INTEREST RATE SENSITIVITY OF SPANISH COMPANIES.
AN EXTENSION OF THE FAMA-FRENCH FIVE-FACTOR MODEL

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This paper studies the sensitivity of share prices of Spanish companies included in the IBEX-35 to changes in different explanatory variables, such as market returns, interest rates and factors proposed by Fama and French (1993, 2015) between 2000 and 2016. In addition, for robustness, this paper analyses whether the sensitivity of stock returns is different between two periods: pre-crisis and recent financial crisis. The results confirm that, in general, all the considered factors are relevant. Furthermore, "market return" and "size" factors show greater explanatory power, together with the "value" factor in the crisis period. Regarding the analysis at sector level, "Oil and Energy", "Basic Materials, Industry and Construction" and "Financial and Real Estate Services" sectors appear to be highly sensitive to changes in the risk factors included in the asset pricing factor model.

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1. INTRODUCTION AND LITERATURE REVIEW

The aim of this paper is to analyse the sensitivity of Spanish stock business re-
turns listed in the Spanish index IBEX-35 to changes in some explanatory factors,
such as Spanish stock market returns, short and long term interest rates, the "size"
factor (Small Minus Big, SMB), the "value" factor (High Minus Low, HML), the
"profitability" factor (Robust Minus Weak, RMW), and the "investment" factor
(Conservative Minus Aggressive, CMA), the latter proposed by Fama and French
(1993, 2015).

Furthermore, to check the consistency of the results properly, we propose two
robustness tests. The first test estimates the extended Fama-French five-factor
model (2015, FF5 for short) by splitting the general sample period (January 2000
– April 2016) into sub-periods: pre-crisis (2000–2008) and the financial crisis
(2008–2016) periods. The second robustness test estimates this model by using
the short-term (instead of long-term) interest rate as nominal interest rate.

A large number of studies have analysed the sensitivity of stock returns to
changes in interest rates. Although the bulk of the researches focused on the fi-
nancial sector, there are also authors who studied the impact on non-financial
institutions (Bartram 2002). In addition, it is important to note that fluctuations in
interest rates have a relevant power in explaining the variability of financial stock
returns (Jianzhou 2007). Regarding the Spanish stock market, some examples are
Jareño (2008); Ferrer et al. (2005) and Ferrando et al. (2017), among others.

With respect to non-financial sectors, Bartram (2002) and Jareño (2008)
showed a negative and statistically significant relationship between nominal in-
terest rates and stock returns. This is related to the flow-through capability of
companies, because according to Jareño – Navarro (2010), the sensitivity of stock
returns to changes in interest rates may be lower in the case of companies that
have a greater ability to transfer inflationary changes to prices.

Changes in interest rates do not affect all sectors in a homogeneous way. The
divergence may be due to different factors, such as the level of liquidity, the com-
position of the asset, the level of leverage, the business structure and the flow-
through capability (Jareño 2008; Jareño – Navarro 2010).

The factor asset pricing models can be classified into two branches: firstly, the
Stone (1974) two-factor model, in which market return and interest rate are the
main explanatory variables of changes in stock returns (Jareño et al. 2016), and
secondly, the Fama–French model (1993, 2015), which proposes the three- and
five-factor models, where the expected returns are related to risk factors, such as
the stock market return minus the risk-free interest rate, and additional factors
related to the "size", "value", "profitability" and "investment". In concrete, FF5

expanded the three-factor model by incorporating two additional factors: "profit-ability" (RMW) and "investment" (CMA).

This innovative asset pricing factor model is applied in recent researches about investment allocation strategies (Angelidis – Tessaromatis 2017), the analysis of US service sector (Yang et al. 2017), and testing the five-factor model for different stock markets (Harshita et al. 2015; Chia et al. 2016; Guo et al. 2017; Fama – French 2017, among others). It should be noted that there is a shortage of papers analysing the impact of the factors proposed by FF5 on the Spanish stock market, especially at company level. Specifically, the analysis of the Spanish market is only residually collected in an original work by Fama – French (2017), as well as in He et al. (2015) and Huynh (2017), as the Spanish stock market is integrated into a European portfolio. Nevertheless, there would not be any particular study only focused on the Spanish stock market.

The most relevant contributions of this research are the following ones: *First*, to the best of our knowledge, it is the first study that analyses the sensitivity of the Spanish stock market at company level in the framework of FF5 during the period of 2000 –2016. *Second*, to check the robustness of the results, the full sample period has been divided into two sub-periods: pre-crisis and global financial crisis periods. In this way, depending on the economic cycle, the sensitivity of certain Spanish stock returns to changes in risk factors may vary. Moreover, to do a second robustness test of our results, this paper proposes two variations of the augmented FF5, using alternatively short- and long-term interest rates.

The rest of the paper is presented in the following way: Section 2 includes discussions on data and methodology. Section 3 shows the empirical results of the augmented Fama–French five-factor asset pricing model. Section 4 includes some robustness checks to confirm the reliability of the results. Finally, Section 5 comprises the main conclusions.

2. DATA AND METHODOLOGY

2.1. Data and sample period

The sample period chosen for the analysis is between January 2000 and April 2016, which consists of a pre-crisis sub-sample (from January 2000 to August 2008) and the financial crisis sub-sample (from September 2008 to April 2016)[1] periods. The reason for this separation is that we can assume that the effect of

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[1]   Although the sample period spans from January 2000 to April 2016, some companies were not on the stock exchange for the whole period.

different factors may depend on the economic cycle (Jareño et al. 2016; Ferrando et al. 2017, among others).

Regarding the data frequency, it considers a monthly average of each business return (196 observations total). This study includes the returns of IBEX-35 companies as a dependent variable and the stock market return, long term interest rates,[2] and the factors proposed by Fama and French, such as "size" factor (SMB), "value" factor (HML), "profitability" factor (RMW), and "investment" factor (CMA), as independent or explanatory variables. In actual, this paper uses the original FF5. According to Angelidis – Tessaromatis (2017), among others, FF5 have broad support and acceptance in the academic community and are the basis for country and global smart beta portfolio strategies used by both institutional and retail investors. Furthermore, while the previous literature usually studies the effect of national variables on the national stock market, Sevillano – Jareño (2018) study to what extent the genuine European Fama–French factors impact the Spanish stock market at company level. Therefore, to some extent, this paper finally studies whether there is an interconnection between international stock markets.

