Surprises in Prices: Facts, Determinants, and Effects

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Abstract

This paper examines the determinants of firms' price expectation errors and their effects on both price setting and inflation dynamics. The analysis differentiates between two types of *surprises*: those prompting price adjustments despite the absence of anticipated changes (termed *flexibility-inducing*) and those failing to induce price adjustments despite expectations of changes (termed *rigidity-inducing*). Survey data for Swiss firms reveals remarkable frequencies and cyclicality in price surprises, with flexibility-inducing surprises dominating: More than half of all price changes materialize as unanticipated adjustments from the prior quarter. Surprise responsiveness to news and predictability through firm-specific factors, profitability and competitive conditions, in particular, challenge the full-information rational expectations hypothesis. At the micro level, firms' pricing decisions display significant and asymmetric responses to surprise shocks. At the macro level, the frequency of flexibility-inducing surprises emerges as a stronger driver of inflation variations than the frequency of anticipated price changes.

Keywords: Firm expectations, expectation errors, expectation formation, firm decisions, price setting, survey data

JEL Classification: D84, E31, E32

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1 Introduction

An extensive and rapidly growing body of research has demonstrated that firms' expectations wield a significant influence over their decisions, even when these expectations prove to be incorrect from an ex-post point of view (e.g., Enders et al., 2022; Born et al., 2022). This phenomenon underscores that expectations serve not only as a transmission channel for news but also as genuine sources of shocks. In the context of firms' price expectations, such shocks may affect both price setting at the micro level and price flexibility at the macro level – aspects for which, however, there is little empirical evidence.

This paper provides insights into these aspects by examining the determinants and effects of what are termed as *price surprises*. These surprises encompass the ex-post forecast errors of firms' price decisions, combining data on firms' expected and realized price changes. In addition, the paper introduces a distinction between two types of surprises, aligning with concepts that hold particular significance in the realm of firms' price-setting behavior: surprises prompting price adjustments despite the absence of anticipated changes (termed *flexibility-inducing surprises*), and those failing to induce price adjustments despite expectations of changes (termed *rigidity-inducing surprises*).

Distinguishing between these two types of surprises throughout, the paper presents stylized facts related to firms' price expectation errors, dissects the determinants that give rise to surprises, and unravels their microeconomic and macroeconomic consequences. By examining the intricate interplay between unexpected price changes, firm behavior, and inflation dynamics, the analysis illuminates some of the mechanisms underpinning price adjustment dynamics and their far-reaching implications for price rigidity and policymaking.

More in detail, the analysis requires a comprehensive panel data set that includes both expected and realized price changes collected recurrently from the same cohort of firms over an extended period. This data set is found in the quarterly KOF business tendency survey, which covers 3,100 firms in the Swiss manufacturing sector from 1999 to 2023. Covering both the situation in the recent past and the near future, the qualitative survey captures firms' assessments of various business activities, including their pricing decisions over the previous quarter and their pricing expectations over the next quarter.

Combining firms' expected and realized price changes as revealed in their responses, I construct the price surprise variables and describe their empirical properties, building on stylized facts about firms' expectation errors that emerge consistently across countries and for both qualitative and quantitative survey data. I contribute to this literature by assessing the validity of these facts separately for the two types of price expectation errors. There are four main findings. First, firms' unconditional price expectation errors are small, on average, and often insignificant. Surprises increasing rigidity are larger, in absolute terms, than those linked to heightened flexibility, suggesting that firms predict non-price changes more accurately than forecast actual price adjustments. Second, firms' price expectations possess substantial information content, and expectations not to change prices, in particular, surpass alternative models for expectation formation in accurately predicting future pricing decisions. Third, larger and more established firms demonstrate greater accuracy in predicting their prices. Although the role of experience is more pronounced for rigidity-inducing surprise, firms are equally subject to surprises that lead to unanticipated price changes regardless of age and years of survey participation. Fourth, the dispersion and volatility of the price expectation errors display a countercyclical pattern. This observation only holds for flexibility-inducing surprises, whereas the dispersion of rigidity-inducing surprises does not display significant fluctuations over the business cycle.

In addition, I present two novel facts related to concepts that hold particular significance in the context of firms' price-setting behavior. The first concerns the frequency of surprises. The average frequency of price surprises is 27.6 percent, indicating that firms' price plans do not align with their subsequent decisions in more than one out of four instances. Downward revisions are more frequent than upward revisions in transitioning from expectations to decisions. The frequency of flexibility-inducing surprises is 14.3 percent. Flexibility-inducing surprises are frequent and account for a relevant share of all price adjustments. On the one hand, flexibility-inducing surprises account for more than half of the total frequency of surprises, surpassing the frequency of rigidity-inducing surprises (12.1 percent). Consequently, more price surprises lead to unanticipated price changes than unexpected non-adjustments. On the other hand, flexibility-inducing surprises account for more than half of the total frequency of price changes (28.0 percent), exceeding the share of anticipated price changes (13.7 percent). Consequently, more than half of all price changes are price adjustments not anticipated in the preceding quarter. This highlights that price setting involves substantial surprise elements that do not materialize until three months before the pricing decision, fostering greater price flexibility.

The second concerns the cyclicality of the surprises. The frequency of surprises exhibits significant variations over time and displays a countercyclical pattern. This cyclical trend is driven by surprising price changes (flexibility-inducing surprises), the frequency of which increases by 4 percentage points to 17 percent during recessions. By contrast, the frequency of rigidity-inducing surprises remains stable and shows no significant changes over the business cycle.

The paper then proceeds to delve into the predictability of firms' price expectation errors, revealing that surprises are responsive to both news and firm-specific information available during the expectation formation phase, thereby violating the full-information rational expectations (FIRE) hypothesis. Specifically, adopting the empirical framework by Coibion and Gorodnichenko (2015) and transferring it to the expectation formation process at the individual firm level following Born et al. (2023) reveals a notable predictability of expectation errors by news, as reflected in forecast revisions, and a consistent pattern of overreaction. However, this overreaction is borne unequally across types of price expectation errors, as surprises inducing firms to maintain their prices unexpectedly are more prone to manifest as an overreaction to news than surprises prompting unanticipated price changes. Furthermore, dissecting the effects of positive and negative news on price expectation errors unveils a marked asymmetry observed for flexibility-inducing surprises, where the overreaction in response to positive news surpasses that stemming from negative news, while the response to rigidity-inducing surprises showcases minimal asymmetry.

By scrutinizing the impact of changes in firms' business conditions, as indicated by their survey responses, the analysis demonstrates that diverse factors exert varying degrees of influence on shaping price surprises. Examining the information set underlying the surprises shows that firms are more inclined to alter their price plans in response to actual shifts in the economic environment rather than in anticipation of future changes, especially in the context of flexibility-inducing surprises. The finding that firms base their pricing decisions on backward-looking information rather than forward-looking expectations echoes survey evidence (e.g., Fabiani et al., 2006; Seiler, 2022) and aligns with the literature that underscores the role of information frictions in shaping economic agents' decision-making processes (e.g., Andrade et al., 2022). A more nuanced picture emerges for surprises inducing rigidity, indicating that the decision to abstain from planned price changes is influenced, at least partially, by firms' expectations of the future.

Profitability emerges as a key determinant of surprises, emphasizing the significance of cost-based pricing rules in firms' pricing behavior. A deterioration in the earnings situation increases the odds of unexpectedly cutting prices by 244%. Conversely, the odds of unexpectedly raising prices increase by 115% when the earnings situation improves. The competitive environment also plays a pivotal role, exerting symmetric impacts on flexibility-inducing surprises. While firms react to changes in their business environment with price changes that they had not anticipated in the previous quarter, no firm-level factor leads firms to unexpectedly forgo price changes that they had planned in the previous quarter. This suggests that factors beyond the business conditions of firms may influence price rigidity, as evidenced by survey-based evidence highlighting elements such as customer relationships, contractual arrangements, and coordination failures (Blinder et al., 1998; Fabiani et al., 2006; Zurlinden, 2007; Seiler, 2022).

The paper culminates with exploring both the micro and macro effects of surprises. To analyze the micro effects, I employ a local-projections approach à la Jordà (2005) and examine how firms' pricing decisions and expectations respond to surprise shocks. I document that firms' pricing decisions respond significantly to flexibility-inducing shocks and that the reaction is asymmetric in its persistence. Companies tend to reduce their prices up to seven quarters after unexpected price decreases, whereas they raise their prices only up to four quarters after unexpected price increases. Similar effects are found for firms' price expectations, albeit less pronounced and less persistent overall. Conversely, rigidity-inducing surprises lead firms to compensate for their omitted price changes in both their price decisions and expectations, more so for unexpectedly omitted price increases than for price decreases.

To analyze the macro effects, I build on Klenow and Kryvtsov (2008) and examine how surprise-induced price variations contribute to fluctuations in inflation. In particular, I introduce a proxy for inflation based on firms' realized price changes and decompose it into the frequency of anticipated and unanticipated price changes. Analyzing the relative importance of these components shows that the frequency of flexibility-inducing surprises is a stronger driver of inflation variations than the frequency of anticipated price changes.

By investigating both micro and macro effects, I illuminate the intricate relationship between unexpected price changes, firms' behavior, and inflation dynamics. These findings contribute to a deeper understanding of how surprises impact both individual firms and the broader economy.

Related literature. This paper is related to different strands of the literature. It is related to the strand research that analyzes firms' expectation errors, an area recently synthesized by Born et al. (2022). The stylized facts about firms' expectation errors that emerge from both qualitative and quantitative survey data revolve around their unbiasedness (Bachmann and Elstner, 2015; Massenot and Pettinicchi, 2018; Barrero, 2022; Altig et al., 2022), the influence of experience (Bachmann and Elstner, 2015; Massenot and Pettinicchi, 2018; Morikawa, 2019), the countercyclical nature of their second-order moments (Bachmann et al., 2013, 2017, 2019; Triebs and Tumlinson, 2013; Morikawa, 2016; Enders et al., 2019), and the information content inherent in firms' expectations (Chen et al., 2020). Notably, only a few studies have documented these observations within the context of firms' price expectations. For instance, Coibion et al. (2018) for New Zealand firms, Coibion et al. (2020) for Italian firms, and Andrade et al. (2022) for French firms demonstrate a robust positive correlation between firms' expected and realized price adjustments, pointing towards unbiased price expectations. Furthermore, Kawasaki and Zimmermann (1986) establish that qualitative price expectations surpass adaptive expectations in a survey of German firms, Smith and McAleer (1995) provide similar evidence relative to static expectations for Australian firms. This paper contributes to the literature by corroborating the empirical properties of firms' expectation errors within the realm of firms' expectations and decisions about their own prices. Moreover, it extends the established set of stylized facts with two novel facts about the frequency and cyclicality of price surprises. It also assesses the validity of all these facts separately for the two types of price expectation errors introduced – namely, flexibility-inducing and rigidity-inducing surprises.

The paper also contributes to the literature that examines the predictability of expectation errors and substantiates the departure from the FIRE hypothesis by demonstrating their responsiveness to news and firm-specific variables. Early investigations have revealed certain deviations from rationality in firms' price expectations (Nerlove, 1983; Kawasaki and Zimmermann, 1986; De Leeuw and McKelvey, 1984). More recently, building upon the empirical framework introduced by Coibion and Gorodnichenko (2015), which involves regressing forecast errors on forecast revisions, multiple studies have evidence the responsiveness of expectation errors to news across survey data gathered from professional forecasters (Coibion and Gorodnichenko, 2012; Bordalo et al., 2020a), firms (Born et al., 2023; Gallegos Dago, 2023), or consumers (Broer and Kohlhas, 2022). Furthermore, many firm-specific variables help in predicting expectation errors for prices. Born et al. (2022) highlight the significant role played by the order backlog, changes in demand, or past expectations for German manufacturing firms. Similarly, Lein (2010) identifies the costs for intermediate products and revenue as influential predictors for non-predetermined price increases and decreases for Swiss manufacturing firms. Both studies underscore that macroeconomic variables assume a subordinate role and often lack significance as predictors for price expectation errors, echoing evidence on the importance of firm-specific and local information (Frache et al., 2021; Andrade et al., 2022; Dovern et al., 2023). This contrasts, however, with the evidence presented by Boneva et al. (2020), who establish that the forecasting errors made by UK firms in predicting price changes exhibit stronger correlations and predictability with macroeconomic shocks compared to the firms' errors in forecasting their own variables. The existing body of literature has put forth a range of explanations for predictable forecast errors, including forecasters' asymmetric loss functions, constraints on information processing, rational inattention, or within a learning environment characterized by parameter uncertainty (Elliott et al., 2008; Farmer et al., 2021; Kohlhas and Robertson, 2022; Abib et al., 2023).

Finally, the paper contributes by substantiating the influence of price expectation errors on firms' price-setting behavior and their broader implications for inflation dynamics. Leveraging expectation errors as empirical proxies for idiosyncratic firm-level volatility, several studies have documented their effects on a range of variables, including production, employment, or investments (Bachmann et al., 2013; Arslan et al., 2015; Morikawa, 2016). Zooming in on the effects on price setting, Bachmann et al. (2019) and Dixon and Grimme (2022) establish that idiosyncratic firm-level volatility increases the frequency of price adjustments, consistent with the model-based analysis of Vavra (2014). Enders et al. (2022) show that negative production expectation errors (i.e., when firms incorrectly expected production to increase) increase the probability of price increases.

Road map. The paper is structured as follows. Section 2 describes the data, explains the construction of price surprises, and summarizes the sample used for the subsequent empirical analysis. Section 3 documents stylized facts about firms' price expectation errors, corroborating them for the two types of surprises and introducing two novel facts concerning the frequency and cyclicality of surprises. Section 4 examines the role of news, as reflected in firms' forecast revisions, and other changes in their business conditions, as reflected by their survey responses, in determining price surprises. Section 5 explores the impact of surprises on firms' price-setting behavior and its broader implications for inflation dynamics. Section 6 concludes.

2 Data

This section introduces the data for the empirical analysis, which is based on the KOF business tendency survey of Swiss manufacturing firms. Further, it details the construction of firms' price expectation errors and summarizes the data sample.

2.1 Description of the survey

The data are firm-level data from the business tendency survey of the manufacturing sector in Switzerland conducted by the KOF Swiss Economic Institute at ETH Zurich. This survey is conducted on a monthly basis and supplemented supplemented quarterly[1] with additional questions and dates back to 1955. The survey covers Swiss private companies in the manufacturing sector[2] which represent, on average, 23 percent of sector employment. Response rates are generally high[3], while sample attrition is moderate.[4] Since 2001, respondents have been able to choose whether to participate online or complete a paper questionnaire.[5]

The business tendency survey is mostly qualitative and captures firms' assessments of various business activities, such as incoming orders or expected production development.[6] The questions are both backward-looking, i.e., they refer to the situation in the recent past, and forward-looking, i.e., they ask about expectations for the near future. All qualitative questions come with predefined answer options that usually fall into three qualitative categories: a positive, a negative, and a neutral response category. Respondents can check a box to select one of the predefined answers or leave the boxes blank if they cannot or do not want to answer the question. Table A.1 in the appendix lists the translated[7] questions relevant to the empirical analysis and their corresponding response categories. It further shows the frequency with which the questions

[1] Companies receive the questionnaire on the first working day of the month. Additional quarterly questions are supplemented to the questionnaires after the end of a quarter, i.e., at the beginning of April, July, October, and January.

[2] The companies are classified via the general classification of economic activity (NOGA), which corresponds to the NACE (nomenclature statistique des activités économiques dans la Communauté européenne) in the EU and the NAICS (North American Industry Classification System) in the US. Based on the NOGA division level, I can distinguish between 23 industries, ranging from NOGA division 10 ("Manufacture of food products") to NOGA division 33 ("Repair and installation of machinery and equipment").

[3] Approximately 69 percent of all firms receiving the survey questionnaire respond. This rate is similar to the comparable ifo Business Climate Survey in the manufacturing sector (Born et al., 2022) but much higher than the comparable Survey of Business Uncertainty in the United States, whose response rate is around one-third only (Altig et al., 2022).

