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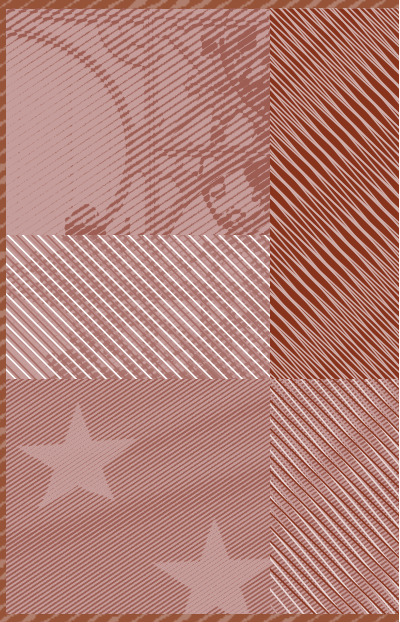

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Abstract

The aim of this paper is to investigate the effect of policy uncertainty on firms' investment decisions. We focus on Spain for the period 1998-2014. To measure policy-related uncertainty, we use a new macroeconomic indicator constructed for this country. We find strong evidence that policy uncertainty reduces corporate investment. Furthermore, the heterogeneous results suggest that the adverse effect of policy uncertainty is particularly relevant for highly vulnerable firms. In particular, non-exporting firms, small and medium enterprises, as well as firms in poorer financial condition are shown to decrease investment significantly more than their counterparts. Overall, these results are consistent with the hypotheses that policy-related uncertainty reduces corporate investment through increases in precautionary savings or to worsening of credit conditions.

Keywords: corporate investment, policy uncertainty, financial frictions.

JEL classification: D80, E22, G18, G31, G38.

Resumen

Este trabajo analiza el impacto que la incertidumbre acerca de las políticas económicas tiene sobre las decisiones de inversión de las empresas. Para ello se hace uso de una muestra de gran tamaño de empresas no financieras españolas, para el período 1998-2014. La incertidumbre se mide utilizando un nuevo indicador, que resume la información contenida en un conjunto de variables referidas a España. Los resultados muestran que un incremento de incertidumbre reduce la inversión empresarial. Asimismo, los resultados obtenidos indican que la incertidumbre tiene un impacto negativo mayor sobre la inversión de las empresas altamente vulnerables. En particular, el impacto es más acusado para las empresas no exportadoras, las empresas pequeñas y medianas, y aquellas empresas que presentan una posición financiera menos robusta. En general, estos resultados son coherentes con el supuesto de que el impacto de la incertidumbre acerca de las políticas económicas sobre la inversión empresarial se produce como consecuencia de un incremento en el ahorro por motivo precaución o por la mayor dificultad de acceso al crédito.

Palabras clave: inversión empresarial, incertidumbre política, fricciones financieras.

Códigos JEL: D80, E22, G18, G31, G38.

1 Introduction

Corporate investment is a key factor in sustaining the productivity and long-term economic growth of firms. The slow recovery of corporate investment in the aftermath of the Great Recession has renewed interest in the drivers of corporate investment and spurred the debate on the effects of uncertainty on real economic variables.[1] The working hypothesis is that uncertainty exacerbates the consequences of downturns (Bloom, 2014). In particular, aggregate uncertainty has been increasingly recognized as an additional relevant determinant of investment decisions.

New evidence from the European Investment Bank Group Survey on Investment and Investment Finance (EIBIS) supports the hypothesis that uncertainty affects investment in Europe.[2] According to the 2016 wave, uncertainty is the most reported obstacle for long-term investment in the European area. 75% of European firms report that uncertainty about the future has been an obstacle in their investment activities, followed by availability of staff with the right skills (71%), and business regulation (64%). In addition, the political and regulatory climate is seen as a major impediment to carrying out planned investment in the short-term.

A growing empirical literature focuses on the impact of aggregate uncertainty on macroeconomic dynamics.[3] Only a few studies investigate this issue from a micro perspective and all focus on the US (Baker et al., 2016; Gulen and Ion, 2016; Bonaime et al., 2018). To our knowledge, there is no evidence available on the impact of macroeconomic uncertainty on investment at the micro-level for Europe.[4] We aim to fill this gap by providing new evidence for Spain. We exploit firm-level panel data for this European country to analyze the effect of macroeconomic policy uncertainty on investment and its potentially heterogeneous effects along the cross-sectional dimension.

The literature focusing on the relationship between uncertainty and investment proposes different channels that may be in place. First, this relationship has mostly been studied through the lens of the real option literature. In the presence of even partially irreversible projects and informational frictions, uncertainty may increase a firm's incentive to delay investment projects. Under high levels of uncertainty, firms exercise "the option value of waiting", which ensures access to additional information. This generates the so called "wait-and-see" effect, which impacts both the timing and level of investment (e.g. Bernanke, 1983; Bertola and Caballero, 1994; Abel and Eberly, 1994; Dixit and Pindyck, 1991).

Another recent branch of the literature points towards financial distortions as the most important mechanism through which uncertainty may affect investment decisions (Gilchrist et al.,

[1] The recovery was sluggish especially in US and Europe. In Spain it started in 2013 after the sovereign debt crisis and investment reached the pre-crisis level in 2017. In many other EU countries the recovery was slower.

[2] EIBIS is a EU-wide firm-level survey that collects information on firms' investment activities, their financing requirements, and the difficulties they face.

[3] E.g. Bloom et al. (2007); Bloom (2009); Bachmann et al. (2013); Jurado et al. (2015); Basu and Bundick (2017). For Spain, see Gil et al. (2017).

[4] A number of papers study the impact of firm-level uncertainty on investment: e.g. Guiso and Parigi (1999); Bontempi et al. (2010) for Italy.

2014; Christiano et al., 2014; Arellano et al., 2016). Financial constraints may significantly affect investment through the cost of raising external finance. In other words, firm-specific characteristics determining credit-worthiness and access to credit – namely, the firm's balance sheet structure, debt burden and profitability – are found to influence investment decisions through the credit channel.[5] The work of the previously mentioned authors adds that financial frictions may also exacerbate the negative effect of uncertainty. Arguably, periods of higher uncertainty, conditional on other determinants, may affect access to credit as banks become more restrictive in granting loans. The "financial frictions" channel thus highlights the role of the effective supply of credit as a main channel through which uncertainty affects investment. Finally, a third possibility is that firms react to high uncertainty with precautionary savings. This holds if firms are risk-averse (Jurado et al., 2015; Femminis, 2012; Saltari and Ticchi, 2007).[6] This channel suggests that credit shrinkage associated with high uncertainty periods may be demand driven, as opposed to the financial frictions story, which offers a supply-driven explanation of credit crunches.

Uncertainty is not a clear-cut concept.[7] We focus on policy uncertainty, which refers to situations characterised by increased dispersion in agents' expectations about governments' future policy stands. The intuition is that greater uncertainty about possible changes in government policies may induce firms to delay investment so as to gain additional information, or may prevent them from investing due to increased financial frictions or increased risk aversion.

Measuring uncertainty is a major difficulty of this stream of literature. Julio and Yook (2012) study the impact of political uncertainty on corporate investment for a large panel of countries. They use elections as a source of exogenous variation in political uncertainty that is not correlated with the business cycle and show that firms reduce investment when elections approach.[8] Shoag and Veuger (2016) construct a measure of US state-level uncertainty based on counts of local newspaper articles related to economic uncertainty and investigate its effect on state-level unemployment.

Baker et al. (2016) construct the Economic Policy Uncertainty (EPU) index for the US and many other countries.[9] The index for the US is based on three components: (i) the volume of newspapers' articles containing words related to "economy", "policy" and "uncertainty"; (ii) an index of about future tax changes; (iii) an index measuring forecasters' disagreement about consumer prices and fiscal policies. In their empirical application, they use this indicator to

[5] E.g. Fazzari et al., 1988, Bond and Meghir, 1994, Hennessy et al., 2007 and Kalemli-Ozcan et al., 2018.

[6] Bianco et al. (2013) show that family firms' investment is sensitive to firm-level uncertainty and relate this to the fact that family firms' owners may be more risk-averse as they hold large shares of wealth in the firm.

[7] The literature proposes alternative proxies to capture specific facets of uncertainty: e.g., stock market volatility (Bloom, 2009); expectations dispersion (Bachmann et al., 2013); newspaper-based index of policy uncertainty (Baker et al., 2016); volatility of unforecastable components of several time-series (Jurado et al., 2015).

[8] Other studies use elections as an instrument for political uncertainty: e.g., Julio and Yook (2016) focus on foreign direct investment of US companies, using elections in host countries as an instrument; Jens (2017) exploits US gubernatorial elections to study the impact of political uncertainty on firm investment.

[9] These indexes are available online at `http://www.policyuncertainty.com/index.html`.

document the real effects of policy uncertainty based on firm-level data. In the same spirit, Gulen and Ion (2016) investigate the impact of policy uncertainty on US corporate investment using the Baker et al. (2016)'s EPU index.[10] Both studies document the adverse effect of policy uncertainty on the corporate investment of publicly listed firms in the US. In line with the wait-and-see channel, this effect is particularly strong for firms with a high degree of irreversibility and those dependent on government spending.

Gil et al. (2017) construct a measure of policy uncertainty for Spain. We employ their macroeconomic indicator in our empirical analysis. It is a synthetic measure resulting from a principal component analysis which combines several policy related aspects and includes measures of the cross-sectional dispersion of individuals' expectations and opinions about the current and future political situation, a measure of political risk, the EPU index constructed by Baker et al. (2016) for Spain, and an indicator of the degree of disagreement in budget deficit forecasts. Gil et al. (2017) use this synthetic indicator to investigate the real effects of uncertainty at the macroeconomic level, based on vector autoregressive models. They find adverse effects of uncertainty on Gross Domestic Product (GDP), consumption, and especially, capital goods investment. We complement this evidence by providing new evidence of the effects of policy uncertainty on corporate investment in Spain, based on firm-level data.

