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ABSTRACT

Uncertainty and Firms' Labour Decisions. Evidence from European Countries*

Uncertainty affects employers' decisions on labour workforce, as it does on capital. We exploit differences on how firms adjust their labour work-force when uncertainty increases. Using data from the Wage Dynamic Network Survey for 25 European countries, we first construct, opposite to usual aggregate indicators, a set of uncertainty indicators exploiting firms' microeconomic environment. We combine variability from the country, sector and size of the firm. Secondly, we investigate the effect of uncertainty on firms' strategies to adjust labour through hirings and rings. Results reveal that firms reduce hiring decisions and recur to individual layos more frequently when uncertainty increases. An increase of one point in the uncertainty indicator increases the probability of having frozen hiring in between 21% to 39%. We also find more significant effects when firms are facing credit constraints and labour adjustment costs are higher.

JEL Classification: D22, D81, J21, J23

Keywords: uncertainty, labour adjustment, firms' labour decisions, freeze hirings, layoffs

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1 Introduction

The effect of uncertainty on economic performance has renewed the interest of both theoretical and empirical research since the last crisis. The increase in financial and economic uncertainty joint with the necessity of finding significant factors explaining the economic downturn has increased the attention on this issue. Other episodes recently hitting the international economy, as the Brexit and the current COVID-19 crisis, are also contributing to highlight the importance of understanding the effect of uncertainty. After all, uncertainty shocks are one of the most important factors behind real GDP growth fluctuations. Macroeconomic uncertainty have significantly contributed to real GDP growth fluctuations in the euro area, after the lagged contribution of past real GDP growth[1] (ECB, 2016), and might have important consequences on firms' decisions and on the labour market in the current economic situation of many countries.

Several channels might explain how uncertainty affects economic activity. Generally, it causes economic activity to slow down and contract by freezing investment through 'wait and see' episodes. But it also affects firms' decisions on labour demand[2]. Uncertainty might reduce hiring and job creation and might increase quits and layoffs. Whereas uncertainty has been generally addressed from a pure macroeconomic and aggregated perspective, decisions on the labour market of firms facing uncertain environment need to be considered from a more pure microeconomic perspective. Basically, we are interested in knowing how firms adjust their labour workforce when dealing with increases in uncertainty in its activity environment.

Studying microeconomic effects on firms' behaviour could bring another perspective with additional information about the mechanisms used by firms to respond to increases in uncertainty. Do firms react with different strategies to face an increase in uncertainty? Are firms from specific countries or industries more prone to reducing hiring or increase firings when uncertainty increases? Uncertainty could be different depending, not only on the country but also on firms' environment and characteristics. Uncertainty might come from different sources (country, sector, type of firm). But it also might have different effects depending on the institutional framework to which the firm is exposed to.

This paper exploits novel data on European companies to design an indica-

[1] As shown in ECB (2016), the average shock contribution of uncertainty to real GDP fluctuations is 20%, only after the real GDP lagged (27%) and before other factors such as world demand (6%), real private consumption, savings rate or real investment (each of these three factors contribute around a 5%.)

[2] Using data from the third wave of the Wage Dynamic Network Survey, around a 65% of the companies in the European Union consider uncertainty as the most relevant obstacle in hiring new workers, before others such as wages, firing or hiring costs, access to credit or cost of other inputs. Uncertainty is even more important in small and medium companies, which is the most predominant size of European businesses.

tor of uncertainty having into account firms' characteristics. Then, we study whether uncertainty affects firms' decisions on labour and what type of mechanism is used to adjust firms' decisions to cope with the effect of an increase on uncertainty. Our contribution to the previous evidence is based on two dimensions. Firstly, we propose a new set of uncertainty indicators disaggregating at several levels -country, sector and size of the firm-, which better captures the microeconomic environment that the firm is facing, opposite to more aggregated macroeconomic indicators. Secondly, we investigate the role of uncertainty on labour market decisions made by firms. Uncertainty might lead to a reduction of labour stock. In case of adjustment costs are important or the firm face credit constraints, it might be optimal for firms to no longer adjust their employees but to wait. Therefore, in those countries with a higher employment protection (where firms face higher labour adjustments costs), firms might be more reluctant to reduce layoffs or firings when uncertainty increases but also firms might be more reluctant to hire workers.

The main results of the paper reveal that firms tend to reduce hiring and increase the adjustment of labour demand with more frequency when uncertainty is higher. An increase of one point in uncertainty increases the probability of having frozen hiring in around 25% during the period 2010-2013. Furthermore, other labour strategies have been also used by firms, such as altering labour workforce or non-renewing temporary contracts: while the probability of recurring to individual layoffs seems also clear, non-renewing temporary contracts seems to be just the opposite, with no significant effect when uncertainty is higher. Finally, significant effects have also been observed for financially constrained firms and by countries with a stricter employment legislation that have higher labour adjustment costs. In these cases, we find that freezing hiring responds with more intensity to increases in uncertainty so that firms are more likely to reduce hirings when adjustment costs are higher.

The remainder of the paper is as follows. Section 2 presents a review of the previous evidence about the effects of uncertainty in the literature. Section 3 describes the construction of the uncertainty indicators with its disaggregation in several dimensions. Section 4 explains the data used to construct the indicators and used in the empirical part. Section 5 presents the model estimated and its main results, together with several robustness checks. Finally, Section 6 summarizes the main conclusions of the paper.

2 Uncertainty and its effects on firms´ decisions

Uncertainty increases and its effects on the economy constitute significant concerns in the study of economic fluctuations. Born et al. (2018) found that up to a 10% of the drop in the gross domestic product of the US and up to 0.6 percentage points of the increased unemployment rates in 2009 through 2011

are explained by macroeconomic and financial uncertainty. As explained in Caldara et al. (2016), the depth and duration of the 2008-2009 financial crisis in the world economy, traditional sources of business cycle fluctuations has become more hesitant. As a consequence, recent evidence has focused on a combination of financial or uncertainty shocks as factors driving economic activity (Bloom, 2009; Bloom et al., 2013; Christiano et al., 2014; Gilchrist et al., 2014).

Several mechanisms might explain the downturn in activity as a consequence of increasing uncertainty. Jurado et al. (2015) mentioned the existence of three different effects of an increase in uncertainty: a "real options" effect, due to the reduction of hiring, investment or consumption; the "precautionary effect" when agents are risk averse, and the "financial frictions" effect if a higher uncertainty causes an increase in financial constraints. Classical literature pointed out that increases in uncertainty causes firms to temporary pause their investment and hiring, which in the medium term produces a rapid drop and rebound in output and employment (Bloom, 2009). Bachmann and Bayer (2013) and Stokey (2013) have both found that uncertainty about a one-time change in a policy induces the firm to temporarily stop investing. Mecikovsky and Meier (2014), using microdata from US establishments, observed that unexpected increases in uncertainty move firms to freeze investment and labour policies, adopting a progressively larger wait-and-see policy. If companies freeze and remain inactive in response to increased uncertainty, real economic activity contracts. As a consequence, wait-and-see policies reduce capital through depreciation of the existing capital stock and thereby lowers labour demand, which implies more layoffs and less hiring, and when it is related to financial markets, the effect is largest and more persistent. In two recent papers, Binding and Dibiasi (2017) and Dibiasi et al. (2018) also show, using a natural experiment after a change in the exchange rate in Switzerland, that uncertainty negatively affected investment in equipment and machinery through real-option channel during 2009-2015. However, it positively affects expenditures in R&D through a growth-option channel. Arellano et al. (2016) argued that an increase in uncertainty generates firms to downsize investment to avoid default. When firms are exposed to idiosyncratic shocks during the production process, hiring inputs are risky.

Uncertainty also plays an important role on labour market dynamics. Kandoussi and Langot (2020) show that uncertainty shocks plays a major role on US unemployment fluctuations explaining 25% of the variance in unemployment and a 20% of the variance in the job finding rate. As uncertainty is also considered by firms as a shock, our paper is also related to the literature trying to explain labour adjustments as a response to shocks. Mathä et al. (2019) found that firms responding to negative shocks were most likely to reduce employment, hourly wages and hours worked, regardless of the source of the shock. These authors also show that, as firms choose the cheapest way to adjust labour costs, strict employment protection legislation make it less likely that firms reduce wages when facing negative shocks.

Credit constraints are also a significant factor on the transmission of uncertainty and volatility to the firms' activity. In the case that the firms has to fulfill financial obligations, they can also experience a costly default. In this situation, an increase in uncertainty due to an increase in the volatility of idiosyncratic productivity shocks induces firms to lower the probability of a default reducing costs, which means definitely that the firm reduces to hire inputs. Therefore, in presence of credit constraints, firms are more reluctant to hire and more cautious to take labour decisions because of rising costs of debt (Christiano et al., 2014; Gilchrist et al., 2014; Bonciani and van Roye, 2015). Choi et al. (2017) find that the impact of uncertainty on industry-level productivity growth is greater when industries have a higher dependance on external financing. During recessions, financing constraints are more important and firms switch the composition of investment being more exposed to liquidity risks, as also predicted by Aghion et al. (2010).