Table 1 shows the companies analysed according to the sectors. We used the composition of the IBEX-35 on April 3, 2016, to study the temporal evolution of these companies based on different factors. Thus, the static analysis of the companies included in the Spanish IBEX-35 index (at that particular point in time) may imply lack of data for certain companies in specific sub-periods, due to the possible entry and exit of some selected companies during the sample period.[3]

The Spanish stock business and stock market returns (the Spanish IBEX-35 index) are extracted from the website of *Invertia*. Then the logarithmic returns are obtained.[4] Regarding the main descriptive statistics of companies' returns listed in the IBEX-35, there are relevant differences between the companies.[5] AENA is the company with the highest mean return followed by other companies, such as Amadeus, Grifols, IAG, Inditex and Red Eléctrica Corporación. On the other hand, Bankia is the company with a lower mean return along the sample, accompained with Arcelomittal, CaixaBank and Sacyr. With regard to the median, AENA, International Consolidat Airlines Group, Grifols, Enagas and Inditex are the companies with the highest median return, whereas CaixaBank and Bankia have a much lower median than the rest. Bankia has the highest risk, jointly with

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[2]   Short-term interest rates are used for robustness.
[3]   Some previous studies, such as Sevillano — Jareño (2018), take similar decisions.
[4]   Closing prices are adjusted by dividends and splits.
[5]   The descriptive statistics and unit root tests are available upon request.

Table 1. Companies and sectors analysed

	Code
Sector 1: Oil and Energy	
Repsol, S.A.	R30
Enagás, S.A.	R14
Endesa, S.A.	R13
Iberdrola, S.A.	R21
Gas Natural, S.A.	R18
Red Eléctrica Corporación (REE), S.A.	R29
Sector 2: Basic Materials, Industry and Construction	
Acerinox, S.A.	R3
Arcelomittal, S.A.	R26
Gamesa Corporación Tecnológica, S.A.	R17
Acciona, S.A.	R2
Actividades de Construcción y Servicios, S.A.	R4
Ferrovial, S.A.	R16
Fomento, Construcción y Contratas, S.A.	R15
Sacyr, S.A.	R32
Obrascon Huarte Lain, S.A.	R27
Técnicas Reunidas, S.A.	R35
Sector 3: Consumer Goods	
Grifols, S.A.	R19
Sector 4: Consumer Services	
Dia, distribuidora int. de alimentación, S.A.	R12
Mediaset España Comunicación, S.A.	R34
Industria de Diseño Textil, S.A. "Inditex"	R22
International Consolidat Airlines Group	R20
Aena, S.A.	R5
Abertis Infraestructuras, S.A.	R1
Sector 5: Financial and Real Estate Services	
Banco Bilbao Vizcaya Argentaria, S.A.	R28
Banco Sabadell, S.A.	R8
Banco Popular Español, S.A.	R7
Banco Santander, S.A.	R31
Bankia, S.A.	R9
Bankinter, S.A.	R10
Caixabank, S.A.	R11
Mapfre, S.A.	R24
Merlin Properties, SOCIMI, S.A.	R25
Sector 6: Technology and Telecommunications	
Telefónica, S.A.	R33
Amadeus IT Holding, S.A.	R6
Indra Sistemas, S.A.	R23

Source: Own preparation based on the Bolsas y Mercados Españoles (BME) website.

Arcelomittal and Sacyr. Furthermore, nearly all the companies present negative asymmetry and there is not a considerable excess of kurtosis.

As regards the explanatory variables, data concerning market returns have been extracted from the *Bolsa de Madrid* website, through the returns of the IBEX-35 Spanish market index. In the case of stock business returns, the logarithmic returns were calculated. Continuing with the bulk of the previous literature, the impact of the interest rate has been analysed.[6] More specifically, 10-year (long-term, IR) and 3-month (short-term, RF) nominal interest rates corresponding to the public debt provided by the official *Banco de España* website are used in the paper.[7]

According to Ferrer et al. (2010) and Akhtaruzzaman et al. (2014), stock business returns may be more sensitive to changes in long-term interest rates than short-term rates. Long-term interest rates incorporate market expectations about the economic cycle, long-term government bonds can be considered as closer maturity substitutes to stocks, and long term rates are more stable. Therefore, the extended FF5 model is estimated by using long-term interest rates, in particular, 10-year nominal interest rates. Besides, for robustness, the model is also estimated including 3-month interest rates.

The rest of the explanatory variables are extracted from the Kenneth R. French website,[8] such as SMB, HML, RMW, and CMA.

The main descriptive statistics of the explanatory variables show a positive mean for all variables, except the stock market return. The HML is the most important factor, whereas the market return shows a much lower value than the rest. In addition, most variables have a median very close to their mean value. With regard to the standard deviation, the Fama and French explanatory factors show more dispersion than the rest of the variables included in the analysis. Finally, half of the values are scattered to the right of the distribution and half of the values are distributed to the left.

Three tests are implemented to study the stationarity of the time series: two unit root tests, such as Augmented Dickey-Fuller (ADF) and Phillips-Perron (P-P) and one stationarity test that is Kwiatkowski-Phillips-Schmidt-Shin (KPSS).[9] Almost all the variables included in the analysis are stationary that is the mean and the median remain constant during the sample period. Only the explanatory

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[6]   After studying the effect of 1-year and 10-year nominal interest rates, the results showed greater effect of the second, which is supported by the inclusion of this variable in most of the works analysed in the literature review (Ferrando et al. 2015).

[7]   https://www.bde.es/bde/es/areas/mercadeuda/

[8]   http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

[9]   These results are available upon request.

variables, such as short and long-term interest rates, CMA and HML, which had a unit root, have to be transformed into first differences.

Finally, to avoid collinearity between explanatory factors, the correlation matrix was studied.[10] There is a statistically significant correlation between stock market returns and SMB. The rest of the correlations are not statistically significant. So it is not necessary to orthogonalize risk factors included in the augmented FF5 model. Moreover, it is usually advised to avoid the orthogonalization process to keep the genuine risk factors.

