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The Effects of Derivatives on the Earnings Volatility of Portuguese and Spanish Listed Companies

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Abstract: The main objective of this paper is to analyse the purposes and effects of using derivatives in Portuguese and Spanish firms. For this purpose, two panel data regression models were estimated, with accounting data and firms' financial cash flow data, as well as the fair value of derivatives. The aim of the first regression was to investigate the impact of the use of derivatives on earnings volatility. The second model was to investigate the use of derivatives through financial cash flows. The results of the first model suggest that an increase in the extent of derivatives reduces earnings volatility. The second model presents debt and exchange rate effects on cash flows that may cause changes in the fair value of derivatives. Furthermore, in the second model, operating income was statistically significant for the use of derivatives, these results may indicate that the extent of derivatives can be driven by operating income. The analyses conducted also indicate that firms engage derivatives for risk management purposes, thus these derivatives are mainly measured as a hedge accounting instrument. This research has contributed to the scientific literature on derivatives by investigating the effects of the use of derivatives on the volatility of earnings of Portuguese and Spanish non-financial firms, as well as how derivatives respond to the financial cash flow sensitivities of these firms.

Keywords: Fair value; derivatives; risk management

1 Introduction

How individuals react to risk is an empirical question (Damodaran, 2010). Risk is an important value creation factor for any company, and derivatives have become an essential tool for companies to economically manage their risks (Campbell et al., 2019).

The main emphasis of derivatives theory is the purpose of reducing the variability of corporate cash flows and, therefore, the possibility of reducing other costs associated with financial difficulties (Stulz, 1996). Derivatives provide a way for companies to protect their exposures to undesirable risks, as they allow companies to enter into contracts whose value moves in the opposite direction to the financial risks existing in companies (Campbell et al., 2019).

Financial markets suggest that derivatives, when well assimilated and used properly, are beneficial for sharing and controlling unwanted risks through hedge accounting strategies (Deng & Oren, 2006). However, the use of financial instruments in accordance with IFRS may affect earnings volatility and/or lead to adjustments in the firm's hedging behavior to achieve more desirable accounting results (Panaretou el al., 2013). For opponents of IFRS, companies mainly use derivatives to reduce their inherent business risk, however, measuring derivatives by the fair value method can provide greater short-term results in the financial statements and, consequently, the volatility of earnings (Zhang 2009).

Therefore, the objective of this paper is to investigate the impacts on the fair value extension of derivatives in response to financial cash flows, as well as the effects of financial instruments on earnings volatility. For this purpose, the study was carried out from a sample of non-financial companies whose shares are traded on the Euronext Lisbon Exchange and on the Madrid Stock Exchange.

Derivatives are normally present in companies, so this study makes important contributions, filling a gap in the analysis of the impact of financial instruments on the results of Portuguese and Spanish companies that use derivatives. First, the study scientifically corroborates, as it investigates the determinants of financial cash flows in the extension of fair value and the application of financial instruments by these companies, providing a better understanding of the subject. Additionally, the study contributes with a new analysis, investigating Portuguese and Spanish companies, for the scope of scientific studies that investigated the impact of financial instruments on the volatility of results of non-financial corporations.

The present study adopted as methodology the tools of descriptive statistics and the statistical method of estimation of ordinary least squares. The sample data is information from 232 Portuguese and Spanish non-financial companies from 2011 to 2020.

This article is structured as follows. Section two is dedicated to the literature review section and the definition of research hypotheses. Then, the sample selection criteria will be presented, and the proposed research methodology will be described. Subsequently, the results were obtained after descriptive and inferential statistical analyses. Finally, a section is dedicated to conclusions. Complementing the sample analysis, the research aims to identify possible areas of investigation to be explored in the future.

2 Literature Review and Research Questions

2.1 Financial instruments and earnings volatility

Financial markets suggest that derivatives, when well assimilated and used properly, are beneficial for sharing and controlling unwanted risks through hedge accounting strategies (Deng & Oren, 2006). The fair value of the derivative depends on the value and volatility of the underlying asset, as well as the assets or financial market indices on which the financial contracts traded are based (Dionne, 2013).

Zhang (2009) analyzed whether the adoption of accounting standards influences the risk management practices of companies using derivatives. In his empirical analysis, after verifying the reduction in the volatility of cash flows and risk exposures, the author suggested that the accounting rules made derivative activities of companies previously classified as hedge/ineffective_speculator more rational (Zhang, 2009). Complementing the idea, other authors have documented that companies for which reducing earnings volatility is one of the main objectives of business management are more likely to apply hedge accounting to measure the fair value of contracted derivates (Glaum & Klcker, 2011).

Subsequently, the authors Beisland & Frestad (2013) suggested that, if earnings stability is relevant for companies, these companies can adapt their risk strategies under the accounting regime to smooth the effects of current regulations.

