UNCERTAINTY, FIRM HETEROGENEITY AND LABOUR ADJUSTMENTS. EVIDENCE FROM EUROPEAN COUNTRIES

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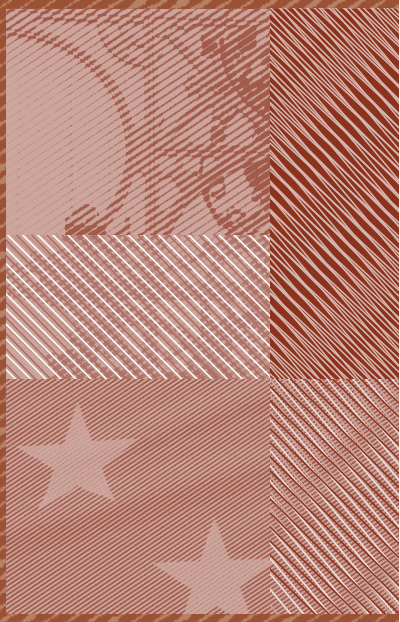

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Abstract

Firms are significantly affected by uncertainty about economic activity. Recent literature has shown that uncertainty is a factor of increasing importance in a globalized world, especially after its sharp increase during the last crisis. However, uncertainty did not impact all the firms in the same way. In this paper, we analyze if uncertainty may have different effects depending on firms' characteristics. We would also like to understand how firms react to uncertainty diversely. Using data from the 3rd wave of the Wage Dynamic Network Survey for 25 European countries, we first construct a set of uncertainty indicators exploiting firms environment. We combine variability from country, sector and size at the firm level in order to disaggregate microeconomic uncertainty, which offers richer information than the traditional macroeconomic indicators. Secondly, we estimate the effect of uncertainty on labour adjustments. Results reveal that firms reduce hiring and increase the adjustment of labour demand with more frequency when uncertainty is higher. An increase of 1% in our uncertainty indicator increases the probability of having frozen hiring in between 21% to 35% during the period 2010-2013. 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. Significant effects have been found in firms subject to credit constraints, and country heterogeneity has also been studied: when EPL is stricter, labour response to uncertainty is also more significant.

Keywords: uncertainty, firm heterogeneity, labour adjustment, freeze hiring, layoffs.

JEL classification: C25, D22, D81, J21, J23.

Resumen

La incertidumbre sobre la situación económica afecta significativamente a las empresas. La evidencia reciente muestra que es un factor de importancia creciente en la economía global, en especial, después del fuerte incremento que experimentó tras la última crisis económica, aunque, no afecta del mismo modo a todas las empresas. En este trabajo se pretende analizar la heterogeneidad de estos efectos, dependiendo de las características de las empresas. También se estudia cómo éstas utilizan diversos mecanismos de ajuste ante un incremento en la incertidumbre que las rodea. Con datos para 25 países europeos procedentes de la *Wage Dynamics Network Survey* se construye un conjunto de indicadores sobre la incertidumbre de la demanda a la que se enfrentan las empresas. Para ello, se combinan la variabilidad a nivel de país, sector y tamaño de empresa, para definir de forma lo más desagregada posible el entorno concreto en el que las empresas toman sus decisiones. En segundo lugar se estima el impacto que tiene un aumento de la incertidumbre en los mecanismos que utilizan para ajustar su demanda de trabajo. Los resultados indican que reducen la contratación y ajustan el empleo en mayor medida ante un incremento de incertidumbre a la que puedan estar expuestas. En concreto, un incremento de un 1 % en el indicador habría aumentado la probabilidad de congelar la contratación entre un 21 % y un 35 % durante el período 2010-2013. Además, las empresas también son más proclives a despedir a sus trabajadores ante un incremento de la incertidumbre. Estos mecanismos se ven significativamente más utilizados en empresas sujetas a restricciones financieras y se ha encontrado heterogeneidad a nivel de país. Por ejemplo, en aquellos países donde la legislación de protección al empleo es más restrictiva, la respuesta del empleo a incrementos en la incertidumbre es también mayor.

Palabras clave: incertidumbre, heterogeneidad de las empresas, ajuste del empleo, congelación de la contratación, despidos.

Códigos JEL: C25, D22, D81, J21, J23.

1 Introduction

Is uncertainty affecting the labour market? Are labour decisions of the employers driven by their perception of an uncertain economic environment? These are the question we want to address in this paper. Uncertainty is well known that affects economic activity. Generally, it causes economic activity to slow down and contract. After the Great Recession, quantifying the impact of uncertainty on macroeconomic dynamics has been rekindled. Capital goods investment reacts negatively to increases in uncertainty, and when it is related to financial markets, the effect is largest and more persistent. Gil et al. (2017) find that an increase in uncertainty in 2016 would have detracted around 2.4 pp to capital goods investment growth in Spain, but most of this impact would be the result of the increase in external uncertainty.

Assessing the impact of uncertainty on economic performance seems to be an important issue in order to determine predictions about future events. Bloom (2009) has observed 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. Literature has pointed out that firms usually follow a "wait-and-see" strategy when uncertainty increases (Bachmann and Bayer, 2013; Stokey, 2013). It means that uncertainty about a one-time change in a policy induces the firm to temporarily stop investing and adopting a "wait-and-see" policy. If companies freeze and remain inactive in response to increased uncertainty, real economic activity contracts (Mecikovsky and Meier, 2014). Therefore, an unexpected increase in uncertainty reduces hiring and job creation, while it raises layoffs and job destruction. Besides that, 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. Uncertainty has also consequences on the effectiveness of public policies. Bloom, Bond and Van Reenen (2007) found that responsiveness of firms to any given policy stimulus may be much weaker in periods of high uncertainty.