2.2. Methodology

We propose an extension of FF5 that explains the companies' returns according to the following explanatory variables: market returns, nominal interest rates, "size" factor – SMB, "value" factor – HML, "profitability" factor – RMW, and "investment" factor – CMA. Thus, the extended FF5 model that includes long-term interest rates is represented as follows:

$$R_{jt} = \alpha_j + \beta_j \cdot MR_t + \mu_j \cdot \Delta IR_t + \gamma_f \cdot SMB_t + \tau_f \cdot \Delta HML_t + \varphi_f \cdot RMV_t + \delta_f \cdot \Delta CMA_t + \varepsilon_{jt} \quad (1)$$

where R_{jt} is the monthly return of company j, α_j is the independent term, β_j shows the market sensitivity of company j listed in the Spanish index IBEX-35, MR_t is the monthly market return, μ_j shows the sensitivity of company j to unexpected changes in long-term nominal interest rates, ΔIR_t is the non-expected change in the long-term nominal interest rate, γ_f shows the sensitivity of company j to changes in the "size" factor, SMB_t shows the monthly "size" factor return, τ_f shows the sensitivity of company j to changes in the "value" factor, HML_t is the monthly "value" factor return, φ_f shows the sensitivity of company j to changes in the "profitability" factor, RMV_t shows the monthly "profitability" factor return, δ_f shows the sensitivity of company j to changes in the "investment" factor, CMA_t shows the monthly "investment" factor return and, finally, ε_{jt} is a random disturbance.

The estimation of the extended FF5 has been done through a system of thirty-five equations (as many as dependent variables are included in the analysis) following the methodology of the *Seemingly Unrelated Regression* (SUR) models. Several authors used this methodology because it allows to avoid the distortions in the estimates due to the presence of heteroscedasticity and simultaneous correlation between the error terms (e.g. Jareño 2008).

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[10]   This matrix is also available upon request.

3. MAIN RESULTS

The empirical analysis (Sections 3 and 4) is multipurpose. First, it carries out a study considering the whole sample period (Jan 2000 – Apr 2016) and the long-term interest rates as additional explanatory factor. Then, for robustness, estimations are also carried out for two sub-periods: pre-crisis (Jan 2000 – Aug 2008) and recent financial crisis (Sept 2008 – Apr 2016) sub-periods.[11] Moreover, this paper also estimates the proposed model with the short-term interest rates instead of the long-term ones. This allows us to corroborate the consistency of the results obtained.

3.1. Estimates of the extended Fama and French five-factor model (2015)

The results of the extended FF5 model for the full period and using long-term interest rates are shown in *Table 2*. It allows to study the relationships between the IBEX-35 companies' returns and the explanatory risk factors.

All the companies, except for R25 (Merlin Properties), have a positive and statistically significant sensitivity to changes in the stock market returns, so a change in this risk factor would imply a change in the same direction in these companies' returns. The value of the coefficients is less than one in all cases, except for R9 (Bankia), R26 (Mittal Steel Company) and R32 (Sacyr), so if the stock market return is positive, these companies would outperform the market, and vice versa. Furthermore, the companies, R11 (Caixabank), R17 (Gamesa), R27 (OHL), R28 (BBVA), R31 (Banco Santander), R34 (Mediaset España) and R35 (Técnicas Reunidas) present coefficients close to one, so their behaviour is close to the Spanish stock market.

The sensitivity of the returns to changes in the long-term interest rate is statistically significant for about 29% of the companies: R8 (Banco Sabadell), R11 (Caixa Bank), R12 (Día), R17 (Gamesa Corporación Tecnológica), R22 (Inditex), R26 (Mittal Steel Company), R27 (OHL), R30 (Repsol), R31 (Banco Santander) and R35 (Técnicas Reunidas). All companies have positive sign (future expectations) except for Banco Sabadell. Moreover, Día, Mittal Steel Company and Técnicas Reunidas are most sensitive to the changes in long-term interest rates.

The "size" (SMB) factor is statistically significant for almost 72% of the companies analysed. In addition, it is positive in all cases, that is, the larger the company size, the greater its returns. For the companies, such as Gamesa, Arce-

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[11]   We have split the whole sample into two sub-samples considering the fall of *Lehman Brothers Holdings*.

Table 2. Estimates for the whole sample and long-term interest rates

Companies	MR	ΔIR	SMB	ΔHML	RMW	ΔCMA	Adj. R^2
R1	0.3769***	–0.5619	0.0034**	0.0009	0.0003	0.0023	0.1863
R2	0.6342***	0.3634	0.0086***	–0.0004	0.0008	0.0022	0.2225
R3	0.5702***	2.1542	0.0076***	0.0025	0.0002	0.0016	0.2535
R4	0.4722***	–1.6684	0.0040*	0.0016	–0.0016	0.0047**	0.2083
R5	0.6754*	–2.5439	0.0145	0.0039	–0.0145	0.0054	0.4864
R6	0.2345***	1.9282	0.0029	–0.0023	–0.0038	0.0007	–0.0019
R7	0.4729***	–3.3151	0.0060**	–0.0050*	–0.0136***	0.0019	0.1769
R8	0.5920***	–3.5479**	0.0036*	0.0008	–0.0005	0.0041*	0.3093
R9	2.0972*	–13.5076	0.0323	0.0119	0.0474	0.0131	–0.0341
R10	0.5528***	0.1277	0.0068***	–0.0039	–0.0041	0.0048*	0.2047
R11	0.8037***	2.8251*	0.0059**	–0.0045**	–0.0100**	–0.0003	0.4180
R12	0.5784***	6.2755***	–0.0001	–0.0020	–0.0082	–0.0048	0.1208
R13	0.4746***	1.2279	0.0043*	–0.0065***	–0.0083**	0.0081***	0.1709
R14	0.4106***	–0.3225	0.0030**	–0.0010	0.0000	0.0007	0.2346
R15	0.5945***	–1.7339	0.0023	–0.0026	–0.0005	0.0094***	0.1982
R16	0.6815***	2.5280	0.0072***	–0.0003	0.0076**	0.0036	0.2572
R17	0.9507***	4.2456*	0.0158***	–0.0032	–0.0050	0.0051	0.3167
R18	0.4409***	0.4534	0.0018	–0.0054***	–0.0045	0.0062***	0.1747
R19	0.5723***	2.4639	0.0091***	–0.0023	0.0037	–0.0012	0.1640
R20	0.6118***	0.8806	0.0074	–0.0062*	–0.0064	–0.0068	0.1570
R21	0.4401***	–0.3718	0.0028*	–0.0013	–0.0010	0.0046***	0.2335
R22	0.5413***	2.3490*	0.0043**	0.0018	0.0086***	0.0008	0.2112
R23	0.6459***	0.9725	0.0082***	–0.0014	–0.0021	0.0029	0.3155
R24	0.5258***	0.0647	0.0069***	–0.0038*	–0.0085***	0.0085***	0.2980
R25	0.4985	–0.2662	0.0027	0.0043	0.0012	0.0014	0.0184
R26	1.1454***	10.5384***	0.0180***	–0.0028	–0.0096	–0.0025	0.3586
R27	0.8786***	3.8276*	0.0134***	–0.0041	–0.0039	0.0087***	0.2686
R28	0.8566***	1.1070	0.0042**	–0.0026	–0.0076***	0.0045**	0.5205
R29	0.3095***	–0.5205	0.0022	0.0002	–0.0015	0.0056***	0.1165
R30	0.5985***	2.4454*	0.0033*	–0.0002	–0.0006	0.0008	0.2500
R31	0.8679***	2.4467*	0.0050***	–0.0017	–0.0062**	0.0052***	0.4974
R32	1.0758***	1.6105	0.0101***	–0.0042	–0.0058	0.0061*	0.3035
R33	0.6864***	0.2487	0.0021	–0.0015	–0.0011	0.0008	0.3894
R34	0.7935***	2.0856	0.0063*	–0.0006	–0.0091*	–0.0010	0.3225
R35	0.9610***	7.8065***	0.0163***	0.0002	0.0013	–0.0008	0.3733