The author Šodan (2015) examined the influence of fair value accounting on six measures of earnings quality: persistence, predictive ability and volatility, mark-to-market quality, conditional conservatism and, finally, value relevance. The author described that the concept of fair value can have a significantly different effect on the quality of earnings of companies located in Eastern European countries, because the focus of financial reports is less oriented to the needs of investors in the capital market and more directed to creditors, suppliers, and other users.

The study carried out by the authors Abdel-khalik & Chen, (2015) aimed to test whether the use of derivatives designated as cash flow hedge reduces earnings volatility. Additionally, the authors investigated the existence of a positive relationship between earnings volatility and the use of non-commercial derivatives.

According to Zhang (2009), managers prefer to reduce earnings volatility and, as a result, earnings smoothing may even sacrifice long-term value to smooth earnings, as lower earnings volatility helps reduce the company's perceived risk. The authors Graham et al. (2005) found that 78% of executives surveyed admit to sacrificing long-term value to smooth present earnings.

The analysis of exposure to accounting for the fair value of financial instruments is measured using the income statement approach (Bratten et al., 2012), this is because the measurement of derivatives contracted for risk management purposes can impact accounting results due to the standards accounting procedures to which companies are subject.

The discussion above suggests that institutional users of derivatives need to understand the best way to maximize their results, combining risk management practices with the use of financial instruments. This is because the measurement of the fair value of derivatives can affect their results. Thus, it is proposed to analyze the impact on earnings volatility resulting from variations in the extent of the fair value of financial instruments, and these derivatives can be measured as hedge accounting or for speculative purposes.

- H.1 What is the impact of measuring the fair value of financial instruments on the earnings volatility of Portuguese and Spanish companies?

2.2 Financial risk and derivatives

The proposal of risk management is to maximize the value of the company by reducing costs associated with different risk factors associated with its operational activities (Dionne, 2013). Risk management has as its main objective the elimination of costly results, that is, those results that would cause financial difficulties or make a company unable to carry out its investment strategies (Stulz, 1996).

A study aimed to analyze the strategies adopted to cover financial risks that may or may not make sense for companies (Froot et al., 1993). In this author's opinion, companies will want to protect their risks less, the more correlated these risks are with the cash flows that enable future investment opportunities. However, companies will want to hedge their risks the more those risks are correlated with their cash flows used as collateral.

Regarding the adoption of financial instruments, the authors Geyer-Klingeberg et al., (2019) stated that the determinants of the adoption of hedge accounting practices depend on the exposure of business activities to risk. Guay, (1999) and Guay & Kothari, (2003) share the same opinion, but consider that most companies adopt low coverage rates in relation to the risks to which their activities are exposed. Additionally, Guay & Kothari (2003) stated that companies, when optimistic, will use derivatives only if the estimated benefits of their hedging programs exceed their costs.

The authors Guay & Kothari (2003) simulated how companies react through the analysis of their derivative portfolios to extreme changes in asset prices. The authors' study was based on the characteristics of the derivatives portfolios of the companies in the sample, mainly on the contractual value and maturity of the derivatives.

Other studies have analyzed the different motivating aspects of the use of derivatives by corporations. After investigating Brazilian non-financial entities between 2010 and 2017, the authors Sticca & Nakao (2019) found statistically significant evidence that the company's level of exposure to exchange rate risk, as well as exchange rate depreciation, are determining factors for the adoption of hedge accounting.

Based on the literature review of studies with data from European companies, empirical investigations of the use of derivatives by these companies are lacking (Carroll et al., 2017; Šodan, 2015). However, some investigations carried out in this context aimed to analyze the impacts of the fair value of financial instruments of European companies listed in the Stoxx Europe Large 600 Index (Gebhardt, 2012), as well as in companies located in Eastern Europe (Šodan, 2015).

In general, research related to derivatives is carried out to understand what the motivators of companies are, as well as the subsequent impacts of contracting financial instruments. In the Portuguese and Spanish context, until now, few empirical studies have explored the context of financial instruments.

If financial instruments are an important component of risk management programs, changes in a company's derivative positions must be economically significant when compared to the objectives of adopting financial instruments (Guay & Kothari 2003). Thus,

in order to understand how financial cash flows impact risk management through the use of derivatives, the next research question is presented below.

- H.2 How do financial cash flow sensitivities influence the extent of fair value of companies' derivatives portfolio?

3 Variable Measurement and Research Design

3.1 Sample collection

The sample data refer to the years 2011 to 2020 and the information that was extracted is only from non-financial companies. The sample selection[1] process considered the following characteristics:

1. Portuguese and Spanish companies listed on Euronext Lisbon or on the Spanish Mercantile Exchange;
2. The companies´ accounting data are incorporated into the Eikon Database;
3. Available total assets data must have at least two years of data for those companies that used derivatives during the data collection period;
4. Available total assets data must have at least three years of data for those companies that did not use derivatives during the data collection period;
5. The companies are characterized in the database as non-financial companies.

