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Caroline Perrin & Laurent Weill

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Université de Strasbourg
Pôle Européen de Gestion et d'Economie
61 avenue de la Forêt Noire
67085 Strasbourg Cedex
http://large.em-strasbourg.eu/

IFS
Institut de Finance de Strasbourg

Girls Will Be Girls?
The Gendered Effect of Economic Policy Uncertainty on Corporate Investment

Caroline Perrin[+]
EM Strasbourg Business School, University of Strasbourg

Laurent Weill[*]
EM Strasbourg Business School, University of Strasbourg

Abstract

We examine the effect of CEO gender on the relation between economic policy uncertainty (EPU) and corporate investment. Using the newspaper-based EPU index developed by Baker, Bloom, and Davis (2016), we perform an empirical investigation on firm-level data of more than 38,000 firms from eight European countries for 2010-2019. We find evidence that higher EPU is associated with higher corporate investment. However, we show that this beneficial effect of economic policy uncertainty is lower when the firm CEO is a woman. We explain this finding by the higher risk aversion of women relative to men. Our work contributes to the debate on the impact of EPU on firm corporate decisions by bringing upfront the influence of CEO gender.

JEL Codes: G30, G32, J16
Keywords: Economic policy uncertainty, firm investment, CEO gender.

[+] Sciences Po Strasbourg, Université de Strasbourg, 7 rue de l'Ecarlate, CS 20024, 67082 Strasbourg, France. Email : caroline.perrin@em-strasbourg.eu
[*] Corresponding author. Sciences Po Strasbourg, Université de Strasbourg, 7 rue de l'Ecarlate, CS 20024, 67082 Strasbourg, France. Email: laurent.weill@unistra.fr

1. Introduction

Encouraging gender equality in executive positions has become the core of political debates over the last decades in the Western world. It has led to the implementation of gender-based quotas for large firms increasing women's presence on corporate boards (de Cabo et al., 2019) in a large number of European countries. [1]

Beyond societal implications, the strong impetus for gender-balanced governance raises questions about its economic impact. In this regard, literature provides equivocal findings. On the one hand, some works have provided evidence of economic benefits associated with female top managers. Among others, firms with a higher share of women in top management have been shown to be more profitable and to have higher stock returns (Krishnan and Parsons, 2008), but also to have lower agency costs (Jurkus and Woodard, 2011). On the other hand, several studies conclude to the absence of any significant effect of executive female representation on firm performance (Campbell and Mínguez-Vera, 2008; Adams and Ferreira, 2009; Kirsh, 2018; Dupatti et al., 2020).[2]

From a theoretical perspective, the different behavior of women in top management positions has been explained by behavioral features affecting preferences, especially stronger risk aversion (Bertrand, 2011; Croson and Gneezy, 2009). Women demonstrate a more emotion-based reasoning, which directly sways their risk-taking behavior. By contrast, men tend to be overconfident compared with women, and as a result, are more likely to take risks. De facto, risks may be perceived as threats by female decision-makers.

A natural question that emerges is the influence of CEO gender on firm investment strategies in presence of uncertainty. Namely, investment is a key corporate decision affected by risk aversion of decision-makers. Managers take corporate investment decisions based on the economic environment and their preferences. Differences in risk aversion can thus lead to differences in investment behavior in presence of economic policy uncertainty. Against this backdrop, the objective of this paper is to examine how CEO gender affects firm investment in presence of

1 At the European Union level, the European Commission enacted the Strategy for Equality between Women and Men 2010-2015 in 2010. In 2017, it adopted the Act on Equality between Women and Men in Supervisory Boards stipulating "there must be at least 30% women on the supervisory boards of publicly traded companies and companies with more than 1 000 employees" (European Commission, 2017, p. 24).

2 In a meta-analysis of 170 studies, Post and Bryon (2015) find a positive effect of women's leadership on firm financial performance for 100 works, whereas the impact is not significant in 70 studies.

economic policy uncertainty. The unpredictability associated with possible changes in government policy or global economic conditions is expected to have gender-disaggregated implications for firm investment strategies.

Theoretical literature on the relation between economic policy uncertainty and corporate investment contributes to establish the hypotheses about the influence of CEO gender on this relation. The general view considers that higher economic policy uncertainty should reduce firm investment. It gives incentives for firms to delay investment projects. The underlying intuition of this so-called *wait-and-see* effect is simple: if an unpredictable environment can potentially result in an undesirable outcome from a firm's perspective, the option value of waiting to invest increases and the firm may rationally postpone investment until some or all of the uncertainty elements are resolved (Bernanke, 1983; Bloom, 2009). The *wait-and-see* effect has been explained by risk aversion (Nakamura, 1999) and investment's degree of irreversibility (Bernanke, 1983; Dixit and Pindyck, 2012). A set of works empirically corroborate this view (Gulen and Ion, 2016; Cerda et al., 2018; Chen, Lee and Zeng, 2019).

An alternative view assumes that greater economic policy uncertainty favors investment. It relies on two effects as explained by Bloom (2014). On the one hand, the *growth options effect* considers that volatile returns caused by uncertainty allow for higher outcomes, although with a lower probability than in a "normal" world where volatility is less important. This increase in potential gains, by generating risk-seeking attitudes, creates incentives for firms to invest. On the other hand, the *Oi-Hartman-Abel effect* considers that higher uncertainty increases investment because firms expand to exploit good outcomes while they contract to insure against bad outcomes, making them more risk loving (Oi, 1961; Hartman, 1972; Abel, 1983). Wu et al. (2019) have found empirical support for this view by showing that economic policy uncertainty helps to promote investment in Australia.