Notes: **MR**: Spanish stock market return, **IR**: (long-term) interest rate, **SMB**: size factor, **HML**: value factor, **RMW**: profitability factor, **CMA**: investment factor.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Own preparation from Eviews results.

lomittal, OHL, Sacyr and Técnicas Reunidas, the coefficients are higher and, therefore, these companies are more sensitive to changes in the SMB variable. In contrast, the less sensitive companies are Abertis, Banco Sabadell and Iberdrola. This variable is not statistically significant for R5 (Aena), R6 (Amadeus), R9 (Bankia), R12 (Dia), R18 (Gas Natural Fenosa), R20 (International Consolidat Airlines Group), R25 (Merlin Properties), R29 (Red Eléctrica Corporación) and R33 (Telefónica).

The "value" (HML) factor has a statistically significant effect on R7 (Banco Popular), R11 (Caixa Bank), R13 (Endesa), R18 (Gas Natural Fenosa), R20 (International Consolidat Airlines Group) and R24 (Mapfre). In addition, it has negative sign, which means that the companies may obtain lower returns when their growth opportunities are greater.

The "profitability" (RMW) factor is statistically significant for about 26% of the companies, such as R7 (Banco Popular), R11 (Caixabank), R13 (Endesa), R16 (Ferrovial), R22 (Inditex), R24 (Mapfre), R28 (BBVA), R31 (Banco Santander) and R34 (Mediaset España). In addition, this sensitivity is negative for all of them, except for Ferrovial and Inditex, which is positive, although with a very small associated coefficient.

The "investment" (CMA) explanatory factor is statistically significant and shows a positive sign for about 37% of the companies: R4 (Actividades de Construcción y Servicios), R8 (Banco Sabadell), R10 (Bankinter), R13 (Endesa), R15 (Fomento, Construcción y Contratas), R18 (Gas Natural Fenosa), R21 (Iberdrola), R24 (Mapfre), R27 (Obrascon Huarte Lain), R28 (BBVA), R29 (Red Eléctrica Corporación), R31 (Banco Santander) and R32 (Sacyr). Therefore, the return of these companies would be greater when having the greater CMA factor. The most sensitive companies are Endesa, Fomento, Construcción y Contratas, Mapfre and OHL. On the contrary, those that are less sensitive are Actividades de Construcción y Servicios, Banco Sabadell, Bankinter, Iberdrola and BBVA. In this proof, the explanatory power is quite different between companies. The adjusted R^2 is about 25% on average and almost 50% for R5 (Aena).

3.2. Analysis at sector level

Table 3 shows the results at sector level to remark possible and relevant differences among them.

First, the weight of each sector in proportion to the number of companies is the following: more than 28% (10/35) for sector 2, about 26% (9/35) for sector 5, slightly more than 17% (5/35) for sectors 1 and 4 , about 9% (3/35) for sector 6, and finally, about 3% (1/35) for sector 3.

Table 3. Sensitivity of the companies listed in the Spanish IBEX-35 index

Percentage of companies with significant exposure, %	Significance (1%)	Significance (5%)	Significance (10%)	No Significance
MR				
Sector 1: Oil and Energy	6/6 (100.0)	6/6 (100.0)	6/6 (100.0)	–
Sector 2: Basic Materials, Industry and Construction	10/10 (100.0)	10/10 (100.0)	10/10 (100.0)	–
Sector 3: Consumer Goods	1/1 (100.0)	1/1 (100.0)	1/1 (100.0)	–
Sector 4: Consumer Services	5/6 (83.3)	5/6 (83.3)	6/6 (100.0)	–
Sector 5: Financial and Real Estate Services	7/9 (77.8)	7/9 (77.8)	8/9 (88.9)	1/9 (11.1)
Sector 6: Technology and Telecommunications	3/3 (100.0)	3/3 (100.0)	3/3 (100.0)	–
ΔIR				
Sector 1: Oil and Energy	–	–	1/6 (16.7)	5/6 (83.3)
Sector 2: Basic Materials, Industry and Construction	2/10 (20.0)	2/10 (20.0)	4/10 (40.0)	6/10 (60.0)
Sector 3: Consumer Goods	–	–	–	1/1 (100.0)
Sector 4: Consumer Services	1/6 (16.7)	1/6 (16.7)	2/6 (33.3)	4/6 (66.7)
Sector 5: Financial and Real Estate Services	–	1/9 (11.1)	3/9 (33.3)	6/9 (66.7)
Sector 6: Technology and Telecommunications	–	–	–	3/3 (100.0)
SMB				
Sector 1: Oil and Energy	–	1/6 (16.7)	4/6 (66.6)	2/6 (33.3)
Sector 2: Basic Materials, Industry and Construction	8/10 (80.0)	8/10 (80.0)	9/10 (90.0)	1/10 (10.0)
Sector 3: Consumer Goods	1/1 (100.0)	1/1 (100.0)	1/1 (100.0)	–
Sector 4: Consumer Services	–	2/6 (33.3)	3/6 (50.0)	3/6 (50.0)
Sector 5: Financial and Real Estate Services	3/9 (33.3)	6/9 (66.7)	7/9 (77.8)	2/9 (22.2)
Sector 6: Technology and Telecommunications	1/3 (33.3)	1/3 (33.3)	1/3 (33.3)	2/3 (66.7)
ΔHML				
Sector 1: Oil and Energy	2/6 (33.3)	2/6 (33.3)	2/6 (33.3)	4/6 (66.7)
Sector 2: Basic Materials, Industry and Construction	–	–	–	10/10 (100.0)
Sector 3: Consumer Goods	–	–	–	1/1 (100.0)
Sector 4: Consumer Services	–	–	1/6 (16.7)	5/6 (83.3)
Sector 5: Financial and Real Estate Services	–	1/9 (11.1)	3/9 (33.3)	6/9 (66.7)
Sector 6: Technology and Telecommunications	–	–	–	3/3 (100.0)