After considering all the filters described for sample collection, information was obtained from 232 companies whose shares are listed on the stock exchange

Stock Exchange	Number of companies	Relative Frequency	Excluded companies	Number of companies	Relative Frequency
BME SPANISH EXCHANGE	210	85,7%	13	197	84,9%
Euronext Lisbon	35	14,3%		35	15,1%
Total	245			232	

Source: author's elaboration

Figure 1. Frequency of companies whose shares are traded on the stock exchange[2]

This sample selection process resulted in a total of 1,808 elements observed. The greatest representation of the elements observed are classified companies in the real estate sector, representing 23% of the sample, followed by classified companies in the industrial sector, which represent 19% of the sample data.

[1] The collection of sample data from the companies was carried out during the month of April 2022.
[2] The 13 companies excluded from the study did not meet the sample selection criteria.

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total	Total frequency
Real Estate	9	12	15	20	31	46	57	76	76	76	418	
% Total	7,1%	8,6%	9,9%	13,0%	18,7%	24,6%	28,4%	33,3%	33,6%	33,6%	23%	23%
Industrials	30	31	32	34	34	35	36	37	37	37	343	
% Total	23,8%	22,3%	22,5%	22,1%	20,5%	18,7%	17,9%	16,2%	16,0%	15,8%	19%	42%
Consumer Cyclicals	26	29	29	29	29	31	31	32	32	32	300	
% Total	20,6%	20,9%	20,4%	18,8%	17,5%	16,6%	15,4%	14,0%	13,4%	13,3%	17%	59%
Technology	12	15	15	17	17	19	20	21	23	23	182	
% Total	9,5%	10,8%	10,6%	11,0%	10,2%	10,2%	10,0%	9,2%	9,7%	10,4%	10%	69%
Basic Materials	15	15	15	16	16	16	17	17	17	17	161	
% Total	11,9%	10,8%	10,6%	10,4%	9,6%	8,6%	8,5%	7,5%	7,1%	7,1%	9%	78%
Healthcare	10	13	13	13	14	14	14	14	14	14	133	
% Total	7,9%	9,4%	9,2%	8,4%	8,4%	7,5%	7,0%	6,1%	5,9%	5,8%	7%	85%
Utilities	9	9	9	9	9	10	10	14	14	14	107	
% Total	7,1%	6,5%	6,3%	5,8%	5,4%	5,3%	5,0%	6,1%	6,3%	6,2%	6%	91%
Consumer Non-Cyclicals	9	9	9	9	9	9	9	9	9	9	90	
% Total	7,1%	6,5%	6,3%	5,8%	5,4%	4,8%	4,5%	3,9%	3,8%	3,7%	5%	96%
Energy	6	6	6	7	7	7	7	7	9	9	71	
% Total	4,8%	4,3%	4,2%	4,5%	4,2%	3,7%	3,5%	3,1%	3,8%	3,7%	4%	100%
Educational Services	-	-	-	-	-	-	-	1	1	1	3	
% Total	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,4%	0,4%	0,4%	0%	100%
Number of total observations	**126**	**139**	**143**	**154**	**166**	**187**	**201**	**228**	**232**	**232**	**1.808**	

Source: Construction of information using the data available in the Eikon database

Figure 2. Sector of sample companies

3.2 Regression Model

The methodology to be used in this paper will be the panel data regression model, because this model allows to study, simultaneously, the changes of the variables in a time among different variables. The quantitative approach adopted in the investigation was supported the studies carried out by Guay, (1999); Zhang, (2009); Glaum & Klcker, (2011); Abdel-khalik & Chen, (2015); Šodan, (2015); Carroll et al., (2017); Sticca & Nakao, (2019). The research questions were previously presented and agree with the following regression models estimated on panel data.

1. Model 1- Estimated regression using the fixed effects model:

$$Earning_{it} = \beta_0 + Hedge_{it-1}\,\beta_1 + Especulative_{it}\beta_2 + Fx_{it-1}\,\beta_3 + Cash_{it}\,\beta_4 + Ebt_{it}\beta_5 + Assets_{it}\,\beta_6 + \varepsilon_{it}\,,$$

2. Model 2- Estimated regression using the pooled model:

$$Derivative_{it} = \beta_0 + Hedge_{it-1}\beta_1 + Fx_{it}\,\beta_2 + Cash_{it}\,\beta_3 + Ebt_{it}\,\beta_4 + Debt_{it}\beta_5 + Interest_{it}\,\beta_6 + \varepsilon_{it}.$$

In both models, i represents each of the companies in the sample that will be collected and t the time horizon of the observations. $\beta_k, with\ k = 1,2,3,4,5,6$ corresponds to the parameters that will be estimated by the model, where:

- $\boldsymbol{Earning_{it}}$ = Represents the volatility of earnings measured over four quarters of company i in period t.

To construct this variable in the model, the four-period standard deviation of quarterly net income before extraordinary items was calculated. For companies that did not have data available for all quarters, the maximum correction was up to one year prior to the observed year.

