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FIRM-LEVEL UNCERTAINTY AND INVESTMENTS: EVIDENCE FROM SOUTH TYROL

by Andrea Locatelli*, Luciano Partacini** and Nicola Riz**

Abstract

In this paper we introduce a novel measure of uncertainty defined at the micro-level as firms' inability to forecast the evolution of own revenues in the current or subsequent year. In order to do so, we exploit newly-available survey data collected by the Chamber of commerce of Bolzano-Bozen for the period 2014–23. Uncertainty is higher among small firms, operating in construction and manufacturing, and whose legal form is that of a sole proprietorship. Looking at the evolution of uncertainty over time, we find a significant increase in the share of uncertain firms in 2021, which persisted (though to a lesser extent) through the most recent available year, 2023. The overall increase was highest among small firms and among sole proprietorships. We finally analyze the link between firm-level uncertainty and investment behavior: the probability of a firm increasing their own investments is 3.6 percentage points lower among uncertain firms compared with the remaining firms (the average share is just above 20 per cent).

JEL Classification: D22, D92, E22.

Keywords: uncertainty, investments, Covid-19.

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1 Introduction¹

Uncertainty stands as a crucial determinant in shaping the behavior of firms. The onset of the Covid-19 pandemic in early 2020 presented unparalleled challenges to businesses worldwide, causing disruptions in global supply chains, altering market conditions, and ushering in an era of unprecedented uncertainty. In response to the escalating public health crisis, the Italian government implemented a series of stringent measures, including closures and restrictions on national and international mobility. These measures, encompassing lockdowns, travel restrictions, and social distancing mandates, were pivotal in mitigating the spread of the virus but simultaneously engendered considerable economic uncertainty. To compound these challenges, the Russian invasion of Ukraine in 2022 introduced geopolitical tensions that reverberated through international relations, trade dynamics, and financial markets, leading to the recent inflationary shock, further heightening the levels of uncertainty faced by businesses. Since 2023, the Israel-Hamas war and the Red Sea crisis have led to a further extension of the period of uncertainty, lasting up to the present day.

In a context characterized by several consecutive shocks, following a prolonged period of stability, economic agents have experienced growing difficulties in managing their activity and in planning their streams of capital accumulation, facing uncertainty about both future macroeconomic and microeconomic outcomes. In fact, not only was the entire economy hit by the shocks and the corresponding policies enacted by national and local authorities, but also firms may have experienced various degrees of idiosyncratic uncertainty depending on individual characteristics (e.g., size and sector of economic activity). While the literature has mainly focused on macroeconomic uncertainty, following the seminal paper of Bloom (2009), in this paper we focus on micro-level uncertainty, and study which firms were mostly affected, to extent of the rise following recent shocks, and how this has, in turn, influenced firms' decision-making processes with a special focus on investments.

To this aim, we exploit a novel dataset collected by the Institute for economic research (IER) of the Chamber of Commerce of Bolzano-Bozen. We initiate our investigation by analyzing the evolution of the proportion of firms *unable* to respond to basic qualitative inquiries regarding the growth of their revenues. This, serving as our proposed measure of uncertainty, is then systematically correlated with firms' decision, particularly emphasizing investments. The potential enduring consequences of these decisions for economic growth, in the region under consideration but also in the entire economy, underscore the significance of our research work.

Overall, the results of our analysis suggest that uncertainty is higher among firms of smaller size and with the legal form of the sole proprietorship, active in construction and in manufacturing. Looking at the evolution of uncertainty over time, we find a significant increase in the share of uncertain firms in 2021, which persisted (although of smaller magnitude) through the most recent available year, 2023. The overall increase was highest among firms of smaller size and among those with the legal form of a sole proprietorship.

¹We are very grateful to the Chamber of commerce of Bolzano-Bozen for granting access to anonymized data from their surveys and to Ulrich Becker for invaluable assistance. Michele Cascarano, Filippo Scoccianti, Francesco David, Roberto Torrini, Silvia Spadafora and seminar participants at the Bank of Italy provided helpful comments and suggestions. All remaining errors are our own. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Bank of Italy.

Analyzing the link between firm-level uncertainty and investment behavior, we find that the probability of a firm increasing their own investments was 3.6 percentage points lower among uncertain firms compared to the remaining firms, given an average share just above 20 per cent.

The paper is organized as follows: section 2 presents a review of the relevant literature, and section 3 describes the database at hand for this work. In section 4 we present our data analysis, and section 5 concludes.

2 Literature review

The literature has long studied firms' uncertainty about future economic outcomes proposing different alternative measures. Bloom (2014) and, more recently, Rossi (2020) provide an overview of the state of the art in measuring uncertainty. First, uncertainty on specific outcomes may be elicited from appropriately-designed surveys asking respondents to report the probability distributions over the future evolution of that variable of interest; in case of simpler surveys, where respondents report only central values of the future distribution of interest, the variance (or disagreement) of collected answers may be analyzed instead to quantify uncertainty. A second way to quantify uncertainty was adopted e.g. by Leahy and Whited (1996), Bloom, Bond and Van Reenen (2007) and Bloom (2009), who resorted to various measures of volatility of actual firms' outcomes (e.g. dispersion of sales growth or stock returns). Third, news-based uncertainty indexes may be built based on the counts of uncertainty-related press articles, in the belief that journalists refer to uncertainty more often at times of higher uncertainty.

Each of these three classes has its own advantages and disadvantages. Surveys may help researchers go straight to entrepreneurs' or managers' uncertainty on a desired outcome, but suitable probabilistic surveys are only rarely available.² To the contrary, one may be more interested in a pervasive condition of uncertainty in which firms (or other agents) operate, and may find text-base algorithms more attractive. In fact, as highlighted by Rossi (2020), this is still a field of continuous innovation, and we mean to contribute to the literature with yet a novel measure of firm-level uncertainty, which may be particularly relevant at times of prolonged uncertainty.

The recent *Handbook of Economic Expectations* edited by Ruediger Bachmann, Topa and Klaauw (2022) presents a broad overview on the collection, study and use of expectations data in economics, as well as on modelling of expectations formation and updating. As highlighted by Enders, Hünnekes and Müller (2022), firm expectations are a key determinant of actual outcomes: firm expectations about future production significantly impact current production and pricing decisions³, and play a key role in shaping firms' investment decisions.⁴ The literature has focused in particular on the implication on capital accumu-

²The growth of the literature on firm-level uncertainty based on survey measures was hindered by inherent data limitations. Few examples include the work of Rüdiger Bachmann, Elstner and Sims (2013) and Rüdiger Bachmann, Elstner and Hristov (2017) on German data, of Alfaro, Bloom and Lin (2024) on US data, and of Guiso and Parigi (1999) and Bontempi, Golinelli and Parigi (2010) on Italy.

³This also holds for expectations that turn out to be incorrect from an ex-post point of view.

⁴Pindyck (1991) pointed out that firms' investments are largely irreversible and can be delayed, allowing firms to wait for the realization of updated information about the market conditions before committing resources.

lation, finding a negative uncertainty-investment relationship, starting from the work of Leahy and Whited (1996) and Bloom, Bond and Van Reenen (2007) who found a negative relationship between uncertainty (measured in terms of realized stock return volatility) and business investment. A similar results was found by Stein and Stone (2013) using the option price, Gulen and Ion (2016) using an index of future policy uncertainty.

Focusing on the Italian economy, Guiso and Parigi (1999) and Bontempi, Golinelli and Parigi (2010) worked on the Invind survey, i.e. the survey of industrial and service firms conducted yearly by the Bank of Italy. Guiso and Parigi (1999) examine how uncertainty affects investment decisions in Italian manufacturing firms, finding that higher uncertainty –measured based on the subjective probability distribution of future demand for firms’ products– reduces investment responsiveness to demand, with stronger effects for firms with irreversible investments or significant market power, independent of liquidity constraints. Bontempi, Golinelli and Parigi (2010) further considered role of growing competition faced by Italian firms between mid 1990s and mid 2000s, along with the increasing flexibility of labour input, finding a weaker negative effect of uncertainty on investment decisions in that context.

More recently, Fiori and Scoccianti (2023) resorted to the Invind survey to measure subjective firm-level uncertainty and quantify its effects on several financial variables. From a methodological point of view, the authors exploit both expectations over the average, the minimum, and the maximum one-year-ahead sales growth rates elicited in the Invind survey, and the full probability distribution of expected sales available in 2005 and 2017 waves of the Invind survey. Starting from managers’ expectations about future sales they construct a measure of subjective firm-level uncertainty, further distinguishing between downward and upward uncertainty. They show that uncertainty depends upon firms’ characteristics (e.g., age, size and sector of economic activity) and that it tends to last for several years. Further, they find that higher firm-level uncertainty has a negative effect on firms’ outcomes only if it is driven by its downside component, leading to a contemporaneous reduction in hours worked and capacity utilization, to cash hoarding for a few periods and to lower capital accumulation in subsequent periods.

2.1 Use of *don’t know* (DK) answers.

Forecasting their own variables is potentially hard for firms, and perhaps even harder than forecasting the aggregate economy (Bloom, Kawakubo et al. 2021). As a result, firms participating in a survey may simply report that they *do not know* how a certain individual outcome will evolve over time, if such an option is included in the set of possible answers.