Table 3 continued

RMW	Significance (1%)	Significance (5%)	Significance (10%)	No Significance
Sector 1: Oil and Energy	–	1/6 (16.7)	1/6 (16.7)	5/6 (83.3)
Sector 2: Basic Materials, Industry and Construction	–	1/10 (10.0)	1/10 (10.0)	9/10 (90.0)
Sector 3: Consumer Goods	–	–	–	1/1 (100.0)
Sector 4: Consumer Services	1/6 (16.7)	1/6 (16.7)	2/6 (33.3)	4/6 (66.7)
Sector 5: Financial and Real Estate Services	3/9 (33.3)	5/9 (55.6)	5/9 (55.6)	4/9 (44.4)
Sector 6: Technology and Telecommunications	–	–	–	3/3 (100.0)
ΔCMA	Significance (1%)	Significance (5%)	Significance (10%)	No Significance
Sector 1: Oil and Energy	4/6 (66.7)	4/6 (66.7)	4/6 (66.7)	2/6 (33.3)
Sector 2: Basic Materials, Industry and Construction	2/10 (20.0)	3/10 (30.0)	4/10 (40.0)	6/10 (60.0)
Sector 3: Consumer Goods	–	–	–	1/1 (100.0)
Sector 4: Consumer Services	–	–	–	6/6 (100.0)
Sector 5: Financial and Real Estate Services	2/9 (22,2)	3/9 (33.3)	5/9 (55.6)	4/9 (44.4)
Sector 6: Technology and Telecommunications	–	–	–	3/3 (100.0)

Notes: **MR**: Spanish stock market return, **IR**: (long-term) interest rate, **SMB**: size factor, **HML**: value factor, **RMW**: profitability factor, **CMA**: investment factor.

Source: Own preparation from Eviews results.

With regard to market returns, all except one of the sectors show a hundred per cent of companies with statistically significant sensitivity, so, stock business returns are mainly affected by the variations in market returns. The exception is sector 5 that exhibits 89% of companies with statistically significant sensitivity at 10% level.

As far as changes in interest rates are concerned, sector 2 shows the greatest sensitivity to changes in this risk factor proposed in this research (40% of companies). Furthermore, sectors 4 and 5 reach 33.3% of companies with statistically significant sensitivity to changes in long-term interest rates.

Most companies of all sectors present statistically significant sensitivity to variations in the "size" factor (SMB). Specifically, 100%, 90% and 78% of companies of the sectors 3, 2 and 5, respectively, are highly sensitive to changes in SMB. As regards the "value" factor (HML), it primarily shows statistically significant impact on sectors 1 and 5 (33.3% of companies).

The "profitability" factor (RMW) exhibits a greater impact than the "value" factor. Sector 5 shows that about 56% of companies are with statistically significant sensitivity to changes in this risk factor. Besides, sector 4 contains 33% of companies sensitive to RMW.

The most sensitive sector to changes in the "investment" factor (CMA) is sector 1 with 66.7% of companies showing statistically significant sensitivity to changes in this risk factor, followed by sector 5 with a 55.6% of companies and, in third position, sector 2 with 40% of companies sensitive to the investment factor.

Finally, the mean explanatory power at sector level is between 17% and 28%. Moreover, sectors 2 and 5 exhibit the highest adjusted R^2 values.

4. ROBUSTNESS CHECKS

This section includes two tests to check the robustness of the findings of the previously estimated augmented FF5 (Equation 1). First, the FF5 model has been estimated splitting the whole sample into two different sub-periods: pre crisis sub-period and crisis sub-period. Second, the sensitivity of stock business returns to changes in short-term interest rates (proxied by 3-month treasury bill rates) has been estimated. The inclusion of this variable instead of long-term interest rates (10-year government bond yields) in the extended Fama–French specification allows for contrasting the reliability of the results.

4.1. Sub-sample analysis

For robustness, this section studies the effect that the economic crisis may have on the relationship between the individual stock returns of the companies listed in the IBEX-35 index and the explanatory variables included in the extension of FF5 model proposed in this research. For that end, this study breaks the whole sample into two different sub-periods: pre crisis sub-period (January 2000 – August 2008) and recent financial crisis sub-period (September 2008 – April 2016). The division into these two consecutive sub-periods is determined by the beginning of the crisis with the fall of Lehman Brothers in September 2008 (Ferrando et al. 2017). So, recent economic events have been taken into account in this analysis

4.1.1. Pre-crisis sub-period: Janurary 2000 – August 2008

This sub-section performs an analysis of the IBEX-35 companies' returns for the first sub-sample, the pre-crisis sub-period. It should be noted that for some companies the analysis could not be carried out since there were no quotations data for these dates or they were not enough to obtain reliable estimates. These companies are Aena, Amadeus, IT Holding, Caixabank, Día, IAG and Merlin.[12]

Table 4 shows the estimates of the factor model proposed in this research including long-term interest rates for this sub-period.

All companies present a statistically significant and positive sensitivity to changes in the stock market return, except for R1 (Abertis) and R7 (Banco Popular). Thus, these results practically coincide with the ones of the full period since the companies that do not offer statistical significance are the same. In this case there is no coefficient greater than one, but five companies with the coefficient value closest to one, such as R17 (Gamesa), R19 (Grifols), R23 (Indra), R33 (Telefónica) and R35 (Técnicas Reunidas), present a behaviour quite similar to the market. In contrast, the companies with a lowest sensitivity are R2 (Acciona), R3 (Acerinox), R4 (Actividades de Construcción y Servicios, ACS), R21 (Iberdrola) and R29 (REE).

With regard to the long-term interest rate, 21.4% of the companies show statistically significant sensitivity. Specifically, the companies that present a statistically significant and positive sensitivity are R2 (Acciona), R8 (Banco Sabadell),

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[12]   As previously explained, *Table 4* does not show results for some specific companies, such as RS5, RS6, RS9, RS11, RS12, RS20 and RS25. The static analysis of the companies included in the Spanish IBEX-35 index (April 3, 2016) indeed implies lack of data for these companies during the pre-crisis sub-period, due to their later entry in the composition of the Spanish stock market index.