We estimate a classical investment model augmented to explicitly account for the impact of aggregate factors in order to identify the average effect of policy uncertainty on the gross investment-to-capital ratio. We use panel data methods to account for firm-specific unobserved heterogeneity. According to our baseline model, an increase in policy uncertainty of one standard deviation decreases the investment rate by about 3.2 percentage points. To give a sense of the magnitude of this effect, consider that the policy uncertainty index increased by one standard deviation between 2008 and 2011, i.e. at the start of the financial crisis. In addition, we study heterogeneous effects along a number of cross-sectional dimensions, such as the firm's orientation to export, its financial position, and whether the firm belongs to a corporate group. We find that exporting firms are less affected than non-exporting firms, which can be explained by the fact that exporters may be less sensitive to domestic policy uncertainty since they operate in foreign markets. In addition, small and medium-sized enterprises (SMEs) and firms in poorer financial condition decrease investment significantly more than their counterparts, while firms that belong to corporate groups are less affected by policy uncertainty shocks than non-member firms. Belonging to corporate groups, a practice that has been increasing in Spain since the Great Recession, may be a strategy for small firms to overcome informational and financial frictions in the credit market. To the extent that belonging to corporate groups facilitates access to banking finance, both results are consistent with the idea that part of the explanation for the negative relation between political uncertainty and corporate investment may be related to the financial frictions channel (supply-driven credit tightening). This is also in line with the

[10] Bonaime et al. (2018) use the same index to study policy uncertainty effects on mergers and acquisitions.

risk aversion story: in this case, the decrease in investment may occur via demand-driven loan reductions for financing investment projects or an increase in precautionary savings.

Our analysis contributes to this stream of literature in two ways. First, our sample is based on annual firm-level data from the Central Balance Sheet Data Office Survey of the Bank of Spain. Our sample not only includes quoted companies but also SMEs, which represents more than 95% of all firms in Spain. Thus, with this significant population coverage, the current work can complement the existing evidence that refers to publicly listed US firms.

Second, we investigate the heterogeneous effects of uncertainty by the financial position of the firm, focusing both on firm-specific characteristics determining credit-worthiness and access to credit, and the role of belonging to a corporate group. This allows us to explore the potential role of risk aversion and financial frictions as channels through which uncertainty shocks may be amplified. The latter is extremely relevant in Spain since credit borrowing is by far the most important source of external finance for corporate investment.[11] All in all, our evidence is novel in allowing us to speculate on the relative importance of the aforementioned channels as an explanation for the negative impact of uncertainty on corporate investment in Spain.

The rest of the article is organized as follows. Section 2 briefly reviews the related literature and outlines our expected results based on the theoretical predictions discussed therein. In Section 3 we present our uncertainty indicator and the firm-level data used in the analysis. The empirical strategy is presented in Section 4. In Section 5, we discuss the results. Robustness tests are presented in Section 6 and Section 7 offers some concluding remarks.

2 Related Literature and theoretical predictions

Our work is mostly related to that of Gulen and Ion (2016) and Baker et al. (2016), both of whom study the relationship between firm-level capital investment and policy-related uncertainty for publicly listed firms in the US. They use the aforementioned Baker et al. (2016)'s EPU index to measure uncertainty. Gulen and Ion (2016) find a strong negative relationship between aggregated policy uncertainty and corporate investment. In addition, these authors study potential cross-sectional heterogeneity in the uncertainty–investment relationship. The negative effect is greater for firms facing a high degree of investment irreversibility and for those that are more dependent on government spending. Their results provide evidence that the wait-and-see effect may be an important channel for US-listed firms. Baker et al. (2016) slightly change the research question, shifting the focus from studying the average effect of policy uncertainty on corporate investment to studying the particular channels through which the adverse effect of policy uncertainty materializes. They also focus on the differential ef-

[11] According to the EIBIS survey, 40% of investment by Spanish firms in 2015 relied on external finance. Spain is ranked fourth among EU countries in terms of external finance usage. 75% of external finance relates to bank loans. This makes Spain one of the EU countries relying most intensively on bank lending (second only to Cyprus).

fect of policy uncertainty along a measure of exposure to government purchases. The working hypothesis is that policy uncertainty matters most for policy-sensitive sectors and firms react to high levels of policy uncertainty by postponing investment decisions. They find that the negative effect of policy uncertainty on investment rate and employment growth is most pronounced among firms largely exposed to government purchases, which is also in favor of real option models.

Therefore, the existing evidence for publicly listed firms in the US corroborates the wait-and-see effect. However, it does not discuss the other two channels proposed by the literature (financial frictions and risk aversion), which also make important theoretical predictions.

According to the financial frictions channel, access to credit may decrease in periods of high uncertainty and this may induce firms to delay investment. In this case, the decision to delay investment stems from the credit supply side and is sub-optimal from a firm's point of view. Therefore, as long as firms rely on external funds to finance their investment projects and uncertainty shocks imply credit tightening, firms that are more exposed to financial frictions will be more severely affected by uncertainty shocks, namely those in a more precarious financial position.[12]

In addition, firms may become more risk-averse in periods of high uncertainty and decide to decrease investment. The risk aversion channel may lead to an increase in precautionary savings or a decrease in the demand for loans (if firms finance investment though bank lending). This has important consequences for the long-term economic growth of the economy, since economic activity and entrepreneurship naturally come with a certain amount of risk.

We posit that the financial frictions and risk aversion channels may also be relevant to explain the adverse effect of policy uncertainty on investment, especially for SMEs or firms that rely on bank lending, and we investigate this for the case of Spain.[13] We explore this by means of our heterogeneous effects analysis (see Section 5.2). In the rest of the section, we summarize our expectations of the heterogeneous results in view of the aforementioned channels.

- Leverage and profitability: There is evidence that, *caeteris paribus*, firms in poorer financial condition and with a lower profitability profile encounter more difficulties in accessing credit markets. Therefore, we expect the negative effect of uncertainty on corporate investment to be higher for firms with higher leverage and lower profitability. Two effects may be in play. On the one hand, according to the bank lending channel, higher uncertainty will induce a credit supply shock that will affect firms asymmetrically: firms in a weaker financial position will be more affected. On the other hand, a credit demand

[12] The role of uncertainty in supply credit tightening has been empirically corroborated (e.g. Alessandri and Bottero, 2017; Buch et al., 2015). Bordo et al. (2016) find that aggregate uncertainty raises the average cost of debt, indicating a deterioration in the access to credit.

[13] Since the recovery (from 2013), Spanish firms increased extensively internal financing to finance investment.

effect may also be in place. Firms in a weaker financial position may reduce their demand for credit relatively more than firms in a sound financial position when faced with uncertainty. This is compatible with the risk aversion story.

- SMEs: We expect that the negative effect of uncertainty on investment is greater for SMEs than for large firms. This may be related to the fact that the former face higher informational frictions, which may be relevant in determining growth opportunities but also in accessing financial markets. As long as informational frictions increase during periods of uncertainty, SMEs will be more affected. Lastly, as SMEs are more vulnerable to shocks, they may increase their aversion to risk when policy uncertainty is high. Thus, in this case, the three channels may affect SMEs to a greater degree.

- Exports: The investment behavior of exporter firms may be different to non-exporters for two main reasons. First, exporters face an international demand and operate in foreign markets. They may therefore be less sensitive to (domestic) uncertainty. Second, as long as exporting firms also exhibit a sound financial profile, they will be less sensitive to the bank lending channel through which uncertainty may affect investment. However, given that we control for firm-specific characteristics associated with the latter point, the main channel we have in mind would be more related to the advantages that come with a geographically diversified demand.

- Corporate groups: The empirical literature does not provide clear-cut conclusions on the implications of belonging to a corporate group. On the one hand, if corporate groups are less affected by financial frictions, firms belonging to corporate groups may be less vulnerable to uncertainty shocks, and enjoy better credit conditions. On the other hand, uncertainty shocks may be amplified within corporate groups due to contagion effects.[14] Our claim is that belonging to a corporate group may be related to lower financial frictions, *caeteris paribus*. In Section D of the Appendix, we provide descriptive evidence that firms belonging to a corporate group enjoy a lower cost of debt (controlling for relevant firm-specific characteristics), and hence better credit conditions.

In the following section we describe our macroeconomic policy uncertainty indicator and the firm-level data used in the analysis.

[14] On the one hand, associations entail a lower risk of non-repayment than individual firms (Inderst and Müller, 2003; Faure-Grimaud and Inderst, 2005). Better access to credit may be also related potential debt coinsurance provided by a conglomerate structure (Kuppuswamy and Villalonga, 2016; Yan et al., 2010). On the other hand, while conglomerates may benefit from economies of scale in the access to credit, contagion effects due to idiosyncratic shocks among firms may prevail over coinsurance gains (Hege and Ambrus-lakatos, 2002).

3 Data

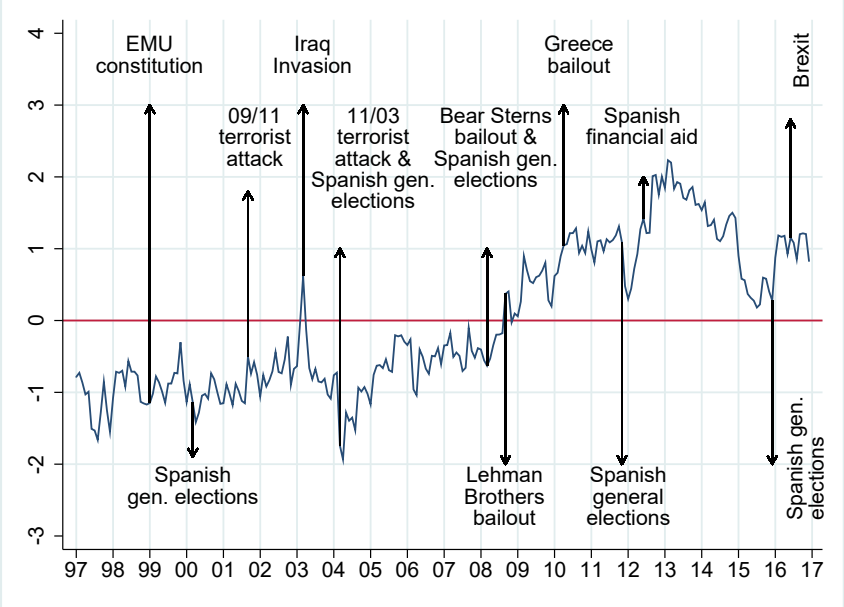
We now describe the data used in the analysis. Section 3.1 presents our policy uncertainty indicator, explains how it is constructed, and why it provides a reliable measure of policy uncertainty for this country. In Section 3.2 we outline the firm-level data used in the empirical exercise.

