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The effect of uncertainty on investment: Evidence from EU survey data

Atanas Kolev* Timothy Randall †

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Abstract

Using firm-level survey data combined with firm-level financial information, we investigate the effect of a subjective, firm-specific measure of uncertainty on firm investment and employment growth in the European Union. We find that uncertainty has an economically significant negative effect on investment. Uncertainty is found to have an economically significant negative effect on employment growth, as well. Firms perceiving uncertainty as a major investment impediment experience 1 p.p. lower employment growth compared to those that do not. Using our estimates, we find that non-financial corporate investment in the European Union in 2022 would have been higher by 1 p.p. of fixed assets, while employment growth would have been by 0.7 p.p. higher had uncertainty remained at its 2021 levels.

JEL Codes: D22, D84, G31

1 Introduction

Heightened uncertainty continues to shape economic conditions in Europe and globally. COVID-19 initially resulted in large spikes in forward-looking uncertainty measures (Meyer et al., 2022) and caused strong decreases in firm investments (Tawiah and O'Connor Keefe, 2022). The war in Ukraine has induced profound uncertainty among firms (Yotzov et al., 2022). In Europe, this was predominantly reflected in

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the strong uncertainty around energy security and energy costs for both households and firms. In light of the highest inflation recorded in decades in both Europe and the United States, economic policymakers have described the state of uncertainty as "enormous" (Schnabel, 2022) and "extraordinary" (Adrian, 2022).

This study builds on a unique dataset of EU firms. Combining firm-level survey data from the European Investment Bank's Group Survey on Investment and Investment Finance (EIBIS) with firms' financial information sourced from Moody's Orbis database, we examine the effect of firms' subjectively perceived uncertainty on investment and employment growth.

Uncertainty is a well-studied phenomenon in economics and finance literature. Several papers, informed by real-options theory, investigate the effect of uncertainty on firm investments. Our study contributes to this line of research in different ways. First, key aspects of our data are unique. Research analyzing the uncertainty-investment relationship often relies on data from publicly listed firms which are typically large and not representative of the overall economy. Consider that in 2022, SMEs employed 64.4 per cent of people in the EU and contributed to 51.8 per cent of value added (Di Bella et al., 2023). The emphasis in the literature on large firms neglects a significant portion of the business landscape, i.e. smaller firms for which data availability tends to be scarce. The non-financial firms interviewed in EIBIS are selected through stratified sampling, producing a data set representative of the population of EU firms by dimensions such as country, broad industrial grouping and size (Ipsos MORI, 2020) thus including micro, small, medium and large firms.

Our survey-based uncertainty measure also differs from conventionally used proxies such as stock-market volatility (Bloom, 2009), uncertainty-inducing events such as elections (Julio and Yook, 2012; Jens, 2017), uncertainty shocks such as wars and terrorist attacks (Kim and Kung, 2017), or uncertainty indices constructed from word-counts in newspapers as popularized in Baker, Bloom, and Davis (2016) and their preceding work (Baker, Bloom, and Davis, 2013). Survey participants in EIBIS are asked to assess the extent to which "uncertainty about the future" hinders their investment activities on a trichotomous scale[2]. We add to the literature using uncertainty indicators within the small but growing body of literature using survey data.

We also make use of a survey response indicating how investment changed compared to the previous year and compute the effect of uncertainty on the likelihood of changing investment using linear probability models and panel logistic regressions. Our findings reveal that firms perceiving uncertainty as a minor or major impediment are associated with a higher probability of investing less by approximately 2 and 3 percentage points (p.p.) compared to firms that do not view uncertainty as

[2] "Not an obstacle at all", "A minor obstacle" and "A Major obstacle". We drop the responses in the remaining two categories - "Don't know" and "Refused" - which account for a very small number of observations.

an impediment to investment. Conversely, the probability of increasing investment is lower by approximately 2.5 and 4.5 p.p., respectively.

Third, we estimate the effect of our uncertainty measure on the investment rate: the net investment in fixed assets as a ratio to fixed assets in the preceding period.[3] Firms perceiving uncertainty as a major obstacle exhibit an approximately 3 p.p. lower investment rate compared to those not viewing uncertainty as an impediment, representing approximately one-third of the average investment rate (9.6 per cent) within our sample. We also predict investment rates using the 2022 vintage of the investment survey, comparing the prediction with a counterfactual one, in which we hold uncertainty perceptions constant, at 2021 levels. Thereby we find that corporate investment in 2022 would have been 1 p.p. of fixed assets higher, had uncertainty perceptions remained at 2021 levels.

Finally, we also estimate the effect of our uncertainty measure on employment growth. Firms that perceive uncertainty as a major impediment to their investment had about a 1 p.p. lower employment growth than firms, which do not consider uncertainty as an investment impediment. We find that employment growth in 2022 would have been 0.7 p.p. higher had uncertainty perceptions remained at their 2021 levels.

The remainder of this paper is structured as follows: Section 2 provides an overview of the relevant literature; Section 3 introduces the data set, the variables used in this study and the empirical specification; Section 4 presents the results and Section 5 concludes.

2 Related literature

2.1 Measuring uncertainty

One of the earliest definitions of uncertainty in economics comes from American Economist Frank Knight. In his seminal contribution *"Risk, Uncertainty and Profit"*, Knight (1921) defines uncertainty and differentiates it from the closely related concept of risk. According to Knight risk describes a measurable concept, while true uncertainty is unmeasurable (Knight, 1921, pp.19-20). Under Knightian uncertainty (sometimes also referred to as ambiguity) economic agents are not able to quantify the sets of future probabilities and assign probability measures to outcomes and future states of the world. Formally, a situation of risk on the other hand allows for such an assignment of probabilities to outcomes (Alhabeeb, 2021). Despite these distinctions, the terms risk and uncertainty are often used interchangeably (see e.g. Bloom, 2014; Castelnuovo, Lim, and Pellegrino, 2017; Meinen and Roehe, 2017).

[3]The quantity thus defined is equivalent to the growth rate of fixed assets.

In EIBIS, firms are asked whether uncertainty about the future represents an investment obstacle. As survey respondents are not presented with a definition of uncertainty, it is unclear what understanding they have of the term. Uncertainty about the future could encompass business-related factors such as consumer demand and revenues, output prices or the cost of inputs. It could also relate to macro-events such as inflation volatility, geo-political tensions, supply chain disruptions, or expected changes in regulation and taxation. What differentiates our uncertainty measure from other survey-based, subjective uncertainty measures, is the fact that it is directly related to its property as an investment obstacle making it unique in the literature. Using a subjective, firm-specific measure of uncertainty tied directly to its property as an investment obstacle surpasses the limitations of generalized uncertainty proxies.

Our subjective uncertainty measure, however, also comes with potential downsides. For instance, our uncertainty measure may also embody the biases and perspectives of the survey respondents rather than reflecting the genuine, business-specific drivers of uncertainty as an investment obstacle. Variations in the response on uncertainty, could also be attributed to different individuals, with their differing perspectives and interpretations, answering the survey. However, these downsides should be mitigated by the fact that survey respondents rank high in the hierarchy within their respective firms with responsibilities for investment decisions and are familiar with their company's financial situation and the broader business environment. As such, they are well positioned to provide informed and accurate responses to the questions.

Lautenbacher (2021) uses a measure of uncertainty that comes closest to ours. He builds on survey data from the German ifo Business Survey. The uncertainty measure used in that study is similarly broad in scope as it is derived from a survey question pertaining to uncertainty around business development in the next 6 months (Lautenbacher, 2021, p.6). In contrast to the trichotomous scale used in EIBIS, survey respondents in the ifo Business Survey use a visual analogue scale, ranging from 0 (low uncertainty) to 100 (high uncertainty). As is the case with our subjective uncertainty measure, it is firm-specific, circumventing the need to rely on uncertainty proxies.

2.2 Uncertainty in investment decision making

Uncertainty may affect decisions through firm's capital budgeting processes. Discounted cash flow and net present value (NPV) computations are the most prominent capital budgeting tools.[4] With increasing uncertainty and an accompanying increasing potential downside associated with unrealized future cash flows, investors may apply a "haircut" on expected cash flows using so-called certainty equivalent fac-

[4]For survey evidence among American CFOs see Graham (2022).

tors (Vernimmen, 2018), or may increase risk-premia incorporated in discount rates.[5] All else equal, either adjustment reduce a project's NPV, which ultimately affects investment as fewer projects go past expected-return hurdles.

Verbeeten (2006) provides survey evidence of uncertainty impacting firms' capital budgeting. It suggests that as uncertainty becomes more pervasive, firms adopt more complex capital budgeting techniques and real options reasoning. Real options theory offers a valuable framework for investment decision-making under uncertainty by considering irreversibility and flexibility in timing capital expenditures. Unlike traditional NPV approaches, real options theory incorporates such timing factors, which are essential for understanding the negative effects of uncertainty on investment.

The uncertainty around the future value of a real asset, such as machinery and equipment, is what makes the real option valuable (Pindyck, 1991). As explained by Dixit and Pindyck (1994), the opportunity costs of investment increase under uncertainty. Once an investment has been made, the option to invest at another time and the possibility of waiting for further information, e.g., on consumer demand, production costs, or price changes, is lost. As uncertainty rises, this opportunity cost to investing increases, thereby reducing actual investment. In periods of high uncertainty, it therefore becomes more attractive for investors to delay their investment plans to wait for additional information (Bernanke, 1983).

In a more recent contribution, Bloom (2009) derives a structural framework to investigate uncertainty shocks and finds that real-option effects reduce investment, output and hiring. Bloom (2009) shows that at very high levels of uncertainty, for instance after major external shocks, the high real-option value of not-investing may even reduce the sensitivity of economic agents to other economic stimuli, such as movements in interest rates, wages, and prices, and may potentially blunt the effect of fiscal policy. Inspired by the real-options literature, a rich set of empirical papers now largely confirms the view that uncertainty negatively affects firm investment.