[4] 2.8 percent of the firms in the panel drop out each quarter. New firms regularly replace exiting firms to maintain a representative sample for the Swiss manufacturing sector. Their entry rate corresponds, on average, to 2.4 percent.

[5] On average, 56 percent of all sample companies participate online, and 44 percent of all participants respond by paper questionnaire.

[6] The survey contains most of the questions from the harmonized survey program of the Directorate General for Economic and Financial Affairs of the European Commission. The harmonized program is implemented in almost all member and candidate countries of the European Union.

[7] The survey is conducted with companies from all parts of Switzerland. Consequently, the questionnaire has German, French, and Italian versions. In addition, some participants fill out an English questionnaire.

are asked and the periods for which data are available.

2.2 Construction of price surprise variables

Price surprises are ex-post forecast errors for price changes, the construction of which combines firms' expected and realized price changes as reported in the quarterly KOF business tendency survey.[8] In particular, firm i reports for its sales price[9] the realized change over the previous quarter, $p_{i,t} \in \{-1, 0, 1\}$, and the expected change over the next quarter, $E_{i,t}(p_{i,t+1}) \in \{-1, 0, 1\}$. Firms report their (expected) price changes on a three-level qualitative scale: increase(d), remain(ed) the same, and decrease(d). To construct the surprise variable, I adopt the approach of Bachmann et al. (2013) and define the price change forecast error of firm i in quarter t as:

$$p_{i,t}^{\text{surprise}} = \begin{cases} 0 & \text{if } \text{sign}\{p_{i,t}\} = \text{sign}\{E_{i,t-1}(p_{i,t})\}, \\ p_{i,t} - E_{i,t-1}(p_{i,t}) & \text{else.} \end{cases} \tag{1}$$

Hence, a price surprise occurs whenever the prior expectation in quarter $t-1$ about a price decision in the next quarter does not coincide with the posterior realization of the price decision in quarter t. The surprise is then equal to the difference between realized and expected price changes and spans the integer interval from -2 to 2, accordingly. Conversely, if expected and realized price changes coincide, no error occurs, and the surprise is zero.

Based on this general definition of price surprises, I distinguish two types of surprises.

Flexibility-inducing surprise The first is a surprise that leads to a price adjustment when no price change was previously expected. I refer to this case as *flexibility-inducing surprise*. A flexibility-inducing surprise, $p_{i,t}^{\text{flexible}}$, is the surprise that occurs if firm i in quarter $t-1$ did not expect to change its price in the next quarter but ends up changing it anyway:

$$p_{i,t}^{\text{flexible}} = \begin{cases} 0 & \text{if } E_{i,t-1}(p_{i,t}) = 0 \wedge \text{sign}\{p_{i,t}\} = \text{sign}\{E_{i,t-1}(p_{i,t})\}, \\ p_{i,t} - E_{i,t-1}(p_{i,t}) & \text{if } E_{i,t-1}(p_{i,t}) = 0 \wedge \text{sign}\{p_{i,t}\} \neq \text{sign}\{E_{i,t-1}(p_{i,t})\}. \end{cases} \tag{2}$$

To investigate asymmetries, I further distinguish between flexibility-inducing surprises that lead to price increases (when no price change was anticipated), $p_{i,t}^{\text{flexible},+} = \{p_{i,t}^{\text{flexible}} | p_{i,t} = 1\}$, and flexibility-inducing surprises that lead to price decreases (when no price change was anticipated), $p_{i,t}^{\text{flexible},-} = \{p_{i,t}^{\text{flexible}} | p_{i,t} = -1\}$.

[8] See Table A.1 in the appendix for the exact wording and answer options of the questions.
[9] Sales prices are not list prices but effective prices net of potential discounts.

Rigidity-inducing surprise The second is a surprise that leads to no price adjustment when a price change was anticipated. I refer to this case as *rigidity-inducing surprise.* A rigidity-inducing surprise, $p_{i,t}^{\text{rigid}}$, is the surprise that occurs if firm i in quarter $t-1$ expected to change its price in the next quarter but did not change after all:

$$p_{i,t}^{\text{rigid}} = \begin{cases} 0 & \text{if } E_{i,t-1}(p_{i,t}) \neq 0 \wedge \text{sign}\{p_{i,t}\} = \text{sign}\{E_{i,t-1}(p_{i,t})\}, \\ p_{i,t} - E_{i,t-1}(p_{i,t}) & \text{if } E_{i,t-1}(p_{i,t}) \neq 0 \wedge \text{sign}\{p_{i,t}\} \neq \text{sign}\{E_{i,t-1}(p_{i,t})\}. \end{cases} \tag{3}$$

Similarly to the flexibility-inducing surprises, I further distinguish between rigidity-inducing surprises that lead to prices not being increased (when a price increase was anticipated in the previous quarter), $p_{i,t}^{\text{rigid},+} = \{p_{i,t}^{\text{rigid}} | E_{i,t-1}(p_{i,t}) = 1\}$, and rigidity-inducing surprises that lead to prices not being decreased (when a price decrease was anticipated in the previous quarter), $p_{i,t}^{\text{rigid},-} = \{p_{i,t}^{\text{rigid}} | E_{i,t-1}(p_{i,t}) = -1\}$.

2.3 Sample summary and descriptive statistics

The sample is limited by the longitudinal consistency of the survey data[10] and covers the period from April 1999 to July 2023.

With both questions on firms' price-setting behavior available quarterly, the analysis utilizes quarterly data. To convert the survey data of the monthly questions into a quarterly frequency, I take the mode of firms' responses in the respective quarter. Aggregating monthly responses over the quarter instead of picking the end-of-quarter monthly response as firms' quarterly assessment minimizes the impact of non-response on the analysis. Furthermore, using the mode guarantees to choose one of the actual response categories, so the aggregation does not introduce artificial responses. In the case of multimodality, I take the last monthly mode of the quarter as the quarterly statement, which minimizes gaps in reference periods between quarters. Finally, for questions included in both the monthly and quarterly questionnaire, and when the quarterly response is missing, I use the last monthly mode response to minimize the impact of non-response in those cases.

As the empirical analysis relies on time-series data at the level of individual firms, I further restrict the sample to firms that have participated in the survey at least eight times (i.e., a firm has been part of the panel for at least two years) and that exhibit some time-series variation in their price surprises (i.e., a firm must have been surprised at least once but not all the time).

The remaining panel comprises 1,894 firms from the second quarter of 1999 to the third quarter

[10] The questionnaire has evolved over time and was revised particularly in 1999, 2004, and 2019. New questions were added to the catalog, while others were discontinued. In addition, the frequency with which some questions were asked changed. For some questions, the survey frequency was increased from quarterly to monthly. For others, a quarterly version was introduced in addition to the monthly questions (*Orders*, *Production*, *Finished stock*).

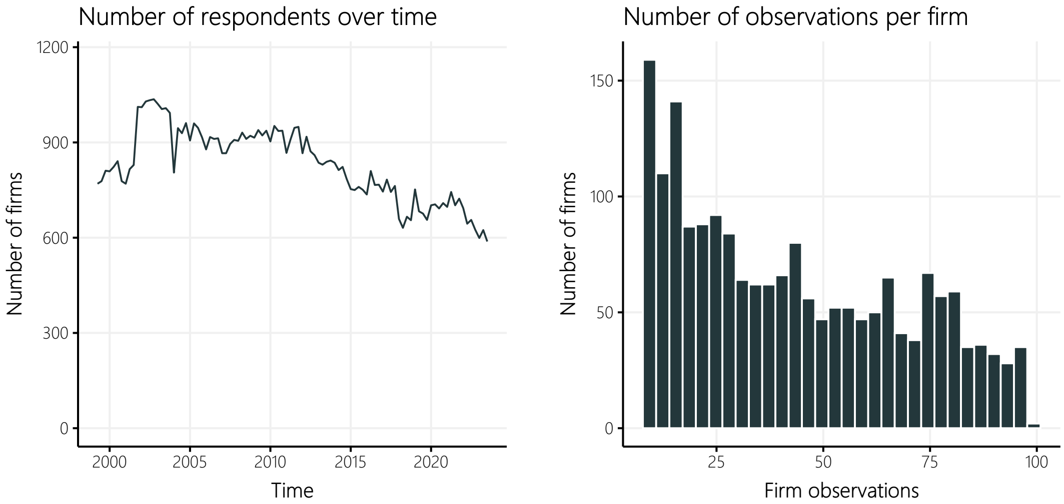

Figure 1: Observations of the KOF business tendency survey across time and firms. The left panel shows the number of firms that respond in a given month. The right panel shows the number of observations per firm.

of 2023. Figure 1 plots the distributions of the observations of the KOF business tendency survey across time (in the left panel) and across firms (in the right panel). The average number of respondents is larger than 800 firms per quarter; it decreases from about 1,000 per quarter at the beginning of the sample to 600 towards the end. In any given quarter, more than 600 firms respond. The median company is part of the panel for 39 quarters (i.e., almost then years), and 25 percent of firms are in the panel for more than 65 quarters (i.e., more than 16 years).

3 Stylized facts about price surprises

In this section, I build upon stylized facts about firms' expectation errors that emerge consistently across countries and for both qualitative and quantitative survey data (see, e.g., Born et al., 2022). The analysis encompasses three primary objectives. Firstly, I systematically consolidate four empirical findings concerning price expectation errors among the firms participating in the KOF business tendency survey (as detailed in Section 3.1 through Section 3.4). Secondly, I introduce two novel empirical observations concerning the frequency (discussed in Section 3.5) and cyclicality (explored in Section 3.6) of price expectation errors, concepts that hold particular significance in the context of firms' price-setting behavior. Lastly, I assess the validity of all these facts separately for the two types of price expectation errors – namely, flexibility-inducing and rigidity-inducing surprises.

3.1 Fact 1: Unbiasedness

Firms' unconditional expectations errors are small and often insignificant. Several studies highlight this phenomenon in both qualitative and quantitative survey data (Bachmann and Elstner, 2015; Massenot and Pettinicchi, 2018; Barrero, 2022; Altig et al., 2022), although only a limited number of these pertain to firms' price expectations (Andrade et al., 2022; Born et al., 2022). Demonstrating this fact for the price expectation errors of the firms from the KOF business tendency survey, Figure 2 shows the distributions of average firm-level price forecast errors. These are computed by regressing a firm's expectation errors on a constant. The figure shows the average price forecast errors of all surprises (in the left panel) and further distinguishes between average price forecast errors of flexibility-inducing surprises (in the middle panel) and rigidity-inducing surprises (in the right panel).

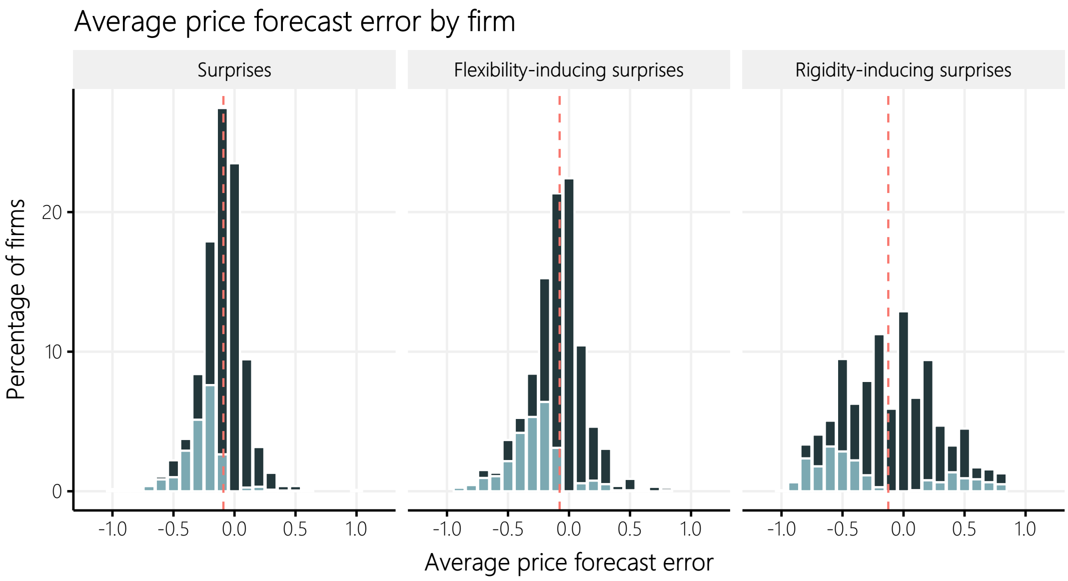

Figure 2: Histogram of firm-level average price surprises. Firm-level average forecast errors are computed by regressing a firm's expectation errors on a constant. Average price forecast errors are distinguished into all surprises (in the left panel), flexibility-inducing surprises (in the middle panel), and rigidity-inducing surprises (in the right panel). The colors indicate if estimates differ significantly from zero at the five percent level (light blue) or not (dark blue). The vertical dotted line indicates the respective median firm-level average surprises.

Firms' average price expectation errors are small and close to zero.[11] Specifically, the median for average firm-level surprises is -0.09, for flexibility-inducing surprises it is -0.08, and for rigidity-inducing surprises it is -0.10. A substantial share of firm-level expectation errors – up to 80 percent – do not differ significantly from zero. This observation holds across all types of surprises and for various classification schemes, such as firm size, sector, or export orientation

[11] Figure A.1 in the appendix presents histograms of firm-level average realized price changes (in the left panel) and expected price changes (in the right panel). They are also small and close to zero.

(see Table B.1 in the appendix), emphasizing the prevailing insignificance of unconditional price surprises.

Among the subset of average expectation errors that do exhibit significant deviations from zero, flexibility-inducing surprises predominantly entail negative revisions. This suggests that a small group of firms consistently experiences surprises that prompt them lower prices unexpectedly. By contrast, when considering rigidity-inducing surprises, the significantly estimated expectation errors are more symmetrically distributed around zero. In this scenario, a minority of firms systematically refrain from both upward and downward price adjustments unexpectedly.

Furthermore, it is noteworthy that the distribution of average rigidity-inducing price expectation errors displays a higher degree of dispersion than that of flexibility-inducing surprises. In absolute terms, the price expectation errors contributing to increased rigidity are larger than those linked to heightened flexibility. This observation raises the hypothesis that firms are more likely to accurately predict non-price changes than forecast actual price adjustments. This hypothesis can be tested in the Markov transition matrices in Table 1, which delineate the transition probabilities between the price expectations formulated in the previous quarter and the realized price decision in the current quarter. The matrix in panel (a) is a left stochastic matrix where each column sums to one. It shows the probabilities for each expectation response category to lead to a given price decision. The matrix in panel (b) is a right stochastic matrix where each row sums to one. It shows the probabilities for each decision response category to be preceded by a given price expectation.

Table 1: Markov transition matrices

(a) Left stochastic matrix

		$p_{i,t}$ 1	0	-1
$E_{i,t-1}(p_{i,t})$	1	0.584	0.103	0.050
	0	0.388	0.832	0.583
	-1	0.027	0.064	0.367

(b) Right stochastic matrix

		$p_{i,t}$ 1	0	-1
$E_{i,t-1}(p_{i,t})$	1	0.420	0.519	0.062
	0	0.054	0.807	0.139
	-1	0.025	0.406	0.569

Notes: Markov transition matrices show the transition probabilities between the price expectations formulated in the previous quarter and the realized price decision in the current quarter. The matrix in panel (a) is a left stochastic matrix where each column sums to one. It shows the probabilities for each expectation response category to lead to a given price decision. The matrix in panel (b) is a right stochastic matrix where each row sums to one. It shows the probabilities for each decision response category to be preceded by a given price expectation. The transition probabilities are pooled over the sample from 1999/II–2023/III.