While both views suggest opposing impacts of uncertainty on investment, they converge on the influence of risk aversion of decision-makers on the relation. The *wait-and-see effect* assumes that uncertainty dampens investment, with a higher reduction for risk-averse managers. The *growth options* and the *Oi-Hartman-Abel effects* suggest that uncertainty fosters investment with a higher increase for risk-loving managers. Thus, the higher risk aversion of women leads to the hypothesis that investment is lower for women-led firms in presence of greater economic policy uncertainty.

We test this hypothesis on a large sample of firms from eight European countries extracted from Amadeus database covering the period 2010-2019. Following recent literature (Gulen and Ion, 2016; Chen, Lee and Zeng, 2019; Wu et al., 2020), we employ the newspaper-based economic policy uncertainty (EPU) index developed by Baker, Bloom and Davis (2016). We perform regressions of corporate investment on a set of variables including *EPU* and *CEO gender* at the firm level. Our dataset includes firms from all sizes with a huge majority of small and non-listed companies in line with the population of companies. It brings a major benefit for our analysis since it has been shown that CEOs of small and non-listed firms have a greater impact on decision-making, for good or for ill, than do their public firm counterparts (Quigley, Chirico and Baù, 2021).

We face two key challenges in our investigation. First, we require information on the gender of CEO for a large sample of companies. We solve this issue with the Amadeus database providing detailed information on CEO gender for a huge number of companies from all sizes all around Europe. Second, the identification requires high variation in economic policy uncertainty across firm level observations. Our sample has two key advantages in this respect. On the one hand, we benefit from a cross-country sample providing more variation in EPU than single-country samples commonly adopted in former papers on the economic policy uncertainty-investment nexus (Gulen and Ion, 2016; Cerda, Silva and Valente, 2018; Wu et al., 2020). On the other hand, the period of study is characterized by high variability concerning both temporal and cross-sectional dimensions. The 2010-2019 decade has been accompanied with many disparities across years and countries in European countries.

By way of preview, the main finding of this paper is that corporate investment is affected by the interplay between economic policy uncertainty and CEO gender. Specifically, we find that economic policy uncertainty enhances corporate investment, but this positive impact is reduced for firms with female CEO. This finding accords with the view of higher risk aversion of women. Facing higher uncertainty, female CEOs increase investment but with a lower degree than male CEOs. Additionally, we find that these results are observed for small and medium enterprises and for microenterprises, i.e. firms for which CEO characteristics can affect the most corporate decisions, but not for large companies. Our main results hold when we apply a battery of robustness tests.

Our paper contributes to two debates in the literature. First, we contribute to the literature exploring the economic implications of CEO gender. A large set of works has investigated how

CEO gender affects firm performance. Our work departs significantly from this literature by considering whether it exerts an impact on corporate decisions that is conditional to the economic environment, thereby affecting firm performance.

Second, we augment the literature on economic policy uncertainty and corporate investment in two ways. On the one hand, we provide an original behavioral contribution to this strand of literature by documenting the influence of CEO gender on this relation. On the other hand, we perform a cross-country approach on a large sample of firms from all sizes. Using the economic policy uncertainty measures proposed by Baker, Bloom and Davis (2016), a handful of works has investigated how economic policy uncertainty can affect corporate investment at the firm level (Baker, Bloom and Davis, 2016; Cerda, Silva and Valente, 2018; Chen, Lee and Zeng, 2019; Gulen and Ion, 2016; Wu et al., 2020). However, they all adopt a single-country framework. In contrast to these single-country studies, our cross-country approach exploits country-level differences in economic policy uncertainty across firms. We have therefore variation in economic policy uncertainty through time and through space in our sample. In addition, former works focus on listed firms. By considering non-listed firms in our analysis, we have a much broader sample of firms that is not restricted to listed firms for which available information is much larger because of their listed status and their large size. We can therefore exploit firm-level differences in exposure to certain aspects of economic policy.

The paper is organized as follows. In Section 2, we provide explanations about the measurement of economic policy uncertainty in Europe. Section 3 presents data and variables. Section 4 reports empirical results. In Section 5, we present robustness checks. Final section concludes the study.

2. Measuring economic policy uncertainty in Europe

Uncertainty is not a sharply outlined concept. Literature proposed several proxies to measure economic policy uncertainty. A first strand of works has considered that uncertainty faced by the individual firm can be represented by stock price volatility (Baum, Caglayan and Talavera, 2008; Bloom, 2009; Panousi and Papanikolaou, 2012). A second strand of studies have utilized elections as a measure of uncertainty (Julio and Yook, 2012; Pastor and Veronesi, 2012; Jens, 2017).

Alternative proxies can also have been used like volatility of unforecastable components of several time series suggested by Jurado, Ludvigson and Ng (2015).