2.3 Prior empirical research

The measurement of uncertainty has induced scholarly contributions highlighting that different uncertainty indicators correlate only loosely and tend to measure different things (Meinen and Roehe, 2017), with implications for the detected episodes of uncertainty (Jurado, Ludvigson, and Ng, 2015). Seminal contributions for uncertainty measurement include Baker, Bloom, and Davis (2013) who create the economic policy uncertainty index from the frequency of word combinations on the

[5]For instance, Jagannathan et al. (2016) survey American CFOs and find that changes in political uncertainty are deemed as important or very important by around one-fifth of survey respondents in adjusting their discount rates.

economy and uncertainty in US newspapers. This index, has inspired a significant body of research investigating the effect this index and derivations thereof have on investment (see e.g., Gulen and Ion, 2015, Husted, Rogers, and Sun, 2020, Meinen and Roehe, 2017). Other research focuses on uncertainty-inducing events such as elections (e.g., Julio and Yook, 2012; Jens, 2017), or exogenous uncertainty shocks (Kim and Kung, 2017).

Our work and the data used herein, is related to a growing body of literature, eliciting measures of subjective, firm-specific uncertainty through surveys. Unlike other uncertainty proxies, subjective measures provide direct insights from business decision makers and allow to capture heterogeneity in uncertainty across firms, industries, and regions. For instance, Altig et al. (2022) create subjective probability distributions on firm-level variables such as sales growth, employment growth, and investment. Firms provide five potential one-year-ahead outcomes and attach probabilities to each. The standard deviation of these point estimates serves as the respective subjective uncertainty measure.

Such survey-based, subjective uncertainty measures have also been used to determine their effect on firm's investment decisions. Pioneering research in this regard comes from Guiso and Parigi (1999), who investigate the effect of such a survey-based uncertainty measure on a representative sample of Italian manufacturing firms and their investment plans. Guiso and Parigi (1999) use a firm survey to glean probability distributions over future product demand from survey respondents. The variance of subjectively perceived future demand serves as their uncertainty measure. The authors find strong negative effects of uncertainty on planned investment. The effect of uncertainty increases for irreversible investment and for firms with higher market power.

Bontempi, Golinelli, and Parigi (2010), use a slightly revised uncertainty measure - the min-max range of expected future growth rates - using the same survey of Italian manufacturing firms (an extended time series) as Guiso and Parigi (1999). Bontempi, Golinelli, and Parigi (2010) test the effect of their uncertainty measure on both planned and actual investment, finding that their subjective survey-based measure of uncertainty is negatively associated with investment plans, while finding a non significant effect of uncertainty on actual investment. Fuss and Vermeulen (2008) use survey questions on demand and price uncertainty from large Belgian manufacturing firms, finding that demand uncertainty reduces both planned and realized investment.

Recent contributions based on firm survey data also come from Bloom et al. (2022) and Kumar, Gorodnichenko, and Coibion (2023). Bloom et al. (2022) create a measure of subjective uncertainty from interviews with senior management in 30,000 plants in 10,000 firms in the United States. Similar to Guiso and Parigi (1999) and Altig et al. (2022), Bloom et al. (2022) gather five-point subjective probability distri-

butions on predicted annual growth rates of the plants from the survey. The standard deviation serves as their subjective uncertainty measure. They find strong and robust negative impacts of uncertainty on investment. Kumar, Gorodnichenko, and Coibion (2023) arguably provide some of the most robust findings on the effects of uncertainty on key outcomes at the firm level yet. Using survey data of firms in New Zealand, the authors use a randomized control trial approach. Kumar, Gorodnichenko, and Coibion (2023) can estimate the causal effect of macroeconomic uncertainty on key outcomes at the firm level, by inducing exogenous variation in uncertainty by randomly providing different information treatments to survey participants on the expected GDP growth in New Zealand. In their sample, the authors find that uncertainty causes a reduction in investment and makes firms less likely to expand operations and incorporate new technologies.

2.4 Effects of uncertainty on employment

While the uncertainty literature is predominately focused on the effect of uncertainty on investment, heightened uncertainty may also affect firm's employment decisions. Increased caution during periods of high uncertainty (or higher subjectively perceived uncertainty) may result in firms holding back on workforce expansion or, in response to uncertain market conditions, could even result in a workforce reduction. As pointed out by Schaal (2017), the nature of employment decisions should theoretically produce real option effects. For instance, costs associated with hiring and training employees are irreversible. The long-term contractual nature of employment also makes reversibility difficult. Labour regulations that affect hiring and firing decisions further reduce reversibility. Therefore, firms may abandon hiring plans under heightened uncertainty or at least take a 'wait-and-see approach' and delay hiring until uncertainty subsides.

Schaal (2017) highlights the potentially ambiguous nature between employment and uncertainty. Firms may hold on to their employees during times of uncertainty due to high costs of finding and hiring new talent once uncertainty subsides. Findings by Bontempi, Golinelli, and Parigi (2010) suggest that the effect of uncertainty on investment plans tends to be weaker for firms relying on more flexible labour inputs, in line with real options reasoning. Recent evidence now confirms the generally negative effect of uncertainty on employment. For instance, Bloom et al. (2022) using their measure of subjective sales-growth uncertainty find a statistically significant negative relationship between uncertainty and employment growth. Kumar, Gorodnichenko, and Coibion (2023), in their representative sample of firms from New Zealand, also find that higher uncertainty tends to reduce employment. Following this recent scholarly work, we investigate the effect of our subjective uncertainty measure on the employment growth of the firms in EIBIS.

3 Data and methodology

The main data source of this work is the EIB Investment Survey (EIBIS), matched with corresponding financial information from Moody's Orbis database.[6] We compile information on the perceptions of uncertainty and other investment impediments, on the overall economic environment assessment by non-financial firms and on their investment activity, with data from their balance sheets and income statements.

3.1 Matched data set

The EIBIS is an annual survey of non-financial firms in the European Union that provides data on investment and investment finance activities, on the perceived business environment and on barriers to investment. The survey includes some 12,500 completed interviews every year since 2016. Using a stratified sampling methodology, the EIBIS is representative across all 27 EU Member States, across four firm size classes – micro, small, medium and large – and across four broad sector groupings – manufacturing, services, construction and infrastructure. In our analysis, we combine data from vintages of the survey, spanning from 2016 to 2022. We select a sample, in which each firm has participated in at least two consecutive vintages.

Table 1: Sample by year, size and broad sector of the economy, (% of respondents by year).

	Sector				Total	
	Manufacturing	Construction	Services	Infrastructure	Count	Percent
2016	31	21	22	26	5878	11
2017	30	21	24	25	8210	15
2018	30	21	25	24	8300	15
2019	31	20	25	24	8159	15
2020	32	21	25	23	8769	16
2021	31	21	24	24	8901	16
2022	31	20	24	25	6910	13
Total	31	21	24	24	55127	100

Note: Share of firms, in percent, in a given sector of the economy in each wave.
Source: EIBIS 2016-2022 and authors' calculations.

The EIBIS survey data is matched with data from the Orbis database, preserving the anonymity of firms, which gives access to the whole history of financial data stored in Orbis for each interviewed firm. These data are used to control for firms'

[6] See Brutscher et al. (2020) for a detailed description of the EIBIS and assessment of its data quality.

financial situation and to measure their investment rates. Using the matched EIBIS-Orbis dataset we construct an unbalanced panel of firms that participated in at least two waves of EIBIS. There are 19,778 firms in the sample and a total of 55,127 firm-year observations, yielding an average of slightly less than three observations per firm.[7] The data is spread evenly across years and broad sectors of the economy (Table 1).

In our analysis, we use two measures of investment to estimate the effects of uncertainty on investment. With the first, we relate the incidence of increasing (or decreasing) investment, relative to the preceding year, to uncertainty perceptions of the firm at the time of this investment. The observations on investment come from the answers to a direct question about whether the firm has increased, decreased or held their investment broadly constant relative to that in the preceding year (see Annex A.1). On average, in our sample, about 20% of firms decreased investment and about 35% increased it. The remaining share of firms maintained broadly the same level as in the previous year (Table 2).

As a second measure of investment, we use the net investment in fixed assets as a ratio to fixed assets in the preceding period, or equivalently the rate of change of fixed assets (FA),

$$IR_{i,t} = \frac{FA_{i,t} - FA_{i,t-1}}{FA_{i,t-1}}. \tag{1}$$

This measure has been used in numerous studies in the corporate finance literature.[8] Using it, we are able to quantify the aggregate effect of the large increase in uncertainty on corporate investment in 2022.[9]

Our uncertainty measure is the respondent's answer to the question: *"Thinking about your investment activities, to what extent is uncertainty about the future an obstacle? Is it a major obstacle, a minor obstacle or not an obstacle at all?"* (Annex A.1). About a fifth of respondents, on average, do not perceive uncertainty as an obstacle to their investment plans, while about a third say that it is a minor obstacle (Table 3). Over the years in our sample, between 35% and 49% of respondents perceive uncertainty as a major obstacle to their investment.

Higher shares of micro and small firms perceive uncertainty as a major obstacle than medium and large firms, while the opposite is true for the share of firms perceiving uncertainty as a minor obstacle. Uncertainty perceptions are evenly spread across sectors, but they are quite dispersed across countries: uncertainty is an obstacle for some 45% of Dutch firms, but for more than 90% of Greek ones (Figure A.1).

[7] We drop all observations that entail answers "Don't know" and "Refused" to a question, used in our analysis.

[8] See for instance Barbiero, Popov, and Wolski (2020), Kalemli-Özcan, Laeven, and Moreno (2022) and references cited therein.

[9] Table A.2 tabulates the average investment rate by firm size and year.

Table 2: Changes in investment relative to preceding year (% of respondents per year).