- $\boldsymbol{Derivative_{it}}$ = Represents the fair value of total derivatives by company *i* in period *t*;
- $\boldsymbol{Hedge_{it-1}}$ = Represents the fair value of derivatives to hedge accounting by company *i* in period *t*-1;
- $\boldsymbol{Especulative_{it}}$= Represents the fair value of derivatives for speculative purposes by company *i* in period *t*.

These proposed variables characterize the negative fair value of financial instruments. The analyzed data represent the calculation of quarterly averages of fair value of available financial instruments for one year. In this study, the variables analyzed take three different forms: derivatives measured as hedge accounting, speculative derivatives, and the sum of both.

- $\boldsymbol{FX_{it}\ and\ FX_{it-1}}$ = Represents the company's exchange rate effects *i* in period *t* and in period *t*-1;
- $\boldsymbol{Interest_{it}}$ = Represents the interest paid in cash by the company *i* in period *t*.

The first variable is calculated as the average value of quarterly currency effects data, representing the increase/decrease in cash and cash equivalents due to changes in exchange rates for the defined fiscal period. The variable $Interest_{it}$ represents the total interest paid in cash during the defined period.

- $\boldsymbol{Cash_{it}}$ = Represents the sum of cash flows from financing and dividend payments in a company' s fiscal year *i* in period *t*.

The purpose of this variable is to represent the payments/receipts of financing obtained with third-party capital and the payments/receipts of financing originated from partners. In place of the use of derivatives, the authors Chang et al., (2016) proposed the control variable represented by debt convertible into preferred shares. According to the authors, preferred stocks reduce the probability of financial difficulties by paying periodic dividends instead of interest.

- $\boldsymbol{Debt_{it}}$ = Represents the debt issued by company *i* in period *t*.

The inclusion of this variable is supported by the study by the authors Carroll et al. (2017) who found that leverage and floating rate debt positions are positively correlated with interest rate derivatives.

- $\boldsymbol{Ebt_{it}}$ = Represents the company's Ebt (earnings before taxes) *i* in period *t*;

- $\boldsymbol{Asset_{it}}$ = Represents the company's assets *i* in period *t*.

Zhang (2009) using Pearson's test found that the size of companies is an important determining factor for the level of risk exposure. Thus, the variables Ebt_{it} and $Asset_{it}$ represented the size of the company. The variables Ebt_{it} and $Asset_{it}$ in the first model were calculated with lag data. In the second model, the lag effect of the Ebt_{it} data was not applied.

4 Empirical Results

4.1 Descriptive statistics – characteristics of companies that use derivatives

As mentioned before, this sample selection process resulted in a total of 1,808 observed elements. Then, in order to analyze the companies that use financial instruments, the sample data were classified into two categories. Companies (N) are classified as companies that did not report any accounting of the fair value of derivatives in each year observed, while companies (S) are classified as companies that reported in their accounting items at least one quarter the fair value of contracts.

As described in figure 3, as of 2016, the total assets of companies that declared themselves to be users of financial instruments showed higher values when compared to companies that did not declare themselves to be holders of financial instrument contracts in the analysed period.

Companies that use derivatives in relation to the sample with valid data (%)

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Avaible data	126	139	143	154	166	187	201	228	232	232
Avaible not data	106	93	89	78	66	45	31	4	-	-
Total	232	232	232	232	232	232	232	232	232	232

Analyzed data
1.808
512

Year (€ Millions)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total	%Sample
Companies (N)	106	92	87	89	103	118	128	146	139	141	1.149	64%
Minimum	7,3	0,3	0,7	1,1	1,3	3,0	1,0	3,2	4,0	4,6		
Maximum	129.623	129.773	118.862	122.348	120.329	17.408	19.621	20.231	21.684	28.391		
Average	6.315	4.540	2.952	2.714	2.740	1.221	1.159	1.062	1.129	1.027		
Median	658	265	218	184	173	138	144	110	118	128		
Standard deviation	16.978	15.840	13.004	13.200	12.343	3.062	3.101	3.070	3.201	3.215		

Year (€ Millions)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total	%Sample
Companies (S)	20	47	56	65	63	69	73	82	93	91	659	36%
Minimum	86,2	26,4	10,2	3,2	2,5	2,8	3,0	2,5	6,6	7,9		
Maximum	97.017	94.123	89.787	93.742	104.664	123.641	115.066	114.047	122.369	122.518		
Average	7.177	8.116	9.009	7.787	7.770	9.406	9.065	8.238	7.849	8.088		
Median	1.130	1.667	2.414	1.951	1.256	1.285	1.405	1.450	1.000	1.147		
Standard deviation	21.486	17.393	17.475	16.024	17.163	21.857	20.866	19.843	19.729	18.900		

Companies that use derivatives in relation to the sample with valid data (%)

	15,9%	33,8%	39,2%	42,2%	38,0%	36,9%	36,3%	36,0%	40,1%	39,2%

Source: Data from Total Assets - Eikon

Figure 3. Descriptive statistics: total assets

In the observed period, only 36% of the companies declared in their accounting reports some amount resulting from the adjustment of the fair value of some category of financial instrument contract. Companies classified as companies in the industrial, real estate, and consumer cyclicals, together, represent 51% of the observations that declared the fair value of financial instruments in the observed period.