In general, companies are strongly inclined to follow through with their intentions of maintaining their prices. The conditional probability that a firm will leave its sales price unchanged in quarter t, given that it had anticipated no change over the next three months in quarter $t-1$, stands at 0.807. This high realization rate for firms' plans of not changing prices stands in stark contrast to their realization rates for expected price changes. Only 42.0 percent of planned price increases materialize. When companies plan to increase their selling price, they are, in fact, more likely not to change prices (51.9 percent). For planned price decreases, the rate of realization amounts to 56.9 percent. Hence, companies are more likely to realize their planned price decreases than increases.

Furthermore, we observe a tendency towards downward revisions when transitioning from expectations to actual decisions. On the one hand, this pertains to firms' expectations to leave their prices unchanged. When firms deviate from their initial expectations of not changing prices, the subsequent revisions are more prone to be downward (13.9 percent) than upward (5.4 percent). On the other hand, this also holds for expected price changes. Firms are more likely to deviate from their plans to increase prices (58.1 percent) than their plans to decrease prices (41.3 percent). Taken together, realized price changes turn out more negative than anticipated, which accounts for the slightly negative average median surprises depicted in Figure 2.

Companies appear particularly cautious when it comes to implementing price increases. This echoes survey evidence which suggests that firms tend to exercise restraint in raising prices due to concerns about customer relationships and the reluctance to initiate price ahead of their competitors, indicative of coordination failure (Amirault et al., 2006; Seiler, 2022). However, the significance of these reasons in inducing upward rigidity in price adjustments might not remain consistent across all contexts. For instance, during periods of heightened inflation, when price increases are more widespread and accepted among customers, these reasons might not hold the same weight. Indeed, the Markov transition matrices (as presented in Table B.3 in the appendix) computed from 2021/I to 2023/III, representing a period of increased inflation[12], paint a different picture. During this period, firms exhibit a notably high likelihood of implementing planned price increases (64.5 percent). Additionally, plans to maintain unchanged prices experience significantly more upward revisions (18.8 percent) than calculations spanning the entire sample period in Table 1. Conversely, plans to decrease prices are only realized in 38.6 percent of cases.

3.2 Fact 2: Information content

Firms' price expectations have significant information content because they outperform alternative models of expectation formation in accurately predicting future price decisions (Nerlove, 1983; Kawasaki and Zimmermann, 1986; Smith and McAleer, 1995). To demonstrate this, I compute the root mean squared expectation error (RMSE) based on actual price expectations and compare it to two alternative price predictions that I derive from a classical model[13] of expectation formation:

$$E_{i,t}(p_{i,t+1}) = \lambda p_{i,t} + (1-\lambda)E_{i,t-1}(p_{i,t}). \tag{4}$$

The first assumes *static* expectations. Under this assumption, I carry forward as an expectation

[12] In Switzerland, CPI inflation averaged 2.5 percent from 2021/I to 2023/III, compared to an average of 0.5 percent from 1999/I to 2020/IV. PPI inflation averaged 3.3 percent from 2021/I to 2023/III, compared to an average of 0.1 percent from 1999/I to 2020/IV.

[13] This model has its origin in the adaptive expectations hypothesis, which dates back to Fisher (1930) and was formally introduced by Cagan (1956), Friedman (1957) and Nerlove (1958).

the most recent price realization ($\lambda = 1$). The second assumes *adaptive* expectations. Under this assumption, I carry forward as an expectation the most recent price expectation ($\lambda = 0$).

Figure 3 compares the RMSEs of these two alternative expectation formation processes to the RMSE based on firms' actual price expectations. The figure shows relative RMSEs for surprises (in the left panel) and further distinguishes between RMSEs for flexibility-inducing (in the middle panel) and rigidity-inducing surprises (in the right panel).

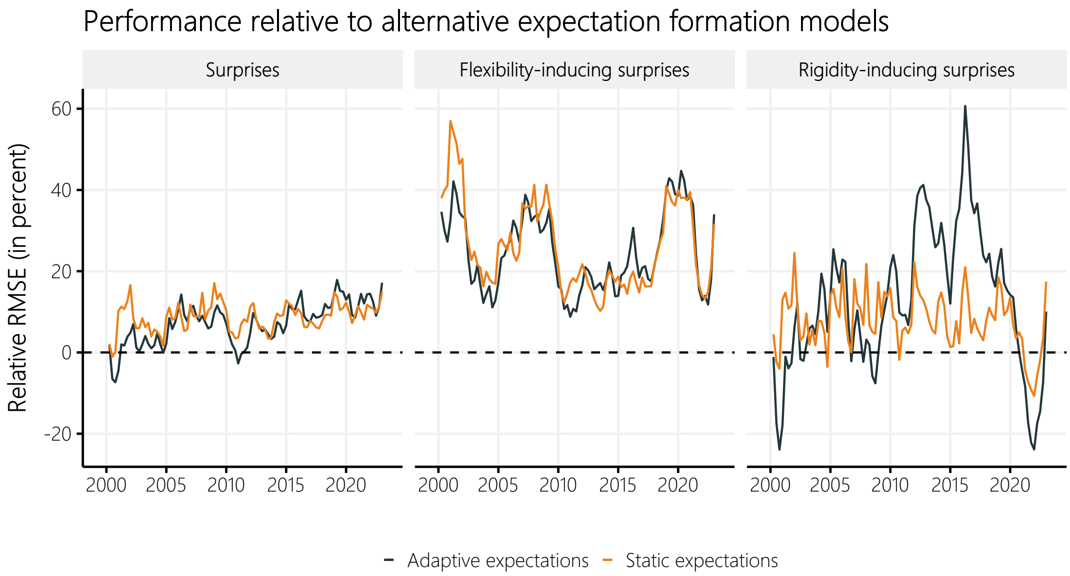

Figure 3: This figure shows the root mean squared expectation error (RMSE) for static expectations (carrying forward as expectation the most recent price realization) and adaptive expectations (carrying forward as expectation the most recent price expectation) relative to the RMSE for firms' actual price expectations, separately for all surprises (in the left panel), flexibility-inducing surprises (in the middle panel) and rigidity-inducing surprises (in the right panel). Values above zero mean that the respective model does not beat firms' actual expectations. All series are plotted as moving averages over the two previous and next quarters.

It shows larger RMSEs of the alternative than reported price expectations for almost all months. Hence, firms' expectations are usually more precise in predicting future price decisions: They outperform static and adaptive expectations. This observation resonates with evidence from prior research. For instance, Kawasaki and Zimmermann (1986) and Smith and McAleer (1995) demonstrate the superiority of the information content of qualitative survey-based expectations over adaptive and static ones. More recently, Born et al. (2022) reveal analogous outcomes for qualitative price and production expectations in German survey data, aligning with the present findings.

Regarding the distinction between flexibility-inducing and rigidity-inducing surprises, it is notable that in the case of flexibility-inducing surprises, both alternative models of price expectations exhibit significantly poorer performance than those of rigidity-inducing surprises. The relative RMSEs for rigidity-inducing surprises average 12.9 percent (based on adaptive expectations) and 8.0 percent (based on static expectations), whereas the corresponding relative RMSEs for flexibility-inducing surprises average 24.6 percent and 26.0 percent, respectively. This observation suggests that, when it comes to price changes, firms' expectations have significant information content compared to a scenario where the most recent price realization or expectation is adopted as the new expectation.

Furthermore, it is evident that while the performance of the two alternative expectations models is quite similar for flexibility-inducing surprises, a more pronounced difference emerges for rigidity-inducing surprises. The relative RMSE based on static expectations is consistently lower and more stable, while the relative RMSE based on adaptive expectations is larger and more volatile. The relatively strong performance of static expectations (incorporating the most recent price realization as expectation) in the case of rigidity-inducing surprises can be attributed to price stickiness. Firms tend to persist with unchanged prices over extended spells (see also Section 3.5). Within such a spell, if a price remained unchanged in the previous period, it is likely to remain unchanged in the next period as well. This results in no expectation error arising when carrying forward the most recent realization as expectation. Nevertheless, static expectations do not outperform firms' actual expectations on average.

3.3 Fact 3: Experience

Experience matters for firms' expectation errors: larger and more established firms exhibit greater accuracy in predicting their own decisions and manifest reduced expectation errors in comparison to their smaller and younger counterparts (Bachmann and Elstner, 2015; Massenot and Pettinicchi, 2018; Morikawa, 2019). Born et al. (2022) have already observed this phenomenon in the context of price expectations. To verify this for firms participating in the KOF business tendency survey and to assess its applicability to different types of surprises, Table 2 presents the mean and median squared expectation errors for the three types of price surprises across various firm size groups (determined by both absolute employee numbers and relative position in the employee distribution) as well as between young and old firms over five-year time windows within the sample. A firm is classified as "old" if its participation in the survey spans a period exceeding ten years at the time of assessment.

Table 2: Experience and expectation errors

Group by	Group	Surprises			Flexibility-inducing			Rigidity-inducing		
		n	Mean	Median	n	Mean	Median	n	Mean	Median
Overall		1894	0.046	0.015	1579	0.062	0.017	1404	0.156	0.090
Firm size	S	700	0.046	0.014	576	0.064	0.015	483	0.167	0.095
	M	872	0.049	0.016	723	0.062	0.019	669	0.156	0.095
	L	322	0.038	0.013	280	0.059	0.020	252	0.139	0.062
Size quartile	First Quartile	392	0.050	0.016	329	0.061	0.015	256	0.182	0.111
	Second Quartile	491	0.050	0.013	405	0.067	0.020	360	0.156	0.082
	Third Quartile	469	0.048	0.016	377	0.064	0.017	359	0.153	0.090
	Fourth Quartile	542	0.038	0.012	468	0.058	0.017	429	0.144	0.078
1999–2004	young	671	0.092	0.020	566	0.099	0.012	395	0.400	0.250
	old	802	0.081	0.020	693	0.107	0.018	550	0.307	0.160
2005–2009	young	469	0.096	0.020	421	0.099	0.010	299	0.382	0.250
	old	782	0.095	0.020	702	0.118	0.016	589	0.329	0.174
2010–2014	young	418	0.122	0.020	372	0.179	0.028	196	0.348	0.250
	old	870	0.092	0.018	805	0.132	0.020	587	0.337	0.111
2015–2019	young	293	0.089	0.016	228	0.110	0.020	127	0.376	0.250
	old	825	0.083	0.010	749	0.116	0.011	491	0.360	0.111
2020–2023	young	316	0.085	0.018	210	0.105	0.028	191	0.229	0.111
	old	676	0.058	0.008	599	0.088	0.008	464	0.267	0.111

Notes: Firm-level mean and median squared expectation errors for the three types of price surprises for groups of firms of different sizes and age. I measure the size in terms of the firms' absolute number of employees (S: fewer than 50 employees; M: 50-249 employees; L: 250 or more employees) and their location in the distribution of employees. I measure age by the length of time a company has been participating in the survey. A company is considered old if it has participated in the survey for more than ten years at the time of being surveyed. The number of firms in each group is denoted by n.

The findings presented in Table 2 indicate that, when considering all price expectation errors, the mean squared price expectation errors (MSE) tend to be smaller for both larger and older firms than their smaller and younger counterparts. The finding concerning firm size may be attributed to the notion that larger companies allocate greater resources and attention to their forecasting activities in general and their price planning in particular, resulting in smaller price expectation errors. This resonates with the literature on rational inattention (Maćkowiak and Wiederholt, 2009, 2015). The finding concerning firm age may be related to the fact that more established firms have had the opportunity to accumulate greater experience in price planning, resulting in reduced price expectation errors. This echoes the concept of learning and lifetime experiences (Malmendier and Nagel, 2016; Bordalo et al., 2020b).

These results hold in particular when it comes to surprises that lead firms to refrain from changing prices (rigidity-inducing surprises): Larger and older firms are more likely to stick to their plans to change prices than smaller and younger ones whose respective MSEs are larger. Conversely, smaller and younger firms experience larger MSEs, suggesting a higher likelihood of deviating from their initial price change intentions to not changing them. However, when examining flexibility-inducing surprises, the variation in MSEs remains less pronounced across different firm sizes or ages. Both groups of companies appear to be equally impacted by surprises that prompt changes in prices contrary to their initial intentions from the preceding quarter.

3.4 Fact 4: Countercyclical second moments

The dispersion and volatility of expectation errors exhibit a countercyclical pattern. This fact has been observed for a variety of survey-based measures based on different survey questions (Bachmann et al., 2013, 2019; Enders et al., 2019; Morikawa, 2016). I validate this phenomenon for firms' price expectation errors and the two types of surprises within the KOF business tendency survey, using two measures of dispersion and volatility: price forecast error dispersion, $\text{fedisp}_t = \sqrt{Var(p_{i,t}^{surprise})}$, and mean absolute price forecast errors, $\text{mae}_t = \frac{1}{n_t}\sum_i abs(p_{i,t}^{surprise})$.

Table 3: Countercyclical second moments: Correlation between measures and types of surprises

		Surprises		Flexibility-inducing		Rigidity-inducing	
		fedisp	mae	fedisp	mae	fedisp	mae
Surprise	fedisp						
	mae	0.99***					
Flexibility-inducing	fedisp	0.80***	0.82***				
	mae	0.77***	0.79***	0.98***			
Rigidity-inducing	fedisp	-0.23**	-0.25**	-0.49***	-0.51***		
	mae	-0.06	-0.08	-0.48***	-0.54***	0.81***	

Notes: This table shows the Spearman rank correlation coefficients of dispersion measures within and across types of price expectation errors. The two measures of dispersion and volatility are the price forecast error dispersion (fedisp) and the mean absolute price forecast errors (mae). One, two, and three stars (*) correspond to significance at the 10-, 5-, and 1-percent significance levels, respectively.

Table 3 shows Spearman rank correlation coefficients for the dispersion measures both within and across the types of price expectation errors. Notably, there is a strong positive correlation between the two dispersion measures, with correlation coefficients of 0.99 for surprises, 0.98 for flexibility-inducing surprises, and 0.81 for rigidity-inducing surprises. Furthermore, the dispersion of flexibility-inducing surprises exhibits a robust positive correlation with the dispersion of surprises, while the dispersion of rigidity-inducing surprises generally demonstrates a negative correlation with the dispersion of surprises.

To investigate the cyclical characteristics of the dispersion of expectation errors, I report correlation coefficients with measures of economic activity, including the growth rate of industrial production and the ILO unemployment rate. Additionally, I regress the dispersion measures on dummies that identify two consecutive quarters of negative GDP growth as a recession. Table 4 presents the results.

The top panel of the table illustrates negative and mostly significant correlation coefficients for surprises and flexibility-inducing surprises. The bottom panel of the table displays regression coefficients revealing a significant increase in the dispersion of surprises (and, to some extent, flexibility-inducing surprises) during economic downturns. This underscores the countercyclical nature of the dispersion of (flexibility-inducing) surprises. Conversely, the dispersion of rigidity-inducing surprises does not exhibit significant fluctuations over the business cycle.

Countercyclical dispersion in firms' price expectation errors holds significant implications for firms, market dynamics, and the effectiveness of economic policies during different phases of the business cycle. In firm behavior, countercyclical dispersion fosters uncertainty and caution in

Table 4: Countercyclical second moments: Correlation between measures and types of surprises

	Surprises		Flexibility-inducing		Rigidity-inducing	
	fedisp	mae	fedisp	mae	fedisp	mae
Production	-0.17*	-0.19*	-0.10	-0.14	-0.02	-0.02
Unemployment	-0.51***	-0.51***	-0.37***	-0.24*	0.05	-0.11
Recession dummy	0.05***	0.06***	0.03	0.06**	0.02	0.02
Recession dummy 2008/2009	0.09**	0.10**	0.05	0.03	0.00	0.07

Notes: The top panel of the table shows Spearman rank correlation of the dispersion measures with aggregate business cycle measures. The two measures of dispersion and volatility are the price forecast error dispersion (fedisp) and the mean absolute price forecast errors (mae). The aggregate business cycle measures are the industrial production growth rate and the ILO unemployment rate. The bottom panel shows regression results using recession dummies. The dummies identify two consecutive quarters of negative GDP growth as a recession. After standardizing each time series by its non-recession mean, the table reports coefficients for a general recession dummy and a dummy for the 2008/09 recession. One, two, and three stars (*) correspond to significance at the 10-, 5-, and 1-percent significance levels, respectively.

pricing decisions, potentially leading to delayed or gradual adjustments due to uncertain demand and competition. Consequently, this contributes to price stickiness, affecting the overall economic recovery. Within markets, countercyclical dispersion signifies diverse future price expectations, amplifying information asymmetry between firms and market players. This disparity challenges accurate price trend predictions, potentially hampering market efficiency and allocation of resources. Moreover, countercyclical dispersion presents challenges for policymakers, as economic downturns lead to misaligned business outlooks. Policymakers may need a cautious, data-driven approach to rate adjustments, factoring in heightened uncertainty from firms' dispersed expectations, thus balancing inflation management and economic support intricately.