	Do not decrease	Decrease	Do not increase	Increase
2016	80	20	65	35
2017	80	20	65	35
2018	81	19	63	37
2019	82	18	64	36
2020	79	21	66	34
2021	67	33	74	26
2022	81	19	64	36
Total	78	22	66	34

Note: The table shows the answers, in percent of respondents in each year, to the question: *Overall, was this more, less or about the same amount of investment as in the previous year?* Don't knows and refusals are excluded from the total. Column 2 shows the percentage of firms answering "more investment" or "broadly the same"; column 3 shows the percentage of firms answering "less investment"; column 4 shows the percentage of firms answering "less investment" or "broadly the same"; column five shows the percentage of firms answering "more investment". See also Annex A.1.
Source: EIBIS 2016-2022 and authors' calculations.

Firms in countries in Southern and Eastern Europe more often perceive uncertainty as an obstacle to investment than firms in Western Europe.

Uncertainty perceptions are positively correlated with other impediments to investment listed in EIBIS question 38 (see section A.1 in the Annex for the definition of questions). Correlation coefficients vary between 0.37 and 0.51 (Table A.5). Correlations with other control variables in our regression analysis are close to zero. The highest correlation is with the ratio of cash-flow to total assets, -0.12 (Table A.7).

Business opportunities are a key determinant of investment. For listed firms, the common approach to measure business opportunities is to employ a measure of Tobin's Q (Hayashi, 1982). In EIBIS, however, the majority of firms are non-listed, which prevents us from using such a measure. In the absence of a measure of Tobin's Q, we control for business growth opportunities using several different variables. First, we use the answer to a question posed in EIBIS about the extent to which demand for a firm's own goods and services is an investment obstacle, which is framed similarly to the question on uncertainty: *"Thinking about your investment activities, to what extent is*

Table 3: Uncertainty about the future (% of responding firms).

	Not an obstacle	A minor obstacle	A major obstacle
Wave			
2016	24	33	42
2017	24	36	39
2018	27	37	35
2019	24	38	38
2020	17	34	49
2021	22	36	42
2022	16	35	49
Size			
Micro	23	31	46
Small	22	35	43
Medium	22	38	40
Large	22	40	38
Sector			
Manufacturing	21	37	42
Construction	23	34	44
Services	22	35	43
Infrastructure	24	37	39
Total	22	36	42

Note: The table shows the answers, in percent of respondents in each year, to the question: *Thinking about your investment activities, to what extent is uncertainty about the future an obstacle? Is it a major obstacle, a minor obstacle or not an obstacle at all?* Don't knows and refusals are excluded from the total.
Source: EIBIS 2016-2022

demand for your products and services an obstacle? Is it a major obstacle, a minor obstacle or not an obstacle at all?"[10]

In addition, we use two more indicators for business prospects. The first is based on other perceived impediments to investment and is constructed as the first principal component of the remaining questions on investment obstacles. These questions concern the availability of staff with the right skills, energy costs, access to digital infrastructure, labour market regulations, business regulations, availability of adequate transport infrastructure and availability of finance.[11] We refer to this variable

[10] See also section A.1 in the Annex for the formulation of the questions used in the present study.
[11] As these are all categorical variables, Pearson correlations or standard covariance matrices based

as *Other investment impediments* (Table A.1). The second composite indicator is based on the first principal component of the answers to a question about near-term expectations: *Do you think that each of the following will improve, stay the same, or get worse over the next 12 months? Availability of internal finance, availability of external finance, business prospects of your sector or industry, overall economic climate, political and regulatory climate*. We refer to this variable as *Near-term outlook*.

The main reason to use indicators, instead of each variable separately is dimension reduction. The total number of investment impediments and near-term expectations questions is eleven and for both groups of questions, a firm's answers tend to cluster on one of the options, say *Not an obstacle at all* for the former group or *Stay the same*, for the latter group.[12] We check that using all variables separately, instead of the indicators, does not have a major effect on the coefficients of interest in our empirical analysis (Figure 1; Tables A.10 and A.11).

Other papers analysing data of non-listed firms use a number of balance-sheet and income-statement variables to control for business opportunities (e.g. Gulen and Ion, 2015 or Kalemli-Özcan, Laeven, and Moreno, 2022). Sales (or turnover) growth, measured as the year-on-year log-difference in the total amount received for the sales of goods and services is commonly used to control for firms' growth opportunities. Cash flows, as a ratio to total assets, is another common control (see Gulen and Ion, 2015; Husted, Rogers, and Sun, 2020; or Jens, 2017). We follow these works and, in some specifications, we add lagged sales growth and the of cash flow to total assets, which are often used to control for business opportunities. The caveat is that the sample size is significantly reduced as these variables contain a lot missing values.

In order to scale up quicker, smaller firms tend to borrow more often and invest more than larger firms (Cooley and Quadrini, 2001). Firm size may thus capture significant effects on investment and as such should be taken into account. Firm size is measured differently in studies on the economic effects of uncertainty. Guiso and Parigi (1999) use the number of employees as a size control, but do not find a statistically significant effect on investment. Alternative size measures, such as market capitalization (Jens, 2017) are only feasible with data on publicly listed firms. Kalemli-Özcan, Laeven, and Moreno (2022), who also use Orbis data, measure firm size through the logarithm of total assets. They find a negative effect on investment, pointing to decreasing returns to scale for investment for larger firms. We control for size using the logarithm of total assets, as well. Our main results are robust to using the logarithm of the number of employees.

on numerical values assigned to each category will not be appropriate. The principal components here are based on the correlation matrix consisting of pairwise polychoric correlations between each pair of cited variables. See the notes to Table A.1 for more information.

[12]See Table A.6 for the polychoric correlations between variables. Using these correlations we produce the first principle component for each group of questions.

The corporate finance literature has also extensively studied the role of external financing costs on firm investment. Empirical findings suggest that financially constrained firms that face high external financing costs tend to invest less (Hennessy and Whited, 2007; Whited and Wu, 2006). Considerable debate in the literature exists about what constitutes the best measure for financial constraints. Popular options are indices by Kaplan and Zingales (1997), Whited and Wu (2006) and Hadlock and Pierce (2010). These indices rely on the availability of firm-level financial information such as cash flow, interest-coverage ratios, or leverage. We use these variables separately, rather than as an index in our estimations.

In addition, we also use a finance constraint indicator built on several survey responses related to external financing in the EIBIS data set. The finance constraint indicator is created on basis of four sub-indicators. Firms are considered (1) quantity constrained if they used external finance but were unhappy with the amount received or sought external finance and were unhappy with the amount offered; (2) price-constrained when they did not seek external financing due to "excessive" costs; (3) rejected when they sought external finance and were rejected or did not receive any financing offers. Finally, firms are considered (4) discouraged when they did not seek external financing due to concerns of being rejected (Brutscher et al., 2020). Firms are considered financially constrained if any of the sub-indicators (1) – (4) apply (see also Table A.3). This approach is similar to a seminal contribution by Jappelli (1990) who sought to identify credit-constrained US households from survey data. A variation of this approach has also been used for firm-level survey data by Ferrando, Popov, and Udell (2017).

3.2 Empirical specification

We estimate investment equations using an approach similar to Barbiero, Popov, and Wolski (2020) and Kalemli-Özcan, Laeven, and Moreno (2022). In these studies, the investment rate, as defined in (1), is a function of business opportunities and other firm-specific control variables. In our study, we use two specifications. In the first, we use a linear probability model (LPM) to estimate the effects of uncertainty on the probability to reduce (or increase) investment. In this specification, $y_{i,c,s,t}$ is as defined in Table 2. We estimate separately one equation for the probability to decrease investment and another for the probability to increase investment. In the second specification, $y_{i,c,s,t}$ is the investment rate, as defined in (1) and described in Table A.2.

$$y_{i,c,s,t} = \beta_1 U_{i,c,s,t-1} + X_{i,c,s,t-1}\Theta + \alpha_i + \delta_t + \gamma_{c,s,t} + \varepsilon_{i,c,s,t} \tag{2}$$

The perception of uncertainty as an impediment to investment - $U_{i,c,s,t}$ - is the main variable of interest. Since the question about the change in investment (Q17 in Annex

A.1) in survey year t refers to investment in year $t-1$ and the questions on investment impediments and near-term outlook refer to year t, we use the answers in the survey of the same firm in year $t-1$ for $U_{i,c,s,t-1}$ and likewise for the remaining questions on investment impediments and near-term outlook. The vector of control variables, $X_{i,c,s,t-1}$ is comprised of three blocks.

The first block contains measures of business opportunities and impediments to investment, like the lagged growth rate of sales, the lagged ratio of cash flow to total assets, the perception of demand for own products and services, the index of perceived impediments to investment and the lagged index of perceived near-term outlook, as described above. The second block contains financial characteristics like lagged financial leverage and interest coverage ratio, which is motivated by the literature on investment sensitivity to financial constraints (Hubbard, 1998 and references therein). This block also contains the finance constraint indicator, constructed using EIBIS data as described above [13] Finally, the third block is comprised of non-financial characteristics, like firm size, measured by the logarithm of total assets. All variables are described in Table A.1. Summary statistics are in Table 4.

Table 4: Summary statistics of the variables

	Min	Mean	Median	Max	SD	N
Other impediments	-2.25	0.00	0.01	1.45	0.91	53036
Near-term outlook	-2.06	0.00	-0.06	1.90	0.93	46834
Size	0.10	15.21	15.16	25.31	2.23	43708
Leverage	0.00	0.19	0.12	0.99	0.21	36651
Cash flow	-0.38	0.10	0.08	0.59	0.12	31402
Sales growth	-0.53	0.06	0.03	1.68	0.28	35969
Interest coverage	-0.85	0.13	0.06	1.48	0.30	32389
Investment rate	-0.45	0.10	-0.01	1.66	0.41	42511
Employment growth	-0.33	0.02	0.00	0.67	0.16	38730

Note: N in the last column shows the number of non-missing values of each variable in the sample. Don't knows and refusals are excluded from the sample. Continuous variables are winsorised so that the kurtosis remains below 10 as in Kalemli-Özcan, Laeven, and Moreno (2022). Leverage, cash flow, sales growth, interest coverage and investment rate are thus winsorised at 1%, 1%, 2%, 2% and 4%, respectively. *Source*: EIBIS 2016-2022 and Orbis.