Sector/Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Relative Frequency	Absolute Frequency
Industrials	5	12	13	17	15	14	15	17	16	16	21%	21%
Real Estate	2	3	4	5	5	10	13	20	24	23	17%	38%
Consumer Cyclicals	1	7	8	8	7	9	10	10	12	12	13%	51%
Basic Materials	1	7	7	7	8	8	8	8	8	8	11%	61%
Technology	1	6	7	9	10	10	9	9	9	8	12%	73%
Energy	4	4	3	4	4	5	6	7	9	9	8%	81%
Consumer Non-Cyclicals	1	2	5	5	5	4	4	3	7	7	7%	88%
Utilities	3	4	6	6	6	6	6	6	5	5	8%	96%
Educational Services	0	0	0	0	0	0	0	0	0	0	0%	96%
Healthcare	2	2	3	4	3	3	2	2	3	3	4%	100%
Total companies using derivatives	20	47	56	65	63	69	73	82	93	91	659	
No. of Companies with valid data - Total	126	139	143	154	166	187	201	228	232	232	1808	
% of companies using derivatives	15,9%	33,8%	39,2%	42,2%	38,0%	36,9%	36,3%	36,0%	40,1%	39,2%	36,4%	

Source: Construction of information using the data available in the Eikon database

Figure 4. Quarterly data available on the fair value of liabilities of derivative contracts

After collecting the quarterly data available in the database for the 232 companies, a total of 2,008 observations of short-term and long-term fair value quarterly data were reported by the companies.

	Total quarterly information				Total quarterly information			
	Fair Value - Hedging				Fair value Speculative			
Year	Short Term	Long Term	Total	Relative Frequency	Short Term	Long Term	Total	Relative Frequency
2011	15	14	29	1%	0	0	0	0%
2012	33	37	70	4%	1	1	2	5%
2013	82	71	153	8%	1	1	2	5%
2014	102	86	188	10%	1	1	2	5%
2015	110	91	201	10%	1	2	3	8%
2016	114	115	229	12%	2	2	4	10%
2017	117	120	237	12%	2	2	4	10%
2018	116	134	250	13%	5	1	6	15%
2019	129	155	284	14%	6	1	7	18%
2020	150	178	328	17%	7	2	9	23%
Total	968	1.001	1.969	100%	26	13	39	100%
Percentage of total			*98%*				*2%*	
Total Information: Hedging + Speculative							2008	

Source: author's elaboration

Figure 5. Sample Collection - Fair Value

Based on descriptive statistics of the fair value of financial instrument contracts, it can be suggested that the sample companies adopt prudent risk management practices by keeping financial instrument contracts in their portfolios of assets designated as derivatives for hedge accounting.

Then, the data are presented from the perspective of the representativeness of the use of derivatives by sector. Companies in the utilities and energy sector are the companies that most presented data observed in fair value items in the observed period, thus, it is possible to suggest that these business sectors are the ones that most use financial contracts instrument.

Sector/Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Real Estate	22,2%	25,0%	26,7%	25,0%	16,1%	21,7%	22,8%	26,3%	31,6%	30,3%
Industrials	16,7%	38,7%	40,6%	50,0%	44,1%	40,0%	41,7%	45,9%	43,2%	43,2%
Consumer Cyclicals	3,8%	24,1%	24,1%	24,1%	27,6%	25,8%	25,8%	25,0%	25,0%	25,0%
Technology	33,3%	26,7%	20,0%	23,5%	23,5%	26,3%	30,0%	33,3%	39,1%	39,1%
Basic Materials	6,7%	40,0%	46,7%	56,3%	62,5%	62,5%	52,9%	52,9%	52,9%	47,1%
Healthcare	20,0%	15,4%	23,1%	30,8%	21,4%	21,4%	14,3%	14,3%	21,4%	21,4%
Utilities	11,1%	77,8%	88,9%	88,9%	77,8%	90,0%	100,0%	71,4%	85,7%	85,7%
Consumer Non-Cyclicals	33,3%	44,4%	66,7%	66,7%	66,7%	66,7%	66,7%	66,7%	55,6%	55,6%
Energy	16,7%	33,3%	83,3%	71,4%	71,4%	57,1%	57,1%	42,9%	77,8%	77,8%
Educational Services	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%

Source: Construction of information using the data available in the Eikon database

Figure 6. The use of financial instruments by sector

4.2 Descriptive statistics – other analysed data

In relation to the impact of earnings volatility, the averages and standard deviation of the collected observations were calculated. In the data collection process, it was found that none of these companies presented the total amount of information published in the analysed period.