Second-wave effects are also observed empirically. Uncertainty also weakens the efficacy of both monetary and fiscal policy. Bloom et al. (2007) found that responsiveness of firms to any given policy stimulus may be much weaker in periods of high uncertainty, which implies that effectiveness of public policies might also be affected by episodes of increased uncertainty.

3 Database and uncertainty indicator

3.1 Database

We use data from Wage Dynamics Network (WDN) Survey. During 2014, national central banks of 25 European countries conducted a survey of firms about changes in their economic environment, labour decisions, wage adjustment and price-setting mechanisms. This survey was the third wave of the project coordinated by the ESCB Wage Dynamics Network. The database consists on an international comparable and harmonized survey of firms with one or more employees. Questions are mainly referred to firms' decisions on labour, wage and prices strategies during the whole period 2010-2013. Only cross-section data at the firm-level is available for most of the questions. In the data there are some questions referred to the year in which negative shocks affected demand, uncertainty or firm access to financing. However, these questions are only available in some of the countries of the database, which are Czech Republic, Estonia, Greece, Luxembourg, Poland, Portugal.

Most of the information of the WDN Survey is qualitative, which implies that most of the variables are categorical. Nevertheless, there is also quantitative information about general characteristics of the firm (country, size, industry, structure of ownership, age of the firm), the composition of workforce (percentage of permanent workers, part-time or full-time workers, collective bargaining

coverage, occupational groups) and some cost-cutting strategies (percentage of wage-cut or percentage of workers affected by wages frozen).

In spite of its limitations, mainly referred to qualitative information and no time-varying variables, WDN Survey offers a large amount of questions related to the perception of the changes in the level of demand and volatility of the firms, together with questions referred to the financial conditions, labour adjustments and decisions taken. It is also a remarkable database with homogeneous and comparable information for 25 countries and firms of different characteristics.

The resulting sample used in this paper contains 23,539 firms from 25 countries of more than 5 employees. Table 1 presents the main descriptives of the sample and the main variables and controls, together with the set of uncertainty indicators. We have introduced in the analysis variables related to general characteristics, mechanisms to adapt to changes in economic activity (labour decisions, price decisions) and qualitative information about firms' performance. We have used employment weights in the subsequent analysis, since they adjust for the unequal probability of firms ending up in the final sample and ensuring that the final sample also represents employees in the population. However, we have carried out a robustness analysis using basic sampling weights and also importance weights of the WDN Survey as an alternative to control for the percentage of responses of the questionnaire.

Finally, we have carried out several robustness exercises for a group of countries (Estonia, Letonia, Latvia, Slovenia, Slovakia, Hungary, Bulgaria, Romania) with comparable information from the second wave of WDN Survey. Furthermore, we have also estimated the model for a subsample of firms from Italy, Portugal and Spain, since labour market institutions are more similar and Employment Protection Legislation (EPL) is stricter in these countries, as we explained in section 4.4.

3.2 An indicator to measure uncertainty

Uncertainty is not an observable concept, which may result in several limitations when estimating its effects. While there is not a single opinion on how to measure it, different proxies has been proposed in the literature. Financial market information, key words found in the newspaper articles, surveys among forecasters, private households and firms, and macroeconomic trends have been used to estimate the impact of uncertainty in economic activity. These proxies have been grouped in different types of uncertainty, such as political, financial or forecast uncertainty. But there is still a certain degree of disagreement about the caveats and limitations of all these variables. For that reason, it is important to continue obtaining reliable indicators of uncertainty with large datasets that permit obtaining robust conclusions.

Traditionally, uncertainty has been addressed as a forecasting indicator from a time-varying perspective. Studying shocks to firm's risks makes it easier to understand bust-boom cycles. Uncertainty has aggregated effects that have been used to forecast economic activity, using single indicators by country (D´Amico and Orphanides, 2008; Bachmann et al., 2013; Ghirelli et al., 2019). However, there is an increasing literature pointing out the challenges of macroeconomic indicators in the analysis of the effects of uncertainty. Binding and Dibiasi (2017) suggest the necessity of using disaggregated data in research on the relationship between uncertainty and investment.

Previous evidence has provided country-specific indicators of time-varying uncertainty with several measures, mainly aggregated and purely macroeconomic. Nevertheless, a more disaggregated indicator of uncertainty may capture heterogeneous effects on economic activity and it has not really been tested in the empirical analysis so far. For instance, the shocks that a company receives from one industry may be completely different than other company in another industry, but the variation can be even similar across countries. Thus, it would be desirable to count on sector-specific information to add to the country-specific indicators. Our contribution is to increase the level of disaggregation of uncertainty indicators by providing a firm-environment specific indicator using cross-sections from country, sector, size and potentially well widened to any other specific characteristics of the firm.

On one hand, our indicator is easily comparable, not only among different countries, but also among different sectors and firms with similar characteristics. A demand shock in a certain sector could be similar among countries with different levels of uncertainty. The analysis has hitherto considered this fact as a country shock, but our disaggregation may contribute to increase the level of variability and to use the properties available from similar firms in different countries. On the other hand, the main caveat of this new indicator is that we do not count on a time-varying indicator with the data available so far. A possible line to potential future work would be to merge uncertainty indicators with a firm-level database with time-varying information since 2013.

One of the more popular measures provided in the analysis of uncertainty is the degree of disagreement among forecasters. As explained in Lahiri and Sheng (2010), when disagreement is taken to indicate uncertainty, the underlying assumption is that this inter-personal dispersion measure is an acceptable proxy for the average dispersion of intra-personal predictive probabilities held by individual experts. Disagreement among respondents is usually measured through the standard deviation. For instance, ECB (2016) constructs the unweighted average of the standard deviations of point forecasts among forecasters for different variables in order to construct a measure of forecast disagreement in the euro area.

It is important to remark that our information is backward-looking and

based on realized volatility of qualitative perceptions of the performance of the firm. Realized volatility is not new in the empirical evidence. Baker et al. (2016) have previously used realized volatility as an alternative measure of uncertainty. Furthermore, traditional literature has considered forward-looking indicators because they estimate implied volatility. However, Choi et al. (2017) also used realized volatility of aggregate stock market returns and the authors have pointed out that the difference is minor at the annual frequency considered.

The WDN Survey offers a set of questions showing the perception of the economic environment. In order to focus on the analysis of the uncertainty coming from the firms' demand, we have chosen the following questions to construct the uncertainty indicator:

Name of the question: $c2\_1$: How did the following factors for your main product/service affect your firm's activity during 2010-2013?

$c2\_1a$. The level of demand

$c2\_1c$. Access to external financing through the usual financial channels

$c2\_1d$. Customers' ability to pay and meet contractual terms

$c2\_1e$. Availability of supplies from the usual suppliers

Name of the question: $c2\_6$. How did the following factors for your main product/service evolve during 2010-2013?

$c2\_6a$. Domestic demand

$c2\_6b$. Foreign demand

$c2\_6c$. Domestic prices

$c2\_6d$. Foreign prices

Respondents to each one of these questions are grouped in five different answers: strong decrease, moderate decrease, unchanged, moderate increase, strong increase. Our main indicator used in the analysis is constructed using the standard deviation of the responses within three different groups: country, sector and size of the firm. Consequently, we obtain one standard deviation which can capture the dispersion of responses from inside the group of companies that are divided according to these three different sources. This indicator easily gives us an idea of the degree of dispersion of companies that belong to the same sector, the same country and are similar in size. We called this indicator "U" because it combines the standard deviation of firms exclusively belonging to the same size, sector and country. It allows us to capture the real heterogeneity at a more disaggregated level, permitting to include the variability of a firm that belongs to both a certain uncertain sector in a certain uncertain country, for instance. We use several uncertainty indicators depending on the question use for constructing the standard deviation of the responses[3].

[3]To simplify the results that will be show in the following section, we have only estimated uncertainty coming from domestic or foreign demand and prices, which is the main aim of this paper, and we avoid to show results of estimating the effects of uncertainty from questions c2_1c, c2_1d and c2_1e, because they are referred to other issues and can be affected by other different factors simultaneously and goes beyond our analysis here. However, considering it

3.3 How volatility/uncertainty shocks correlate with the uncertainty indicator

As we have previously pointed out, classical literature has constructed a set of proxies to measure uncertainty. Nevertheless, Jurado et al. (2015) showed that some of the classical proxies used in the analysis to measure uncertainty have some peculiarities that deserve further attention. Even in the case that uncertainty remains constant, stock market volatility can be time-varying because leverage changes or sentiment or risk aversion fluctuate. Cross-sectional dispersion also can hide heterogeneity in the cyclicality of firm's performance and not due to pure uncertainty. Thus, it is important to clarify the link between our uncertainty indicator and real economic uncertainty.