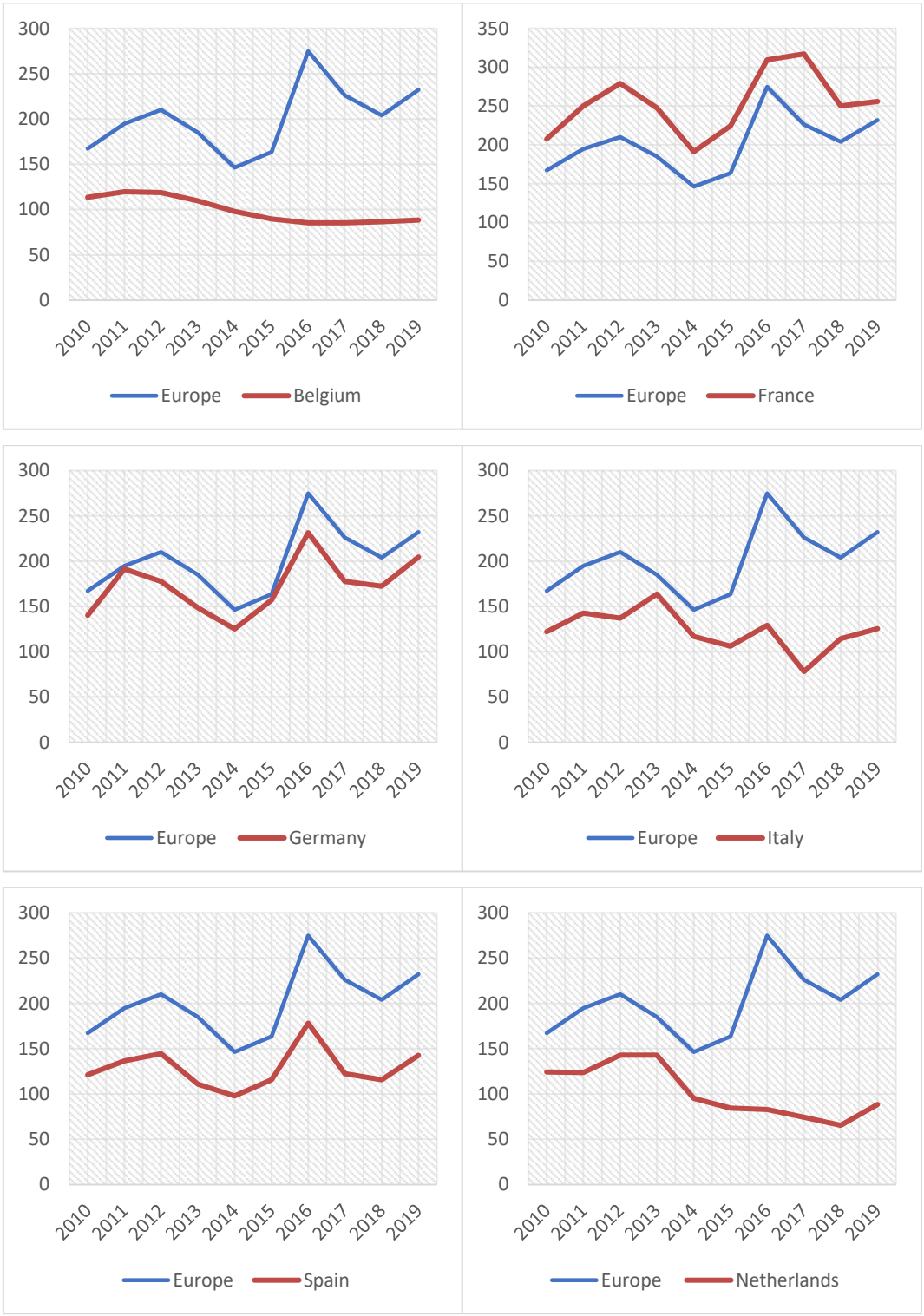
Although these measures all find acceptance in literature, they have been criticized since they do not cover the whole spectrum of uncertainty. For instance, as mentioned by Gulen and Ion (2016), using elections as an indicator variable implies the assumption that policy uncertainty does not change during non-election years. Moreover, Bloom (2014) argued that an uncertainty proxy should be a mixture of risk and economic uncertainty. Baker, Bloom and Davis (2016) stated the fact that market volatility index pertains to uncertainty only about equity returns. All these efforts guide the search for a wider measure of uncertainty that captures all these factors. Lastly, most economic policy uncertainty indices are not cross-country comparable. For instance, the *EPU* measure proposed by Leduc and Liu (2016) is only covering the US. Furthermore, Tobback et al. (2018) attempt to develop an *EPU* index for Belgium using, among others, support vector machine classification. However, their initiative to regularly publish index updates fell short due to data scraping issues.

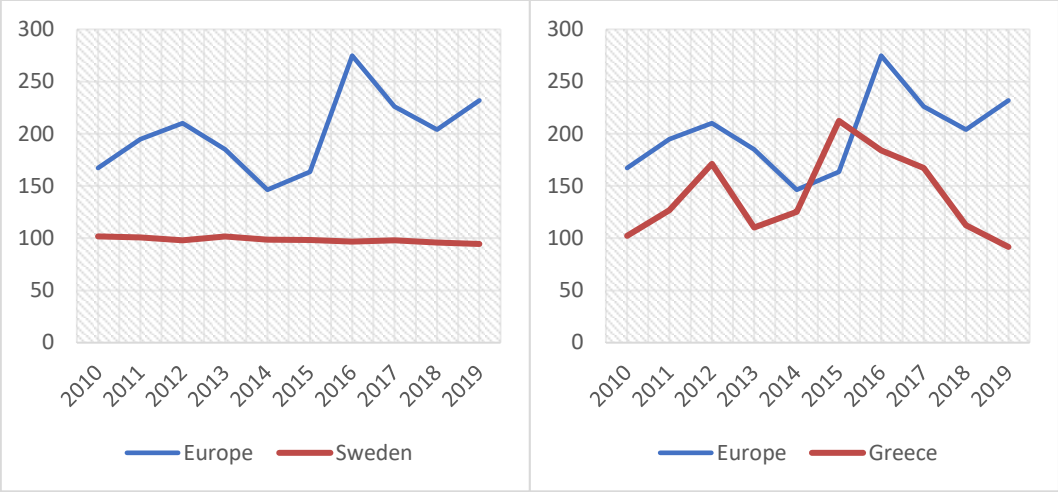
In order to fill this gap, Baker, Bloom and Davis (2016) have developed an *EPU* index, for the United States first, and for several other countries including major European countries subsequently. On the one hand, the U.S. *EPU* index is built out of three components: *(i)* the first component treats newspaper coverage policy-related economic uncertainty in major newspapers, i.e. the frequency of references to policy-uncertainty in leading newspapers; *(ii)* the second element reflects the number of federal tax code provisions that have to expire in the next 10 years as well as a proxy of risk; and *(iii)* the third component reflects disagreements among forecasters about inflation and government purchases.[3] On the other hand, European countries' *EPU* indices are built using exclusively the first component. Both second and third components are not used in the case of Eurozone countries because they capture a U.S.-specific source of *EPU*. To do so, Baker, Bloom and Davis (2016) select articles from major newspapers and scan for three groups of words related to economy, uncertainty and economic policy. There should be at least one word from each group in the article for the article to be counted as an indicator of EPU. In this study, we only consider the newspaper-based index available for several European economies, because this index has several advantages over other extant uncertainty measures.