Earning - Net income before extraordinary items												Total - Number of observations
Type of information - Quarter - (€ Millions)												
Year	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	
Number of observations	377	355	370	387	414	448	476	504	573	600	681	5185
Average	63	26	18	21	21	21	29	34	31	27	18	
Maximum	3.475	1.351	982	1.148	792	834	958	1.052	1.122	1.157	1.263	
Minimum	- 36	- 536	- 509	- 657	- 746	- 350	- 214	- 403	- 713	- 954	- 826	
Standard deviation	352	141	130	149	109	98	111	129	137	137	143	

Source: Construction of information using the data available in the Eikon database

Figure 7. Quarterly Earning

In addition, for the other variables analysed, the means and standard deviation of the collected observations were calculated. In the process of collecting the other sample data, it was also found that none of these companies presented the total amount of information published in the analysed period.

(€ Millions)

Type of information	Interest			Cash Effects			Exchange variation effects			Debt Issuance			Ebt		
	Yearly			Yearly			Quarterly			Quarterly			Quarterly		
Year	Number of observations	Average	Standard deviation	Number of observations	Average	Standard deviation	Number of observations	Average	Standard deviation	Number of observations	Average	Standard deviation	Number of observations	Average	Standard deviation
2011	76	131	298	125	-192	849	143	-9	56	66	495	1.785	141	559	1.969
2012	87	95	233	134	-133	642	140	0	89	67	1.100	2.587	155	530	2.045
2013	90	97	233	137	-163	544	145	-28	148	64	698	1.764	161	460	1.774
2014	103	82	203	148	-238	1.366	171	12	224	68	876	2.268	170	380	1.339
2015	116	67	177	159	-153	618	167	-7	92	72	781	2.132	182	369	1.275
2016	134	49	149	180	-122	504	172	4	28	73	1.135	2.954	204	354	1.365
2017	146	42	124	196	-46	395	178	-12	62	84	1.034	2.794	220	339	1.352
2018	173	38	119	222	-101	536	196	-6	28	93	934	2.770	248	324	1.342
2019	183	37	119	230	-92	766	201	2	16	86	845	2.583	259	325	1.289
2020	180	32	83	229	-18	739	223	-28	57	90	835	2.264	258	281	1.248
Total	1.288			1.760			1.736			763			1.998		

Source: Construction of information using the data available in the Eikon database

Figure 8. Descriptive Statistics - Other Data

Next, the Pearson determination coefficients estimated with the variables of the analysis are presented. Pearson's test presents the correlation between the variables, and the observed results provide preliminary evidence between the volatility of earnings and the fair value of financial instruments.

It is also possible to verify a positive correlation between the fair value of derivatives and interest payments. Additionally, the Person's test resulted in a negative correlation between the fair value of derivatives and the effects of financing (represented by the variable Cash). In addition, the negative correlation of the fair value of financial instruments with the effects of exchange rate variability on cash flows is evidenced.

Hedge	Especulative	Fx	Cash	Earning	Debt	Assets	Ebt	Derivative	Interest	
1,000	0,014	-0,171	-0,364	0,246	-0,097	-0,099	0,560	0,791	0,393	Hedge
	1,000	0,000	0,008	-0,002	0,017	0,012	0,007	0,004	0,010	Especulative
		1,000	0,153	-0,200	0,246	0,282	-0,367	-0,132	-0,067	Fx
			1,000	-0,453	0,037	0,458	-0,595	-0,301	-0,348	Cash
				1,000	-0,035	-0,079	0,529	0,299	0,430	Earning
					1,000	0,157	0,010	-0,004	0,060	Debt
						1,000	-0,076	0,040	-0,024	Assets
							1,000	0,487	0,462	Ebt
								1,000	0,469	Derivative
									1,000	Interest

Interpretation of coefficients

Correlations from 0.10 to 0.30 are considered low, in the range from 0.30 to 0.70 they are moderate and above 0.7 strong. The interpretation of the coefficients is the same for both a positive and a negative correlation.

Source: Construction of information using the data available in the Eikon database

Figure 9. Correlation coefficients - Pearson's Test

As the effects of multicollinearity are not controlled, the Variance Inflation Factor (VIF) test of the two regression models was performed. VIF values up to 1 do not indicate multicollinearity, from 1 to 10 are acceptable. The results indicate the presence of acceptable multicollinearity between the variables.

Model 1	Hedge (t-1)	Especulative	FX (t-1)	Cash	Ebt	Asset
	1,2	1,001	1,119	1,599	1,067	1,363

Model 2	Hedge (t-1)	FX	Cash	Ebt	Debt	Interest
	1,698	1,271	1,532	2,443	1,115	1,369

Source: author's elaboration

Figure 10. Variance Inflation Factor (VIF) Test

4.3 The regression models

Before executing the proposed models, tests were carried out to verify which is the best regression model to be used[3]. Then, it was found that the first model most suitable for the first regression was the fixed effects model, and the pooled model is the most appropriate model for the second regression.

