirical correlations between the values of the aggregate realization are equal to or above 0.98, while the correlations between expectation errors are at least 0.84. The means of the expectation errors for production and prices, independent of the definition, are close to zero.

A.2 Additional figures and tables

Table A.2: Relevant questions from the ifo Survey

Label	Name	Question	Possible answers
Q1	Realized Production	Tendencies in the previous month: Our domestic production activities with respect to product XY have	increased [1] not changed [0] decreased [-1]
Q2	Expected Production	Expectations for the next 3 months: Our domestic production activity regarding good XY will probably	increase [1] not change [0] decrease [-1]
Q3	Realized Prices	Tendencies in the previous month: Taking changes of terms and conditions into account, our domestic sales prices (net) for product XY have been	increased [1] not changed [0] decreased [-1]
Q4	Expected Prices	Expectations for the next 3 months: Taking changes of conditions into account our domestic sales prices (net) for XY will probably be	rising [1] not changing [0] falling [-1]

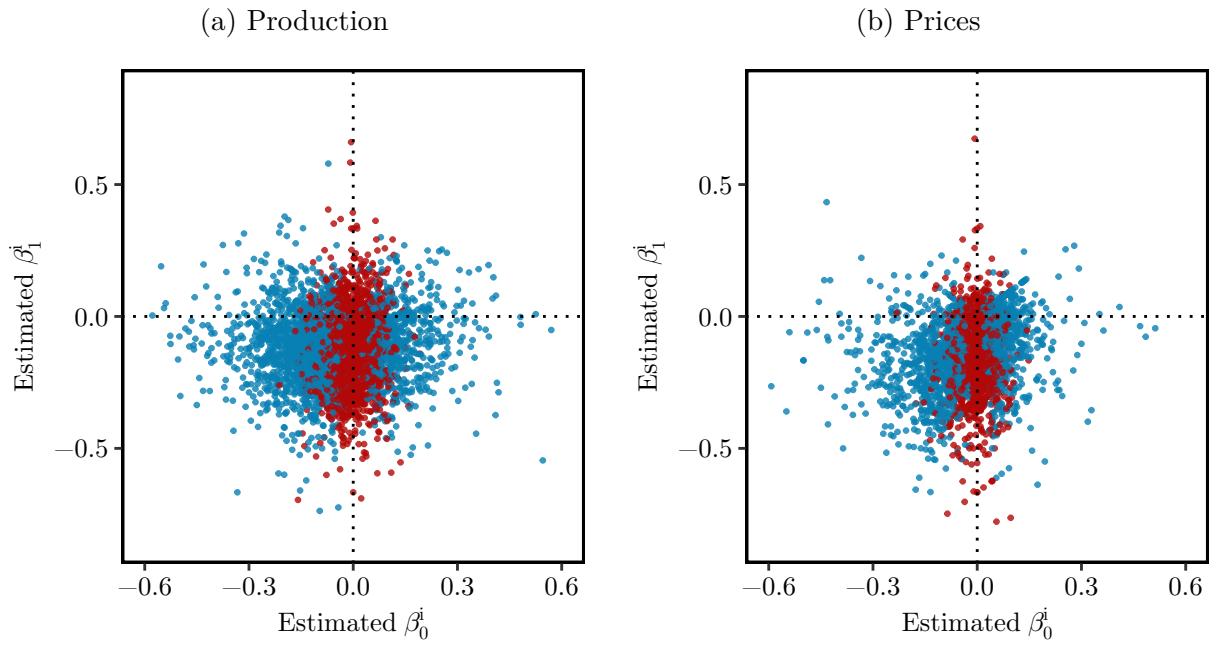
Notes: most recent formulation of the survey questions taken from the EBDC Questionnaire manual.

Table A.3: Summary statistics on firm-level average forecast errors

		Production			Prices		
Grouped by	Group	N	Median	% insig.	N	Median	% insig.
Sector	Chemical	226	-0.0087	83.19	226	-0.0048	78.32
	Electrical	599	-0.0194	78.80	600	-0.0101	82.00
	Food	277	-0.0198	80.51	278	-0.0092	81.29
	Furniture	242	-0.0187	74.79	237	-0.0084	83.97
	Glass	288	-0.0201	76.04	294	-0.0102	79.25
	Leather	63	-0.0111	73.02	62	0.0064	77.42
	Machine	772	-0.0155	80.83	766	-0.0032	84.20
	Metal	612	-0.0129	78.43	583	-0.0104	79.59
	Oil	14	-0.0275	92.86	13	-0.0000	92.31
	Paper	710	-0.0248	75.49	700	-0.0269	72.86
	Rubber	333	-0.0171	76.58	328	-0.0146	79.57
	Textile	315	-0.0261	73.33	329	-0.0108	82.37
	Vehicle	130	0.0031	74.62	128	-0.0021	82.03
	Wood	209	-0.0333	76.56	207	-0.0210	69.08

Notes: estimation of firm-level average forecast errors, entries above provide summary statistics for the estimates for different subgroups of firms. N denotes the number of firms in each group. Sectors are from Bachmann et al. (2019).