3.1 The policy uncertainty measure

We measure policy uncertainty using a new aggregate index constructed by Gil et al. (2017) for Spain.[15] It is a synthetic measure that combines information reflected in a number of distinct indicators associated with policy-related uncertainty. This indicator has been constructed for the period 1997-2016.[16]

Gil et al. (2017) consider the following indicators: (i) an indicator of individuals' opinions about the current political situation; (ii) an indicator of individuals' expectations about the future political situation; (iii) an indicator of political risk; (iv) the EPU index for Spain;

Figure 1: Policy uncertainty index



This figure depicts the monthly policy uncertainty indicator constructed by Gil et al. (2017) for Spain. Its values represent the distance in terms of standard deviations to the mean for the period 1997-2016.

[15] Uncertainty comprises two concepts: *risk* and *Knightian uncertainty*. *Risk* relates to situations where the outcome of an event is not known but the probabilities of potential outcomes are, so that the odds of the event can be computed. With *Knightian uncertainty*, not only is the outcome is unknown, but one also does not have the necessary information to compute the odds of potential outcomes. As common in this literature, our indicator of uncertainty encompasses both concepts and refrains from distinguishing between them.

[16] This is due to data availability. For more details, see Gil et al. (2017).

and (v) an indicator of disagreement about public deficit forecasts. Index (i) and (ii) are based on monthly survey data gathered by the Spanish Center for Research on Sociology (CIS). In particular, they rely on individuals' answers to two questions asking participants to assess the quality of the current political situation (from very good to very bad) and whether they expect the political situation to be worse, the same, or better in the future.[17] Index (iii) is constructed by the PRS Group and is a weighted average of measures related to government stability, socioeconomic conditions, and the quality of institutions.[18] Indicator (iv) is constructed by Baker et al. (2016) based on counts of articles in two Spanish newspapers (*El país* and *El mundo*) containing simultaneously words related to the notion of "uncertainty", "economy" and "policy". Lastly, index (v) is calculated as the cross-sectional dispersion of public deficit forecasts provided by a panel of experts.[19] This survey is run by Funcas, a Spanish foundation. Intuitively, this index measures the degree of disagreement between experts' expectations about fiscal policy. A more dispersed aggregate distribution of agents' expectations indicates higher uncertainty (e.g., Bachmann et al., 2013). Each of measures (i)-(v) capture specific facts of policy-related uncertainty. Gil et al. (2017) combine all information contained in each of these single measures by means of a Principal Component Analysis (PCA). This allows to obtain a measure of uncertainty that is more complete and less volatile that any of the single uncertainty indexes used in the PCA. The resulting synthetic policy uncertainty indicator is the first principal component extracted from the PCA.

The evolution of the policy uncertainty indicator is shown in Fig. 1. Our uncertainty proxy seems to be jointly capturing two relevant aspects. First, the index increases when events occur that are generally considered to be related to policy uncertainty. For instance, the policy uncertainty indicator is high at the time of the Greek bail-out request in April 2010, and of the Spanish request for financial aid in June 2012. It also picks when Brexit takes place. Another example may be periods just before general political elections. Electoral campaigns can increase policy uncertainty depending on agents' expectations about the outcome of the election and whether agents believe that the announced political stands will be followed coherently after the election.[20] According to Fig. 1, policy uncertainty increased during the most recent Spanish general electoral campaign. This suggests that the index takes higher values in periods when policy uncertainty increases.

Second, in contrast to other events such as the invasion of Iraq, the specific events occurring during the financial crisis have not only resulted in peaks in our proxy, but also an increasing trend that reverts only after the Spanish bank rescue package. In other words, the construction

[17] These indexes are computed as weighted averages of the shares of alternative answers.

[18] The PRS Group uses the International Country Risk Guide method and considers these dimensions: government stability, socioeconomic conditions, investment profile, internal and external conflicts, corruption, military in politics, religious tensions, law and order, ethnic tensions, democratic accountability, and bureaucracy quality.

[19] When constructing this index, Gil et al. (2017) account for the disagreement about GDP forecasts in order to isolate the genuine disagreement in public deficit forecasts.

[20] This is not necessarily the case and depends on the dispersion of citizens' expectations about future policies.

of the measure correctly captures the accumulated political uncertainty that built up after the collapse of Lehman Brothers, and not just non-persistent shocks. This is relevant since firm-level variables are measured annually, and hence our analysis is able to detect the impact of uncertainty for shocks that are quite persistent.

Table 1 shows the correlation between the policy uncertainty index and its components. The components that are most closely correlated to our policy uncertainty indicator are the index related to individuals' opinions about the current political situation and the political risk index (with a correlation of 0.9). By contrast the EPU index shows a weak correlation of 0.2. Hence, our indicator mostly reflects the assessment of political stability in the country, as well as citizens' opinions about the current political situation.

Since we use yearly firm data, we aggregate the monthly series of uncertainty at the annual level. To do that, we take a weighted average of monthly values for each calendar year and assign increasing weights to later months.[21] Since in our empirical analysis the uncertainty indicator is lagged by one year, this means assuming that the uncertainty related to the later

Table 1: Correlation matrix for the policy uncertainty indicator and its components (monthly obs.)

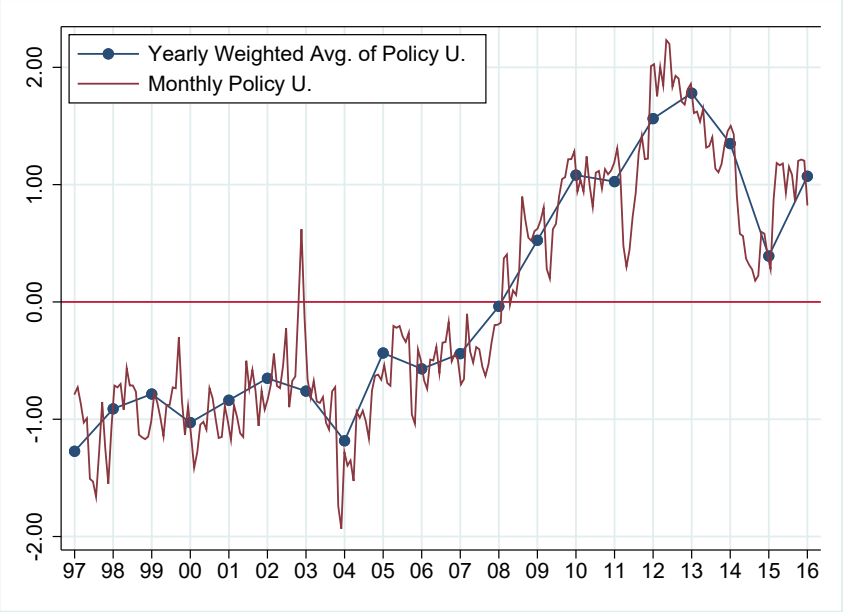
	policy U	(i) pol.sit.	(ii) exp.pol.sit.	(iii) pol.risk	(iv) EPU	(v) dis.pub.def.
policy U	1.00					
(i) pol.sit.	-0.94	1.00				
(ii) exp.pol.sit.	-0.68	0.50	1.00			
(iii) pol.risk	-0.90	0.91	0.40	1.00		
(iv) EPU	0.28	-0.21	-0.06	-0.15	1.00	
(v) dis.pub.def.	0.28	-0.13	-0.21	-0.18	-0.12	1.00

months of year $t-1$ is more likely to have an impact on firms' decisions in t than the uncertainty related to the beginning of year $t-1$.

Figure 2 depicts the evolution of the yearly policy uncertainty index, showing our annual weighted average construction against the original monthly variation. The political uncertainty index shows an upward trend in the period of interest. As expected, policy uncertainty is countercyclical and as suggested by Bloom (2014), the measure may actually be reflecting economic conditions. A major challenge we face in our analysis is disentangling the effect of policy uncertainty from other aggregate time-varying confounding factors (such as macroeconomic variables) that may explain investment. Our baseline analysis controls explicitly for the business cycle by including the GDP growth rate. In addition, in Section 6.1, we discuss the robustness of the heterogeneous results by further controlling for time fixed effects, which allows us to account for any aggregate factors that may be correlated with both uncertainty and investment decisions.

[21] For each month $m = 1, ...12$, the weight is $m/12$. Hence, December is given weight equal to 1 while January is given weight equal to $1/12$.

Figure 2: Annual policy uncertainty index



This figure plots the original monthly index of policy uncertainty constructed by Gil et al. (2017) against the annual weighted average of policy uncertainty that we use in this analysis.

3.2 Firm-level data

We use firm data from the Integrated Central Balance Sheet Data Office Survey (CBI) of the Bank of Spain. This database includes data reported in the CBA Annual Survey by non-financial firms, as well as administrative data from the accounts filed with the mercantile registries. Overall, the CBI has a wide coverage of the Spanish non-financial sector, representing around 50% of non-financial corporations in 2015 (Bank of Spain, 2016). Firm data is available on an annual level.

Our analysis relies on an unbalanced panel of a representative sample of Spanish firms for the period 1998-2014.[22] We apply standard cleaning procedures to firm data and consider firms that are observed at least twice in the period of study (1998-2014). Table 9 in Section B of the Appendix shows the panel structure of the data.

The final sample contains more than 3 million firm-year observations for a total of 616,740 firms. Table 8 in Section A of the Appendix compares the distribution of our sample to that of the population of Spanish firms for the period 1999-2014, as provided by the Central Directory of Firms (DIRCE). Overall, we observe a good representativeness of our final sample, although it is slightly underrepresentative of small firms, especially during the first years of the sample. Table 2 shows descriptive statistics for firm-level variables in the final sample. 1.3% of these are large firms, while all others are SMEs. Exporting firms and firms belonging to a corporate group represent small fractions of the sample. The gross investment-to-capital ratio is positive for

[22] We cannot consider years before 1998 because our uncertainty index is available from 1997 and all regressors are lagged by one year. The timespan ends in 2014 because we include information on exports, which is available until 2013. If we excluded export variables, we could extend the analysis to the period 1998-2016.

74% of observations in the sample, indicating that a large proportion of firm-year observations in the sample are characterised by investment (in gross terms). The average gross investment rate amounts to 13% with a standard deviation of about 26 percentage points (pp). This suggests that the gross investment rate shows important variation in our data. This can also be seen in Figure 3 in Section B of the Appendix, which shows the evolution of the average gross investment rate over time. Between 2007 and 2009, the average gross investment rate drops by about 7 pp and maintains a lower level thereafter.