[3] More details about authors methodology can be found in https://www.policyuncertainty.com/

A first advantage of the *EPU* index is that it allows for international time and cross-country simile compared to other indices. Hence, considering the *EPU* index ensures national comparability as the same methodology is used for 22 countries over at least 20 years. Second, the *EPU* index covers both the intensity and persistency of movements in policy-related economic uncertainty events. Figure 1 displays the quarterly *EPU* index both for Europe and for the countries studied, respectively Belgium, France, Germany, Italy, Spain, the Netherlands, Sweden and Greece over our sample period. Swedish and Belgian indices exhibit a dampened volatility relative to other surveyed countries. It fluctuates around consistently high levels from 2011 to early 2013, a period characterized by recurring sovereign debt and banking crises in the Eurozone. In 2016, the Brexit announcement in the UK has opened a Pandora's box, ushering in a new period of uncertainty. Except for Sweden and Belgium, the *EPU* index is shown to raise in the same year, thus reflecting the general turmoil caused by the political watershed. Interestingly, significant cross-country *EPU* transmissions are observable during the post-referendum period. Moreover, the *EPU* index also deals with country-specific patterns: for instance, the dramatic rise observed in Spain at the end of 2017 corroborates with the Catalan unilateral declaration of independence. At the European scale, the recent pattern of the *EPU* index shows that the current levels of economic policy uncertainty are at slightly high levels compared to the past, suggesting a growing persistent concern. All in all, this index is consistent with the ups and downs in the level of economic activity of the eight countries covered in this study.

Figure 1 - Newspaper-based EPU index from 2010 to 2019





3. Data and methodology

The sample data come from three sources. Firm-level data are gathered from the Amadeus database maintained by Bureau van Dijk. Amadeus contains financial information on over 7 million firms across 38 European countries. Data are collected by 35 information providers across Europe, generally the office of the Registrar of Companies, and are standardized. We combine the latter with the *EPU* monthly index data available for European countries available online. *EPU* indices for France, Germany, Italy, Spain and Sweden are provided by Baker, Bloom and Davis (2016). The same methodology is used for Greece (Fountas, Karatasi and Tzik, 2018), Netherlands (Kroese, Kok and Parlevliet, 2015), Belgium (Algaba et al., 2020). Since monthly financial statement information are not available, we conduct our analysis of corporate investment based on annual data. Thus, we calculate the annual *EPU* value as the yearly average of monthly data (*EPU mean*)[4]. Lastly, country-level variables are extracted from the World Development Indicators database from the World Bank.

The number of firms included in the Amadeus database varies across countries: in our sample, Spain and Italy were overrepresented compared to other countries. To deal with this selection bias, firms were selected using a sampling design that stratifies companies by sector and

[4] Several prior studies also adopted the annual arithmetic mean of EPU index to investigate investment under uncertainty (e.g., Wu et al., 2020; Chen, Lee and Zeng, 2019)

by size. Hence, three elements were used in the sample stratification: industry classification (2-digit level NACE codes provided by Amadeus), firm size (classification employed by the European Commission in microenterprises, small and medium enterprises, and large companies[5]), and country. The data have been cleaned for outliers[6] and missing observations (especially CEO gender). Thus, we obtain a fairly broad dataset including 38,173 European firms from eight economies. The choice of countries is driven by the availability of both firm-level information and the *EPU* index. About 39.69% of firms are from Italy, 30.22% and 20.12% respectively from Spain and France, and the remainder are from Greece, Netherlands, Belgium, Germany and Sweden. Firm-years observations with female CEOs represent 22.30% of our sample. Regarding firms' size, most entities are small: 58.62% of the firms are microenterprises whereas 38.39% are classified as small and medium enterprises and only 3.01% as large firms. Regarding time dimension, our analysis spans the 2010-2019 period as Amadeus includes up to 10 years of information per company.

In the estimations, the dependent variable is a measure of investment. As suggested by Becker and Sivadasan (2010), investment is measured as *Gross Investment*, defined as the sum of fixed assets and depreciation for year *t* minus fixed assets in year *t-1*, all scaled by total assets in year *t-1*. As aforementioned, we employ *EPU mean* to measure economic policy uncertainty. *CEO gender* is estimated by a dummy equal to one if the CEO is a woman in year *t* and zero otherwise. Our explanatory variable of interest is the interaction term between *CEO gender* and *EPU mean*, denoted as *CEO gender×EPU*. A statistically significant negative coefficient for *CEO gender×EPU* indicates that an increase in uncertainty reduces the firm-level investment for a female CEO.

Hence, we estimate the following model:

$$Gross\ Investment_{i,t} = \alpha_t + \tau_k + \theta_j + \beta_1\ CEO\ gender_{i,t-1} + \beta_2\ EPU_{k,t-1} + \beta_3\ CEO\ gender_{i,t-1} \times EPU_{k,t-1} + \beta_4\ firm\ controls_{i,t-1} + \beta_5\ country\ controls_{k,t-1} + \varepsilon_{i,t} \quad (1)$$

[5] For further details, see https://ec.europa.eu/eurostat/web/structural-business-statistics/structural-business-statistics/sme.

[6] Note that firm-level variables have been winsorized at the 1st and 99th percentiles to reduce the potential impact of outliers.

The subscript *i* refers to firm, subscript *j* to industry, subscript *k* to country and finally subscript *t* to year. $\varepsilon_{i,k,t}$ is the idiosyncratic error term.