Figure A.1: Point estimates for constant and slope



Notes: estimation of equation (4) on firm-level observations. Horizontal axis: estimates of β_0^i; vertical axis: estimates of slope coefficient β_1^i. Colors indicate if the constant is significantly different from 0 (blue) or not (red) at the 5% level. Plot shows values within the 99.95 quantiles.

Table A.4: Summary statistics on firm-level average squared forecast errors

		Production			Prices		
Grouped by	Group	N	Mean	Median	N	Mean	Median
Sector	Chemical	226	0.1279	0.1152	226	0.0783	0.0498
	Electrical	599	0.1195	0.1083	600	0.0474	0.0332
	Food	277	0.1314	0.1262	278	0.0588	0.0329
	Furniture	242	0.1353	0.1281	237	0.0406	0.0292
	Glass	288	0.1209	0.1073	294	0.0586	0.0349
	Leather	63	0.1127	0.1052	62	0.0490	0.0357
	Machine	772	0.1209	0.1058	766	0.0477	0.0319
	Metal	612	0.1301	0.1156	583	0.0625	0.0354
	Oil	14	0.1054	0.0788	13	0.1557	0.1086
	Paper	710	0.1321	0.1243	700	0.0692	0.0521
	Rubber	333	0.1369	0.1289	328	0.0695	0.0473
	Textile	315	0.1203	0.1118	329	0.0618	0.0330
	Vehicle	130	0.1185	0.1065	128	0.0422	0.0283
	Wood	209	0.1400	0.1299	207	0.0739	0.0496

Notes: estimation of firm-level average squared forecast errors, entries above provide summary statistics for the estimates for different subgroups of firms. N denotes the number of firms in each group. Sectors are from Bachmann et al. (2019).

Table A.5: Definition of variable blocks

Block	Variable	Description	Frequency	Periods
Survey	Business Situation		monthly	t to t-3
	Realized Production		monthly	t to t-2
	Expected Production		monthly	t-1 to t-3
	Realized Prices		monthly	t to t-2
	Orders		monthly	t to t-3
	Foreign Orders		monthly	t to t-3
	Demand		monthly	t to t-2
	Capacity		monthly	t-1 to t-3
	Expected Prices		monthly	t-1 to t-3
	Employees		annual	
	Avg. Business Situation	two-digit sector level	monthly	t
	Sectoral Fixed Effects			
Fundamentals	Financing Coefficient	$\frac{\text{Liabilities - Provisions}}{\text{Equity + Provisions}}$	annual	
	Debt Share	$\frac{\text{Total debt}}{\text{Assets}}$	annual	
	Total Assets		annual	
Macro	PPI Growth	versus previous month	monthly	t-2
	CPI Growth	versus previous month	monthly	t-2
	Unemployment		monthly	t-1
	IP Growth	versus previous month	monthly	t-2

Notes: components of the three variable blocks considered as explanatory variables in the ordered probit. The survey and fundamental blocks are taken from Enders et al. (2021a).