Table 2: Descriptive statistics, full sample

	mean	sd	min	max	N
ROA	0.049	0.170	-1.676	0.721	3,318,739
Debt burden	0.581	0.954	0.000	2.771	3,318,739
Debt rate	0.693	0.454	0.000	4.830	3,318,739
Cash flow	-0.002	0.133	-0.979	0.920	3,318,739
Sales growth	0.050	0.534	-1.000	10.289	3,318,739
SMEs	0.987	0.114	0.000	1.000	3,318,739
Export	0.030	0.172	0.000	1.000	3,318,739
Corp_group	0.004	0.065	0.000	1.000	3,318,739
$\mathbb{1}$(Gross Inv.>0)	0.738	0.440	0.000	1.000	3,318,739
Gross Inv.Rate	0.130	0.255	-1.594	2.143	3,318,739

4 Empirical Strategy

In order to identify the contribution of macroeconomic policy uncertainty to firms' investment decisions, we estimate static investment equations by means of panel regressions as in Gulen and Ion (2016) and Baker et al. (2016). Our baseline model is a classical investment equation of this type, augmented to control for both firm-specific investment predictors and macroeconomic conditions:

$$(I/K)_{it} = \alpha_i + \beta_1 U_{t-1} + \boldsymbol{\beta}_2^\top \boldsymbol{X}_{it-1} + \boldsymbol{\beta}_3^\top \boldsymbol{M}_{t-1} + \epsilon_{it} \quad (1)$$

Index i and t refer to the firm and the calendar year, respectively. α_i indicates firm fixed effects. The dependent variable is the gross investment rate, which is defined as gross fixed capital formation over total capital stock. All explanatory variables are lagged by one year in order to minimize endogeneity concerns. $\boldsymbol{X}$ is a vector of relevant firm-level characteristics explaining investment: we include variables that characterize the financial position of the firm (i.e. *debt burden*, *debt rate*, and *cash flows*), its profitability (*ROA*), future growth opportunities (i.e.

[22] We cannot consider years before 1998 because our uncertainty index is available from 1997 and all regressors are lagged by one year. The timespan ends in 2014 because we include information on exports, which is available until 2013. If we excluded export variables, we could extend the analysis to the period 1998-2016.

sales growth), and other potentially relevant features, i.e. being a small or medium enterprise (*SMEs*), being an exporting firm (*export*), and belonging to a corporate group ($corp\_group$).[23] Our parameter of interest is the coefficient of the macroeconomic policy uncertainty indicator (U). We lag it by one year because it takes time for investment decisions to materialize and we are interested in the causal effect of uncertainty. $\boldsymbol{M}$ is a vector of aggregate controls and possible confounders of our uncertainty proxy.

Finally, ϵ is the error term, which we cluster at the firm and year level by means of two-way clustering (Petersen, 2009; Cameron et al., 2011). This enables us to simultaneously control for serial correlation (i.e. observations of the same firm may be correlated over time) and cross-sectional correlation (i.e. all firms are exposed to the same aggregate shocks each year). This allows us to keep the panel data structure unaltered and provide correct inference for our estimates (Petersen, 2009).

Since we include firm fixed effects, everything that is constant in time and firm-specific is controlled for. Hence, the identification of the effects of firm-level factors relies on the variation of firm-level variables over time, i.e. variation with respect to the firm-specific mean in the observed period (within transformation). It must be noted that since policy uncertainty varies over time but does not vary along the cross-section, we cannot include time fixed effects in our equation. If we did, time fixed effects would absorb all explanatory power of any aggregate time-varying variable, including our measure of policy uncertainty.

The main challenge of our estimation strategy is to properly control for aggregate confounders of policy uncertainty. Given that investment opportunities and demand expectations are only partially proxied by firm-specific controls, investment decisions are expected to be correlated with the business cycle, which is itself correlated with residual investment opportunities and demand expectations. Furthermore, policy uncertainty may be negatively correlated with the business cycle and investment opportunities since policy makers often experience pressure to make policy changes during times of recession. Thus, the effect of policy uncertainty could be capturing the effect of poor investment opportunities (which are not controlled for by the explanatory variables and are therefore unobservable to the econometrician). In our baseline specification, we explicitly account for the business cycle by controlling for aggregate GDP growth rate. This indicator, which is available at an annual level from the Spanish Statistical Office's (INE) webpage, is meant to capture the aggregate dynamics of investment opportunities and expected demand.[24] GDP growth rate and the policy uncertainty indicator show a

[23] We include *SMEs*, *export*, and $corp\_group$ in the baseline model since we are interested in the heterogeneous effects of policy uncertainty along these dimensions. However, the firm fixed effects model poorly estimates the coefficient of these variables due to their limited time variation. For this reason, the coefficients of these control variables are not reported. In contrast, the fixed effect model correctly estimates the interaction of these variables with the (time-varying) policy uncertainty index, which are reported and interpreted (see Section 6.1).

[24] There exists many alternative proxies for the business cycle, such as unemployment rate, Economic Sentiment Indicator (ESI), etc. Our results remain robust to individually including the mentioned variables.

pairwise correlation of 0.9, i.e. they are highly linearly related. However, we check that such a correlation does not lead to problems of multicollinearity in our regression.[25]

The following section discusses the baseline results. In Section 6.1, we discuss whether our baseline results are biased by the omission of other aggregate factors that may affect both policy uncertainty and corporate investment.

5 Baseline results

5.1 The average effect of policy uncertainty

We begin our empirical analysis by considering a classical investment panel regression with time fixed effects (Column 1 of Table 3). Then, we drop time fixed effects in order to identify the direct effect of aggregate policy uncertainty on the investment ratio.

Table 3: Baseline model: average effect of policy uncertainty

	(1)	(2)	(3)	(4)
ROA	0.026***	0.036***	0.034***	0.035***
	(0.005)	(0.006)	(0.006)	(0.006)
debt burden	-0.009***	-0.009***	-0.009***	-0.009***
	(0.000)	(0.000)	(0.000)	(0.000)
cash flow	0.065***	0.068***	0.068***	0.068***
	(0.003)	(0.003)	(0.003)	(0.003)
debt rate	-0.036***	-0.027***	-0.029***	-0.028***
	(0.004)	(0.003)	(0.003)	(0.003)
sales growth	0.011***	0.013***	0.012***	0.012***
	(0.001)	(0.001)	(0.001)	(0.001)
policy U		-0.048***	-0.032**	-0.041***
		(0.005)	(0.008)	(0.007)
GDP growth			0.004**	
			(0.001)	
GVA Sector				0.002*
				(0.001)
Time FE	yes	no	no	no
Observations	3318685	3318685	3318685	3318685
Adjusted R^2	0.154	0.147	0.148	0.147

*, **, *** statistically significant at the 10%, 5% and 1% level, respectively.
Note. This table reports results from estimating Eq. 1. The dependent variable is the investment rate. Firm FEs are accounted for by means of the within transformation. Standard errors are clustered at both the firm and year level through two-way clustering. In all regressions, the firm-level covariates are: *debt burden*, *debt rate*, *cash flows*, *ROA*, *sales growth*, $SMEs$, $export$, and $corp\_group$ ($SMEs$, $export$, and $corp\_group$ not reported). Column 1 includes time fixed effects (not reported), as opposed to all other columns. Column 2 includes the policy uncertainty indicator. Column 3 further includes GDP growth rate to the estimation in column 2. Column 4 replaces the GDP growth rate in column 3 with the sector-specific GVA growth rate.

[25] We compute the variance inflation factors (VIF), which is the diagnostic used for collinearity. The average VIF for the baseline model is 2, while the VIFs associated with policy uncertainty and GDP growth rate are both around 5. While there is no consensus on a VIF threshold indicating multicollinearity, $VIF > 10$ are often considered alarming. Therefore, we believe that in our case, multicollinearity is of minor concern.

The first block of variables in Table 3 presents the role of traditional determinants of investment. No matter which specification is considered, these determinants appear to be significant and present the expected sign in accordance with the literature. Both the debt burden and the debt-to-asset ratio present a negative coefficient. This indicates that on average and *caeteris paribus*, being in a weaker financial position negatively affects the level of investment. In contrast, indicators of profitability such as the ROA ratio, and indicators related to future profitability such as sales and employment growth, present a positive coefficient. Thus, our results suggest that the financial and profitability position of a firm appears to affect the investment ratio, as suggested by the literature, which highlights the role of financial frictions in accessing external finance and in making investment decisions.

In column 2 of Table 3, we drop time fixed effects in order to include our policy uncertainty proxy, which appears to negatively affect the investment ratio. However, as expected, the magnitude of this effect decreases when further controlling for the business cycle, reinforcing the above-mentioned need to control for potential confounders.[26] As expected, lagged GDP growth, which is a proxy for investment opportunities, positively affects the investment rate.

According to our baseline specification (column 3), a one standard deviation increase in the uncertainty measure decreases the investment rate by 3.2 pp. To give a sense of this magnitude, several things are worth noting. First, as documented in Section 3.1, our uncertainty index represents the distance in terms of standard deviations from the mean for the period 1997-2016. An increase of one standard deviation represents variation that is equivalent to episodes characterized by a significant increase in political uncertainty, such as that experienced between 2008-2011.

Second, as illustrated in Fig. 3, the average investment rate has experienced fluctuations of considerable magnitude throughout the business cycle. In particular, we observe that during the financial crisis, investment decreased by about 7 pp. All in all, our estimation indicates that uncertainty has a sizable effect on investment, although other determinants are also behind the observed fluctuations in the investment ratio.