A first way to check the robustness of our uncertainty indicator is to compare it with a usual indicator, the Economic Policy Uncertainty (EPU) indicator and nd European News Based Index of Uncertainty, elaborated by Baker et al. (2016). Figure 1 of the Appendix shows the correlation between EPU and our uncertainty indicator for the question $c2\_1a$. As we can see, the indicator correlates positively and significantly for the most important countries of the EU.

Firms may be exposed to external shocks during their activity. The WDN Survey offers an extra set of questions related to the possibility that the firm has experienced a negative uncertainty shock. This information is only available for a sample of 8 countries (Czech Republic, Estonia, Greece, Luxembourg, Poland, Portugal). The questionnaire asks if the firm has perceived a negative volatility/uncertainty shock during each one of the years of the period 2010-2013 (question "$nc2\_9b$"). This information is extremely valuable if we want to understand if the uncertainty indicator recollects the variability in the response of each firm to their environment.

As a first stage estimation, we have estimated if having experienced a negative shock of volatility/uncertainty might have affected the probability that the level of demand and the credit availability of the firm have decreased during the same period. Then we have estimated the effect of the shock on labour adjusting mechanisms, as we will see in the following section.

Table A1 of the Appendix show the results of the estimation of the effect of having experienced an uncertainty shock on a decrease of demand level (column 1) and on a decrease of credit availability (column 2). Results confirm a significant negative impact of an uncertainty shock on demand. Being exposed to an uncertainty shock in any of the years in between 2010 and 2013 significantly

is interesting to see the dispersion of responses, we keep our descriptives related with these variables too.

increases the probability of having experienced a decrease in the level of demand during these years and a decrease in the probability of accessing credit. After considering this, firms might consider adjust labour costs by adjusting capital or labour workforce, which is what we will try to understand in the following section.

4 Results

4.1 Empirical exercise

To identify the correlation between the uncertainty indicator explained in Section 3 and the firm's adjustment strategies we use a probit model. We estimate the impact of uncertainty on the probability of occurrence of several proxies of economic activity ($EmplAdj$). We try to measure if a higher uncertainty affects the probability that the firm has used some of the following adjustment mechanisms: freeze hiring ($FREEZE$), alter labour workforce ($ALTERLABOUR$), non-renew temporary employment ($NONRENEW$) and if there are credit constrains ($FINANCONSTR$). We have also included the possibility that the firm has adjusted prices more frequently in the descriptive part of the paper.

The equation we want to estimate is given by:

$$EmplAdj_i = \alpha_0 + \alpha_1 U_{jkl} + \alpha_2 X + \epsilon_i \tag{1}$$

where i is the firm, U_{jkl} represents the uncertainty indicator at the jkl level[4], as j represents the country, k the sector and l the size to which the firm i belongs, and X refers to a set of controls of firm's characteristics observed (autonomy, composition of the workforce, age, degree of competition in foreign markets, behavior of demand, credit and supply, collective bargaining and share of foreign markets). Each firm belongs to one of six sectors defined in the data (manufacturing; electricity, gas, water; construction; trade; business services, and financial intermediation) and size is defined for four categories (5-19 employees, 20-49 employees, 50-199 employees, and 200 employees and more employees).

Still, estimate the equation by firm level using our set of uncertainty indicators as U, explained in detailed in Section 3. Employment and sampling weights provided by the WDN Survey are alternatively used in the estimation.

Firstly, we have grouped firms according to the degree of uncertainty in two groups: those with a lower level (p25) and those with a higher level (p75). As it

[4]While main results from Table 2 and 3 show uncertainty using all the indicators described, some of the charts only show uncertainty using our main indicator (from the question c2_1a) to simplify the explanation. Alternative charts have been used with the other main indicator (from question c2_6a) with similar results

is shown in Figure 1, there are clear differences on the probability of using each mechanism depending on the degree of uncertainty they perceive. If a firm competes in a higher uncertainty environment, its probability of using some of this mechanism significantly increases. In some cases, such as decisions on freezing hiring, this probability doubles in a high uncertainty environment than when the firm is surrounded by a low uncertainty environment[5]. This probability is also higher in those firms affected by a higher uncertainty than in the mean of the distribution of all firms, whereas differences are much lower than compared with the probability of using a mechanism by firms in a low uncertainty environment.

Secondly, we have pictured the simple correlation between the dependen variables and the uncertainty indicator by country in Figure 2 (a to d). Uncertainty indicator is positively correlated with the probability of using an adjusting mechanism. We can also see that some countries, such as Greece, Portugal, France, Cyprus or Poland, have high levels of uncertainty and high probability of using these adjustment mechanisms while there are others, such as Hungary, Germany, Estonia, Latvia, Malta or UK, with a low uncertainty and low probability of using these mechanisms.

Nevertheless, a further and detailed analysis requires to be done due to the lack of control for several variables affecting adjustment mechanisms too and potential composition effects. The correlations could simply arise because in certain environments with more adjustments, the variation across firms is also higher and the firms perceived the situation as more disperse or volatile.

4.2 The causal relationship between uncertainty and labour adjustment

Table 2 shows marginal effects resulting from the estimation of a probability model for each of the dependent variables specified in the equation (1). Controlling for activity and including several dummies representing characteristics of the firm as well as fixed effects, uncertainty still causes firms to increase the probability of adjusting their labour workforce. As stated in columns 1 and 2 of Table 2, a higher degree of uncertainty affected positive and significantly the probability that the firm would have frozen hiring or alter labour during 2010-2013. Firms tend to reduce hiring and increase the adjustment of labour demand when uncertainty is higher. An increase of one point in uncertainty increases the probability of having frozen hiring in between 21% and 39% during the period 2010-2013, depending on the source of the uncertainty (according to the questions used to construct the indicator). Furthermore, other labour strategies have been also taken by firms, such as altering labour workforce: the more the uncertainty is, the more probability of recurring to individual layoffs. An increase of one point in uncertainty increases the probability of using indi-

[5] A t-test for equal means proves the different probability in these two groups of firms

vidual layoffs by between 0.8% and 13%.

A practical example might help to highlight these results. Small firms (5-19 employees) operating in trade in Portugal have an uncertainty indicator of 1.12. If we exposed to an uncertainty level of the size of those firms of the same sector and size but in the UK, with an indicator of 2.12, the probability that the Portuguese firm would have frozen their hirings during that period would have move from their current average probability (50%) to one higher, between 60% (=0.5+0.5*0.21) and 67.5% (=0.5+0.5*0.35). If we take into account the probability of altering labour that Portuguese small firms operating in trade have had during this period (0.5%), moving to that uncertainty that UK firms have had would have made that Portuguese firms experience a probability of altering labour between 0.6% to 0.67%.

If we take into account the question *c2_6a*, related to the level of demand of domestic products/services (Table 2, first row), an increase of one additional point in the uncertainty indicator increases the probability of having frozen hirings by a 25%, increases the probability of altered labour force of the firm in a 6.5% and increases the probability that the firm might be financially constrained in 21.3%. Apparently, an increase in uncertainty seems to have a non significant impact on the probability of non-renewing temporary contracts. Only the effect of uncertainty that comes from foreign demand (Table 2, second row, using question *c2_6b*), seems to affect temporary contracts renovations, by increasing its probability in a 15% by each point of increase in uncertainty.

While the effect of uncertainty on freezing hiring and recurring to individual layoffs (altering labour) seems clear, it is probable that the firm faces the increase in uncertainty by recurring to temporary contracts with lower adjustment costs. This might explain why the effect on non-renewing contracts is not significant or close to zero in most of the cases shown in Table 2. The mechanism through which the uncertainty affects credit constraints could be different. Uncertainty might not significantly affect directly the probability of being financially constrained, which should explain why only the marginal effect related to the indicator used in the first row of Table 2 is significant. However, it might affect more intensively the labour adjustments when the firm is financially constrained. We address the study of this effect in the following section by introducing interactions in the estimation, and we also address together a detailed analysis for firms in some of the countries of the sample with stricter legislations for facilitating hiring or firing.

4.3 For what type of firms is uncertainty more relevant?

In this section we would like to answer if there are any differences on the source of uncertainty and if uncertainty differs in the way affecting some of the firms. Firstly, as we have previously pointed out that uncertainty is more damaging when credit constrains have arisen, we might think that uncertainty cause more

problems to financially constrained firms at the same time that financially constrained firms can used more labour adjustments than other firms (Bodnr et al., 2017). The size of the firm seems to be a significant impact on how firms alter their labour force and cope the effects of an increase in uncertainty. It seems understandable that the effects of uncertainty are not the same for small or large firms.

