Firm Expectations and News: Micro v Macro*

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Abstract

Firm expectations reflect micro and macro news: information about firm-level developments and the aggregate economy. We formalize this notion in a stylized general-equilibrium model where firms face a signal-extraction problem and study the implications of 'island illusion,' meaning that firms systematically underestimate the importance of aggregate developments for their own performance. Island illusion is governed by a single parameter that captures the departure from rational expectations. It imposes joint restrictions on the impact of micro and macro news that we confront with survey data for Italian and German firms. While both surveys differ along many dimensions, we find robustly that firms' expectations about their own prices and output overreact to micro news and underreact to macro news—just like the model predicts for island illusion. Moreover, also consistent with the model, we find the extent of overreaction and underreaction to co-move positively, both over time and across firms.

Keywords: Survey data, salience, overreaction, underreaction, micro news, macro news, island illusion, inflation, business cycle

JEL-Codes: D84, C53, E71

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1 Introduction

How do firms adjust their expectations to news? We take up this question against the background of recent work that leverages survey data to provide insights into the expectation-formation process. Coibion and Gorodnichenko (2015), CG for short, investigate the consensus forecast of professional forecasters and find that forecast revisions predict forecast errors. This conflicts with the full information rational expectations (FIRE) benchmark but not necessarily with rational expectations because the consensus forecast is not available to individual forecasters in real time. Yet Bordalo et al. (2020) show that forecast revisions predict forecast errors also at the level of individual forecasters, which contradicts the assumption of rational expectations. We take the analysis to the next level and study expectations at the firm level—expectations that are directly relevant to economic decisions. To do so, we distinguish forecast revisions that reflect micro news, information about firm-specific developments, and macro news, information about the aggregate economy. Both matter for firm-level outcomes and, by implication, for firm expectations.

We show this in the first step of our analysis in a stylized general-equilibrium model with noisy information. Firms take center stage in the model and suffer from 'island illusion,' meaning they systematically underestimate the importance of aggregate developments for their own performance. The departure from rational expectations is governed by a single parameter that jointly restricts the impact of micro and macro news: firm expectations overreact to micro news and underreact to macro news under island illusion; they do neither under rational expectations.

Informed by the model, we estimate a variant of CG's empirical specification on data from two distinct firm surveys: The Banca d'Italia's 'Survey on Inflation and Growth Expectations' (SIGE) of Italian firms and the German 'ifo Business Climate Survey', or ifo survey for short. They differ along many dimensions, including how answers are solicited, the time frequency, and even the variables of interest. In the SIGE, firms report expectations about their own prices; in the ifo survey, firms report expectations about their own production. Yet, we find robustly across all specifications that firm expectations overreact to micro news and underreact to macro news. Also, the extent of overreaction and underreaction co-moves positively both over time and across firms—just like the model would have it assuming there is island illusion.

More in detail, we build on the classic island models of noisy information (Lucas 1972; Lorenzoni 2009). In a nutshell, as firms observe their productivity, they cannot tell apart the aggregate and the idiosyncratic components. They rely on an additional noisy signal about the aggregate economy to extract information about aggregate productivity, which will determine the prices of their competitors and, eventually, their own performance. Formally, island illusion means that firms systematically underestimate the weight of the aggregate component in the signals they receive. More broadly, island illusion is an instance of salience, which Taylor and Thompson (1982) define as "the phenomenon that when one's attention is differentially directed to one portion of the environment rather than to others, the information contained in that portion will receive disproportionate weighing in subsequent judgments" and which has been shown to bias inference in various contexts (Bordalo et al. 2022, 2023).[1]

Our model setup differs from earlier work by Bordalo et al. (2020) and Broer and Kohlhas (2024) because it is tailored to provide a microfoundation for our empirical specification, which, in turn, extends the original framework of CG by distinguishing between micro and macro news. Specifically, we regress firms' forecast errors about firm-level outcomes on news as processed by firms in real time, measured as forecast revision across survey rounds. Importantly, these revisions may reflect firm-specific news (micro news) or news about the aggregate economy (macro news). We isolate the effect of the micro component as we purge a firm's forecast revision of the firm-specific impact of a set of macroeconomic indicators that are available in real-time or, more generally, by controlling for macro news.

The SIGE is particularly suited for our analysis because it solicits expectations of firms' own prices and aggregate inflation for various horizons. The revision of firm expectations of aggregate inflation provides a straightforward measure of macro news, allowing us to isolate the micro news reflected in the forecast revision of firms' own prices. The responses to the SIGE are reported quarterly on a quantitative scale, and our sample covers the period 2002–2022, featuring some 500 firms with 35 observations each, on average.

[1] Bianchi et al. (2022) use a machine-learning algorithm to estimate time-varying systematic expectational errors and find that survey respondents place too much weight on the private or judgmental component of their forecasts and too little weight on publicly available economic information. Also, at a more general level, direct experience has been found to impact (risk) perceptions more strongly than outcomes experienced by others (Smith et al. 2001; Viscusi and Zeckhauser 2015).

The German ifo survey, in contrast, captures expectations for more than 3000 firms with 100 observations each, on average, during the sample period 2004–2019. Among other variables, the ifo survey solicits firms' expectations about their production over the next three months, which are reported qualitatively. Also, the ifo survey does not ask for macroeconomic expectations regularly. To measure macro news, we resort to the surprise component in the ifo *Business Climate Index*, an aggregate indicator of the German business cycle based on the ifo survey, relative to the corresponding consensus forecast of professional forecasters. Importantly, in both surveys, the responses are confidential and the weight of individual responses sufficiently small for strategic motives not to matter (Gemmi and Valchev 2023).

Our main result emerges robustly across both surveys: Firm expectations overreact to micro news and underreact to macro news. Macro news, or new information about the overall economy, tends to lead to positive forecast errors, meaning that actual outcomes exceed expectations. More concretely, if firms revise inflation expectations upwards, their own prices down the road will be even higher than expected. Or, if the current ifo index surprises positively, a firm's production will likely exceed its expectation. In this sense, firm expectations do not fully account for macro news as it becomes available: they underreact to macro news. Micro news, instead, has a negative effect on the forecast error; that is, an upward revision of a firm's price (production) expectation tends to be followed by a lower-than-expected price (production). Firm expectations respond too strongly to micro news: they overreact. We find that these patterns are not only a distinct feature of both data sets but also emerge robustly for alternative definitions of news and forecast errors across various specifications. Moreover, we also find that underreaction and overreaction are persistent over time—forecast errors respond not only to concurrent but also to past news—suggesting that our results are not caused by measurement error, which has been brought forward as a potential explanation for overreaction (Juodis and Kučinskas 2023).

Our baseline specifications pool firm-level observations for, in turn, the SIGE and the ifo survey. But for the ifo survey, we also estimate the reaction to news firm by firm, taking advantage of the large number of consecutive observations available for most firms. We find that overreaction to micro news is a pervasive feature across firms. The estimates for individual firms are consistently negative and distributed

in a narrow range. The response to macro news is somewhat more dispersed across firms. Although there is underreaction for most firms, firms differ in how strongly they underreact to macro news. Larger firms, for instance, underreact more strongly. This result may reflect a stronger impact of the macroeconomy on the production—and hence the forecast errors—of larger firms.

We also detect a pattern in the cross-section: Firms that tend to overreact strongly to micro news also tend to underreact strongly to macro news. Likewise, as we allow estimates to vary over time, we find that in periods when there is a strong underreaction to macro news, the overreaction to micro news is also strong, and vice versa. Lastly, we establish that the variation in the reaction to news across firms systematically correlates with firm-level outcomes. We find, in particular, that a stronger overreaction to micro news is associated with lower profits, and both overreaction to micro news and underreaction to macro news are associated with higher firm-level production and forecast-error volatility—consistent with earlier work showing that firm expectations matter for firm outcomes (Bachmann et al. 2013; Enders et al. 2022).

The rest of the paper is organized as follows. In the remainder of the introduction, we place the paper's contribution in the context of the literature. Section 2 introduces our empirical framework alongside a model-based microfoundation. Sections 3 and 4 introduce the SIGE and ifo surveys and present results for price and production expectations, respectively. The conclusion outlines potential venues for future research.

Related Literature. Our paper builds on three strands of the literature. First, at an empirical level, our work relates to the literature which is concerned with macroeconomic expectations of firms; see, for instance, Andrade et al. (2022), Kumar et al. (2023), Coibion et al. (2020), and Savignac et al. (2024), as well as the recent survey by Candia et al. (2023). In contrast, our focus is on firms' expectations about their own performance. Here, only a limited number of studies have analyzed firm expectations about firm outcomes (see Born et al. 2023). Massenot and Pettinicchi (2018) and Barrero (2022) document 'over-extrapolation' for firm expectations based on the ifo survey and for U.S. managers, respectively, meaning that firm-level performance (rather than forecast revisions) predicts forecast errors. Enders et al. (2019), in turn, take a macro perspective and document that the response of firm expectations to

monetary policy shocks is non-linear in the shock size. Neither of these studies distinguishes between the response to micro and macro news.

Second, our empirical setup builds on CG's widely used framework; see Born et al. (2024) for a survey. Importantly, as in Bordalo et al. (2020), we estimate our model at the level of individual forecasters.[2] Predictable forecast errors at this level allow us to reject rational expectations. But this does not imply a rejection of rationality *per se*: Predictable forecast errors may emerge because of forecasters' asymmetric loss function, specific constraints on information processing, or in a learning environment with parameter uncertainty (e.g., Elliott et al. 2008; Farmer et al. 2023; Kohlhas and Roberston 2022; Bachmann et al. 2023).[3]

Lastly, our paper relates to theoretical work that accounts for behavioral aspects in expectation formation.[4] Models of *level-K thinking*, *cognitive discounting* and *sticky expectations* can rationalize why there is underreaction to current news (e.g., Farhi and Werning 2019; García-Schmidt and Woodford 2019; Gabaix 2020; Bouchaud et al. 2019; Carroll et al. 2020), while *constrained memory* may account for overreaction (Azeredo da Silveira and Woodford 2019). Ba et al. (2023) show that bounded rationality at various stages of belief formation can lead to both over- and underreaction. Potentially unrepresentative media reporting or, more broadly, *narratives* may also distort the expectation formation process (Shiller 2017; Chahrour et al. 2021; Andre et al. 2022). Our model of island illusion is conceptually closely related to *diagnostic expectations* and *overconfidence* (Bordalo et al. 2019, 2020; Broer and Kohlhas 2024). It differs from these approaches in simultaneously accounting for under- and overreactions in a general-equilibrium setting. Such a setting is key because it allows us to consistently model expectations about firm outcomes based on micro and macro news.

[2]See also Angeletos et al. (2021), Broer and Kohlhas (2024), and Kučinskas and Peters (2022) for evidence on the reaction to news of households, professional forecasters, or participants of experiments.

[3]However, we stress that models that abandon the full information assumption in favor of noisy information still predict that forecast errors should not be predictable at the level of individual forecasters (see, again CG and Bordalo et al. 2020). This includes models of rational inattention (e.g., Mackowiak and Wiederholt 2009). Kohlhas and Walther (2021) put forward a model of asymmetric attention which rationalizes the observation that forecasts of output growth underreact to *average* forecast revisions (news) but overreact to recent realizations of output growth. They stress that asymmetric attention may arise in a fully rational framework.

[4]Under certain conditions, behavioral models and incomplete information models give rise to equivalent equilibrium effects (Angeletos and Huo 2021).

2 Framework

This section presents our empirical framework, placing it in the context of earlier work. It also offers a microfoundation based on a stylized general-equilibrium model where firm expectations are subject to 'island illusion.'

2.1 Baseline specification

Our empirical analysis extends the approach of CG and related studies in two ways. First, we consider firm expectations of firm-level outcomes: either a firm's production or its price. Second, as we study the impact of news on expectations, we distinguish between different *types* of news: Firm expectations about firm-level outcomes may respond to a) news about firm-specific developments, that is, 'micro news' and b) news about relevant macro variables, that is, 'macro news.'[5]

To measure micro news, we rely on firms' forecast revisions about firm-level outcomes because forecast revisions reflect the reaction to available news (Bordalo et al. 2020). Of course, such revisions may reflect both micro news and macro news. To isolate micro news, we pursue two alternative strategies. First, we explicitly control for macro news in the empirical analysis. Second, we purge forecast revisions of a macro component before the estimation. Specifically, in this case, we measure micro news as the residual of firm-level regressions, which relate forecast revisions to changes in relevant macro variables observable to firms in real time. To measure macro news about inflation and the business cycle, we use firms' forecast revisions about macro variables (whenever they are available). Alternatively, we rely on the surprise component of relevant macro variables, measured relative to the consensus forecast.[6] Table B.1 in the appendix provides a formal overview of our news measures.

Our empirical analysis is centered around the following specification (baseline):

$$x^i_{t+h,t} - \mathrm{F}^i_t(x^i_{t+h,t}) = \beta_0 + \beta_1 \cdot \text{micro news}^i_t + \beta_2 \cdot \text{macro news}^i_t + v^i_t \ . \tag{1}$$

[5]Broer and Kohlhas (2024) study systematically how professional forecasters respond to various real-time indicators, including macroeconomic variables. They do not, however, focus on the distinction between micro and macro news, as we do below.

[6]Surprises are measured relative to a firm's information set, e.g., in period t, we subtract from the release at the end of period $t-1$ the corresponding consensus forecast.

Here, $x^i_{t+h,t} - \mathrm{F}^i_t(x^i_{t+h,t})$ is the forecast error of firm i regarding firm-level outcome x^i_t, which is either production or prices, depending on the specification. In what follows, we refer to β_1 as the 'micro coefficient' and β_2 as the 'macro coefficient': under rational expectations, these coefficients are zero—independently of whether there are information frictions or not—because micro and macro news are part of a firm's information set.[7]

Specification (1) is not simply a test of rational expectations. It also points towards specific alternative models of expectation formation. When positive news ($\text{news}_t > 0$) tends to be followed by positive forecast errors ($\beta > 0$), the forecast revision turns out to be too weak from an ex-post point of view. Hence, there is underreaction to news. Conversely, when positive news is, on average, followed by negative forecast errors ($\beta < 0$), the forecast revision is too strong from an ex-post point of view: There is overreaction to news (Bordalo et al. 2020). Section 2.2 develops a stylized general-equilibrium model, providing a microfoundation to Specification (1). It also establishes conditions under which β_1 and β_2 indeed differ from zero.

Before that, we take up a potential complication. In principle, measurement error may mechanically induce a negative correlation between the forecast revision and the forecast error, a concern raised by Juodis and Kučinskas (2023). To see this, consider the possibility that firms do not report their actual expectations but, for whatever reason, deviate from the true value when reporting their expectations in the survey. Formally, let $\varepsilon^{i,rep.}_t$ denote some i.i.d. measurement error. Reported expectations are then given by $\mathrm{F}^{i,rep.}_t(x^i_{t+h,t}) = \mathrm{F}^i_t(x^i_{t+h,t}) + \varepsilon^{i,rep.}_t$. The observed forecast error, $x^i_{t+h,t} - \mathrm{F}^i_t(x^i_{t+h,t}) - \varepsilon^{i,rep.}_t$, is then negatively correlated with the reported forecast revision by construction: $FR^{i,rep.}_t = FR^i_t + \varepsilon^{i,rep.}_t - \varepsilon^{i,rep.}_{t-1}$.

Hence, taken at face value, measurement error offers an explanation for overreaction, which we find robustly across specifications in response to micro news ($\beta_1 < 0$), but

[7] Coibion and Gorodnichenko (2015) estimate a version of Specification (1) on the median (consensus) professional forecast for inflation and find a positive coefficient. This result is still consistent with rational expectations: It may simply reflect a failure of the full-information assumption. Intuitively, by estimating the specification on the consensus forecast, the econometrician uses information not available to the individual forecaster. Instead, if Specification (1) is estimated on data for individual forecasters, rational expectations imply that forecast errors are not predictable by $news_t$ that forecasters observe in real time—independently of whether there is otherwise full information or not. Bordalo et al. (2020) estimate a version of Specification (1) at the forecaster level using a single news measure and find a negative coefficient, rejecting rational expectations.

not in response to macro news where overreaction dominates. Still, we can reject this explanation based on two robustness tests. First, we exclude outliers, which are especially prone to measurement error. Second, we consider a dynamic version of Specification (1) which relates forecast errors to concurrent and *lagged* news, including p lags for both micro and macro news:

$$x^i_{t+h,t} - \mathrm{F}^i_t(x^i_{t+h,t}) = \beta_0 + \sum_{\rho=0}^{p}(\beta_{1,\rho} \cdot \text{micro news}^i_{t-\rho} + \beta_{2,\rho} \cdot \text{macro news}^i_{t-\rho}) + v^i_t \ . \quad (2)$$

Based on this specification, we find robustly that over- and underreaction is not confined to concurrent news but extends to lagged news as well.[8]

2.2 Microfoundations

We develop a stylized general-equilibrium model of firm expectations tailored to illustrate how expectations about firm-level outcomes depend on micro and macro news. This perspective sets the model apart from earlier work by Bordalo et al. (2020) and Broer and Kohlhas (2024). Specifically, we propose a particularly simple departure from rational expectations that allows us to map the model solution into Specification (1). This departure is captured by a single parameter, which, in turn, represents the degree of island illusion and imposes joint restrictions on β_1 and β_2.