Model 1 - Estimated regression using the fixed effects model				
Dependent variable	Earning			Expected Signal
Independent variables	*Coefficient*	*p-value*		
const	3,37E+07	<0,0001	***	
Hedge (t-1)	−0,198569	0,0205	**	-
Especulative	−0,0181268	<0,0001	***	-
FX (t-1)	0,547844	<0,0001	***	+
Cash	0,00669024	<0,0001	***	?
Ebt	−0,0479754	<0,0001	***	?
Asset	−0,0504284	0,0322	**	-
R-square LSDV		50,54%		
Number of observations	232	p-value		
Wald Test	1,67417E+14	0		

F statistic
F(231, 1850) = 4,96267 - p-value 5,92216e-087

Breusch-Pagan test stats:
LM = 300,388 - p-value = prob(qui-square(1) > 300,388) = 2,71105e-067

Hausman test stats:
H = 316,753 - p-value = prob(qui-square(6) > 316,753) = 2,09752e-065

Model 2 - Estimated regression using the pooled model				
Dependent variable	Derivative			Expected Signal
Independent variables	*Coefficient*	*p-value*		
const	80245,2	0,8782		
Hedge (t-1)	0,900564	<0,0001	***	+
FX	0,112943	0,0013	***	-
Cash	−0,00899333	<0,0001	***	?
Ebt	0,0155011	<0,0001	***	+
Debt	0,00949723	<0,0001	***	?
Interest	−0,0469942	0,0663	*	-
R-square		77,25%		
Number of observations	232	p-value		
White Test	LM = 1542,09	0		

F statistic
F(231, 1850) = 1,1773 p-value 0,0432404

Hausman test stats:
H = 248,478 - p-value = prob(qui-square(6) > 248,478) = 8,67446e-051

* Indicates statistical significance at the 10% level
** Indicates statistical significance at the 5% level
*** Indicates statistical significance at the 1% level

Source: author's elaboration

Figure 11. Results observed from multiple regression models

[3] Test results to verify the best panel data model for the sample are reported in table 10.

4.3.1 Impact of derivatives on earnings volatility

In the first model, it is estimated that 50.54% of earnings volatility is explained by control variables. For both variables that represent the fair value of derivatives, whether these instruments are accounted for as derivatives for speculative purposes or accounted for hedge accounting purposes, the relationship with earnings volatility is statistically significant and negative. The results observed for both variables in the model confirm the results obtained by the authors Abdel-khalik & Chen, (2015) who analyzed how the volatility of results influences managerial decisions regarding the level of contracting derivatives.

In the models estimated by the authors Panaretou et al (2013) found that changes in the fair value of derivatives that do not qualify for hedge accounting can increase the volatility of earnings. The results obtained by this author are contrary to the results of the model proposed in this study.

The earnings volatility is sensitive to exchange rate effects and financing effects on cash flow, both variables are represented by the variables Fx_{it-1} e $Cash_{it}$. Based on the observed results, it is possible to suggest that the negative impact on earnings volatility caused by measuring the fair value of derivatives is offset by current financial impacts. In the proposed model, the Fx_{it-1} parameter estimates a variation of 0.54 in the volatility of earnings for the variation of 1 unit in the impacts arising from foreign exchange financial flows. In the study by Muller (2020), the author also found based on her empirical results that portfolio earnings are more sensitive to changes in exchange rates.

Additionally, the volatility of earnings in the estimated model is statistically significant for operational results before taxes (Ebt_{it}), and for company size ($Asset_{it}$). Such results contradict those observed by the author Zhang (2009), in his model, although there is a high correlation between the size of the company and the other variables, the size of the company has no statistical significance for the volatility of earnings.

4.3.2 The impact of cash flow and results on the fair value of derivatives

In the second model, it is estimated that 77.25% of the variability in the measurement of the fair value of derivatives is explained by the control variables. The estimated coefficient for the $Hedge_{it-1}$, variable confirms the idea that companies are consistent in the use of derivatives. Based on the results observed in the variable $Hedge_{it-1}$, it is possible to suggest that companies contract derivatives with long-term maturity. To complement the analysis, Figures 12 presents the average of the fair values measured by the companies, considering the composition of the short and long term.

(€ Millions)	Fair Value - Hedging				Fair value Speculative			
Year	Short Term	Long Term	% LT Annual	Total	Short Term	Long Term	% LT Annual	Total
2011	852	923	52%	1.775	0,0	0,0		0
2012	3.796	1.012	21%	4.808	0,6	0,3	32%	1
2013	2.330	8.650	79%	10.981	0,3	4,9	95%	5
2014	5.610	8.903	61%	14.513	0,5	1,3	72%	2
2015	9.137	8.979	50%	18.117	0,3	0,4	54%	1
2016	7.052	11.261	61%	18.313	77,6	0,7	1%	78
2017	5.316	9.637	64%	14.952	3,9	2,6	40%	6
2018	5.524	10.357	65%	15.881	4,1	1,8	31%	6
2019	7.701	14.055	65%	21.756	3,4	1,3	28%	5
2020	9.272	20.169	69%	29.440	6,3	1,9	23%	8
% Total	31%	69%			77%	23%		