3.5 Fact 5: Frequency

Though hitherto undocumented in the literature, the frequency of price expectation errors assumes paramount importance in firms' price-setting behavior by potentially influencing the transmission of shocks and the effectiveness of monetary policy. Exploring this concept holds dual interest: examining the connection between the frequency of flexibility-inducing surprises and the share of price adjustments, as well as delving into the frequency of rigidity-inducing surprises in relation to the proportion of unadjusted prices. The former sheds light on the anatomy of price flexibility, while the latter unveils rigidity as a source that could stem from firms' infrequent updating due to sticky information, constituting a key friction for business cycle dynamics (Mankiw and Reis, 2002).

To investigate the frequency of price surprises, I begin by calculating the relative frequencies of all combinations of price expectations in the previous quarter and price realizations in the current quarter, pooling data from 1999/II to 2023/III.

The results in Table 5 show that 72.4 percent of all realized price decisions align with prior expectations (as indicated along the diagonal of the table). Decisions not to change prices that are consistent with prior expectations dominate, accounting for 59.9 percent. Price adjustments that match predictions are less common (12.5 percent), with price decreases (6.5 percent) being

Table 5: Prediction-realization table (relative frequencies)

		$p_{i,t}$ 1	0	-1
$E_{i,t-1}(p_{i,t})$	1	0.060	0.074	0.009
	0	0.040	0.599	0.103
	-1	0.003	0.046	0.065

Notes: The prediction-realization table shows the relative frequencies for all combinations of price expectations in the previous quarter and realizations in the current quarter. The statistics are pooled over the sample 1999/II–2023/III.

slightly more often accurately predicted than price increases (6.0 percent). The vast majority of observations fall along the main diagonal. This suggests an overall positive relationship between firms' expected price decisions in quarter $t-1$ and their realized decisions in quarter t, in line with previous findings from qualitative and quantitative survey data (e.g., Coibion et al. (2018) for New Zealand firms, Coibion et al. (2020) for Italian firms, and Andrade et al. (2022) for French firms).

By contrast, the average frequency of price surprises stands at 27.6 percent (as indicated by the off-diagonal elements of the table). This indicates firms' planned price adjustments do not align with their subsequent price decisions in more than one out of four instances. Downward revisions are more frequent than upward revisions during this transition, confirming the slightly negative price expectation errors discussed in Section 3.1. Specifically, 18.6 percent of price expectations turn out to be more negative than anticipated (upper triangular elements). In comparison, only 8.9 percent of price expectations exceed predictions in a positive direction (lower triangular elements). This implies that Swiss manufacturing firms are more prone to refrain from planned price hikes unexpectedly or surprisingly reduce prices rather than unexpectedly avoiding planned price reductions or unexpectedly raising prices. This suggests that firms meticulously plan price increases and rarely raise prices due to unexpected circumstances.

Moreover, price expectation errors infrequently reverse the expected direction of price changes: 0.9 percent of anticipated price increases lead to price decreases, while 0.3 percent of expected price decreases lead to increases. Thus, most revisions involve transitions from expecting not to change prices to changing them (flexibility-inducing surprise) or transitioning from expecting to change prices to not changing them (rigidity-inducing surprise).

Accordingly, flexibility-inducing surprises play, on average, a larger role than rigidity-inducing surprises, as revealed by the comparison between the frequency of expected and realized price changes. The frequency of expected price changes is 25.7 percent (values in rows 1 and 3), while the frequency of realized price changes is 28.0 percent (values in columns 1 and 3).[14] Therefore,

[14]This survey-based value compares plausibly with estimates of the frequency of price changes based on other periods and data sources. Lein (2010) documents a frequency of price changes of 31 percent using the same survey of Swiss manufacturing firms from 1984 to 2007. Using microdata underlying the Swiss producer and import price index from December 2010 to November 2016, Kaufmann and Renkin (2019) show that the frequency of price changes for domestic and export prices is similar, at about 25 percent. Rudolf and Seiler (2022) find an average frequency of price changes of 26.9 percent in the microdata underlying the Swiss consumer price index from January 2008 to December 2020.

surprises lead to more flexibility than initially anticipated in transitioning from expectations to decisions.

The frequency of flexibility-inducing surprises is 14.3 percent. This figure indicates that flexibility-inducing surprises are frequent compared to both overall surprises and effective price changes. On the one hand, flexibility-inducing surprises account for over half of the total frequency of surprises (27.6 percent), surpassing the frequency of rigidity-inducing surprises. Consequently, more price surprises lead to unanticipated price changes than unexpected non-adjustments. On the other hand, flexibility-inducing surprises account for over half of the total frequency of price changes (28.0 percent), exceeding the share of anticipated price changes (13.7 percent). Consequently, more than half of all price changes are price adjustments not anticipated in the preceding quarter. This highlights that price setting largely involves elements of surprise, which are not expected until three months before the price decision and lead to greater price flexibility.

The frequency of rigidity-inducing surprises is 12.1 percent. Notably, rigidity-inducing surprises constitute a smaller portion of the overall frequency of surprises compared to flexibility-inducing surprises. This type of expectation error also comprises a relatively modest share of decisions not to adjust prices. With a frequency of 72.1 percent for non-price changes, only about one in six decisions involve a rigidity-inducing surprise. As a result, decisions to maintain prices unchanged are considerably more often accurately predicted and less frequently the outcome of surprises.

3.6 Fact 6: Cyclicality

The frequency of surprises exhibits significant variations over time and displays a countercyclical pattern. To see this, I examine the frequencies of surprises from a time-series perspective. Figure 4 illustrates the overall frequency of price surprises (in the left panel), as well as the frequencies of flexibility-inducing (in the middle panel) and rigidity-inducing surprises (in the right panel) for each quarter spanning from April 1999 to April 2023. The frequency of any type of surprise represents the proportion of firms with a corresponding price expectation error in a given quarter. Within each type of surprise, Figure 4 further differentiates between positive and negative surprises, depending on the sign of the surprise variable. Positive surprises capture upward revisions in the transition from expected to realized price changes, while negative surprises capture downward revisions in transitioning from expectations to realizations.

The frequency of surprises varies considerably over time. Analyzing expectation errors through the lens of positive and negative surprises reveals that negative surprises tend to be consistently more frequent than positive ones. Furthermore, the frequency of negative surprises experiences greater fluctuations over time compared to positive surprises. This pattern holds true for both flexibility-inducing and rigidity-inducing surprises.

The strongly varying frequency of negative surprises, in particular, shows distinct peaks and troughs, for some of which there are straightforward explanations. For example, the substantial

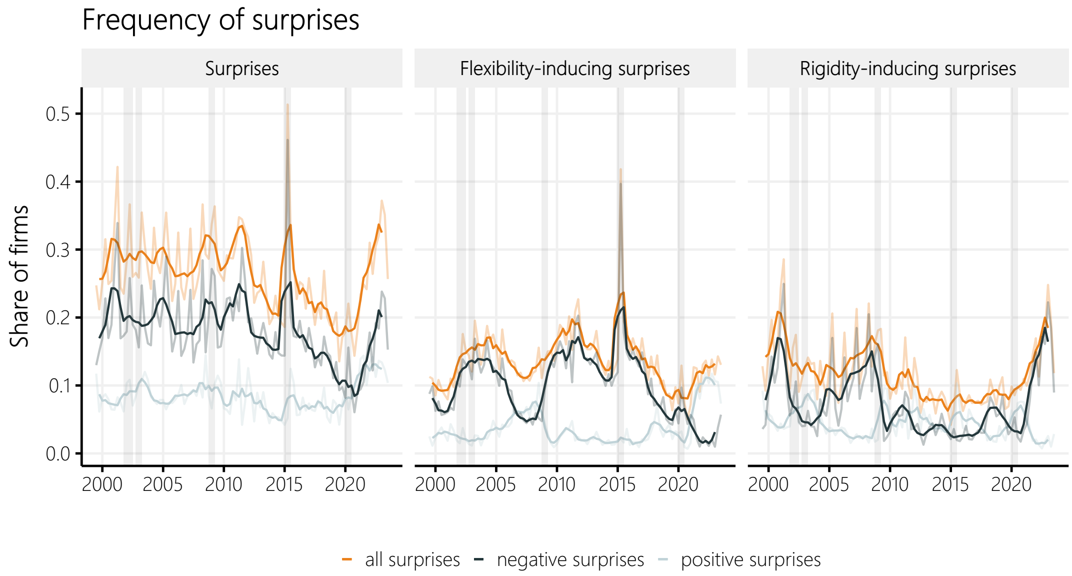

Figure 4: This figure plots the overall frequency of price surprises (in the left panel), as well as the frequencies of flexibility-inducing (in the middle panel) and rigidity-inducing surprises (in the right panel) for each quarter over the sample from April 1999 to April 2023. It further distinguishes between the frequency of all, positive and negative surprises, depending on the sign of the surprise variable. Positive surprises capture upward revisions in the transition from expected to realized price changes. Negative surprises capture downward revisions in transitioning from expectations to realizations. The frequency of any type of surprise captures the share of firms making a respective price expectation error in a given quarter. Bold lines are moving average frequencies over the previous and the next two quarters.

increase in the frequency of surprises in early 2015 likely mirrors the aftermath of the unexpected decision of the Swiss National Bank (SNB) to discontinue the minimum exchange rate for the Swiss franc against the euro.[15] This event triggered a substantial appreciation of the Swiss franc, leading to a notable price reduction in the Swiss manufacturing sector (Kaufmann and Renkin, 2019). This increase primarily emanates from a heightened frequency of negative flexibility-inducing surprises. Similarly, the recent period of inflationary pressure since 2021 has led to an increased frequency of surprises driven by negative rigidity-inducing surprises. At its peak, over 20 percent of companies anticipated price increases within the subsequent three months but opted to keep prices unchanged instead.

To systematically evaluate the cyclical properties of the frequencies of surprises, I regress the frequencies on dummies that identify two consecutive quarters of negative GDP growth as a recession. Table 6 shows the results.

The regression coefficients in the top panel of the table reveal a significant increase in surprise frequencies during economic downturns. The frequency of surprises experiences a significant increase during recessions, rising from 26 percent in normal times to 32 percent during downturns.

[15]The SNB enforced a minimum exchange rate of 1.20 CHF per EUR from 6 September 2011 to 15 January 2015. After the discontinuation of the minimum exchange rate floor, the Swiss franc appreciated sharply before stabilizing at approximately 1.10 CHF per EUR in 2015 and 2016.

Table 6: Cyclicality of surprises

	Surprises			Flexibility-inducing			Rigidity-inducing		
	all	positive	negative	all	positive	negative	all	positive	negative
Non-recession mean	0.26***			0.13***			0.12***		
Recession dummy	0.06***			0.04**			0.01		
Non-recession mean		0.08***	0.18***		0.04***	0.09***		0.04***	0.07***
Recession dummy		0.01	0.05***		-0.02*	0.05***		0.02***	-0.01

Notes: This table reports estimation results from regressing a recession dummy on the frequency of surprises as well as the frequencies of flexibility-inducing and rigidity-inducing surprises. The top panel of the table shows regression coefficients for all surprises. The bottom panel distinguishes the regression coefficients for positive and negative surprises. Positive surprises capture upward revisions in the transition from expected to realized price changes. Negative surprises capture downward revisions in transitioning from expectations to realizations. The frequency of any type of surprise captures the share of firms making a respective price expectation error in a given quarter. The recession dummy identifies two consecutive quarters of negative GDP growth as a recession. The intercept gives the non-recession mean of the respective series. One, two, and three stars (*) correspond to significance at the 10-, 5-, and 1-percent significance levels, respectively.

This cyclical trend is driven by surprising price changes (flexibility-inducing surprises), the frequency of which increases by 4 percentage points to 17 percent during recessions. By contrast, the frequency of rigidity-inducing surprises remains stable and displays no significant changes over the business cycle.

To explore potential asymmetries in the direction of price changes, the bottom panel of the Table 6 dissects the regression coefficients for positive and negative surprises. The analysis demonstrates that negative flexibility-inducing surprises exhibit countercyclical behavior, whereas positive flexibility-inducing surprises are procyclical. Consequently, during recessions, companies are more inclined to unexpectedly decrease their prices and less prone to unexpected price hikes relative to non-recessionary periods. At the same time, the coefficient of the recession dummy of positive rigidity-inducing surprises is also statistically significant and positive, suggesting that firms are more likely than usual to unexpectedly forgo planned price increases during economic downturns.

Taken together, these findings imply that price adjustment becomes unexpectedly more flexible during recessions, frequently leading to price reductions. This conclusion is consistent with evidence on the frequency of price changes drawn from the same survey data[16] as well as previous findings in the literature. The countercyclical nature of the price adjustment frequency has been documented, for example, by Vavra (2014) and Berger and Vavra (2018) in US CPI microdata or by Bachmann et al. (2019) in German survey data.

4 Determinants of surprises

This section delves into the process of firms' expectation formation and how it is influenced by various factors, ultimately leading to the occurrence of price surprises. Expectation formation involves firms making predictions about future economic conditions and incorporating inform-

[16]Table B.2 in the appendix regresses the frequency of (expected) price changes on recession dummies and shows that the frequency of (expected) price decreases is significantly higher in recessions (26.0 percent) than in normal times (16 percent).

ation, news, or events into existing expectations. The nature of this adjustment process varies with different expectation models or theories. Initially rooted in the full-information rational expectation (FIRE) hypothesis, which posits instantaneous and accurate adjustments to new information, it is now well established that expectations often deviate from this benchmark, leading to predictable expectation errors.

This departure from FIRE serves as the backdrop for my exploration within the context of the KOF business tendency survey. I delve into the predictability of firms' price expectation errors and unravel intricate dynamics contributing to price surprises. Section 4.1 focuses on the impact of news, as reflected in forecast revisions, on firms' expectations, revealing a notable predictability of expectation errors and a consistent pattern of overreaction. Additionally, I dissect the asymmetric effects of positive and negative news on price expectation errors, unveiling distinct dynamics across different surprise types. Moving to Section 4.2, I shift the focus to firm-level factors and examine how changes in business conditions, as reflected by firms' survey responses, shape price surprises. This analysis uncovers the prominent role of backward-looking information and the asymmetric influence of specific firm-level factors on the different types of surprises.

4.1 Response of surprises to news

How do firm expectations respond to news? According to the FIRE hypothesis, firms' expectation errors should not be predictable based on real-time information. This is because, under the FIRE hypothesis, all information is instantaneously and accurately processed upon arrival. To study the response of expectations to news, I adopt the empirical framework introduced by Coibion and Gorodnichenko (2015) that regresses forecast errors on forecast revisions. I follow Born et al. (2023) in transferring their framework from averages across forecasters to the expectation formation process at the individual firm level and estimate a simplified version of their specification using price forecasts and expectation errors:

$$p_{i,t}^{\text{surprise}} = \beta_0 + \beta_1 \text{news}_{i,t} + \nu_{i,t}, \tag{5}$$

where $p_{i,t}^{\text{surprise}}$ is the price expectation error of firm i in quarter t, as defined in Equation (1). The measure of news, denoted as $\text{news}_{i,t}$, is based on firms' price forecast revision, defined as the first difference of their price expectations, $FR_{i,t} = \text{sign}\{E_{i,t}(p_{i,t+1}) - E_{i,t-1}(p_{i,t})\} \in \{-1, 0, 1\}$.[17] To isolate the idiosyncratic news component, I eliminate time-fixed effects from firms' forecast revisions, representing common macro news that affects all firms equally. This is achieved by expressing firms' price forecast revision as the sum of a time-dependent component (μ_t) and the

[17]Hence, firms' price forecast revision, $FR_{i,t}$, is equal to 0 if expectations do not change, equal to 1 for an upward revision (e.g., from no change in $t-1$ to an increase in t), and equal to -1 for a downward revision (e.g., from no change in $t-1$ to decrease in t).

idiosyncratic news component: $FR_{i,t} = \mu_t + \text{news}_{i,t}$.

