

# **Using Principal Component Analysis to create an index of financial conditions in Spain. Differences by firm size and industry \***

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# **Using Principal Component Analysis to create an index of financial conditions in Spain. Differences by firm size and industry**

## **Abstract**

In the last decades, a large number of academic contributions have investigated the access to credit from a great variety of perspectives. The aim of this paper is to develop an index of financial conditions to contrast subsequently, the impact of firm size and industry on it according to the information asymmetric theory. To that end, we implement a Principal Component Analysis with a database made up of 233 Spanish freelancers and MSMEs in 2018. This technique permits us to gather the objective facts and subjective perceptions of the surveyed by detecting common elements in their responses. Once components are identified, we run statistical tests to find out if firm size and industry explain the differences amongst companies. Our outcome only proves the theory for firm size, meanwhile the hypothesis remains unclear for industry.

*JEL CODES:* G20; G30; M21; M41

*Keywords:* Index of financial conditions, Principal Components Analysis, asymmetric information

## **1. Introduction**

The productive structure in Spain is essentially characterised by the crucial role of freelancers and micro, small, and medium enterprises (MSMEs, hereafter). To get an idea of how important they are, we can mention that the ratio of companies belonging to these categories reaches 99.8%, according to the Central Directory of Business. Their not negligible contribution to Gross Domestic Product and to the total labour force is 61% and 70%, respectively.

In the recent years, their access to credit has suffered severe constraints and the tightening of conditions have derived in a set of well-known harmful consequences for the economy. This situation has the origin in the restructuring of the banking system motivated by the worrying exposure of financial entities to Real Estate and to certain toxic risk assets. The European Bailout of 100 billion € and the nationalization of three entities for €4,751 million were part of the substantial transformation experimented.

In literature, there is a broad consensus on the crucial role of external finance in the ability of small companies to operate in demanding markets as exposed in some interesting contributions like Bougheas et al. (2006) and López et al. (2007). Due to the importance of this issue, one may wonder which are the external variables affecting the flow of credit to companies.

We can highlight the early works of Kashyap et al. (1993, 1996) and more recently, the above cited Bougheas et al. (2006), who pointed that access to credit is significantly affected by the macroeconomic scenario. On the other hand, Petersen and Rajan (1995), Demirgüç-Kunt and Maksimovic (1999) and Hernández-Cánovas and Koëter-Kant (2008) put the focus on the structure of the banking market (size and concentration, among other elements). Recently, other disrupting works like Ryan, O'Toole and

McCann, (2014) or Love and Martínez Pería (2015) studied if competition on the banking market could favour or hamper the access to credit. In both cases, authors demonstrate its benefits, particularly for smaller companies.

Although the aim of this paper is slightly different, we present some data to understand how credit to private sector has suffered the consequences of the economic environment in Spain and European Union. According to the data published by the International Monetary Fund, in 2001 the Spanish private debt to GDP was about 95%. At the end of the decade, the property bubble had elevated it to 172.4%. The last data, released in 2017, highlighted a remarkable decline to 105.8%. For the European Union, this variable moved from 92.6% to 117,3% between 2001 and 2009, and fell to 95.4% in 2017.

The awareness of this recent drop-off has **motivated some empirical** investigations about how the lack of liquidity put in risk the continuity of companies, mainly, the smaller ones (Beck and Demirgüç-Kunt, 2006; Carpenter and Petersen, 2002, Lee et al., 2015 and Gupta and Gregoriou, 2018 <sup>1</sup>).

Within this framework, we propose the analysis of the access to credit in Spain through an index of financial conditions derived from a sample collected in 2018 of Spanish freelancers and MSMEs. After that, we contrast if firm size and industry have an effect in the index generated before. Our results confirm the impact of firm size in the negotiation of loans, but for industry, it remains unclear and controversial.

The theoretical background comes from the concept of information asymmetry. The hypothesis establishes that one party (credit supplier) has less information about the

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<sup>1</sup>Other academic contributions like Lawless et al. (2015) and Moritz et al. (2016) are addressed to describe financing patterns for micro, small, medium and large companies. Beck et al (2015) and Masiak et al. (2017) provide two comprehensive analysis of financing among micro companies.

financial position of the applicant than the other party (company) during the negotiation. The cause is in the fact smaller companies do not normally publish their financial accounts, generating a panorama of distrust, that could hamper the likelihood of achieving good conditions. Including industry allows us to reinforce the empirical analysis of the asymmetry and it can be useful to reinforce the outcome concerning firm size, since third sector companies are often smaller than manufacturing ones.