Secondly, we would also like to explore whether the adjustment mechanisms are equally used by firms placed in different countries, as we know that Employment Protection Legislation (EPL) is not as flexible as in some of the main countries of the EU. Previous evidence has supported that EPL is stricter in some European countries (Italy, Portugal, Spain). In 2008, these countries were some of the countries with the most restrictive protection of permanent workers against individual and collective dismissal, higher than the average of the OECD countries. After several reforms, protection has slightly decreased, but it still remains very high. After several reforms, this protection has decreased, but it still remains very high. This fact could imply some particular way of incidence in the labour response to economic activity fluctuations and we think it deserves special attention. We think that the stricter legislation could affect in a different way the effect of uncertainty in the mechanisms used by firms for adjusting labour workforce. In countries where EPL is stricter, the gap between firing costs of fair and unfair dismissals is larger, which makes labour courts? intervention more critical to the determination of "effective" firing costs (Jimeno et al., 2020) and firing costs are could be finally higher. This fact definitely makes it more uncertain to dismiss a worker or even it could made the firm more reluctant to hire (Flanagan, 1988). Employers also use fixed-term and other kind of temporary contracts (amounting to around a 25% of employment) to buffer against negative shocks leading to downsizing of their labour force due to the significant gap of firing costs between permanent and temporary contracts (Costain et al., 2010). Because a higher uncertainty seems to have a significant impact on labour adjustments taken by firms, it would be desirable to test into what extent this effect may be more important when EPL is stricter.

To that end, we have introduce a set of interactions between several dummy variables for controlling for the size of the firm and for credit constrains, given by the specification:

$$EmplAdj_i = \alpha_0 + \alpha_1 U_{jkl} + \alpha_2 U_{jkl} S_i + \alpha_3 X + \epsilon_i \tag{2}$$

where S is a dummy depending on if the firm is (=1) or not (=0) financially constrained or a categorical variable for its size (5 to 19 employees, 20 to 49, 50 to 199 or more than 200 employees). Results are shown graphically in Figure 3 (depending on if the firm is credit-constrained) and Figure 4 (depending on the firm size). Financially constrained firms suffer a higher impact when uncertainty increases, but the impact is specially significant analyzing the probability

of freeze hiring, being a 10% higher than a non-financially constrained firm by each point of increase in the uncertainty indicator. On the other hand, uncertainty might affect more to smaller firms. Figure 4 shows how hiring and firing decisions of small firms (5-19 employees) are more significantly affected than those of large firms. When a small firm increases its probability of freezing hiring more than 50% when uncertainty increases one point, that effect decreases to around a 18% of freezing hiring in a large company of 50 to 199 employees. This fact also happens when comparing decisions on altering labour. Small companies might increase their probability of altering labour more than 41% if uncertainty increases one point whereas large companies might be affected only by around 25%.

Table 3 shows results only for firms from Portugal, Italy and Spain. In these countries, uncertainty affects more significantly than in the rest of European countries the probability of freeze hiring, while it does not affect (or even affect negatively) any of the other mechanisms (non-renew temporary contracts or altering labour force). An increase in 1% increases the probability of freeze hiring in between 63% and 90%. The effect on financially constrained firms is not significant anymore.

4.4 Does uncertainty affect employment at the firm-level in the long-run?

One of the limitations of the previous estimation is that we estimate probit models using exclusive information from WDN Survey. While this survey made possible to compare this information across 25 countries, it only provides qualitative data on labour decisions of employers during the period 2010-2013, which might be affected by simultaneous information about the evolution of demand during the same period. We can think that a shock on uncertainty during 2010-2013 can even affect labour decisions during the subsequent period. To consider this effect, we use information from SABI dataset until 2016. SABI database offers information on Spanish and Portuguese companies from Business Registry from 1994. It covers a large amount of companies, representing more than the 90% of companies presenting their accounts officially. For those companies, we have yearly information on number of employees, international presence, sector, revenues, profit, costs and sales, among other variables.

Uncertainty indicators can easily be merged with quantitative information provided by SABI at the firm level to see if results are consistent and if decisions on labour response to uncertainty have long-lasting effects. We have assigned to each company its own uncertainty indicator depending on its size, sector and country (Spain or Portugal) according to WDN indicators. We have test the effect of uncertainty indicators on employment level and employment growth for the period 2013-2016, controlling for the firm international presence and revenues. Table 4 presents results estimating the effect of uncertainty indicators on

the logarithm of employment and on the employment growth rate for more than 50.000 companies from SABI. Results of the estimation reveal that companies exposed to a higher degree of uncertainty show a significant decrease on their employment level or a significant slower increase of employment growth rate for these two countries, as in line with previous results.

4.5 Robustness analysis

Firms from different countries may have a different perception of what a moderate or strong change in their level of demand is. To solve the possible misinterpretation of the questionnaire we also propose and alternative version of the uncertainty indicator grouping the responses only in three different categories: increase, unchanged or decrease in their demand. We think that whereas a firm in Germany may have a different perception of what a "strong increase" is compared with a "moderate increase" for a firm in Italy or Spain, there is no doubt of what an increase or decrease in the level of demand is for different firms from different countries.

The percentage of firms responding that the level of demand increased during the period 2010-2013 are represent by $frac_i^+$. This way, we construct an indicator for each one of the options at the country, sector and size level. We exploit firm's qualitative responses for computing uncertainty indicators by country, sector and size of the firm. The uncertainty indicator is now computed, following Bachmann et al. (2013), as given by:

$$U_{jkl}^b = \sqrt{frac_i^+ + frac_i^- - (frac_i^+ - frac_i^-)^2} \tag{3}$$

where U^b refers to the alternative version of the uncertainty indicator, following the criteria of Bachmann et al. (2013), jkl is the group (conformed by country, sector and size cells) as considered before and $frac_i$ denotes the weighted fraction of firms considering that the level of demand increased/decreased (strongly or moderately) during the period 2010-2013 within the group jkl.

Results are shown in the Table A2 of the Appendix. Using both responses to the question *c2_1a* and *c2_6a*, uncertainty correlates significant and positively with the labour adjustment mechanisms, which points out that the analysis perform in the previous section is robust to the introduction of alternative disaggregated measures of uncertainty about the demand of the firms in the database.

Table A3 shows an alternative estimation of the impact of an uncertainty shock on labour decisions for a group of countries (Estonia, Czeck Republic, Greece, Luxembourg, Poland and Portugal). We have replicated the same analysis of the empirical section but, in this case, using the uncertainty shock variable instead of the uncertainty indicator. As we have mentioned, the shock variable

corresponds with a question only available in the questionnaires of these eight countries. The question states if the company has found a volatility/uncertainty shock of demand during 2010, 2011, 2012 or in 2013 or has not reported a negative shock (question "$nc2\_9b$").

Results confirm a significant negative impact of an uncertainty shock on labour decisions for these countries with different effects depending on the year of the shock. Uncertainty shock of 2012 had a significant negative effect on the probability of having frozen hiring whereas uncertainty shock of 2013 significantly affected the probability of altering labour.

5 Concluding remarks

Uncertainty is well proofed to affect economic activity. Whereas the effect of uncertainty on investment and firms' capital decisions is well proofed in the literature, less attention has been given to labour decisions. In this paper, we construct a group of uncertainty indicators exploiting firms' variability in each country, sector and depending on their size by means of a set of varied questions regarding firms' perceptions on demand. Our aim is to measure the effect of uncertainty on labour decisions at a more disaggregated level.

Using a set of uncertainty indicators for 25 European countries, we are able to proof that uncertainty affected positively and significantly the probability of having adjusted labour workforce during 2010-2013. Firms tend to reduce hiring and increase firings with more frequency when uncertainty is higher. An increase of one point in the uncertainty indicator increases the probability of having frozen hiring in between 21% and 39% during the period 2010-2013. Altering labour workforce by using individual layoffs has also been significantly affected by increases in uncertainty.

Significant differences by country have also been found: countries with higher labour adjustment costs exhibit a more significant effect of uncertainty on labour adjustment decisions, both in hirings and firings. We have also pointed out that the impact of uncertainty is especially important in the case of financially constrained firms. Finally, it is important to remark that whereas the effect of uncertainty on the probability of recurring to individual layoffs seems clear, there cannot be found a significant effect on the probability of non-renewing temporary contracts by firms when uncertainty is higher. Probably it seems to reveal that firms might recur to temporary contracts with more intensity as an escape mechanism to avoid stricter layoff legislations or higher costs in case of a significant decrease in their demand.

References

[1] Aghion, P., G. Angeletos, A. Banerjee, and K. Manova (2010), "Volatility and growth: Credit constraints and the composition of investment", Journal of Monetary Economics, 57, no. 3: 246-265.

[2] Arellano, C., J. Bai and P. J. Kehoe (2016), "Financial frictions and fluctuations in volatility", NBER Working Paper 22990.