Under the FIRE hypothesis, β_1 equals zero, as news constitutes part of a company's information set. Departures from this hypothesis are inferred from β_1 being nonzero, and the sign of the coefficient provides information about the nature of the firms' response. A positive β_1 indicates an underreaction to positive news, where the subsequent forecast revision proves insufficient ex-post. Conversely, a negative β_1 signifies an overreaction, where a positive news shock leads to a disproportionately negative forecast error.

I estimate Equation (5) separately for each firm and present the results in Figure 5. The left panel depicts the distribution of the estimates of β_1 based on price surprises across firms. The middle and the right panels exhibit the distributions of these estimates for flexibility-inducing and rigidity-inducing surprises, respectively. The colors indicate if estimates significantly differ from zero at the five percent level (light blue) or not (dark blue).

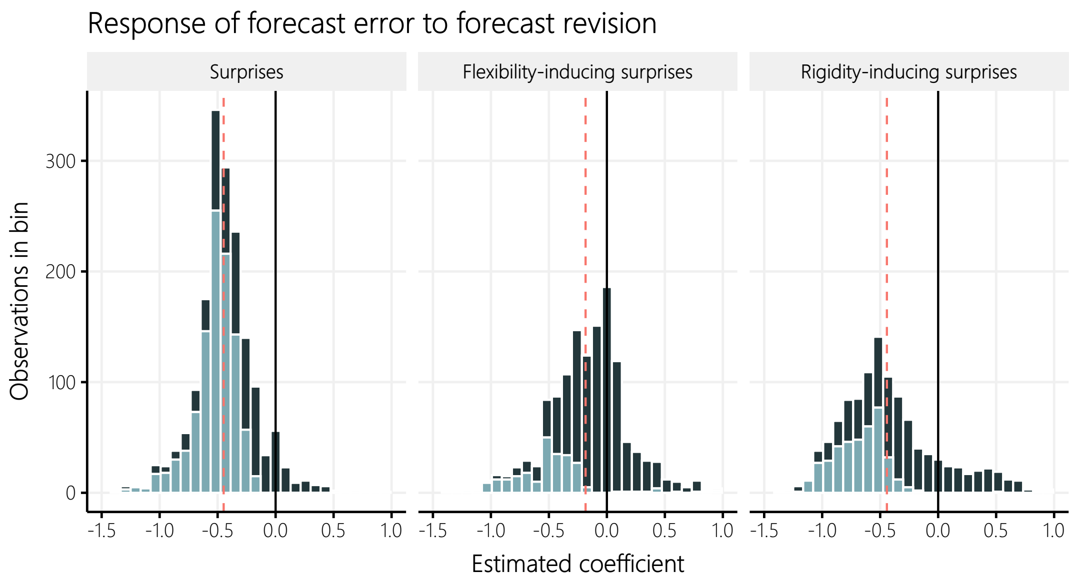

Figure 5: Histograms of estimated β_1-coefficients in firm-level regressions based on Equation (5) for price surprises (in the left panel), flexibility-inducing surprises (in the middle panel), and rigidity-inducing surprises (in the right panel). Coefficients outside of the 1 and 99 percentiles (pooled over all panels) are not shown. The colors indicate if estimates significantly differ from zero at the five percent level (light blue) or not (dark blue). The vertical dotted line indicates the respective mean firm-level coefficient. Positive coefficients indicate an underreaction to news, as firms' forecast revisions prove to be too weak from an ex-post perspective. Negative coefficients indicate an overreaction to news, as firms' forecast revisions are too strong from an ex-post perspective.

Regarding price surprises in the left panel of Figure 5, a distinct pattern emerges. Most β_1 coefficients exhibit significant deviations from zero, underscoring the consistent predictive capacity of news in relation to forecast errors. This contradicts the premise of full-information rational expectations. Notably, these estimates cluster prominently to the left of zero. Most estimates are significantly smaller than zero (represented by light blue bars) with a mean of -0.447. In particular, the news coefficient is negative for all firms for the subset of significant estimates. This result suggests that firms tend to overreact to news. Specifically, an upward revision in price expectations often yields outcomes lower than anticipated.

This overreaction, however, is borne unequally across types of price expectation errors. The distribution of the estimates of β_1 for flexibility-inducing surprises tends to be centered more closely around zero with a mean of -0.186. Although mostly negative, fewer than 19 percent of all estimated coefficients are significant. Conversely, in the case of rigidity-inducing surprises, β_1 estimates exhibit a strong leftward concentration with a mean of -0.442. Up to 36 percent of the estimated coefficients achieve significance. Surprises inducing firms to maintain their prices unexpectedly are more prone to manifest as an overreaction to news than surprises prompting unanticipated price changes.

To dissect the asymmetries in the response of price expectation errors to news, I partition the price forecast revisions into positive and negative values and conduct pooled data regressions to estimate the respective average effects. Throughout all specifications, I account for firm fixed effects and cluster standard errors at the firm level. Table 7 summarizes the main results. As already visible from the distribution of individual estimates in Figure 5, there exists a statistically significant and negative average relationship between firms' price forecast revisions and their corresponding price surprises. Moreover, differentiating between positive and negative forecast revisions unveils an asymmetric influence of forecast revisions on price surprises.

Table 7: Reaction to news

	Surprise		Flexibility-inducing		Rigidity-inducing	
Forecast revisions	-0.445***		-0.236***		-0.566***	
Positive forecast revisions		-0.495***		-0.282***		-0.538***
Negative forecast revisions		-0.393***		-0.193***		-0.595***
Observations	51996	51996	35596	35596	12254	12254
R^2	0.182	0.183	0.051	0.052	0.357	0.357

Notes: This table shows estimated β_1-coefficients from pooled regressions across firms based on Equation (5) for price surprises, flexibility-inducing surprises, and rigidity-inducing surprises. The first row uses a news variable based on all price expectation revisions. The second and third rows show the estimation results when the news variable is split into positive and negative components. All specifications include firm fixed effects. One, two, and three stars (*) correspond to significance at the 10-, 5-, and 1-percent significance levels, respectively.

While the qualitative nature of the variables complicates the interpretation of effect magnitudes, the coefficients allow for a comparative assessment of the relative significance of positive and negative news. Regarding price surprises, the overreaction is marginally more pronounced in response to positive forecast revisions than negative news. Particularly striking is the marked asymmetry observed for flexibility-inducing surprises, where the overreaction in response to positive news surpasses that stemming from negative news by a factor of 1.5. Conversely, the response to rigidity-inducing surprises showcases minimal asymmetry.

The analysis underscores the responsiveness of firm expectations to news. This is in line with recent survey evidence showing that firm-specific information exerts a more potent influence on expectations than information concerning the overall economy (Bordalo et al., 2020a; Born et al., 2023). In particular, Born et al. (2023) rationalize their finding in a general equilibrium model through firms suffering from "island illusion," through which firms underestimate the influence of overall economic conditions on their performance.

4.2 Response of surprises to firm-level factors

This section shifts the focus to exploring firm-level factors and their role in shaping price surprises based on changes in business conditions, as reflected by firms' survey responses. In a first exercise, I examine the information set underlying surprises. In particular, I investigate whether surprises in firms' price plans occur in response to actual changes in their economic environment (i.e., the information set is backward-looking), or in anticipation of forthcoming changes (i.e., the information set is forward-looking).

The information used by companies when setting their prices influences the sluggishness of prices in response to shocks. Companies that rely predominantly on backward-looking information when setting prices may set a price far from optimal if the economic environment changes significantly. Conversely, prices may be set optimally if firms use forward-looking information and include their expectations about future economic conditions in their decision making.

To evaluate the relative significance of backward-looking assessments and forward-looking expectations in determining surprises, I employ an ordered logit model. This model accounts for the qualitative nature of firms' surprises, which are categorical variables. Specifically, using $j = \{-1, 0, 1\}$ to index expectation errors in firms' own prices[18], I estimate

$$\begin{aligned} Pr(p_{i,t}^{\text{type}} = j) &= Pr(\alpha_{j-1} < p_{i,t}^{\text{type},*} \leq \alpha_j) \\ &= F(\alpha_j - X'_{i,t}\beta) - F(\alpha_{j-1} - X'_{i,t}\beta), \end{aligned} \tag{6}$$

where $F(\cdot)$ is the logistic distribution function, $X'_{i,t}$ is the set of explanatory variables that influence firms' price surprises, $p_{i,t}^{\text{type},*}$ is the latent variable, and α_{j-1} and α_j are threshold parameters.

The dependent variable, $p_{i,t}^{\text{type}}$, will be surprises involving all price changes ($p_{i,t}^{\text{surprise}}$), flexibility-inducing surprises ($p_{i,t}^{\text{flexible}}$), and rigidity-inducing surprises ($p_{i,t}^{\text{rigid}}$).

The set of explanatory variables includes three pairs of qualitative variables[19] for which both companies' assessment of changes in the recent past and their expectations of changes in the

[18] Even though firms' price surprises span the integer interval from -2 to 2 (see Equation (1)), revisions rarely reverse the anticipated sign of price changes (as shown in Section 3.5). To discipline the estimations in this section, I, therefore, use the sign of firms' surprises in the regression models, i.e., $p_{i,t}^{\text{surprise}} = \text{sgn}\ p_{i,t}^{\text{surprise}} \in \{-1, 0, 1\}$.

[19] These qualitative variables have three response categories: a negative, a neutral, and a positive response category (see Table A.1 in the appendix for the exact wording and answer options of the questions). For example, firms can indicate whether their incoming orders ($Orders_{i,t}$) have decreased, remained the same, or increased in the last three months.

near future were consistently collected through the KOF business tendency survey: Orders, Production, and Business Situation. Each variable is divided into positive and negative response indicators to account for potential asymmetries.[20]

To account for macroeconomic conditions, I include time-fixed effects. These time dummies capture aggregate shocks that influence price surprises of all firms in the same way in a given quarter. I further control for unobserved heterogeneity between industries through industry-fixed effects (at the NACE Rev. 2 division level), and I control for seasonal effects (by including seasonal dummies for the second, third, and fourth quarters of the year), and changes in the value-added tax (VAT) rate (by including a dummy that is equal to one in the first quarters of 2001, 2011, and 2018). While all of these fixed effects are included in the estimations, they are not shown separately in the regression tables. Standard errors are clustered at the firm level.

Table 8 presents the estimation results.[21] Columns (1) to (3) report the estimates for the models concerning all surprises, Columns (4) to (6) for the models concerning the flexibility-inducing surprises, and Columns (7) to (9) for the models concerning rigidity-inducing surprises. In each of these three blocks, the first column reports the estimates for the models using firms' backward-looking assessments only, the middle column reports the estimates for models using firms' forward-looking expectations only, and the last column reports the estimates of the joint estimations. The table reports all coefficients as relative risk ratios.[22]

Comparing the influence of firms' assessments and expectations shows that surprises are predominantly determined by a backward-looking information set. The coefficients of the backward-looking assessment variables are more often significantly estimated than those of the forward-looking expectations variables (e.g., $Orders$). When both coefficients are estimated significantly in the individual estimations, only the coefficients of the backward-looking variables remain significant in the joint estimates (except for the case where business conditions are expected to worsen).

The dominant effect of the backward-looking information set on the surprises is driven by flexibility-inducing surprises. In these cases, the coefficients of the assessment variables are almost exclusively significant and far outweigh the effects of the expectations in the joint estimation. This indicates that unanticipated price changes are primarily driven by firms' reliance on past conditions rather than their future expectations. A more balanced picture emerges for the surprises inducing rigidity. In those cases, the coefficients of fewer firm-level variables are estimated significantly.

[20] For example, the variable $Orders_{i,t}$ is divided into $Orders^{+}_{i,t}$ and $Orders^{-}_{i,t}$. If the number of incoming orders for firm i has increased in quarter t over the last three months, the variable $Orders^{+}_{i,t}$ is equal to one, and the variable $Orders^{-}_{i,t}$ is equal to zero. If orders have decreased, $Orders^{+}_{i,t}$ is equal to zero, and $Orders^{-}_{i,t}$ is equal to one. If orders have remained the same, both $Orders^{+}_{i,t}$ and $Orders^{-}_{i,t}$ are equal to zero. The same logic applies to the corresponding expectations variables, e.g., $E(Orders)^{+}_{i,t}$ and $E(Orders)^{-}_{i,t}$.

[21] To ease readability, the regression table omits the subscripts of the firm- and quarter-specific regressors.

[22] Relative risk ratios are the exponentiated values of the ordered logit coefficients. Standard errors and other test statistics in the table remain untransformed.

Table 8: Information sets determining surprises

	Dependent variable:								
		$p_{i,t}^{\text{surprise}}$			$p_{i,t}^{\text{flexible}}$			$p_{i,t}^{\text{rigid}}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Orders^{+}	0.931***		0.938***	0.918***		0.902***	0.977		1.000
	(0.020)		(0.021)	(0.027)		(0.029)	(0.036)		(0.037)
E(Orders^{+})		0.978	0.999		0.897***	0.953		1.053	1.034
		(0.026)	(0.027)		(0.036)	(0.036)		(0.046)	(0.046)
Orders^{-}	0.944***		0.956**	0.902***		0.938**	1.018		1.011
	(0.020)		(0.021)	(0.027)		(0.028)	(0.035)		(0.037)
E(Orders^{-})		1.064**	1.045		1.117***	1.047		1.053	1.072
		(0.030)	(0.030)		(0.041)	(0.041)		(0.048)	(0.048)
Production^{+}	1.045**		1.033	1.096***		1.061**	1.078**		1.086**
	(0.021)		(0.022)	(0.028)		(0.030)	(0.036)		(0.038)
E(Production^{+})		1.001	0.984		1.072*	1.008		0.983	0.994
		(0.026)	(0.027)		(0.035)	(0.036)		(0.045)	(0.046)
Production^{-}	0.982		0.989	0.915***		0.930**	1.078**		1.082**
	(0.021)		(0.022)	(0.028)		(0.029)	(0.037)		(0.038)
E(Production^{-})		0.924***	0.969		0.848***	0.972		1.016	0.951
		(0.031)	(0.031)		(0.041)	(0.042)		(0.049)	(0.050)
Situation^{+}	1.134***		1.128***	1.491***		1.455***	0.855***		0.862***
	(0.019)		(0.019)	(0.026)		(0.027)	(0.033)		(0.034)
E(Situation^{+})		1.002	1.014		1.166***	1.212***		0.874***	0.860***
		(0.023)	(0.023)		(0.031)	(0.032)		(0.041)	(0.041)
Situation^{-}	0.845***		0.860***	0.621***		0.647***	1.159***		1.152***
	(0.020)		(0.021)	(0.026)		(0.027)	(0.034)		(0.036)
E(Situation^{-})		0.859***	0.903***		0.561***	0.638***		1.151***	1.097**
		(0.025)	(0.025)		(0.033)	(0.033)		(0.038)	(0.039)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Seasonal dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
VAT dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	47,198	44,441	44,230	35,049	32,920	32,752	11,661	11,065	11,024
Note:							*p<0.1; **p<0.05; ***p<0.01		

Overall, these results echo evidence from a survey in the euro area, suggesting that many firms base their pricing decisions on backward-looking information (Fabiani et al., 2006). For example, in Spain (Alvarez and Hernando, 2005) or Austria (Kwapil et al., 2005), the share of firms that calculate their prices using past and current information is higher than those that use current and future information. More generally, the results add to the growing empirical evidence of information frictions on the part of economic agents, according to which firms in their decision making pay limited attention to future economic conditions (e.g., Andrade et al., 2022).