In both specifications, we include firm- (α_i) and time fixed effects (δ_t) to capture

[13] See Tables A.1 and A.3.

firm-specific and time-related effects, such as the state of the business cycle or large one-off events, like COVID-19. In addition, we estimate specifications in which we saturate the model with country-year and sector-year, or with country-sector-year fixed effects ($\gamma_{c,s,t}$). In this way, we absorb country- and sector-specific time-varying shocks to demand or to technology in any given year.

4 Results

4.1 The effects of uncertainty on the likelihood to change investment

Uncertainty has a large negative effect on investment across models and specifications in our study. Consider first the probability to invest less than in the preceding year (Table A.8). Models (1) and (2) use only EIBIS data. Model (1) is a two-way fixed-effects panel regression, while model (2) is saturated with country-sector-year fixed effects in addition to firm-level fixed effects. In both specifications, the probability to invest less than the previous year, for firms perceiving uncertainty as a major impediment to their investment, is significantly higher (by around 4 percentage points) than the same probability for firms that report uncertainty as no impediment at all. Similarly, a firm that perceives uncertainty as a minor impediment to investment has a higher likelihood of reducing investment relative to the preceding year, of about 2.5 percentage points, than a firm that does not see uncertainty as an investment impediment.

Turning to the likelihood of increasing investment relative to the preceding year (Table A.9), it is about 6 percentage points lower for a firm that sees uncertainty as a major impediment to investment than for a firm that does not see uncertainty as an impediment to investment. The likelihood decreases for firms that perceive uncertainty as a minor impediment compared to firms that do not see uncertainty as investment impediment by about 1 percentage point, but the coefficient is not significant at conventional confidence levels.

In models (1) and (2), demand for the firm's products or services controls for business prospects and opportunities, as perceived by the firm. Firms that perceive demand as a major obstacle are about 4.5 p.p. more likely to reduce investment than those that do not see it as an obstacle. The likelihood is also higher for firms that see demand as a minor obstacle, by about 1 p.p. and the estimate is not statistically significant. Firms that perceive demand as an obstacle to investment are also less likely to increase investment (Table A.9), but the estimates are not significant at conventional confidence levels.

Better near-term outlook has the expected effects on the likelihood to change in-

vestment: it decreases the likelihood to invest less than the previous period and increases the likelihood to invest more. The estimates are statistically significant, but as the variable is a unit-free index they do not have a quantitative interpretation.

The coefficients on the index summarising the remaining impediments to investment are positive (*Other investment impediments*), implying that perception of higher investment impediments increases the likelihood to reduce investment. Similarly, the coefficients on this variable in Table A.9 are negative, implying that perceptions of higher investment barriers reduce the likelihood of increasing investment.

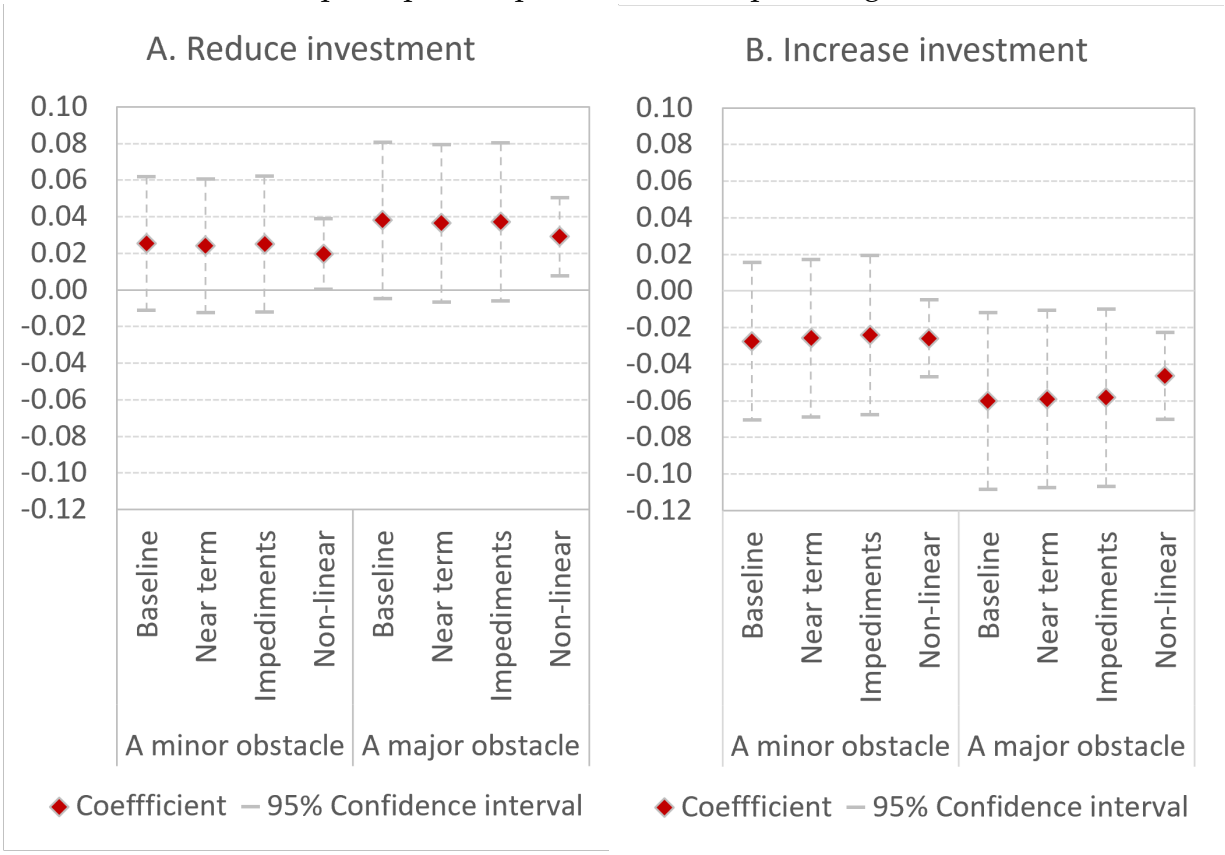
Tables A.11 and A.10 show the estimated coefficients of each component of the *Near-term outlook* and *Other investment impediments*, respectively. They demonstrate that controlling for each variable separately, instead of using a composite index, does not have a significant effect on the coefficients of interest: estimated coefficients on uncertainty remain practically the same (see also Figure 1).

The coefficients on the EIBIS indicator of financial constraints have the correct sign but are not significant at conventional confidence levels. Given the importance of financial indicators in the literature, (Hubbard, 1998), we draw on the matching of EIBIS with Orbis data and add measures of profitability, leverage and solvency. While this reduces the sample significantly, it provides a way to compare results with other studies and a robustness check for our results. Models (3) and (4) in Tables A.8 and A.9 show the results of including these indicators. Model (3) saturates the fixed effects estimator with country-year and sector-year fixed effects, whereas model (4) adds country-sector-year fixed effects to the standard fixed-effects estimator.

The size and significance of the main coefficients of interest, those on uncertainty, remain broadly unchanged across specifications, despite the smaller sample size and additional controls. Coefficients on financial leverage are significant in both models. A one-standard deviation increase in financial leverage increases the probability of investing less than in the preceding year by 6 p.p. and reduces the probability of investing more than in the preceding year by about 8.5 p.p. The coefficients on the interest coverage ratio and the EIBIS financial constraints indicator are not significant at conventional confidence levels.

The linear probability model used in the baseline specification has the advantage of providing direct estimates of marginal effects in the probability scale, but predicted probabilities are not restricted to the unit interval. A logistic regression addresses this problem and provides a test for the validity of the estimates in the LPM. One complication in panel logistic regressions is the incidental parameters problem, which makes estimates biased in small T panels like ours. We use the method proposed in Stammann, Heiß, and McFadden (2016) that circumvents these problems. Estimated effects of uncertainty on the probabilities to reduce and increase investment remain significant, albeit slightly smaller than in the LPM. The probability to invest less for firms that perceive uncertainty as a minor or major impediment relative to those that

Figure 1: Comparison of estimates for the baseline linear probability model, the robustness check for the principal components and the panel logistic model.



Note: The figures shows the estimates and 95 per cent confidence intervals for the baseline model (Tables A.8, A.9, model (4)), the robustness of the two principal components for near-term expectations (Table A.11) and investment impediments (Table A.10) and the panel logistic model (Table A.12, AME).

do not consider uncertainty an impediment is higher by 2 and 3 p.p., respectively. Similarly, the probability to increase investment is lower by about 2.5 and 4.5 p.p., respectively (Table A.12).

Figure 1 compares the coefficient estimates on the effect of uncertainty on investment. It illustrates that coefficient estimates are stable across models and are robust to the use of principal-component indicators to summarise the information in the variables measuring near-term expectations and investment impediments.

4.2 The effects of uncertainty on the investment rate

As described above, a different way to assess the effects of uncertainty on investment is to measure the quantity invested. We use the specification in (2), and replace the dependent variable with the investment rate, i.e. net investment to fixed assets, or equivalently the growth rate of fixed assets, see (1).