[3] Bachmann, R., S. Elstner, and E. R. Sims (2013), "Uncertainty and Economic Activity: Evidence from Business Survey Data", American Economic Journal: Macroeconomics, 5(2): 217-249.

[4] Bachmann, R. and C. Bayer (2013), "Wait-and-See business cycles?", Journal of Monetary Economics, 60: 704-719.

[5] Baker, S.R., N. Bloom and S. J. Davis (2016), "Measuring Economic Policy Uncertainty", The Quarterly Journal of Economics, 131 (4): 1593-1636.

[6] Binding, G. and A. Dibiasi (2017), "Exchange rate uncertainty and firm investment plans. Evidence from Swiss survey data", Journal of Macroeconomic, 51: 1-27.

[7] Bloom, N. (2009), "The Impact of Uncertainty Shocks", Econometrica, 77(3): 623-685.

[8] Bloom, N.; S. Bond and J. Van Reenen (2007), "Uncertainty and Investment Dynamics", Review of Economic Studies, 74(2): 391-415.

[9] Bloom, N.; M. Floetotto, N. Jaimovich, I. Saporta-Eksten and S. J. Terry (2013), "Really Uncertain Business Cycles", CEP Discussion Paper No. 1195.

[10] Bodnr, K.; L. Fadejeva; M. Hoeberichts; M. Izquierdo; C. Jadeau and E. Viviano (2017), "Credit shocks and the European labour market", Bank of Spain Working Papers, No. 1747.

[11] Bonciani, D. and D. Van Roye (2015), "Uncertainty shocks, banking frictions and economic activity", European Central Bank Working Paper Series, No. 1825.

[12] Born, B.; Breuer, S. and S. Elstner (2018), "Uncertainty and the Great Recession", Oxford Bulletin of Economic and Statistics, 80, 5: 0305-9049.

[13] Caldara, D., C. Fuentes-Albero, S. Gilchrist and E. Zakrajsek (2016), "The Macroeconomic Impact of Financial and Uncertainty Shocks". International Finance Discussion Papers 1166.

[14] Christiano, L. J., R. Motto, and M. Rostagno (2014), "Risk shocks", American Economic Review, 104(1): 27-65.

[15] Choi, S., D. Furceri, Y. Huang and P. Loungani (2017), "Aggregate Uncertainty and Sectoral Productivity Growth: The Role of Credit Constraints". Working Paper No. HEIDWP09-2017, Graduate Institute of International and Development Studies.

[16] Costain, J., J. F. Jimeno, and C. Thomas (2010), "Employment fluctuations in a dual labor market", Bank of Spain working paper 1013.

[17] D´Amico, S. and A. Orphanides (2008), "Uncertainty and Disagreement in Economic Forecasting", Finance and Economics Discussion Series, 2008-56, Federal Reserve Board, Washington, D.C.

[18] Dibiasi, A., K. Abberger, M. Siegenthaler and J. Sturm (2018), "The effects of policy uncertainty on investment: Evidence from the unexpected acceptance of a far-reaching referendum in Switzerland", European Economic Review, 104: 38-67.

[19] Euroean Central Bank (2016), "The impact of uncertainty on activity in the euro area". ECB Economic Bulletin, 19, December.

[20] Flanagan, R. J. (1988), "Unemployment as a hiring problem", OECD Economic Studies, no. 11.

[21] Ghirelli, C., Gil, M., Pérez, J.J. and A. Urtasun (2019), Measuring economic and economic policy uncertainty and their macroeconomic effects: the case of Spain. Empirical Economics.

[22] Gilchrist, S., Sim, J. W., and E. Zakrajsek (2014), "Uncertainty, Financial Frictions, and Investment Dynamics". NBER Working Papers 20038, National Bureau of Economic Research, Inc.

[23] Jimeno, J. F., M. Martínez-Matute and J.S. Mora-Sanguinetti (2020), "Employment protection legislation, labour courts and effective firing costs", IZA Journal of Labor Economics, vol. 9: 1.

[24] Jurado, K., S. C. Ludvigson and S. Ng (2015), "Measuring uncertainty", American Economic Review, 105 (3): 1177-1216.

[25] Kandoussi, M. and F. Langot (2020), "Uncertainty Shocks and Unemployment Dynamics", IZA Discussion Paper, no. 13438.

[26] Lahiri, K. and X. Sheng (2010), "Measuring forecast uncertainty by disagreement: the missing link", Journal of Applied Econometrics, 25: 514-538.

[27] Mathä, T. Y., Millard, S., Rõõm, T., Wintr, L. and R. Wyszyński (2019). "Shocks and labour cost adjustment: evidence from a survey of European firms," Working Paper Series 2269, European Central Bank.

[28] Mecikovsky A. and M. Meier (2014), "Do plants freeze upon uncertainty shocks?", EconStor Preprints, ZBW - German National Library of Economics.

[29] Stokey, N. L. (2013), "Wait-and-See: Investment Options under Policy Uncertainty", NBER Working Paper, No. 19630.

Table 1: Descriptive statistics

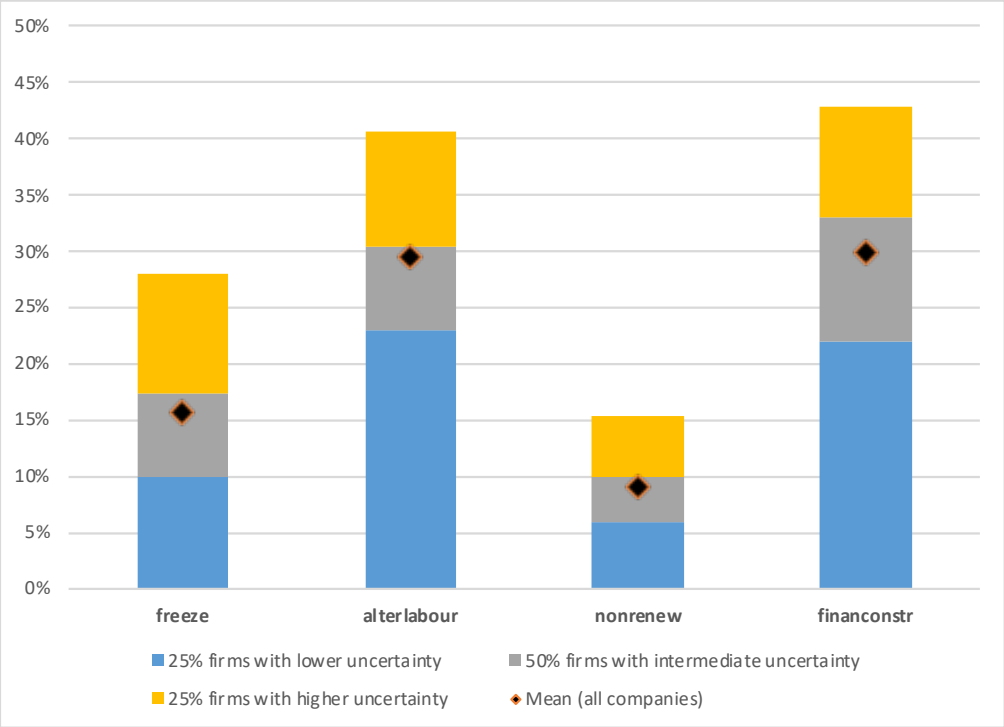
Variable		Obs	Mean	Std. Dev.	Min	Max
Dep. var.	FREEZE	23316	0.1569	0.3637	0	1
(EmplAdj)	ALTERLABOUR	23539	0.2939	0.4555	0	1
	NONRENEW	23539	0.0912	0.2879	0	1
	FINANCONSTR	23539	0.2995	0.4581	0	1
Controls	Age of the firm (years in 2014)	16757	27.1842	22.8155	0	99
	Proportion of employees full-time	23539	0.8059	0.2442	0	1
	Proportion of temporary employees	22926	0.0974	0.1723	0	1
	Proportion of high-skilled employees	22531	0.5823	0.3164	0	1
	Decreasing level demand	23354	0.4319	0.4953	0	1
	Decreasing external financing	22836	0.2511	0.4337	0	1
	Decreasing customers´ paying	23269	0.4381	0.4962	0	1
	Decreasing availability supplies	23059	0.1591	0.3658	0	1
	Mainly domestic	22786	0.8102	0.3922	0	1
	Mainly foreign	22786	0.1898	0.3922	0	1
	Parent company	22142	0.6834	0.4652	0	1
	Subsidiary/affiliate	22142	0.3166	0.4652	0	1
	Collective bargaining coverage rate	22023	0.5198	0.4829	0	1
	Firm collective agreement	23539	0.2388	0.4264	0	1
	Other collective agreement	23539	0.3311	0.4706	0	1
	Share in foreign markets	16029	0.2188	0.3360	0	1
	Severe foreign competition	23539	0.2524	0.4344	0	1
Uncertainty	U_c2_1a	23526	1.0708	0.1565	0	2.12
indicators	U_c2_1c	23524	0.7696	0.1577	0	2.12
	U_c2_1d	23526	0.8087	0.1299	0	2
	U_c2_1e	23522	0.5931	0.1532	0	2.12
	U_c2_6a	22452	1.0236	0.1255	0	2.12
	U_c2_6b	22401	0.8714	0.1898	0	2.83
	U_c2_6c	22450	0.9167	0.1236	0	2.12
	U_c2_6d	22395	0.7467	0.1504	0	1.53