% LT - Percentage of long-term fair value of the observed total

Source: author's elaboration

Figure 12. Annual average fair value

The variables FX_{it} and $Interest_{it}$ are statistically significant, however, the variable FX_{it} showed a positive sign, contrary to the expected sign. First, it is concluded that the extent of financial instruments is influenced by cash flows from exchange rate effects and interest rate risks. The estimated signal for the exchange rate effects on cash flow agrees with the study carried out by the authors Sticca & Nakao, (2019) who showed that exchange rate gains/losses in the cash flow statement positively affect deferred losses in OCI. The results observed by the variable $Interest_{it}$ agree with the empirical results observed by the author Guay, (1999) who found that interest rates are negatively related to starting a derivatives program.

In the analyzed model, for both variables that represent cash flows from financing activities, whether equity financing ($Cash_{it}$) or third-party borrowing ($Debt_{it}$), their changes reflect the extent of fair value of financial instruments. The authors Carroll et al. (2017) found that leverage and floating rate debt positions are positively correlated with interest rate derivatives. The results estimated in the present model agree with the results obtained by the authors Carroll et al. (2017).

According to the authors Chang et al., (2016) and Nance et al., (1993) the capitalization of resources via shares reduces interest payments, so these alternatives reduce the incentive to hedge with derivatives (Nance et al., 1993). The present estimated model agrees with the statements of both authors, so it is verified that the impacts of equity financing ($Cash_{it}$) reduce the extent of the fair value of derivatives.

Another finding in the second model is that current operating results (Ebt_{it}) are statistically significant with the extent of the derivatives' negative fair value, this relationship being positive. Consequently, gains or losses on derivatives under IFRS may affect the income statement in a different financial period than changes in the fair value of the hedged item (Panaretou et al., 2013).

Based on the results obtained, it is possible to suggest that the increase in results increases the extent of the fair value of derivatives. As the fair value variable of financial instruments is represented by the current liability position, this reflects the opposite

exposure to the risk component of the hedged asset or liability. Thus, for hedged assets that are not yet measured in current income, subsequently, the fair value of their derivative instruments measured as a hedge will be offset in operating income (if the operations are considered effective in accordance with accounting standards).

5 Conclusions

The present study investigated two main questions. The first question aimed to analyze the impact of the use of financial instruments on earnings volatility. Then, the second question investigated how the extent of derivatives is influenced by companies' financial cash flows.

The study was based on a sample of 232 non-financial companies listed on Euronext Lisbon and on the Madrid Stock Exchange over a period of ten years, the data are analyzed using descriptive and inferential statistical tools. The first proposed model aimed to analyze the connection between earnings volatility and the use of financial instruments. The second proposed model was intended to analyze the impacts of financial cash flows on the extent of the fair value of derivatives.

In relation to the first estimated model, the control variables explain around 50% of earnings volatility. In the second estimated model, the control variables explain around 77% of the changes in the extent of the fair value of derivatives. Based on the sample data, it was possible to verify that only 36% of the companies in the observed period used financial instruments and most of the user companies use derivatives for hedging purposes.

In the first model, it is observed that the financial instruments contracted for speculative purposes and measured as hedge accounting, are statistically significant in terms of earnings volatility, and both relationships with earnings volatility are negative. Based on the results obtained, it is possible to suggest that the volatility of results is lower when there is a reduction in the extent of the fair value of derivatives for hedging and speculation purposes. Furthermore, in the first model, it was found that the impact of financial cash flows, such as exchange rate effects and debt movements, are statistically significant for earnings volatility.

In the second model, it is observed that the extent of the fair value of derivatives has statistical significance for the exchange rate impacts on cash flow and cash flows related to debt positions. Then, based on the observed results of the second model, it is possible to state that financial cash flows influence the extent of the fair value of financial instruments.

In addition, these results corroborate that the use of derivatives by these companies is related to financial risk management activities, as the extent of the fair value of derivatives responds to movements in financial cash flows. These derivatives are mainly contracted with long-term maturities.

The results presented in this study contribute scientifically by describing the profile of Portuguese and Spanish non-financial companies that use derivatives in their financial risk management activities, as well as the impacts of the use of financial instruments on the accounting and financial results of these companies.

Finally, the findings obtained in the study contribute to the body of empirical studies on the use of financial instruments and the uses of hedge accounting, mainly because

financial derivatives are considered an important tool for companies' financial risk management activities. However, the adoption of such risk management programs through derivative in corporate activities, as presented in the estimated models, may have economically significant effects on volatility, as well as on the companies' results.

The main limitation of the study is that it was entirely based on data extracted from the Eikon database. Therefore, the entire analysis was based on the negative fair value that the companies kept accounted for in their accounting reports and that were available in the database.

For a better analysis of the data, a complementary study may contain data obtained directly from the companies' reports, such as information on contract maturities, positive fair value, and the financial instruments contracted in the risk management of companies.

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