Table A.6: Overreaction to firm-specific news

		Production			Prices		
Grouped by	Group	N	Mean	Median	N	Mean	Median
Overall		4851	-0.1121	-0.1089	4851	-0.1070	-0.0820
Number of Employees	Fewer than 50	236	-0.1050	-0.1041	236	-0.1029	-0.0777
	50-199	156	-0.0844	-0.0660	156	-0.1108	-0.0827
	200-499	78	-0.0918	-0.0825	78	-0.1059	-0.0739
	500-999	22	-0.1586	-0.1721	22	-0.0826	-0.0693
	More than 1000	5	-0.1433	-0.1833	5	-0.0751	-0.0736
Employees (Quartile)	First Quartile	124	-0.0964	-0.0971	124	-0.1047	-0.0878
	Second Quartile	124	-0.1158	-0.1160	124	-0.1025	-0.0647
	Third Quartile	124	-0.0816	-0.0555	124	-0.1139	-0.0907
	Fourth Quartile	125	-0.1029	-0.1042	125	-0.0978	-0.0667
Sales (Quartile)	First Quartile	107	-0.0989	-0.1029	107	-0.1234	-0.0912
	Second Quartile	112	-0.1016	-0.0846	112	-0.0983	-0.0642
	Third Quartile	109	-0.0999	-0.0903	109	-0.1080	-0.0940
	Fourth Quartile	110	-0.1060	-0.1047	110	-0.1087	-0.0659
Total Assets (Quartile)	First Quartile	130	-0.0962	-0.0955	130	-0.1107	-0.0840
	Second Quartile	131	-0.0979	-0.0987	131	-0.1131	-0.0829
	Third Quartile	130	-0.0954	-0.0870	130	-0.0932	-0.0675
	Fourth Quartile	131	-0.1146	-0.1071	131	-0.1129	-0.0730
Location	Eastern Germany	2203	-0.1121	-0.1099	2203	-0.1060	-0.0806
	Western Germany	1198	-0.1055	-0.1025	1198	-0.1081	-0.0824
Sector	Chemical	271	-0.1113	-0.1105	271	-0.1025	-0.0718
	Electrical	515	-0.1147	-0.1131	515	-0.1078	-0.0876
	Food	358	-0.1092	-0.1108	358	-0.1043	-0.0786
	Furniture	238	-0.1082	-0.1018	238	-0.1117	-0.0817
	Glass	262	-0.1090	-0.0980	262	-0.1170	-0.0931
	Leather	86	-0.1309	-0.1266	86	-0.0880	-0.0523
	Machine	646	-0.1185	-0.1111	646	-0.1088	-0.0813
	Metal	719	-0.1073	-0.1105	719	-0.1052	-0.0773
	Oil	11	-0.0541	-0.0443	11	-0.1178	-0.0508
	Paper	574	-0.1111	-0.1060	574	-0.1102	-0.0892
	Rubber	343	-0.1167	-0.1097	343	-0.1125	-0.0885
	Textile	265	-0.1042	-0.0924	265	-0.1064	-0.0825
	Vehicle	144	-0.1113	-0.1172	144	-0.1042	-0.0755
	Wood	248	-0.1263	-0.1272	248	-0.1042	-0.0862

Notes: estimation of equation (4) on firm-level observations. Entries provide summary statistics for the slope estimates based for different subgroups of firms. N denotes the number of firms in each group. When grouping by location, we only consider firms that joined the ifo Survey after the German reunification.

Table A.7: Summary statistics firm-level constant estimates

		Production			Prices		
Grouped by	Group	N	Mean	Median	N	Mean	Median
Overall		4851	-0.0317	-0.0263	4851	-0.0093	0.0056
Number of Employees	Fewer than 50	236	-0.0236	-0.0155	236	0.0005	0.0062
	50-199	156	-0.0237	-0.0274	156	0.0048	0.0133
	200-499	78	0.0068	-0.0023	78	0.0065	0.0094
	500-999	22	-0.0200	-0.0299	22	-0.0004	-0.0071
	More than 1000	5	-0.0148	-0.0344	5	-0.0132	-0.0090
Employees (Quartile)	First Quartile	124	-0.0232	-0.0103	124	-0.0057	0.0053
	Second Quartile	124	-0.0240	-0.0188	124	0.0092	0.0123
	Third Quartile	124	-0.0242	-0.0264	124	0.0011	0.0115
	Fourth Quartile	125	-0.0032	-0.0232	125	0.0058	0.0099
Sales (Quartile)	First Quartile	107	-0.0192	0.0000	107	0.0002	0.0052
	Second Quartile	112	-0.0258	-0.0111	112	0.0032	0.0079
	Third Quartile	109	-0.0127	-0.0150	109	0.0024	0.0103
	Fourth Quartile	110	-0.0311	-0.0325	110	-0.0095	0.0065
Total Assets (Quartile)	First Quartile	130	-0.0196	0.0002	130	-0.0058	0.0051
	Second Quartile	131	-0.0270	-0.0220	131	0.0018	0.0105
	Third Quartile	130	-0.0104	-0.0153	130	0.0107	0.0134
	Fourth Quartile	131	-0.0311	-0.0265	131	-0.0092	0.0093
Location	Eastern Germany	2203	-0.0256	-0.0208	2203	-0.0060	0.0070
	Western Germany	1198	-0.0373	-0.0303	1198	-0.0126	0.0038
Sector	Chemical	271	-0.0446	-0.0291	271	-0.0162	0.0060
	Electrical	515	-0.0435	-0.0315	515	-0.0113	0.0051
	Food	358	-0.0225	-0.0230	358	-0.0070	0.0046
	Furniture	238	-0.0269	-0.0231	238	-0.0113	0.0076
	Glass	262	-0.0343	-0.0128	262	-0.0097	0.0056
	Leather	86	-0.0395	-0.0264	86	-0.0120	0.0113
	Machine	646	-0.0239	-0.0230	646	-0.0052	0.0046
	Metal	719	-0.0303	-0.0231	719	-0.0104	0.0057
	Oil	11	0.0085	-0.0230	11	0.0035	0.0185
	Paper	574	-0.0322	-0.0304	574	-0.0119	0.0032
	Rubber	343	-0.0318	-0.0265	343	-0.0123	-0.0000
	Textile	265	-0.0370	-0.0276	265	-0.0067	0.0065
	Vehicle	144	-0.0360	-0.0332	144	-0.0096	0.0021
	Wood	248	-0.0317	-0.0233	248	-0.0063	0.0100