Source: own elaboration using WDN Survey

a. The dependent variable of each specification are referred to the probability that the firm has recurred to freezing labour workforce (*freeze*), altering labour workforce (*alterlabour*), not renewing temporary contracts (*nonrenew*) or experienced financial constrains (*financonstr*) during the period 2010-2013.

b. Regarding controls, the variable "Decreasing level demand" specifies the proportion of firms that perceive a decrease in level demand. Likewise, "Decreasing external financing", "Decreasing customers' paying" and "Decreasing availability supplies" includes the proportion of firms of the sample that face a decrease of each type. Other controls, as "Mainly domestic", "Mainly foreign", "Parent company", "Subsidiary/affiliate", "Firm collective agreement", "Other collective agreement" and "Severe foreign competition" also show the proportion of companies

Figure 1: Percentage of firms having used any of the mechanisms by level of uncertainty



Source: own elaboration using WDN Survey

1. All countries of the sample considered.
2. The level of uncertainty is defined as high when the company is in the 25% of firms with a higher uncertainty indicator, and low uncertainty when is in the 25% with lower uncertainty. The grey colour shows companies between the 25% and the 75% levels of uncertainty.
3. The indicator varies between 0 and 2.12 and its mean is 1.07 (st. dev. of 0.15)
4. The uncertainty indicator used is constructed using the standard deviation of the question c2_1a. Alternative indicators (using other questions) have been used with similar results.
5. A t-test has been done for each of the dependent variables to contrast if the mean of both groups of firms (those with low or high uncertainty) is equal. The test shows that the mean value of both groups is significantly different at 99% confindence level.

Figure 2a: Uncertainty indicator and average probability of freezing hiring

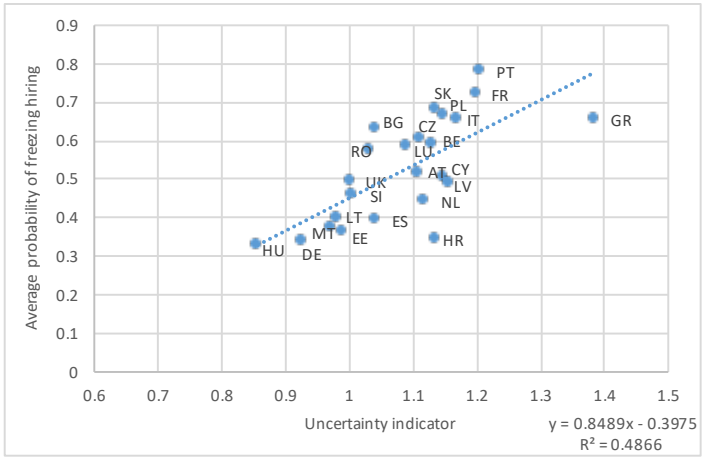


Figure 2b: Uncertainty indicator and average probability of being financially constrained

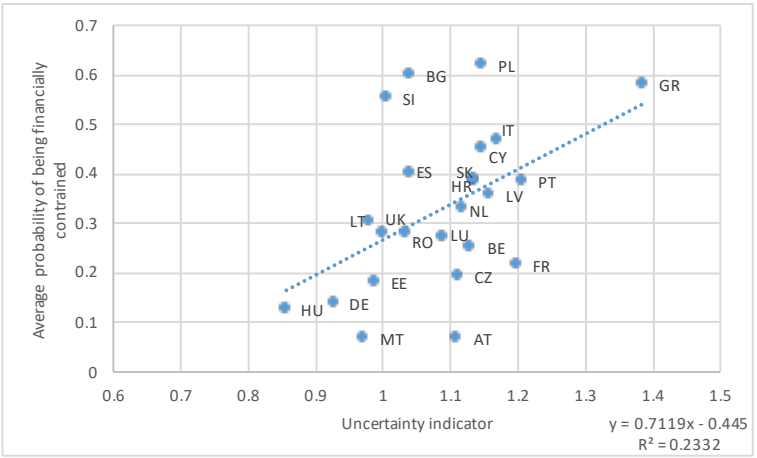


Figure 2c: Uncertainty indicator and average probability of altering labour force

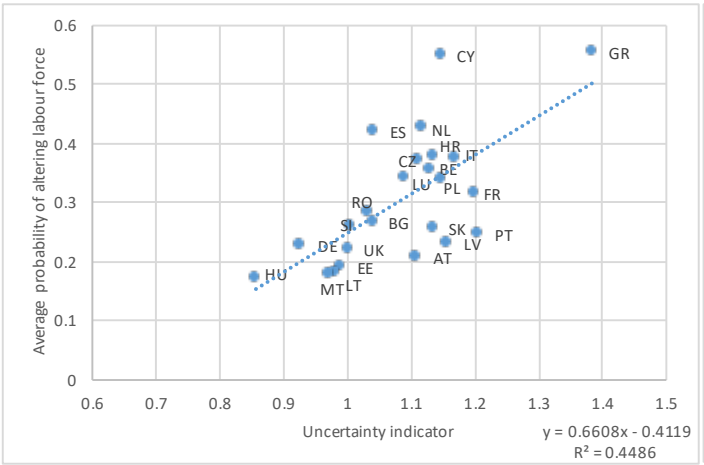
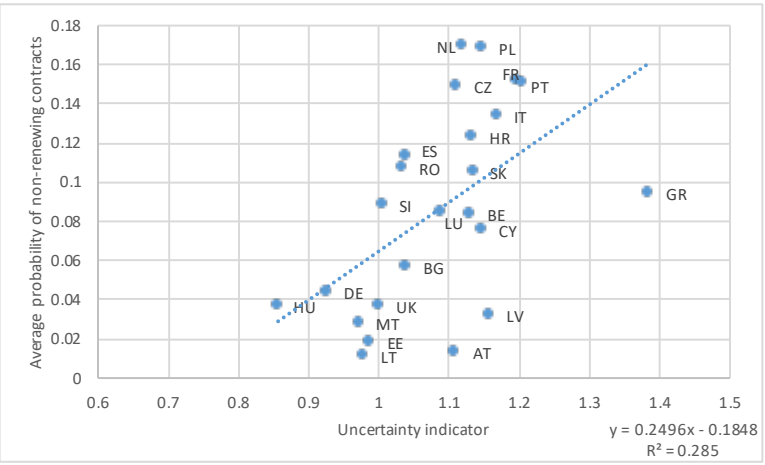


Figure 2d: Uncertainty indicator and average probability of non-renewing contracts



Source: own elaboration using WDN Survey

Notes: 1. All the scatter plots show the country average of the uncertainty indicator measured as the firms´ responses variability to the question c2_1a.

2. The linear regression show a positive correlation between both variables measured in each chart.

Table 2: Marginal effects of the main estimation

	(1)	(2)	(3)	(4)
VARIABLES	**freeze**	**alterlabour**	**nonrenew**	**financonstr**
U_c2_6a	0.250***	0.065***	-0.014	0.213**
	(0.0336)	(0.0204)	(0.111)	(0.100)
U_c2_6b	0.209***	0.131***	0.151**	0.111
	(0.0305)	(0.065)	(0.065)	(0.074)
U_c2_6c	0.345***	0.029***	-0.019	0.183
	(0.0613)	(0.0159)	(0.125)	(0.118)
U_c2_6d	0.210***	0.026	0.0291	0.0283
	(0.0276)	(0.0215)	(0.061)	(0.0713)
Observations	3,933	13,029	13,029	13,029
U_c2_1a	0.389***	0.088	0.0498	0.056
	(0.112)	(0.060)	(0.052)	(0.061)
Observations	4,194	13,941	13,941	13,941