Based on prior research on the determinants of firm investment (Gebauer, Setzer and Westphal, 2018, Wu et al., 2020), we control for an array of five firm-specific variables. In particular, we include *Firm size* (natural logarithm of total assets), *Profitability* (return on assets), *Leverage* (total debt over total assets), *Growth opportunity* (sales growth) and *Tangibility* (fixed assets scaled by total assets).

Since the *EPU* index may capture not only policy-related uncertainty but also fundamental economic volatility, we consider a set of country-specific controls to alleviate endogeneity concerns. In line with Chen, Lee and Zeng (2019), the latter contains *GDP growth* (real GDP growth) and *Inflation* (natural logarithm of inflation rate measured by the consumer price index).

As it takes time for investment decisions to materialize, we lag all endogenous variables by one year allowing us to distinguish the causal effect of uncertainty. To deal with a potential heterogeneity bias, we use fixed effect regression. We control for the country fixed effects (τ_k) to capture time-invariant specific effects across countries. Industry fixed effects (θ_j) and year fixed effects (α_t) capture respectively unobservable industry heterogeneity and aggregate shocks. As *EPU* varies at the country level and not at the firm level, we use country fixed effects rather than firm ones. Standard errors are clustered at the firm level to control for cross-sectional correlation. Definition of variables is summarized in the Appendix.

Panel A of Table 1 displays summary statistics of variables used in our study. The mean value for *Gross investment* is 3.67%. *EPU* ranges between 78.22 and 317.12 with a standard deviation of 60.59, demonstrating considerable variation around the sample mean value as mentioned above. We observe that 22.23% of CEOs are women in our sample, which is in line with the fact that our sample includes a large number of non-listed firms.

Panel B of Table 1 reports univariate correlations. Results suggest that correlation coefficients are below the serious multicollinearity threshold of 0.7 set by Kervin (1992). We can point out that *Gross investment* has a positive correlation with *EPU mean* and a negative correlation with CEO gender.

4. Results

4.1 Main estimations

Table 2 reports the main estimations. We perform several estimations. The first model considers only *EPU mean* and control variables (column 1). The second model considers only the three variables of interest (*EPU mean*, *CEO gender*, *EPU mean*×*CEO gender*) (column 2). The third and fourth models respectively add firm-level (column 3) and country-level control variables (column 4). Finally, the fifth model includes all control variables in addition to the three variables of interest, and is our preferred specification. Several findings emerge.

First, we observe that women-led firms have lower investment than men-led firms. *CEO gender* has a significantly negative coefficient in all estimations. The effect on corporate investment of a female CEO is economically significant: the presence of a female CEO lowers the firm-level investment by 1.174% in our preferred specification.

Second, we find that economic policy uncertainty exerts a positive impact on corporate investment. The coefficient of *EPU mean* is significantly positive in all estimations. Therefore, we find evidence in favor of the *growth options* and the *Oi-Hartman-Abel effects*. This finding is consistent with what Wu et al. (2020) have found for Australia. It however differs from the conclusion all obtained in single-country samples of listed firms from Gulen and Ion (2016) and Chen, Lee and Zeng (2019) for US firms and Cerda, Silva and Valente (2018) for Chile. Economically, a one standard deviation rise in *EPU mean* is associated with a rise in investment of 0.0073 percentage points in our preferred specification.

Third, we find that the presence of a female CEO reduces the beneficial impact of economic policy uncertainty on corporate investment. The coefficient of *EPU mean*×*CEO gender* is negative and significant for each specification. Thus, this finding supports our initial hypothesis that the presence of a female CEO leads to lower firm investment in presence of uncertainty relative to the presence of a male CEO. We explain this conclusion by the higher risk aversion of women relative to men. Women are more reluctant to increase investment than men are in presence of higher uncertainty.

Furthermore, this result also provides additional support to the *growth options* and the *Oi-Hartman-Abel effects* according to which uncertainty is associated with higher investment. Namely, the full effect of *EPU mean* is still positive even for female-led firms in the sense that the

negative coefficient of the interaction term is not high enough to turn the positive impact of *EPU mean* in a negative one for female-led firms. Hence, the growth options effect is supported for all firms whatever the gender of the CEO.

Regarding firm-level controls, the significantly negative coefficient for *Size* implies that small firms have higher investment rates than large firms, consistent with Gebauer, Setzer and Westphal (2018). Interestingly, *Tangibility* has a negative and significant effect on investment, which accords with the result from Gebauer, Setzer and Westphal (2018) for European firms. We find a positive and significant relationship between *Profitability, Growth Opportunity* and firm investment in line with existing literature. Finally, none of the coefficients on *Leverage* is significant.

The estimated coefficients of the country-level variables have the expected sign. *GDP growth*, which is an aggregate proxy for investment opportunities, is positively and significantly associated with investment, while *Inflation* has a significant and positive sign in line with Wu et al. (2020).

4.2 Estimations by firm size

Our main results show that the effect of uncertainty on corporate investment is influenced by CEO gender. We further investigate whether this gendered effect varies with the size of the firm. The analysis by firm size is of utmost interest from two perspectives. First, it contributes to the identification of the core effect of the paper, i.e. the effect of gender on the EPU-investment relation. Indeed, the CEO characteristics play a stronger role on corporate decisions in smaller firms. It results from the higher involvement of CEOs in firm activities in smaller firms. It also comes from the fact that CEOs of small firms are free from the burdens associated with the performance metric of share price characterizing public firms and other efforts aimed at managing investor expectations (Zahra and Pearce, 1989). Furthermore, in the case of large firms, the strongest regulation and oversight can inhibit the CEO effect. Hence, scrutinizing the effect of uncertainty on female-led smaller companies allows for better identification of the impact of CEO personal traits (Quigley, Chirico and Baù, 2021).

Second, it brings relevant findings to understand the differences in the determinants of corporate investment across types of firms. It is of importance to know whether firm investment

has the same sensitivity to EPU and to other factors whatever firm size to assess the influence of policies favoring firm investment on different types of firms.