To the best of our knowledge, this measure of uncertainty has not been studied in economics. However, this response behavior received some attention in fields other than economics. In psychology, Glucksberg and McCloskey (1981) studied the decision-making process of respondents choosing a DK answer and the speed of their choice, depending on the different settings and the ability to recover relevant memories. In political science, Mondak and Davis (2001) debated how much citizen know about politics, and how the inclusion of a DK option may reduce perceived knowledge; Luskin and Bullock (2011) concluded that the different was quite minor.

More relevant examples for our work can be found in the medical literature, that tries to characterize people responding DK, who may be targeted by appropriate knowledge-

enhancing campaigns. Waters et al. (2013) study perceived risk of cancer, and examine the prevalence of DK answers in different surveys and characteristics of respondents, finding that DK answers were generally more common among disadvantaged respondents, with lower educational attainments; they conclude that studying DK responding may help reduce health disparities of disadvantaged social groups. Similarly, Hay et al. (2015) find that DK response are less likely among respondents with greater knowledge of cancer prevention and screening, and with higher levels of numeracy, and conclude that health behavior research could benefit from the inclusion of data on DK responses to risk perception questions, to identify individuals requiring information campaigns.

Along these lines, we make a first attempt to analyze DK answers from a business survey. In this work, we call “uncertain” those firms which do not know how their sales will evolve in a certain year (current or following). Since the wording of the survey does not allow us to distinguish between uncertain respondents and those unwilling to reply to a specific question, to limit the extent of the latter case we restricted the analysis to firms participating in all five waves of the year (more details in Section 3) and we excluded respondents providing a DK answer in the last wave of the year (when information about the previous year is complete). Differently from other measures of uncertainty mentioned earlier in this review, this measure is outcome-specific, we are dealing with uncertainty on the evolution of firms’ own revenues. In fact, uncertainty could be measured based on DK answers also for different outcomes elicited in the survey, e.g., investments and profitability (although with some difference in the wording of the survey questions). Here we focus on revenues as the most relevant outcome to firms; as a comparison, we present also some evidence on profitability-related uncertainty.

With this work we aim to contribute to the economic literature with a *description* of the characteristics of firms which display the highest degrees of uncertainty, and with some evidence on firms’ *response* to uncertainty, particularly in the most recent years. Having a measure of uncertainty observed several times during each year, and focusing on different waves in turn, our results may help policy makers in early identification of firms’ mostly affected by uncertainty in case of future crises, in order to target policies to the most vulnerable subjects.

3 Data

The analysis is based on survey data collected by the Institute for economic research (IER) of the Chamber of commerce of Bolzano-Bozen between 2014 and 2024. Firms are interviewed three times per year (around February, June, and October) and are asked to provide qualitative judgements about the evolution of their economic activity in terms of revenues, profitability, investments, selling prices, and employment. Survey questions in February of year t refer to years $t - 1$ and t ; in June they refer to the current year t ; in October they refer to years t and $t + 1$. As a result, five observations ($\tau = 1,2,3,4,5$) are available for each variable X_{it}^τ for every firm-year pair i,t .

Each time, firms are asked qualitative questions, to which they may respond that they report or expect any outcome variable to increase, stay the same or decrease with respect to the previous year. This type of questions has long been used in firm surveys (Born et al. 2023). Not only may such qualitative format help increase the return rate of the survey but it may also increase the chances that senior management answers the questionnaires

(Glynn 1969; Rosewell 1987). On top of this, questions about both expectations and actual outcomes can be asked at the same time. Results from these surveys can be very informative: aggregated answers in terms of balances of positive vs. negative answers, in fact, tend to have a high predictive value for sector-wide and national economic developments (Trebing and Fenske 2018; Lehmann 2023).

The survey covers a panel of about 3,000 firms with “persons employed”⁵. In order to be highly representative of the local economy, the sample is stratified based on industry and firm size in terms of number of persons employed, active in all main sectors of economic activity⁶. Each wave of the survey concludes when at least 1,800 questionnaires have been completed.⁷ Restricting the analysis to industrial and service firms, the number observations is around 1,700 per year and this figure is fairly stable over time (tables 1–2).

“Don’t know” *answers*. – Notwithstanding the short length of the survey (equivalent to two columns on one single page), the availability of both main official languages spoken in the province of Bolzano-Bozen (i.e., Italian and German), and the qualitative nature of the questions, some respondents are unable to answer certain questions; in order to address this issue, an option is provided to allow firms to report that they “don’t know” (DK) how to answer a specific question regarding, e.g., the current or future evolution of their revenues or investments. No other option is provided to reply that the firms is unwilling to respond to a specific question. This makes it impossible to distinguish in a clear-cut fashion between firms unwilling or unable to respond to a question, given participation to the survey. As a result, we acknowledge that we cannot separate between unwillingness and inability to respond to a question. However, given participation in the survey, we deem more likely that firms are unable rather than unwilling to provide this information. To limit the extent of unwillingness, we limit the analysis that follows to firms participating in all waves of a year, excluding those that are always uncertain about the variation of their revenues (i.e., responding “don’t know” in all waves) or uncertain about the past (i.e., responding “don’t know” in the last wave).

Table 3 reports the share of firms providing a DK answer to the question on the evolution of their revenues. We call these firms “uncertain”. We focus on the question on revenues, which we regard as the most relevant to the firm. Table 4 restricts the sample to firms participating to all surveys in a given year. Table 5 further excludes firms replying DK in the last wave of the survey, conducted at the beginning of a year with reference to

⁵The IER adopts a definition of firm-level employment based on the [Eurostat’s Glossary](#), according to which: the number of “persons employed” is defined, within the context of structural business statistics, as the total number of persons who work in the observation unit (inclusive of working proprietors, partners working regularly in the unit and unpaid family workers), as well as persons who work outside the unit who belong to it and are paid by it (e.g. sales representatives, delivery personnel, repair and maintenance teams). It excludes manpower supplied to the unit by other enterprises, persons carrying out repair and maintenance work in the enquiry unit on behalf of other enterprises, as well as those on compulsory military service.

⁶Agricultural and forestry companies are excluded from the survey sample. The agricultural sector is represented by fruit, wine, and dairy cooperatives. The following sectors are also excluded: fishing, extractive industries, some transportation support activities, financial holdings, real estate leasing agencies, education, healthcare, and social services.

⁷Interviews are conducted using a mixed methodology (online, over the phone, or by mail, depending on the company’s preferences). Companies in the sample are contacted through their chosen method and invited to respond to the questionnaire. The data collected in this manner is consolidated on a single survey platform (IdSurvey). To maximize the response rate, companies that do not respond are contacted again through various means.

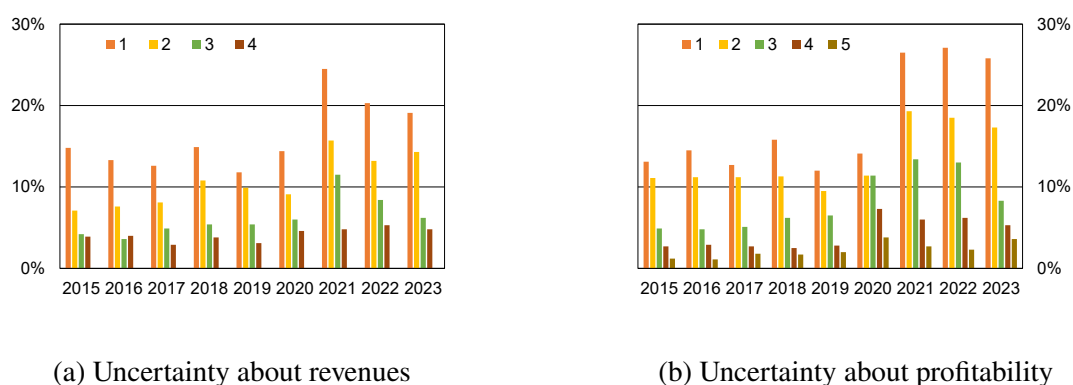


Figure 1: Share of firms uncertain about the evolution of their own revenues (panel a) and about the judgement of their own profitability (panel b) for each reference year (2015–2023) and observation (1–5).

Note: observation 1 data referring to year t are collected in October of year $t-1$; obs. 2-4 data referring to year t are collected in February, July and October of year t ; obs. 5 data referring to year t are collected in February of year $t+1$. Sub-sample participating in all waves of a year, excluding firms that are always uncertain about the variation of their revenues (i.e., responding “don’t know” in all waves) or uncertain about the past (i.e., responding “don’t know” in the last wave). The last wave is omitted in panel (a) because the share is equal to nil by construction.

the previous year. The first panel of Figure 1, analogous to table 5, represents the share of uncertain firms by year and wave, showing a progressive decline in the share of DK answers over the year (restricted to be equal to nil in the last observation when actual outcomes are known to the firm) with fairly similar values between 2015–2020. In 2020 firms became rapidly aware that their revenues would have declined, so our measure of uncertainty does not grow in that year. In the most recent years (2021–2023) instead the figure highlights a marked increase in firms uncertainty about the evolution of own revenues; the share of uncertain firms, much higher in the first few observations of those years compared to the pre-pandemic average, reverts to values in line with the historical average in the last (fourth) observation of each year.