The study of uncertainty could have several approaches. Traditionally, uncertainty has been addressed as a forecasting indicator from a time-varying perspective. Studying shocks to firm risk makes it easier to understand bust-boom cycles. Uncertainty has been found to have aggregate effects used to forecast economic activity, using single indicators by country (D´Amico and Orphanides, 2008; Bachmann et al., 2013; Gil et al., 2017). However, there is an increasing literature pointing out the challenges of macroeconomic indicators in the analysis of the effects of uncertainty. Binding and Diabisi (2017) suggest the necessity of using disaggregated data in research on the relationship between uncertainty and investment. Studying microeconomic effects on firms´ behavior could bring another perspective with additional information about the mechanisms used by firms to respond to increases in uncertainty. Do firms react to uncertainty in a different way? Are firms from specific countries or industries more prone to reducing hiring or adapting prices when uncertainty increases? Uncertainty could be different depending on the country, industry or firms´ characteristics.

Uncertainty could come from different sources (country, sector, types of firms). But it also could have different effects depending on the institutional framework to which the firm is exposed to.

To that end, our aim is to design several indicators of uncertainty having into account a wide variety of firms´ characteristics. That is where the contribution of this paper could help most. Hence, this paper first addresses the construction of an uncertainty indicator which reflects firms´ environment in a deeper sense. Whereas uncertainty has been addressed from a pure macroeconomic and aggregated perspective, decisions on the labour market are purely microeconomic but uncertainty seems to have a clear impact on them too. A company can be force to adjust its productive factors in a certain sector due to a demand shock but aggregated indicators underestimate these microeconomic effects. Secondly, we are going to study whether uncertainty affects firms´ decisions about labour or prices and what type of mechanism firms use to adjust their decisions when uncertainty in a certain microeconomic environment increases. In this paper we aim to study if there is a causal effect of different sources of uncertainty on firms´ decisions about labour and prices.

We exploit information from the 3rd wave of the Wage Dynamics Network Survey provided by the European Central Bank and conducted together with National Central Banks (NCBs) of 25 European countries. The survey was conducted in 2014, and mainly referred to the period 2010-2013. The resulting sample contains 23,539 firms from 25 countries about 2010-2013. Variables are related to general characteristics of firms, mechanisms to adapt to changes in economic activity (labour decisions, price decisions) and qualitative information about firms performance and perception of economic environment.

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 1% in uncertainty increases the probability of having frozen hiring in about 25% on average during the period 2010-2013. Furthermore, other labour strategies have been also taken 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.

The remainder of the paper proceeds 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 a robustness check. Finally, Section 6 summarizes the main conclusions of the paper.

2 Uncertainty and its effects on firms´ decisions

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. 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).

However, uncertainty is difficult to measure because it is an unobservable concept. While there is not a single opinion on how to measure it, different proxies has been proposed and applied in the literature. Financial market information, key words found in the newspaper articles, surveys among forecasters, private households and firms, and macroeconomic trends has 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. While all these proxies have let estimate the impact of uncertainty on GDP, investment, consumption or firms´ output, there is also a certain degree of disagreement about the caveats and limitations of all these sources. For that reason, it is important to continue obtaining reliable indicators of uncertainty with large datasets that permit obtaining robust conclusions.

The effects of uncertainty on the economic activity have been addressed through several channels. First of all, investment and hiring are usually the initial factors affected by an increase in uncertainty. The classical work of Bloom (2009) 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. Furthermore, this conclusion is in line with the idea that the firms usually follow a 'wait-and-see' strategy when uncertainty increases. 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) also observed a similar effect using microdata from US establishments. They observed that unexpected increases in uncertainty move firms to freeze investment and labor policies, adopting a progressively larger wait-and-see policy. If companies freeze and remain inactive in response to increased uncertainty, real economic activity contracts. Because of that, two main facts are also pointed out. Initially, wait-and-see policies reduce capital through depreciation of existing capital stock. Consequently, these policies also lower labor demand, which is consequent with the idea that uncertainty also reduces hiring and job creation and increases quits and layoffs. This is especially important when employment protection legislation is more flexible: countries with flexible labor market regulations experienced more layoffs and job destruction upon a uncertainty shock than countries with stricter regulations.

Another explanation for the effect of uncertainty in hiring is found in Arellano et al. (2016). The authors 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. 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 such risk, which means definitely that the firm reduces to hire inputs. Credit constraints are also an important issue affecting the transmission of uncertainty and volatility to the firms´ activity. Consequently, credit constraints are also an important issue affecting the transmission of uncertainty and volatility to the firms´ activity. In presence of credit constraints, firms are more reluctant to hire and more cautious to take labor 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).

All these effects are summarized in Jurado et al. (2015). The authors 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. In two recent papers, Binding and Diabiasi (2017) and Diabiasi et al. (2018) also show, using a natural experiment after a change in the exchange rate with Switzerland firms, that uncertainty negatively affected investment in equipment and machinery through real-option channel during 2009-2015. However, it positively affects expenditures in RD through a growth-option channel.

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.

3 Database and uncertainty indicator

3.1 Database

During 2014, the NCBs 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, the Wage Dynamics Network (WDN) 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. However, there are some questions referred to the year in which a negative shocks related to demand, uncertainty, or firm access to financing took place, but only available for some of the countries (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 carry 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.