To further illustrate this issue, we compute a simple exercise to get a sense of the contribution of policy uncertainty on the evolution of the aggregate investment rate during the financial crisis (for details, see Section C of the Appendix). Results indicate that the increase in policy uncertainty between 2007 and 2010 would be accountable for roughly 30% of the 7 pp fall in the average capital investment observed during this period. In this exercise, we maintain the uncertainty level of 2006 constant and look at the predicted investment ratio according to our

[26] We expect the coefficient of policy uncertainty to be overestimated if the omitted variable is the business cycle. Consider a simplified linear model: $y = \alpha + \beta U + \gamma C + \epsilon$, where U is policy uncertainty, y is the investment rate and C is the business cycle. By assumption: $E(U\epsilon) = 0$ and $E(C\epsilon) = 0$; we expect $\beta < 0$ and $\gamma > 0$. Let $Cov(U, C) \neq 0$. If C is observed, β and γ are unbiased: $\beta = Cov(U, y)/Var(U)$, and $\gamma = Cov(C, y)/Var(C)$. If C is omitted instead: $\beta = E(U, y)/E(U)^2 = E(U, \beta U + \gamma C + \epsilon)/E(U)^2 = \beta + \gamma \times Cov(U, C)/Var(U)$. The estimator of β is biased. The direction of the bias depends on the sign of the relationship between C and y (γ) and the correlation between C and U. Since $Cov(U, C) < 0$ and $\gamma > 0$, the overall bias is negative.

estimation. In the year 2007, the actual average investment rate was 17%. In 2010, the predicted average investment rate when fixing uncertainty at the 2006 level would have been 12% rather than the observed 10%, remaining always above the observed level in the 2007-2010 period (see Fig. 4 in Section C of the Appendix). Thus, roughly 30% of the decrease in investment between 2007 and 2010 may be accounted for by the high levels of uncertainty following the financial turmoil of 2008.

As a robustness check, we estimate the model by replacing the aggregate GDP growth rate with the sector-specific Gross Value Added (GVA) growth rate.[27] When sector-specific GVA growth rate is included in the model, results are very similar to those we obtain when controlling for the GDP growth rate. The parameter in front of the GVA growth rate is positive and significant, while the effect of policy uncertainty remains negative and significant, amounting to -0.04, a slighly higher value than in the baseline model. As expected, this suggests that the sector-specific GVA growth rate may not capture the business cycle as fully as the GDP growth rate. As a consequence, the policy uncertainty estimator is slightly overestimated.

5.2 Heterogeneous effects

This section investigates the heterogeneous effects of policy uncertainty along a number of cross-sectional dimensions. We are interested to test whether the macroeconomic policy uncertainty has differential effects for certain types of firms, or if the effect of policy uncertainty is the same for all firms. As discussed in Section 2, exporters should be less sensitive to domestic policy uncertainty to the extent that they face external demand. Therefore, we expect the impact of policy uncertainty to be higher for non-exporting firms. In addition, to the extent that SMEs face informational frictions, they should be more vulnerable to changes in policy uncertainty than big firms. This may occur through worsening of credit conditions or increases in precautionary savings. Finally, firms in a weaker financial position may find it more difficult to access credit markets. Hence, we expect them to be more exposed to macroeconomic policy uncertainty in case of credit tightening.

To identify heterogeneous effects of policy uncertainty, the baseline specification becomes:

$$(I/K)_{it} = \alpha_i + \beta_1 U_{t-1} + \boldsymbol{\beta}_2^{\top} \boldsymbol{X}_{it-1} + \beta_3 M_{t-1} + \beta_4 U_{t-1} \times C_{it-1} + \epsilon_{it} \tag{2}$$

where M represents the GDP growth rate. C is a firm-level control for which we compute the heterogeneous effect and which we interact with the policy uncertainty indicator. Note, we compute one heterogeneous effect at a time for the following variables: a dummy that equals

[27] The GVA growth rate shows higher variation than the GDP growth rate since the time variation faced by firms is sector-specific. However, it relies on the hypothesis that firms are only affected by the business cycle of the sectors in which operate, and that they are not affected by the business cycles of other sectors. This ignores across-sectors spillover effects. By contrast, including the aggregate GDP growth rate implies assuming that all firms face the same business cycle, regardless of the sector in which they operate, which seems more reasonable.

one if the ROA is above the median, a dummy that equals one if *debt rate* is above the median, *SMEs*, *export*, and $corp\_group$. Since these variables are all dummy variables, the coefficient β_1 represents the effect of policy uncertainty for the baseline group (i.e. the group of firms such that $C_{it-1} = 0$), while β_4 gives the differential effect of policy uncertainty for the other group (i.e. firms with $C_{it-1} = 1$).

Note that while the effects of constant or almost-constant firm-level characteristics are largely absorbed by the fixed effects, proper identification of the corresponding heterogeneous effects of policy uncertainty by these dimensions stems from the interaction of these variables with our uncertainty measure, which varies over time (Wooldridge et al., 2001, Ch. 10.5).

Table 4: Baseline results: heterogeneous effects

	(1)	(2)	(3)	(4)	(5)
policy U	-0.009	-0.028**	-0.028**	-0.032**	-0.032***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
U x SMEs	-0.023***				
	(0.003)				
U x debt rate p[50-100]		-0.011***			
		(0.001)			
U x ROA p[50-100]			-0.007**		
			(0.002)		
U x export				0.009***	
				(0.002)	
U x corp_group					0.018*
					(0.007)
Time FE	no	no	no	no	no
Observations	3318685	3318685	3318685	3318685	3273106
Adjusted R^2	0.148	0.149	0.148	0.148	0.147

*, **, *** statistically significant at the 10%, 5% and 1% level, respectively.
Note. This table reports results from estimating Eq. 2. Each column reports the coefficient of the macroeconomic policy uncertainty index and the coefficient of the interaction between the latter and one firm-level variable. The dependent variable is the investment rate. Firm FEs are accounted for by means of the within transformation. Standard errors are clustered at both the firm and year level through two-way clustering. In all regressions, the firm level covariates are: *debt burden*, *debt rate*, *cash flows*, *ROA*, *sales growth*, $SMEs$, $export$, and $corp\_group$ (not reported). In column 2, we interact the policy uncertainty indicator with a dummy equal to one if the debt rate is higher than the median. In column 3, the policy uncertainty index is interacted with a dummy equal to one if the ROA is higher than the median.

In column 2, we look at the differential effect of uncertainty on investment rate for SMEs. We find a significant accentuation of the average negative effect for this group of firms, relative to larger ones. A one standard deviation increase in uncertainty entails a decrease in the investment rate of less than one pp (not significant) in the case of large firms, while the same change in uncertainty induces a 3.2 pp fall in the investment rate of SMEs. This finding sug-

gests that there is important heterogeneity in the effect of uncertainty by firm size. According to the estimates, SMEs bear almost all of the burden of policy uncertainty.[28]

Significant heterogeneity is also found when looking at firms in poorer financial condition. For a one standard deviation increase in economic policy uncertainty, the investment rate increases by one pp for firms with a debt ratio above the median level. This finding may relate to the bank lending channel, which predicts that uncertainty shocks will asymmetrically affect firms that are not financially sound through an increase in the cost of debt and the tightening of access to credit.

Heterogeneous effects along the profitability dimension suggest that highly profitable firms (i.e. those with an ROA above the median value of the distribution) are slightly more affected than their counterparts. We interpret this result as follows. On the one hand, the effect of policy uncertainty on the investment decisions of profitable firms cannot be explained either by the risk aversion channel (since, if anything, more vulnerable firms should be more negatively affected by a policy uncertainty shock), or by the financial frictions channel. In fact, if the latter is in place, we would expect more profitable firms to be less affected by a policy uncertainty shock, since they enjoy better access to credit and, as a consequence, can smooth the negative uncertainty shock if the investment is profitable. On the other hand, since the profitability of a firm relates not only to lower financial frictions but also to other factors such as higher expected growth and investment opportunities, our estimate could be consistent with the wait-and-see channel. Firms with higher future growth opportunities may decide to delay (irreversible) investment projects in response to an increase in policy uncertainty. In other words, the greater ability of profitable firms to optimally adjust their investment levels may induce these firms to react to policy uncertainty by exercising the wait-and-see option.

Finally, we find significant differential effects for exporting firms and firms belonging to a corporate group. We observe that being an exporter firm reduces the average effect of a one standard deviation increase in uncertainty on investment rate by about one pp, while the negative effect of policy uncertainty is further reduced up to 2 pp for firms belonging to a corporate group. Thus, operating in external markets and belonging to a corporate group seem to partially alleviate the detrimental effects of higher uncertainty levels. On the one hand, the result for export can be rationalized by the fact that exporters are less sensitive to domestic policy uncertainty because they face an international demand. On the other hand, the role that corporate groups play in sheltering firms from uncertainty shocks may directly relate to the bank lending channel, to the extent that belonging to a corporate group facilitates access to credit. This should be particularly relevant for smaller firms, which face more financial frictions and have more difficulties in accessing credit.

[28] Note, large firms comprise only 1.3% of our sample. We may not be able to detect a significant effect due to the small proportion of this type of firm. In any case, the estimate is consistent with the idea that large firms are *less* affected by policy uncertainty than SMEs, as expected.

6 Robustness analysis

6.1 The omitted bias problem

The main challenge of our estimation strategy (Eq. 1) is to properly control for aggregate confounders of policy uncertainty. Investment decisions may be correlated with residual unobserved investment opportunities and demand expectations, to the extent that the latter are only partially proxied by firm-specific controls and the aggregate GDP growth rate. In this case, the effect of policy uncertainty could be capturing the effect of poor investment opportunities. Recall that we already control for future investment opportunities at the firm level by including sales growth rate, as is standard in the literature. This variable (like all other firm-level controls), is lagged by one year so as to minimize reverse causality concerns. However, the baseline specification may not properly control for relevant aggregate measures of investment opportunities that are not captured by the firm-level sales growth rate.

Aggregate measures of future investment opportunities are difficult to find and are highly correlated with the business cycle. As a robustness check, we additionally control for a measure of future investment opportunities at the sectoral level, which we compute based on the Business and Consumer Surveys of the European Commission. We exploit questions asking firms about their expectations regarding future demand trends and compute a sector-specific measure of confidence about future demand.[29] Results (not reported) are robust to this procedure and the coefficient of the sector-specific investment opportunities has a positive and significant effect.[30] In any case, the correlation between this indicator and the firm-level sales growth rate aggregated at the sectoral level amounts to 77%. Such a high correlation suggests that firm-level sales growth also appropriately controls for future investment opportunities at the sectoral level.

Ultimately, to minimize the possibility of bias, we would need to explicitly include in the model all relevant aggregate and time-varying confounders of the uncertainty–investment relationship. This is the empirical strategy followed by Gulen and Ion (2016). Possible candidates for aggregate factors that may affect firms' investment decisions are: measures of aggregate future growth opportunities; legislated corporate tax changes;[31] indicators about other relevant types of uncertainties (such as financial uncertainty or uncertainty about future aggregate de-

[29] To minimize endogeneity concerns (respondents with optimistic expectations are more likely to invest and vice versa), we lag the indicator. Thus, we are explaining the investment rate in t with the firm-level sales growth rate in $t-1$ (where the growth is computed by comparing the level in $t-1$ with the one in $t-2$) and the sector-level expectations about investment opportunities in $t-1$.