We re-estimate the regression by considering separately the following groups of firms: micro companies, small and medium enterprises (SMEs), and large companies. We follow the European Commission classification by defining microenterprises as firms with real total assets below 2 million euros each year, SMEs as firms with real total assets below 43 million euros each year, and large firms as the remaining ones.

The results are reported in Table 3. We find that the interaction term between *EPU mean* and CEO gender is significantly negative for microenterprises and SMEs, while it is not significant for large firms. Additionally, the coefficient of *EPU mean* is significantly positive for microenterprises and SMEs but not significant for large firms.

Therefore, these results mean that our two key results – the positive impact of economic policy uncertainty on corporate investment, which is lower for female-led firms – are only observed for microenterprises and SMEs. The interplay between CEO gender and uncertainty is not significant for large firms.

This conclusion provides additional support to our key finding of a gendered effect of uncertainty on corporate investment, since CEO characteristics exert a greater influence on corporate decisions in smaller firms.

5. Robustness tests

5.1 Alternative model specification

One of the main challenges of our estimation strategy is to properly control for aggregate confounders of policy uncertainty that might cause omitted variable bias. Corporate investment also possibly relies on unobserved or hidden investment opportunities that are only partly controlled by *Sales growth* at the firm level and by *GDP growth* at the country level, both lagged by one year to minimize reverse causality concerns. Furthermore, another main empirical concern is the possible endogeneity problem: corporate investment could potentially affect economic uncertainty, thereby impacting the EPU index. In order to alleviate omitted variable and endogeneity biases, we employ the dynamic panel system Generalized Method of Moments (GMM

hereafter) method developed by Arellano and Bover (1995) and Blundell and Bond (1998)**.** The system GMM estimator improves the efficiency of the first difference GMM estimator by introducing equations in both levels and differences. Thus, we consider lagged levels as instrumental variables for the equations in first differences and lagged differences as instruments for the levels equations. As suggested by Roodman (2009), system GMM is particularly consistent for panels with small T and large N, e.g. few periods and many individuals like ours compared to two-step least square estimations.

The reason why we do not consider system GMM in the main specification is the following. The dynamics of the model and its transformation to first differences imply that the sample is conditional to observing the outcome for at least three consecutive periods. Thus, a trade-off arises between the lag distance used to generate internal instruments and the size of the sample considered for our estimation. As our sample only covers the 2010-2019 period, we choose to keep the largest T as possible for our main demonstration.

The results of the system GMM estimations are presented in Table 4[7]. Two lags are used as the instrument set. The coefficients of *CEO gender* and *EPU mean* remain statistically significant at the 1% level, consistently with our main estimation. Focusing on our main variable of interest, the estimator of the interplay between *CEO gender* and *EPU mean* is still negative and significant. Hence, these results corroborate those obtained in the main estimations.

5.2 Alternative measures for firm investment

Up to this point, we have used the *Gross investment* measure for firm investment following among others Becker and Sivadasan (2010). We redo the estimations with two alternative measures. First, we consider *Alternative investment* defined as the change in the real capital stock plus depreciation divided by the level of the real capital stock (proxied by tangible fixed assets), in line with Konings, Rizov and Vandenbussche (2003). Normalizing by capital stock allows considering firm size effect. Indeed, the propensity of investment in fixed assets tends to be higher for large firms as they have a greater output capability, allowing them to smooth the cost of capital over time. Second, we use *Investment relative to industry* which is measured by the ratio of *Gross*

[7] We utilize the system GMM estimation module provided by Stata, xtabond2 proposed by Roodman (2009) for econometric estimation.

*investmen*t to the median *Gross investment* in the industry of the firm. We consider to this end the NACE section to define the industry of the firm. With this indicator, we take into account differences across industries and thus provide a relative measure of investment. We provide the results for both alternative measures of firm investment in columns (1) and (2) of Table 5. We find again a significant and negative coefficient for *EPU mean*×*CEO gender*, which confirms our key finding that in presence of higher economic policy uncertainty investment is lower in female-led firms than in male-led firms. Therefore, these results provide additional support for our key finding.

5.3 Alternative dataset of firms with no change in CEO

We have performed all estimations by considering all firms of the dataset mixing thus firms with change in CEO over the period and firms with no change in CEO. A potential criticism deals with the fact that economic changes can affect both the likelihood of female CEO hirings as well as investment. A first answer to this criticism is the fact that the vast majority of the firms of the sample (about 89%) have the same CEO for the whole period of study, revealing that no change of CEO takes place before any change in corporate decisions. It accords with the fact that we mostly consider small firms in our dataset, meaning companies with strong links between management and ownership. A second answer is to provide the estimations for companies with no change of CEO over the period to check if our findings stand. We present these estimations in column (3) of Table 5.

We find again a significantly negative coefficient for *EPU mean*×*CEO gender*. Hence our conclusion that investment is lower in female-led firms than in male-led firms in presence of higher economic policy uncertainty is also observed for firms with no change in CEO over the period of the study.

6. Conclusion

This study examines the influence of CEO gender on the relation between economic policy uncertainty and corporate investment. To this end, we perform an empirical investigation on firm-level data of more than 38,000 firms from eight European countries for the 2010-2019 period. To

capture the overall level of policy uncertainty in the economy, we employ the newspaper-based EPU index developed by Baker, Bloom, and Davis (2016).

We first find evidence that higher economic policy uncertainty is associated with higher corporate investment. However, we show that this beneficial effect of economic policy uncertainty is reduced when the firm CEO is a woman. Namely, an increase in economic policy uncertainty leads to higher firm investment, but the rise in investment is lower for women-led companies. We explain this finding by the higher risk aversion of women relative to men. In presence of higher economic policy uncertainty, women are more reluctant to increase investment than men.