Robustness exercises have been carried out for an extended dataset of countries (Estonia, Letonia, Latvia, Slovenia, Slovakia, Hungary, Bulgaria, Romania) with comparable information from the second wave of WDN Survey. Furthermore, the exercise have also been estimated for a a subsample of firms from some of the 25 countries (Italy, Portugal, Spain), since labour market institutions are more similar and Employment Protection Legislation (EPL) is stricter in these countries, as we explained in section 6.2.

3.2 An indicator to measure uncertainty

As we have previously mentioned, uncertainty is intrinsically unobservable, which can result in several limitations when estimating its effects. Alternative

measures have been proposed in the literature. To the best of our knowledge, previous literature 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 firm´ 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_intern" 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 U_intern indicators depending on the question use for constructing the standard deviation of the responses[1].

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

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

leverage changes or sentiment or risk aversion fluctuate. Cross-sectional dispersion also can hide heterogeneity in the cyclicality of firms performance and not due to pure uncertainty. Thus, it is important to clarify the link between our uncertainty indicator and real economic uncertainty.

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 shock. This information is only available for a sample of 8 countries (Czech Republic, Estonia, Greece, Luxembourg, Poland, Portugal), but this information is perfectly matched with the firm information. The questionnaire asks if the firm has perceived a negative volatility/uncertainty shock during each one of the years of the period 2010-2013. 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.

To summarize the information, we have construct a dummy variable (DSHOCK) that takes the value 1 if the firm has experience a negative shock of volatility/uncertainty at least in one of the years between 2010 and 2013 and 0 otherwise. We have then estimated a first stage trying to point out if having experience a negative shock of volatility/uncertainty correlates with the probability that the level of demand and the credit availability of the firm have decreased during the same period. Both correlations are positive and significant, even after controlling for firm characteristics. Results of a probit model are shown in the Table A1 of the Appendix.

Another way used to check the robustness of our uncertainty indicator is to compare it with more general admitted indicators, such as the Economic Policy Uncertainty (EPU) indicator constructed by Baker et al. (2016). Figure 1 of the Appendix shows the correlation between EPU and our uncertainty indicator for the question Q2.

4 Results

4.1 Empirical exercise

To identify the causal impact of uncertainty, measured by the uncertainty indicator explained in Section 3, on the firms adjustment strategies, a probit model has been estimated. We estimate the impact of uncertainty on several proxies of economic activity (L). 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 posibility that the firm has adjusted prices more frequently in the descriptive part of the paper.

The equation we want to estimate is given by:

$$L_i = \alpha_0 + \alpha_1 U_{jkl} + \alpha_2 X + \epsilon_i \quad (1)$$

where i is the firm, $Ujkl$ represents the uncertainty indicator construct at the jkl level following section 3[2], jkl are respectively the country j, sector k and size l 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).

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 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 freezing hiring, this probability increases the double when the firm is in a high uncertainty environment than when the firm is in a low uncertainty environment[3]. 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 where have been more adjustments, the variation across

[2]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

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

firms is also higher and the firms perceived the situation as more disperse or volatile.

4.2 The causal relationship between uncertainty and adjustment mechanisms

Table 2 shows marginal effects resulting from the estimation of a probit model for each of the dependent variables. Controlling for activity and including several dummies related with characteristics of the firm as well as fixed effects, uncertainty still causes firms to increase the probability of adjust their labour workforce and prices more frequently. As stated in Table 2, a higher degree of uncertainty affected positive and significantly the probability that during 2010-2013 the firm would have frozen hiring or alter labour.

The main results of the paper reveal that firms reduce hiring and increase the adjustment of labour demand when uncertainty is higher. An increase of 1% in uncertainty increases the probability of having frozen hiring in between 21% and 35% during the period 2010-2013, depending on the source of the uncertainty (according to the question 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.

Marginal effects indicate that an increase of one additional point in the uncertainty indicator about the level of demand of domestic products/services (first row) increases the probability of having done altering labour force of the firm in a 6.5%, and increases the probability of being financially constrained in 21.3%. Apparently, an increase in uncertainty seems not to have a significant impact on the probability of non-renewing temporary contracts. Only the effect of uncertainty that comes from foreign demand seems to affect this probability, by increasing it in a 15% per each 1 point increased in uncertainty.

While the effect of uncertainty coming from demand on freezing hiring and recurring to individual layoffs (altering labour) seems clear, as a matter of fact, it is probable that the firm faces the increase in uncertainty by using temporary contracts (which might explain why the effect on non-renewing contracts is not significant or close to zero when uncertainty comes from domestic demand). The mechanism through which the uncertainty affects credit constrains could be different. Uncertainty could not affect directly the probability of being financially constrained, but it could 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 (Bodnt 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 an 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 labor courts? intervention more critical to the determination of "effective" firing costs (Jimeno et al., 2018) 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:

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

where S is a dummy depending on if the firm is (=1) or not (=0) financially constrained or a categorical variable for its size (less than 5 employees, 5 to 19,

20 to 49, 50 to 199 or more than 200 employees). Results are shown graphically in Figure 3 (by credit constrains) and Figure 4 (by size). Financially constrained firms suffer a higher impact when uncertainty increases, but the impact is specially significan on freeze hiring, being a 10% higher than a non-financially constrained firm by each percentage point of increase in the uncertainty indicator. Furthermore, we can observe that large firms use both alter labour force and freeze hiring while the probability of freeze hiring is significantly higher for small and medium firms and practically no effect of uncertainty is seen in these firms on altering labour force.

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 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. We think that whereas a firm in Germany may have a different perception of what a "strong increase" is compared with 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:

$$DISP_i = \sqrt{frac_i^+ + frac_i^- - (frac_i^+ - frac_i^-)^2} \tag{3}$$

where i is the cross-section variable (country, sector, size) and denotes the weighted fraction of firms responding that the variable has increased/decreased (strongly or moderately) within the group i.