Uncertainty has a large negative effect on the investment rate, too (Table A.13). The investment rate of firms perceiving uncertainty as a major obstacle is some 3 p.p. lower than of firms, who do not consider uncertainty an investment impediment. This is about a third of the average investment rate (9.6 per cent) in the sample (Table 4). The investment rate of firms that perceive uncertainty as a minor impediment does not seem to differ from that of firms, who do not consider uncertainty as an impediment to investment.

Coefficients on financial leverage are statistically significant in this specification. Higher financial leverage reduces investment rates. A one-standard deviation of increase in leverage (21 per cent of total assets) decreases the investment rate by 7 p.p. As would be expected, higher levels of cash flow, relative to total assets, and sales growth are associated with higher investment rates. A one-standard deviation increase of the cash flow ratio is associated to a 3 p.p. higher investment rate, while a one-standard deviation increase in sales growth raises the investment rate by 1 p.p.

The results of our regressions using a measure of actual investment as a dependent variable lend themselves most obviously for comparison to the existing literature, usually concerned with uncertainty's effect on investment. However, our dependent variable differs from that conventionally employed. Whereas we use the rate of change in fixed assets, most authors use annual (quarterly) capital expenditures scaled by total assets in the preceding year (quarter) as a dependent variable (e.g., Jens, 2017; Gulen and Ion, 2015; Kim and Kung, 2017; Bloom et al., 2022). The Orbis database does not include information on firms' capital expenditures, limiting our ability to directly compare our results to the relevant research.

Furthermore, our measure of uncertainty captures the gradations of perceived barriers to investment on a trichotomous scale, complicating the comparison of effect size expressed in standard deviation increases in uncertainty. In this regard, our measure of uncertainty compares to other categorical uncertainty variables, like election indicators used by Julio and Yook (2012) and Jens (2017). These authors estimate negative effects of uncertainty on investment at around 5 per cent, which is not too different from our results, while, again comparability is limited due to differences in our dependent variable and the way we capture uncertainty.

EIBIS documents a large increase in uncertainty perceptions in 2022 compared to 2021, pushing the share of firms that perceive uncertainty as an obstacle to investment to the levels in 2020, when the COVID-19 pandemic broke (Table 3). Examining the contingency table of the answers in the two years (Table 5) shows that only a third of those who answered that uncertainty was not an obstacle in 2021 repeated their answer in 2022. Even fewer of the remaining firms changed their answer to "Not an obstacle at all" in 2022. At the same time 70 per cent of those that thought that uncertainty was a major obstacle to their investment plans in 2021 gave the same answer in 2022.

One motivation for this study is to use EIBIS to assess in real time the likely effects of uncertainty on investment. We use our estimates (Table A.13 model (4)) to illustrate the effect of this large increase in uncertainty on corporate investment in the European Union. The specification in Table A.13, together with the fact that the EIBIS is representative for the EU non-financial corporate sector, allows to assess the aggregate economic effect of uncertainty on the non-financial corporate investment in 2022. To this end, we use model (4) in Table A.13 to predict the investment rate in 2022 using the 2022 vintage of the investment survey and compare this prediction with a counterfactual one, in which uncertainty perceptions of each firm in 2022 remain at their 2021 levels. Predictions for each firm are weighed with the firm's share of economy-wide gross value added. Our calculations show that non-financial corporate investment in 2022 would have been 1 p.p. of fixed assets higher had uncertainty perceptions remained at their levels in 2021.[14] This is about 10 per cent of the average investment rate in the sample (see Table 4).

Table 5: Uncertainty perceptions in 2021 and 2022 (% of respondents)

	Not an obstacle	A minor obstacle	A major obstacle
Not an obstacle	35	17	6
A minor obstacle	39	47	24
A major obstacle	26	36	70
Total	100	100	100

Note: The contingency table documents the responses, in % of respondents, to question 38 I in EIBIS on uncertainty perceptions (see A.1 for the question) for 2021 (columns) and 2022 (rows).

4.3 The effects of uncertainty on employment

Employment and investment decisions of a firm are closely related. Due to complementarities, firms typically increase employment when they invest in new capacity. With high labour costs, however, firms might reduce employment by replacing capacity with labour-saving technologies. Furthermore, high uncertainty might prompt firms to increase the number of employees to meet demand without increasing installed capacity, or to keep employment unchanged, but increase hours. As mentioned previously, the relationship between employment and uncertainty is somewhat ambiguous. Using the EIBIS-Orbis dataset, we investigate this relationship. Our model is similar to the specification in equation (2) and also to Lang, Ofek, and

[14] Equivalently, the growth rate of fixed assets would have been higher by 1 p.p.

Stulz (1996), who study the effect of leverage on firm growth, including employment growth.

Column (1) and (2) in Table A.14 show the estimated coefficients. In line with Bloom et al. (2022) we find that uncertainty has a negative effect on employment growth. It is one percentage point lower for firms that perceive uncertainty as a major obstacle than for firms that do not perceive uncertainty as an obstacle at all. The coefficient on *Other investment impediments* is negative, implying that the higher are perceptions of investment impediment the lower is employment growth. Improving near-term outlook has a positive effect on hiring. Higher past asset growth is associated with higher employment growth, in line with results in Lang, Ofek, and Stulz (1996). A one standard-deviation increase in fixed-assets growth (investment rate) in the preceding year, increases employment growth in the average firm by 8 percentage points. Higher profitability is also associated with higher firm-level employment growth: a one standard-deviation increase in the cash flow to total assets ratio, increases employment growth by about 8 percentage points. Unlike Lang, Ofek, and Stulz (1996), our estimates of leverage and sales growth are not significant at conventional confidence levels.

The estimated coefficient on size is negative and significant, implying that larger firms have lower employment growth. This violates Gibrat's law, which postulates that a firm's employment growth should be independent of its absolute size. However, such a result is not uncommon in the literature (Lotti, Santarelli, and Vivarelli, 2003; Hijzen, Upward, and Wright, 2010). Haltiwanger, Jarmin, and Miranda (2013), however, show that after controlling for age, there is no relationship between size and employment growth. In order to address this criticism, We incorporate firm age defining young firms as those with age 5 years or less and old firm as those older than 5 years as in Criscuolo and Menon (2014). We further create a new categorical variable that defines groups of micro-, small-, medium- and large young and old firms.[15]

Columns (4) and (5) in Table (A.14) show the estimated coefficients. The effect of uncertainty remains virtually unchanged, as do the rest of coefficients. The base category in the estimation is large and old firm. There is no systematic relationship between size and employment any more. Small and young firms, as well as medium and old firms grow faster than large and old firms, but large and young firm grow faster than any other category except small and young firms.

Furthermore, we use our estimates (Table A.14, model (4)) to repeat our coun-

[15]The underlying data necessary to create these two variables are readily available in EIBIS, where respondents are asked for their age and number of employees. The different sizes are created using the definition of the European Commission for small and medium size enterprises, namely, firms with less than 10 employees are micro firms; those with 10-49 are small firms; firms with 50-249 employees have medium size and those with 250 or more are large firms.

terfactual experiment in sub-section 4.2 and assess the effect of the increase in uncertainty in 2022 on corporate employment growth in the European Union. To this end, we use model (4) in Table A.14 to predict employment growth in 2022 using the 2022 vintage of the investment survey and compare this prediction with a counterfactual one, in which uncertainty perceptions of each firm in 2022 remain at their 2021 levels. Predictions for each firm are weighed with the firm's share of economy-wide gross value added. Our calculations show that employment growth of non-financial corporations in the European Union in 2022 would have been 0.7 p.p. higher had uncertainty perceptions remained at their levels in 2021. This is about one half of employment growth's standard deviation in the sample (see Table 4).

5 Conclusion

This paper contributes to the comparatively small body of literature utilizing a granular and firm-specific subjective uncertainty measure. A unique feature of our measure is that respondents are asked directly to assess how perceived uncertainty affects their investment decisions. It is derived from a pan-European survey, which is representative of the non-financial corporate sector of each EU Member State. Thus, unlike other papers focused on larger, publicly-listed firms, the analysis includes data from micro, small, medium, and large enterprises. This allows us to make inferences about aggregate economy effects of uncertainty on investment and employment.

The main finding of this study, in line with theoretical and empirical literature, is that uncertainty has a large negative effect on firm investment. Thus, as the number of firms perceiving uncertainty changes in the economy, the aggregate effects are potentially very significant. We estimate that the deterioration of subjective uncertainty perceptions of firms in 2022 relative to 2021 may have reduced aggregate non-financial corporate investment by 1 p.p. of fixed assets. This is 10% of the sample average rate of growth.

Investment and employment decisions of a firm are closely related and interdependent. Thus, despite the fact that our uncertainty measure relates to investment decisions, we estimate the effects on uncertainty on employment decisions, as well. We find that employment growth is 1 p.p. lower for firms that perceive uncertainty as a major impediment to investment than for firms, which do not perceive uncertainty as an investment impediment. This is one-half of the sample average employment growth. Furthermore, the estimated effect of increased uncertainty in 2022 is 0.7 p.p. of reduced employment growth compared to a counterfactual where uncertainty perceptions remained at their 2021 level. This is approximately equal to one half of standard deviation.

Our results indicate that prolonged periods of uncertainty may have large nega-

tive consequences for the economy. This is in line with existing studies on the macroeconomic effects of uncertainty (Bloom, 2009; Jurado, Ludvigson, and Ng, 2015). Uncertainty perceptions are influenced by different events. In order to mitigate such consequences, policymakers should identify the sources of uncertainty and try to address them. In some cases, as shown in Kumar, Gorodnichenko, and Coibion (2023), policymakers can reduce uncertainty through communication. Communication likely helped also in 2022, when uncertainty perceptions were driven by the large and protracted increases in energy prices and the war in Ukraine. The announcement of the RePowerEU, a sizeable policy package, however helped reducing uncertainty by providing clear policy commitments to reduce dependence on Russian fossil fuels and to speed up the green transition.

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A Annex

A.1 Survey questions used

Q17. Overall, was this more, less or about the same amount of investment as in the previous year?