In addition to revenues, another key outcome of the survey at hand regards firms’ profitability.⁸ Table 6 reports the share of firms uncertain about their profitability among the same subset of firms as table 5. The second panel of figure 1 reports these same values. The evolution of uncertainty about own profitability is similar to that observed for revenues on average, although with some differences at the micro level. In mid 2020, few months after the outbreak of Covid-19, while firms did not become more uncertain about the evolution of their own revenues, they displayed growing uncertainty about their profitability, as lower incomes were accompanied by lower costs at times of forced closures, as well as public measures to support firms at those hard times. In this work we focus on the measure of uncertainty which is more clearly defined in the questionnaire and that is the most relevant to firms, i.e., their own revenues.⁹

⁸For this outcome, firms are asked to judge their profitability as either good, satisfactory or unsatisfactory.

⁹We conducted the following check on the quality of the data on the evolution of revenues. For a subset of firms, mainly cooperative societies and incorporated firms, it is possible to link the dataset of the Chamber of commerce to the corresponding balance sheet data from Cerved archives. This allows us to

Summary statistics. – Before proceeding with the data analysis presented in Section 4, Table 8 provides summary statistics on the firms participating in the surveys, based on the available data. The share of respondents choosing the German version of the questionnaire is about three quarters, reflecting the share of the German-speaking population in the province of Bolzano-Bozen (about two thirds). About one quarter of the firms are active in manufacturing, one out of ten in construction and the remaining two thirds in various services, in line with the composition of the local economy (predominantly based on services¹⁰). The structure of survey allows us to reach a large number of very small firms (below 10 and even below 3 persons employed), which characterize both the local economy and the country as a whole. About 40 percent of the firms are corporations, one quarter partnerships and one quarter sole proprietorships.

This table shows that the composition of the sample varies moderately along some of these dimensions. Notice that the sample is restricted under the conditions set out for table 5, in line with the analysis presented in the rest of the paper, which excludes (typically smaller, less structured) firms that do not participate in all waves of a year and those still uncertain at the last available observation; this leaves us with a higher share of larger firms and corporations in the most recent years, making it particularly relevant to control for firm-level characteristics in the analysis.¹¹

Table 9 presents summary statistics on the two outcome variables considered in this work, i.e., revenues and profitability (under the same sample restrictions of the previous table). Throughout the entire period, with the notable exception of 2020 when the Covid-19 pandemic hit the economy, the share of firms declaring increasing revenues with respect to the previous year exceeded the share declaring a decline, in with the sustained growth of the local economy observed over the past 15 years. Coherently, the share of firms judging their own profitability as either satisfactory or good was at very high levels (exceeding 80 percent) throughout the sample period (except for 2020).

Validation of the uncertainty measure. – To conclude this section, we provide some evidence in support of our definition of uncertainty. In particular we exploit quantitative data on use of firms' productive capacity to see if uncertain firms display more volatility.¹² We therefore compare the standard deviation of this variable between uncertain firms and the remaining companies, both measuring uncertainty at the first observation of the year (first two bars of figure 2) and throughout the year (last two bars in the figure). In both cases, uncertain firms display a higher dispersion in this measure of capacity utilization, providing some evidence in support of our definition of uncertainty.

compare their declared evolution of revenues (growth/stability/decline) to the observed variation (table 7). Overall, answers to the survey correspond to the actual evolution in revenues observed in balance sheet data. In 2020, in coincidence with the outbreak of the Covid-19 pandemic, firms appear to have provided more pessimistic replies in the survey compared to actual outcomes, often pointing to stable/lower revenues also when an increase can be observed in the data, and to lower revenues in case of actual stability.

¹⁰According to the most recent Istat data, manufacturing and construction contribute about about one quarter of local value added (18 percent and 7 percent each), with services contributing more than 70 percent of total.

¹¹In the analysis we do this by means of a set of either firm-level controls or firm-level fixed effects.

¹²This information is available only for industry and construction firms.

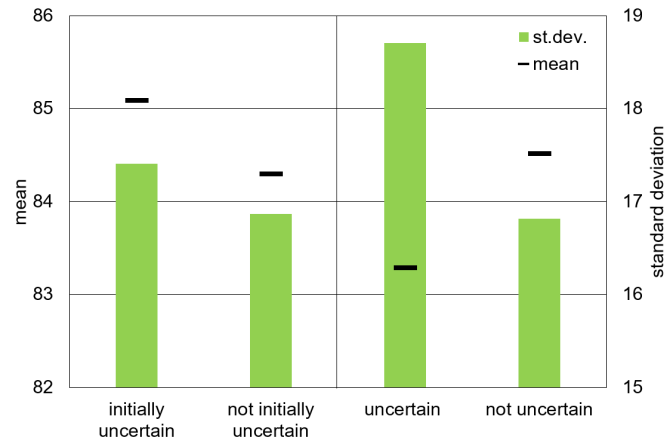


Figure 2: Summary statistics on the use of firms' own productive capacity.

Note: sample restricted to firms participating in all five waves of the reference year are included. Firms uncertain for the entire period and all those still uncertain in February of t+1 are omitted. Data is available only for industry and construction firms.

4 Analysis

4.1 Characteristics of uncertain firms

Firms in South Tyrol may communicate with the public administration in either Italian or German. In the data, about three quarters of questionnaires were completed in German. The degree of uncertainty is heterogeneous across firms that choose either language to participate in the survey, with German respondents displaying a lower share of DK answers compared to the Italian counterpart (6.7 and 9.4 per cent, respectively; table 10). In addition to that, the survey covers several types of business entities, including sole proprietorships, cooperative societies, incorporated firms and partnerships. Pooling all observations together, sole proprietorships, incorporated firms and partnerships represent approximately one third of the sample each, with but a handful of cooperative societies. As may be expected, sole proprietorships tend to display higher levels of uncertainty compared to partnerships and especially with respect to incorporated firms (9.6, 7.6 and 5.4 per cent, respectively; table 11). This may reflect their smaller size. The share of large firms reportedly unaware of the evolution of own revenues is significantly lower than that computed for smaller firms, throughout the entire period of observations (table 12). This holds true both pooling together all observations of a reference year (panel a) and focusing on the first observation of each year (panel b) which is characterized by the highest levels of uncertainty. In both cases, the share of uncertain firms with 50 persons employed or more is less than one third of that displayed by firms with less than 10 persons employed. Heterogeneity along the firm size distribution may reflect actual differences in the degree of uncertainty between firms of different size, but also different availability of skills and competencies, typically more advanced and sophisticated in larger firms. Experience (in terms of firm age)¹³ does not seem to help firm reduce their perceived uncertainty. Among

¹³We do not find evidence of declining uncertainty among older firms (table 13). However data on firm age suffers from data quality issues; we therefore do not devote much attention to this information.

aggregate sectors, the share of uncertain firms is lower in services (6.8 per cent) compared to manufacturing (8.1) and construction companies (9.6).

The availability of a firm-level panel dataset allows us to take all characteristic into account (controlling at the same time for the reference year of each survey at the time at which it was conducted) to identify the most significant features of uncertain firms. Table 14 presents the estimated coefficients from the following linear probability model (LPM)

$$Uncertain_{i,t}^{obs=\tau} = \beta \mathbf{X}_{it} + \gamma_t + \gamma_\tau + \varepsilon_{it} \quad (1)$$

where the probability of firm i being uncertain in year t at observation $\tau = 1, \dots, 5$ is a function of firm-level observable characteristics \mathbf{X}_{it} and two sets of year and observation fixed effects.

Overall, results confirm that *ceteris paribus* uncertainty is higher among firms taking part to the survey in Italian, of smaller size, active in manufacturing and –particularly– in construction compared to services, and with the legal form of the sole proprietorship. These results are in line with those of Fiori and Scoccianti (2023) pointing to lower uncertainty among larger firms.

4.2 Evolution of uncertainty

As pointed out in section 3, firm-level uncertainty about the evolution of own revenues raised markedly between 2021–2023 after a prolonged period of stability. The availability of firm-level micro data allows us to study the evolution of uncertainty among firms controlling for firm-specific fixed effects (i.e., time invariant characteristics of each firm). The estimated equation is the following LPM

$$Uncertain_{i,t}^{obs=\tau} = \gamma_t + \gamma_\tau + \eta_i + \beta German_{it} + \varepsilon_{it} \quad (2)$$

where a binary variable for firm i 's uncertainty at time t is regressed on a set of year fixed effects γ_t , observation fixed effects γ_τ , firm-level time-invariant fixed effects η_i and a binary variable $German_{it}$ capturing changes in the language chosen for each survey.

Estimates presented in table 15 show a fairly stable level of uncertainty among firms between 2016 and 2020, controlling for individual level unchanging characteristics, with an increase of 7.4pp in 2021, down to about 4.5pp in both 2022 and 2023. Among different business types, the increase observed in 2021 among corporations (6.3pp) was about 2pp smaller than among sole proprietorships and partnerships (about 8.5pp); in the two following years it declined to close to 4pp among corporate firms and to close to 3pp for partnerships, while remaining above 5pp among sole proprietorships (fig. 3a).

In 2021 uncertainty rose for firms of all sizes, with the sharpest increase among micro firms (close to 10pp among those with 1-3 persons employed) and the lowest among those with at least 50 persons employed (around 3 pp; figure 3b and table 16). In 2022 and 2023 a significant increase in uncertainty could be detected only among small and medium firms (below 10 persons employed in 2022 and below 20 persons employed in 2023).