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 per-

form in the previous section is robust to the introduction of alternative disaggregated measures of uncertainty about the demand of the firms in the database.

5 Concluding remarks

Uncertainty is well proofed to affect economic activity. In our paper, we have constructed an uncertainty indicator with firms' disagreement about demand and economic activity. We have employed several ways to measure uncertainty, computing several indicators depending on different questions of the data source and clusters. Our aim was to measure the effect of uncertainty on labour and prices adjustment at the firm level.

Results indicated that uncertainty affected positively and significantly the probability of having adjusted labour force during 2010-2013. Firms tend to reduce hiring and increase the adjustment of labour demand with more frequency when uncertainty is higher. An increase of 1 percentage point in the uncertainty indicator increases the probability of having frozen hiring in about 25% on average during the period 2010-2013. Altering labour workforce (individual layoffs) has also been significantly affected.

Differences by country have also pointed out: the more restrict the EPL, the more significant the impact of uncertainty is. Uncertainty in Spain, Italy and Portugal has a higher impact on labour adjustments. 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 can used this escape mechanism to avoid stricter layoff legislations or higher costs in case of a significant decrease in their demand and tend to incorporate a higher proportion of labour force using this type of contracts.

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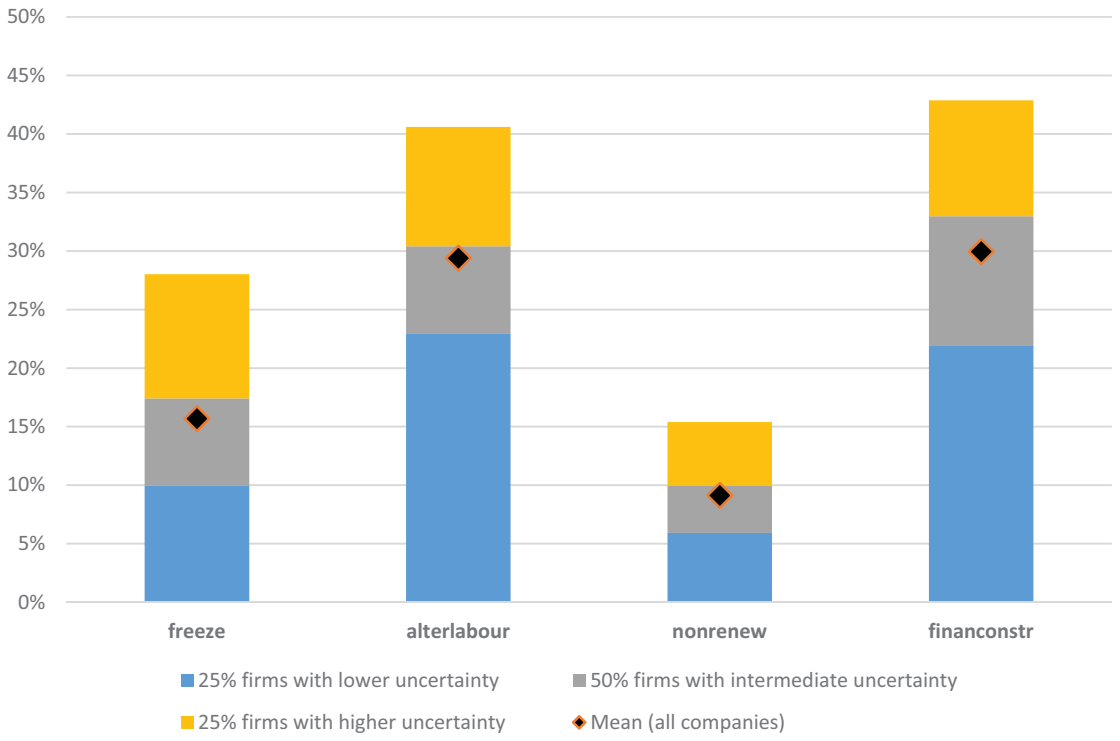
DESCRIPTIVE STATISTICS TABLE 1

Variable		Obs	Mean	Std. Dev.	Min
Dep. var.	FREEZE	23316	0.1569	0.3637	0
	ALTERLABOUR	23539	0.2939	0.4555	0
	NONRENEW	23539	0.0912	0.2879	0
	FINANCONSTR	23539	0.2995	0.4581	0
Controls	Age of the firm (in 2014)	16757	27.1842	22.8155	0
	Proportion employees full-time	23539	0.8059	0.2442	0
	Proportion temporary employees	22926	0.0974	0.1723	0
	Proportion high-skilled employees	22531	0.5823	0.3164	0
	Decreasing level demand	23354	0.4319	0.4953	0
	Decreasing external financing	22836	0.2511	0.4337	0
	Decreasing customers´ paying	23269	0.4381	0.4962	0
	Decreasing availability supplies	23059	0.1591	0.3658	0
	Mainly domestic	22786	0.8102	0.3922	0
	Mainly foreign	22786	0.1898	0.3922	0
	Parent company	22142	0.6834	0.4652	0
	Subsidiary/affiliate	22142	0.3166	0.4652	0
	Collective bargaining coverage	22023	0.5198	0.4829	0
	Firm collective agreement	23539	0.2388	0.4264	0
	Other collective agreement	23539	0.3311	0.4706	0
	Share in foreign markets	16029	0.2188	0.3360	0
	Severe foreign competition	23539	0.2524	0.4344	0
Uncertainty indicators	U_intern_c2_1a	23526	1.0708	0.1565	0
	U_intern_c2_1c	23524	0.7696	0.1577	0
	U_intern_c2_1d	23526	0.8087	0.1299	0
	U_intern_c2_1e	23522	0.5931	0.1532	0
	U_intern_c2_6a	22452	1.0236	0.1255	0
	U_intern_c2_6b	22401	0.8714	0.1898	0
	U_intern_c2_6c	22450	0.9167	0.1236	0
	U_intern_c2_6d	22395	0.7467	0.1504	0

SOURCE: own elaboration using WDN Survey.