But, what is the origin of the asymmetry? Hernández-Cánovas and Koëter-Kant (2008) and Masiack et al (2017) point to the fact that micro companies are not legally compelled to publish their annual accounts. This spreads a bad atmosphere of growing mistrust on the part of banks which hinder the access to credit. To cover the risks, banks have different options; they can demand reliable information which increases the borrowing costs or imposes collateral requirements. As they have a better access to the financial information provided by big companies than that of small ones, and they find it more reliable, they will prefer to take the risk of lending to a big company although the size of the loan is higher. As a consequence, the percentage of rejections in loan applications is significantly greater among micro firms according to the empirical evidence found in Kraemer-Eis et al., (2017). Other papers like Bougheas et al. (2006) aims towards the serious problems smaller companies face to access to capital markets, which leads them to draw on banks to get funding.

The rest of the paper is organized as follows. Section 2 analyses some noteworthy academic work about the access to credit for small companies. Section 3 explains the data and methodology. Section 4 displays the main results obtained. Finally, the last section summarizes the main conclusions. The Appendix A details the questions included in the survey.

## **2. Literature review**

The research field has the origin in the seminal analysis of the factors that influence the way firms finance their operations, commonly known as capital structure (Modigliani and Miller, 1958). Over the following decades, a large number of researchers contributed to this theory with empirical evidences, many of which are collected in the excellent review of Harris and Raviv (1990,1992).

Leaping forward until recent years, it is suitable to put the focus on the interesting contribution of Bougheas et al. (2006) whose outcomes show a positive effect of firm size in the volume of external finance and a negative impact of GDP thereof. Similarly, López et al. (2007) found that firm size is negatively related with access to credit. Hernández-Cánovas and Koëter-Kant (2008) obtained a negative relationship between firm size and short-term debt according to the asymmetric information theory.

Several academic contributions such as Wittenberg-Moerman (2009) or Bharath et al. (2007) confirms that the incidence of information asymmetry is more evident for smaller borrowers. In the first research, the author also concludes that loans to larger firms have lower interest rates. Hernández-Cánovas and Martínez-Solano (2010) also prove a negative link between size and cost of debt. Kuntchev et al. (2012) obtain a similar result in their analysis of surveys drawn from a sizable number of countries all over the globe.

Regarding public debt markets, several investigations find that larger firms have also better access to them (Loof, 2004; Drobetz and Wanzenried 2006 or Mukherjee and Mahakud, 2010)

The information asymmetry is also mentioned as a recurring problem in borrower-lender relationships when the capital is demanded by a micro company (Masiack et al. (2017). In this empirical context, high agency costs are considered as a serious obstacle in

Daskalakis et al. (2013) and Kraemer-Eis et al., (2016). In the revealing paper of Beck et al. (2005), the focus is put on the country level of corruption as an obstacle for access to credit, but they also encountered that smaller firms use to find more obstacles in their search for financing.

Chavis et al. (2011) propose a detailed study of financing patterns for a dataset of companies. Their results suggest that smaller companies are less willing to trust in banks when applying for loans than in informal sources of financing, but this changes when firms grow. Then, the authors sustain that the problem of information asymmetry takes place in the survey analysed, but in this case, the lack of confidence takes place on the other way around.

Once reviewed a relevant number of empirical papers, we find especially interesting the analysis of how Spanish freelancers and MSMEs access to credit through an index of financial conditions. This represents the main innovative contribution of our investigation to academic literature. Additionally, to test the existence of asymmetry we divide the sample by firm size and, unlike preceding articles, by industry affiliation.

### **3. Data and methodology**

As exposed above, in a first stage, we will conduct a multivariate analysis to extract the most important information of the data. The methodology selected is the Principal Component Analysis since, it leads us to generate an index of financial conditions. Secondly, we test the differences by groups of companies.

### 3.1 Data

Our data set is provided by Smart Finance, an European project within the framework of the Interreg SUDOE Programme. It was led by Cámara Oficial de Comercio, Industria, Servicios y Navegación de Oviedo.

Its purpose was to promote the entrepreneurial spirit, providing different sources of financing through a platform (<http://es.smartfinanceplatform.eu/>) and promoting the growth of the business ecosystem (entrepreneurs and SMEs) in Southeast Europe. During 2018<sup>2</sup>, 566 surveys were collected in Spain, France and Portugal by partners who took part in this project<sup>3</sup>

Bearing in mind the key objective of this paper, we have limited the sample to the 233 individual **surveys** to freelancers and managers of medium, small, and micro companies in Spain that have received a loan during the last year. The number of surveys, although is not very high, is similar to that used in other studies like Hernández-Cánovas and Martínez-Solano (2010) where 183 SMEs were analysed.