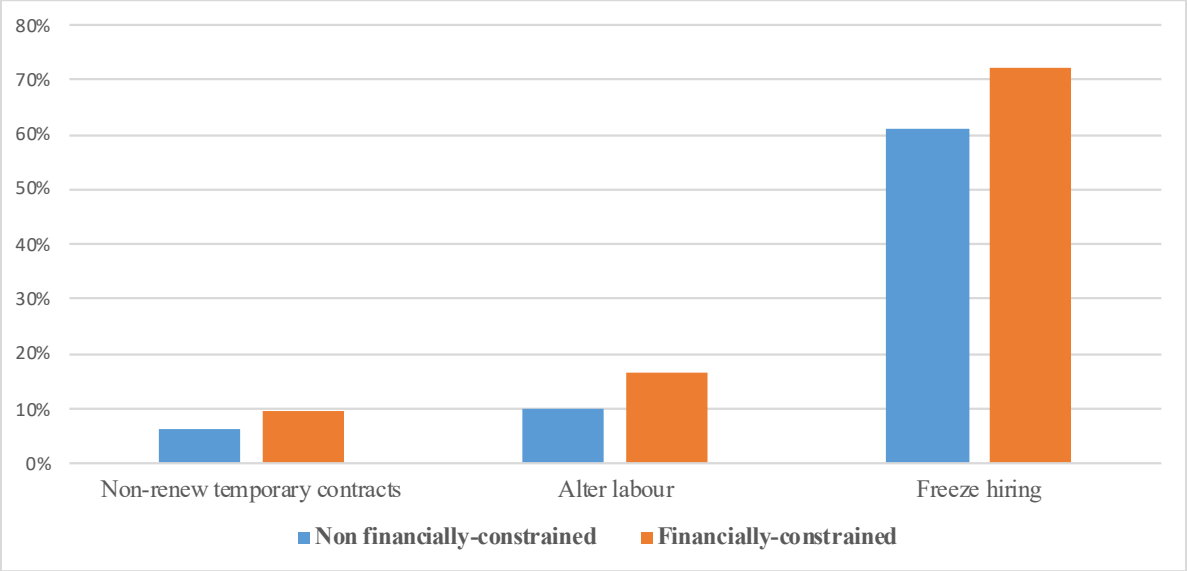
a. All countries included.

b. *U_c2_6a* is the uncertainty indicator constructed from question c2_6a, which is referred to how the firm perceives the evolution of the domestic demand during 2010-2013. Similarly, *U_c2_1a* refers to the uncertainty indicator constructed from how the firm perceives that the level of demand affected the firm´s activity during 2010-2013. The dependent variables of each specification are referred to the probability that the firm has recurred to freezing labour workforce (*freeze*), altering labour workforce (*alterlabour*), not renewing temporary contracts (*nonrenew*) or experienced financial constrains (*financonstr*) during the period 2010-2013. Each specification has been estimated alternatively using one uncertainty indicator or the other.

c. Regressors include controls for the age of the firm, the composition of labour force, if the firm competes in foreign markets, type of collective bargaining and the share in foreign markets.

d. ***,**,* over an estimate denote that the estimate is statistically different from zero at the 99th, 95th and 90th confidence level, respectively.

Figure 3: Probability of altering labour or freezing hiring as a result of an increase in uncertainty depending on if the firm is credit constrained

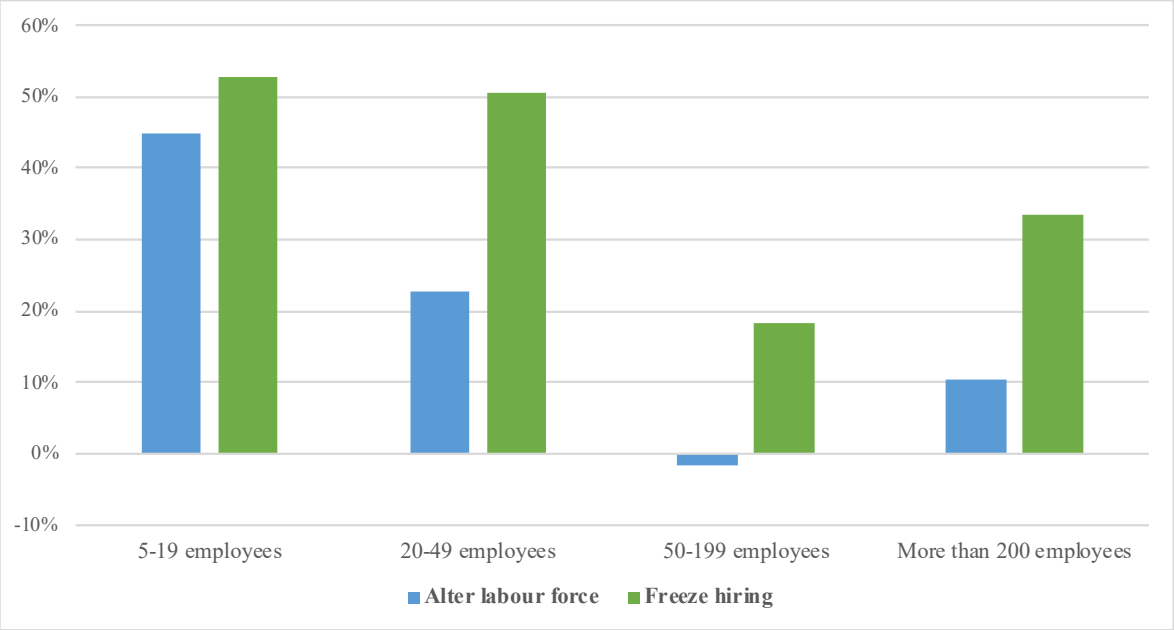


Source: own estimates using WDN Survey

a. All countries included.

b. The chart represents how an increase of one point in the uncertainty indicator would have increased the probability of non-renewing temporary contracts, altering labour or freezing hiring. The indicator used to produce the average marginal effects is the one from question c2_6a. The marginal effects have been taking as the result of a probability regression as that of Table 2 also including an interaction between the uncertainty indicator and a dummy variable that represents if the firm is financially constrained, and using controls for the age of the firm, the composition of labour force, if the firm competes in foreign markets, type of collective bargaining and the share in foreign markets.

Figure 4: Probability of altering labour or freezing hiring as a result of an increase in uncertainty depending on the size of the firm.



Source: own estimates using WDN Survey

a. All countries included.

b. The chart represents how an increase of one point in the uncertainty indicator would have increased the probability of altering labour or freezing hiring differentiating by size of the firm. The indicator used to produce the average marginal effects is the one from question c2_6a. The marginal effects have been taking as the result of a probability regression as that of Table 2 also including an interaction between the uncertainty indicator and the size of the firm, and using controls for the age of the firm, the composition of labour force, if the firm competes in foreign markets, type of collective bargaining and the share in foreign markets.

Table 3: Marginal effects of the estimation for more rigid EPL countries

	(1)	(2)	(3)	(4)
VARIABLES	**freeze**	**alterlabour**	**nonrenew**	**financonstr**
U_c2_6a	0.901**	-0.076	-0.139	0.097
	(0.403)	(0.258)	(0.310)	(0 .254)
U_c2_1a	0.631**	-0.207	-0.007	-0.209
	(0.306)	(0.209)	(0.192)	(0.165)
Observations	1,332	3,754	3,754	3,754

a. Countries considered in the estimation: Italy, Portugal and Spain.

b. *U_c2_6a* is the uncertainty indicator constructed from question c2_6a, which is referred to how the firm perceives the evolution of the domestic demand during 2010-2013. Similarly, *U_c2_1a* refers to the uncertainty indicator constructed from how the firm perceives that the level of demand affected the firm´s activity during 2010-2013. The dependent variables of each specification are referred to the probability that the firm has recurred to freezing labour workforce (*freeze*), altering labour workforce (*alterlabour*), not renewing temporary contracts (*nonrenew*) or experienced financial constrains (*financonstr*) during the period 2010-2013. Each specification has been estimated alternatively using one uncertaintv indicator or the other.

c. Regressors include controls for the age of the firm, the composition of labour force, if the firm competes in foreign markets, type of collective bargaining and the share in foreign markets.

d. ***,**,* over an estimate denote that the estimate is statistically different from zero at the 99th, 95th and 90th confidence level, respectively.

Table 4: Panel estimation of uncertainty impact on firms employment

VARIABLES	log(Employment)		Employment growth rate	
	(1)	(2)	(3)	(4)
Uncertainty indicator (c2_6a)	-0.506***		-0.570**	
	(0.0829)		(0.234)	
Uncertainty indicator (c2_1a)		-0.623***		-0.617*
		(0.203)		(0.357)
log(Revenues)	0.258***	0.259***	-3.48e-08*	-3.26e-08*
	(0.00476)	(0.00480)	(1.82e-08)	(1.83e-08)
Export-Import	-0.0293***	-0.0295***	-0.0270*	-0.0274*
	(0.00302)	(0.00287)	(0.0159)	(0.0157)
Size	0.980***	0.991***	0.111***	0.120***
	(0.0142)	(0.0177)	(0.0389)	(0.0461)
Sector	-0.0102***	-0.0213***	0.0440***	0.0340***
	(0.00272)	(0.00647)	(0.0140)	(0.0132)
Country	0.102***	0.164***	0.129***	0.190***
	(0.00705)	(0.0205)	(0.0487)	(0.0555)
Time dummies	YES	YES	YES	YES
Clustered errors	YES	YES	YES	YES
Observations	363,700	363,700	301,643	301,643
Number of firms	54,560	54,560	52,225	52,225

Source: own elaboration using SABI and WDN Survey

a. Only Spain and Portugal are included in the estimation.

b. The dependent variables are the logarithm of the yearly firm-specific number of employees (columns 1 and 2) or the year on year firm-specific employment growth during the period 2009-2016.