Having established that price surprises primarily stem from backward-looking information, I now shift the focus to dissecting the firm-level determinants of price expectation errors to better understand the anatomy of surprises. To this end, I build upon the ordered logit model in Equation (6) and estimate it using firms' backward-looking assessments of changes in their business environment from the quarterly KOF survey data. These are the qualitative variables detailed in Table A.1 in the appendix. As in the specifications before, each of these variables is split into two indicators that reflect positive and negative response values, respectively, to account for possible asymmetries. Furthermore, the estimations control for the same time and individual fixed effects.

Table 9 presents the estimation results.[23] Columns (1) to (2) report the estimates for the models concerning all surprises, Columns (3) to (4) for the models concerning the flexibility-inducing surprises, and Columns (5) to (6) for the models concerning rigidity-inducing surprises. In each of these three blocks, the first column reports the estimates for the models using firms' own business conditions as ordinal variables with all three response categories (a negative, a neutral, and a positive), the second column reports the estimates for the models using firms' own business conditions split into two indicator variables that reflect the positive and negative response values separately. The table reports the coefficients of the linear contrasts[24] as relative risk ratios.[25]

The estimation results reveal several insights into the determinants of price surprises. First, they confirm that several aspects of firms' business environment affect firms' price expectation errors significantly. This result resonates with earlier work underscoring the significance of firm-specific information as a determinant of firms' price expectations (e.g., Massenot and Pettinicchi, 2018; Ma et al., 2020; Boneva et al., 2020). However, there are also a few other factors that have little or no effect on price surprises (for example, changes in production or inventory levels of finished products).

[23] To ease readability, the regression table omits the subscripts of the firm- and quarter-specific regressors.

[24] The explanatory variables in the regression model are ordered categorical variables with two (e.g., $Orders^{+}_{i,t}$ or $Orders^{-}_{i,t}$) or three levels (e.g., $Orders_{i,t}$). To represent the relationship between the ordered explanatory variable and the response variable, the regression model uses polynomial contrasts to account for the ordered nature of the regressor, fitting one fewer polynomial function than the number of levels available. Therefore, for the categorical variables with two levels, the model fits a linear polynomial, while for the categorical variables with three levels, it fits both a linear and cubic polynomial. The table includes only the coefficients of the linear contrasts, i.e., the coefficients that represent a linear relationship between the levels of the ordered independent variable and the dependent variable.

[25] Relative risk ratios are the exponentiated values of the ordered logit coefficients. Standard errors and other test statistics in the table remain untransformed.

Table 9: Determinants of surprises

	Dependent variable:					
	Surprise		Flexibility-inducing		Rigidity-inducing	
	$p_{i,t}^{surprise}$	$p_{i,t}^{surprise}$	$p_{i,t}^{flexible}$	$p_{i,t}^{flexible}$	$p_{i,t}^{rigid}$	$p_{i,t}^{rigid}$
	(1)	(2)	(3)	(4)	(5)	(6)
Orders	0.930***		0.915**		0.949	
	(0.027)		(0.037)		(0.047)	
Orders+		0.920***		0.883***		0.982
		(0.025)		(0.035)		(0.044)
Orders−		0.989		0.966		1.036
		(0.025)		(0.034)		(0.044)
Production	0.966		0.982		1.004	
	(0.031)		(0.043)		(0.053)	
Production+		1.037		1.043		1.103**
		(0.026)		(0.036)		(0.044)
Production−		1.074***		1.062*		1.099**
		(0.026)		(0.036)		(0.045)
Finished stock	0.987		0.979		1.015	
	(0.031)		(0.043)		(0.051)	
Finished stock+		0.954*		0.988		0.977
		(0.025)		(0.035)		(0.041)
Finished stock−		0.966		1.010		0.963
		(0.026)		(0.035)		(0.043)
Profit	2.052***		4.497***		1.025	
	(0.036)		(0.052)		(0.056)	
Profit+		1.289***		1.672***		1.108**
		(0.030)		(0.043)		(0.048)
Profit−		0.628***		0.372***		1.081*
		(0.024)		(0.034)		(0.041)
Competition	1.041		1.396***		0.925	
	(0.046)		(0.064)		(0.071)	
Competition+		0.906***		0.954		0.957
		(0.035)		(0.050)		(0.054)
Competition−		0.870***		0.683***		1.035
		(0.033)		(0.043)		(0.050)
Situation	0.966		1.198***		0.786***	
	(0.032)		(0.044)		(0.056)	
Situation+		0.999		1.172***		0.857***
		(0.023)		(0.033)		(0.040)
Situation−		1.034		0.978		1.090*
		(0.027)		(0.035)		(0.045)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Seasonal dummies	Yes	Yes	Yes	Yes	Yes	Yes
VAT dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	31,472	31,472	23,034	23,034	8,085	8,085

Note: *p<0.1; **p<0.05; ***p<0.01

Second, the determinants of flexibility-inducing surprises do not uniformly align with those of rigidity-inducing surprises. Changes in demand (as measured by incoming orders) have an effect on flexibility-inducing but not on rigidity-inducing surprises. Conversely, a deterioration in the overall business situation has an effect on rigidity-inducing surprises but not on flexibility-inducing surprises. Third, the effects of changes in firms' business conditions on surprises can be either positive or negative. Changes in demand and the overall business situation exhibit a negative relationship with surprises, while shifts in profitability or competitive position demonstrate a positive correlation. Fourth, asymmetric effects emerge in certain scenarios. An improvement in the competitive situation has no significant effect on either flexibility-inducing or rigidity-inducing surprises, while a deterioration is negatively related to flexibility-inducing surprises and positively related to rigidity-inducing surprises. Fifth, relative risk ratios exhibit varying magnitudes across firm-level variables. The relative risk ratios are the highest (and lowest) for changes in profitability. However, interpreting the size of these effects on the likelihood of surprises is challenging due to the three-level ordinary scale that follows their definition. A positive correlation between a firm-level factor and surprises can mean that negative surprises become less likely (i.e., instead of a negative surprise, there is no surprise) or that positive surprises become more likely (i.e., instead of no surprise, there is a positive surprise).

To disentangle such countervailing effects, I estimate the regression model based on Equation (6) using a new set of dependent variables comprising the surprises associated with unexpected price increases ($p_{i,t}^{flexible,+}$) and decreases ($p_{i,t}^{flexible,-}$) as well as the surprises associated with forgone price increases ($p_{i,t}^{rigid,+}$) and decreases ($p_{i,t}^{rigid,-}$). Because these dependent variables are binary, the regression model simplifies to a logit model. Apart from that, all specifications remain the same as in the ordered logit model before. Table 10 reports the estimated coefficients as relative risk ratios.

A first glimpse at the estimation results across types of surprises confirms their plausibility. Whenever both coefficients of surprises involving price increases ($p_{i,t}^{flexible,+}$ and $p_{i,t}^{rigid,+}$) or price decreases ($p_{i,t}^{flexible,-}$ and $p_{i,t}^{rigid,-}$) are significant, the coefficients across types of surprises bear opposite signs. This aligns logically with the notion that a surprise driving unexpected price increases (decreases) would not concurrently lead to firms unexpectedly avoiding price decreases (increases).

Investigating the effects of changes in firms' business environment on the likelihood of surprises within types reveals both symmetric and asymmetric impacts. For instance, an asymmetric effect materializes with a good business situation ($state_pos$), wherein firms are 1.092 times more likely to raise prices unexpectedly, while the odds of unexpected price decreases decline by 20.9% under the same circumstances. A similar asymmetry surfaces with improved demand, with the relationship reversed for positive and negative flexibility-inducing surprises. An increase in incoming orders increases the odds of an unexpected price decrease by 13.2%, while the odds of an unexpected price increase is 11.9% lower.

Table 10: Determinants of flexibility-inducing and rigidity-inducing surprises

	Dependent variable:			
	Flexibility-inducing surprises		Rigidity-inducing surprises	
	$p_{i,t}^{flexible,+}$	$p_{i,t}^{flexible,-}$	$p_{i,t}^{rigid,+}$	$p_{i,t}^{rigid,-}$
	(1)	(2)	(3)	(4)
Orders+	0.880**	1.131***	0.960	0.889
	(0.059)	(0.052)	(0.064)	(0.086)
Orders−	0.969	1.078*	0.915	0.976
	(0.066)	(0.050)	(0.067)	(0.089)
Production+	1.202***	1.042	0.921	1.137
	(0.060)	(0.054)	(0.061)	(0.090)
Production−	1.201***	1.037	0.927	1.109
	(0.064)	(0.051)	(0.072)	(0.081)
Finished stock+	1.113*	1.086*	0.896*	1.009
	(0.064)	(0.054)	(0.063)	(0.091)
Finished stock−	1.112*	1.067	0.885**	0.942
	(0.067)	(0.055)	(0.067)	(0.085)
Profit+	2.127***	0.950	0.579***	1.020
	(0.060)	(0.075)	(0.067)	(0.128)
Profit−	1.093	3.393***	1.009	0.353***
	(0.073)	(0.049)	(0.070)	(0.079)
Competition+	1.330***	1.426***	0.930	1.097
	(0.074)	(0.077)	(0.081)	(0.135)
Competition−	1.229**	1.553***	0.970	0.649***
	(0.100)	(0.064)	(0.100)	(0.094)
Situation+	1.097*	0.792***	1.026	0.961
	(0.056)	(0.064)	(0.058)	(0.091)
Situation−	0.977	1.018	0.998	0.967
	(0.084)	(0.054)	(0.084)	(0.082)
Time fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Seasonal dummies	Yes	Yes	Yes	Yes
VAT dummies	Yes	Yes	Yes	Yes
Observations	20,186	21,609	4,834	3,251
Log Likelihood	−4,456.866	−6,747.190	−3,010.315	−1,817.634
Akaike Inf. Crit.	9,139.731	13,720.380	6,246.630	3,861.268
Note:			*p<0.1; **p<0.05; ***p<0.01	

However, symmetric effects are also evident, such as in the case of competition, where improvements and deteriorations in the competitive landscape augment the likelihood of both unexpected price increases and decreases. Notably, odds for price decreases (42.3% for an improvement, 55.3% for a deterioration of the competitive situation) outweigh those for increases (32.8% for an improvement, 24.2% for a deterioration of the competitive situation).

Overall, profitability emerges as a paramount determinant of surprises, underscoring the centrality of cost-based pricing rules in firms' price-setting behavior (Fabiani et al., 2006; Zurlinden, 2007). There is a strong asymmetry. A deterioration in the earnings situation increases the odds of cutting prices unexpectedly by 244%. Conversely, the odds of raising prices unexpectedly increases by 115% when the earnings situation improves. At the same time, the odds of the corresponding rigidity-inducing surprises decrease sharply.

This observation regarding rigidity-inducing surprises generalizes to the effects of all other variables: no firm-level factors induce unexpected price rigidity but only ever lead to more unanticipated price flexibility. Indeed, if we compare the effects of changes in firm-level business conditions (irrespective of whether they are positive or negative) on the likelihood of flexibility-inducing and rigidity-inducing surprises, we find that they increase the odds of flexibility-inducing surprises in most cases. That is, firms react to changes in their business environment with price changes that they had not anticipated in the previous quarter. This is different for rigidity-inducing surprises. No firm-level factors lead firms to unexpectedly forgo price changes that they had planned in the previous quarter. It is worth noting that factors beyond firms' own business conditions may play a role in price rigidity, as evidenced by survey-based evidence highlighting elements like customer relationships, contractual arrangements, and coordination failures (Blinder et al., 1998; Fabiani et al., 2006; Seiler, 2022).

5 Effects of surprises

In this section, I delve into the multifaceted impact of surprises on firms' price-setting behavior ("micro effects") and its broader implications for inflation dynamics ("macro effects"). Section 5.1 delves into how surprises influence firms' pricing decisions and their price expectation formation. Employing a local-projections approach inspired by Jordà (2005), I analyze firms' realized and expected price changes in response to flexibility-inducing and rigidity-inducing surprises. This section provides insight into the temporal patterns of firms' price adjustments and the formation of their price expectations following surprise shocks. Section 5.2 extends the analysis to explore the macroeconomic consequences of surprised-induced price variations. Building on Klenow and Kryvtsov (2008), I examine how surprise dynamics contribute to fluctuations in inflation. I introduce a proxy for inflation based on firms' realized price changes and decompose it into the frequency of anticipated and unanticipated price changes. This section sheds light on the relative importance of these components in driving inflation variations.

By investigating both micro and macro effects, I illuminate the intricate relationship between unexpected price changes, firms' behavior, and inflation dynamics. These findings contribute to a deeper understanding of how surprises impact both individual firms and the broader economy.

5.1 Micro effects of surprises

How do surprises affect firms' price-setting behavior? And what influence do they have on the formation of firms' price expectations? To address these questions, I use local-projections specifications à la Jordà (2005) to trace out the dynamic response of firms' realized and expected price changes to both flexibility-inducing and rigidity-inducing surprises. Specifically, to address the first question, I regress:

$$\sum_{k=0}^{h} \mathbb{I}\{p_{i,t+k}\} = \alpha_{i,h} + \beta_h p_{i,t}^{type} + \sum_{p=1}^{P} \theta_h^p X_{i,t-p} + \varepsilon_{i,t,h}, \tag{7}$$

where $p_{i,t+k}$ represents the pricing decision of firm i at time $t+k$ over the last three months. Since companies provide qualitative assessments of their price changes, $\mathbb{I}\{\cdot\}$ takes values $\{-1, 0, 1\}$ if prices have decreased, remained the same, or increased over the last three months, respectively.

To address the second question and characterize the formation of firms' price expectations following price surprise, I estimate the following modification of Equation (7):

$$\sum_{k=0}^{h} \mathbb{I}\{E_{t+k}^{i} p_{t+k+1}^{i}\} = \alpha_{i,h} + \beta_h p_{i,t}^{type} + \sum_{p=1}^{P} \theta_h^p X_{i,t-p} + \varepsilon_{i,t,h}, \tag{8}$$

where $E_{t+k}^{i} p_{t+k+1}^{i}$ is the pricing expectation of firm i and time $t+k$ and takes values $\{-1, 0, 1\}$ for firm-level prices expected to decrease, stay the same, or increase over the next three months, respectively.

The right-hand side of both Equation (7) and Equation (8) include firm-level surprises in prices, which I distinguish into flexibility-inducing and rigidity-inducing surprises: $p_{i,t}^{type} \in \{p_{i,t}^{flexible}, p_{i,t}^{rigid}\}$. To further uncover potential asymmetries in firms' response to both flexibility-inducing and rigidity-inducing surprises, I estimate Equation (7) and Equation (8) separately for surprises associated with unexpected price increases ($p_{i,t}^{flexible,+}$) and decreases ($p_{i,t}^{flexible,-}$) as well as for surprises associated with forgone price increases ($p_{i,t}^{rigid,+}$) and decreases ($p_{i,t}^{rigid,-}$). In all specifications, I control for firm fixed effects ($\alpha_{i,h}$) and include a matrix of controls ($X_{i,t-p}$). In the baseline specification, I control for three lags ($P = 3$) of the quarterly dependent variable. The standard errors are clustered at the firm level.

Even though the magnitude of the coefficient β_h does not have a direct interpretation due to the qualitative nature of the dependent variables in both Equation (7) and Equation (8), the cumulative summation in the left-hand side of the local-projections specifications can still be interpreted as speaking to the degree to which realized and expected price changes respond to each of the surprises. It captures the share of firms that (expect to) increase, decrease, or leave the dependent variable unchanged.

I begin by characterizing how firms' realized and expected price changes are affected by flexibility-inducing surprises. Figure 6 plots the estimated $\{\beta_h\}$ as a result of the regressions in Equation (7) and Equation (8), where the dependent variables are firms' realized (in the left panel) and expected price changes (in the right panel), respectively. Flexibility-inducing surprises are distinguished into surprises associated with unexpected price increases and decreases.