To complete the picture, table 17 replicates the analysis distinguishing between manufacturing, construction and service firms. Manufacturing firms started experiencing a rise in uncertainty back in 2020 (before the other sectors), while the increase spread to the entire economy in the following year. While manufacturing and services firms experienced

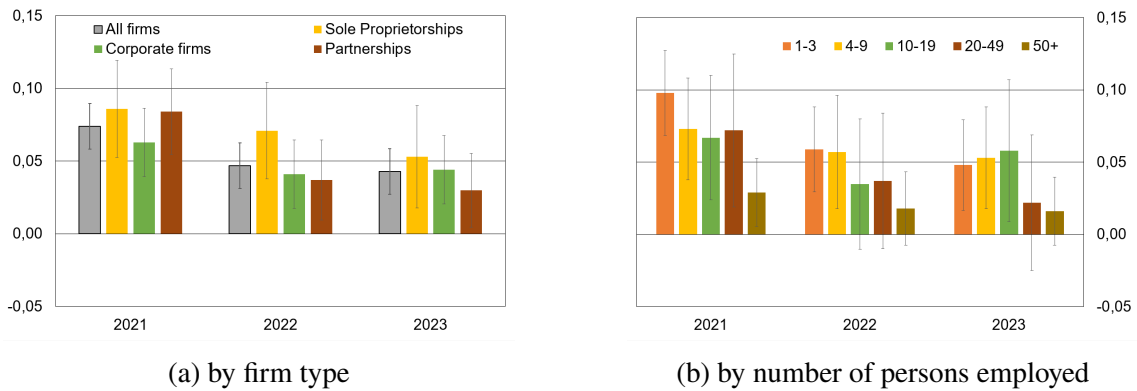


Figure 3: Estimated increase in the share of uncertain firms in years 2021–2023 compared to year 2015, along with 95 percent confidence intervals.

a moderate decline in uncertainty in the following two years, construction companies reverted to pre-pandemic levels in 2022 and displayed but a modest increase in 2023.

Evolution of uncertainty within years. – As pointed out in figure 1, uncertainty about the evolution of revenues in any given year tends to decline during the year. However little is known about the evolution of uncertainty about firms’ own revenues, i.e., the path followed by firms’ responses after an initial statement of uncertainty. To address this issue, table 18 reports the share of firms answering either increase, stable, decrease or DK, among those that were uncertain at the beginning of each reference year t , i.e., in October of year $t - 1$. In order to observe the evolution of answers over time, the sample is restricted to firms participating in all waves of a year, excluding those uncertain through the last observation.

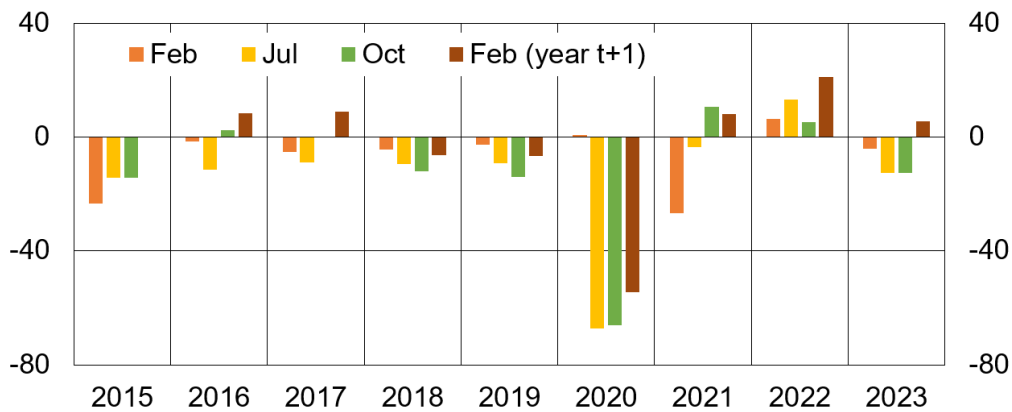


Figure 4: Percentage difference between the share of initially-uncertain firms reporting an increase vis-à-vis a decrease in revenues, in subsequent observations of each year.

Note: sample restricted to firms uncertain about the evolution of their revenues in year t when interviewed in October of year $t-1$; only firms participating in all five waves of the reference year are included. Firms uncertain for the entire period and all those still uncertain in February of $t+1$ are omitted.

The last column of table 18 further reports the balance between the share of firms

declaring an increase vis-à-vis a decrease in own revenues, also shown in figure 4. Between 2015–2019, initially-uncertain firms tended to report a decline in revenues in subsequent waves of the survey, to finally distribute quite evenly between revenue growth and decline. In 2020, uncertain firms rapidly learnt that they would observe a decline in revenues in that year, and the percentage difference between the share of initially-uncertain firms reporting an increase vis-à-vis a decrease in revenues exceeded -50 percentage points (pp) through the fifth observation recorded in February of the following year. At the beginning of 2021 uncertainty rose sharply: at the end of the year, uncertain firms were broadly evenly distributed between the possible answers (about one third reported either a revenues growth/stability/decline; table 18). The pattern observed in 2023, the most recent year, is quite similar to that observed up until 2019.

In order to further characterize initially uncertain firms, we further present two tables that report the share of firms reporting a revenue growth, stability or decline at the end of the year, among a “control” group defined as either all firms (not only those that were initially uncertain; table 19) or the subset of firms that were not initially uncertain about the evolution of own revenues (table 20). The two tables are fairly similar and show that initially uncertain firms display, at the end of the year, both a slightly lower share of “stable” answers in every year (by few percentage points, about -3pp) and a lower proportion of “higher” answers (i.e., revenue growth, about -5pp on average, with ample variation between close to nil in 2020 and over -10pp in 2018 and 2021).

4.3 Persistence of uncertainty

In order to fully characterize the measure of uncertainty we propose in this paper, in this section we look at the persistence of uncertainty among firms. In particular we ask whether uncertain firms tend to remain so from year to year.

We bring to the data this simple AR(λ) model

$$Uncertain_{i,t}^{obs=1} = \gamma_0 + \sum_{\lambda=1,2,\dots} \gamma_{\lambda} Uncertain_{i,t-\lambda}^{obs=1} + \varepsilon_{it} \quad (3)$$

where $Uncertain_{i,t-\lambda}^{obs=1}$ is a binary variable equal to 1 if firm i is uncertain about the evolution of own revenues in (the first observation of) year $t - \lambda$ and 0 otherwise. In this section we focus on the initial observation of each year, when the highest levels of uncertainty are observed; this is also the time of the year when firms plan investments for the year ahead, which is relevant for the analysis presented in the section 4.4.

Table 21 reports the estimates of Γ in equation 3 for values of $\lambda = 1, 2, \dots, 7$. Evidence from table 21 suggests that uncertainty is a highly persistence process, i.e., firms that are uncertain (at the beginning of) a year tend to be uncertain for several years (about 5 years, on average). This evidence is common to both small and large firms, with the different legal forms available in the dataset.¹⁴

A limitation of this exercise lies in the fact that the data does not allow us to distinguish between persistence due to either one single source of uncertainty or to the several shocks observed in recent years. This could be investigated in extensions of this work.

¹⁴Estimates are available from the authors upon request.

4.4 Uncertainty and investment behavior

In this section we investigate the link between our measure of micro-level uncertainty and firms' investment decisions, and we analyze how this changed over time, paying special attention to what occurred after 2020, i.e. after the onset of the pandemic, the Russian invasion of Ukraine and the inflationary shock that followed.¹⁵

For this analysis we attribute, to each year t , the *initial* measure of uncertainty, elicited in the last few months of year $t - 1$, when firms establish a budget for the following year's investments, and the *actual* evolution of investment reported in the most recent survey, i.e., in the so-called "retrospective survey", conducted in the first months of year $t + 1$.

On average, just above one fifth of the firms declare an increase in investments in the period of analysis (figure 5). The share of firms increasing their investments displayed a moderate decline up to 2019 and dropped more severely in 2020, to later revert to the values observed before the pandemic. The share of uncertain firms reporting an increase in investments is about 5pp lower than for the rest of the sample.

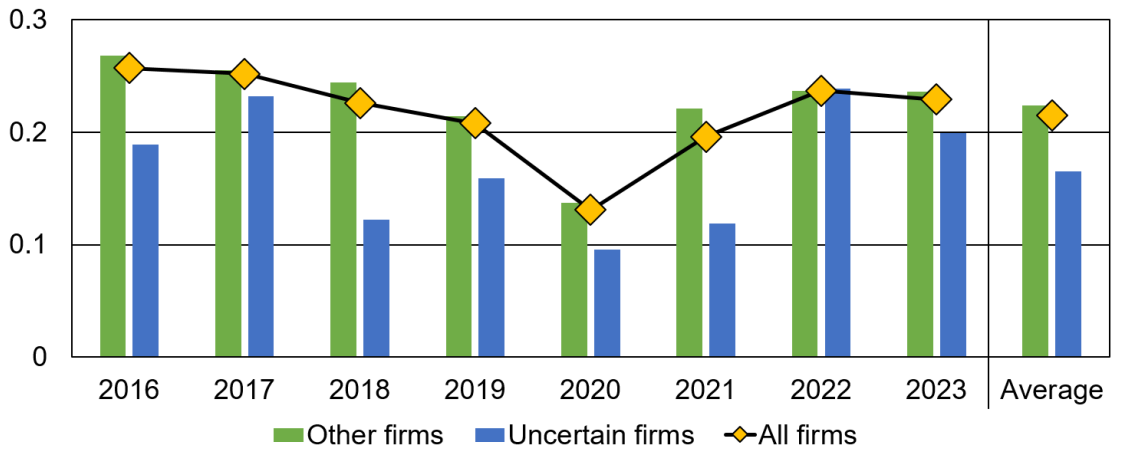


Figure 5: Share of firms increasing own investments by year.