2.2.1 Model outline

A continuum of islands is populated by a representative firm indexed by $i \in [0, 1]$. Firms operate under monopolistic competition and manufacture differentiated goods based on island-specific productivity, simultaneously driven by an aggregate component and an island-specific component as in Lorenzoni (2009). Firms adjust production to meet the demand that arises at pre-set prices. A representative household buys from and supplies labor to all firms at a fixed nominal wage.

The timing of events is as follows: firms start with expectations about their own

[8] In the context of our analysis, this approach is more suitable than local projections to trace out the effect of news over time because news may be autocorrelated. Indeed, we find that—since micro (macro) news is negatively (positively) autocorrelated—the micro (macro) coefficient on concurrent news tends to be larger (smaller) than on lags.

output, which will depend on their price relative to the aggregate price index.[9] Firms may revise expectations once they observe their own productivity. They do not observe its underlying components. However, they also receive a noisy signal about the aggregate price index (macro news), which is informative about aggregate productivity. Once they have set prices, demand, sales, and production are realized. Below, we evaluate firm expectations and relate them to forecast revisions and news according to Specification (1). Time subscripts are omitted for simplicity.

More in detail, production Y^i is linear in productivity A^i and labor L^i: $Y^i = A^i L^i$. Demand, in turn, is given by $Y^i = (P^i/P)^{-\gamma} M/P$, where $\gamma > 1$ is the elasticity of substitution between differentiated goods, P is the aggregate price index, and $M > 0$ is constant nominal demand, see Appendix A.1. Using small letters to denote logs, productivity is the sum of the aggregate component ε and the island-specific component η^i: $a^i = \varepsilon + \eta^i$. Both components are i.i.d. random variables with mean zero, variances σ^2_ε and σ^2_η, and the cross-island average of η^i is zero.

Productivity on island i matters not only for production. It is also a signal about the aggregate component that, in equilibrium, is inversely related to the aggregate price level and, hence, determines a firm's relative price, $p^i - p$. Formally, ignoring constants in what follows, we have $p = -\varepsilon$. In addition to their own productivity, firms receive a noisy signal of the aggregate price index, that is, macro news: $s = p + e$. σ^2_e denotes the variance of the noise term e.

2.2.2 Island illusion

As we turn to expectation formation, we further simplify the model and assume $\mathrm{Var}(a^i) = \mathrm{Var}(s)$.[10] The parameter ω measures the weight of the aggregate component in firm-level productivity such that $\sigma^2_\varepsilon = \omega \,\mathrm{Var}(a^i)$. This implies $\sigma^2_\eta = (1-\omega)\,\mathrm{Var}(a^i)$ and $\sigma^2_e = (1-\omega)\,\mathrm{Var}(s)$. The weight of the aggregate component perceived by firms potentially differs from the actual weight and is given by ω/Υ. Under rational

[9] For simplicity, we use firms' level forecasts of output. Since earlier variable realizations are assumed to be known, we obtain the same predictions when considering forecasts of output changes, as we do in our empirical analysis. Similar for price expectations, discussed below.

[10] In the model, this holds if macro news is published by a forecaster which observes productivity on one island and makes this information public so that firms effectively observe two technology draws: their own and that of one competitor. In Appendix A.3, we relax the assumption $\mathrm{Var}(a^i) = \mathrm{Var}(s)$ and establish a (fairly mild) condition for our main result to go through.

expectations: $\Upsilon = 1$. Values of $\Upsilon \geq 1$ capture island illusion, meaning the *perceived weight* is smaller than the actual weight. Then, as Appendix A.2 shows, we have

$$\mathrm{F}^i(p) = \frac{\omega}{\Upsilon + \omega} s - \frac{\omega}{\Upsilon + \omega} a^i \ . \tag{3}$$

Intuitively, expectations about the aggregate price level decline in a firm's own productivity—and more strongly so, if the weight of the aggregate component is large. They increase in the signal about the aggregate price level—and more strongly so, if the signal is perceived to be precise. This holds for rational expectations ($\Upsilon = 1$) and in the case of island illusion ($\Upsilon > 1$). Crucially, in the latter case, expectations respond less to both signals. As a result, the aggregate price index—and, hence, own sales—will, on average, be higher than expected, given $s > 0$. The reverse holds for $a^i > 0$. Put differently, firms make systematic forecast errors in response to signals. Note, however, that firms do not err when it comes to the variances of s and a^i; they just misjudge the relative importance of the driving forces.[11] Moreover, the implied probability distribution cannot be rejected based on a finite number of draws from the data-generating process—an instance of near rational expectations (Woodford 2010).[12]

Formally, the forecast error of firm i is the difference between actual output, y^i, and the firm forecast conditional on productivity and macro news $\mathrm{F}^i(y^i|a^i, s)$. The forecast revision is the change in the forecast upon observing these signals relative to the initial expectation $\mathrm{F}_0^i(y^i)$, which is based on the commonly known pre-shock value of aggregate technology: $FR^i = \mathrm{F}^i(y^i|a^i, s) - \mathrm{F}_0^i(y^i)$. Armed with these definitions, we state our main result (derived in Appendix A.3):

Proposition 1. *Consider the regression*

$$y^i - \mathrm{F}^i(y^i) = \beta_1 FR^i + \beta_2 s + v^i \ , \tag{4}$$

[11] Note that island illusion does not lead to unconditionally biased expectations but an underestimation of future output volatility (which depends on the underestimated volatility of ε). Both predictions are consistent with evidence established by Barrero (2022) based on a survey of managers.

[12] In this framework, placing an upper bound on the relative entropy (a measure of the discrepancy) between firms' subjective and objective conditional probabilities implies an upper bound for Υ, given the remaining parameter values.

where all terms are defined as introduced above, and v^i represents a potential error term. In the case of island illusion, that is, for $\Upsilon > 1$, we obtain

$$\beta_1 < 0 \qquad \textit{and} \qquad \beta_2 > 0 \ .$$

Furthermore, a higher degree of island illusion (a higher Υ) implies larger absolute values of β_1 and β_2. For $\Upsilon = 1$, we obtain $\beta_1 = \beta_2 = 0$ (rational expectations).

Equation (4) is the counterpart to our baseline Specification (1) and Proposition 1 establishes stringent cross-parameter restrictions on a possible deviation from rational expectations. With island illusion, the model predicts a simultaneous overreaction to private signals and an underreaction to public information by individual firms—based on a single parameter that captures the departure from rational expectations. Appendix A.4 provides more details.

2.2.3 Price expectations

A relation isomorphic to Proposition 1 emerges for firms' price expectations once we consider a simple model extension. In particular, assume that the aggregate component of technology follows a random walk while the idiosyncratic component is white noise. Furthermore, assume firms operate for multiple periods. In this case, firms expect to re-adjust prices once they can (at the end of the period) to align them with the long-run technology level. Given that they overestimate (underestimate) the distance between their own and the aggregate technology in response to $a^i(s)$, they also overestimate (underestimate) their future price adjustment. In this way, the model can also rationalize over- and underreaction of price expectations to micro and macro news.

3 Price expectations

In this section, we estimate our empirical specification on data for price expectations elicited in a survey of Italian firms. The data is uniquely suited for this purpose since it permits constructing direct measures of micro news and macro news, as processed

by firms, and relating them to forecast errors about their own prices. We briefly describe the data before presenting the results.

3.1 The Survey of Inflation and Growth Expectations

The quarterly *Survey of Inflation and Growth Expectations* (SIGE) among Italian firms is run by the Banca d'Italia. It was launched as a panel in 1999 and polls firms in the industrial sector, excluding construction, and non-financial services. The average response rate in the survey is 45 percent.[13] Our sample starts in 2002, when questions about realized changes in firms' own prices were introduced in the survey, and runs up to the end of 2022. Firm responses are generally in the form of growth rates, and the wording of the relevant questions is documented in Table B.2 in Appendix B.1.[14] As a unique feature, the SIGE asks firms about expected changes in both their own prices and aggregate inflation, such that it is possible to measure micro and macro news straightforwardly.

To construct forecast errors in quarter t about a firm's price change, we subtract from the realized change reported in period $t+4$ its four-quarter ahead expectation, as reported in period t. We measure macro news as the first difference of firms' four-quarter-ahead expectations for aggregate inflation across survey rounds. Next, we compute the forecast revision of a firm for its own price: the change in its four-quarter ahead expectation relative to what it reported in the previous quarter. This is not a direct measure for micro news. As discussed above, forecast revisions may reflect not only micro but also macro news.[15] Hence, we control for macro news in our specification as we estimate the impact of forecast revisions on forecast errors. In this way, we can isolate the effect of micro news.

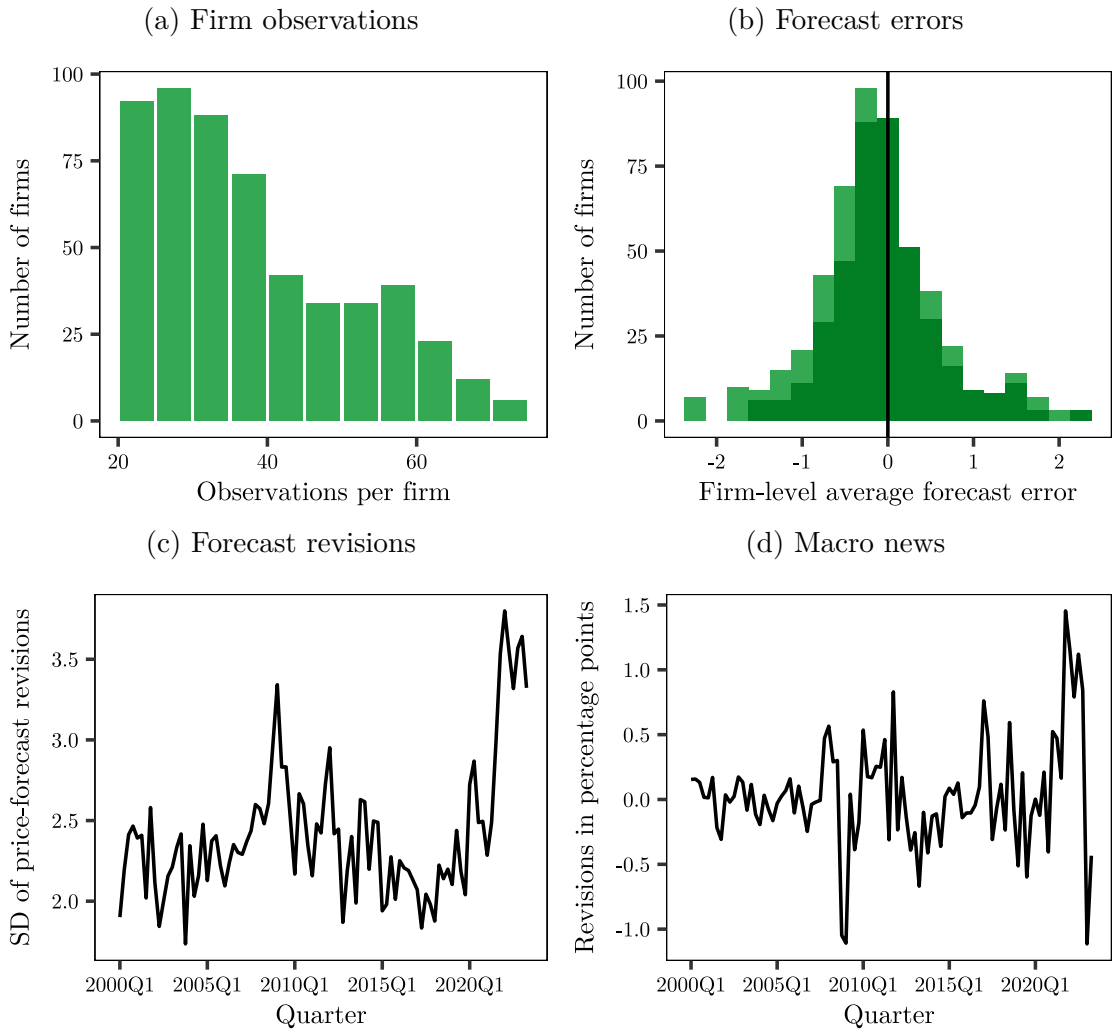
For both forecast revisions and macro news, the overlap in forecasting periods is three out of four quarters, which we consider large enough for changes to reflect actual news (rather than changes in the forecast horizon). Still, in our robustness analysis, we consider alternative measures for which there is full overlap. Lastly, we emphasize

[13] For the comparable Survey of Business Uncertainty in the United States, the response rate is around one-third (Altig et al. 2022).

[14] For further details on the SIGE, see Banca d'Italia (2022) and Grasso and Ropele (2018).

[15] And indeed, we find across a number of specifications that macro news predicts forecast revisions; see the Online Appendix, Table OA.1.

Figure 1: Basic statistics for SIGE



Notes: Panel (a): distribution of (quarterly) observations per firm, that is, the number of firms for which a firm-specific number of observations is available. Panel (b): histogram of firm-level average forecast errors for own prices (after winsorizing). Color indicates significance at the five percent level: light green or dark green if not. Bins with less than three firms are not shown due to confidentiality constraints. Panel (c): cross-sectional standard deviation of own-price-forecast revision. Panel (d): macro news as average forecast revision for the one-year-ahead inflation rate.

that we measure forecast revisions, macro news, and forecast errors at the level of individual firms based on firms' responses in the survey and measured in percentage points. Table B.1 provides formal definitions.

In our baseline, we winsorize these survey-based variables at the top and bottom one percent to account for potential measurement error. To obtain a consistent sample for the entire analysis, we consider only observations for firms in the survey for at least 20 quarters.[16] When asked about their expectations for aggregate inflation, firms are generally provided with Italy's most recent inflation rate. Since 2012, a randomly selected subset of firms has not received this information. Our baseline sample features only observations for firms that receive the inflation update, but we also assess how much this information treatment matters for our results.

Figure 1 presents descriptive statistics. Panel (a) shows how the number of time-series observations varies across firms. More than 530 firms are in the survey for 20 quarters or more, with some firms in the survey for more than 75 quarters. We plot the distribution of forecast errors in Panel (b). It turns out that expectation errors about firms' own prices are generally (for more than 75% of firms) not significantly different from and centered around zero. This is a general pattern in firm surveys (Born et al. 2023). Panel (c) shows a sizeable dispersion of firms' forecast revisions about their own prices, notably in times of macroeconomic turmoil. Finally, Panel (d) illustrates the evolution of average macro news over the sample period. We observe that firms' revisions of inflation expectations are generally moderate, at least during the low and stable inflation environment through 2020. There are more sizeable revisions as inflation takes off in the post-pandemic period.

3.2 Results for price expectations

We are finally in the position to estimate Specification (1). For this purpose, we pool observations across firms, accounting for firm-fixed effects. Table 1 reports the results. Consider Column (1) first: Both types of news induce predictable, statistically significant forecast errors. Hence, we reject rational expectations for firms, consistent with the result of Bordalo et al. (2020) for professional forecasters. On top of that, we find that the type of news is key for *how* expectations fail to meet the rational expectations benchmark: While positive micro news predicts negative forecast errors, positive macro news predicts positive forecast errors. This implies that firms overreact

[16] Figure OA.1 shows that the resulting sample is representative of all firms in the survey based on their geographic location, number of employees, export orientation, and sector.