The companies selected operate **in various industries**, although they mainly belong to the tertiary sector. In this way, sampling reflects the productive structure of most of the developed countries in the world (UNCTAD, 2017).

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<sup>2</sup> Due to the nature of our dataset, we work from a static perspective.

<sup>3</sup> The list of partners: Cámara Oficial de Comercio, Industria, Servicios y Navegación de Oviedo (España). Consejo de Cámaras Oficiales de Comercio, Industria, Servicios y Navegación de la Comunidad Valenciana (España). Cambra Oficial de Comerç, Indústria, Serveis i Navegació de Barcelona (España). Instituto para la Competitividad Empresarial de la Junta de Castilla y León (España). CCI Nouvelle-Aquitaine (France). Agência Nacional de Inovação, S.A. (Portugal). ANJE-Associação Nacional de Jovens Empresários (Portugal).



**Table 1: Survey classification**

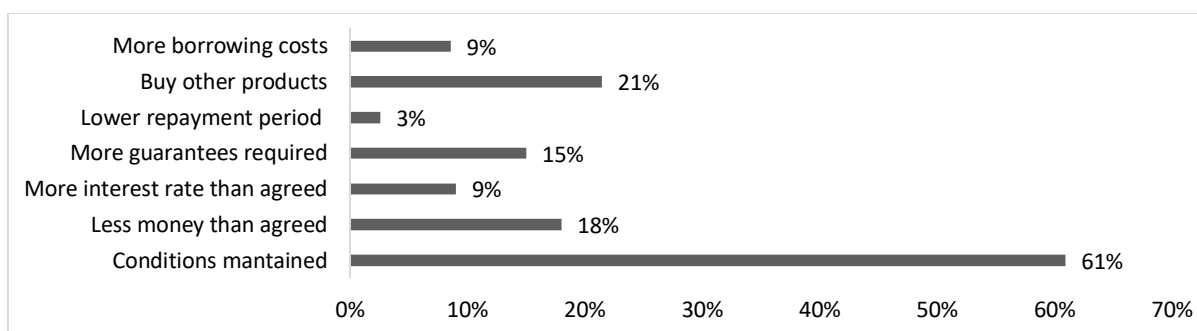
<b>Size</b>	Micro	44%
	Freelance	12%
	Small	36%
	Medium	8%
<b>Industry</b>	Services	49%
	Primary Activity	2%
	Manufacturing and construction	37%
	Freelances	12%

With regard to the survey design, we have sought to capture objective facts and business managers' perceptions in accordance with other comprehensive surveys released by the European Central Bank (ECB, 2009;2018) or NFIB Research Foundation (2011)

The first two questions essentially seek for objective issues. The first (Q3 in the questionnaire, see Annex A1) asks about how long they must wait until receiving an answer from the bank. The interval is between 1 and 6 weeks, and we will consider that the longer the time banks need before the answer, they are offering less trust with respect to the lender and consequently, the worse the conditions are. The concept of trust is referred in the above cited work of Hernández-Cánovas and Martínez-Solano (2010).

The following question (Q4 in the questionnaire, see Annex A1) is addressed to know how many extra requirements they have found once the contract is signed, here the respondent had to choose one or more from a list of options.

**Figure 1: Incidence of extra requirements (Question 4)**

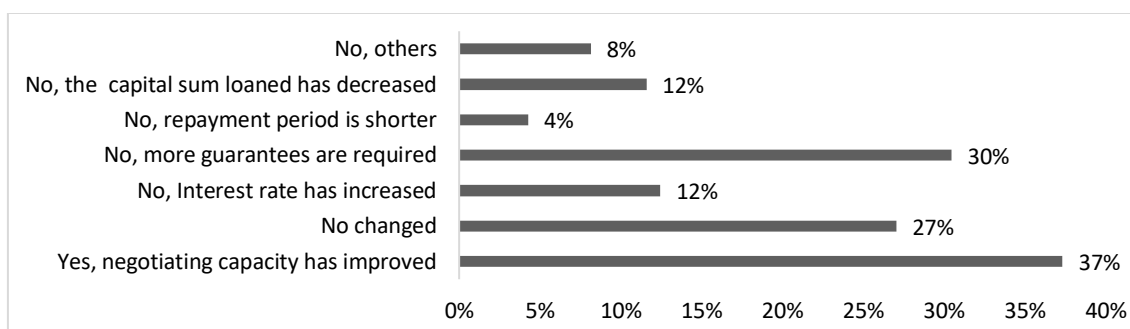


Note: SMEs can find more than one constraint. Sum is not equal to 100%.