Note: for this analysis we attribute, to each year t , the *initial* measure of uncertainty, elicited in the last few months of year $t - 1$, when firms establish a budget for the following year's investments, and the *actual* evolution of investment reported in the most recent survey, i.e., in the so-called "retrospective survey", conducted in the first months of year $t + 1$. Sub-sample as in Table 5.

To estimate the size of the difference between the two shares controlling for time-invariant firm-level characteristics, we bring to the data the following LPM

$$\mathbf{1}(I_i^t > I_i^{t-1}) = \beta_0 + \beta_1 \text{Uncertain}_{i,t}^{obs=1} + \eta_i + \gamma_t + \varepsilon_{it} \quad (4)$$

where $\mathbf{1}(I_i^t > I_i^{t-1})$ is an indicator variable equal to 1 if firm i increases investments at year t with respect to year $t - 1$, and η_i and γ_t are two sets of year- and firm-level fixed effects. Uncertainty on the evolution of revenues in year t is proxied by the binary variable

¹⁵Given the measure of uncertainty adopted in this work, which may vary from year to year and –within the same year– from wave to wave, we focus on a one-year horizon even though uncertainty may well influence long-term investment plans. However, this exercise fall outside the scope of this analysis and the question remains open for future research.

$Uncertain_{i,t}^{obs=1}$, measured at the end of year $t - 1$, i.e., at the first observation for year t , when uncertainty on outcomes in t is highest. Estimates of equation (4) suggest that, on average, controlling for year- and firm-level fixed effects, the probability of increasing firms' own investments is 3.6pp lower among uncertain firms compared to the remaining firms (model 3 in table 22).

Incorporating financial constraints or liquidity issues in the models of firm-level uncertainty may enrich the exercise presented in this Section, as their omission could potentially lead to biased estimates.¹⁶ However, data limitations do not allow for the inclusion of these variables in the analysis. Future research with more comprehensive data could address these limitations and provide a more nuanced understanding of the determinants of firm-level investment under uncertainty.

One may also be concerned that firms' current economic activity may simultaneously determine their uncertainty and investment behavior, leading to omitted variable bias. To address this issue, table 23 reports estimates of model 3 in table 22 (model 1), adding controls for firms' judgment on their revenues and profitability in the previous year (models 2–3) and in the current year (models 4–5), and pooling all controls in model 6. In these specifications, $Y_{i,t}^{obs=5}$ represents firm i 's judgment on own revenues on year t and $\Pi_{i,t}^{obs=5}$ captures firm i 's judgment on own profitability on year t ; both measures refer to the latest observation available for the year. Estimates suggest that although current firms' performance plays an important role in determining firms' investment decisions (with worse performance associated to lower capital accumulation), estimates of coefficient β_1 remain roughly unchanged and significant, confirming the main result presented in model 3 of table 22, i.e., that the probability of increasing firms' own investments is about 3.6pp lower among uncertain firms compared to the remaining firms.

We finally study the evolution of the estimated differential after the outbreak of the Covid-19 pandemic by means of equation (5)

$$\mathbf{1}(I_i^t > I_i^{t-1}) = \beta_0 + \beta_1 Uncertain_{i,t}^{obs=1} + \beta_2 Uncertain_{i,t}^{obs=1} \times Since2021 + \eta_i + \gamma_t + \varepsilon_{it} \quad (5)$$

which includes an interaction between the uncertainty dummy and a binary variable *Since2021*, equal to 1 for years 2021–2023 and to 0 for previous years.

The gap in the probability to increase investments remains above 3 percentage points and we cannot detect a difference between the two periods (the estimate of coefficient β_2 is close to nil and not statistically significant; model 4 in table 22). As a robustness check, we estimate the same regression replacing *Since2021* with *Since2020*, a binary variable equal to 1 for years 2020–2023 and to 0 for previous years; results remain basically unchanged (model 5 in table 22).

¹⁶Financial constraints limit a firm's ability to invest in new projects, innovate, or expand, thereby affecting its growth trajectory and risk profile. Firms facing liquidity issues might prioritize short-term solvency over long-term investments, skewing the observed relationship between uncertainty and investment behavior.

5 Conclusions

In this paper we introduce a novel measure of uncertainty defined at the micro-level as firms' inability to forecast the evolution of own revenues in the current or subsequent year. In order to do so, we exploit newly-available survey data collected by the IER of the Chamber of commerce of Bolzano-Bozen for the period 2014–2023.

We first analyze the characteristics of the most uncertain firms in South Tyrol, and find that uncertainty is higher among firms of smaller size, active in manufacturing and –particularly– in construction compared to services, and with the legal form of the sole proprietorship.

We then look at the evolution of uncertainty over time, paying special attention to the evolution after the outbreak of the Covid-19 pandemic in 2020 and the Russian invasion of Ukraine in early 2022. In 2020 firms were widely aware that their revenues would shrink, so they did not display a significant rise in their uncertainty as to the evolution of their revenues. Since 2021, instead, uncertainty increased significantly (by over 7pp) and this increase persisted through 2023 (although of smaller magnitude, at 4.5pp), also as a consequence of the several shocks that hit the economy in the most recent years. The overall increase was highest among firms of smaller size (especially below 20 persons employed) and among those with the legal form of a sole proprietorship (compared to corporate firms and partnerships).

We finally analyze the link between firm-level uncertainty and investment behavior. On average, the probability of a firm increasing their own investments is 3.6 percentage points lower among uncertain firms compared to the remaining firms (compared to an average share just above 20 per cent). The size of this gap remained unchanged in the most recent years, following the onset of the Covid pandemic.

The evidence of a stable relationship between firm-level uncertainty and investments underlines the importance of monitoring and addressing firm-level uncertainty with appropriate policies, in order to support firms' capital accumulation and, ultimately, economic growth. The available sample size does not allow for a robust year-by-year analysis, which may be of interest to policy makers in light of the several sources of uncertainty that occurred in the most recent years. This leaves room for additional research on this topic.

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6 Tables

Table 1: Number of observations per month and year

year	month		
	February	June	October
2014			1,533
2015	1,605	1,509	1,656
2016	1,671	1,684	1,690
2017	1,783	1,601	1,641
2018	1,623	1,824	1,783
2019	1,740	1,762	1,728
2020	1,735	1,706	1,733
2021	1,798	1,747	1,729
2022	1,722	1,689	1,724
2023	1,732	1,755	1,731
2024	1,744		

Source: Chamber of commerce of Bolzano-Bozen. The table reports the number of industrial and service firms surveyed in each month.

Table 2: Number of observations per wave and reference year

ref. year	obs. (τ)				
	1	2	3	4	5
2014				1,533	1,605
2015	1,533	1,605	1,509	1,656	1,671
2016	1,656	1,671	1,684	1,690	1,783
2017	1,690	1,783	1,601	1,641	1,623
2018	1,641	1,623	1,824	1,783	1,740
2019	1,783	1,740	1,762	1,728	1,735
2020	1,728	1,735	1,706	1,733	1,798
2021	1,733	1,798	1,747	1,729	1,722
2022	1,729	1,722	1,689	1,724	1,732
2023	1,724	1,732	1,755	1,731	1,744
2024	1,731	1,744			

Source: Chamber of commerce of Bolzano-Bozen. For each reference year, the table reports the number of industrial, construction and service firms surveyed for each available observation τ : obs. 1 data referring to year t are collected in October of year $t-1$; obs. 2-4 data referring to year t are collected in February, July and October of year t ; obs. 5 data referring to year t are collected in February of year $t+1$.

Table 3: Share of firms uncertain about the evolution of their revenues

ref. year	obs. (τ)				
	1	2	3	4	5
2014				0.080	0.026
2015	0.166	0.092	0.055	0.051	0.033
2016	0.159	0.090	0.052	0.060	0.043
2017	0.153	0.112	0.085	0.068	0.069
2018	0.159	0.132	0.078	0.068	0.063
2019	0.146	0.128	0.076	0.055	0.058
2020	0.168	0.130	0.077	0.057	0.044
2021	0.250	0.194	0.152	0.083	0.057
2022	0.237	0.161	0.103	0.072	0.055
2023	0.219	0.165	0.085	0.082	0.069
2024	0.199	0.159			

Source: Chamber of commerce of Bolzano-Bozen. The note to table 2 defines the values of τ .

Table 4: Share of firms uncertain about the evolution of their revenues; sub-sample participating in all waves of a year

ref. year	obs. (τ)				
	1	2	3	4	5
2015	0.154	0.075	0.045	0.045	0.024
2016	0.137	0.077	0.038	0.046	0.035
2017	0.138	0.096	0.071	0.048	0.050
2018	0.161	0.127	0.073	0.063	0.052
2019	0.134	0.118	0.073	0.051	0.055
2020	0.153	0.104	0.073	0.060	0.041
2021	0.264	0.179	0.135	0.070	0.050
2022	0.218	0.156	0.105	0.065	0.054
2023	0.213	0.163	0.081	0.074	0.064

Source: Chamber of commerce of Bolzano-Bozen.

The note to table 2 defines the values of τ .