[30] Results are available upon request. Note, this measure has a drawback in that it is based on managers' evaluations (the survey asks if they expect future demand to be normal, high, or low), which may depend on the cycle. For instance, the concept of "normal" demand may differ in upturns/downturns. This may bias the indicator.

[31] They are relevant since investment decisions are shaped by fiscal policy and the timing of such policies may be correlated with the business cycle and policy uncertainty

mand).[32] Note that a limitation of this strategy is that there is always the possibility that the list of aggregate control variables is not exhaustive. Therefore, the possibility of omitted variable bias remains.

In this section, we follow Baker et al. (2016) and present the results of an additional exercise that allows us to overcome such limitations and provide additional evidence in favor of the channels through which the policy uncertainty effect materializes (heterogeneous effects). In particular, we modify Eq. 2 as follows: we include time fixed effects, drop the policy uncertainty variable, and maintain the interaction of policy uncertainty with firm-level characteristics. This is formalized in Eq. 3:

$$(I/K)_{it} = \alpha_i + \boldsymbol{\beta}_1^{\top} \boldsymbol{X}_{it-1} + \beta_2 U_{t-1} \times C_{it-1} + \phi_t + \epsilon_{it} \tag{3}$$

with C being a firm-level control for which we compute the heterogeneous effect. As in the previous exercise, we compute one heterogeneous effect at a time for the following variables: a dummy equal to one if ROA is above the median, a dummy equal to one if *debt rate* is above the median, *SMEs*, *export*, and $corp\_group$.

Note, the time fixed effects (ϕ) absorb the effect of all factors that are common to the cross-section and that vary over time. This means that we can no longer identify the effect of the policy uncertainty index as such (as well as the effect of the business cycle or the effect of any other aggregate control variable), because they are collinear with time fixed effects. However, we can identify the interaction between policy uncertainty and one specific firm-level variable. This gives us a measure of the extent to which the investment rate of firms with specific characteristics covaries with policy uncertainty. Table 5 presents the differential effect of policy uncertainty for specific groups (the groups that are interacted with policy uncertainty) compared to the corresponding baseline groups. Note, in contrast to Eq. 2, when time fixed effects are included in the specification one cannot compute the total effect of policy uncertainty by groups of firms, since the effect of policy uncertainty for the baseline groups is absorbed by the time fixed effects.[33]

The following comments are worth mentioning. First, the coefficients of the interactions in Table 5 are very similar to those displayed in Table 4. Since the interpretation of the interaction variables is the same across both models, this means that the omitted variable bias in the heterogeneous results based on the baseline model is negligible. Arguably, the fact that the differential effects are stable across both specifications suggests that the results regarding heterogeneous effects are robust.

[32] Another stream of literature underlines the role of *firm-level* uncertainty about future demand on investments: e.g. Guiso and Parigi (1999); Bontempi et al. (2010); Fuss and Vermeulen (2008); Bachmann et al. (2013); Leahy and Whited (1996); Bloom et al. (2007). This is not possible in our case, due to data availability.

[33] The total effect of policy uncertainty for the group that is interacted with policy uncertainty is the sum of the differential effect (the coefficient of the interaction) and the effect of policy uncertainty for the baseline group (the coefficient of the policy uncertainty itself). The latter is absorbed by the time fixed effects.

Table 5: Heterogeneous effects including time fixed effects

	(1)	(2)	(3)	(4)	(5)
U x SMEs	-0.014***				
	(0.002)				
U x debt rate p[50-100]		-0.009***			
		(0.001)			
U x ROA p[50-100]			-0.003		
			(0.002)		
U x export				0.010***	
				(0.001)	
U x corp_group					0.012**
					(0.003)
Time FE	yes	yes	yes	yes	yes
Observations	3318685	3318685	3318685	3318685	3318685
Adjusted R^2	0.154	0.155	0.154	0.154	0.154

*, **, *** statistically significant at the 10%, 5% and 1% level, respectively.
Note. This table reports results when estimating Eq. 3. Each column reports the equation when interacting policy uncertainty with different covariates individually. The dependent variable is the investment rate. Firm FEs are accounted for by means of the within transformation. Time FEs are included. Standard errors are clustered at both the firm and year level through two-way clustering. In all regressions, the firm-level covariates are: *debt burden*, *debt rate*, *cash flows*, *ROA*, *sales growth*, $SMEs$, $export$, and $corp\_group$ (not reported). In column 2, we interact the policy uncertainty indicator with a dummy equal to one if the debt rate is higher than the median. In column 3, the policy uncertainty index is interacted with a dummy equal to one if the ROA is higher than the median.

Second, the interaction with the debt rate remains negative and the interaction with the dummy for belonging to a corporate group remains positive. The former result suggests that the negative effect of debt rate on investment becomes larger during periods of higher uncertainty.[34] In addition, belonging to a corporate group seems to shelter firms from the negative effect of policy uncertainty on investment. Hence, our estimations seem to corroborate the hypothesis that financial frictions, which are relevant in investment decisions, may be exacerbated during periods of high uncertainty.

Third, the negative interaction between policy uncertainty and SMEs is in line with the hypothesis that the latter may be more exposed to shocks in policy uncertainty, arguably due to informational frictions. By contrast, the interaction with profitability is not significant (although the sign remains negative). This offers weak evidence in favor of the hypothesis that the negative effect of policy uncertainty is stronger for firms with a better profitability profile.

Finally, the interaction between the export dummy and policy uncertainty is positive and significant. This is also consistent with previous results: exporting firms are less sensitive to policy uncertainty since they have access to foreign markets.

[34] The coefficient of the debt rate is not shown in Table 5 but it is negative and significant.

6.2 Additional robustness checks

We perform two additional robustness checks.

In a first exercise we show that the results are robust when conditioned on strictly positive investment, that is, when we restrict the analysis to firms that decide to invest (in gross terms). Note that this restricted sample may be selective, which may prevent the making of inferences about the entire population. However, unconditional estimates might be biased if the dependent variable is not normally distributed. In our case, this might occur if there are a high number of observations with values of the dependent variable equal to zero. However, note that the gross investment rate is zero for 9% of observations. It can also be negative when firms decide to reduce capital and liquidate assets. This occurs for 18% of observations in our sample. Hence, we do not believe that the proportion of zeros in the dependent variable is a major concern.[35] Results based on the sub-sample of observations with a strictly positive gross investment rate are reported in tables 6 and 7. The coefficients of interest are close to those estimated for the entire sample (unconditional estimates).

As a last robustness check, we consider the dynamic version of the baseline model, in which the lagged dependent variable is included as additional regressor on the right-hand side of the empirical specification. On the one hand, it is appealing to consider a dynamic investment equation since it allows to model a partial adjustment mechanism in investment decisions.[36] On the other hand, from an empirical point of view, adding the lagged values of the dependent variable on the right-hand side of the equation introduces an endogeneity problem. This is because the within or first difference transformation needed to drop firm fixed effects introduces a negative correlation between the transformed residuals and the transformed lagged dependent variable. As a consequence, the estimate of the lagged dependent variable is biased downwards. In addition, the estimated coefficients of the other regressors may be biased as well to the extent that they are correlated with the lagged dependent variable. One way to tackle this problem is to rely on the Generalized Methods of Moments (GMM), where the lagged values of the regressors are used as instruments for the (endogenous) variables. Of course, as any instrumental variable approach, GMM estimations rely on the validity of the chosen instruments, namely relevance and exogeneity. In particular, the latter, known as the exclusion restriction, implies that the assumptions should be assessed on a case by case basis.

For instance, in the difference GMM estimator (Arellano and Bond, 1991), the model is transformed in first differences, and the lagged values of the regressors in level are used as instruments. The identifying assumption is that lagged values of variables are independent

[35] In addition, since the fixed effects model exploits within-firm time variation, we might also be concerned about the loss of observations with no variability in the observed period. However, this is only the case for 2% of the firms in our sample.

[36] From a theoretical point of view, smoothing investment over time is rationalized by convex adjustment costs. A static investment model is equivalent of ignoring adjustment costs of capital (or assuming linear adjustment costs). That is, in each period the firm observes the shock and chooses tomorrow's optimal capital stock regardless of the current value of the capital stock.

Table 6: Baseline model and heterogeneous results conditional on a positive investment rate

	(1)	(2)	(3)	(4)	(5)	(6)
policy U	-0.031**	-0.010	-0.028**	-0.029**	-0.032**	-0.031**
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
U x SMEs		-0.021***				
		(0.003)				
U x debt rate p[50-100]			-0.010***			
			(0.001)			
U x ROA p[50-100]				-0.004*		
				(0.002)		
U x export					0.011***	
					(0.002)	
U x corp_group						0.023***
						(0.004)
Time FE	no	no	no	no	no	no
Observations	2366581	2366581	2366581	2366581	2366581	2366581
Adjusted R^2	0.182	0.183	0.184	0.183	0.183	0.182

*, **, *** statistically significant at the 10%, 5% and 1% level, respectively.
Note. This table reports results for firms with positive investment rate. Column 2 reports the baseline model (Eq. 1). Columns 2-5 report the heterogeneous results (Eq. 2). The dependent variable is the investment rate. Firm FEs are accounted for by means of the within transformation. Standard errors are clustered at both the firm and year level through two-way clustering.

Table 7: Heterogeneous results with time fixed effects conditional on a positive investment rate

	(1)	(2)	(3)	(4)	(5)
U x SMEs	-0.013***				
	(0.002)				
U x debt rate p[50-100]		-0.008***			
		(0.001)			
U x ROA p[50-100]			0.000		
			(0.001)		
U x export				0.011***	
				(0.001)	
U x corp_group					0.008*
					(0.004)
Time FE	yes	yes	yes	yes	yes
Observations	2366581	2366581	2366581	2366581	2366581
Adjusted R^2	0.189	0.190	0.189	0.189	0.189

*, **, *** statistically significant at the 10%, 5% and 1% level, respectively.
Note. This table reports results when estimating Eq.3 for firms with positive investment rate. Each column reports the equation when interacting policy uncertainty with different covariates individually. The dependent variable is the investment rate. Firm FEs are accounted for by means of the within transformation. Time FEs are included. Standard errors are clustered at both the firm and year level through two-way clustering.

from future shocks. This is reasonable, unless one does not argue that firms anticipate future shocks and change their behaviour accordingly. In addition, a limit of the difference GMM is that for highly persistent variables the lagged values of the variables in level may be poor instruments for their first difference transformation.