PERCENTAGE OF FIRMS HAVING USED SOME OF THE MECHANISMS DEPENDING ON THEIR LEVEL OF UNCERTAINTY

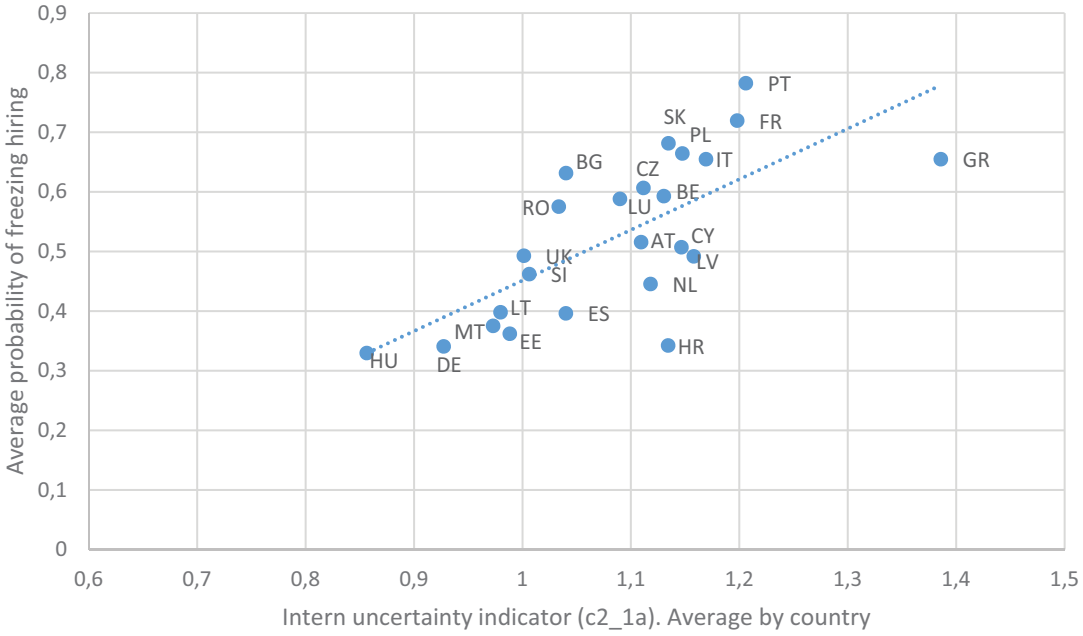
FIGURE 1



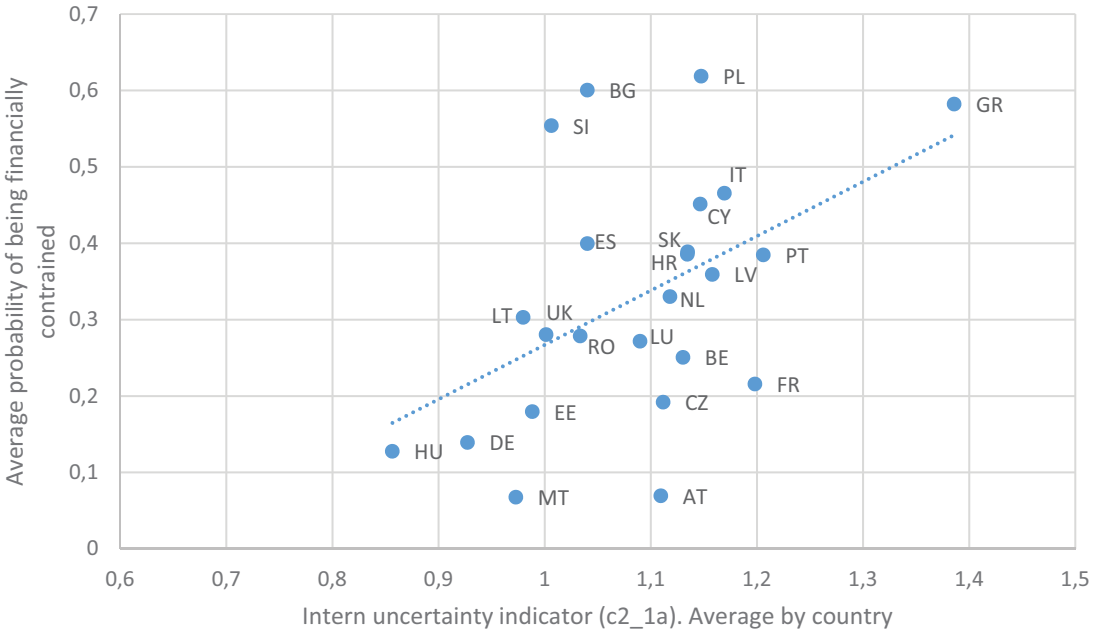
SOURCE: own elaboration using WDN Survey.

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 (S.D. 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.