Table 5: Share of firms uncertain about the evolution of their revenues; sub-sample participating in all waves of a year, excluding firms that are always uncertain about the variation of their revenues (i.e., responding “don’t know” in all waves) or uncertain about the past (i.e., responding “don’t know” in the last wave).

ref. year	obs. (τ)				
	1	2	3	4	5
2015	0.148	0.071	0.042	0.039	–
2016	0.133	0.076	0.036	0.040	–
2017	0.126	0.081	0.049	0.029	–
2018	0.149	0.108	0.054	0.038	–
2019	0.118	0.099	0.054	0.031	–
2020	0.144	0.091	0.060	0.046	–
2021	0.245	0.157	0.115	0.048	–
2022	0.203	0.132	0.084	0.053	–
2023	0.191	0.143	0.062	0.048	–

Source: Chamber of commerce of Bolzano-Bozen.

The note to table 2 defines the values of τ .

Table 6: Share of firms uncertain about the judgement on their own *profitability*

ref. year	obs. (τ)				
	1	2	3	4	5
2015	0.131	0.111	0.049	0.027	0.012
2016	0.145	0.112	0.048	0.029	0.011
2017	0.127	0.112	0.051	0.027	0.018
2018	0.158	0.113	0.062	0.025	0.017
2019	0.120	0.095	0.065	0.028	0.020
2020	0.141	0.114	0.114	0.073	0.038
2021	0.265	0.193	0.134	0.060	0.027
2022	0.271	0.185	0.130	0.062	0.023
2023	0.258	0.173	0.083	0.053	0.036

Source: Chamber of commerce of Bolzano-Bozen.
Firms are asked to judge their profitability as either unsatisfactory, satisfactory or good. The note to table 2 defines the values of τ . Sub-sample as in Table 5.

Table 7: Distribution of declared and observed evolution of firms' revenues

actual evolution of revenues (1)	declared evolution of rev.		
	higher	stable	lower
ref. year up to 2019			
higher	73.0	22.5	4.5
stable	38.5	42.1	19.3
lower	10.2	34.8	55.0
ref. year 2020			
higher	50.8	25.0	24.2
stable	24.4	30.9	44.7
lower	1.4	8.1	90.6
ref. year 2021			
higher	69.4	22.0	8.6
stable	22.6	56.9	20.6
lower	16.0	25.3	58.7
ref. year 2022			
higher	83.4	14.1	2.6
stable	34.6	39.7	25.6
lower	10.0	26.0	64.0

Source: Chamber of commerce of Bolzano-Bozen and Cerved Group.
The table reports the share of firms reporting higher/stable/lower revenues in survey data from the Chamber of commerce of Bolzano-Bozen (in the last wave for each reference year) among firm displaying higher/stable/lower revenues in balance sheet data from Cerved Group.
(1) higher if var.>5%; stable between -5% and 5%; lower if var. <-5%.

Table 8: Summary statistics (shares)

	Language used in the survey								
	2015	2016	2017	2018	2019	2020	2021	2022	2023
Italian	24.69	24.02	20.36	24.29	25.14	24.10	23.38	23.39	21.29
German	75.31	75.98	79.64	75.71	74.86	75.90	76.62	76.61	78.71
	Sector of economic activity								
Manufacturing	22.14	22.20	20.70	21.71	23.11	23.08	24.68	24.88	24.51
Construction	9.90	8.98	10.35	9.90	10.43	9.88	10.56	10.37	10.13
Services	67.96	68.82	68.95	68.38	66.46	67.04	64.76	64.75	65.36
	Firm size (persons employed)								
1-3	36.71	38.55	34.08	34.48	37.35	36.29	30.50	30.65	30.49
4-9	27.70	27.04	27.78	29.05	28.17	26.50	27.05	22.81	21.40
10-19	13.90	12.92	15.30	14.95	14.40	16.44	16.70	17.28	16.23
20-49	9.45	10.09	10.80	10.57	9.57	11.36	12.72	14.98	15.30
50+	12.24	11.40	12.04	10.95	10.51	9.42	13.04	14.29	16.57
	Firm age (years)								
0-4	2.11	0.81	0.00	0.48	0.78	0.74	0.86	1.50	1.50
5-9	6.34	6.66	5.17	3.14	2.96	2.22	2.91	2.30	3.22
10-19	20.69	19.17	17.21	16.76	17.67	16.25	17.03	15.67	14.96
20+	70.86	73.36	77.62	79.62	78.60	80.79	79.20	80.53	80.32
	Legal form								
Corporations	34.48	32.90	35.10	34.86	33.62	37.30	42.67	43.89	45.57
Partnerships	33.93	33.40	34.42	34.10	31.21	30.38	30.17	27.88	25.55
Sole proprietor.	30.48	32.90	29.36	29.81	33.62	30.29	25.11	26.15	25.78
Cooperatives	1.11	0.81	1.12	1.24	1.56	2.03	2.05	2.07	3.11
Observations	899	991	889	1,050	1,285	1,083	928	868	869

Number of observations and share of firms in each category in every year. Sub-sample as in Table 5. Please refer to footnote 5 for a definition of “persons employed” according to Eurostat’s Glossary.

Table 9: Summary statistics on firms' outcomes (shares)

	Evolution of own revenues w.r.t. previous year (*)								
	2015	2016	2017	2018	2019	2020	2021	2022	2023
Higher	35.48	34.51	38.02	33.05	29.81	12.47	42.67	51.15	39.01
Stable	39.60	45.01	41.28	46.19	46.15	16.99	31.57	31.11	36.02
Lower	24.92	20.48	20.70	20.76	24.05	70.54	25.75	17.74	24.97
	Judgement of own profitability								
Good	18.46	20.59	23.06	20.95	18.60	11.27	20.37	22.35	23.48
Satisfactory	59.73	62.56	61.75	63.43	66.15	46.08	58.08	62.21	61.45
Unsatisfactory	20.58	15.74	13.39	13.90	13.23	38.87	18.86	13.13	11.51
Uncertain	1.22	1.11	1.80	1.71	2.02	3.79	2.69	2.30	3.57

Share of firms in each group in every year. Data drawn from the retrospective survey conducted at the beginning of the following year. Sub-sample as in Table 5; * the sample excludes firms uncertain about the evolution of own revenues at the beginning of the year following the reference year.

Table 10: Firm-level uncertainty about the evolution of own revenues, by language used in the survey

ref. year	Italian language	German language
2015	0.089	0.051
2016	0.061	0.056
2017	0.068	0.054
2018	0.089	0.064
2019	0.070	0.057
2020	0.090	0.061
2021	0.147	0.103
2022	0.116	0.088
2023	0.140	0.075
Total	0.094	0.067

Source: Chamber of commerce of Bolzano-Bozen. The table reports yearly averages. Sub-sample as in Table 5.

Table 11: Firm-level uncertainty about the evolution of own revenues, by firm types

	Observations	Share of uncertain firms
Sole proprietorship	27,307	0.096
Cooperative society	1,396	0.061
Incorporated firms	29,533	0.054
Partnership	25,241	0.076
Total	83,477	0.073

Source: Chamber of commerce of Bolzano-Bozen. The table reports yearly averages. Sub-sample as in Table 5.

Table 12: Firm-level uncertainty about the evolution of own revenues, by number of persons employed.

(a) Average of each year

ref. year	number of persons employed				
	1-3	4-9	10-19	20-49	50+
2015	0.076	0.068	0.053	0.043	0.015
2016	0.082	0.054	0.038	0.038	0.013
2017	0.076	0.059	0.048	0.038	0.020
2018	0.094	0.072	0.070	0.031	0.009
2019	0.083	0.062	0.049	0.031	0.008
2020	0.084	0.075	0.075	0.037	0.017
2021	0.138	0.126	0.113	0.100	0.041
2022	0.112	0.112	0.108	0.076	0.026
2023	0.106	0.105	0.123	0.055	0.033
total	0.092	0.079	0.076	0.051	0.021

(b) First obs. of each year

ref. year	number of persons employed				
	1-3	4-9	10-19	20-49	50+
2015	0.158	0.183	0.148	0.138	0.046
2016	0.185	0.125	0.089	0.104	0.037
2017	0.167	0.133	0.070	0.125	0.032
2018	0.196	0.156	0.123	0.064	0.032
2019	0.148	0.118	0.090	0.077	0.028
2020	0.162	0.170	0.159	0.096	0.043
2021	0.310	0.262	0.235	0.238	0.069
2022	0.206	0.229	0.256	0.188	0.089
2023	0.240	0.231	0.211	0.129	0.076
total	0.185	0.169	0.149	0.134	0.048

Source: Chamber of commerce of Bolzano-Bozen.
Sub-sample as in Table 5.

Table 13: Firm-level uncertainty about the evolution of own revenues, by age group.

ref. year	(a) Yearly average			(b) First observation		
	1-9	10-19	20+	1-9	10-19	20+
2015	0.080	0.062	0.057	0.165	0.145	0.146
2016	0.048	0.054	0.059	0.093	0.134	0.139
2017	0.029	0.054	0.060	0.103	0.129	0.128
2018	0.065	0.062	0.072	0.136	0.135	0.153
2019	0.062	0.061	0.060	0.140	0.130	0.112
2020	0.044	0.066	0.070	0.094	0.136	0.149
2021	0.124	0.113	0.112	0.236	0.263	0.241
2022	0.125	0.092	0.093	0.184	0.203	0.204
2023	0.126	0.077	0.089	0.302	0.183	0.184
total	0.074	0.069	0.074	0.154	0.157	0.160

Source: Chamber of commerce of Bolzano-Bozen. Sub-sample as in Table 5.