Table 1: The response of price expectations to news

	Firms' forecast errors about their own prices				
	(1)	(2)	(3)	(4)	(5)
Micro News					
Forecast rev. for $\pi^i_{t+4,t}$	-0.423^{***}		-0.422^{***}		-0.426^{***}
	(0.018)		(0.031)		(0.018)
Forecast rev. for $\pi^i_{t+4,t}$ net of $\gamma_i \Delta\pi_t$		-0.416^{***}		-0.416^{***}	
		(0.018)		(0.031)	
Forecast rev. for $\pi^i_{t+4,t} \times$ no treatment					-0.064
					(0.046)
Macro News					
Forecast rev. for $\pi_{t+4,t}$	0.275^{***}	0.246^{***}			0.289^{***}
	(0.050)	(0.050)			(0.050)
Inflation surprise			3.059^{***}	2.984^{***}	
			(0.404)	(0.407)	
Forecast rev. for $\pi_{t+4,t} \times$ no treatment					0.305^{***}
					(0.111)
Observations	18,284	18,284	6,640	6,640	21,982
R^2	0.071	0.070	0.074	0.073	0.079
Within R^2	0.080	0.079	0.089	0.089	0.086

Notes: Results are based on Specification (1), relating firms' forecast errors about their own prices to micro news and macro news. Micro news is measured either by forecast revisions while controlling for macro news, or by forecast revisions purged of changes in aggregate inflation. Macro news is measured by firms' forecast revisions about aggregate inflation or by the surprise component of inflation relative to (mean) professional forecast from Consensus Economics. The top and bottom one percent of firms' forecast revisions for their own prices and aggregate inflation and their forecast errors about their own prices are winsorized. Column (5): results for news interacted with a treatment indicator equal to 1 when the survey question does not feature the recent inflation rate and equal to 0 when the survey question does feature the recent inflation rate (baseline). The treatment indicator is also included in the regression. Sample: 2002 (2013 for inflation surprises) to 2022. Firm-fixed effects are always included, standard errors clustered at the firm level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

to micro news but underreact to macro news, consistent with our model of island illusion, which restricts the response of expectations to both types of news jointly.

The estimates are quantitatively important. Consider again Column (1). On average, an *upward* revision of price expectations due to micro news by one percentage point (standard deviation) is followed by a forecast error in the other direction: eventually, prices *fall short* of expectations by 0.423 percentage points (0.27 standard deviations of the forecast error). After an *upward* revision of a firm's expectation of

aggregate inflation by one percentage point (standard deviation), a firm's own price *exceeds* expectations by 0.275 percentage points (0.05 standard deviations).[17]

The measures for news in Column (1) are based entirely on survey responses, reflecting the change in the four-quarter ahead expectations for own prices and aggregate inflation, respectively. In Column (2), we show results obtained once we purge micro news of the most recent change in inflation while allowing for firm-specific loadings, γ_i. In Columns (3) and (4), we vary the measure of macro news, replacing the forecast revision with the inflation surprise relative to the average professional forecast taken from Consensus Economics.[18] Our main result is robust across all specifications: the data never rejects the model's predictions under island illusion.[19]

The SIGE survey is the basis for an influential study on firms' inflation expectations by Coibion et al. (2020). For this purpose, the authors exploit that since 2012, the survey no longer provides information about the most recent inflation rate to a randomly selected group of firms (about one-third of all firms).[20] Recall that our baseline estimates are based on the sample of firms that receive the information treatment. To assess the extent to which the treatment matters, we interact news in our regression with an indicator variable that assumes a value of one if a firm receives no information about aggregate inflation in a given forecasting period. Column (5) shows the result: Whether firms are treated or not does not change their response to micro news but to macro news. Firms that receive no inflation update tend to underreact more strongly to macro news. This is intuitive: absent treatment, news

[17] The standard deviation of micro (macro) news is 2.456 (0.724); that of the forecast error is 3.791.

[18] Our specification makes sure that the surprise is in a firm's information set for the relevant survey round. Consider, e.g., the Summer of 2022. On June 13, Consensus Economics polled professional forecasters about their inflation expectations in the second quarter and published results on June 16. The Banca d'Italia published the inflation rate on July 8. The difference between the realized value and the average professional forecast is the measure of macro news that we use for 2022Q3. In this case, the SIGE was conducted between August 25 and September 15. Recall that firms are explicitly informed about the current inflation rate when asked about their inflation expectations (baseline).

[19] The coefficients on macro news in Columns (3) and (4) are an order of magnitude larger than in Columns (1) and (2). This reflects the fact that inflation surprises are much smaller if we compute them relative to the consensus forecast.

[20] See Table B.2 for the exact wording. The information treatment generates exogenous variation in inflation expectations and is shown to influence not only pricing decisions but also credit demand, employment, and capital. Ropele et al. (2023) utilize the survey to study how the dispersion of beliefs about future inflation influences the misallocation of resources. Rosolia (2021) investigates how the information provision impacts the level of inflation expectations, as well as pricing and labor demand.

are less salient and forecasts are revised even less.

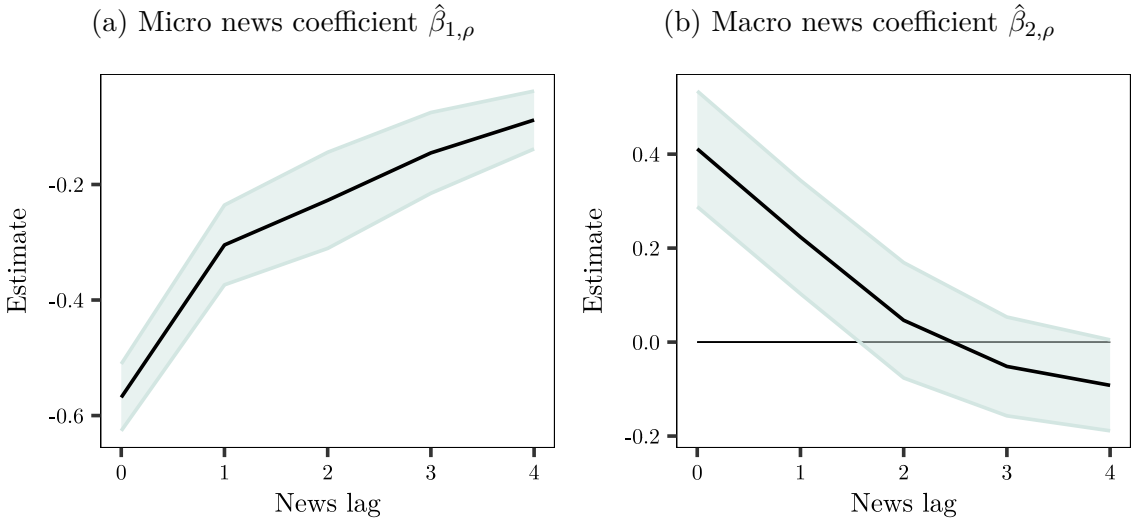
We find that our results are robust along a number of further dimensions and provide results in the appendices. Specifically, as we limit the sample to observations up until 2019 to check whether results are driven by the pandemic and the following surge of inflation, we find they are not, albeit the underreaction to macro news is somewhat weaker in the shorter sample, see Column (1) of Table OA.2 in the online appendix. Results are also robust as we consider an alternative measure of macro news. In the baseline, macro news is the change in the four-quarter-ahead inflation forecast from one quarter to the next and, as such, does not pertain to the same target date. But the SIGE surveys firms' inflation expectations not only four-quarters ahead but also two- and eight-quarters ahead.[21] Based on these different forecast horizons, we can measure macro news as the difference between the current shorter-term forecasts (two quarters and four quarters) and lagged longer-term forecasts (four quarters and eight quarters) for the same target date. For both fixed-target measures of macro news, we obtain results that are very similar to the baseline; see again Table OA.2.

We further verify that our results also hold for numerous alternative specifications. Namely, if we no longer winsorize survey variables or if we trim the top and bottom 1% of survey variables, results are very similar to the baseline; see Panels (a) and (b) of Table OA.3. We also consider alternative ways to purge forecast revisions of their macro component. First, we employ time-fixed effects and isolate micro news as the deviation from the cross-sectional mean even though, strictly speaking, this mean is not observable by firms in real time. Second, we purge micro news of recent changes in inflation with homogeneous loading γ (instead of γ_i). Results are similar to the baseline, as Panel (c) shows. Lastly, we show that our results also hold when including only micro and macro news separately instead of including them jointly; see Panel (d) of Table OA.3.

In principle, as discussed in Section 2 above, measurement error may induce a negative contemporaneous correlation between the forecast error and the forecast revision—a risk that we reduce by winsorizing observations in the baseline. Now, we go one step further and estimate the dynamic Specification (2) and show results in

[21] Questions about two-quarter-ahead inflation expectations were introduced in 2010. Four-quarter-ahead expectations are available for the entire sample period. Eight-quarter-ahead expectations were introduced in 2009. See Appendix B.1 for details.

Figure 2: Response of price expectations to current and past news



Notes: Results based on Specification (2), where we extend the baseline specification to include four lags of micro and macro news, that is, firms' forecast revisions (first differences) for their own prices (micro news) and aggregate inflation (macro news). Panel (a) shows point estimates and confidence intervals for current and lagged micro news. Panel (b) shows point estimates and confidence intervals for macro news. Confidence intervals are at the 95 percent level in both panels. Firm-fixed effects are included and standard errors are clustered at the firm level.

Figure 2. The solid line represents the point estimates for various news lags, and the shaded area indicates 95 percent confidence intervals. We find there is overreaction not only to contemporaneous micro news but also to lagged news: Panel (a). We are thus confident that measurement error is not driving our results. We also find that the underreaction to macro news is fairly persistent, albeit to a lesser extent than the overreaction to micro news: Panel (b).

4 Production expectations

We complement the evidence from the SIGE with evidence from the ifo survey of German firms. We do so with a focus on production expectations rather than price expectations. In addition to robustifying our results along this dimension, the ifo survey features long time series for individual firms, thus allowing us to probe into the heterogeneity of the expectation-formation process across firms.

4.1 The ifo Business Climate Survey

The *ifo Business Climate Survey*, or ifo survey for short, is maintained by the ifo institute in Munich and a mostly qualitative, monthly survey representative of the German economy (Hiersemenzel et al. 2022). It has been conducted since 1949 and its design has since been adopted by surveys worldwide (Becker and Wohlrabe 2008; Born et al. 2023). By way of compensation, participating firms receive sectoral and aggregate survey results, a feature we rely on below. The average monthly response rate is 82 percent, and the sample attrition is moderate (Enders et al. 2022). Our sample runs from April 2004 to December 2019.[22] Given our focus on production expectations, we only use data from the manufacturing sector, and given that we are particularly interested in estimates for individual firms, we restrict our sample to those firms that have been in the survey for at least 30 months.[23] In any given month, this leaves us with at least 1,000 responses, and often considerably more.

The ifo survey features questions about expected and realized production, where firms can report either an increase, no change, or a decrease; see Table B.3 for details. We follow the approach of Bachmann et al. (2013) to compute forecast errors based on these qualitative responses. We aggregate the monthly changes in realized production over three months as reported ex post and compare the result with the ex-ante expectation for the same period; see Table B.1 for details. As before, our basis for measuring micro news is the forecast revision of firms. Formally, given the qualitative responses in the ifo survey, we define the forecast revision of firm i in month t as the sign of the first difference of production expectations. It is equal to 0 when there is no change in expectations, equal to $+1$ for an upward revision (for example, from no change in $t-1$ to an increase in t), and equal to -1 for a downward revision (for example, from no change in $t-1$ to decrease in t). As mentioned above, we assume the forecast revision reflects news because the overlap in the revision is two months.[24]

[22] The ifo survey was launched in 1949, and the underlying micro data is available from 1980 onward. Some aggregate statistics based on it were first used by Theil (1955). As discussed below, our sample is restricted by data we rely on to construct macro news. The individual filling a firm's questionnaire is a member of the senior management; 85 percent are CEOs or department heads (Sauer and Wohlrabe 2019).

[23] Given the ifo survey runs at the monthly frequency, we use a higher threshold for the minimum number of observations than for the SIGE (minimum: 20 quarters). Also, for inclusion, we require firm responses to exhibit some time-series variation in their expectations and expectation errors.

[24] We verify that the forecast revisions are informative by relating the average forecast revisions

Likewise, we need to control for macro news to isolate the effect of micro news that is reflected in the forecast revision.[25]

Yet, in contrast to the SIGE, the ifo survey does not solicitate macroeconomic expectations regularly. We, therefore, measure macro news by the surprise component of the ifo index, an aggregate index compiled based on the ifo survey and a widely watched indicator of the German business cycle (Carstensen et al. 2020; Lehmann 2023). We compute the surprise component by subtracting the consensus forecast for the index, compiled by Bloomberg, from the actual index once it is released.[26] Importantly, we require macro news to be in the forecasters' information set, given Specification (1). This is likely to be the case for the surprises of the ifo index for several reasons. As stressed above, participating firms receive the latest release of the ifo index as a token of appreciation. In addition, media attention to the index is high. The ifo index is ranked among Bloomberg's "12 Global Economic Indicators to Watch," and news outlets regularly report on the realized value as well as on the professional forecasts.

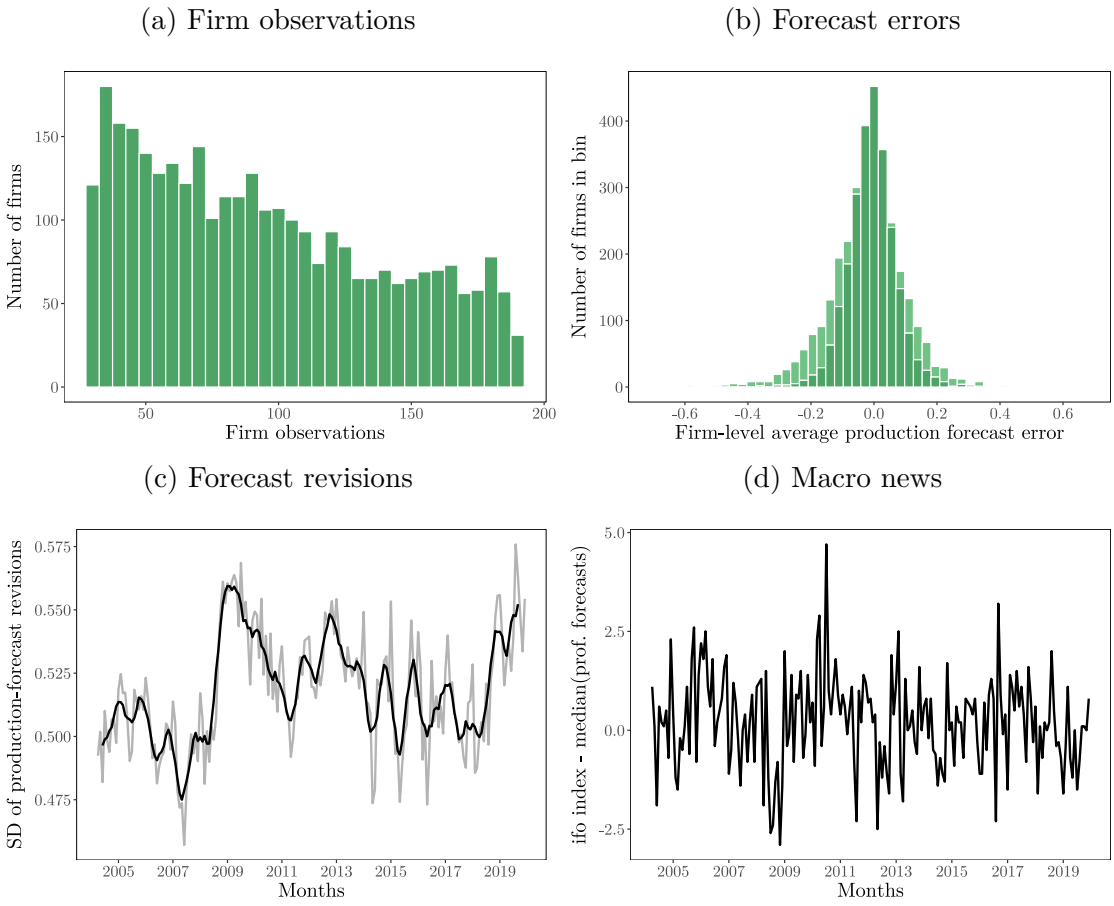
Figure 3 presents basic statistics for the ifo survey and is organized in the same way as Figure 1 above. Panel (a) shows the distribution of firms sorted according to the number of months a firm is in the sample. Here, the median is around 90 months, and 25 percent of firms are in the survey for over 130 months. These numbers are considerably higher than in the case of the SIGE and allow us to zoom in on the firm-level heterogeneity below. Panel (b) shows the distribution of forecast errors. Just like in the case of the SIGE, they are generally well-behaved: More than 75 percent of firm-level average forecast errors are not significantly different from zero. In Panel (c) we display the cross-sectional dispersion of forecast revisions and how it fluctuates over time. It is largest during the Great Recession, the Euro debt crisis, and towards the end of our sample. Panel (d) shows the time series for macro news.

over time to German manufacturing production growth, see Figure OA.3: The average forecast revision is a leading indicator for changes in manufacturing production. This was especially visible during the Great Recession and in 2018/2019, when the manufacturing sector cooled considerably.