UNCERTAINTY INDICATOR AND AVERAGE PROBABILITY OF FREEZING HIRING FIGURE 2A

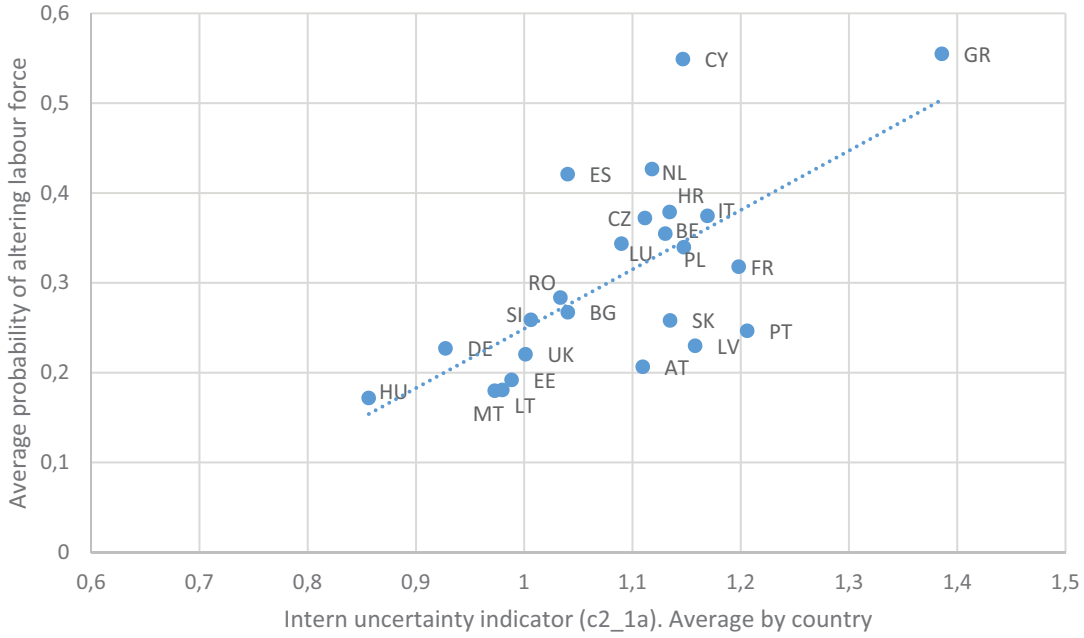


UNCERTAINTY INDICATOR AND AVERAGE PROBABILITY OF BEING FINANCIALLY CONSTRAINED FIGURE 2B



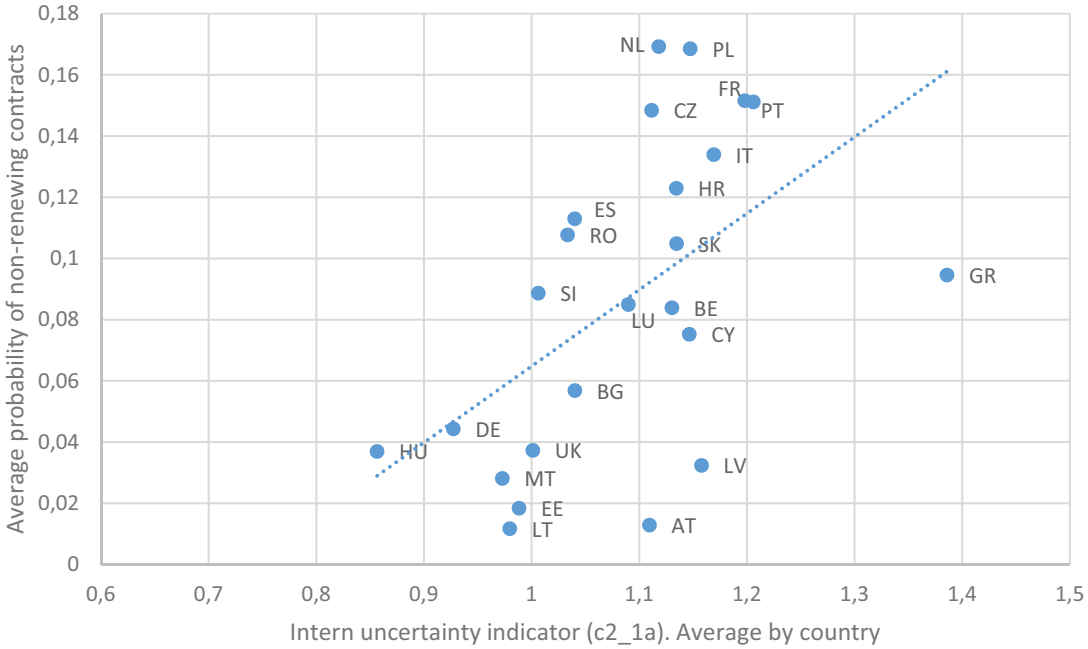
UNCERTAINTY INDICATOR AND AVERAGE PROBABILITY OF ALTERING LABOUR FORCE

FIGURE 2C



UNCERTAINTY INDICATOR AND AVERAGE PROBABILITY OF NON-RENEWING CONTRACTS

FIGURE 2D



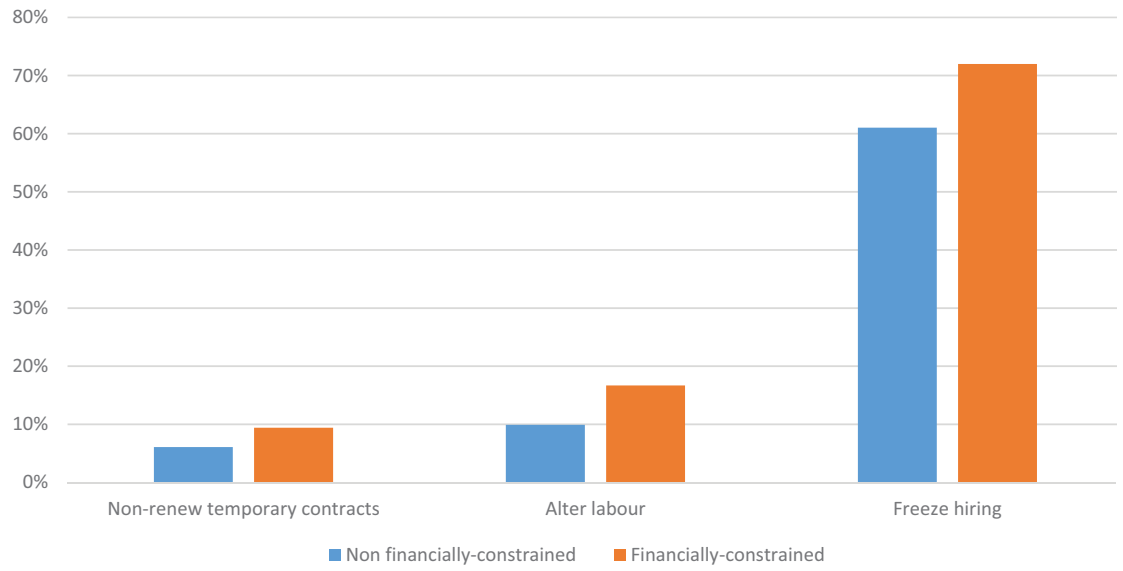
MARGINAL EFFECTS OF THE ESTIMATION TABLE 2

VARIABLES	freeze	alterlabour	nonrenew	financonstr
U_intern_c2_6a	0.250***	0.065***	-0,014	0.213**
	(0.0336)	(0.0204)	(0.111)	(0.100)
U_intern_c2_6b	0.209***	0.131***	0.151**	0,111
	(0.0305)	(0.065)	(0.065)	(0.074)
U_intern_c2_6c	0.345***	0.029***	-0,019	0,183
	(0.0613)	(0.0159)	(0.125)	(0.118)
U_intern_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_intern_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 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 ***,**,* over an estimate denote that the estimate is statistically different from zero at the 99th, 95th and 90th confidence level, respectively.