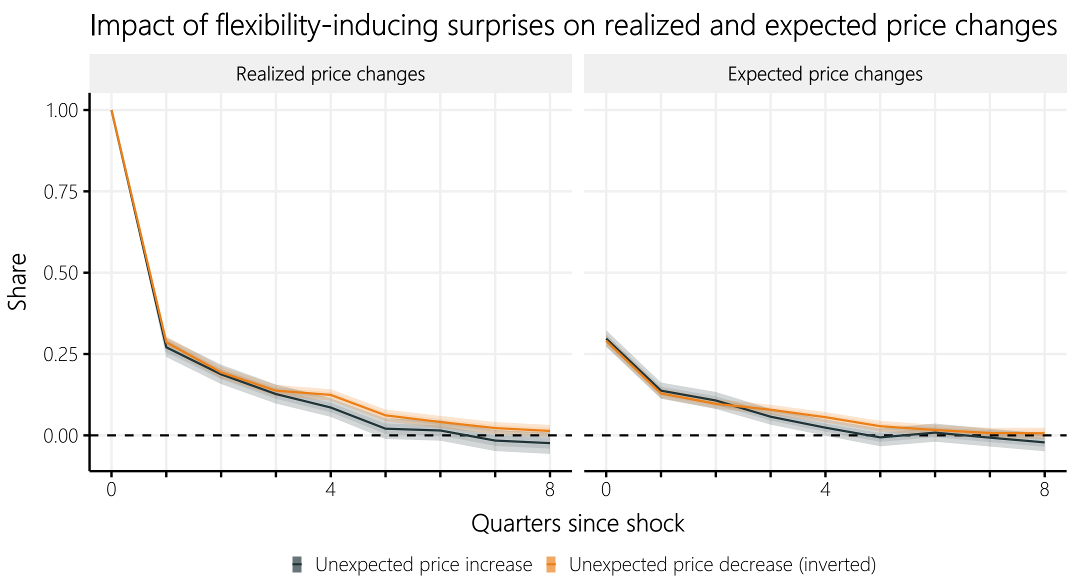

Figure 6: The figure plots the cumulative response of firms' realized (in the left panel) and expected price changes (in the right panel) to flexibility-inducing surprises according to Equation (7) and Equation (8). Flexibility-inducing surprises are distinguished into surprises associated with unexpected price increases ($p_{i,t}^{flexible,+}$) and decreases ($p_{i,t}^{flexible,-}$). The shaded areas show the 68% (dark-shaded area) and 90% confidence intervals (light-shaded area) in each panel. The horizontal axis shows the impulse-response horizon measured in quarters. To ease comparability, the impulse response function for unexpected price decreases has been inverted.

By definition, firms increase (decrease) their prices on the impact of an unexpected price increase (decrease). A flexibility-inducing surprise is followed by a pattern of prices changing even several quarters after the initial shock. Firms' price-setting response slows down gradually, and it does so faster for surprises leading to unexpected price increases than price decreases. After an unexpected price increase, companies tend to raise prices up to four quarters after the initial shock. From the fifth quarter onward, however, the surprise no longer impacts price setting. By contrast, the pricing response to an unexpected price decrease is much more long-lasting. After an unexpected price decrease, companies tend to reduce their prices up to seven quarters after the initial shock. Therefore, surprises that lead to unexpected price increases affect firms' price-setting behavior up to one year after the initial shock, while surprises that lead to unexpected price decreases affect their pricing decisions up to two years after the surprise.

Similar patterns emerge for firms' price expectations, although less pronounced overall. Flexibility-inducing surprises have a significant impact on firms' price expectations. About one-third expect to further increase (decrease) their prices after an unexpected price increase (decrease) on impact. Again, the effect wears off quicker for price increases than price decreases. Unexpected price increases affect expectations to increase prices up to three quarters after the shock. After unexpected price decreases, on the other hand, firms generally expect price reductions up to the fifth quarter after the initial surprise.

Turning to the effect of rigidity-inducing surprises on firms' price setting and price expectation formation, Figure 7 plots the estimated $\{\beta_h\}$ as a result of the regressions in Equation (7) and Equation (8), where now rigidity-inducing surprises are distinguished into surprises associated with refrained price increases and decreases.

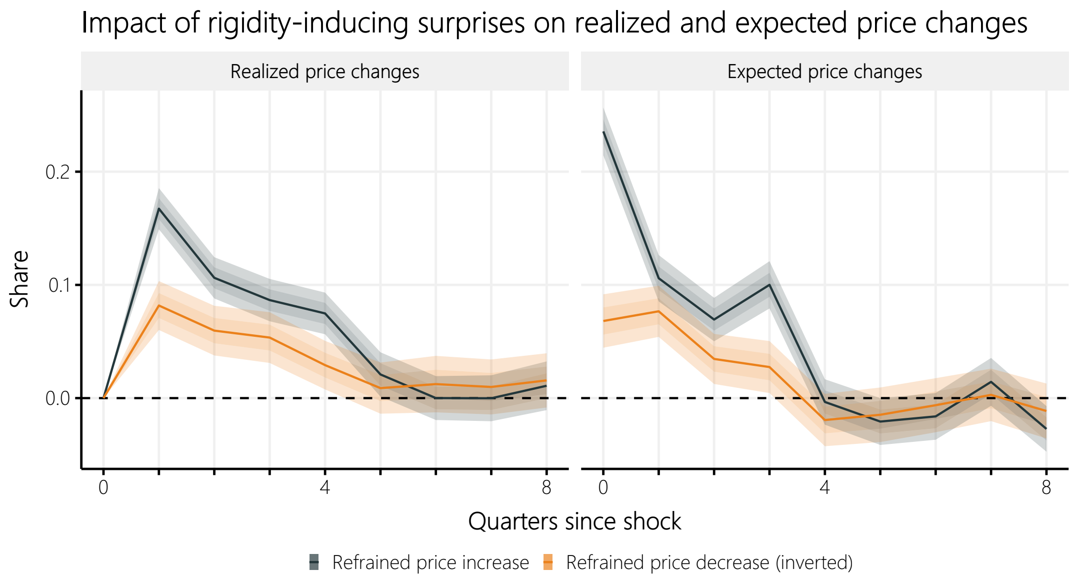

Figure 7: The figure plots the cumulative response of firms' realized (in the left panel) and expected price changes (in the right panel) to rigidity-inducing surprises according to Equation (7) and Equation (8). Rigidity-inducing surprises are distinguished into surprises associated with forgone price increases ($p_{i,t}^{rigid,+}$) and decreases ($p_{i,t}^{rigid,-}$). The shaded areas show the 68% (dark-shaded area) and 90% confidence intervals (light-shaded area) in each panel. The horizontal axis shows the impulse-response horizon measured in quarters. To ease comparability, the impulse response function for unexpected price decreases has been inverted.

By definition, firms do not change their prices on the impact of rigidity-inducing surprise. When hit by a surprise that makes them refrain from raising prices unexpectedly, 17 percent of companies make up for the price increase in the following quarter. This compares to only 8 percent of companies that decrease their prices in the following quarter after being hit by a surprise that makes them refrain from decreasing their prices unexpectedly. Overall, unexpectedly omitted price increases are more likely to be made up than unexpectedly omitted price reductions. Firms' price-setting response then slows down gradually, and it does so faster for surprises that make firms refrain from price decreases than price increases. After they refrained from price decreases unexpectedly, companies tend to decrease prices up to one year after the initial shock. By contrast, after they refrained from price increases unexpectedly, companies tend to increase prices up to five quarters after the initial shock.

Turning to the response of firms' price expectations following a rigidity-inducing surprise, the right panel of Figure 7 shows that, on average, 23 percent of companies expect to raise their prices in the next three months after unexpectedly foregoing a price increase in the previous quarter. This compares to only 7 percent of companies that expect to decrease their prices in the next quarter after unexpectedly foregoing a price reduction in the previous one. Overall, the effect of unexpectedly omitted price increases on firms' price expectations is larger than the effect of unexpectedly omitted price decreases. In both cases, however, the response slows down at a similar pace and wears off one year after the initial shock.

5.2 Macro effects of surprises

In this last exercise, I examine how variation in surprises over time contributes to inflation variation, following the approach of Klenow and Kryvtsov (2008). Using CPI microdata, they decompose inflation into the frequency and size of price changes and analyze the contributions of these extensive and intensive margins of price adjustment to inflation dynamics. In the absence of the intensive margin of price adjustments, I apply their approach to the qualitative survey data at hand by approximating inflation using the balance statistic of firms' realized price changes over the last three months,

$$\pi_{i,t} \approx \hat{\pi}_{i,t} = f^{+}_{i,t} - f^{-}_{i,t}, \tag{9}$$

which is equal to the percentage of firms in industry i (at the NACE Rev. 2 group level) that increased their prices in quarter t minus the percentage of firms that decreased their prices. Indeed, this proxy shows a strong positive correlation with PPI inflation in manufacturing in Switzerland, see Figure C.1 in the appendix. The Spearman rank correlation between the two series is 0.78.

Using the information on firms' expected price changes from the survey data, I further decompose the frequencies of price increases and decreases in Equation (9) into:

$$\begin{aligned}\hat{\pi}_{i,t} &= (f_{i,t}^{+|E(+)} + f_{i,t}^{+|E(0)} + f_{i,t}^{+|E(-)}) - (f_{i,t}^{-|E(+)} + f_{i,t}^{-|E(0)} + f_{i,t}^{-|E(-)}) \\ &= \underbrace{f_{i,t}^{+|E(+)} - f_{i,t}^{-|E(-)}}_{\text{correct forecast}} + \underbrace{f_{i,t}^{+|E(0)} + f_{i,t}^{+|E(-)} - (f_{i,t}^{-|E(+)} + f_{i,t}^{-|E(0)})}_{\text{flexibility-inducing surprise}}\end{aligned} \tag{10}$$

where $f_{i,t}^{+|E(+)}$ is the percentage of firms that expected to increase prices in the previous quarter $t-1$ and effectively increased them in quarter t, $f_{i,t}^{+|E(0)}$ is the percentage of firms that expected to leave their prices unchanged but increased them, and $f_{i,t}^{+|E(-)}$ is the percentage of firms that expected to decrease their prices but increased them. The same is true for the frequencies of price decreases: $f_{i,t}^{-|E(+)}$, $f_{i,t}^{-|E(0)}$, and $f_{i,t}^{-|E(-)}$.

Rearranging terms reveals that the proxy for inflation consists of two components: the frequency of anticipated price changes (i.e., correct forecasts of firms' own price decisions), and the frequency of unanticipated price changes (i.e., the frequency of flexibility-inducing surprises). Using this decomposition, I construct two counterfactual estimates of inflation to assess the contributions of the frequency of anticipated and unanticipated price changes to variations in inflation. The two estimates differ in that I allow either the frequency of anticipated or unanticipated price changes to vary over time while holding the other constant at its industry-specific mean. The frequency-related inflation rate, holding the frequency of surprises constant, is:

$$\hat{\pi}_{i,t}^{\overline{surprise}} = (f_{i,t}^{+|E(+)} + f_{\cdot,t}^{+|E(0)} + f_{\cdot,t}^{+|E(-)}) - (f_{\cdot,t}^{-|E(+)} + f_{\cdot,t}^{-|E(0)} + f_{i,t}^{-|E(-)}) \tag{11}$$

All variation in $\hat{\pi}_{i,t}^{\overline{surprise}}$ is due to variation in the frequencies of anticipated price changes. Similarly, holding the frequency of anticipated price changes constant, the surprise-related inflation rate is:

$$\hat{\pi}_{i,t}^{\overline{f}} = (f_{\cdot,t}^{+|E(+)} + f_{i,t}^{+|E(0)} + f_{i,t}^{+|E(-)}) - (f_{\cdot,t}^{-|E(+)} + f_{i,t}^{-|E(0)} + f_{i,t}^{-|E(-)}) \tag{12}$$

All variation in $\hat{\pi}_{i,t}^{\overline{f}}$ is due to variation in the frequency of unanticipated price changes.

I can calculate the correlation between the balance statistic for each industry, as in Equation (9), and the two counterfactual estimates. Figure 8 plots the distribution of these correlations at the industry level. Both counterfactual estimates strongly highly correlate with the balance statistic as a proxy for inflation, suggesting that, in general, time variation in the frequency of price increases and the frequency of price decreases are strong drivers of time variation in inflation. This result is broadly consistent with the literature emphasizing the greater importance of variation in the frequency (extensive margin) versus the size of price changes (intensive margin) as a driver of inflation variation over time in CPI microdata, for example, in Switzerland (Rudolf and Seiler, 2022), Norway (Wulfsberg, 2016), or the euro area (Gautier et al., 2022).

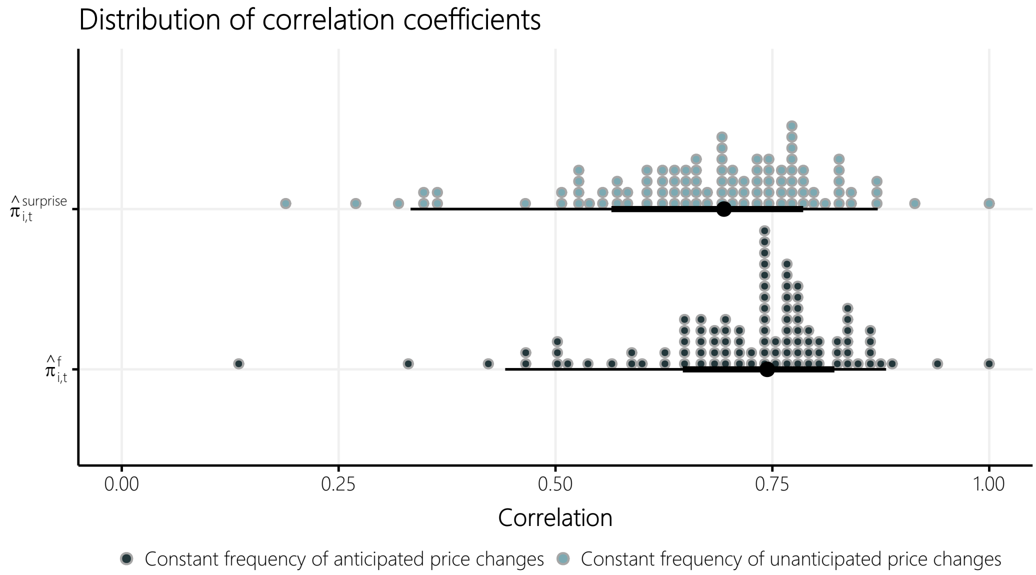

Figure 8: This figure plots the distribution of correlation coefficients between the balance statistics, as in Equation (9), and counterfactual estimates of inflation, as in Equation (11) and Equation (12). These correlation coefficients are calculated at the industry level (NACE Rev. 2 groups) using more than 100 industries.

However, the main finding of this exercise pertains to the distinction between the relative contribution of the frequency of anticipated and unanticipated price changes to inflation variation. It turns out that the balance statistic is more strongly correlated with counterfactual inflation assuming constant frequency (the average correlation coefficient is 0.720) than with counterfactual inflation assuming constant surprises (correlation coefficient of 0.673). Therefore, fluctuations in inflation over time are more strongly driven by the variation in the frequency of unanticipated price changes, i.e., the frequency of flexibility-inducing surprises.

6 Conclusion

This paper has delved into the determinants of firms' price expectation errors and their far-reaching implications for both price setting and inflation dynamics. Price surprises, encompassing the ex-post forecast errors of firms' price decisions, shed light on the nuanced interplay between firms' expectations, their decision making, and inflation dynamics.

The paper introduced the distinction between flexibility-inducing and rigidity-inducing surprises, acknowledging the distinct nature of these surprises in shaping pricing decisions. The examination of survey data from Swiss manufacturing firms has uncovered significant frequencies and cyclicality in price surprises, with flexibility-inducing surprises dominating the landscape. The prevalence of such surprises underscored the substantial role of unanticipated price adjustments in firms' price-setting behavior.