[25] As with the SIGE, we find that macro news impacts forecast revisions significantly, see Table OA.4 for a range of specifications that interact macro news with several indicators.

[26] Bloomberg surveys professional forecasters who can submit and update their forecasts of macro indicators, for example, GDP and employment, but also the ifo index, up until its release. For the ifo index, the consensus forecast is based on about 40 forecasters; it has been available since April 2004. This constrains the beginning of our sample period.

Figure 3: Basic statistics for the ifo survey



Notes: Panel (a): distribution of monthly firm observations, that is, the number of firms for which a firm-specific time series of a certain length is available. Panel (b): histogram of firm-level average forecast errors for production. The color indicates if estimates significantly differ from zero at the five percent level (light green) or not (dark green). Panel (c): cross-sectional standard deviation of forecast revisions. The grey line depicts the standard deviation of forecast revision at the monthly level, and the black line depicts the six-month rolling average. Panel (d): macro news over time, defined as the surprise in the ifo index compared to median professional forecasts, see Table B.1.

4.2 Results for production expectations

Armed with these definitions, we revisit our baseline Specification (1) using firms' production expectations. We first pool, as before, observations across time and firms while allowing for firm-fixed effects. Table 2 reports the results. Column (1) is based on the specification that simultaneously features forecast revisions and macro news.

Table 2: Response of production expectations to news

	Firms' forecast errors about their own production			
	(1)	(2)	(3)	(4)
Micro News				
Forecast Revision for $y^i_{t+3,t}$	-0.191***			
	(0.001)			
Forecast Revision for $y^i_{t+3,t}$ net of $\gamma_i \Gamma_t$		-0.209***	-0.208***	
		(0.001)	(0.001)	
Macro News				
Surprise component of the ifo index	0.022***	0.022***		0.021***
	(0.0007)	(0.0007)		(0.0007)
Observations	302,737	302,737	302,737	302,737
R^2	0.16260	0.15806	0.15313	0.08967
Within R^2	0.08471	0.07974	0.07435	0.00498

Notes: Results based on Specification (1); observations are pooled across firms. The table shows results for the qualitative production expectations (3-month horizon) for German firms surveyed monthly in the ifo survey. Macro news is the surprise component of the ifo index. Column (1): micro news measured by forecast revisions (while controlling for macro news). Columns (2) and (3): micro news measured by forecast revisions net of real-time observable macro indicators, Γ_t, with firm-specific loading γ_i (see Footnote 28). Column (4): macro news only. All specifications include firm-fixed effects and standard errors clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

We find that production expectations, too, overreact to micro news and underreact to macro news. While this pattern is consistent with island illusion, its robustness is remarkable because it emerges as we estimate Specification (1) on data sets which differ not only—among other things—in terms of country, data frequency, and survey design but, importantly, also in terms of firm-level variables: price expectations vs. production expectations.[27]

The remaining columns of the table further validate the robustness of our results: The micro coefficient remains negative and highly significant when we purge the forecast revision of the impact of real-time macro indicators, Γ_t, with firm-specific loadings γ_i (second column).[28] In fact, estimates hardly differ from the baseline. In

[27]The ifo survey also features price expectations. We verify that in this case, too, our main result obtains: see Table OA.7 in the online appendix.

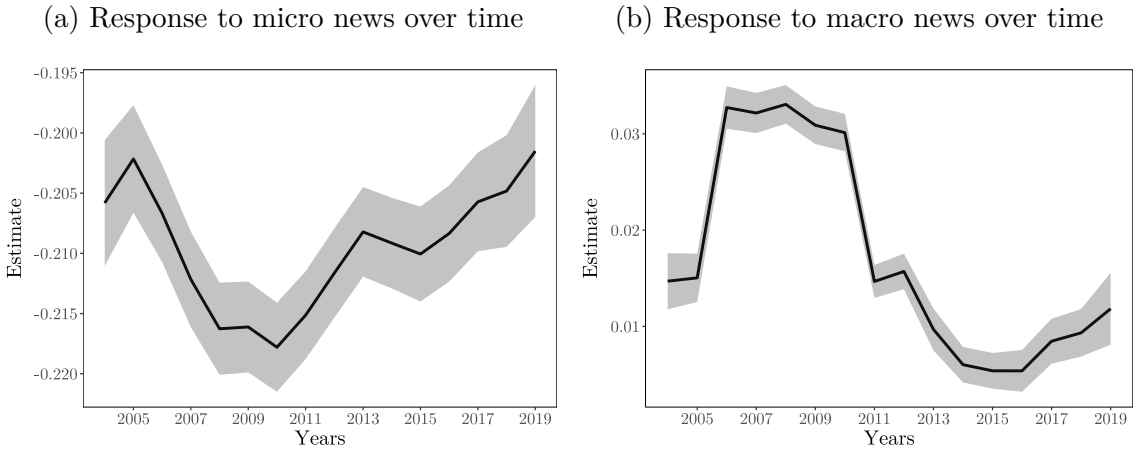
[28]Since the ifo survey does not ask firms about their inflation expectations, we rely on a set of macroeconomic indicators to proxy the relevant information set of firms: real-time monthly changes in German industrial production, the CPI, manufacturing orders, the stock market index DAX, as well as month-fixed effects to control for potential seasonality.

what follows, we, therefore, always measure micro news by the forecast revision net of the macro factors. Note further that when we drop macro news from the regression, the result for the impact of micro news also remains virtually unchanged (third column). The macro coefficient remains positive and significant when including only macro news in the regression (fourth column).

Note that the magnitude of the coefficients in Table 2 is again quantitatively relevant—although not as straightforward to assess due to the qualitative nature of the forecast revisions. Consider, for example, Column (2). A one-standard-deviation increase in micro news (0.46) predicts a forecast error of -0.1 (-0.209×0.46; that is, 0.27 standard deviations of the forecast error). A one-standard-deviation increase in macro news (1.2) leads to a forecast error of 0.03 (0.022×1.2; 0.08 standard deviations of the forecast error). Hence, the effects on forecast errors are not negligible, and the micro-news effect is about three times stronger than that of macro news. In terms of standard deviations, the magnitude is very close to our findings for the SIGE.

We further verify that results are robust across a range of alternative specifications. We show first that forecast errors are also significantly affected by past news in Figure OA.5 and report results of additional robustness tests in Table OA.5. This includes, first, estimates based on a subsample of observations restricted to firms that revise their qualitative production expectations to zero. In this way, we ensure that the results are not mechanically biased by the qualitative revision scale. Next, and in addition, we also set small errors to zero. Second, we estimate a specification in which we again set small forecast errors—potentially driven by measurement error—to zero and, in addition, consider only firms that expect 'no change' in production. Third, we use an ordered logit rather than OLS for the estimation. Fourth, we consider alternative ways to measure macro news. Specifically, we purge firms' forecast revision through time-fixed and time-sector-fixed effects. Lastly, we vary the measure for macro news and replace the surprise component in the ifo index, in turn, with the surprise component in manufacturing orders, the change in the ifo index, the average forecast revision, the average forecast revision per sector, and the change in the stock market index. We find robust overreaction to micro news and underreaction to macro news across all specifications.

Figure 4: Response to news over time

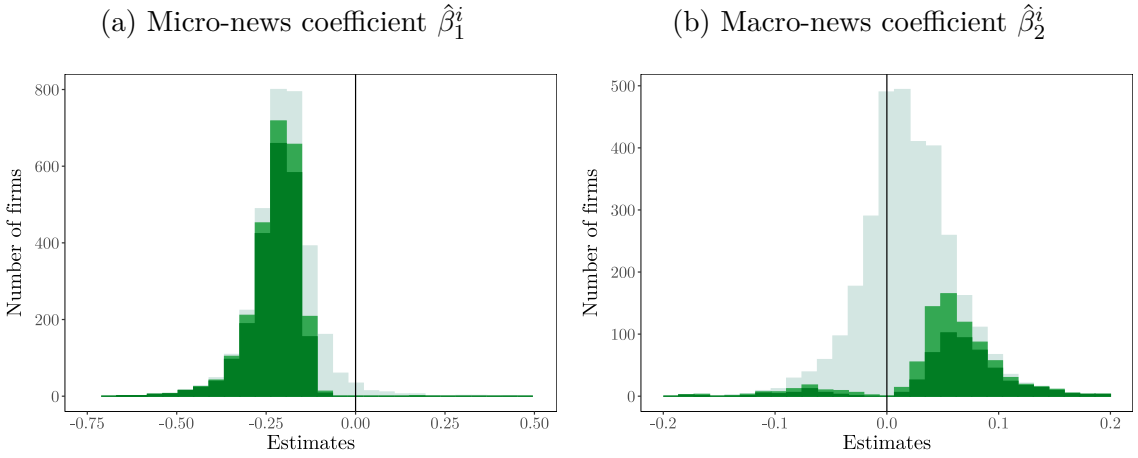


Notes: Estimates based on five-year rolling windows. Black lines represent point estimates; grey areas correspond to 95 percent confidence intervals.

The ifo also elicits a quantitative measure of firm expectations, which pertains to a firm's expected business situation over the next six months, and answers are provided in a range from 0 (rather less favorable) to 100 (rather favorable). Correspondingly, the survey also asks about the current business situation, with possible answers ranging from 0 (bad) to 100 (good); see Table B.3. We use these answers to compile a quantitative measure of forecast errors but note that in this case, data is only available for a subset of firms and since September 2005. Micro and macro news are measured in the exact same way as above, except that micro news is measured quantitatively in terms of revisions in business expectations instead of production expectations. Here, we also find overreaction to micro and underreaction to macro news; see Table OA.6.

Finally, because the ifo panel is sufficiently large, we can also investigate whether the patterns in the data are robust over time. For this purpose, we follow Coibion and Gorodnichenko (2015) and estimate the baseline specification on five-year rolling windows. Figure 4 shows how the estimated response coefficients evolve over time both for micro news (left) and for macro news (right). We observe, first, that firms overreact to micro news and underreact to macro news over the entire sample. Second, there is a co-movement of overreaction and underreaction. Such a pattern is consistent with Proposition 1: If the extent of island illusion varies over time, overreaction and

Figure 5: Firm-by-firm estimates



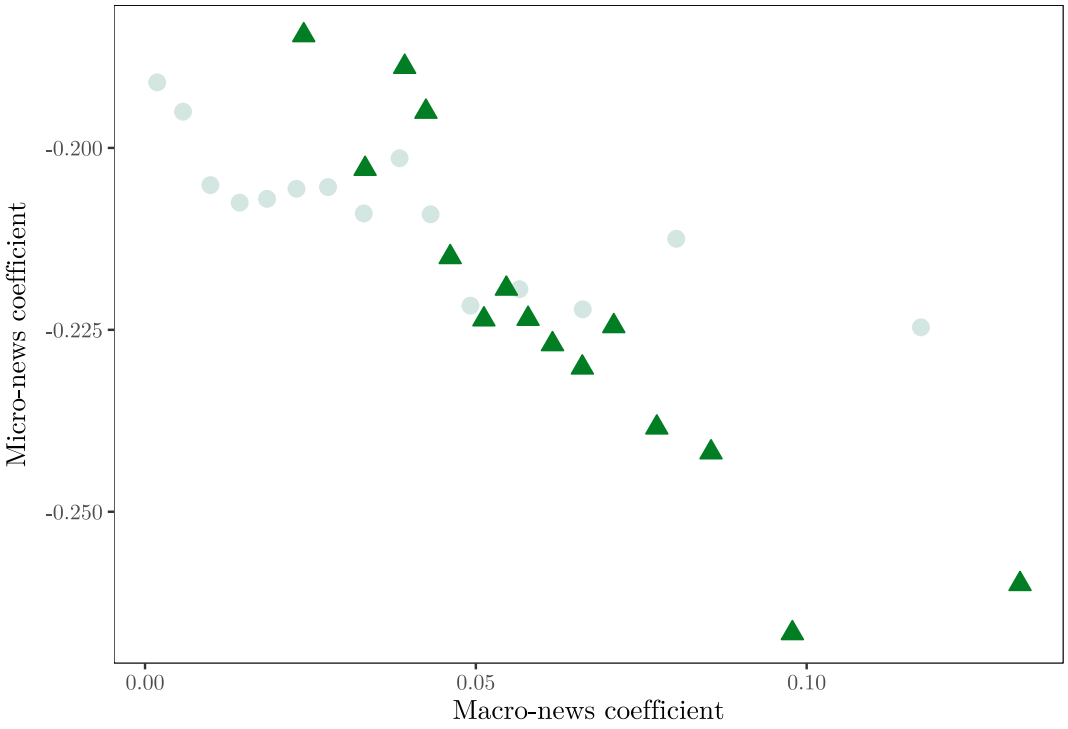
Notes: Distribution of estimates for individual firms on Specification (1) for production expectations of German firms in the ifo survey (three-month horizon, qualitative data). Grey area represents insignificant estimates, light green area represents estimates significant at the 10% level, dark green area indicates significance at the 5% level.

underreaction will co-move in sync. Third, for macro news, the variation over time appears to be substantial in economic terms: the underreaction is about three times as large during the Great Recession compared to non-recession periods. Taken at face value, this may appear surprising because one might expect firms to pay more attention to the aggregate economy in times of crisis (see also, Flynn and Sastry 2022). Yet, as we document below, an increased underreaction may reflect a stronger impact of macro variables on firm outcomes without a sufficiently large increase in attention. Consistent with this notion, we find a weaker underreaction to macro news after the Great Recession: The crisis may have increased the attention firms pay to the macroeconomy, resulting in less underreaction once the macro environment stabilized.

4.3 Firm-level variation

The ifo survey features sufficiently long time series for individual firms so that we can confidently estimate the reaction to news firm by firm. Specifically, we re-estimate Specification (1) for each of the 3,215 firms in our sample and show the distribution of the estimates for β_1 and β_2 in Figure 5. There is a clear pattern: Panel (a) shows that the mass of the estimates for β_1 is concentrated to the left of zero, with most estimates

Figure 6: Relation between macro and micro coefficients at the firm level



Notes: The figure displays two binned scatter plots (15 bins) between firm-level micro-news coefficients and macro-news coefficients. The grey points display the binned scatter for the set of firms with negative micro-news coefficients and positive macro-news coefficients ($\rho = -0.09$). The green triangles display the binned scatter based on the set of firms with significantly negative micro-news coefficients and significantly positive macro-news coefficients ($\rho = -0.35$).

being significantly smaller than zero (dark green bars). Specifically, for the subset of significant estimates, β_1 is negative for all firms. Hence, overreaction to micro news is a pertinent feature in firms' expectation formation. Instead, the estimates for β_2 are centered to the right of zero; see Panel (b). In this case, estimates are not always significantly different from zero (grey bars), but when we consider significant estimates only, the macro coefficient is positive for 92 percent of firms.[29]

Given the firm-level variation, we investigate whether a systematic relationship exists between the estimated coefficient in the cross-section of firms. To this end, we

[29]Repeating this exercise for the SIGE, where the number of firms is substantially smaller and the time series per firm are shorter, yields similar results, see Figure OA.2.