PERCENTAGE OF INCREASE IN THE PROBABILITY OF USING THE MECHANISM WITH AN INCREASE OF 1% OF UNCERTAINTY DEPENDING ON THE CREDIT CONSTRAINTS O THE FIRM

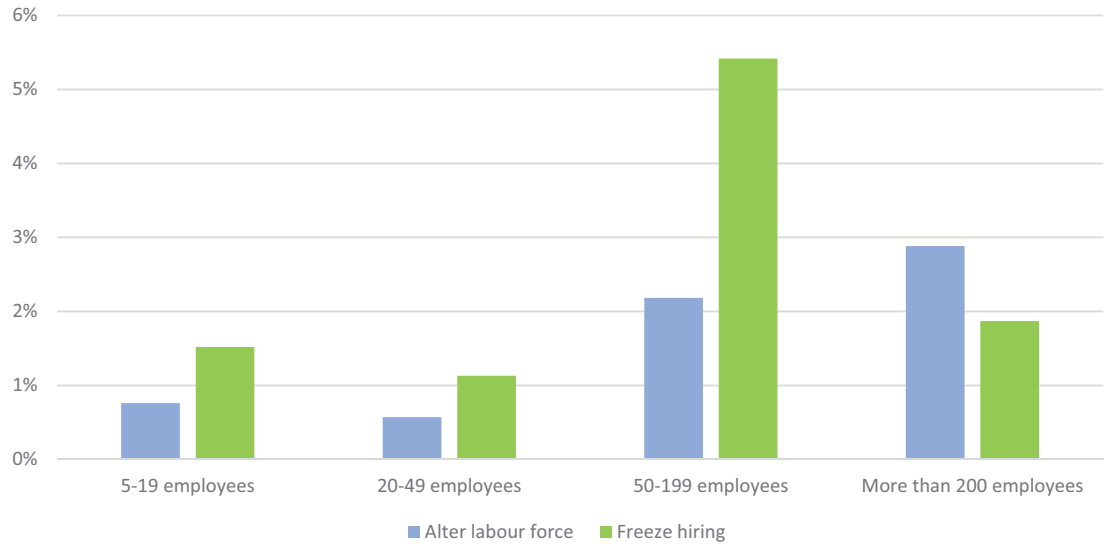
FIGURE 3



SOURCE: own estimates using WDN Survey.

PERCENTAGE OF INCREASE IN THE PROBABILITY OF USING THE MECHANISM WITH AN INCREASE OF 1% OF UNCERTAINTY DEPENDING ON THE SIZE OF THE FIRM

FIGURE 4



SOURCE: own estimates using WDN Survey.

MARGINAL EFFECTS OF THE ESTIMATION TABLE 3

VARIABLES	freeze	alterlabour	nonrenew	financonstr
U_intern_c2_6a	0.901**	-0,076	-0,139	0,097
	(0.403)	(0.258)	(0.310)	(0 .254)
U_intern_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: only IT, SP, and PT.
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 ***,**,* over an estimate denote that the estimate is statistically different from zero at the 99th, 95th and 90th confidence level, respectively.