An alternative is the system GMM (Arellano and Bover, 1995; Blundell and Bond, 1998), which augments the difference GMM with an equation in level and uses lagged differenced variables as instruments for the variables in level. The additional assumption is that lagged changes in the variables should be independent from firm fixed effects and future shocks. This implies that the variables are mean stationary, i.e. firms of given type perform around their steady state in the period of observation. This may be correct for mature firms, but harder to assume for young firms which do not have yet reached their steady state level. In this case, changes in the past values of the variables may be related to their firm-type.

In our case, the debt rate variable is very persistent (with a serial correlation coefficient of 0.9), while the profitability and the debt burden show a serial correlation coefficient of 0.47 and 0.45, respectively. Hence, using the lagged levels of these variables as instruments in the difference GMM may not be desirable. As for using lagged differenced variables as instruments in the level equation, this relies on the assumption that the variables are mean stationary. In our case, this may not hold since our observation period includes the Great Recession which may have induced a structural break in certain variables.

We estimate the dynamic equation using a GMM approach but the obtained results are questionable, for the reasons illustrated above. The tests for the validity of the instruments (the Hansen test of over-identifying restrictions and the second order serial correlation test) lead us to reject the null hypothesis that the instruments are valid. As a consequence, we refrain to use a dynamic specification and rather maintain the static one as the main model, which provides a cleaner setting to identify the coefficient of the macroeconomic policy uncertainty on firms' investment decision. In addition, this choice allows us to compare the findings with those by Gulen and Ion (2016) and Baker et al. (2016), which adopt the same empirical strategy.

7 Conclusion

This study exploits firm-level panel data to study the impact of policy uncertainty on corporate investment in Spain. We focus on the average effect of policy uncertainty on the gross investment-to-capital ratio, as well as its heterogeneous effects along a set of firm-specific controls that may be related to different channels for the effect of uncertainty. In order to measure the aggregate level of policy uncertainty in the Spanish economy, we rely on the policy uncertainty indicator constructed by Gil et al. (2017). This measure results from a principal component analysis that considers a number of indicators related to policy uncertainty.

The baseline model controls for the business cycle and aggregate demand by including the aggregate GDP growth rate. This specification allows us to identify the average effect of policy uncertainty on the investment rate, as well as heterogeneous effects according to firm characteristics. As a robustness exercise, we replicate the heterogeneous results by further including time fixed effects, which control for any aggregate time-varying factor affecting all firms over

time. This minimizes the problem of omitted variable bias in estimating the heterogeneous effects of policy uncertainty. This robustness exercise suggests that our heterogeneous results, as well as the estimated coefficient of the effect of policy uncertainty in the baseline model, are not biased by omitted aggregate factors.

The existing literature documents the adverse effect of macroeconomic policy uncertainty on the investment decisions of publicly listed firms in the US. This paper provides similar evidence for a representative sample of Spanish firms, most of which are SMEs and not quoted on the Spanish stock exchange. We find strong evidence that policy uncertainty reduces the rate of corporate investment in Spain. According to our baseline specification, a one standard deviation increase in policy uncertainty decreases the average investment rate by about 3 pp. To give a sense of the magnitude of this effect, we estimate that the increase in policy uncertainty between 2007 and 2010 may be accountable for roughly one-third of the 7 pp fall in the capital investment rate observed during this period.

The heterogeneous results indicate that the adverse effect of policy uncertainty is particularly relevant for highly vulnerable firms. Specifically, exporting firms are less affected by policy uncertainty than non-exporting ones, presumably because they operate in foreign markets and are therefore less exposed to policy uncertainty. SMEs and highly indebted firms decrease investment significantly more than their counterparts. In addition, firms belonging to a corporate group are less affected by policy uncertainty shocks. To the extent that belonging to a corporate group facilitates access to banking finance, these results are consistent with the hypothesis that firms in a weaker financial position are more sensitive to policy uncertainty shocks than their counterparts. This is in line with the idea that part of the explanation for the negative relationship between policy uncertainty and corporate investment is the financial frictions channel, according to which the credit supply shrinks when uncertainty is high and this reduces investment spending. This channel may be particularly relevant in the Spanish context, since corporate investment is largely financed by bank lending. Our results are also compatible with the risk aversion channel, according to which firms may become more risk-averse during periods of high policy uncertainty and hence reduce investment.

Ultimately, our findings have the following implication: investing firms like predictability, and since corporate investment is a key driver of the growth of the economy in the long term, policy uncertainty should be minimized. While some degree of policy uncertainty is intrinsic to the democratic game and cannot be avoided, it could be certainly minimized if policy makers, politicians, and institutions stick to credible announcements and consistent behavior. Such an environment would set favorable conditions for economic agents to engage in investment projects. In other words, not only does the content of implemented policies have real effects, but the way in which policies are brought forward also shapes the decisions of economic agents.

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APPENDIX

A Firm data appendix

Data cleaning.

- We replace negative values with missing ones in the following variables: fixed tangible capital stock, fixed intangible capital stock, net capital amortization.
- We drop observations with zero or missing sales for two consecutive years or with zero or missing employment for two consecutive years if the firm operates in the construction or housing sectors.
- We exclude holdings.
- We drop observations with negative values in debt, total assets, sales, or fixed capital.
- We drop observations where the current value of sales is positive but the lagged value of sales is zero.
- We drop observations with missing values in at least one of the following variables: investment rate, debt burden, debt rate, sales growth rate, cash flow, and size.
- We remove outliers by dropping observations with values lying in the 1st or 99th percentile of the distribution of relevant variables (dependent or explanatory variables).
- We restrict the sample of analysis to non-financial firms which are observed in the CBI for at least two years. The structure of the panel is reported in Table 9.

Variables definition.

- Debt burden: interest payments plus financial costs divided by gross operating revenue plus gross financial revenue.
- Profitability (ROA): sum of gross operating revenue plus gross financial revenue minus financial costs and interest payments, divided by total assets.
- Debt ratio: total outstanding debt minus cash and its equivalents, divided by total assets.
- Cash flows: change in cash holdings relative to the previous year divided by total assets.
- Total capital stock: sum of fixed tangible capital stock (including real estate investment) and fixed intangible capital stock.
- Gross investment rate: the sum of gross fixed tangible and intangible capital formation, divided by the total capital stock.

- Sales growth rate (at firm level): computed with respect to the previous year. The variable takes a value of zero if firm sales are zero in two subsequent years.
- SME dummy: equal to one if the firm is an SME and zero otherwise. SME is based on the definition of the European Commission (2003/361/CE): SMEs are firms with fewer than 250 employees and fewer than 50 million euros of turnover or firms for which the total balance sheet is lower than 43 million euros. The SME dummy variable takes a value of one if the firm fulfills these conditions and zero otherwise.
- Corporative group dummy: equal to one if the firm belongs to a corporate group, zero otherwise.
- Exporter dummy: This variable is derived from the Spanish Balance of Payments micro-dataset. The dataset includes all firms that have exported with transaction values above 50,000 euros.

B Descriptive Statistics

Figure 3: Average gross investment rate in the sample.

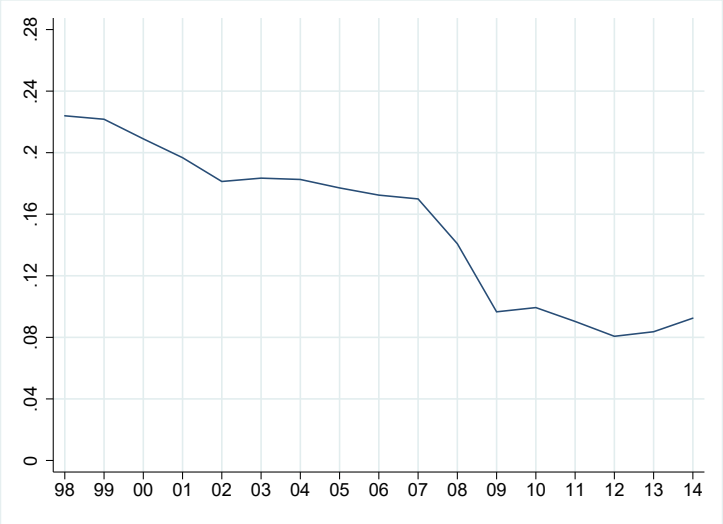


Table 8: Representativeness of the data

Panel A: Central Business Register (number of firms and share by employment type)

Firm size category	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1-9 employees	439093	454687	493184	521945	555442	592875	624678	651899	689095	719884	705950	685023	666620	658036	677207	669183
10-19 employees	64926	69861	71527	74900	77776	81561	84464	89009	92398	94092	87285	75394	72210	67271	62630	59365
20-49 employees	39681	43578	42416	44663	45405	46930	49705	51910	53764	54764	49089	42448	39956	37013	33804	32538
+ 50 employees	17716	19388	20434	21343	21790	21871	23043	24138	25470	26417	23700	21402	20373	19552	18566	17746
Total	561416	587514	627561	662851	700413	743237	781890	816956	860727	895157	866024	824267	799159	781872	792207	778832

Firm size category	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1-9 employees	78,21%	77,39%	78,59%	78,74%	79,30%	79,77%	79,89%	79,80%	80,06%	80,42%	81,52%	83,11%	83,42%	84,16%	85,48%	85,92%
10-19 employees	11,56%	11,89%	11,40%	11,30%	11,10%	10,97%	10,80%	10,90%	10,73%	10,51%	10,08%	9,15%	9,04%	8,60%	7,91%	7,62%
20-49 employees	7,07%	7,42%	6,76%	6,74%	6,48%	6,31%	6,36%	6,35%	6,25%	6,12%	5,67%	5,15%	5,00%	4,73%	4,27%	4,18%
+ 50 employees	3,16%	3,30%	3,26%	3,22%	3,11%	2,94%	2,95%	2,95%	2,96%	2,95%	2,74%	2,60%	2,55%	2,50%	2,34%	2,28%
Total	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%

Panel B: Final Sample (number of firms and share by employment size)