Table 3: Accounting for firm-level heterogeneity

		Micro News			Macro News		
Interaction	N	$\widehat{\beta}_i$	$SE(\widehat{\beta}_i)$	W	$\widehat{\beta}_i$	$SE(\widehat{\beta}_i)$	W
(1) News	302,737						
Overall (see Table 2)		-0.209^{***}	0.001		0.022^{***}	0.001	
(2) News	302,737			0.001			0.000
× 1. Quartile by employees		-0.216^{***}	0.003		0.013^{***}	0.002	
× 2. Quartile by employees		-0.211^{***}	0.002		0.019^{***}	0.001	
× 3. Quartile by employees		-0.210^{***}	0.002		0.022^{***}	0.001	
× 4. Quartile by employees		-0.203^{***}	0.002		0.026^{***}	0.001	
(3) News	162,776			0.554			0.408
× Firm age $<$ 20 years		-0.205^{***}	0.005		0.019^{***}	0.003	
× Firm age $\geq$ 20 years		-0.208^{***}	0.002		0.021^{***}	0.001	
(4) News	302,737			0.919			0.045
× Time in survey $<$ half a year		-0.210^{***}	0.010		0.033^{***}	0.006	
× Time in survey $\geq$ half a year		-0.209^{***}	0.001		0.021^{***}	0.001	
(5) News	129,053			0.25			0.038
× Low business-cycle exposure		-0.203^{***}	0.003		0.016^{***}	0.002	
× Med. business-cycle exposure		-0.209^{***}	0.002		0.021^{***}	0.001	
× High business-cycle exposure		-0.208^{***}	0.003		0.022^{***}	0.002	

Notes: All regressions include micro and macro news with interaction terms and firm-fixed effects. Standard errors are clustered at the firm level. N is the number of observations, $\widehat{\beta}_i$ is the point estimate and SE($\widehat{\beta}_i$) its standard error. Column W reports the p-value for the null that the news coefficients are jointly the same. We run the Wald test separately for each type of news. For (quartiles of) the number of employees, we rely on annual questions in the ifo survey. For firm age, we rely on a one-time question about the year the firm was founded. To compute the firm age, we subtract the year of response from the year of foundation. For business-cycle exposure, we rely on a one-time question, where firms rank the importance of general economic developments in Germany for their business on a five-point scale from very important [1] to unimportant [5]. Business-cycle exposure is high when the response is very important [1], medium when the response is important [2], and low otherwise [3-5]. *** p<0.01, ** p<0.05, * p<0.1.

show a binned scatterplot of the micro and macro news coefficients in Figure 6: There is a negative association, in particular for the set of firms with significant overreaction to micro news and underreaction to macro news, indicated by the dark triangles. Recall from Proposition 1 that such a negative association is precisely what we would expect if island illusion varies across firms.

We conclude this section with a brief analysis of potential drivers of the variation of firm-level estimates apparent in Figure 5. Specifically, we re-run the estimation

on pooled samples but add interaction terms that control for specific dimensions of heterogeneity. Table 3 reports results. The micro coefficient is robustly negative in the cross-section and does not differ systematically along many dimensions. We run a Wald test and find that across different levels of firm age (Panel 3), time in the survey (Panel 4), and the self-reported importance of the business cycle (Panel 4), there are no significant differences. The overreaction significantly decreases with firm size (Panel 2), but the differences in terms of magnitude are small. This is consistent with the evidence in Panel (a) of Figure 5, which shows that the estimates for β_1 cluster in a fairly tight range. Turning to the response to macro news, we find the underreaction to macro news is strictly and statistically significantly increasing across employee quartiles (Panel 2). The underreaction of the largest firms is twice as strong as that of the smallest firms. This result may reflect a stronger impact of the macroeconomy on the production—and hence the forecast errors—of larger firms. Regarding firm age, there is no statistical difference in the response to macro news between young and old firms. When comparing the underreaction of firms that recently joined the survey (within six months) to firms with longer tenure, we find evidence for "learning through survey" (Kim and Binder 2023). The underreaction among longer-tenured firms is about one-third smaller than for firms that recently joined the survey, and the difference is statistically significant. For the exposure to the business cycle, we distinguish between firms that rank the business cycle as very important, important, or less important to them. Here, in line with the effect of firm size, a high business-cycle exposure comes with a significantly larger underreaction.

4.4 Real effects

Expectations matter for firm decisions and outcomes, as a recent study confirms for the ifo survey (Enders et al. 2022). Against this background, we investigate whether overreaction and underreaction to news are associated with measures of firm performance. Specifically, in the cross-section of firms, we relate the estimated response coefficients to profits, production volatility, and forecast error volatility. We restrict the sample to firms that overreact to micro and underreact to macro news.

Table 4: Over- and underreaction to news and real activity

	$\text{mean}_i(\text{profits}_{it})$		$\text{sd}_i(\text{production}_{it})$		$\text{sd}_i(\text{error}_{it})$	
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.224		0.383***		0.226***	
	(0.177)		(0.011)		(0.007)	
Reaction to	1.70**	1.79**	-0.371***	-0.360***	-0.318***	-0.312***
micro news ($\beta_1 < 0$)	(0.782)	(0.756)	(0.046)	(0.046)	(0.028)	(0.028)
Reaction to	-0.673	-1.10	1.63***	1.61***	1.31***	1.30***
macro news ($\beta_2 > 0$)	(1.79)	(1.78)	(0.097)	(0.097)	(0.062)	(0.062)
Observations	1,691	1,691	2,227	2,227	2,227	2,227
R^2	0.003	0.051	0.146	0.162	0.230	0.252
Within R^2		0.004		0.143		0.228
Sector FE		✓		✓		✓
Size FE		✓		✓		✓

Notes: Estimates from linear regressions of average profits, Columns (1)–(2), production dispersion of firms, Columns (3)–(4), and forecast-error dispersion, Columns (5)–(6), on the firm-by-firm estimates of the micro and macro news coefficients. The sample is restricted to firms that overreact to micro news and underreact to macro news. Size-fixed effects refer to firm-size quartiles based on the number of employees. Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

Since 2009, the ifo survey asks firms twice a year about profits in the current year, in May and September.[30] For each firm, we calculate the average profit and regress them on the micro and macro news coefficients estimated in Section 4.2. In addition, we absorb sector- and size-fixed effects. Table 4, Columns (1) and (2), shows that a stronger overreaction to micro news is associated with significantly lower average profits, while a stronger underreaction to macro news is not significantly related to the average profits. Quantitatively, a one standard deviation increase in the overreaction to micro news leads to an average reduction in profits by about 0.14 percentage points.

Second, we calculate the standard deviation of realized production changes as a proxy for firm-level production volatility. We then follow the procedure above and regress it on the estimated response coefficients to micro and macro news, obtained in Section 4.2. Columns (3) and (4) in Table 4 show a tight relation between production

[30] We build our measure of firm profits based on the September wave, subtracting from the response the annual cross-sectional average of firm profits to ensure that the results are not confounded by heterogeneity over time (in a recession, profits are lower and underreaction stronger, see Section 4.3).

volatility and the over- and underreaction to news at the firm level. An increase in the overreaction to micro news is associated with higher volatility. While the point estimate is larger for micro news than for macro news, a one standard deviation increase in the estimated coefficient is associated with a somewhat stronger increase of output volatility in the case of macro news. Projecting these cross-sectional estimates to the macro level implies higher micro-level volatility in the presence of over- and underreaction, potentially explaining the high observed idiosyncratic volatility of firm outcome variables (Bachmann et al. 2013; Bloom 2009; Bloom et al. 2018).

Lastly, we do the same for the standard deviation of qualitative forecast errors as a proxy for the accuracy of firm expectations. Columns (5) and (6) in Table 4 display the results. Again, the estimates indicate a tight (negative) relation between the accuracy of forecasts and the over- and underreaction to news at the firm level.

5 Conclusion

How do firms adjust their expectations to news? As we address this question, we make a material and a conceptual contribution. First, our material contribution concerns a potentially important aspect of firm behavior. We find a simultaneous overreaction and underreaction of firm expectations to news, which we interpret—against the background of our model—as an instance of salience: Firms are excessively preoccupied with one portion of the environment at the expense of another. This is likely to matter for firm outcomes, and we present some evidence for island illusion to have real effects. Investigating this issue further and in more detail appears to be a fruitful avenue for future research.

Second, conceptually, by emphasizing the distinction between different types of news, we move beyond existing work on expectation formation that links forecast errors to news. The distinction turns out to be essential for understanding firm expectations, and we conjecture that it matters beyond the context of firms. For instance, the distinction between micro and macro news may also be relevant for investor expectations or for workers where related patterns have been identified (e.g., Daniel et al. 1998; Jäger et al. 2023). Hence, we expect—an instance of overreaction, perhaps—this conjecture to be the subject of further research, too.

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Appendix

A Model appendix

Section A.1 presents the household sector, Section A.2 derives the solution of the model, and Section A.3 provides the proof of Proposition 1. Section A.4 discusses the extension for price expectations.

A.1 Households

The representative household maximizes a standard utility function of the form

$$U = \ln(C) + \ln(M) - \frac{1 + N^{1+\varphi}}{1+\varphi} \ ,$$

where consumption is a Dixit-Stiglitz bundle consisting of goods from all islands with an elasticity of substitution γ. M is the (exogenously fixed) money supply, $N = \int N^i di$ total hours worked, and φ is the inverse of the Frisch elasticity. Given the budget constraint $CP + M = WN$ and market clearing, we obtain the demand function for individual goods as $Y^i = (P^i/P)^{-\gamma} M/P$. Optimal labor supply is given by $N^\varphi C = W/P$ and optimal money holdings by $C = M/P$.

A.2 Solution

Throughout, we consider a linear approximation to the equilibrium conditions of the model. Lower-case variables denote percentage deviations from steady state, and variables without island subscripts refer to economy-wide values. The wage is set at the beginning of the period based on all available information. As information sets of agents are perfectly aligned at this point, we use the expectation operator $\mathrm{F}_0 = \mathrm{F}_0^i$ to denote (common) stage-one expectations. Linearized expected labor supply can be combined with expected labor demand $\mathrm{F}_0(w-p) = \mathrm{F}_0(\varepsilon)$, the linearized production function $\mathrm{F}_0(y^i) = \mathrm{F}_0(n^i + \varepsilon)$, optimal money holdings $\mathrm{F}_0(c) = m - \mathrm{F}_0(p)$, market clearing, and symmetry assumptions to obtain $w = m$. We furthermore normalize the commonly known initial value of technology, i.e., before the realization of ε, to zero.

The mentioned equilibrium conditions, together with $\mathrm{F}_0(\varepsilon) = 0$, also imply $\mathrm{F}_0(y^i) = 0$. After w is set, firms observe their own productivity and the public signal.

Linearized demand for firm j's goods is given by

$$y^i = -\gamma p^i + (\gamma - 1)p + m \ . \tag{A-1}$$

Given the production function $y^i = a^i + n^i$, firms set prices according to

$$p^i = w - a^i_t \ . \tag{A-2}$$

Firm-specific technology equals $a^i = \varepsilon + \eta^i$ with $\int \eta^i di = 0$. Aggregating over all producers gives the aggregate price index

$$p = w - \varepsilon \ . \tag{A-3}$$

The public signal is $s = p + e$. Without loss of generality we can define ω_1 and ω_2 such that $\sigma^2_\varepsilon = \omega_1 \operatorname{Var}(a^i)$ and $\sigma^2_\eta = (1 - \omega_1) \operatorname{Var}(a^i)$ as well as $\sigma^2_\varepsilon = \omega_2 \operatorname{Var}(s)$ and $\sigma^2_e = (1 - \omega_2) \operatorname{Var}(s)$, where $\operatorname{Var}(s)$ refers to the variance of s conditional on w. Firms therefore form their expectation regarding ε after observing a^i and s according to

$$\mathrm{F}^i(\varepsilon) = \delta a^i - \rho(s - w) = \delta(\varepsilon + \eta^i) + \rho(\varepsilon - e) \ . \tag{A-4}$$

Here, F^i refers to subjective expectations of firm i after observing its own technology and the public signal,

$$\delta = \frac{\hat{\sigma}^2_e}{\hat{\sigma}^2_\eta + \hat{\sigma}^2_e + \frac{\hat{\sigma}^2_\eta \hat{\sigma}^2_e}{\hat{\sigma}^2_\varepsilon}} \qquad \text{and} \qquad \rho = \frac{\hat{\sigma}^2_\eta}{\hat{\sigma}^2_\eta + \hat{\sigma}^2_e + \frac{\hat{\sigma}^2_\eta \hat{\sigma}^2_e}{\hat{\sigma}^2_\varepsilon}} \ ,$$

where $\hat{\sigma}^2$ refers to perceived variances that result from a perceived weight $\hat{\omega}_1 = \omega_1 / \Upsilon$ of aggregate technology in own technology. $\Upsilon = 1$ represents rational expectations. For $\sigma^2_a = \operatorname{Var}(a^i) = \operatorname{Var}(s) = \sigma^2_s$, the above equations collapse to those in the main text, using (A-3). Otherwise, expectation formation is consistent with the structure of technology and the signal, such that $\hat{\sigma}^2_\varepsilon = \hat{\omega}_1 \operatorname{Var}(a^i) = \hat{\omega}_2 \operatorname{Var}(s)$, i.e., $\hat{\omega}_2 = \hat{\omega}_1 \operatorname{Var}(a^i) / \operatorname{Var}(s)$.

A.3 Proof of Proposition 1

Observing market clearing and (A-3), aggregate output results as

$$y = m - p = m - w + \varepsilon = \varepsilon \ . \tag{A-5}$$

The gap between expected own and aggregate output can then be calculated using (A-1), (A-2), and (A-3), as

$$\mathrm{F}^i(y^i) - \mathrm{F}^i(y) = -\gamma \left(p^i - \mathrm{F}^i(p)\right) = \gamma \, \mathrm{F}^i(\eta^i) \ . \tag{A-6}$$

Forecast revisions are given by the change in expectations between before and after receiving the private and public signals. Before receiving the signals, firms expect their output to equal aggregate output since $\mathrm{F}_0(\eta^i) = 0 \ \forall \ i$. Equation (A-5) implies $\mathrm{F}_0(y) = \mathrm{F}_0(\varepsilon) = 0$. and $\mathrm{F}^i(y) = \mathrm{F}^i(\varepsilon)$. Using this together with equation (A-6) gives

$$FR^i = \mathrm{F}^i(y^i) - \mathrm{F}_0(y) = \mathrm{F}^i(y^i) - \mathrm{F}^i(y) + F^i(y) = \gamma \, \mathrm{F}^i(\eta^i) + \mathrm{F}^i(\varepsilon) \ .$$

Because of equation (A-4) and

$$\mathrm{F}^i(\eta^i) = (1-\delta)(\varepsilon + \eta^i) + \rho(s - w) \ ,$$

we can write the above as

$$\begin{aligned} FR^i &= \gamma(1-\delta)(\varepsilon + \eta^i) + \delta(\varepsilon + \eta^i) + \rho(s-w)(\gamma - 1) \equiv X\varepsilon + X^\eta \eta^i - X^e e \ , \\ \text{with} \quad X^\eta &= (\gamma - 1)(1 - \delta) + 1 > 0 \ , \quad X^e = -\rho(\gamma - 1) < 0 \ , \quad X = X^\eta + X^e > 0 \ . \end{aligned}$$

Calculating the expectation error of firms for idiosyncratic output, using the island-specific demand equation (A-1) and the price-level equation (A-3), yields

$$FE^i = y^i - \mathrm{F}^i(y^i) = \Lambda \left(\varepsilon - \mathrm{F}^i(\varepsilon)\right) = \Lambda \left[(1 - \delta - \rho)\varepsilon - \delta\eta^i + \rho e\right] \ . \tag{A-7}$$

The effect $\Lambda = -(\gamma - 1)$ of the expectation error regarding aggregate technology innovations on the expectation error regarding own output is negative.