Notes: summary statistics for the estimates of the constant from the forecaster-by-forecaster regressions in equation (4) for different groups of firms. When grouping by location we only consider firms that joined the ifo Survey after the German reunification.

Table A.8: Predictability of expectation errors

		Production			Prices		
Variable	Timing	estimate	t-value	p-value	estimate	t-value	p-value
Constant		0.022	1.22	0.22	0.037***	3.14	0.00
IP growth	real-time	0.424*	1.93	0.05	0.165	1.58	0.11
Unemployment rate	t-1	0.002	1.16	0.24	−0.001	-0.86	0.39
PPI growth	t-2	0.005	0.23	0.82	0.036***	3.61	0.00
CPI growth	t-2	−0.016	-1.07	0.29	−0.007	-1.00	0.32
	t	0.012***	3.97	0.00	−0.258***	-81.95	0.00
Expectation about own	t-1	−0.001	-0.39	0.70	0.055***	21.63	0.00
prices	t-2	−0.010***	-3.87	0.00	0.010***	4.23	0.00
	t-3	−0.010***	-3.30	0.00	0.001	0.26	0.79
	t	−0.301***	-94.38	0.00	0.002	1.22	0.22
Expectation about own	t-1	0.041***	15.97	0.00	−0.001	-0.78	0.43
production	t-2	0.007**	2.52	0.01	−0.001	-0.89	0.37
	t-3	−0.004	-1.26	0.21	0.000	-0.19	0.85
	t	0.007**	2.48	0.01	0.004**	2.21	0.03
Reported business	t-1	−0.004*	-1.93	0.05	0.000	-0.17	0.87
situation	t-2	0.004*	1.77	0.08	0.002	1.21	0.23
	t-3	0.019***	5.95	0.00	0.001	0.74	0.46
	t	−0.020***	-7.01	0.00	−0.011***	-6.23	0.00
Reported backlog of	t-1	0.001	0.49	0.63	0.000	0.25	0.80
orders	t-2	0.004**	1.97	0.05	0.000	0.30	0.76
	t-3	−0.007***	-2.85	0.00	−0.001	-0.73	0.47
	t	0.038***	12.22	0.00	0.003	1.58	0.12
most recent reported	t-1	0.025***	8.98	0.00	0.003*	1.75	0.08
change in production	t-2	0.021***	7.83	0.00	0.004**	2.43	0.02
	t-3	0.023***	7.63	0.00	0.001	0.52	0.60
	t	−0.003	-1.11	0.27	0.060***	16.43	0.00
most recent reported	t-1	−0.003	-1.35	0.18	0.038***	13.73	0.00
change in prices	t-2	0.000	-0.08	0.93	0.033***	12.65	0.00
	t-3	−0.003	-0.91	0.36	0.041***	12.20	0.00
	t	0.048***	16.18	0.00	0.010***	5.45	0.00
Reported change in	t-1	0.023***	9.39	0.00	0.004**	2.45	0.01
demand	t-2	0.014***	6.09	0.00	0.002	1.24	0.22
	t-3	0.006**	2.14	0.03	0.001	0.89	0.38
R^2		0.172			0.170		

Notes: predictive regressions for forecast errors for prices and production. For IP growth we use real-time data for the seasonally and calendar adjusted industrial production and compute monthly growth rates that are also reported in the press releases of DESTATIS. We assume that firms update their information set on the day after the release. Since 2005 firms may complete the survey online. Only for these firms the day of completion is known, which is the sample used for this exercise. One, two, and three stars (*) correspond to significance on the 10, 5, and 1 percent significance levels.