The analysis by firm size reveals that this effect is observed for microenterprises and SMEs but not for large companies. This additional result supports our key finding about the influence of CEO gender since the influence of the CEO on corporate decisions is more prominent in small companies.

The implications of our findings are twofold. First, European policymakers should be aware of the beneficial effects of economic policy uncertainty for investment. In opposition with the common view that firms become cautious and reduce investment with high uncertainty, European firms tend to increase investment when the degree of economic policy uncertainty rises. In other words, there is no motive associated with favoring investment to reduce economic policy uncertainty in Europe. Second and foremost, a higher share of female CEOs in a country contributes to reduce the beneficial effect exerted by uncertainty on corporate investment. In other words, greater EPU benefits less to countries with higher presence of women CEOs. The higher presence of women CEOs contributes therefore to reduce the impact of changes in economic policy uncertainty on corporate investment and through that exerts a moderating effect.

Our research is thus an initial step towards understanding how CEO gender affects the consequences of greater economic policy uncertainty. It would notably be of particular interest to investigate whether CEO gender affects the relation between economic policy uncertainty and firm performance. We let this question for further research.

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Table 1.
Descriptive statistics and correlation matrix

This table provides descriptive statistics in Panel A and correlation matrix in Panel B for the variables used in the estimations. Definitions of variables are reported in the Appendix.

Panel A: descriptive statistics

Variable	*N*	*Mean*	*Std Dev.*	*Min*	*Max*
Gross investment	319,441	.0367564	.0833643	-.2568617	.6154242
CEO gender	319,441	.2229895	.416252	0	1
EPU mean	319,441	153.6562	60.58902	78.21642	317.1186
Size	319,441	7.339385	1.538899	3.433987	10.94005
Profitability	319,441	4.782868	10.9388	-33.64	45.82
Leverage	319,441	.0012864	.0059355	2.85e-06	.6672462
Growth Opportunity	319,441	.1656247	1.32067	-1	21.67626
Tangibility	319,441	.2442865	.268857	0	.981759
GDP growth	319,441	1.016886	1.753026	-2.980906	3.925193
Inflation	319,441	-.1288345	.4589732	-1.130416	.6726341

Panel B: correlation matrix

Variable	*Gross investment*	*CEO gender*	*EPU mean*	*Size*	*Profitability*	*Leverage*	*Growth opportunity*	*Tangibility*	*GDP growth*	*Inflation*
Gross investment	1.0000									
CEO gender	-0.0072	1.0000								
EPU mean	0.0172	-0.0653	1.0000							
Size	0.0204	-0.0435	0.2116	1.0000						
Profitability	0.0370	-0.0121	0.0530	-0.0322	1.0000					
Leverage	0.0070	0.0129	-0.0430	-0.2994	-0.0572	1.0000				
Growth Opportunity	0.0592	-0.0120	-0.0098	0.0028	0.0354	0.0073	1.0000			
Tangibility	0.1437	0.0572	-0.1275	0.1045	-0.1292	-0.0332	-0.0105	1.0000		
GDP growth	0.0078	0.0196	0.0378	0.1261	0.0575	-0.0575	-0.0124	-0.0365	1.0000	
Inflation	0.0271	0.0054	-0.1674	-0.0385	0.0310	0.0406	0.0312	0.0479	-0.2150	1.0000

Table 2.
Main estimations

This table presents the results of fixed-effects regressions examining the relation between economic policy uncertainty, CEO gender and investment. All firm and country characteristics are lagged one year relative to the dependent variable to mitigate endogeneity concerns. Definitions of variables are provided in the Appendix. Standard errors (in brackets) are robust to arbitrary heteroskedasticity. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Dependent variable = *Gross Investment*					
	(1)	(2)	(3)	(4)	(5)
EPU mean×CEO gender		-0.00283**	-0.00390**	-0.00288**	-0.00396**
		(0.00177)	(0.00173)	(0.00177)	(0.00173)
EPU mean	0.00618*	0.00250*	0.00298*	0.00692**	0.00732**
	(0.00331)	(0.00208)	(0.00203)	(0.00334)	(0.00333)
CEO gender	-0.118	-0.866	-1.153**	-0.885*	-1.174**
	(0.222)	(0.528)	(0.517)	(0.528)	(0.517)
Size	-4.071***		-4.075***		-4.073***
	(0.195)		(0.195)		(0.195)
Leverage	1.114		1.144		1.143
	(18.00)		(17.96)		(17.96)
Growth opportunity	0.0933***		0.0934***		0.0932***
	(0.0337)		(0.0337)		(0.0337)
Tangibility	(0.898)		(0.898)		(0.899)
	0.0409***		0.0409***		0.0409***
Profitability	(0.00496)		(0.00496)		(0.00496)
	0.178			-0.126	0.172
GDP growth	(0.147)			(0.121)	(0.147)
	-0.127			0.198	-0.140
Inflation	(0.121)			(0.154)	(0.121)
	47.68***	0.0822***	47.62***	7.927***	47.34***
Constant	(2.071)	(0.0136)	(2.080)	(1.347)	(2.076)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	98,862	98,862	98,862	98,862	98,862
R-squared	0.054	0.001	0.054	0.002	0.054
Number of id	38,173	38,173	38,173	38,173	38,173