The sign of β_1 of regression (4) can then be determined in two steps. Since both independent variables, forecast revisions and the signal, are correlated, we first regress the forecast revisions on the signal, yielding the regression coefficient

$$Coef_1 = \frac{\text{Cov}(FR^i, s)}{\text{Var}(s)} = -\frac{X^\eta \sigma_\varepsilon^2}{\sigma_\varepsilon^2 + \sigma_e^2} - X^e \ . \tag{A-8}$$

The residual of this regression is $FR^i - Coef_1\, s$. Thus, the coefficient β_1 in (4) is

$$\beta_1 = \frac{\text{Cov}(FE^i, FR^i - Coef_1 s)}{\text{Var}(FR^i - Coef_1 s)} \ .$$

The sign of β_1 equals the sign of the numerator, which can be written as

$$\text{Cov}(FE^i, FR^i) - Coef_1\, \text{Cov}(FE^i, s) = \Lambda[X^\eta R_\eta + (X^e + Coef_1) R_e] \ ,$$

with $R_e \equiv (1-\delta-\rho)\sigma_\varepsilon^2 - \rho\sigma_e^2$ and $R_\eta \equiv (1-\delta-\rho)\sigma_\varepsilon^2 - \delta\sigma_\eta^2$. These two terms are proportional to the covariances of the forecast error with the public signal and idiosyncratic technology, respectively. Both covariances are zero under rational expectations ($\Upsilon = 1$), such that $R_e = R_\eta = \beta_1 = 0$. If firms underestimate the signal-to-noise ratio (proportional to the covariance of a^i with ε) of micro news, we get $R_\eta > 0$. In contrast, an underestimation of the signal-to-noise ratio of macro news (proportional to the covariance of s with ε) yields $R_e > 0$. Island illusion ($\Upsilon > 1$) therefore implies $R_\eta, R_e > 0$. Hence, because of (A-8), β_1 is negative if

$$R_\eta - \frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2 + \sigma_e^2} R_e > 0 \quad \Leftrightarrow \quad \frac{R_e}{R_\eta} = \frac{\hat{\sigma}_\eta^2/\sigma_a^2}{\hat{\sigma}_e^2/\sigma_s^2} < \frac{\sigma_\varepsilon^2 + \sigma_e^2}{\sigma_\varepsilon^2}. \tag{A-9}$$

The sign of β_2 in (4) can equivalently be derived by first regressing the forecast revision on the signal, which gives the coefficient

$$Coef_2 = \frac{\text{Cov}(FR^i, s)}{\text{Var}(FR^i)} = -\frac{X\sigma_\varepsilon^2 + X^e\sigma_e^2}{X^2\sigma_\varepsilon^2 + (X^\eta)^2\sigma_\eta^2 + (X^e)^2\sigma_e^2} \ ,$$

such that β_2 equals

$$\beta_2 = \frac{\text{Cov}(FE^i, s - Coef_2 FR^i)}{\text{Var}(s - Coef_2 FR^i)} \ .$$

Its sign depends on the sign of the numerator, which can be written as

$$\mathrm{Cov}(FE^i, s) - Coef_2 \,\mathrm{Cov}(FE^i, FR^i) = -\Lambda\left[(1 + Coef_2 X^e)R_e + Coef_2 X^\eta R_\eta\right] \ .$$

With $\Upsilon = 1$ (rational expectations), we have $R_e = R_\eta = \beta_2 = 0$. Note that $(1 + Coef_2 X^e)R_e + Coef_2 X^\eta R_\eta$ has the same sign as $[X\sigma_\varepsilon^2 + X^\eta \sigma_\eta^2]R_e - [X\sigma_\varepsilon^2 + X^e\sigma_e^2]R_\eta$, which is positive if

$$\frac{R_e}{R_\eta} > \frac{X\sigma_\varepsilon^2 + X^e\sigma_e^2}{X\sigma_\varepsilon^2 + X^\eta\sigma_\eta^2} \quad \Leftrightarrow \quad \frac{R_e}{R_\eta} = \frac{\hat{\sigma}_\eta^2/\sigma_a^2}{\hat{\sigma}_e^2/\sigma_s^2} > \frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2 + \gamma\sigma_\eta^2} \ . \tag{A-10}$$

Combining (A-9) and (A-10), we obtain $\beta_1 < 0$ and $\beta_2 > 0$ for

$$\frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2 + \gamma\sigma_\eta^2} < \frac{\hat{\sigma}_\eta^2/\sigma_a^2}{\hat{\sigma}_e^2/\sigma_s^2} < \frac{\sigma_\varepsilon^2 + \sigma_e^2}{\sigma_\varepsilon^2} \ . \tag{A-11}$$

Condition (A-11) states that the ratio of the subjective signal-to-noise ratios of the two signals needs to stay within certain bounds. It is automatically fulfilled for the assumption of $\mathrm{Var}(a^i) = \mathrm{Var}(s)$, made in the main text. This case corresponds to firms observing their own technology and, additionally, one price forecast based on the technology of one island, made public by, e.g., a forecasting firm on that island. In this case, $(\hat{\sigma}_\eta^2/\sigma_a^2)/(\hat{\sigma}_e^2/\sigma_s^2) = 1$. Furthermore, condition (A-11) is always fulfilled for high degrees of island illusion ($\Upsilon \to \infty$) and/or a high weight of the idiosyncratic component in technology ($\sigma_\eta^2/\sigma_a^2 \to 1$) and/or a high weight of noise in the public signal ($\sigma_e^2/\sigma_s^2 \to 1$), where the two last conditions are simultaneously given by a low volatility of aggregate technology ($\sigma_\varepsilon^2 \to 0$). The first part is also fulfilled for a high demand elasticity ($\gamma \to \infty$).

Regarding the derivatives of β_1 and β_2, note that we can write

$$\beta_1 = \frac{\Lambda}{X^\eta} \frac{R_\eta - \frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2 + \sigma_e^2} R_e}{\sigma_\varepsilon^2\sigma_e^2/(\sigma_\varepsilon^2 + \sigma_e^2) + \sigma_\eta^2} = \frac{\Lambda}{\gamma + \delta/(1-\delta)} \left[\frac{\sigma_\varepsilon^2\sigma_e^2}{\sigma_\varepsilon^2 + \sigma_e^2} - \frac{\delta}{1-\delta}\left(\sigma_\eta^2 + \frac{\sigma_\varepsilon^2\sigma_e^2}{\sigma_\varepsilon^2 + \sigma_e^2}\right)\right] \ .$$

Its derivative w.r.t. Υ is negative whenever the derivative of $\delta/(1-\delta)$ w.r.t. Υ is negative. This is the case if

$$\frac{\hat{\sigma}_\eta^2/\sigma_a^2}{\hat{\sigma}_e^2/\sigma_s^2} < \frac{\sigma_e^2 + \sigma_\varepsilon^2}{\hat{\sigma}_\varepsilon^2} \ ,$$

which is given by Condition (A-11). For the derivative of β_2 w.r.t. Υ, we can write

$$\beta_2 = \frac{\text{Cov}(FE^i, s - Coef_2 FR^i)}{\text{Var}(s - Coef_2 FR^i)} = -\Lambda \frac{\sigma_\eta^2 \sigma_\varepsilon^2 - [\sigma_e^2 \sigma_\varepsilon^2 + \gamma \sigma_\eta^2 (\sigma_\varepsilon^2 + \sigma_e^2)] \rho / X^\eta}{\sigma_\varepsilon^2 \sigma_e^2 / \bar{\delta}} \ ,$$

where $\bar{\delta}$ is δ under rational expectations, and hence independent of Υ. Hence, β_2 depends on Υ only via ρ / X^η, which can be written as

$$\frac{(1 - \omega_1/\Upsilon)\omega_2}{\gamma\Upsilon - \omega_1(\gamma - 1 + \omega_2/\Upsilon)} \ .$$

The derivative of this term is negative whenever

$$\frac{\omega_1/\Upsilon}{\gamma(1 - \omega_1/\Upsilon) + \omega_1/\Upsilon} < \frac{1 - \omega_1/\Upsilon}{1 - \omega_2/\Upsilon} \ ,$$

which is given if Condition (A-11) is fulfilled, such that β_2 depends positively on Υ. ■

A.4 Price expectations

To derive the expectations of firms regarding their future prices, we need to specify how technology evolves after the period of pre-set prices. We follow Lorenzoni (2009) and assume that aggregate technology ε is a random walk while the idiosyncratic component η^i is white noise. From above, we have $\text{F}_+^i(w) = m$, where F_+^i refers to expectations regarding the time after the pre-set price period. With expected labor demand $F_+^i(w - p) = F_+^i(\varepsilon)$, it follows that $F_+^i(p^i) = F_+^i(p) = m - F_+^i(\varepsilon)$, where $F_+^i(\varepsilon) = F^i(\varepsilon)$ because of the random-walk assumption. Thus, the forecast revision (before and after receiving the signals) regarding the change in own future prices is $F_+^i(p - p^i) = F^i(\eta^i)$ and the forecast error is $(p - p^i) - F_+(p - p^i) = -(\varepsilon - F(\varepsilon))$, see equation (A-7). The forecast revision and the forecast error are, hence, as for production expectations, but divided by $\gamma - 1$ and for $\gamma \to \infty$. It follows that β_1 remains unchanged and β_2 turns into $\beta_2/(\gamma - 1)$ (note that β_2 is proportional to $\gamma - 1$). Hence, we obtain the same results for price expectations as in Proposition 1 for production expectations.

B Empirical appendix

Table B.1: Construction of micro and macro news and forecast errors

Component	SIGE ($x^i = \pi^i$, t in quarters)	ifo ($x^i = y^i$, t in months)
Micro News	$\mathrm{F}_t^i(\pi_{t+4,t}^i) - \mathrm{F}_{t-1}^i(\pi_{t-1+4,t-1}^i)$	$\mathrm{sign}\{\mathrm{F}_t^i(y_{t+3,t}^i) - \mathrm{F}_{t-1}^i(y_{t-1+3,t-1}^i)\}$
alternative	net of $\gamma_i \Delta\pi_t$	net of $\gamma_i \Gamma_t$
Macro News	$\mathrm{F}_t^i(\pi_{t+4,t}) - \mathrm{F}_{t-1}^i(\pi_{t-1+4,t-1})$	no macro expectations solicited
alternative	π_{t-1} − mean forecast$_{t-1}$	ifo index$_{t-1}$ − median forecast$_{t-1}$
Forecast error	$\pi_{t+h,t}^i - \mathrm{F}_t^i(\pi_{t+h,t}^i)$	$\begin{cases} 0 & \text{if } \mathrm{sign}(y_{t+3,t}^i) = \mathrm{F}_t^i(y_{t+3,t}^i) \\ \frac{1}{3}\left(y_{t+3,t}^i - \mathrm{F}_t^i(y_{t+3,t}^i)\right) & \text{else} \end{cases}$

Notes: Formal definitions of micro and macro news and forecast errors in the SIGE and ifo surveys. $\mathrm{F}_t^i(x_{t+h,t}^i)$ is the reported expectation of firm i in month t for variable $x_{t+h,t}^i$ that is realized and surveyed h periods in the future. When x carries a superscript i, it is specific to firm i; when there is no superscript, x is an aggregate variable. Micro news is generally based on firms' forecast revisions for their own variables, as reported in the surveys. Alternatively, we purge these forecast revisions for firms' own variables of an aggregate component, where γ_i represents firm-specific factor loadings for aggregate variables. Macro news is based on firms' forecast revisions for aggregate inflation in the SIGE. For the ifo survey, comparable macro expectations are not solicited. Alternatively, we compute the surprise component to a macro variable defined as the difference between the realized value of the macro variable and its consensus professional forecast taken from Consensus Economics (SIGE) or Bloomberg (ifo). The definition of forecast errors in the ifo survey is from Bachmann et al. (2013).

B.1 Survey on Inflation and Growth Expectations

Table B.2: Relevant questions from SIGE

Question	Name	Introduced	Wording
Q1	expected change in own price	1999q4	For the next 12 months, what do you expect will be the average change in your firm's prices?
Q2	expected inflation (12 months ahead)	1999q4	In July consumer price inflation, measured by the 12-month change in the harmonized index of consumer prices was 8.4 percent in Italy and 8.9 percent in the euro area. What do you think it will be in Italy in September 2023?
Q3	realized change in own prices	2002q4	In the last 12 months, what has been the average change in your firm's prices?
Q4	expected inflation (24 months ahead)	2009q2	In July consumer price inflation, measured by the 12-month change in the harmonized index of consumer prices was 8.4 percent in Italy and 8.9 percent in the euro area. What do you think it will be in Italy in September 2024?
Q5	expected inflation (6 months ahead)	2010q4	In July consumer price inflation, measured by the 12-month change in the harmonized index of consumer prices was 8.4 percent in Italy and 8.9 percent in the euro area. What do you think it will be in Italy in March 2023?
Q6	expected inflation (12 months ahead, no infl. update)	2012q3	What do you think consumer price inflation in Italy, measured by the 12-month change in the harmonized index of consumer prices, will be in September 2023?

Notes: Wording taken from the September 2022 questionnaire. Questions elicit growth rates in percentage points. We construct firms' forecast error for their own prices by subtracting their expectation reported in quarter t (Q1) from their realization reported in quarter $t+4$ (Q3). For micro news, we generally consider the first difference of firms' one-year-ahead expectation for the change in their own prices (Q1). For macro news, we generally consider the first difference of firms' one-year-ahead inflation expectation (Q2). Since 2009 and 2010, the SIGE features additional questions about firms' inflation expectations six months and two years ahead (Q5 and Q4). We use these questions to construct macro news that uniquely refer to the same forecasting target. See main text for more details.

B.2 ifo Business Climate Survey

Table B.3: Relevant questions from ifo survey

Label	Name	Question	Possible answers
Q1	Expected state of business (qualitative)	Plans and Expectations for the next 6 months: Our business situation will be	rather more favorable [1] not changing [0] rather less favorable [-1]
Q2	Expected state of business (quantitative)	Expectations for the next 6 months: In cyclical regards our state of business will be	slider with range 0 [be rather less favorable] to 100 [rather more favorable]
Q3	Realized state of business (qualitative)	Current situation: We evaluate our state of business to be	good [1] satisfiable [0] bad [-1]
Q4	Realized state of business (quantitative)	Current situation: We consider our state of business to be	slider with range good [100] to bad [0]
Q5	Realized production	Review - tendencies in [t-1]: Compared to [t-2] our production	increased [1] stayed about the same [0] decreased [-1]
Q6	Expected production	Plans and Expectations for the next 3 months: Our production is expected to be	increasing [1] not changing [0] decreasing [-1]
Q7	Macro importance	How important is the general economic development in Germany for your business situation?	very important [1] important [2] not as important [3] less important [4] unimportant [5]

Notes: Most recent wording of relevant questions from the ifo survey taken from the EBDC Questionnaire manual. t denotes the month of the survey, so in July Q5 asks about the change in June compared to May.

Online Appendix

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Firm Expectations and News: Micro v Macro

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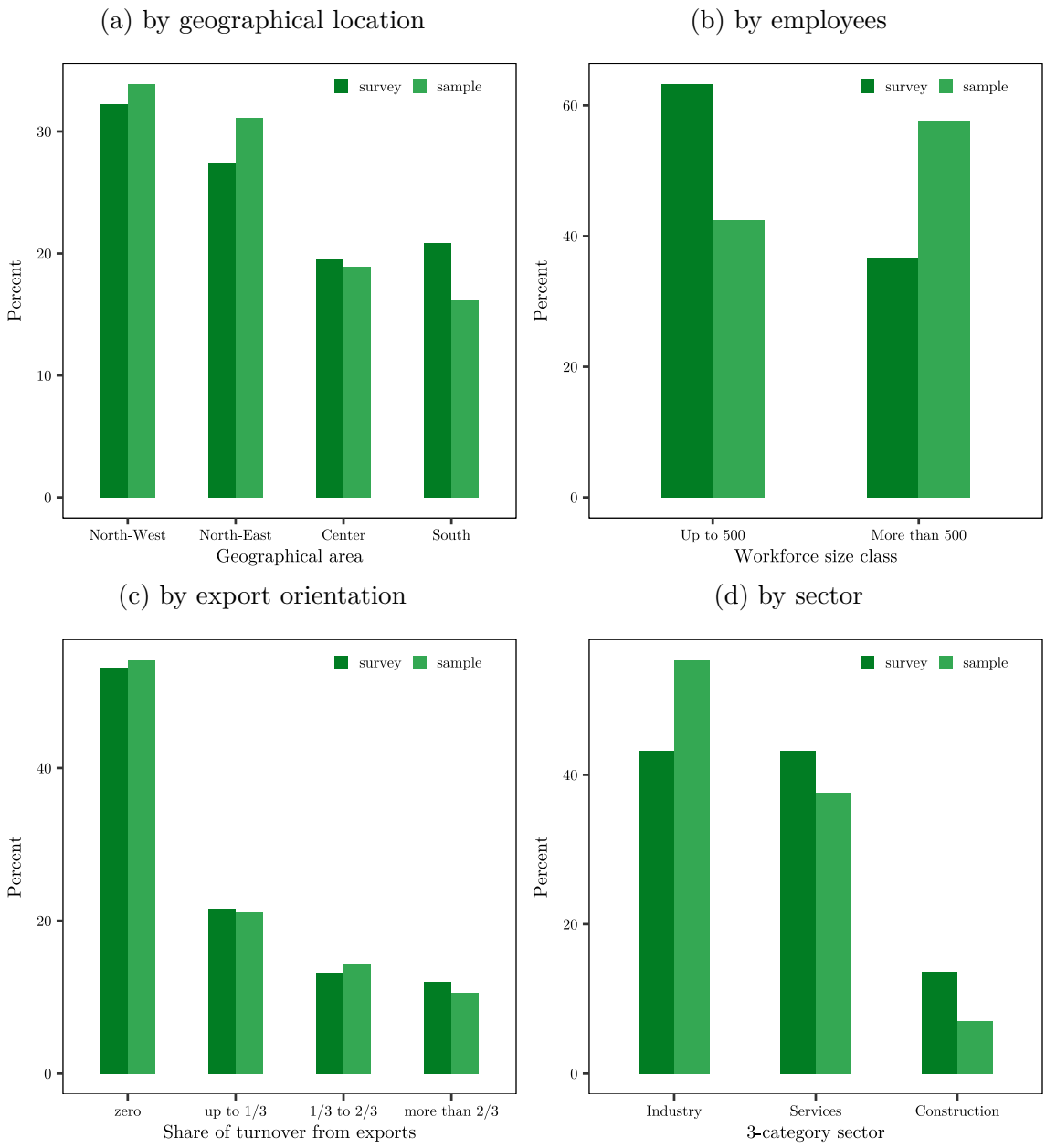
OA.1 Survey on Inflation and Growth Expectations