By demonstrating that surprises exhibit responsiveness to both news and firm-specific information, the analysis challenged the assumptions underlying the full-information rational expectations hypothesis. This deviation from rational expectations hints at the influence of information frictions and the intricate cognitive processes shaping firms' expectation formation.

Finally, the paper studies both the micro and macro effects of surprises. At the micro level, firms' pricing decisions react significantly to flexibility-inducing shocks, with an intriguing asymmetry in persistence. Conversely, rigidity-inducing surprises led to compensatory adjustments, particularly for omitted price increases. At the macro level, the frequency of flexibility-inducing surprises emerged as a stronger driver of inflation variations than the frequency of anticipated price changes. Taken together, these findings contribute to a deeper understanding of how surprises impact both individual decisions and the broader economy, and illuminate the intricate relationship between firms' expectations, their decision making, and inflation dynamics.

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Appendix

Surprises in Prices: Facts, Determinants, and Effects

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In this appendix, I present additional figures, tables and analyses that are not featured in the main body of the paper. The appendices refer to the corresponding sections in the main text.

A Data

This appendix refers to Section 2 in the main body of the paper and presents additional figures, tables, and analyses that are not featured in the main text.

Figure A.1 presents histograms of firm-level average realized price changes (in the left panel) and expected price changes (in the right panel). The vertcial dotted lines indicate the respective median firm-level averages. Firms' average price changes are small and close to zero. The median price change is -0.03. Firms' average expected price changes are small and close to zero, too. The median expected price change is 0.04.

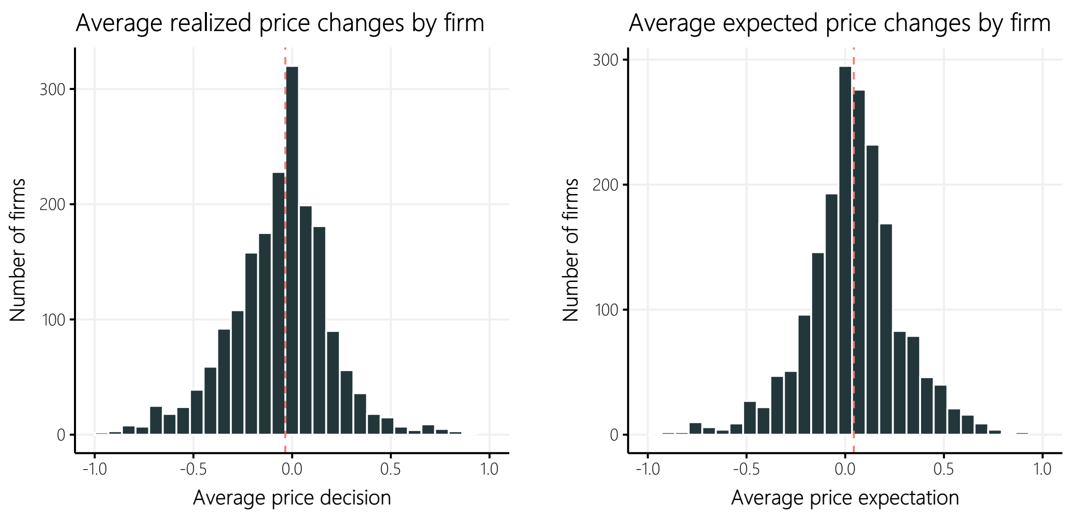

Figure A.1: Histograms of firm-level average realized price changes (in the left panel) and expected price changes (in the right panel). The vertical dotted lines indicate the respective median firm-level averages.

Table A.1 lists the translated[26] questions relevant to the empirical analysis and their corresponding response categories. It further shows the frequency with which the questions are asked and the periods for which data are available.

B Stylized facts about price surprises

This appendix refers to Section 3 in the main body of the paper and presents additional figures, tables, and analyses that are not featured in the main text.

Table B.1 shows median unconditional expectation errors across types of surprises and for various firm classification schemes: firm size, sector, and export orientation. Within groups, firm-level

[26] The survey is conducted with companies from all parts of Switzerland. Consequently, the questionnaire has German, French, and Italian versions. In addition, some participants fill out an English questionnaire.

Table A.1: Relevant questions from the KOF business tendency survey in the Swiss manufacturing sector

Variable	Question	Response categories			Frequency	Availability
$p_{i,t}$	In the last 3 months[a], our sales prices (in Swiss francs) have …	increased	remained the same	decreased	quarterly	1999/II–2023/III
$E_{i,t-1}(p_{i,t})$	In the next 3 months[b], we expect our sales prices (in Swiss francs) to …	increase	remain the same	decrease	quarterly	1999/II–2023/III
Orders	In the last 3 months[c,d], incoming orders have …	increased	remained the same	decreased	monthly[c,d] & quarterly	1999/II–2023/III
E(Orders)	In the next 3 months, we expect incoming orders to …	increase	remain the same	decrease	quarterly	1999/II–2023/III
Production	In the last 3 months[c,d], production has …	increased	remained the same	decreased	monthly[c,d] & quarterly	1999/II–2023/III
E(Production)	In the next 3 months, we expect production to …	increase	remain the same	decrease	quarterly	1999/II–2023/III
Finished stock	In the last 3 months[c,d], finished products inventory has …	increased	remained the same	decreased	monthly[c,d] & quarterly	1999/II–2023/III
Profit	In the last 3 months[a], our profitability has …	improved	remained the same	deteriorated	quarterly	1999/II–2023/III
Competition	In the last 3 months[e], our domestic competitive position has …	improved	not changed	decreased	quarterly	1999/II–2023/III
Situation	We assess our current overall business situation as …	good	satisfactory	poor	monthly[d]	2004/I–2023/III
E(Situation)	In the next 6 months[f], we expect our business situation to …	improve	remain the same	get worse	quarterly	1999/II–2023/III

Notes: This table provides the most recent wording of the relevant questions from the KOF business tendency survey in the Swiss manufacturing sector with the corresponding response categories. It further shows the frequency with which the questions were asked and the quarters for which data are available. When answering, firms are explicitly asked to ignore seasonal fluctuations.
[a]: From 1999/II to 2003/IV, the assessment was made in comparison to the previous quarter ("In the last 3 months compared to the previous quarter, …"). From 2004/I onward, the previous quarter was no longer used as a reference point.
[b]: From 1999/II to 2003/IV, the time frame was not specified ("In the next few months, we expect …"). From 2004/I onward, the time frame was specified as "in the next 3 months."
[c]: From 1999/II to 2018/IV, these questions were asked monthly and referred to the last month ("In the last month compared to the previous month, …"). From 2019/I onward, they were also asked quarterly.
[d]: I transform the monthly statements to a quarterly frequency by taking the mode response of the respective quarter. If there are multiple modes, I take the most recent monthly response as the quarterly statement.
[e]: From 1999/II to 2003/IV, the time frame was not specified ("In the recent past, …"). From 2004/I onward, the time frame was specified as "in the last 3 months." [f]: From 1999/II to 2003/IV, the time frame was specified over the next quarter ("In the next three months, …"). From 2004/I onward, the time frame was specified as "in the next 6 months."

average forecast errors are computed by regressing a firm's expectation error on a constant. The table verifies that firms' average price expectation errors are small and a substantial share of it – around 80 percent – does not differ significantly from zero.

Table B.1: Median unconditional expectation error across firm classifications

Group by	Group	Surprise n	Surprise Median	Surprise % insig.	Flex-inducing n	Flex-inducing Median	Flex-inducing % insig.	Rigid-inducing n	Rigid-inducing Median	Rigid-inducing % insig.
Overall		1894	-0.091	78.4	1579	-0.077	74.1	1404	-0.125	79.7
Firm size	L	322	-0.096	79.5	280	-0.089	72.5	252	-0.086	77.8
	M	872	-0.097	76.8	723	-0.083	71.8	669	-0.154	79.1
	S	700	-0.083	79.7	576	-0.065	77.8	483	-0.100	81.6
Sector	CA	142	-0.063	85.2	113	-0.036	85.0	117	-0.143	84.6
	CB	81	-0.085	77.8	65	-0.086	75.4	65	-0.000	73.8
	CC	339	-0.143	69.6	303	-0.167	57.4	259	-0.100	76.1
	CG	216	-0.103	70.8	178	-0.074	73.6	166	-0.072	78.3
	CH	362	-0.083	80.9	301	-0.067	73.4	255	-0.125	80.4
	CI	189	-0.049	87.3	151	-0.049	80.1	126	-0.069	82.5
	CJ	104	-0.100	77.9	86	-0.091	80.2	76	0.000	82.9
	CK	248	-0.105	77.8	209	-0.088	75.6	186	-0.134	82.3
	CL	26	-0.083	96.2	17	-0.067	94.1	12	-0.036	100.0
	CM	130	-0.093	78.5	108	-0.067	75.9	91	-0.200	69.2
	CN	106	-0.061	84.9	90	-0.040	86.7	86	-0.167	84.9
Export	1	833	-0.103	74.3	679	-0.095	70.4	605	-0.143	77.2
	2	305	-0.100	77.4	260	-0.055	78.1	228	-0.167	78.9
	3	214	-0.078	80.8	181	-0.071	79.6	169	-0.143	79.9
	4	481	-0.077	83.0	411	-0.077	74.5	366	-0.000	83.1

Notes: This table shows median unconditional expectation errors across types of surprises and for various firm classification schemes such as firm size (S: fewer than 50 employees; M: 50-249 employees; L: 250 or more employees), sector, and export orientation (1: 0-4% export share; 2: 5-33% export share; 3: 34-66% export share, 4: 67-100% export share). Within groups, firm-level average forecast errors are computed by regressing a firm's expectation error on a constant. "n" indicates the number of firms per group. "% insig." denotes the share of firms whose estimates differ significantly from zero at the five percent significance level. Sectors are defined as follows: CA: Manufacture of food products, beverages and tobacco products; CB: Manufacture of textiles, wearing apparel and leather products; CC: Manufacture of wood and paper products, and printing; CG: Manufacture of rubber and plastics products, and other non-metallic mineral products; CH Manufacture of basic metals and fabricated metal products, except machinery and equipment; CI: Manufacture of computer, electronic and optical products; CJ: Manufacture of electrical equipment; CK: Manufacture of machinery and equipment n.e.c.; CL: Manufacture of transport equipment; CM: Manufacture of furniture; other manufacturing; repair and installation of machinery and equipment; CN: Manufacture of coke and refined petroleum products, chemicals and chemical products, basic pharmaceutical products and pharmaceutical preparations.

Table B.2 regresses the frequency of (expected) price changes on recession dummies and shows that the frequency of (expected) price decreases is significantly higher in recessions (26.0 percent) than in normal times (16 percent). The top panel of the table shows regression coefficients for all price changes. The bottom panel distinguishes the regression coefficients for positive and negative price changes. The frequency captures the share of firms changing its prices a in a given quarter.

The Markov transition matrices in Table B.3 show transition probabilities pooled over the sample from 2021/I–2023/III, representing a period of increased inflation in Switzerland. The transition matrices delineate the transition probabilities between the price expectations formulated in the previous quarter and the realized price decision in the current quarter. The matrix in panel (a) is a left stochastic matrix where each column sums to one. It shows the probabilities for each expectation response category to lead to a given price decision. The matrix in panel (b) is a

Table B.2: Cyclicality of price changes

	Frequency of price changes all	positive	negative	Frequency of expected price changes all	positive	negative
Non-recession mean	0.27***			0.26***		
Recession dummy	0.05			0.02		
Non-recession mean		0.11***	0.16***		0.16***	0.10***
Recession dummy		-0.05	0.10***		-0.08*	0.10***

Notes: This table reports estimation results from regressing a recession dummy on the frequency of (expected) price changes. The top panel of the table shows regression coefficients for all price changes. The bottom panel distinguishes the regression coefficients for positive and negative price changes. The frequency captures the share of firms changing its prices a in a given quarter. The recession dummy identifies two consecutive quarters of negative GDP growth as a recession. The intercept gives the non-recession mean of the respective series. One, two, and three stars (*) correspond to significance at the 10-, 5-, and 1-percent significance levels, respectively.

right stochastic matrix where each row sums to one. It shows the probabilities for each decision response category to be preceded by a given price expectation.

Table B.3: Markov transition matrices

(a) Left stochastic matrix

		$p_{i,t}$ 1	0	-1
$E_{i,t-1}(p_{i,t})$	1	0.695	0.226	0.127
	0	0.291	0.733	0.502
	-1	0.014	0.041	0.371

(b) Right stochastic matrix

		$p_{i,t}$ 1	0	-1
$E_{i,t-1}(p_{i,t})$	1	0.645	0.339	0.016
	0	0.188	0.767	0.044
	-1	0.108	0.505	0.386

Notes: Markov transition matrices show the transition probabilities between the price expectations formulated in the previous quarter and the realized price decision in the current quarter. The matrix in panel (a) is a left stochastic matrix where each column sums to one. It shows the probabilities for each expectation response category to lead to a given price decision. The matrix in panel (b) is a right stochastic matrix where each row sums to one. It shows the probabilities for each decision response category to be preceded by a given price expectation. The transition probabilities are pooled over the sample from 2021/I–2023/III.

C Effects of surprises

This appendix refers to Section 5 in the main body of the paper and presents additional figures, tables, and analyses that are not featured in the main text.

Figure C.1 compares PPI inflation (quarter-on-quarter and year-on-year) from the manufacturing sector in Switzerland with the balance statistics calculated as in Equation (9) using the KOF survey data. The survey balance statistics shows a strong positive correlation with PPI inflation: the Spearman rank correlation is 0.57 (with quarter-on-quarter inflation) and 0.78 (with year-on-year inflation).

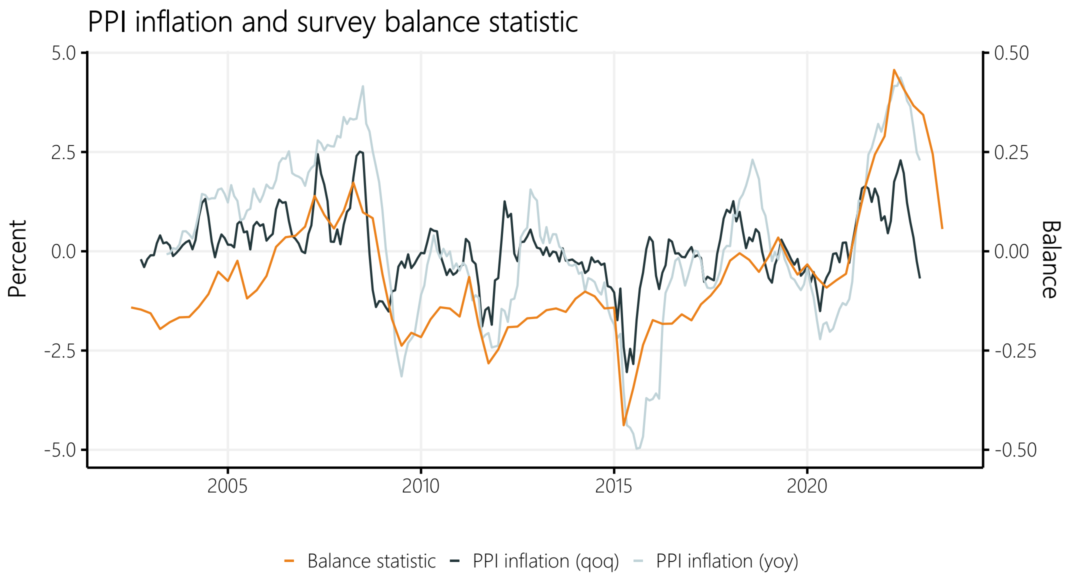

Figure C.1: Comparison of PPI inflation and survey balance statistic. PPI inflations are from the manufacturing sector in Switzerland and calculated quarter-on-quarter and year-on-year. The survey balance statistic is calculated as in Equation (9) using the KOF survey data.