Table 14: Characteristics of firms uncertain firms. The dependent variable is an indicator of uncertainty about the evolution of own revenues.

	(1)	(2)	(3)	(4)
Language (omitted category: Italian)				
– German	-0.026*** (0.003)	-0.030*** (0.003)	-0.030*** (0.003)	-0.030*** (0.003)
Firm size (omitted category: 1-3 persons employed)				
– 4-9	-0.014*** (0.003)	-0.008** (0.003)	-0.009*** (0.003)	-0.007** (0.003)
– 10-19	-0.016*** (0.004)	-0.014*** (0.004)	-0.016*** (0.004)	-0.014*** (0.004)
– 20-49	-0.042*** (0.004)	-0.036*** (0.005)	-0.039*** (0.005)	-0.037*** (0.005)
– 50+	-0.072*** (0.004)	-0.067*** (0.005)	-0.068*** (0.005)	-0.066*** (0.005)
Aggr. sector of activity (Manufacturing omitted)				
– Construction		0.012*** (0.005)	0.014*** (0.005)	0.013*** (0.005)
– Services		-0.026*** (0.003)	-0.025*** (0.003)	-0.025*** (0.003)
Firm type (omitted category: Corporations)				
– Sole Proprietorship		0.019*** (0.004)	0.022*** (0.004)	0.023*** (0.004)
– Cooperative Society		0.008 (0.010)	0.005 (0.010)	0.005 (0.010)
– Partnership		0.003 (0.003)	0.006* (0.003)	0.006 (0.003)
Firm age	YES	YES	YES	YES
Ref. year FEs	NO	NO	YES	YES
Obs. (τ) FEs	NO	NO	NO	YES
Constant	YES	YES	YES	YES
Observations	44,310	44,310	44,310	44,310
Adj. R-squared	0.009	0.013	0.019	0.062

Source: Chamber of Commerce of Bolzano-Bozen. The table reports estimated coefficients from equation 1. Sub-sample restricted as in Table 5. The note to table 2 defines the values of observations τ . * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$

Table 15: Regression Estimates. The dependent variable is an indicator of uncertainty about the evolution of firms' own revenues. Heterogeneity by type of business.

	All Firms	Firm Types		
		Sole Proprietorships	Corporate firms	Partnerships
year 2016	-0.008 (0.006)	-0.011 (0.012)	0.001 (0.008)	-0.011 (0.010)
year 2017	-0.004 (0.006)	0.001 (0.014)	0.006 (0.010)	-0.015 (0.010)
year 2018	0.008 (0.007)	0.017 (0.015)	0.007 (0.010)	0.002 (0.011)
year 2019	0.000 (0.006)	0.009 (0.014)	-0.003 (0.009)	-0.003 (0.011)
year 2020	0.011 (0.007)	0.020 (0.015)	0.013 (0.010)	0.004 (0.012)
year 2021	0.074*** (0.008)	0.086*** (0.017)	0.063*** (0.012)	0.084*** (0.015)
year 2022	0.047*** (0.008)	0.071*** (0.017)	0.041*** (0.012)	0.037** (0.014)
year 2023	0.043*** (0.008)	0.053*** (0.018)	0.044*** (0.012)	0.030** (0.013)
obs=February(t)	-0.053*** (0.004)	-0.068*** (0.009)	-0.045*** (0.006)	-0.050*** (0.008)
obs=June(t)	-0.098*** (0.005)	-0.115*** (0.010)	-0.078*** (0.007)	-0.106*** (0.009)
obs=October(t)	-0.118*** (0.005)	-0.139*** (0.011)	-0.094*** (0.008)	-0.128*** (0.009)
Firms fixed effects	YES	YES	YES	YES
German language	YES	YES	YES	YES
Constant	YES	YES	YES	YES
Observations	35,448	10,472	13,121	11,263
Clusters	2,178	726	788	667
Adj. R-squared	0.220	0.238	0.206	0.205

Source: Chamber of Commerce of Bolzano-Bozen. The table reports estimated coefficients from equation 2. Sub-sample restricted as in Table 5. Standard errors clustered at the firm level.

* p<0.10 ** p<0.05 *** p<0.01

Table 16: Regression Estimates. The dependent variable is an indicator of uncertainty about the evolution of firms' own revenues. Heterogeneity by firm size.

	Number of persons employed				
	1-3	4-9	10-19	20-49	50+
year 2016	-0.001 (0.010)	-0.018* (0.011)	-0.008 (0.014)	-0.009 (0.016)	0.002 (0.009)
year 2017	-0.000 (0.012)	-0.011 (0.013)	-0.002 (0.017)	-0.014 (0.016)	0.015 (0.013)
year 2018	0.017 (0.013)	0.001 (0.014)	0.029 (0.019)	-0.019 (0.015)	0.000 (0.010)
year 2019	0.014 (0.013)	-0.008 (0.014)	-0.008 (0.018)	-0.010 (0.018)	-0.000 (0.009)
year 2020	0.023* (0.014)	0.003 (0.015)	0.020 (0.020)	-0.019 (0.020)	0.003 (0.010)
year 2021	0.098*** (0.015)	0.073*** (0.018)	0.067*** (0.022)	0.072*** (0.027)	0.029** (0.012)
year 2022	0.059*** (0.015)	0.057*** (0.020)	0.035 (0.023)	0.037 (0.024)	0.018 (0.013)
year 2023	0.048*** (0.016)	0.053*** (0.018)	0.058** (0.025)	0.022 (0.024)	0.016 (0.012)
obs=February(t)	-0.069*** (0.008)	-0.064*** (0.009)	-0.030*** (0.011)	-0.052*** (0.012)	-0.029*** (0.008)
obs=June(t)	-0.115*** (0.009)	-0.106*** (0.010)	-0.099*** (0.012)	-0.099*** (0.013)	-0.033*** (0.009)
obs=October(t)	-0.132*** (0.009)	-0.130*** (0.011)	-0.120*** (0.012)	-0.116*** (0.014)	-0.041*** (0.009)
German language	YES	YES	YES	YES	YES
Firms fixed effects	YES	YES	YES	YES	YES
Constant	YES	YES	YES	YES	YES
Observations	12,591	9,115	5,370	3,939	4,049
Clusters	997	777	519	354	288
Adj. R-squared	0.223	0.227	0.233	0.158	0.148

Source: Chamber of Commerce of Bolzano-Bozen. The table reports estimated coefficients from equation 2. Sub-sample restricted as in Table 5. Standard errors clustered at the firm level.

* p<0.10 ** p<0.05 *** p<0.01

Table 17: Regression Estimates. The dependent variable is an indicator of uncertainty about the evolution of firms' own revenues. Heterogeneity by sector of economic activity.

	Sector of economic activity			
	All Firms	Manufacturing	Construction	Services
year 2016	-0.008 (0.006)	-0.011 (0.013)	0.025 (0.021)	-0.012* (0.006)
year 2017	-0.004 (0.006)	0.002 (0.014)	-0.000 (0.020)	-0.007 (0.008)
year 2018	0.008 (0.007)	0.024 (0.016)	0.002 (0.020)	0.004 (0.008)
year 2019	0.000 (0.006)	0.012 (0.014)	-0.024 (0.021)	0.000 (0.008)
year 2020	0.011 (0.007)	0.038** (0.016)	-0.017 (0.024)	0.007 (0.008)
year 2021	0.074*** (0.008)	0.089*** (0.018)	0.060** (0.028)	0.071*** (0.010)
year 2022	0.047*** (0.008)	0.066*** (0.019)	0.022 (0.027)	0.044*** (0.010)
year 2023	0.043*** (0.008)	0.055*** (0.019)	0.054* (0.030)	0.036*** (0.009)
obs=February(t)	-0.053*** (0.004)	-0.054*** (0.010)	-0.077*** (0.016)	-0.050*** (0.005)
obs=June(t)	-0.098*** (0.005)	-0.119*** (0.011)	-0.145*** (0.018)	-0.083*** (0.006)
obs=October(t)	-0.118*** (0.005)	-0.139*** (0.011)	-0.162*** (0.017)	-0.104*** (0.006)
Firms fixed effects	YES	YES	YES	YES
German language	YES	YES	YES	YES
Constant	YES	YES	YES	YES
Observations	35,448	8,158	3,564	23,726
Clusters	2,178	487	207	1,487
Adj. R-squared	0.220	0.258	0.189	0.211

Source: Chamber of Commerce of Bolzano-Bozen. The table reports estimated coefficients from equation 2. Sub-sample restricted as in Table 5. Standard errors clustered at the firm level.