To define the variable, we add the number of constraints declared by participants. Having higher value will be considered as a sign of worse conditions in access to credit. If a participant holds that any extra requirement has been demanded, the variable takes value zero. Collateral or personal guarantees frequently appear in literature as we can see in Bougheas et al. (2006), López et al. (2007) or Hernández-Cánovas and Martínez-Solano (2010), among others.

In addition, the ECB annual survey includes a question to capture individual views and subjective perceptions about the conditions of loans. Delving into the issue, the surveyed were asked if they have perceived an improvement or a worsening with regards to the negotiation capacity on one hand, and the causes of deterioration of financial conditions, on the other (Q5 in the questionnaire, see Annex A1)

**Figure 2: Perception about negotiation (Question 5)**



Note: SMEs can find more than one cause of worsening. Sum is not equal to 100%.

We add up the causes of worsening of financial conditions using a similar reasoning than before.

$$\text{Perception} = (\text{Option 1} * 0) + (\text{Option 2} * 1) + \left[ (\text{Option 3}) * 2 + \frac{\sum_{n=1}^5 n}{5} \right] \quad (1)$$

If a participant believes that the negotiation has improved (*Option 1*), it takes zero and if it has not changed (*Option 2*), the variable takes one. In case someone considers that the negotiation has worsened for one cause or another, the variable will take 2 plus 0,2 (1 reason out of 5), if the participant reports two causes, 2 plus 0,4 and so forth. In consequence, the marginal effect of each additional cause will depend on the starting value. This aggregation enables us to analyse the perception in negotiation as a whole, as we can see in Table 4.

Finally, we introduce a question with the purpose of knowing their perception of bureaucratic burden associated to loan application<sup>4</sup>. We present an interval from 1 to 10, where 1 represents less concern on this issue. Not surprisingly, it is so high that most of answers are between 7 and 10 (Q6 in the questionnaire, see Annex A1)

<sup>4</sup>This question is included in the questionnaire to fast growth companies of technological sector launched by OCDE in 2009.

In summary, the questions have been designed to obtain in-depth knowledge of the situation and to draw a reliable overview (see Annex 1 for more detail).

### **3.2 Methodology**

The application of Principal Component Analysis in our paper responds to the need of reducing the number of variables and extract the most important information from our dataset, but retaining as much variance as possible (Conway & Huffcutt, 2003). Additionally, it is potentially used to generate a composite (like those proposed in Sarma, 2008 or Arora, 2014), which is precisely, what our work is aimed at, therefore it is the most suitable methodology.

In literature, we can find some examples of the application of multivariate techniques in financial investigations. Using data from 500 surveys about loan granting of a German bank, Ioniță and Șchiopu (2010) applies PCA to reduce the number of variables from 15 to 7 components. Here, the authors pinpoint which variables have more effect on credit scoring calculation. In this line, Arora (2014) uses this methodology to combine elements for creating an index of financial access, by weighting dimensions with PCA. Other examples of the application of PCA in the area of finance are oriented to portfolio's management (Connor and Korajczyk ;1993 and Aït-Sahalia and Xiu; 2017).

The procedure operates under the hypothesis of the existence of common factors, although we do not need to define neither latent factors nor previous specifications in our dataset.

The goal is rescaling  $n$  variables in  $p$  principal components, through the weighted linear combinations thereof. These components are defined to explain the source of variation in decreasing order, in such a way that the first component has the biggest contribution of total variance.

$$y_1 = \sum_{i=1}^p a_{i1} x_{ij} \quad j = 1 \dots n \quad (2)$$

The second component will have the second biggest contribution and so on.

$$y_{ij} = a'_i b_j + e_{ij} \quad i = 1, \dots, n \quad j = 1, \dots, p \quad (3)$$

Where  $y_{ij}$  are the components of the results matrix,  $a'_i$  represents the scores for the vectors of parameters derived from the survey  $b_j$ , and  $e_{ij}$  are the residuals.

As mentioned in the preceding section, our first two variables -*time until response*- and -*number of requirements*- are derived from objective questions, while the second two variables -*Perception in negotiation*- and -*Concern on bureaucratic burden*- are created based on subjective views.

**Table 2: Descriptive statistics**

Variable	Mean	Standard Dev.	Min	25 <sup>th</sup> Percentile	50 <sup>th</sup> Percentile (Median)	75 <sup>th</sup> Percentile	Max
Time until response	2.699	1.638	1	1	2	3	6
Extra requirements	0.721	1.142	0	0	0	1	5
Perception	1.107	1.004	0	0	1	2.2	2.8
Bureaucratic burden	6.665	2.421	0	5	7	8	10

Once developed the composite, our first hypothesis establishes that the smaller the business, the worse the financial conditions are. The second hypothesis will permit us to know if third sector businesses suffer from worse financial conditions, since banks are expected to show a better level of trust when they negotiate loans with larger and manufacturing companies. To contrast this, we will perform multivariate tests of means.