- More investment than in the previous year
- Investment broadly stayed the same to the previous year
- Less investment than in the previous year
- Don't know
- Refused

Q23. Do you think that each of the following will improve, stay the same, or get worse over the next 12 months?

A. Availability of internal finance within the company (e.g. internal funds like cash)

B. Availability of external finance (e.g. bank financing, private or public equity)

C. Business prospects specific to your sector or industry

D. Overall economic climate

E. Political and regulatory climate

- Improve
- Stay the same
- Get worse
- Don't know
- Refused

Q38. Thinking about your investment activities, to what extent is each of the following an obstacle? Is it a major obstacle, a minor obstacle or not an obstacle at all?

A. Demand for products or services

B. Availability of staff with the right skills

C. Energy costs

D. Access to digital infrastructure

E. Labour market regulations

F. Business regulations (e.g. licences, permits, bankruptcy) and taxation

G. Availability of adequate transport infrastructure

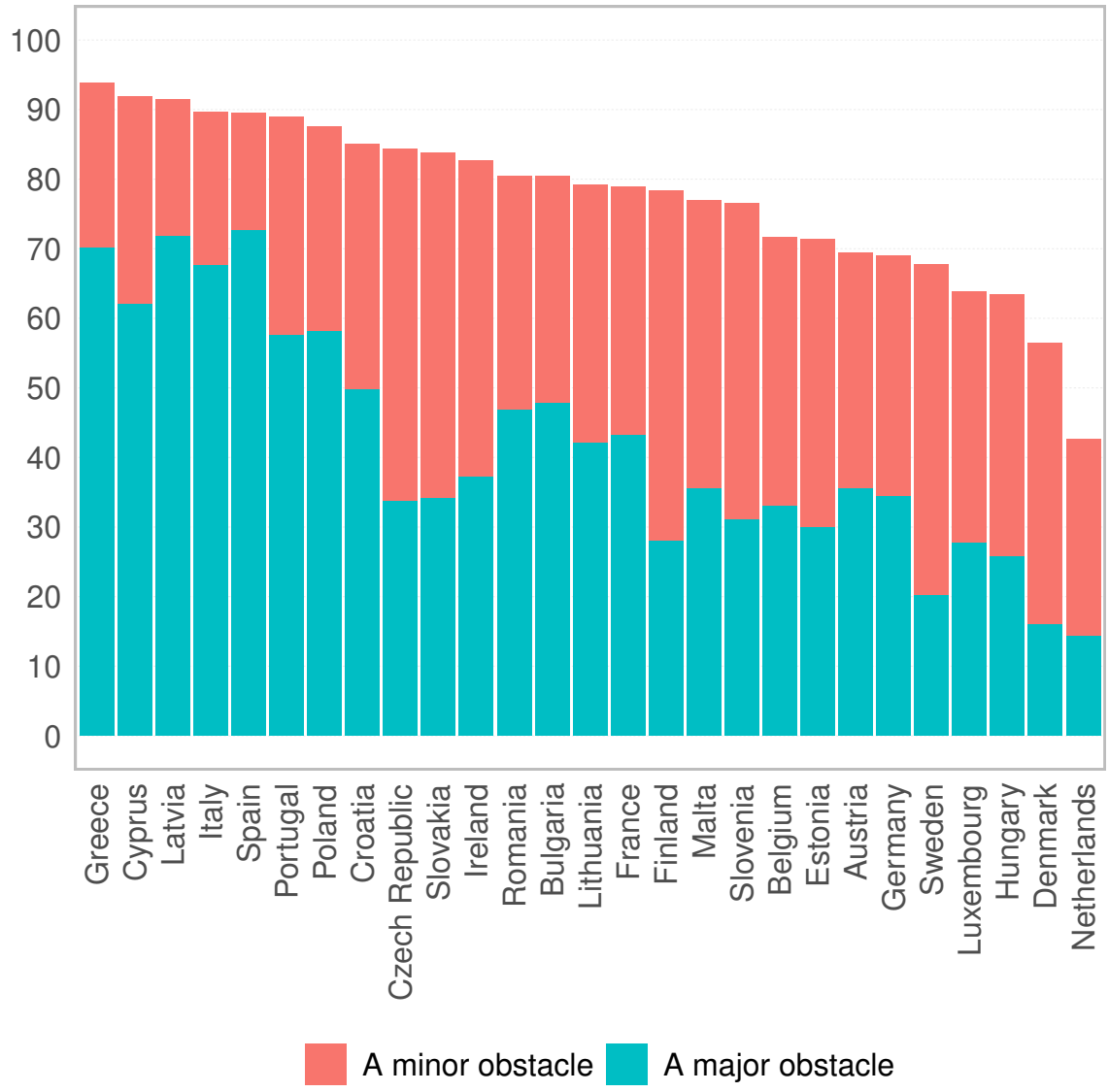
H. Availability of finance

I. Uncertainty about the future

- A major obstacle
- A minor obstacle
- Not an obstacle at all
- Don't know
- Refused

A.2 Figures and tables

Figure A.1: Uncertainty as an obstacle to investment (% of responding firms)



Note: The figure shows the answers, in percent of all respondents, to the question: *Thinking about your investment activities, to what extent is uncertainty about the future an obstacle? Is it a major obstacle, a minor obstacle or not an obstacle at all?* Don't knows and refusals are excluded from the total.
Source: EIBIS 2016-2022

Table A.1: Definition of variables and data sources

Variable	Description	Source
Uncertainty	Q38I	EIBIS
Demand	Q38A	EIBIS
Other impediments	First principal component of questions Q38B-Q38H	EIBIS
Near-term outlook	First principal component of questions Q23A-Q23E	EIBIS
Size	Logarithm of total assets	Orbis
Leverage	Ratio of financial debt to total assets	Orbis
Cash flow	Ratio of cash flow to total assets	Orbis
Sales growth	Sales, annual rate of change	Orbis
Interest coverage	Ratio of financial expenses to EBITDA	Orbis
Finance constrained	1 if finance constrained	EIBIS
Investment rate	Fixed assets, rate of change	Orbis
Employment growth	Number of employees, rate of change	Orbis
Reduce investment	1 if answer to Q17 is less investment	EIBIS
Increase investment	1 if answer to Q17 is more investment	EIBIS

Notes: Finance-constrained firms include those dissatisfied with the amount of finance obtained, firms that sought external finance but did not receive it and those who did not seek external finance because they thought borrowing costs would be too high or they would be turned down. Financial debt is the sum of loans and long-term debt. Principal components were computed from the matrix of polychoric correlations, which estimate the correlation between two hypothesised normally distributed continuous latent variables, from two observed ordinal variables (Drasgow, 1986). Before computing the correlations, the categories "Not an obstacle at all", "A minor obstacle" and "A major obstacle" in Q38 A-I are assigned values 1, 2 and 3, respectively. The categories "Improve", "Stay the same" and "Get worse" in Q23 A-E are assigned 1, 2 and 3, respectively. Don't knows and refusals are excluded before constructing the principal components.

Table A.2: Average investment rate by firm size classes and year

	Micro	Small	Medium	Large	Total
2015	0.097	0.133	0.109	0.091	0.111
2016	0.120	0.129	0.093	0.062	0.103
2017	0.101	0.125	0.090	0.081	0.101
2018	0.097	0.127	0.093	0.072	0.100
2019	0.078	0.117	0.095	0.096	0.099
2020	0.055	0.070	0.042	0.039	0.053
2021	0.086	0.078	0.089	0.057	0.080

Note: The table shows the average rate of change of fixed assets, or equivalently, the net investment in fixed assets as a ratio of fixed assets in the previous period.
Source: Moody's Orbis

Table A.3: Indicator for finance constrained firms, % and number of respondents

	2015	2016	2017	2018	2019	2020	2021
No	90.87	90.47	92.37	92.35	91.95	91.38	92.48
	(5137)	(7246)	(7445)	(7289)	(7868)	(7996)	(6259)
Yes	9.13	9.53	7.63	7.65	8.05	8.62	7.52
	(516)	(763)	(615)	(604)	(689)	(754)	(509)

Note: Source EIBIS 2016-2022. Number of respondents in brackets. Finance-constrained firms include those dissatisfied with the amount of finance obtained, firms that sought external finance but did not receive it and those who did not seek external finance because they thought borrowing costs would be too high or they would be turned down.

Table A.4: Demand for products or services (% of respondent by year).

year	Not an obstacle	A minor obstacle	A major obstacle
2016	46	27	27
2017	48	30	22
2018	51	28	20
2019	48	32	20
2020	45	31	23
2021	43	33	24
2022	43	34	23
Total	46	31	23

Note: The table shows the answers, in percent of respondents in each year, to the question: *Thinking about your investment activities, to what extent is demand for your products or services an obstacle? Is it a major obstacle, a minor obstacle or not an obstacle at all?*. Don't knows and refusals are excluded from the total.
Source: EIBIS 2016-2022

Table A.5: Polychoric correlation between investment impediments

	A	B	C	D	E	F	G	H	I
A	1								
B	0.27	1							
C	0.32	0.35	1						
D	0.40	0.33	0.47	1					
E	0.31	0.39	0.42	0.49	1				
F	0.32	0.28	0.44	0.43	0.64	1			
G	0.35	0.30	0.42	0.50	0.44	0.45	1		
H	0.43	0.22	0.36	0.41	0.38	0.42	0.43	1	
I	0.51	0.24	0.43	0.37	0.42	0.45	0.37	0.47	1

Note: Variables are the answers to EIBIS question 38, A-I (see section A.1 above): A. Demand for product or service; B. Availability of skilled staff; C. Energy costs; D. Access to digital infrastructure; E. Labour market regulations; F. Business regulations; G. Adequate transport infrastructure; H. Availability of finance; I. Uncertainty about the future. Reported numbers represent polychoric correlations, which estimate the correlation between two hypothesised normally distributed continuous latent variables, from two observed ordinal variables (Drasgow, 1986).