Table 4. Estimates for the pre-crisis sub-sample and long-term interest rates

Companies	MR	ΔIR	SMB	ΔHML	RMW	ΔCMA	Adj. R²
R1	0.1665	−0.8664	0.0025	0.0019	0.0038	0.0011	0.0087
R2	0.3645*	6.0008*	0.0072***	0.0011	0.0036	−0.0006	0.1587
R3	0.3327**	5.5798	0.0080***	0.0070**	0.0024	−0.0005	0.1758
R4	0.3626*	−2.1382	0.0031	0.0074	−0.0003	0.0033	0.1745
R7	0.3347	−7.5738	0.0042	−0.0043	−0.0113	0.0005	0.0489
R8	0.4600***	8.0538***	0.0077***	−0.0022	0.0041	0.0035	0.3255
R10	0.6536***	6.8050*	0.0079***	0.0025	0.0019	0.0021	0.3562
R13	0.5973***	0.1968	0.0024	0.0033	−0.0025	0.0030	0.3432
R14	0.5202***	−3.4537	0.0031	0.0027	0.0056	−0.0015	0.1530
R15	0.4814***	1.0710	0.0018	0.0072*	0.0037	0.0036	0.2544
R16	0.5131***	1.2054	0.0068***	0.0063*	0.0093**	−0.0002	0.2159
R17	0.7826***	8.0818*	0.0075	0.0043	0.0074	0.0007	0.2586
R18	0.4485***	−5.8476**	−0.0013	0.0017	0.0045	0.0033	0.1617
R19	0.8103**	8.9273	0.0123	0.0083	−0.0125	−0.0004	0.1913
R21	0.3603***	−2.0652	−0.0003	0.0020	0.0050	0.0050**	0.1597
R22	0.5834***	2.8778	0.0048	−0.0055	0.0083	0.0024	0.1441
R23	0.9470***	−1.4811	0.0071***	0.0046*	0.0000	0.0006	0.5052
R24	0.3708**	−2.1067	0.0081***	0.0012	−0.0048	0.0064*	0.2236
R26	0.4572**	−0.0753	0.0018	−0.0137	0.0186	−0.0356***	0.4214
R27	0.6165***	−0.4912	0.0112**	0.0043	0.0055	0.0048	0.1953
R28	0.6783***	4.3248	0.0050**	0.0016	−0.0050	0.0017	0.4781
R29	0.3325**	−7.4647	0.0004	0.0061	0.0005	0.0044	0.1304
R30	0.3540***	4.0105	0.0043	0.0038	0.0026	−0.0016	0.1093
R31	0.6498***	4.9294*	0.0057**	0.0032	−0.0046	0.0019	0.4607
R32	0.5832***	−0.2481	0.0092***	0.0070	−0.0008	0.0008	0.1732
R33	0.9379***	−2.7511	0.0031	0.0004	−0.0002	0.0015	0.4538
R34	0.5125*	−5.9068	0.0057	0.0057	−0.0033	−0.0129	0.2165
R35	0.9841***	−9.2107	0.0135**	−0.0020	0.0268	−0.0189**	0.4730

Notes: **MR**: Spanish stock market return, **IR**: (long-term) interest rate, **SMB**: size factor, **HML**: value factor, **RMW**: profitability factor, **CMA**: investment factor.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Source: Own preparation from Eviews results.

R10 (Bankinter), R17 (Gamesa) and R31 (Banco Santander). In addition, this sensitivity is very high, since in all the cases the coefficients are much larger than the unit is. The only company that presents negative sensitivity is R18 (Gas Natural Fenosa), so that increases in the long-term interest rate mean decreases in its returns.

For the "size" (SMB) explanatory variable, it is statistically significant for twelve companies (almost 43% of the analysed companies). Specifically, companies that show a positive and statistically significant sensitivity to changes in the

"size" factor are R2 (Acciona), R3 (Acerinox), R8 (Banco Sabadell), R10 (Bank-inter), R16 (Ferrovial), R23 (Indra), R24 (Mapfre), R27 (OHL), R28 (BBVA), R31 (Banco Santander), R32 (Sacyr) and R35 (Técnicas Reunidas). Thus, the larger (smaller) the business size, the higher (lower) is the expected return. In addition, the highest sensitivity is found in OHL and Técnicas Reunidas, and the least sensitivity in BBVA and Banco Santander.

The "value" (HML) explanatory variable is statistically significant and positive for R3 (Acerinox), R15 (FCC), R16 (Ferrovial) and R23 (Indra), and the highest sensitivity corresponds to FCC. So, the higher the business growth, the higher would be the expected return for the companies mentioned.

Regarding the "profitability" (RMV) factor, it is not statistically significant for most companies, and is statistically significant and positive only for R16 (Ferrovial).

And finally, as regards the "investment" (CMA) explanatory variable, about 14% of the companies show statistically significant sensitivity, such as R21 (Iberdrola), R24 (Mapfre), R26 (Arcelomittal) and R35 (Técnicas Reunidas). This sensitivity is positive for Iberdrola and Mapfre, and negative for Arcelomittal and Técnicas Reunidas.

In this study, the explanatory power of the proposed factor model is quite different between companies. The adjusted coefficient R^2 shows mean values around 25%, and it is almost 50% for R28 (BBVA), R31 (Banco Santander), R33 (Telefónica) and R35 (Técnicas Reunidas) and somewhat higher than 50% for R23 (Indra).

4.1.2. Recent financial crisis sub-period: September 2008 – April 2016

This sub-section includes the analysis for the second sub-sample, the recent financial crisis sub-period. During this crisis sub-period, the results of our proposed model using long-term interest rates are shown in *Table 5*.

First, all companies present a positive and statistically significant sensitivity to changes in the stock market return. In addition, the companies whose coefficients (and sensitivity) are greater than one, which means that they overreact to changes in the market, are R9 (Bankia), R17 (Gamesa), R26 (Arcelomittal), R27 (OHL), R28 (BBVA), R31 (Banco Santander), R32 (Sacyr) and R35 (Técnicas Reunidas). The least sensitive company to changes in the market return is R6 (Amadeus), followed by R10 (Bankinter), R14 (Enagas), R20 (International Consolidated Airlines Group) and R33 (Telefónica).