Table OA.1: Macro news and forecast revisions

	Forecast revision for $\pi^i_{t+4,t}$		$\pi^i_{t+4,t}$ net of $\gamma_i \Delta\pi_t$	
	(1)	(2)	(3)	(4)
Macro News				
Forecast revision for $\pi_{t+4,t}$	0.292***		0.230***	
	(0.033)		(0.031)	
Inflation surprise		0.861***		0.636***
		(0.191)		(0.206)
Observations	22,970	8,389	22,970	8,389
R^2	0.007	0.003	0.004	0.001
Within R^2	0.007	0.003	0.005	0.001

Notes: The macro component of forecast revisions for firms' own prices. We regress firms' forecast revisions for their own prices on macro news. Columns (1) and (2) use firms' forecast revisions for their own prices as reported in the SIGE. In Columns (3) and (4), these revisions are purged of recent changes in inflation. Firm-fixed effects are always included, and standard errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure OA.1: Representativeness of survey and sample



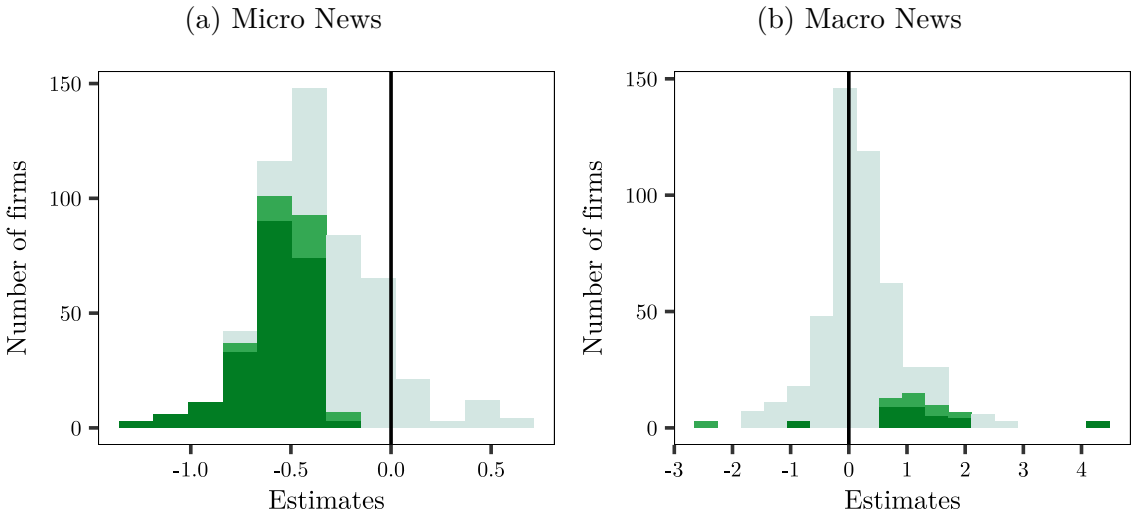
Notes: Distribution of firms' geographical location, employees, export orientation and sector in the full SIGE (survey) and the sample used in our baseline specification.

Table OA.2: The response of price expectations to news—robustness

	Forecast error about firm's own prices				
	(1)	(2)	(3)	(4)	(5)
Micro News					
Forecast revision for $\pi^i_{t+4,t}$	-0.438^{***}	-0.457^{***}		-0.431^{***}	
	(0.019)	(0.026)		(0.027)	
Forecast revision for $\pi^i_{t+4,t}$ net of $\gamma_i \Delta\pi_t$			-0.451^{***}		-0.428^{***}
			(0.026)		(0.028)
Macro News					
Forecast revision for $\pi_{t+4,t}$	0.071^{*}				
	(0.043)				
Forecast revision for $\pi_{t+4,t}$ (2q v 4qm)		0.305^{***}	0.290^{***}		
		(0.059)	(0.059)		
Forecast revision for $\pi_{t+4,t}$ (4q v 8q)				0.198^{***}	0.190^{***}
				(0.046)	(0.046)
Observations	16,675	8,858	8,858	9,067	9,067
R^2	0.084	0.082	0.080	0.069	0.068
Within R^2	0.094	0.098	0.097	0.085	0.085

Notes: Alternative measures of micro and macro news. Column (1) estimates the baseline specification where we cut off the sample after 2019. Columns (2) and (3) use as macro news firms' forecast revisions for a fixed forecasting date. Specifically, we subtract from firms' two-quarters ahead inflation forecast their four-quarter-ahead forecasts reported two quarters ago. For Columns (3) and (4), we proceed in the same fashion but compare current four-quarters ahead forecasts to eight-quarters ahead forecasts reported four quarters ago. Firm-fixed effects are always included. Standard errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure OA.2: Firm-level regressions



Notes: We estimate our baseline specification (micro and macro news are firms' forecast revisions (first difference) for changes in their own prices and aggregate inflation, respectively) for each firm separately and show the univariate distribution of firm-level news coefficients; grey=not significant, bright green=10%, dark green=5%. Bars with less than three observations per group are not shown due to confidentiality.

Table OA.3: Additional regression results from the SIGE

(a) without winsorizing survey variables

	Forecast error about firm's own prices			
	(1)	(2)	(3)	(4)
Micro News				
Forecast revision for $\pi^i_{t+4,t}$ (all obs.)	-0.431^{***}		-0.401^{***}	
	(0.029)		(0.043)	
Forecast revision for $\pi^i_{t+4,t}$ net of $\gamma_i \Delta\pi_t$ (all obs.)		-0.438^{***}		-0.417^{***}
		(0.022)		(0.032)
Macro News				
Forecast revision for $\pi_{t+4,t}$ (all obs.)	0.316^{***}	0.305^{***}		
	(0.088)	(0.089)		
Inflation surprise			3.994^{***}	3.925^{***}
			(0.792)	(0.806)
Observations	18,284	18,284	6,640	6,640
R^2	0.065	0.067	0.053	0.056
Within R^2	0.070	0.071	0.061	0.065

Notes: Baseline specifications as in Table 1, except that we do not winsorize the survey variables. Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

(b) dropping top and bottom 1% of survey variables

	Forecast error about firm's own prices			
	(1)	(2)	(3)	(4)
Micro News				
Forecast revision for $\pi^i_{t+4,t}$ (no outliers)	-0.348^{***}		-0.347^{***}	
	(0.016)		(0.033)	
Forecast revision for $\pi^i_{t+4,t}$ net of $\gamma_i \Delta\pi_t$ (no outliers)		-0.339^{***}		-0.320^{***}
		(0.016)		(0.032)
Macro News				
Forecast revision for $\pi_{t+4,t}$ (no outliers)	0.245^{***}	0.222^{***}		
	(0.038)	(0.037)		
Inflation surprise			2.506^{***}	2.424^{***}
			(0.313)	(0.312)
Observations	17,634	17,587	6,445	6,426
R^2	0.053	0.048	0.057	0.050
Within R^2	0.061	0.055	0.070	0.060

Notes: Baseline specifications as in Table 1, except that we drop the bottom and top 1% of survey variables (rather than winsorizing at these values). Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

Table OA.3: Additional regression results from the SIGE, continued

(c) alternative definitions of micro news

	Forecast error about firm's own prices			
	(1)	(2)	(3)	(4)
Micro News				
Forecast revision for $\pi^i_{t+4,t}$ net of time-fixed effects	-0.441^{***}		-0.443^{***}	
	(0.018)		(0.031)	
Forecast revision for $\pi^i_{t+4,t}$ net of $\gamma\Delta\pi_t$		-0.424^{***}		-0.423^{***}
		(0.018)		(0.031)
Macro News				
Forecast revision for $\pi_{t+4,t}$	0.212^{***}	0.259^{***}		
	(0.050)	(0.050)		
Inflation surprise			2.564^{***}	2.967^{***}
			(0.409)	(0.404)
Observations	18,284	18,284	6,640	6,640
R^2	0.078	0.072	0.082	0.074
Within R^2	0.087	0.081	0.097	0.090

Notes: Specifications as in Table 1, using alternative definitions of news. Column (1) purges firms' forecast revisions for own prices of time-fixed effects. Column (2) purges forecast revisions of recent changes in inflation with homogeneous loading γ (instead of γ_i). In both columns, macro news is a firm's forecast revision for inflation. Columns (3) and (4) use inflation surprises as macro news, micro news as in Columns (1) and (2). Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

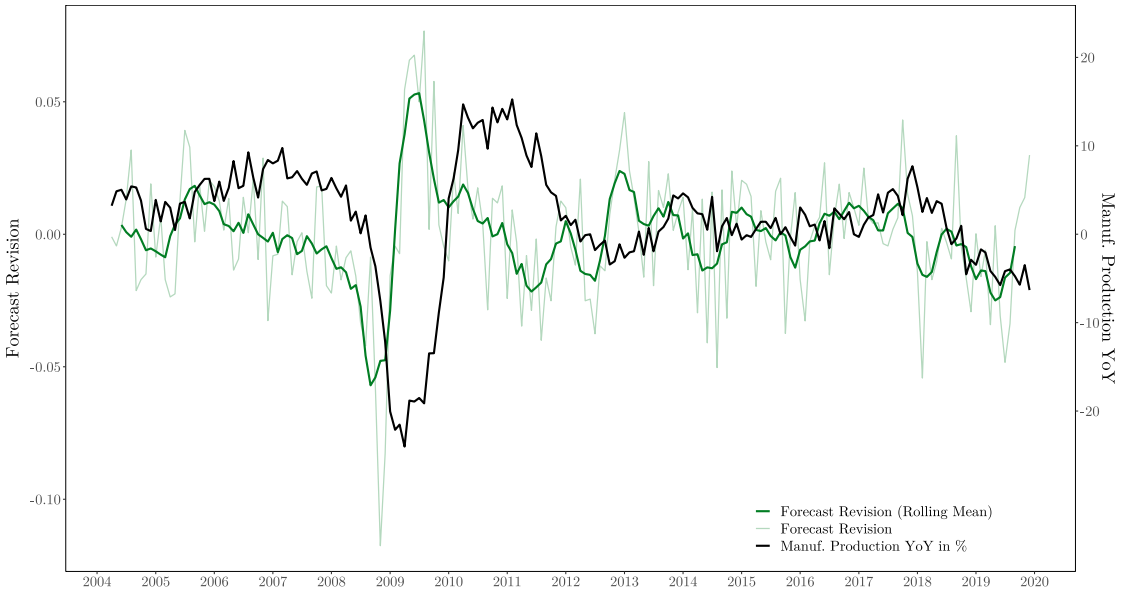
(d) Univariate results

	Forecast error about firm's own prices					
	(1)	(2)	(3)	(4)	(5)	(6)
Micro News						
Forecast revision for $\pi^i_{t+4,t}$	-0.417^{***}					
	(0.019)					
Forecast revision for $\pi^i_{t+4,t}$ net of $\gamma_i\Delta\pi_t$		-0.412^{***}				
		(0.018)				
Macro News						
Forecast revision for $\pi_{t+4,t}$			0.150^{***}			
			(0.055)			
Inflation surprise				2.756^{***}		
				(0.401)		
Forecast revision for $\pi_{t+4,t}$ (6m v 12m)					0.264^{***}	
					(0.056)	
Forecast revision for $\pi_{t+4,t}$ (12m v 24m)						0.157^{***}
						(0.046)
Observations	18,284	18,284	18,284	7,196	9,486	9,754
R^2	0.068	0.067	0.001	0.015	0.009	0.005
Within R^2	0.078	0.077	0.001	0.013	0.006	0.003

Notes: Univariate versions of the baseline specification. Firm-fixed effects are always included. Standard errors are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

OA.2 ifo Business Climate Survey

Figure OA.3: Average forecast revisions and production growth

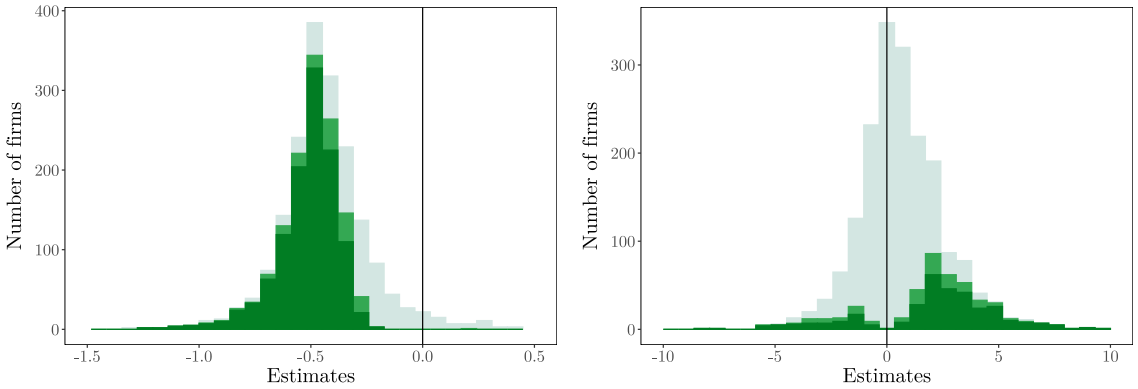


Notes: Figure displays the average, seasonally adjusted forecast revision (rolling mean over 6 months) in green and year-on-year growth of manufacturing production in black (administrative data).

Figure OA.4: Distribution of firm-level responses to news

(a) Business expectations: micro

(b) Business expectations: macro

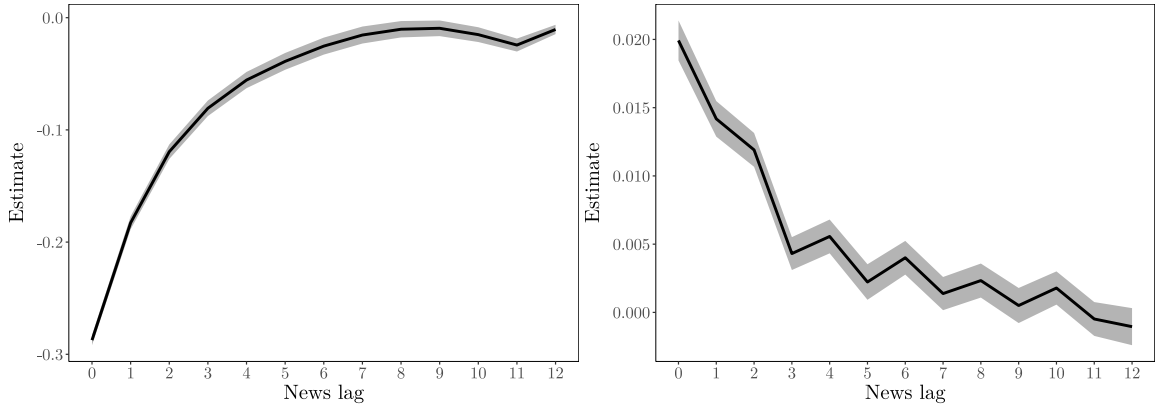


Notes: The figure shows results for expectations about firms' business situation (6-month horizon, quantitative data). Grey area represents insignificant estimates, light green area represents estimates significant at the 10% level, dark green area indicates significance at the 5% level.

Figure OA.5: Response to concurrent and lagged news

(a) Response to lagged micro news

(b) Response to lagged macro response



Notes: Estimates based on Equation (2). Black lines represent point estimates, grey areas correspond to 95% confidence intervals.