Table A.6: Polychoric correlation between near-term outlook answers.

	(1)	(2)	(3)	(4)	(5)
(1) Political and regulatory climate	1				
(2) Economic climate	0.48	1			
(3) Sector business prospects	0.46	0.36	1		
(4) Availability of external finance	0.42	0.34	0.62	1	
(5) Availability of internal finance	0.24	0.22	0.30	0.49	1

Note: Variables are the answers to EIBIS question 23 A-E. Reported numbers represent polychoric correlations, which estimate the correlation between two hypothesised normally distributed continuous latent variables, from two observed ordinal variables (Drasgow, 1986).

Table A.7: Polyserial correlation between uncertainty about the future and continous control variables

Size	Leverage	Cash flow	Sales growth	Interest coverage
-0.05	0.08	-0.12	-0.04	0.03

Note: Variables are as defined in Table A.1. Polyserial correlation measures the correlation between two continuous variables with a bivariate normal distribution, where one variable is observed directly, and the other is unobserved. Information about the unobserved variable is obtained through an observed ordinal variable that is derived from the unobserved variable by classifying its values into a finite set of discrete, ordered values (Olson, Drasgow, and Dorans, 1982).

Table A.8: A linear probability model for the probability to invest less than the previous year.

	Dependent variable: Reduce investment			
	(1)	(2)	(3)	(4)
Uncertainty about the future				
A minor obstacle	0.026*	0.027**	0.027	0.025
	(0.011)	(0.013)	(0.018)	(0.019)
A major obstacle	0.043**	0.038**	0.041*	0.038*
	(0.015)	(0.016)	(0.021)	(0.022)
Demand for own product or service				
A minor obstacle	0.009	0.013	0.017	0.017
	(0.011)	(0.012)	(0.015)	(0.016)
A major obstacle	0.042**	0.046***	0.061***	0.063***
	(0.014)	(0.015)	(0.019)	(0.019)
Other investment impediments	0.010	0.010	0.012	0.015
	(0.006)	(0.007)	(0.009)	(0.010)
Near-term outlook	-0.020**	-0.018***	-0.017**	-0.016*
	(0.007)	(0.007)	(0.008)	(0.009)
Total assets, log	0.056*	0.056**	0.200***	0.227***
	(0.023)	(0.026)	(0.037)	(0.037)
Finance constrained	0.018	0.016	0.033	0.036
	(0.015)	(0.019)	(0.026)	(0.027)
Financial leverage, lag			0.295***	0.272***
			(0.080)	(0.081)
Cash flow, lag			-0.082	-0.122
			(0.095)	(0.096)
Sales growth, lag			0.058**	0.070***
			(0.026)	(0.025)
Interest coverage ratio, lag			-0.002	-0.008
			(0.024)	(0.024)
Fixed effects				
Firm	Yes	Yes	Yes	Yes
Year	Yes			
Country-sector-year		Yes		Yes
Country-year			Yes	
Sector-year			Yes	

Continued on next page

Table A.8 – continued from previous page

	Dependent variable: Reduce investment			
	(1)	(2)	(3)	(4)
Observations	21,569	21,500	12,583	12,583
R^2	0.636	0.662	0.636	0.658
Within R^2	0.006	0.006	0.018	0.020

Note: Clustered (firm-level) standard-errors in parentheses. Rejection probabilities, indicated with asterisks *, **, ***, denote significance at 10%, 5% and 1% respectively. The number of observations in models (3) and (4) is significantly smaller than that in models (1) and (2) due to missing observations for financial variables from Moody's Orbis database.

Table A.9: A linear probability model for the probability to invest more than the previous year.

	Dependent variable: Increase investment			
	(1)	(2)	(3)	(4)
Uncertainty about the future				
A minor obstacle	-0.011	-0.007	-0.029	-0.028
	(0.016)	(0.016)	(0.021)	(0.022)
A major obstacle	-0.064**	-0.054***	-0.066***	-0.060**
	(0.020)	(0.018)	(0.024)	(0.025)
Demand for own product or service				
A minor obstacle	-0.010	-0.012	-0.004	-0.003
	(0.011)	(0.013)	(0.017)	(0.018)
A major obstacle	-0.010	-0.003	0.001	0.004
	(0.014)	(0.016)	(0.020)	(0.021)
Other investment impediments	-0.027**	-0.025***	-0.025**	-0.021*
	(0.008)	(0.008)	(0.010)	(0.011)
Near-term outlook	0.027**	0.023***	0.021**	0.018*
	(0.008)	(0.007)	(0.009)	(0.009)
Total assets, log	-0.090**	-0.095***	-0.301***	-0.313***
	(0.026)	(0.031)	(0.043)	(0.041)
Finance constrained	0.005	0.007	0.005	-0.002
	(0.019)	(0.021)	(0.029)	(0.029)
Financial leverage, lag			-0.361***	-0.387***
			(0.088)	(0.087)
Cash flow, lag			0.180	0.147
			(0.111)	(0.112)
Sales growth, lag			-0.043	-0.038
			(0.028)	(0.028)
Interest coverage ratio, lag			-0.017	-0.013
			(0.026)	(0.026)
Fixed effects				
Firm	Yes	Yes	Yes	Yes
Year	Yes			
Country-sector-year		Yes		Yes
Country-year			Yes	
Sector-year			Yes	

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Table A.9 – continued from previous page

	Dependent variable: Increase investment			
	(1)	(2)	(3)	(4)
Observations	21,569	21,500	12,583	12,583
R^2	0.648	0.674	0.655	0.677
Within R^2	0.009	0.008	0.023	0.023

Note: Clustered (firm-level) standard-errors in parentheses. Rejection probabilities, indicated with asterisks *, **, ***, denote significance at 10%, 5% and 1% respectively. The number of observations in models (3) and (4) is significantly smaller than that in models (1) and (2) due to missing observations for financial variables from Moody's Orbis database.

Table A.10: A linear probability model for the probability to invest: unpacking the composite indicator for investment impediments

Dependent Variables:	Reduce investment	Increase investment
Uncertainty about the future		
A minor obstacle	0.0250	-0.0242
	(0.0189)	(0.0221)
A major obstacle	0.0372*	-0.0583**
	(0.0220)	(0.0247)
Demand for own product or service		
A minor obstacle	0.0178	-0.0039
	(0.0163)	(0.0179)
A major obstacle	0.0603***	0.0030
	(0.0197)	(0.0213)
Availability of staff with the right skills		
A minor obstacle	-0.0214	-0.0099
	(0.0188)	(0.0200)
A major obstacle	-0.0120	0.0015
	(0.0206)	(0.0222)
Energy costs		
A minor obstacle	0.0096	-0.0111
	(0.0163)	(0.0182)
A major obstacle	0.0003	0.0101

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Table A.10 – continued from previous page

Dependent Variables:	Reduce investment	Increase investment
	(0.0206)	(0.0225)
Availability of digital infrastructure		
A minor obstacle	-0.0073	0.0117
	(0.0160)	(0.0177)
A major obstacle	-0.0199	0.0157
	(0.0245)	(0.0272)
Labour market regulations		
A minor obstacle	0.0095	-0.0106
	(0.0178)	(0.0194)
A major obstacle	-0.0166	0.0018
	(0.0207)	(0.0232)
Business regulations		
A minor obstacle	-0.0091	0.0112
	(0.0173)	(0.0190)
A major obstacle	-0.0282	0.0233
	(0.0212)	(0.0222)
Availability of transport infrastructure		
A minor obstacle	0.0029	0.0063
	(0.0163)	(0.0179)
A major obstacle	0.0108	0.0033
	(0.0213)	(0.0241)
Availability of finance		
A minor obstacle	-0.0158	0.0243
	(0.0170)	(0.0185)
A major obstacle	0.0159	0.0198
	(0.0215)	(0.0240)
Near-term outlook	-0.0163*	0.0187**
	(0.0086)	(0.0095)
Finance constrained	0.0370	-0.0028
	(0.0270)	(0.0287)
Financial leverage	0.2661***	-0.3886***
	(0.0812)	(0.0866)
Cash flow	-0.1172	0.1448
	(0.0960)	(0.1125)
Total assets, log	0.2270***	-0.3142***
	(0.0372)	(0.0411)

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Table A.10 – continued from previous page

Dependent Variables:	Reduce investment	Increase investment
Sales growth, %	0.0701***	-0.0370
	(0.0247)	(0.0285)
Interest coverage ratio	-0.0069	-0.0142
	(0.0241)	(0.0257)
Fixed-effects		
Firm	Yes	Yes
Country-sector-year	Yes	Yes
Observations	12,583	12,583
R^2	0.65876	0.67725
Within R^2	0.02143	0.02383

Note: Clustered (firm-level) standard-errors in parentheses.
Rejection probabilities indicated with asterisks denote: *** 1%, ** 5 % and * 10%.