## 4. Results

### 4.1. Main results

As stated before, we have decided to **employ** PCA instead of other techniques of data reduction because we are looking for a measurable index of financial terms, but previously, it is necessary to know if the sample is suitable for the PCA<sup>5</sup>. For that, we calculate the Barlett`s test of sphericity (Barlett, 1950) and the Kaiser-Meyer-Olkin measure of sampling adequacy (takes values between 0 and 1). For the first one, we reject the null hypothesis that variables are not intercorrelated (p-value=0.000). For the second, small values indicate that PCA may not be used according to the classification proposed by Kaiser (1974). Our result; 0,6446 overcomes 0.5, considered as the minimum value to accept the use of this technique, although it is far from being “*marvellous*”. Table 3 displays the eigenvalues.

**Table 3: Eigenvalues of the correlation matrix**

<i>Component</i>	<i>Eigenvalue</i>	<i>Difference</i>	<i>Proportion</i>	<i>Cumulative</i>
<i>Component 1</i>	1.96023	1.09127	0.4901	0.4901
<i>Component 2</i>	0.86896	0.191018	0.2172	0.7073
<i>Component 3</i>	0.67794	0.185083	0.1695	0.8676
<i>Component 4</i>	0.49286	.	0.1232	1.0000

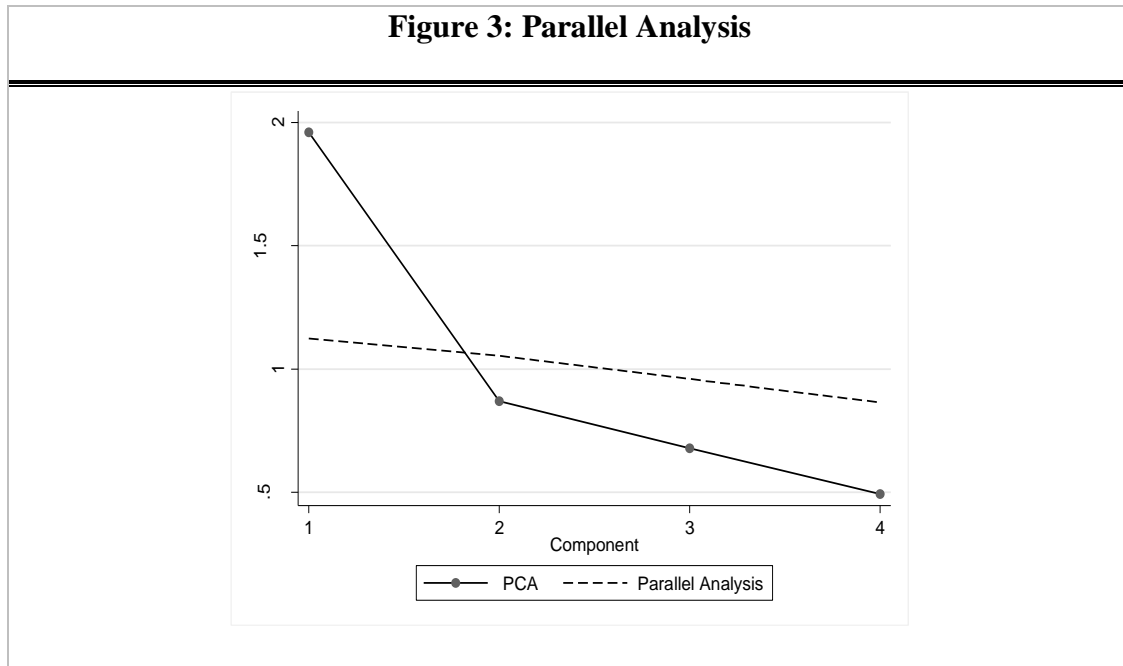
The eigenvalues of the correlation matrix measure how much variation is explained by each component. As we can see in the last column, the variance of the first component represents the 49.01% of the total variance, the second component is the 21.72%, the third

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<sup>5</sup>PCA is applied by using correlations instead of covariances, because our variables are measured on different sensory scales and the method would be conditioned to this issue as stated in Croux and Haesbroeck (2000)

is 16.95% and fourth is 12.32%. To select the adequate number of principal components, we use the Parallel Analysis<sup>6</sup>.