6 Appendix

PROBIT ESTIMATION OF THE EFFECT OF A NEGATIVE SHOCK IN VOLATILITY/ UNCERTAINTY ON THE DECREASE OF THE LEVEL OF DEMAND AND CREDIT AVAILABILITY

TABLE A1

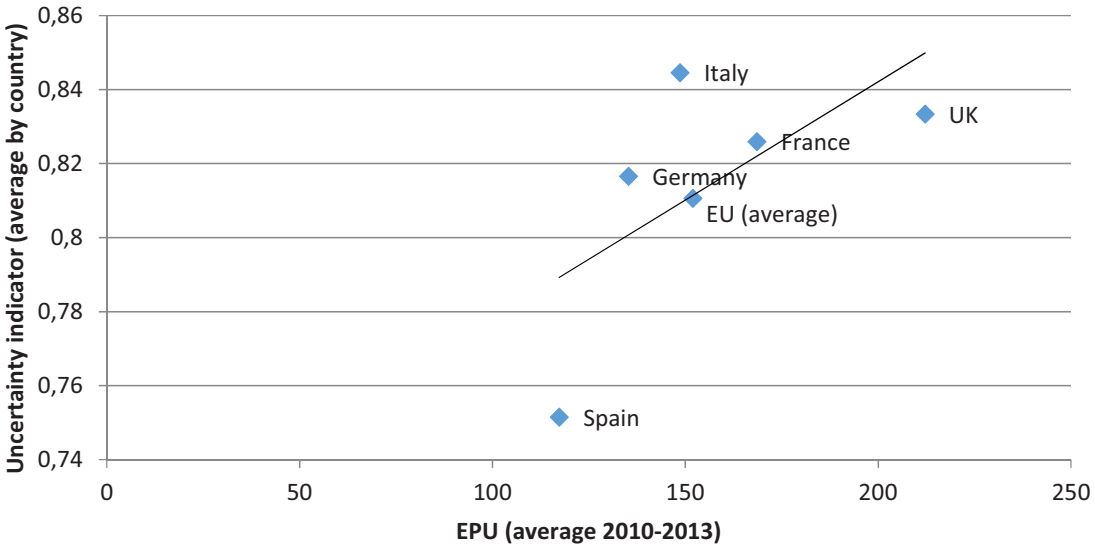
	(1)	(2)
VARIABLES	**declevdemand**	**deccredit**
dshock	1.008***	0.956***
	(0.104)	(0.133)
age	0.00290	-0.00285
	(0.00411)	(0.00442)
propfulltime	0.0107***	0.00384**
	(0.00197)	(0.00185)
proptemporary	0.0134***	-0.00148
	(0.00421)	(0.00473)
prophighskill	-0.00361**	-0.00236
	(0.00172)	(0.00206)
competenciafor	-0.232**	-0.325**
	(0.106)	(0.127)
cbcov	-0.00359	0.00379
	(0.00267)	(0.00320)
conveniofirm	0.371	-0.293
	(0.265)	(0.325)
conveniosup	0.625***	-0.180
	(0.240)	(0.333)
sharefor	-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.

a The simple correlation between dshock and declevdemand is 0.42 and between dshock and deccredit 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, Portugal.

CORRELATION BETWEEN UNCERTAINTY INDICATOR AND ECONOMIC POLICY UNCERTAINTY (EPU) INDICATOR

FIGURE 1A

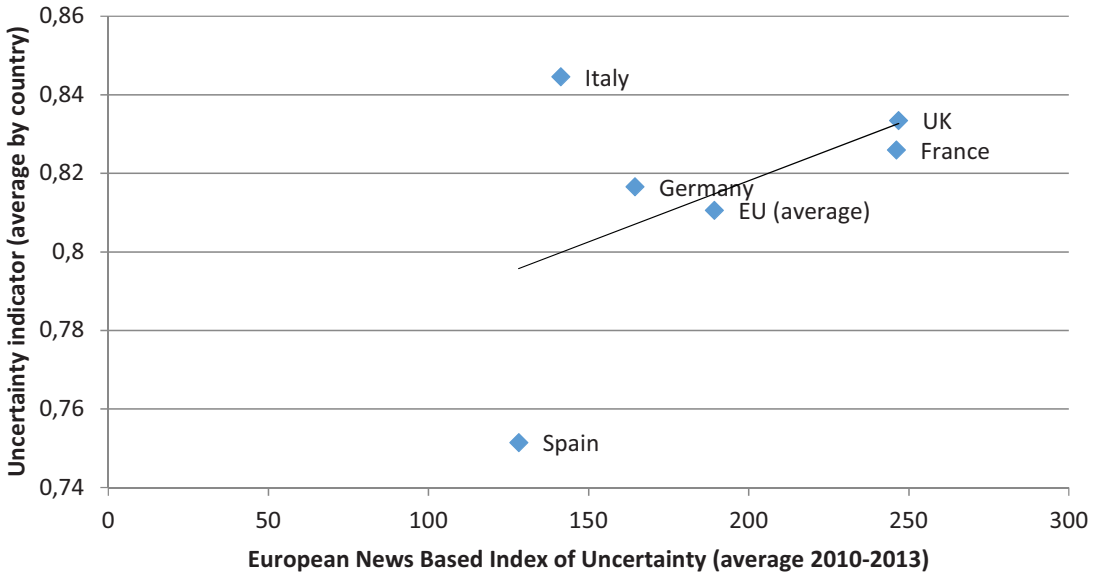


SOURCE: Baker et al. (2016) and self elaboration.

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.

CORRELATION BETWEEN UNCERTAINTY INDICATOR AND EUROPEAN NEWS BASED INDEX OF UNCERTAINTY

FIGURE 1B



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

a Correlation between News Based Indicator and our indicator is about 0.48.
b FFor constructing the uncertainty indicator, the question c2_1a from WDN Survey has been used.

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