Table A.11: A linear probability model for the probability to invest: unpacking the composite indicator for the near-term outlook

Dependent Variables:	Reduce investment	Increase investment
Uncertainty about the future		
A minor obstacle	0.0242	-0.0258
	(0.0186)	(0.0220)
A major obstacle	0.0364*	-0.0590**
	(0.0219)	(0.0247)
Demand for own product or service		
A minor obstacle	0.0151	-0.0024
	(0.0158)	(0.0175)
A major obstacle	0.0631***	0.0041
	(0.0193)	(0.0210)
Other investment impediments	0.0143	-0.0207*
	(0.0096)	(0.0108)
Availability of internal finance		
Unchanged	-0.0051	-0.0296
	(0.0221)	(0.0225)
Improve	-0.0436*	0.0197

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Table A.11 – continued from previous page

Dependent Variables:	Reduce investment	Increase investment
	(0.0251)	(0.0266)
Availability of internal finance		
Unchanged	0.0332	0.0290
	(0.0231)	(0.0239)
Improve	0.0048	0.0664**
	(0.0250)	(0.0260)
Own sector business prospects		
Unchanged	-0.0326	0.0425**
	(0.0203)	(0.0208)
Improve	-0.0206	0.0347
	(0.0227)	(0.0239)
Overall economic climate		
Unchanged	-0.0147	0.0036
	(0.0177)	(0.0190)
Improve	-0.0005	-0.0297
	(0.0202)	(0.0217)
Political and regulatory climate		
Unchanged	-0.0081	-0.0015
	(0.0153)	(0.0175)
Improve	0.0095	-0.0079
	(0.0214)	(0.0242)
Finance constrained	0.0364	-0.0050
	(0.0270)	(0.0287)
Financial leverage	0.2677***	-0.3769***
	(0.0808)	(0.0860)
Cash flow	-0.1238	0.1434
	(0.0955)	(0.1119)
Total assets, log	0.2233***	-0.3065***
	(0.0369)	(0.0407)
Sales growth, %	0.0728***	-0.0404
	(0.0247)	(0.0284)
Interest coverage ratio	-0.0100	-0.0129
	(0.0240)	(0.0257)
Fixed-effects		
Firm	Yes	Yes

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Table A.11 – continued from previous page

Dependent Variables:	Reduce investment	Increase investment
Country-sector-year	Yes	Yes
Observations	12,583	12,583
R^2	0.65929	0.67859
Within R^2	0.02293	0.02791

Note: Clustered (firm-level) standard-errors in parentheses.
Rejection probabilities indicated with asterisks denote: *** 1%, ** 5 % and * 10%.

Table A.12: A panel logistic regression for the probability to increase or decrease investment relative to previous year.

	Reduce investment		Increse investment	
	Log-odds	AME	Log-odds	AME
Uncertainty about the future				
A minor obstacle	0.308**	0.020*	-0.328**	-0.026**
	(0.157)	(0.010)	(0.135)	(0.011)
A major obstacle	0.455***	0.029**	-0.584***	-0.046***
	(0.175)	(0.011)	(0.155)	(0.012)
Demand for own product or service				
A minor obstacle	0.155	0.010	-0.014	-0.001
	(0.119)	(0.008)	(0.104)	(0.010)
A major obstacle	0.517***	0.033***	-0.007	-0.001
	(0.140)	(0.009)	(0.125)	(0.010)
Other impediments to investment	0.136*	0.009*	-0.190***	-0.015***
	(0.071)	(0.004)	(0.063)	(0.005)
Near-term outlook	-0.155**	-0.010* *	0.161***	0.012***
	(0.061)	(0.004)	(0.054)	(0.004)
Finance constrained	0.158	-0.010	0.035	0.003
	(0.174)	(0.011)	(0.166)	(0.014)
Leverage, lag	2.712***	0.174***	-2.977***	-0.239***
	(0.623)	(0.041)	(0.573)	(0.048)
Cash flow, lag	-0.998	-0.064	1.182*	0.095
	(0.770)	(0.051)	(0.683)	(0.057)
Size, lag	1.984***	0.127***	-2.226***	-0.178***

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Table A.12 – continued from previous page

	Reduce investment		Increse investment	
	Log-odds	AME	Log-odds	AME
	(0.298)	(0.021)	(0.274)	(0.026)
Sales growth, lag	0.728***	0.046***	-0.448**	-0.036**
	(0.200)	(0.014)	(0.185)	(0.015)
Interest coverage, lag	-0.014	-0.001	-0.092	-0.007
	(0.172)	(0.011)	(0.162)	(0.012)
Firm FE	Yes		Yes	
Year FE	Yes		Yes	
Observations	3972		4785	

Notes: Rejection probabilities, indicated with asterisks *, **, ***, denote significance at 10%, 5% and 1% respectively. The table shows the log-odds and the average marginal effects (AME). Computations use the estimator of Stammann, Heiß, and McFadden (2016). The number of observations is significantly smaller than that used in the estimation of the linear models above as observations, for which there is perfect classification, are dropped.

Table A.13: Effects of uncertainty on the investment rate.

	Dependent Variable: Investment rate, %			
	(1)	(2)	(3)	(4)
Uncertainty about the future				
A minor obstacle	0.006	0.005	0.000	0.000
	(0.010)	(0.010)	(0.013)	(0.013)
A major obstacle	-0.028**	-0.030**	-0.027*	-0.026*
	(0.012)	(0.012)	(0.015)	(0.015)
Demand for own product or service				
A minor obstacle	0.007	0.006	-0.005	-0.002
	(0.008)	(0.008)	(0.010)	(0.010)
A major obstacle	-0.003	-0.007	-0.008	-0.005
	(0.010)	(0.010)	(0.012)	(0.012)
Other investment impediments	-0.008	-0.009*	-0.007	-0.008
	(0.005)	(0.005)	(0.006)	(0.006)
Near-term outlook	0.019***	0.019***	0.010*	0.011**
	(0.005)	(0.005)	(0.006)	(0.006)
Size, lag	-0.320***	-0.323***	-0.323***	-0.332***
	(0.025)	(0.025)	(0.036)	(0.037)
Finance constrained	-0.006	-0.002	0.001	0.004
	(0.013)	(0.014)	(0.016)	(0.016)
Financial leverage, lag			-0.348***	-0.345***
			(0.074)	(0.074)
Cash flow, lag			0.271***	0.251***
			(0.083)	(0.085)
Sales growth, lag			0.041**	0.039*
			(0.020)	(0.021)
Interest coverage ratio, lag			0.014	0.013
			(0.014)	(0.014)
Fixed effects				
Firm	Yes	Yes	Yes	Yes
Year	Yes			
Country-sector-year		Yes		Yes
Country-year			Yes	
Sector-year			Yes	

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Table A.13 – continued from previous page

	Dependent Variable: Investment rate, %			
	(1)	(2)	(3)	(4)
Observations	28,094	28,026	16,608	16,608
R^2	0.556	0.579	0.570	0.589
Within R^2	0.033	0.033	0.040	0.041

Note: Clustered (firm-level) standard-errors in parentheses. Rejection probabilities, indicated with asterisks *, **, ***, denote significance at 10%, 5% and 1% respectively. Estimates differ from an earlier version quantitatively. The reason is a different treatment of the data before estimation. In an earlier version, outliers of each continuous variable were trimmed at 0.1 percentile in the upper and in the lower tail. The present version uses the winsorising scheme of Kalemli-Özcan, Laeven, and Moreno (2022). The number of observations in models (3) and (4) is significantly smaller than that in models (1) and (2) due to missing observations for financial variables from Moody's Orbis database.

Table A.14: Effects of uncertainty on employment growth.

	Dependent Variable: Employment growth			
	(1)	(2)	(3)	(4)
Uncertainty about the future				
A minor obstacle	-0.001	-0.003	-0.001	-0.003
	(0.005)	(0.005)	(0.005)	(0.005)
A major obstacle	-0.010*	-0.011*	-0.010*	-0.011*
	(0.006)	(0.006)	(0.006)	(0.006)
Demand of own product or service				
A minor obstacle	0.005	0.005	0.004	0.005
	(0.004)	(0.004)	(0.004)	(0.004)
A major obstacle	-0.001	0.000	-0.001	0.000
	(0.005)	(0.005)	(0.005)	(0.005)
Other investment impediments	-0.005*	-0.005*	-0.005**	-0.005*
	(0.003)	(0.003)	(0.003)	(0.003)
Near-term outlook	0.007***	0.007***	0.006***	0.006***
	(0.002)	(0.002)	(0.002)	(0.002)
Investment rate, lag	0.019***	0.020***	0.015***	0.015***
	(0.005)	(0.005)	(0.005)	(0.005)
Financial leverage, lag	0.004	-0.005	-0.010	-0.020
	(0.023)	(0.024)	(0.023)	(0.024)
Cash flow, lag	0.065**	0.069**	0.054*	0.059*
	(0.032)	(0.033)	(0.032)	(0.033)
Sales growth, lag	0.008	0.007	0.003	0.003
	(0.008)	(0.008)	(0.008)	(0.008)
Interest coverage ratio, lag	0.002	0.001	0.003	0.002
	(0.006)	(0.006)	(0.006)	(0.006)
Size, lag	-0.036***	-0.035***		
	(0.013)	(0.013)		
Size and age				
Micro and old			-0.015	-0.016
			(0.028)	(0.028)
Small and old			0.019	0.020
			(0.021)	(0.021)
Medium and old			0.031**	0.032**

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Table A.14 – continued from previous page

	Dependent Variable: Employment growth			
	(1)	(2)	(3)	(4)
			(0.014)	(0.014)
Micro and young			-0.085	-0.090
			(0.054)	(0.055)
Small and young			0.067*	0.065*
			(0.037)	(0.038)
Medium and young			0.028	0.028
			(0.027)	(0.028)
Large and young			-0.058**	-0.059**
			(0.025)	(0.026)
Firm	Yes	Yes	Yes	Yes
Country-year	Yes		Yes	
Sector-year	Yes		Yes	
Country-sector-year		Yes		Yes
Observations	15,845	15,845	15,837	15,837
R^2	0.585	0.600	0.587	0.602
Within R^2	0.008	0.009	0.010	0.010

Notes: Clustered (firm-level) standard-errors in parentheses. Rejection probabilities, indicated with asterisks *, **, ***, denote significance at 10%, 5% and 1% respectively. Estimates differ from an earlier version quantitatively. The reason is a different treatment of the data before estimation. In an earlier version, outliers of each continuous variable were trimmed at 0.1 percentile in the upper and in the lower tail. The present version uses the winsorising scheme of Kalemli-Özcan, Laeven, and Moreno (2022).

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