* p<0.10 ** p<0.05 *** p<0.01

Table 18: Evolution of uncertainty about firms' own revenues, among initially uncertain firms.

ref. year (t)	answers about revenues				hi-lo
	uncertain	higher	stable	lower	
obs.=Feb.(t)					
2015	27.1	7.5	34.6	30.8	-23.3
2016	29.6	10.6	47.7	12.1	-1.5
2017	25.0	14.3	41.1	19.6	-5.3
2018	38.5	5.8	45.5	10.3	-4.5
2019	34.4	8.6	45.7	11.3	-2.7
2020	27.6	12.8	47.4	12.2	0.6
2021	35.2	6.6	24.7	33.5	-26.9
2022	41.5	15.3	34.1	9.1	6.2
2023	42.8	8.4	36.1	12.7	-4.3
obs.=Jun.(t)					
2015	12.0	12.0	49.6	26.3	-14.3
2016	9.9	8.3	62.1	19.7	-11.4
2017	14.3	11.6	53.6	20.5	-8.9
2018	20.5	9.6	50.6	19.2	-9.6
2019	17.9	11.9	49.0	21.2	-9.3
2020	16.0	2.6	11.5	69.9	-67.3
2021	26.4	21.2	27.8	24.7	-3.5
2022	26.7	29.0	28.4	15.9	13.1
2023	16.3	10.8	49.4	23.5	-12.7
obs.=Oct.(t)					
2015	11.3	15.0	44.4	29.3	-14.3
2016	7.6	24.2	46.2	22.0	2.2
2017	4.5	23.2	49.1	23.2	0.0
2018	13.5	12.8	48.7	25.0	-12.2
2019	9.3	15.2	46.4	29.1	-13.9
2020	10.9	3.9	15.4	69.9	-66.0
2021	10.6	30.8	38.3	20.3	10.5
2022	13.1	25.6	40.9	20.5	5.1
2023	19.3	17.5	33.1	30.1	-12.6
obs.=Feb.(t+1)					
2015	–	29.3	41.4	29.3	0.0
2016	–	31.1	46.2	22.7	8.4
2017	–	33.0	42.9	24.1	8.9
2018	–	21.8	50.0	28.2	-6.4
2019	–	19.2	55.0	25.8	-6.6
2020	–	12.2	21.2	66.7	-54.5
2021	–	37.0	33.9	29.1	7.9
2022	–	42.6	35.8	21.6	21.0
2023	–	34.3	36.8	28.9	5.4

Source: Chamber of commerce of Bolzano-Bozen. The table reports the share of firms providing each answer, among those that were uncertain in the first observation of each reference year t, i.e., in October of year t-1. Sub-sample as in Table 5.

Table 19: Judgment on own revenues at the end of the year, irrespective of firms' answer in the first observation of the same year.

ref. year (t)	answers about revenues			
	uncertain	higher	stable	lower
obs.=Feb.(t+1)				
2015	–	35.5	39.6	24.9
2016	–	34.5	45.0	20.5
2017	–	38.0	41.3	20.7
2018	–	33.0	46.2	20.8
2019	–	29.8	46.2	24.0
2020	–	12.5	17.0	70.5
2021	–	42.7	31.6	25.8
2022	–	51.2	31.1	17.7
2023	–	39.0	36.0	25.0

Source: Chamber of commerce of Bolzano-Bozen. The table reports the share of firms providing each answer. Sub-sample as in Table 5.

Table 20: Judgment on own revenues at the end of the year, excluding firms that were uncertain in the first observation of the same year

ref. year (t)	answers about revenues			
	uncertain	higher	stable	lower
obs.=Feb.(t+1)				
2015	–	36.6	39.3	24.2
2016	–	35.0	44.8	20.1
2017	–	38.7	41.1	20.2
2018	–	35.0	45.5	19.5
2019	–	31.2	45.0	23.8
2020	–	12.5	16.3	71.2
2021	–	44.5	30.8	24.7
2022	–	53.3	29.9	16.8
2023	–	40.1	35.9	24.0

Source: Chamber of commerce of Bolzano-Bozen. The table reports the share of firms providing each answer, among those that were not uncertain in the first observation of each reference year t, i.e., in October of year t-1. Sub-sample as in Table 5.

Table 21: Persistence of uncertainty about the evolution of firms' own revenues.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$Uncertain_{i,t-1}^{obs=1}$	0.308*** (0.012)	0.275*** (0.012)	0.268*** (0.013)	0.247*** (0.015)	0.243*** (0.017)	0.235*** (0.021)	0.215*** (0.026)
$Uncertain_{i,t-2}^{obs=1}$		0.173*** (0.013)	0.154*** (0.014)	0.160*** (0.015)	0.140*** (0.018)	0.150*** (0.022)	0.162*** (0.027)
$Uncertain_{i,t-3}^{obs=1}$			0.132*** (0.016)	0.107*** (0.017)	0.108*** (0.019)	0.105*** (0.024)	0.099*** (0.031)
$Uncertain_{i,t-4}^{obs=1}$				0.133*** (0.018)	0.110*** (0.019)	0.115*** (0.024)	0.159*** (0.032)
$Uncertain_{i,t-5}^{obs=1}$					0.145*** (0.022)	0.123*** (0.024)	0.134*** (0.031)
$Uncertain_{i,t-6}^{obs=1}$						0.056** (0.029)	0.024 (0.032)
$Uncertain_{i,t-7}^{obs=1}$							0.038 (0.039)
Constant	0.123*** (0.004)	0.103*** (0.004)	0.089*** (0.005)	0.084*** (0.006)	0.080*** (0.007)	0.089*** (0.008)	0.101*** (0.011)
Observations	8,862	7,567	6,115	4,868	3,712	2,590	1,709
Adj. R-squared	0.073	0.108	0.134	0.149	0.168	0.176	0.182

Source: Chamber of Commerce of Bolzano-Bozen. Sub-sample as in Table 5. Uncertainty is measured at the first observation of each year. One observation per firm and year. The table reports estimated coefficients of equation 3. * p<0.10 ** p<0.05 *** p<0.01

Table 22: Uncertainty about the evolution of firms' own revenues, and capital accumulation.

	(1)	(2)	(3)	(4)	(5)
$Uncertain_{i,t}^{obs=1}$	-0.059*** (0.012)	-0.059*** (0.012)	-0.036** (0.015)	-0.031* (0.019)	-0.037* (0.021)
$Uncertain_{i,t}^{obs=1} \times Since2021$				-0.010 (0.026)	
$Uncertain_{i,t}^{obs=1} \times Since2020$					0.002 (0.026)
constant	0.224*** (0.007)	0.265*** (0.014)	0.284*** (0.014)	0.283*** (0.014)	0.284*** (0.014)
Firms fixed effects	NO	NO	YES	YES	YES
Year fixed effects	NO	YES	YES	YES	YES
Observations	7,963	7,963	7,963	7,963	7,963
Clusters	2,080	2,080	2,080	2,080	2,080
Adj. R-squared	0.003	0.010	0.017	0.017	0.017

Source: Chamber of Commerce of Bolzano-Bozen. Sub-sample as in Table 5. The table reports estimates of coefficients β_1 and β_2 in equations 4 (models 1–3) and 5 (models 4–5). *Since2021* is a binary variable equal to 1 for years 2021–2023 and to 0 for previous years. *Since2020* is a binary variable equal to 1 for years 2020–2023 and to 0 for previous years. Standard errors clustered at the firm level.

* p<0.10 ** p<0.05 *** p<0.01

Table 23: Uncertainty about the evolution of firms' own revenues, firm's performance and capital accumulation.

	(1)	(2)	(3)	(4)	(5)	(6)
$Uncertain_{i,t}^{obs=1}$	-0.036** (0.015)	-0.033** (0.015)	-0.036** (0.015)	-0.035** (0.015)	-0.032** (0.015)	-0.028* (0.016)
$Y_{i,t-1}^{obs=5}$ stable		0.010 (0.014)				-0.000 (0.015)
$Y_{i,t-1}^{obs=5}$ lower		0.002 (0.015)				-0.001 (0.017)
$\Pi_{i,t-1}^{obs=5}$ satisfactory			0.007 (0.018)			-0.002 (0.018)
$\Pi_{i,t-1}^{obs=5}$ unsatisfactory			-0.031 (0.022)			-0.049** (0.024)
$Y_{i,t}^{obs=5}$ stable				-0.108*** (0.015)		-0.106*** (0.016)
$Y_{i,t}^{obs=5}$ lower				-0.127*** (0.015)		-0.120*** (0.017)
$\Pi_{i,t}^{obs=5}$ satisfactory					-0.059*** (0.017)	-0.034* (0.017)
$\Pi_{i,t}^{obs=5}$ unsatisfactory					-0.092*** (0.021)	-0.041* (0.023)
constant	0.284*** (0.014)	0.284*** (0.016)	0.287*** (0.020)	0.355*** (0.017)	0.335*** (0.019)	0.395*** (0.027)
Firms fixed effects	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES
Observations	7,963	7,721	7,790	7,963	7,775	7,444
Adj. R-squared	0.017	0.018	0.019	0.033	0.021	0.035
Clusters	2,080	2,029	2,063	2,080	2,058	1,988

Source: Chamber of Commerce of Bolzano-Bozen. Sub-sample as in Table 5. The table reports estimates of coefficients β_1 in equation 4. Model 1 is equivalent to model 3 in Table 22. Variable $\Pi_{i,t}^{obs=5}$ captures firm i 's judgement on own profitability on year t in the latest available observation. Possible answers are: good, satisfactory and unsatisfactory. The omitted category of $\Pi_{i,t}^{obs=5}$ is *good*. Variable $Y_{i,t}^{obs=5}$ captures firm i 's judgement on own revenues on year t in the latest available observation. Possible answers are: higher, stable, lower (compared to the previous year). The omitted category of $Y_{i,t}^{obs=5}$ is *higher*. Standard errors clustered at the firm level.

* $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$