About 34% of the companies present statistically significant sensitivity to changes in long-term interest rates. R11 (Caixabank), R12 (Día), R16 (Ferrovial), R22 (Inditex), R26 (Mittal steel company), R27 (OHL), R30 (Repsol),

Table 5. Estimates for the crisis sub-sample and long-term interest rates

Companies	MR	ΔINT	SMB	ΔHML	RMW	ΔCMA	Adj. R²
R1	0.5538***	1.1233	0.0056**	–0.0013	–0.0054	0.0010	0.3191
R2	0.9377***	0.3967	0.0168***	–0.0028	0.0013	0.0025	0.2693
R3	0.8616***	2.6447	0.0101***	–0.0024	–0.0036	–0.0015	0.3855
R4	0.7509***	–0.8457	0.0095***	–0.0019	–0.0006	–0.0026	0.3499
R5	0.6805*	–2.6380	0.0153	0.0153	–0.0141	0.0056	0.5120
R6	0.1926*	1.7980	0.0022	–0.0016	–0.0038	0.0000	0.0126
R7	0.7392***	–1.7473	0.0123**	–0.0071*	–0.0150*	0.0020	0.2505
R8	0.6283***	–4.8723**	0.0039	–0.0020	–0.0098	0.0022	0.3256
R9	1.7963*	–20.2970*	0.0179	0.0098	0.0313	0.0143	–0.0421
R10	0.4179*	–1.8932	0.0059	–0.0080**	–0.0170**	0.0006	0.0989
R11	0.8922***	3.0069*	0.0066*	–0.0062**	–0.0126**	–0.0008	0.4428
R12	0.6183***	5.7550***	0.0026	–0.0021	–0.0090	–0.0032	0.2232
R13	0.5977***	0.8172	0.0071	–0.0118***	–0.0120	0.0058	0.1478
R14	0.4791***	0.6716	0.0034	–0.0027	–0.0020	–0.0016	0.2792
R15	0.8481***	–2.5674	0.0084	–0.0084**	–0.0025	0.0093*	0.2047
R16	0.9601***	3.5904**	0.0107***	–0.0052**	0.0057	0.0008	0.3838
R17	1.3657***	3.8221	0.0300***	–0.0079*	–0.0078	0.0051	0.4215
R18	0.7199***	2.3958	0.0056	–0.0119***	–0.0125**	0.0040	0.3429
R19	0.6058***	1.1924	0.0119***	–0.0030	0.0062	–0.0005	0.1497
R20	0.5305*	0.4664	0.0051	–0.0049	–0.0095	–0.0088*	0.1288
R21	0.6943***	1.1737	0.0070***	–0.0053***	–0.0057	–0.0014	0.4600
R22	0.5720***	3.3172***	0.0069***	0.0021	0.0057	–0.0005	0.3113
R23	0.5538***	–0.2806	0.0102***	–0.0031	–0.0014	0.0014	0.1857
R24	0.8376***	1.7086	0.0083**	–0.0091***	–0.0133**	0.0049	0.4196
R25	0.5473*	–0.5914	0.0041	0.0035	0.0006	0.0014	–0.0215
R26	1.4702***	10.8020***	0.0250***	–0.0052	–0.0064	–0.0011	0.5195
R27	1.3318***	6.4485**	0.0178***	–0.0121***	–0.0137	0.0047	0.4128
R28	1.0891***	1.3344	0.0064*	–0.0070***	–0.0121**	0.0031	0.5707
R29	0.5917***	1.4666	0.0058**	–0.0033*	–0.0003	–0.0017	0.3354
R30	0.9007***	3.1450*	0.0048	–0.0051**	–0.0059	–0.0015	0.4463
R31	1.1791***	2.9335*	0.0093***	–0.0059**	–0.0071	0.0042	0.5744
R32	1.8504***	4.7237	0.0180***	–0.0141***	–0.0081	–0.0021	0.5101
R33	0.5219***	–0.1121	0.0002	–0.0015	–0.0045	–0.0042	0.3420
R34	0.9215***	4.1983*	0.0095**	–0.0032	–0.0145**	–0.0016	0.3765
R35	1.0055***	7.5965***	0.0177***	–0.0006	0.0014	–0.0004	0.4601

Notes: **MR**: Spanish stock market return, **IR**: (long-term) interest rate, **SMB**: size factor, **HML**: value factor, **RMW**: profitability factor, **CMA**: investment factor.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Source: Own preparation from Eviews results.

R31 (Banco Santander), R34 (Mediaset) and R35 (Técnicas Reunidas) show a positive sensitivity, and in addition, Mittal steel company and Técnicas Reunidas overreact to changes in interest rates. According to Díaz and Jareño (2013), this positive effect could be explained because an increase in interest rates is considered as "good news" for investors in the context of crisis. In contrary, R8 (Banco Sabadell) and R9 (Bankia) have statistically significant and negative sensitivity to changes in this explanatory factor. So, long-term interest rates exhibit high explanatory power.

The "size" factor (SMB) is statistically significant for all companies, except for R5 (Aena), R6 (Amadeus), R8 (Banco Sabadell), R9 (Bankia), R10 (Bankinter), R12 (Día), R13 (Endesa), R14 (Enagas), R15 (FCC), R18 (Gas Natural Fenosa), R20 (IAG), R25 (Merlin Properties), R30 (Repsol) and R33 (Telefónica). The rest of the companies (about 60% of them) show positive sensitivity to changes in SMB. In addition, this sensitivity is higher for R17 (Gamesa), R26 (Arcelomittal), R27 (OHL), R32 (Sacyr) and R35 (Técnicas Reunidas), and lower for R1 (Abertis) and R29 (REE). Therefore, the SMB factor also shows high explanatory power.

The "value" factor (HML) influences significantly and negatively on 46% of the companies, specifically, R7 (Banco Popular), R10 (Bankinter), R11 (Caixabank), R13 (Endesa), R15 (FCC), R16 (Ferrovial), R17 (Gamesa), R18 (Gas Natural Fenosa), R21 (Iberdrola), R24 (Mapfre), R27 (OHL), R28 (BBVA), R29 (Red Eléctrica), R30 (Repsol), R31 (Banco Santander) and R32 (Sacyr). Among them, the highest sensitivity to changes in this factor corresponds to Red Eléctrica and the lowest to Sacyr.

For the "profitability" factor (RMW), the sensitivity is statistically significant and negative in about 20% of the companies, such as R7 (Banco Popular), R10 (Bankinter), R11 (Caixabank), R18 (Gas Natural Fenosa), R24 (Mapfre), R28 (BBVA) and R34 (Mediaset).