The empirical evidence denotes that only the eigenvalue for the first PCA component is larger than the corresponding PA eigenvalue and only one component is above the threshold represented in Figure 3.



In conclusion, we must choose one component and calculate the corresponding eigenvectors for this component. To that end, we replicate PCA by retaining only the first component<sup>7</sup>.

**Table 4: Eigenvector for component 1**

<sup>6</sup> An incorrect choice can result in overextraction (more components) or underextraction (less components), in both cases, we will be misinterpreted. To prevent this, Zwick and Velicer (1986) suggest the Parallel Analysis to determine the significance of loadings for each component through several replications.

<sup>7</sup> Once the number of components has been selected, some empirical contributions rotate the components to strengthen the results obtained in PCA. Using the controversial technique of rotation implies a violation of some properties of PCA, like maximal variance of the first rotated component. When should we use it? Abdi and Williams (2010) provide two simple rules; each variable loads only one factor and there is a significant difference between the eigenvalues which are above one and the “noise”. Furthermore, Conway and Huffcutt (2003) indicate that it is necessary to have a number of components greater than one. In our case, these conditions are not satisfied and, rotation would not be appropriate.

<i>Variable</i>	<i>Component 1</i>	<i>Unexplained</i>
Time until response	0.5026	0.5048
Extra requirements	0.5226	0.4647
Perception	0.4618	0.5819
Bureaucratic burden	0.5109	0.4883

Note: As only one component is retained, part of the variance remains unexplained

Table 4 reports the loadings of component 1 on the variables. The application of Wald Test will permit us to know if the differences between the loadings of the first component are not statistically significant. The test result ( $\chi^2(3) = 0.71$ , p-value = 0.8697) confirm the non-rejection of null hypothesis, and consequently, the similarity of loadings. Recalling, in consequence the objective of this paper, this component can be interpreted as an index of financial conditions for freelancers and MSMEs in Spain.

To close this section, we perform two tests to find out if the outcome composed by the loadings of our 4 variables in *Component 1*, has significant differences in firm size and industry.

**Table 5: Test of differences**

<i>Comp 1</i>	<b>Size</b>	Test for equality = 12.05 P-value = 0.0072***	Freelancers	.0275332
			Micro	.3372923
	Small	-.3433595		
	Medium	-.3911516		
<i>Comp 1</i>	<b>Industry</b>	Test for equality = 2.46 P-value = 0.4827	Freelancers	.0275332
			Prim. activity	.0203903
			Manuf.& Cons.	-.189278
			Services	.136084

Note: Multivariate test for equality of 4 group means, allowing for heterogeneity

This outcome denotes that firm size can be considered as a relevant factor for explaining credit conditions, which coincides with the evidence exposed in Daskalakis et al., (2013) and Lawless et al (2015), Moritz et al. (2016) or Masiak et al. (2017). However, regarding industry affiliation, we cannot conclude in a more meaningful way.



## 4.2 Robustness checks. PCA with disaggregated dummies

In the analysis displayed above, we have created the variable *perception of negotiation* (1) by adding up the dummies that refer to subjective perceptions about the conditions of loans. Although the aggregation permits us to get a valuable conclusion about the general perception, in doing so, the marginal effect of an additional cause changed depending on the initial value. To overcome this concern, we replicate the PCA but including all dummies separately.

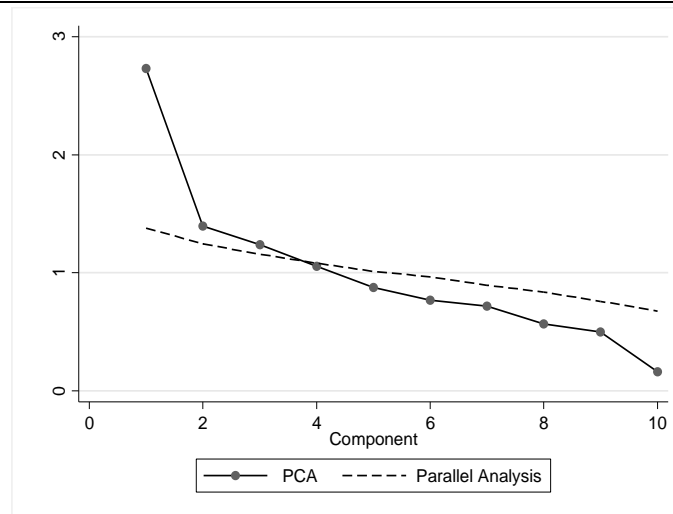
Both Barlett test of sphericity (p-value =0.000) and Kaiser-Meyer-Olkin Measure of Sampling Adequacy (0.520 > 0.5) enables us to continue with this methodology. Table 6 shows the eigenvalues.