Firm size category	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1-9 employees	29657	31354	31354	44444	56717	73997	109143	133427	151699	161031	168337	160527	184078	241324	257156	268597
10-19 employees	6168	7811	7811	12148	14729	17601	22026	25423	27800	28262	28381	26129	25709	30867	30852	29805
20-49 employees	4165	5135	5135	7577	8708	10006	12472	14407	15540	15778	15655	13902	13373	16455	16616	16115
+ 50 employees	1824	2051	2051	2241	2065	2202	2737	3329	3626	3699	3519	3137	4219	5064	5292	5547
Total	41814	46351	46351	66410	82219	103806	146378	176586	198665	208770	215892	203695	227379	293710	309916	320064

Firm size category	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1-9 employees	70,93%	67,64%	67,64%	66,92%	68,98%	71,28%	74,56%	75,56%	76,36%	77,13%	77,97%	78,81%	80,96%	82,16%	82,98%	83,92%
10-19 employees	14,75%	16,85%	16,85%	18,29%	17,91%	16,96%	15,05%	14,40%	13,99%	13,54%	13,15%	12,83%	11,31%	10,51%	9,95%	9,31%
20-49 employees	9,96%	11,08%	11,08%	11,41%	10,59%	9,64%	8,52%	8,16%	7,82%	7,56%	7,25%	6,82%	5,88%	5,60%	5,36%	5,03%
+ 50 employees	4,36%	4,42%	4,42%	3,37%	2,51%	2,12%	1,87%	1,89%	1,83%	1,77%	1,63%	1,54%	1,86%	1,72%	1,71%	1,73%
Total	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%

Table 9: Panel structure

Obs. per firm	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total
Large	2,213	1,583	1,055	672	490	198	171	103	152	98	61	79	49	57	12	46	7,039
SMEs	127,238	101,866	82,640	74,866	56,134	43,763	35,562	28,403	21,782	16,586	12,412	8,918	5,072	4,236	1,117	1,335	621,930
All	129,451	103,449	83,695	75,538	56,624	43,961	35,733	28,506	21,934	16,684	12,473	8,997	5,121	4,293	1,129	1,381	628,969

Table 10: Means by export status

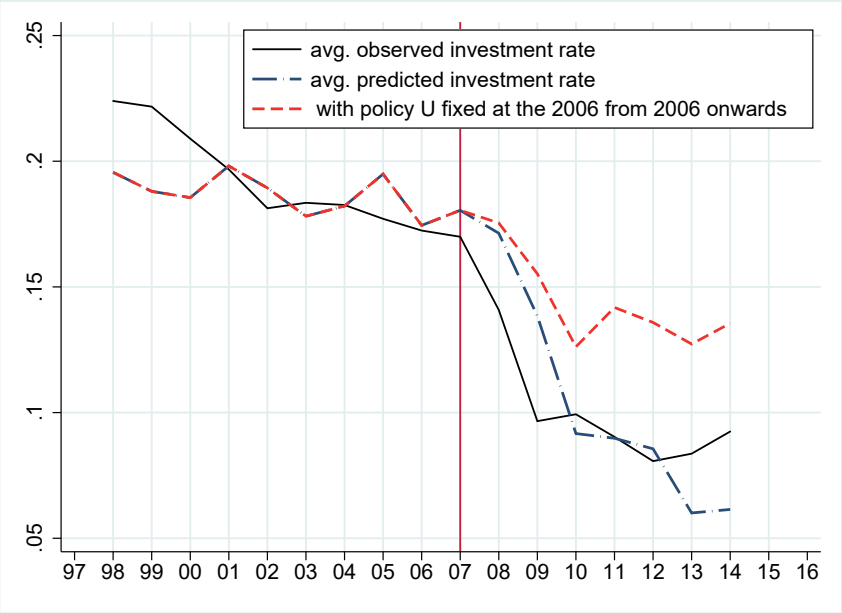
	Not Exporters	Exporters	Diff. in Means	Pval
ROA	0.048	0.085	-0.038	0.000
debt burden	0.587	0.394	0.193	0.000
debt rate	0.696	0.601	0.095	0.000
cash flow	-0.002	0.005	-0.007	0.000
sales growth	0.049	0.072	-0.023	0.000
SMEs	0.991	0.871	0.119	0.000
export	0.000	1.000	-1.000	.
corp group	0.002	0.075	-0.073	0.000
$\mathbb{1}$(Gross Inv.>0)	0.734	0.871	-0.137	0.000
Gross Inv.Rate	0.129	0.170	-0.042	0.000
N.Obs.	3,217,536	101,203		

Table 11: Means by being part of corporate group statu

	Not part of $corp\_group$	Part of $corp\_group$	Diff. in Means	Pval
ROA	0.049	0.085	-0.037	0.000
debt burden	0.582	0.397	0.185	0.000
debt rate	0.694	0.577	0.116	0.000
cash flow	-0.002	-0.000	-0.001	0.196
sales growth	0.050	0.026	0.023	0.000
SMEs	0.990	0.304	0.685	0.000
export	0.028	0.534	-0.506	0.000
corp_group	0.000	1.000	-1.000	.
$\mathbb{1}$(Gross Inv.>0)	0.738	0.892	-0.154	0.000
Gross Inv.Rate	0.130	0.146	-0.016	0.000
N.Obs.	3,304,558	14,181		

C The role of policy uncertainty on the investment rate

Figure 4: Predicted gross investment rate if policy uncertainty remains fixed at the level attained in 2006 from 2007 onwards.



In this Section we run an exercise to get a sense of the magnitude of the direct contribution of policy uncertainty to the evolution of the aggregate investment rate in the country. To do this we compute the evolution of the average gross investment rate in the simulated situation in which the policy uncertainty index is fixed at the value attained in 2006 for the period 2007-2014. Results are depicted in Figure 4. The black line represents the evolution of the actual average investment-to-capital ratio. The chart shows a sharp decline in investment from 2008, with a mild recovery starting in 2013. The dashed blue line depicts the average predicted evolution of the investment rate based on our baseline model, and is constructed in two steps. First, we estimate Eq. 1 and obtain the predicted values for the investment ratio. Second, we obtain yearly averages for this estimate. Finally, the dashed red line refers to the average predicted values for the investment rate mimicking the previous aggregate until 2006, whereas afterwards, we assume the uncertainty level to remain fixed at the year 2006 level.

Note that this exercise allows to get an idea of the *direct* effect of uncertainty on investment during the crisis. This is because we set uncertainty at the pre-crisis level but leave unchanged the other regressors. In this sense, we provide a lowerbound of the impact of uncertainty.

D Corporate groups

Using the information from the CBI database, we construct a proxy for the cost of debt in order to provide descriptive evidence about the relationship between belonging to a corporate

group and the cost of accessing external finance. As previously mentioned, several authors emphasize the potential benefits of conglomerates for access to credit. Inderst and Müller (2003) and Faure-Grimaud and Inderst (2005) suggest that associations entail a lower risk of non-repayment than individual firms. Better access to credit may be also related to potential debt coinsurance provided by the conglomerate structure (Kuppuswamy and Villalonga, 2016; Yan et al., 2010). However, other authors suggest that while conglomerates may bring the benefits of economies of scale to the access to credit, contagion effects due to idiosyncratic shocks among firms may prevail over coinsurance gains (Hege and Ambrus-lakatos, 2002).

Our cost of debt variable is defined in the following way:

$$\text{Cost of debt}_{it} = 1/2 \times \text{Interest payments}_{it} / \left(\text{Total debt}_{it} + \text{Total debt}_{it-1}\right) \tag{4}$$

Figure 5 depicts the evolution of our proxy for both groups of firms, as well as the proportion of firms belonging to a corporate group. Several things are worth noting. First, we observe a positive wedge in the cost of debt between firms belonging to a corporate group and the rest of the corporations throughout the entire period. The difference is found to be significant even after controlling for firm size, time dummies, and other possible determinants (see Table 12 below). Second, we find that the difference between the two groups becomes smaller after the Great Recession. This occurs at the same time as a significant increase in the proportion of firms belonging to corporate groups is taking place and could be related to a change in the composition of the sample of firms that belong to each group.

Figure 5: Average cost of debt and proportion of firms belonging to a corporate group

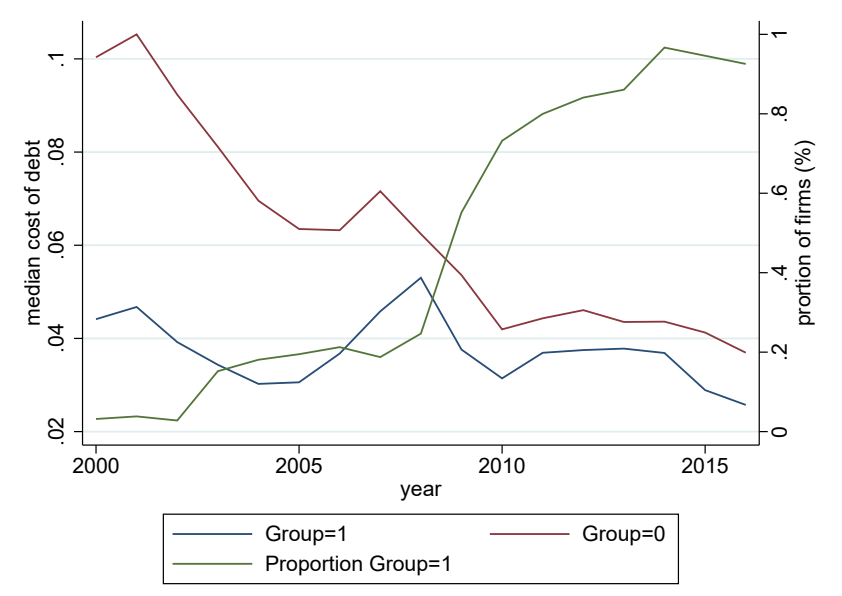


Table 12: Descriptive evidence: Average cost of debt.

cost of debt	(1)
corp-group	-0.024***
	(0.001)
Large company	-0.023***
	(0.001)
debt burden	0.017***
	(0.000)
sales growth	-0.001***
	(0.000)
ROA	-0.011***
	(0.001)
Observations	3125532
R^2	0.035

*, **, *** statistically significant at the 10%, 5% and 1% level, respectively. Note: OLS with time FEs and control variables. Standard errors are clustered at the firm level.

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