Table OA.4: Macro news and forecast revisions

	$\widehat{\beta}$	$SE(\widehat{\beta})$
Macro News	0.008	0.001
Macro News		
× 1. Quartile by employees	0.007	0.002
× 2. Quartile by employees	0.008	0.002
× 3. Quartile by employees	0.008	0.002
× 4. Quartile by employees	0.008	0.001
Macro News		
× Firm age $<$ 20 years	0.007	0.003
× Firm age $\geq$ 20 years	0.006	0.001
Macro News		
× Time in survey $<$ half a year	0.015	0.007
× Time in survey $\geq$ half a year	0.008	0.001
Macro News		
× Low business-cycle exposure	0.005	0.002
× Medium business-cycle exposure	0.008	0.002
× High business-cycle exposure	0.006	0.003

Notes: Reaction of forecast revisions to macro news. Firms' forecast revisions are regressed on macro news, interaction terms, and firm-fixed effects for each interaction variable separately. For (quartiles of) the number of employees, we rely on annual questions in the ifo survey. For firm age, we rely on a one-time question about the year the firm was founded. To compute the firm age, we subtract from the year of response the year of foundation. For business-cycle exposure, we rely on a one-time question, where firms rank the importance of general economic developments in Germany for their business on a five-point scale from very important [1] to unimportant [5]. Business-cycle exposure is high when the response was very important [1], medium when the response was important [2], and low otherwise [3-5]. Standard errors are clustered at the firm level.

Table OA.5: Production expectations—robustness

Variation	Details	Micro coeff.	Macro coeff.
1) Micro news (forecast revisions)			
Use only revisions towards zero	Table OA.8a	-0.110^{***}	0.030^{***}
As above and set small errors ($\pm\frac{1}{3}$) to zero	Table OA.8b	-0.086^{***}	0.023^{***}
2) Forecast error (Bachmann et al. 2013)			
Set small errors ($\pm\frac{1}{3}$) to zero	Table OA.8c	-0.128^{***}	0.018^{***}
Above only for no-change expectations	Table OA.8d	-0.192^{***}	0.018^{***}
3) Estimation (OLS)			
Ordered logit	Table OA.8e	-1.24^{***}	0.11^{***}
4) Macro component of forecast revision (real-time indicators)			
Fixed effect by time	Table OA.8f	-0.194^{***}	0.021^{***}
Fixed effect by time and sector	Table OA.8g	-0.196^{***}	0.021^{***}
5) Macro news (surprise component in ifo index)			
Surprise component in manuf. orders	Table OA.8h	-0.208^{***}	0.005^{***}
First difference of ifo index	Table OA.8i	-0.208^{***}	0.002^{***}
Average forecast revision	Table OA.8j	-0.209^{***}	0.345^{***}
Average forecast revision by sector[a]	Table OA.8k	-0.211^{***}	0.216^{***}
First difference of stock market index	Table OA.8l	-0.208^{***}	0.328^{***}

Notes: Each row corresponds to a variation of the specification for which we report results in Table 2, see Appendix OA.2 for details. Micro coefficient and macro coefficient are the estimates on micro and macro news. [a] In this specification, macro news is the time and sector average. *** p<0.01, ** p<0.05, * p<0.1.

Table OA.6: Business situation as outcome variable (ifo survey)

	Firms' forecast errors about their business situation			
	(1)	(2)	(3)	(4)
Micro News				
Forecast Revision for $y^i_{t+6,t}$	-0.441***			
	(0.004)			
Forecast Revision for $y^i_{t+6,t}$ net of $\gamma_i \Gamma_t$		-0.453***	-0.450***	
		(0.004)	(0.004)	
Macro News				
Surprise component of the ifo index	0.857***	0.795***		0.697***
	(0.044)	(0.044)		(0.044)
Observations	153,398	153,398	153,398	153,398
R^2	0.31864	0.30652	0.30357	0.25466
Within R^2	0.08861	0.07240	0.06845	0.00303

Notes: Results based on Equation (1); observations are pooled across firms. The table shows results for the quantitative business expectations (6-month horizon) for German firms as surveyed monthly in the ifo survey. Macro news is the surprise component of the ifo index. Column (1): micro news measured by forecast revisions (while controlling for macro news). Columns (2) and (3): micro news represents forecast revisions net of real-time observable aggregate developments, measured by macroeconomic indicators Γ_t with idiosyncratic reaction coefficient γ_i (see Footnote 28 for more details). All specifications include firm-fixed effects. Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

Table OA.7: Prices as outcome variable (ifo survey)

	Firms' forecast errors about their price			
	(1)	(2)	(3)	(4)
Micro News				
Forecast Revision for $p^i_{t+3,t}$	-0.175***			
	(0.001)			
Forecast Revision for $p^i_{t+3,t}$ net of $\gamma_i \Gamma_t$		-0.186***	-0.185***	
		(0.001)	(0.001)	
Macro News				
Surprise component of the ifo index	0.010***	0.009***		0.009***
	(0.0005)	(0.0005)		(0.0005)
Observations	298,400	298,400	298,400	298,400
R^2	0.15826	0.14937	0.14746	0.07552
Within R^2	0.09112	0.08151	0.07945	0.00178

Notes: Results based on Equation (1); observations are pooled across firms. The table shows results for the qualitative price expectations (3-month horizon) for German firms as surveyed monthly in the ifo survey. Macro news is the surprise component of the ifo index. Column (1): micro news measured by forecast revisions (while controlling for macro news). Columns (2) and (3): micro news represents forecast revisions net of real-time observable aggregate developments, measured by macroeconomic indicators Γ_t with idiosyncratic reaction coefficient γ_i (see Footnote 28 for more details). All specifications include firm-fixed effects. Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

Table OA.8: Alternative specifications

(a) Expectations: only forecast revisions towards zero

	Firms' forecast errors about their production			
	(1)	(2)	(3)	(4)
Micro News				
Forecast Revision for $y^i_{t+3,t}$	-0.091***			
	(0.003)			
Forecast Revision for $y^i_{t+3,t}$ net of $\gamma_i \Gamma_t$		-0.110***	-0.112***	
		(0.003)	(0.003)	
Macro News				
Surprise component of the ifo index	0.030***	0.030***		0.030***
	(0.0008)	(0.0008)		(0.0009)
Observations	205,962	205,962	205,962	205,962
R^2	0.17355	0.17605	0.16728	0.16331
Within R^2	0.02310	0.02605	0.01569	0.01100

Notes: Set-up as in Table 2, except that we only use observations where firms revise their expectations towards zero. Firm-fixed effects are always included. Standard errors are clustered at firm level. *** p<0.01, ** p<0.05, * p<0.1.

(b) Expectations: only forecast revisions towards zero and set small errors to zero

	Firms' forecast errors about their production			
	(1)	(2)	(3)	(4)
Micro News				
Forecast Revision for $y^i_{t+3,t}$	-0.072***			
	(0.002)			
Forecast Revision for $y^i_{t+3,t}$ net of $\gamma_i \Gamma_t$		-0.086***	-0.088***	
		(0.002)	(0.002)	
Macro News				
Surprise component of the ifo index	0.024***	0.023***		0.024***
	(0.0008)	(0.0008)		(0.0008)
Observations	205,962	205,962	205,962	205,962
R^2	0.14081	0.14270	0.13592	0.13288
Within R^2	0.01729	0.01945	0.01170	0.00823

Notes: Set-up as in Table 2, except that we only use observations where firms revise their expectations towards zero and set small forecast errors ($\pm\frac{1}{3}$) to zero. Firm-fixed effects are always included. Standard errors are clustered at firm level. *** p<0.01, ** p<0.05, * p<0.1.

Table OA.8: Alternative specifications, continued.

(c) Forecast error: set small errors to zero

	Firms' forecast errors about their production			
	(1)	(2)	(3)	(4)
Micro News				
Forecast Revision for $y^i_{t+3,t}$	-0.115***			
	(0.001)			
Forecast Revision for $y^i_{t+3,t}$ net of $\gamma_i \Gamma_t$		-0.128***	-0.128***	
		(0.002)	(0.002)	
Macro News				
Surprise component of the ifo index	0.018***	0.018***		0.018***
	(0.0006)	(0.0006)		(0.0006)
Observations	302,737	302,737	302,737	302,737
R^2	0.11352	0.11278	0.10838	0.07974
Within R^2	0.04103	0.04022	0.03547	0.00449

Notes: Set-up as in Table 2, except small forecast errors ($\pm\frac{1}{3}$) are set to zero. Firm-fixed effects are always included . Standard errors are clustered at firm level. *** p<0.01, ** p<0.05, * p<0.1.

(d) Forecast error: set small errors to zero and no change expected

	Firms' forecast errors about their production			
	(1)	(2)	(3)	(4)
Micro News				
Forecast Revision for $y^i_{t+3,t}$	-0.176***			
	(0.001)			
Forecast Revision for $y^i_{t+3,t}$ net of $\gamma_j \Gamma_t$		-0.192***	-0.191***	
		(0.001)	(0.001)	
Macro News				
Surprise component of the ifo index	0.018***	0.018***		0.017***
	(0.0006)	(0.0006)		(0.0006)
Observations	302,737	302,737	302,737	302,737
R^2	0.14684	0.14143	0.13768	0.07495
Within R^2	0.08113	0.07529	0.07125	0.00369

Notes: Set-up as in Table 2, except small forecast errors ($\pm\frac{1}{3}$) are set to zero when expectations are zero. Firm-fixed effects are always included. Standard errors are clustered at firm level.
*** p<0.01, ** p<0.05, * p<0.1.

Table OA.8: Alternative specifications, continued.

(e) Estimation: Ordered Logit rather than OLS

Term	Estimate	Standard Error	t-value	Coeficient type	exp(estimate)
Micro News	-1.24	0.01	-158.19	coefficient	0.29
Macro News	0.11	0.00	37.16	coefficient	1.12
-4/3|-1	-6.04	0.03	-173.89	scale	0.00
-1|-2/3	-3.56	0.01	-337.00	scale	0.03
-2/3|-1/3	-2.45	0.01	-370.14	scale	0.09
-1/3|0	-1.27	0.00	-280.89	scale	0.28
0|1/3	1.52	0.00	314.78	scale	4.57
1/3|2/3	2.71	0.01	373.96	scale	15.10
2/3|1	3.91	0.01	321.66	scale	49.88
1|4/3	6.66	0.05	144.17	scale	782.37

Notes: Results using ordered logit to estimate the effect of micro news and macro news on the production forecast error. The last column shows the odds ratios. Rows 3 to 10 depict the cut points of the latent variable. The full, pooled sample is used.

(f) Micro news: absorb macro component of forecast revision with time-fixed effect

	Firms' forecast errors about their production			
	(1)	(2)	(3)	(4)
Micro News				
Forecast Revision for $y^i_{t+3,t}$	-0.191***			
	(0.001)			
Forecast Revision for $y^i_{t+3,t}$ net of $\gamma_i \Gamma_t$		-0.194***	-0.194***	
		(0.001)	(0.001)	
Macro News				
Surprise component of the ifo index	0.022***	0.021***		0.021***
	(0.0007)	(0.0007)		(0.0007)
Observations	302,737	302,737	302,737	302,737
R^2	0.16260	0.16471	0.16015	0.08967
Within R^2	0.08471	0.08701	0.08202	0.00498

Notes: Set-up as in Table 2, except that we absorb the macro component from forecast revisions by means of time-fixed effects. Firm-fixed effects are always included. Standard errors are clustered at firm level. *** p<0.01, ** p<0.05, * p<0.1.

Table OA.8: Alternative specifications, continued.

(g) Micro news: absorb macro comp. of forecast revision with time-sector-fixed effect

	Firms' forecast errors about their production			
	(1)	(2)	(3)	(4)
Micro News				
Forecast Revision for $y^i_{t+3,t}$	-0.191***			
	(0.001)			
Forecast Revision for $y^i_{t+3,t}$ net of $\gamma_i \Gamma_t$		-0.196***	-0.196***	
		(0.001)	(0.001)	
Macro News				
Surprise component of the ifo index	0.022***	0.021***		0.021***
	(0.0007)	(0.0007)		(0.0007)
Observations	302,737	302,737	302,737	302,737
R^2	0.16260	0.16555	0.16100	0.08967
Within R^2	0.08471	0.08793	0.08295	0.00498

Notes: Set-up as in Table 2, except that we absorb the macro component from forecast revisions by means of time-sector-fixed effects. Firm-fixed effects are always included. Standard errors are clustered at firm level. *** p<0.01, ** p<0.05, * p<0.1.

(h) Macro news: manufacturing orders rather than ifo index

	Firms' forecast errors about their production			
	(1)	(2)	(3)	(4)
Micro News				
Forecast Revision for $y^i_{t+3,t}$	-0.190***			
	(0.001)			
Forecast Revision for $y^i_{t+3,t}$ net of $\gamma_i \Gamma_t$		-0.208***	-0.208***	
		(0.001)	(0.001)	
Macro News				
Surprise component of the ifo index	0.005***	0.005***		0.005***
	(0.0003)	(0.0003)		(0.0003)
Observations	298,586	298,586	298,586	298,586
R^2	0.15828	0.15383	0.15286	0.08580
Within R^2	0.08023	0.07536	0.07431	0.00103

Notes: Set-up as in Table 2, except macro news is constructed from the median professional forecast of manufacturing orders. Firm-fixed effects are always included. Standard errors are clustered at firm level. *** p<0.01, ** p<0.05, * p<0.1.

Table OA.8: Alternative specifications, continued.

(i) Macro news: first difference of ifo index rather than ifo index surprise

	Firms' forecast errors about their production			
	(1)	(2)	(3)	(4)
Micro News				
Forecast Revision for $y^i_{t+3,t}$	-0.190***			
	(0.001)			
Forecast Revision for $y^i_{t+3,t}$ net of $\gamma_i \Gamma_t$		-0.208***	-0.208***	
		(0.001)	(0.001)	
Macro News				
Surprise component of the ifo index	0.002***	0.002***		0.001***
	(0.0002)	(0.0003)		(0.0003)
Observations	301,185	301,185	302,737	301,185
R^2	0.15737	0.15318	0.15313	0.08505
Within R^2	0.07908	0.07450	0.07435	0.00004

Notes: Set-up as in Table 2, except macro news is constructed with the first difference of the ifo index. Firm-fixed effects are always included. Standard errors are clustered at firm level.
*** p<0.01, ** p<0.05, * p<0.1.

(j) Macro news: average forecast revisions rather than ifo index

	Firms' forecast errors about their production			
	(1)	(2)	(3)	(4)
Micro News				
Forecast Revision for $y^i_{t+3,t}$	-0.194***			
	(0.001)			
Forecast Revision for $y^i_{t+3,t}$ net of $\gamma_i \Gamma_t$		-0.209***	-0.208***	
		(0.001)	(0.001)	
Macro News				
Surprise component of the ifo index	0.502***	0.345***		0.308***
	(0.019)	(0.018)		(0.018)
Observations	302,737	302,737	302,737	302,737
R^2	0.16186	0.15526	0.15313	0.08681
Within R^2	0.08389	0.07668	0.07435	0.00187

Notes: Set-up as in Table 2, except macro news is constructed with average production forecast revisions. Firm-fixed effects are always included. Standard errors are clustered at firm level.
*** p<0.01, ** p<0.05, * p<0.1.

Table OA.8: Alternative specifications, continued.

(k) Macro news: average forecast revisions for each sector rather than ifo index

	Firms' forecast errors about their production			
	(1)	(2)	(3)	(4)
Micro News				
Forecast Revision for $y^i_{t+3,t}$	-0.196***			
	(0.001)			
Forecast Revision for $y^i_{t+3,t}$ net of $\gamma_i \Gamma_t$		-0.211***	-0.208***	
		(0.001)	(0.001)	
Macro News				
Surprise component of the ifo index	0.326***	0.216***		0.129***
	(0.013)	(0.011)		(0.012)
Observations	302,737	302,737	302,737	302,737
R^2	0.16169	0.15506	0.15313	0.08580
Within R^2	0.08371	0.07646	0.07435	0.00076

Notes: Set-up as in Table 2, except macro news is constructed with average production forecast revisions for each sector. Firm-fixed effects are always included. Standard errors are clustered at firm level. *** p<0.01, ** p<0.05, * p<0.1.

(l) Macro news: first difference of stock market index rather than ifo index surprise

	Firms' forecast errors about their production			
	(1)	(2)	(3)	(4)
Micro News				
Forecast Revision for $y^i_{t+3,t}$	-0.190***			
	(0.001)			
Forecast Revision for $y^i_{t+3,t}$ net of $\gamma_i \Gamma_t$		-0.208***	-0.208***	
		(0.001)	(0.001)	
Macro News				
Surprise component of the ifo index	0.371***	0.328***		0.328***
	(0.014)	(0.014)		(0.014)
Observations	302,737	302,737	302,737	302,737
R^2	0.15999	0.15518	0.15313	0.08716
Within R^2	0.08185	0.07659	0.07435	0.00224

Notes: Set-up as in Table 2, except macro news is constructed with the first difference of the German stock market index DAX. Firm-fixed effects are always included. Standard errors are clustered at firm level. *** p<0.01, ** p<0.05, * p<0.1.