**Table 6: Eigenvalues of the correlation matrix**

<i>Component</i>	<i>Eigenvalue</i>	<i>Difference</i>	<i>Proportion</i>	<i>Cumulative</i>
<i>Component 1</i>	2.7304	1.33347	0.2730	0.2730
<i>Component 2</i>	1.39693	.159723	0.1397	0.4127
<i>Component 3</i>	1.23721	.183401	0.1237	0.5365
<i>Component 4</i>	1.05381	.177743	0.1054	0.6418
<i>Component 5</i>	.876065	.110512	0.0876	0.7294
<i>Component 6</i>	.765553	.0472689	0.0766	0.8060
<i>Component 7</i>	.718284	.152038	0.0718	0.8778
<i>Component 8</i>	.566246	.0698223	0.0566	0.9344
<i>Component 9</i>	.496424	.337345	0.0496	0.9841
<i>Component 10</i>	.159078	.	0.0159	1.0000

In accordance with the criteria adopted before (eigenvalue >1) and the Parallel Analysis presented in Figure 4, we select four components.

**Figure 4: Parallel Analysis**



The loadings of each variable on the components are presented in the Table 7:

**Table 7: Eigenvector for components**

<i>Variable</i>	<i>Component 1</i>	<i>Component 2</i>	<i>Component 3</i>	<i>Component 4</i>	<i>Unexplained</i>
Time until response	0.3126	-0.0682	0.5196	-0.2350	.3346
Extra requirements	0.3741	0.0518	0.3387	-0.2654	.398
Improvement in perception	-0.4009	0.4916	0.2789	-0.0835	.1201
No change in perception	-0.0456	-0.7510	-0.2073	-0.2567	.08386
Deterioration_more_interest	0.2725	0.0526	-0.3129	0.4372	.4708
Deterioration_more_guarantees	0.4512	0.1261	-0.0939	-0.0031	.411
Deterioration_less_pay_return	0.2254	0.2762	-0.3422	-0.1310	.5917
Deterioration_less_money	0.3645	0.2298	-0.2925	-0.0578	.4542
Deterioration_others	0.0843	-0.1673	0.3387	0.7679	.1782
Bureaucratic burden	0.3619	-0.1061	0.2655	-0.0120	.5393

Note: Following the criteria of Abdi and Williams (2010) about rotation presented above, we do not rotate our components.

To interpret the components, we must take notice on the concept of simple structure, defined in Thurstone (1947) and revisited in Fabrigar et al. (1999) for factor analysis.

Based on these authors, simple structure indicates that each factor is largely associated

with some variables, but not with the rest, and each variable has high loadings on some factors, but not on the others.

Following this approach, we detect that all the dummies which reflect a worsening in perception have a positive loading on component 1, yet only two of them, *Deterioration\_more\_guarantees* and *Deterioration\_less\_money* have higher loadings on this component than on the others. Moreover, *Time until response*, *Extra requirements* and *Bureaucratic Burden* have positive loadings, and for the latter two, is indeed the highest one. To all this, we must add the negative linkage of *improvement in perception*. This result seems to strengthen the outcome previously obtained: the first component is expected to be the index of financial conditions, and more concretely, of the degradation in financial conditions.

Turning our attention to component 2, we remark the positive sign of *improvement in perception* which implies that the greater the number of managers perceiving an improvement in their negotiation, the greater the value of this component. In contrast, if more managers declare no changes in their perception, the component decreases. This is due to the fact that *improvement in perception* and *no change in perception* are mutually incompatible.

The Table 7 illustrates that component 3 has a strong positive association with *Time until response* and, strangely enough, negative with *Deterioration\_less\_pay\_return*. So, it may be suggested that those banks which take more time to answer when a loan is requested, demand short period of return for the loans conceded.

Regarding component 4, just *deterioration\_more\_interest* and *deterioration\_others* show a positive effect. Therefore, this component collects the causes of degradation not largely connected to component 1.

Now, we present the statistical tests implemented to verify the existence of asymmetry.