Table 3.
Estimations by firm size

This table presents the results of fixed-effects regressions examining the relation between economic policy uncertainty, CEO gender and investment. All firm and country characteristics are lagged one year relative to the dependent variable to mitigate endogeneity concerns Definitions of variables are provided in the Appendix. Standard errors (in brackets) are robust to arbitrary heteroskedasticity. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Dependent variable = *Gross Investment*			
	(1) Microenterprises	(2) SMEs	(3) Large firms
EPU mean×CEO gender	-0.00475*	-0.00258*	-0.00483
	(0.00296)	(0.00212)	(0.00763)
EPU mean	0.00601**	0.00497*	-0.00760
	(0.00689)	(0.00430)	(0.0126)
CEO gender	-1.444*	-0.739*	1.491
	(0.883)	(0.624)	(1.997)
Size	-3.553***	-5.462***	-14.08***
	(0.318)	(0.330)	(4.506)
Leverage	10.18	-2,243	329,904**
	(18.98)	(1,545)	(131,529)
Growth opportunity	0.115	0.116***	0.0184
	(0.0714)	(0.0417)	(0.117)
Tangibility	-24.86***	-17.48***	-13.09***
	(1.378)	(1.287)	(3.426)
Profitability	0.0389***	0.0391***	0.0499
	(0.00672)	(0.00756)	(0.0324)
Inflation	0.0928	0.218*	0.667
	(0.336)	(0.190)	(0.529)
GDP growth	-0.150	0.000985*	-0.0379
	(0.231)	(0.161)	(0.388)
Constant	35.16***	55.90***	160.2***
	(2.722)	(3.079)	(49.72)
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes
Observations	42,187	47,548	4,771
R-squared	0.077	0.051	0.026
Number of id	21,354	15,632	1,473

Table 4.
Generalized Method of Moments

This table presents the results of GMM regressions examining the relation between economic policy uncertainty, CEO gender and investment. All firm and country characteristics are lagged one year relative to the dependent variable to mitigate endogeneity concerns Definitions of variables are provided in the Appendix. Standard errors (in brackets) are robust to arbitrary heteroskedasticity. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Dependent variable = *Gross Investment*	
Lagged investment	0.594***
	(0.182)
EPU mean×CEO gender	-0.00338*
	(0.00412)
CEO gender	-0.649*
	(0.838)
Size	-0.257***
	(0.0297)
Leverage	24.34***
	(8.624)
Growth opportunity	-0.251***
	(0.0864)
Tangibility	-3.584**
	(1.735)
Profitability	0.0302***
	(0.00442)
Inflation	0.231**
	(0.114)
GDP growth	0.112***
	(0.0337)
EPU mean	4.187***
	(0.299)
Constant	-0.257***
	(0.0297)
Observations	86,322
Number of id	32,014

Table 5.
Robustness checks

This table presents the results of fixed-effects regressions examining the relation between economic policy uncertainty, CEO gender and investment. In specification (1), the dependent variable is *Alternative investment* defined as the change in the real capital stock plus depreciation divided by the level of the real capital stock (proxied by tangible fixed assets). In specification (2), the dependent variable is *Investment* relative to industry defined as Gross investment / Median gross investment in the industrythe change in the real capital stock plus depreciation divided by the level of the real capital stock (proxied by tangible fixed assets). All firm and country characteristics are lagged one year relative to the dependent variable to mitigate endogeneity concerns. Definitions of variables are provided in the Appendix. Standard errors (in brackets) are robust to arbitrary heteroskedasticity. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	(1) Dependent variable= *Alternative Investment*	(2) Dependent variable= *Investment relative to industry*	(3) Dependent variable= *Gross investment* No change in CEO
EPU mean×CEO gender	-0.00668***	-0.00243**	-0.00461**
	(0.00215)	(0.00109)	(0.00209)
EPU mean	0.000453*	0.00591***	0.00549*
	(0.00418)	(0.00208)	(0.00334)
CEO gender	-1.632**	-0.766**	-
	(0.658)	(0.319)	-
Size	-2.765***	-1.702***	-4.061***
	(0.532)	(0.105)	(0.209)
Leverage	-29.18	-6.406	3.406
	(23.75)	(8.883)	(14.66)
Growth opportunity	-0.0171	0.0542**	0.112***
	(0.0326)	(0.0211)	(0.0399)
Tangibility	-9.430***	-8.867***	-19.27***
	(1.832)	(0.485)	(1.008)
Profitability	0.0104	0.0239***	0.0394***
	(0.00640)	(0.00270)	(0.00530)
Inflation	-0.0830	0.210**	0.117
	(0.148)	(0.0891)	(0.150)
GDP growth	-0.0653	-0.138*	-0.0875
	(0.100)	(0.0735)	(0.124)
Constant		17.03***	38.55***
	10.04	(0.889)	(1.730)
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes
Observations	98,571	98,862	87,722
R-squared	0.077	0.031	0.055
Number of id	38,058	38,173	35,827

Appendix.

Variable	Definition
Dependent variables	
Gross investment	= (Fixed assets – Lagged fixed assets + Depreciation) / Total assets. Source: Amadeus
Alternative investment	= (Fixed assets – Depreciation – Lagged fixed assets – Lagged depreciation)/ Tangible fixed assets. Source: Amadeus
Investment relative to industry	Gross investment / Median gross investment of the industry (NACE section). Source: own computations with Amadeus data.
Firm level variables	
Size	= the natural logarithm of firm total assets in million USD. Source: Amadeus
Leverage	= the ratio of debt to total assets. Source: Amadeus
Growth opportunity	= (Sales – Lagged sales)/Lagged sales. Source: Amadeus
Tangibility	= tangible fixed assets scaled by total assets. Source: Amadeus
Profitability	= EBIT scaled by total assets. Source: Amadeus
CEO gender	= dummy variable equal to 1 if the CEO is a woman and 0 otherwise. Source: Amadeus
Country level variables	
Inflation	= natural logarithm of inflation rate measured by the consumer price index. Source: World Bank Development indicators
GDP growth	= real GPD growth. Source: World Bank Development indicators
EPU mean	= average national EPU index. Source: Baker, Bloom and Davis (2016), Fountas et al. (2018), Kroese et al. (2015), Algaba et al. (2020)
EPU geometric mean	= geometric mean of national EPU index. Source: Baker, Bloom and Davis (2016) among others
EPU median	= median of national EPU index. Source: Baker, Bloom and Davis (2016) among others