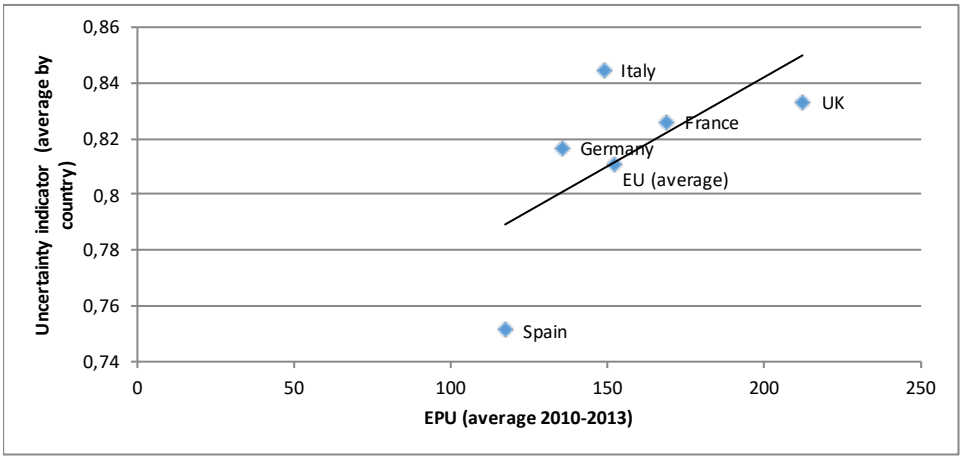
c. The uncertainty indicator is designed using alternatively questions *c2_6a* and c2_1a of WDN Survey data and has been merged at the country, size and sector level with SABI data. An uncertainty indicator is assigned to each firm of SABI data depending on which country, size and sector they correspond.

d. The additional controls (shown) are the logarigthm of the revenues of the firm that year, a dummy variable if the firm exports or imports, controls for the size, sector and country of the firm and time dummies. Standard errors are clustered at the city level.

e. ***,**,* over an estimate denote that the estimate is statistically different from zero at the 99th, 95th and 90th confidence level, respectively.

6 Appendix

Figure A1a: Correlation between uncertainty indicator and Economic Policy Uncertainty (EPU) indicator

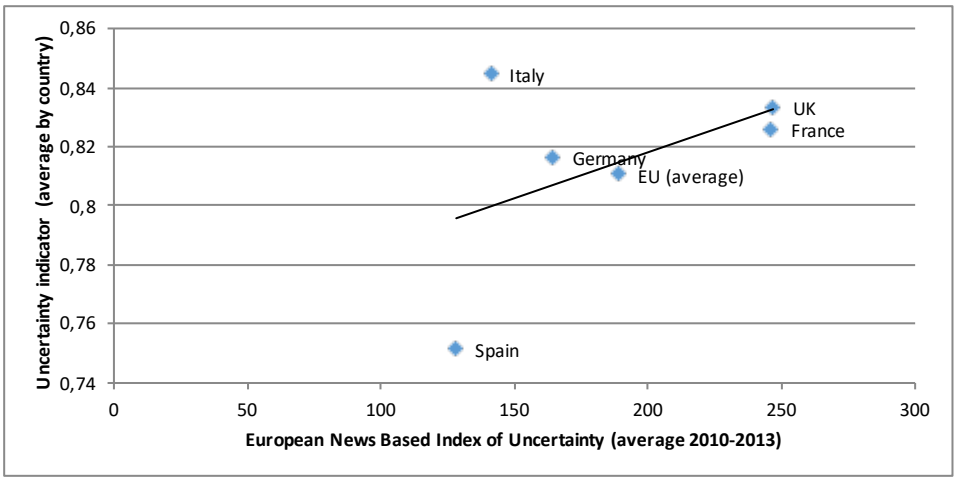


Source: Baker et al. (2016) and self elaboration

a. Correlation between EPU and our uncertainty indicator is about 0.43 to 0.46.

b. For constructing the uncertainty indicator, the question c2_1a from WDN Survey has been used.

Figure A1b: Correlation between uncertainty indicator and European News Based Index of Uncertainty



Source: Baker et al. (2016) and self elaboration

a. Correlation between News Based Indicator and our indicator is about 0.48.

b. For constructing the uncertainty indicator, the question c2_1a from WDN Survey has been used.

Table A1: Probit estimation of the effect of a negative shock in volatility/uncertainty on the decrease of the level of demand and credit availability

VARIABLES	(1) **Decrease in the level of demand**	(2) **Decrease in credit availability**
Uncertainty shock	1.008***	0.956***
	(0.104)	(0.133)
Age of the firm	0.00290	-0.00285
	(0.00411)	(0.00442)
Proportion employees full time	0.0107***	0.00384**
	(0.00197)	(0.00185)
Proportion temporary employees	0.0134***	-0.00148
	(0.00421)	(0.00473)
Proportion high-skilled employees	-0.00361**	-0.00236
	(0.00172)	(0.00206)
Foreign competence	-0.232**	-0.325**
	(0.106)	(0.127)
Collective bargaining coverage ratio	-0.00359	0.00379
	(0.00267)	(0.00320)
Collective agreement at the firm-level	0.371	-0.293
	(0.265)	(0.325)
Collective agreement higher level than the firm	0.625***	-0.180
	(0.240)	(0.333)
Share of foreign markets	-0.00169	-0.00333**
	(0.00147)	(0.00168)
Constant	-1.651***	-1.752***
	(0.183)	(0.190)
Observations	1,914	1,888

Source: own elaboration using WDN Survey

a. The simple correlation between *Uncertainty shock* and *Decrease in the level of demand* is 0.42 and between *Uncertainty shock* and *Decrease in credit availability* is 0.23.

b. Regressors include controls for the age of the firm, the composition of labour force, if the firm competes in foreign markets, type of collective bargaining and the share in foreign markets

c. Estimation is only made for Czech Republic, Estonia, Greece, Luxembourg, Poland and Portugal.

Table A2: Marginal effects of the main estimation using alternative uncertainy indicator

VARIABLES	freeze	alterlabour	nonrenew	financonstr
Uncertainty indicator (using Bachmann et al version with question c2_1a)	0.7068***	0.2686*	0.3769***	0.3367**
	(0.1429)	(0.1593)	(0.1414)	(0 .1389)
Uncertainty indicator (using Bachmann et al version with question c2_6a)	0.6017***	0.5017***	0.6024***	0.3379*
	(0.1688)	(0.1859)	(0.1688)	(0.1952)
Observations	8959	9013	9013	9013

a. All countries included in the sample.
b. The dependent variable of each specification is referred to the probability that the firm has recurred to freezing labour workforce (*freeze*), altering labour workforce (*alterlabour*), not renewing temporary contracts (*nonrenew*) or experienced financial constrains (*financonstr*) during the period 2010-2013.
c. Regressors include controls for the age of the firm, the composition of labour force, if the firm competes in foreign markets, type of collective bargaining and the share in foreign markets
d. ***,**,* over an estimate denote that the estimate is statistically different from zero at the 99th, 95th and 90th confidence level, respectively.

Table A3: Probit estimation of the effect of a negative shock in volatility/uncertainty on probability of adjusting labour

VARIABLES	freeze	alterlabour	financonstr	nonrenew
Uncertainty shock in 2010	0.0077	0.0773*	0.0629	-0.0032
	(0.049)	(0.046)	(0.046)	(0.039)
Uncertainty shock in 2011	-0.0333	0.0266	0.0697	0.0389
	(0.052)	(0.049)	(0.052)	(0.041)
Uncertainty shock in 2012	0.1068**	0.0091	0.0205	0.0028
	(0.046)	(0.049)	(0.058)	(0.039)
Uncertainty shock in 2013	0.0307	0.1016**	0.0536	0.0880
	(0.045)	(0.045)	(0.053)	(0.038)
Weights	Employment	Employment	Employment	Employment
Observations	518	1461	1461	1461

a. Countries consdered in the estimation: Czech Republic, Estonia, Greece, Luxembourg, Poland, Portugal

b. The dependent variable of each specification is referred to the probability that the firm has recurred to freezing labour workforce (*freeze*), altering labour workforce (*alterlabour*), not renewing temporary contracts (*nonrenew*) or experienced financial constrains (*financonstr*) during the period 2010-2013.

c. Regressors include controls for the age of the firm, the composition of labour force, if the firm competes in foreign markets, type of collective bargaining and the share in foreign markets