Finally, regarding the "investment" variable (CMA), it is only statistically significant and positive for R15 (FCC) and negative for R20 (IAG). Thus, the explanatory power of CMA is quite low.

As previously said, the explanatory power is quite different between companies. The mean adjusted R^2 is about 32%. Besides, the explanatory power exceeds 50% for R5 (Aena), R26 (Arcelomittal) and R32 (Sacyr) and almost reaches 60% for R28 (BBVA) and R31 (Banco Santander). Therefore, the explanatory power of the augmented Fama and French (2015) five-factor model increases in this recent financial crisis sub-period in comparison with the pre-crisis sub-period.

4.2. Short-term interest rate analysis

Additionally, to check the robustness of these results, the sensitivity of stock business returns to changes in short-term interest rates (proxied by 3-month treasury bill rates) has been tested in the extended Fama and French specification. Thus, the extended FF5 model that includes short-term interest rates is represented as follows:

$$R_{jt} = \alpha_j + \beta_j \cdot MR_t + \mu_j \cdot \Delta RF_t + \gamma_t \cdot SMB_t + \tau_t \cdot \Delta HML_t + \varphi_t \cdot RMV_t + \delta_t \cdot \Delta CMA_t + \varepsilon_{jt} \quad (2)$$

where, ΔRF_t is the non-expected change in the short-term (risk-free) nominal interest rate.

The results of this robustness exercise show that the sensitivity of Spanish companies to movements in the selected risk factors, using 3-month treasury bill rates, is in line with the results using fluctuations in 10-year government bond yields for all companies regardless of the sub-period examined.[13] This evidence is fully in line with some previous studies such as Ferrando et al. (2017), among others. Furthermore, these results confirm the reliability of previous results from the augmented FF5 model proposed in this research.

Table 6 summarizes the percentages of companies that show statistically significant sensitivities to variations in the explanatory variables in the full period as well as in the two sub-periods (pre-crisis and crisis) both in short- and long-term interest rates. In actual fact the percentage of companies with statistically significant sensitivity to the "size", "value", "profitability" and "investment" factors is slightly lower in the short-term interest rate analysis in comparison with the long-term interest rates analysis.

Table 6. Percentages of statistically significant sensitivities (short- and long-term interest rates), %

Period	Models/Variables	MR	ΔINT	SMB	ΔHML	RMW	ΔCMA
Full period	Long-term interest rates	97.14	28.57	71.43	17.14	25.71	37.14
	Short-term interest rates	97.14	11.43	51.43	11.43	22.86	31.43
	Difference	0.00	17.14	20.00	5.71	2.85	5.71
Pre-crisis sub-period	Long-term interest rates	92.86	21.43	42.86	14.29	3.57	14.29
	Short-term interest rates	89.29	3.57	46.43	14.29	10.71	7.14
	Difference	3.57	17.86	−3.57	0.00	−7.14	7.15
Crisis sub-period	Long-term interest rates	100	34.29	60.00	45.71	20.00	5.71
	Short-term interest rates	97.14	20.00	65.71	51.43	22.86	2.86
	Difference	2.86	14.29	−5.71	−5.72	−2.86	2.85

[13] These results for the whole sample period and by sub-periods (using short-term interest rates) are available upon request.

Nevertheless, the number of companies sensitive to changes in short-term interest rates is reduced by more than half. Thus, this result corroborates our choice of long- instead of short-term interest rates as explanatory variable.

5. CONCLUDING REMARKS

This paper analyses the sensitivity of company returns in the Spanish stock market to changes in a set of explanatory factors, such as the stock market return, long-term (and short-term) interest rates, and other risk factors proposed by Fama and French, which are: the "size" factor, the "value" factor, the "profitability" factor, and the "investment" factor.

Thus, the main objective of the present study is to determine the effect of each explanatory factor on the returns of the companies listed in the Spanish index IBEX-35 in the period from January 2000 to April 2016. In addition, to check the robustness of the results in the framework of the augmented Fama and French five-factor model, two robustness tests have been carried out. The first one estimates this model by splitting the whole sample period into sub-periods (pre-crisis and recent financial crisis). This robustness test may enable us to know which stock business returns are most sensitive to changes in the risk factors included in this study, considering the relevant economic and historical events, such as the fall of Lehman Brothers in September 2008 (Ferrando et al. 2017). To reach greater consistency in our conclusions, the second robustness test estimates the extended FF5 model using an alternative risk factor for the nominal interest rate: the short-term (instead of long-term) interest rate. As defended by previous literature, this robustness test corroborates the main results obtained in this research and our choice of long- instead of short-term interest rates as an explanatory variable.

The Spanish stock market return shows a positive and statistically significant effect on the companies' returns. The results obtained in the case of the interest rate as an explanatory variable show a negative and statistically significant sensitivity of the company returns to changes in this variable. Nevertheless, short-term interest rates seem to have a negative effect, meanwhile long-term interest rates would show a positive impact on some company returns (considering future expectations). Moreover, the effect of long-term interest rates on stock business returns would be greater than the impact of short-term interest rates, at least in terms of number of companies with statistically significant sensitivities to changes in interest rates.

Among the risk factors proposed by Fama and French, the "size" and the "value" factors show a high level of statistical significance in the whole sample

period and in the recent financial crisis sub-period. The "size" factor reveals a positive impact on stock business returns while the "value" factor produces a negative impact. In addition, the "profitability" and the "investment" factors also show a relevant level of statistical significance, mainly in the whole sample, with negative sign for "profitability" and positive sign for "investment". Although "profitability" and "investment" factors seem to be more relevant for the full period, the "profitability" factor also keeps its relevance in the crisis sub-period.

As far as the analysis at the sector level is concerned, it is remarkable that all but one of the 35 companies listed in the Spanish index (IBEX-35) are mainly affected by the variations in market returns. Moreover, sector 1 (Oil and Energy) shows one of the greatest percentages of companies sensitive to changes in the "size" and the "investment" factors, and sector 2 (Basic Materials, Industry and Construction) presents one of the highest percentages of companies sensitive to variations in the long-term interest rates as well as in the "size" factor. Companies of sector 5 (Financial and Real Estate Services) are highly sensitive to changes in the other risk factors proposed by Fama and French. Additionally, sectors 2 and 5 show the highest explanatory power. Thus, Fama and French five-factor model may be more suitable to forecast portfolio returns than their three-factor model.

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