**Table 8: Test of differences**

<i>Comp 1</i>	<b>Size</b>	Test for equality = 10.68 P-value = 0.0136**	Freelancers	.0355185
			Micro	.3734177
			Small	-.3843875
			Medium	-.4215496
	<b>Industry</b>	Test for equality = 1.16 P-value = 0.7621	Freelancers	.0355185
			Prim. activity	.2684847
			Manuf.& Cons.	-.153994
			Services	.0962038
<i>Comp 2</i>	<b>Size</b>	Test for equality = 12.82 P-value = 0.0050***	Freelancers	-.6348433
			Micro	-.0534059
			Small	.2085327
			Medium	.3668361
	<b>Industry</b>	Test for equality = 10.87 P-value = 0.0125**	Freelancers	-.6348433
			Prim. activity	.1583765
			Manuf.& Cons.	-.0068491
			Services	.1611291
<i>Comp 3</i>	<b>Size</b>	Test for equality = 7.92 P-value = 0.0478**	Freelancers	-.410936
			Micro	.1502786
			Small	-.0505074
			Medium	.035031
	<b>Industry</b>	Test for equality = 11.59 P-value = 0.0089***	Freelancers	-.410936
			Prim. activity	.0341128
			Manuf.& Cons.	-.132784
			Services	.2050089
<i>Comp 4</i>	<b>Size</b>	Test for equality = 5.21 P-value = 0.1568	Freelancers	.1169831
			Micro	.1266689
			Small	-.1664763
			Medium	-.1456595
	<b>Industry</b>	Test for equality = 3.22 P-value = 0.3593	Freelancers	.1169831
			Prim. activity	.4677776
			Manuf.& Cons.	-.1367861
			Services	.0533824

Note: Multivariate test for equality of 4 group means, allowing for heterogeneity

Looking at component 1, the tests outcomes indicate that firm size as a significant effect in the index of financial conditions, in contrast to the effect of industry. Hence, the main hypothesis of this investigation is again confirmed.

The tests performed on component 2, associated to the concept of the perceived improvement in negotiation, have determined that both variables permit us to differentiate

among groups of companies. Moreover, freelancers have declared that have perceived improvement the least.

For component 3, strongly connected to the variable *Time until response*, the outcome evidences significant differences among companies as well, and the freelancers are the group that reported less time until response.

However, we do not find evidence for the tests on component 4, related to *deterioration\_more\_interest* and *deterioration\_others*, in such a way, there are not significant differences in terms of firm size and industry

## 5. Conclusions

The obstacles for achieving financing on concessional terms represent a potential barrier for freelancers and companies, and they can become a serious threat to their survival. The social aspect of this issue is patently clear if one thinks in how they contribute to economic development and social welfare.

In order to investigate the nature of the financial conditions in Spain, we have implemented a multivariate technique, Principal Component Analysis, with the observations provided by a survey to 233 Spanish freelancers and companies in 2018. Its application has allowed us creating an index of financial conditions. We have subsequently analysed if firm size and industry are determinants of the index, in other words, if asymmetric information phenomenon takes place in Spain during the post crisis period. The tests of differences between company groups for partially certified our previous outcome since it presents significant difference in terms of size, although not for industry.

In conclusion, we confirm the existence of asymmetric information in so far as smaller companies provide less information to banks, generate an atmosphere of mistrust, and find more obstacles.

In any case, as an inexhaustible source of welfare and employment in our societies, our empirical evidence should have an implication for policy-makers and companies. On one hand, we recommend to develop ambitious programs, adequately resourced, to provide micro loans or public guarantees for small MSMEs and freelancers in good conditions. This should be carried out throughout the Official Credit Institute (ICO, by its initial in Spanish).

In addition, we suggest freelancers and MSMEs overcome the distrust of financial entities and to project an image of transparency, by presenting comprehensive reports with reliable information about their financial position when they ask for a credit.

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## **Annex A1: Questionnaire**

1. Select your Company activity code (CNAE).
2. How many employees does your company have?
3. Select the Autonomous Community where your activity is located
4. Select the province where your activity is located
5. Have you applied for a credit in the last year?
6. Has the bank conceded the loan?
7. How long have you been waiting until receiving an answer? (1-6)
8. Once the contract was signed, Were the conditions maintained?
  - a) Yes.
  - b) No, they offered less money than agreed
  - c) No, they required more interest rate than agreed
  - d) No, they demanded more guarantees required
  - e) No, they proposed a lower repayment period
  - f) No, we were expected to buy other products
  - g) No, they required more borrowing costs
9. Do you believe that the negotiating capacity has improved in the last years?
  - a) Yes.
  - b) No, it has not changed
  - c) No, the interest rate has increased
  - d) No, more guarantees are requested
  - e) No, the repayment period is shorter
  - f) No, the capital sum loaned has decreased
  - g) No, others

10. If you had to evaluate from 0 to 10 the bureaucratic burden associated with the request for a loan, where 0 is nothing and 10 is a lot of bureaucratic burden, how would you rate it?