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Does the use of derivatives influence the cost of equity?

The case of Portuguese listed non-financial companies.

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Biographical Note

Daniel Filipe da Cunha Gachineiro was born in Viana do Castelo in 1997. Completed secondary school in Paredes de Coura, studying Science and Technology. His curiosity for management and financial markets led him to pursue a management degree at the University of Minho, which he completed in 2018. This degree gave a fundamental contribution in the decision of his enrolment in the Master in Finance at Faculdade de Economia do Porto, which culminates with this dissertation.

Since, September 2019 he started is professional career at Deloitte, providing Audit & Assurance services, experiencing contacts with companies from Portugal, Mozambique and the United States.

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Abstract

The importance of derivatives has grown over the past decades and nowadays they assume a relevant role in the financial markets. When speaking about derivatives is fundamental to refer their role in risk management, since it has become a common practice the use of derivatives in hedging strategies. This research is aimed at exploring how the use of derivatives instruments impact the cost of equity of Portuguese non-financial listed companies and what are the variables that drive the impact, completing the existing studies by giving insights about the Portuguese market, absent in the existing literature.

Our methodology relies on panel data, with OLS regressions with firm fixed effects models being estimated and we performed a multivariate analysis. The sample comprises 41 companies from different economic sectors and spans 6 years, from 2014 to 2019. Data were retrieved from the *Datastream* database and from the annual reports of each company.

Based on our multivariate results, we found the impact of the use of derivatives (negative), the book-to-market (positive) and illiquidity (positive) on the cost of equity, to be statistically significant and consistent with our initial prediction and the existing literature. Other variables such as the leverage level, size, number of segments and the ownership30 are statistically insignificant.

We conclude by analyzing each specific type of derivative instrument, providing evidence that the use of interest rate derivatives and currency derivatives allow companies to reduce their cost of equity.

Key-words: Derivatives; cost of equity; risk management

JEL-Codes: G12; G13; G32

Resumo

A importância dos instrumentos derivados tem crescido nas últimas décadas e, atualmente, estes instrumentos apresentam um papel muito importante nos mercados financeiros. Abordando este tema, é fundamental referir a sua relevância na gestão ativa de riscos, tendo-se tornado comum as empresas adotarem estratégias de cobertura de risco utilizando instrumentos derivados. Esta pesquisa tem como principal objetivo explorar de que modo o uso de instrumentos derivados pode afetar o custo de capital próprio das empresas não financeiras cotadas no mercado Português, e perceber quais as variáveis que exercem um maior impacto no mesmo. Este estudo pretende complementar a pesquisa existente sobre o tema, providenciando informação, até então inexistente, sobre o mercado Português.

A metodologia utilizada baseia-se na utilização de dados em painel e na estimação de modelos *OLS* com efeitos fixos, tendo sido realizada uma análise multivariada. A nossa amostra é composta por 41 empresas e abrange 6 anos, de 2014 a 2019. Todos os dados foram retirados da base de dados *Datastream* e dos relatórios e contas anuais das empresas.

Com base nos resultados obtidos através da nossa análise multivariada, o uso de instrumentos derivados (negativo), o indicador *Book-to-market* (positivo) e o rácio de iliquidez (positivo) apresentam um impacto estaticamente significativo no custo de capital próprio, o que vai de encontro com as nossas espectativas iniciais e com a literatura já existente. Outras variáveis, como o nível de endividamento, o tamanho, o nº de seguimentos ou a variável *ownership30*, são estatisticamente insignificantes, logo não nos permitem retirar nenhuma conclusão.

Concluímos a nossa pesquisa, providenciando evidência que os instrumentos de cobertura de taxas de juro e de câmbio são os principais responsáveis pela redução verificada no custo de capital próprio.

Palavras-chave: Derivados; custo de capital próprio; gestão de risco

Códigos JEL: G12; G13; G32

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1. Introduction

The importance of derivatives has grown over the past decades and nowadays they assume a relevant role in the financial markets. As stated by Hull (2011, pp. 1) "Whether you love derivatives or hate them, you cannot ignore them! The derivatives market is huge - much bigger than the stock market when measured in terms of underlying assets. The value of the assets underlying outstanding derivatives transactions is several times the world gross domestic product." When speaking about derivatives is also fundamental to refer their role in risk management, since, the risk management trough financial hedging has become a common practice. As Campello, Lin, Ma and Zou (2011) refer the world's largest companies use derivatives to hedge their business operations and financial risks. Arguably, we can state that nowadays, these mechanisms of risk management are essential for firms in order to prevent financial distress.

This increased relative importance of the use of derivative instruments encourages and adds relevance to research aimed at exploring not only how companies manage their financial risks, but also what type of instruments companies use and how they affect, specifically the cost of equity. This study focusses on this less explored strand of literature, whose conclusions can help managers when deciding which hedging strategies to adopt and what type of instruments to use.

According to Modigliani and Miller (1958) framework, under perfect market conditions, risk management decisions have no impact on the outcome of firms and thus, these companies would not engage in hedging activities once they do not create any additional value. However, when we adopt a more realistic viewpoint on the capital markets, we can identify some market imperfections, such as transactions costs, agency costs, asymmetric information or taxes. When we consider the existence of such imperfections that can justify the need of companies to engage in hedging decisions. Smith and Stulz (1985) argue in their investigation that it is possible for companies to create value through hedging strategies. Froot, Scharfstein and Stein (1993) argue, for instance, that hedging activities alleviate the underinvestment problem and Mayers and Smith (1982) argue that it can reduce the costs of financial distress. Different authors present several factors that may encourage companies to engage in hedging activities, however some authors,

such Ahmed, Judge, and Mahmud (2018) argue that most of the studies that explain the positive relation between the use of derivatives, the cost of equity and firm value, fail to control for endogeneity problems. These differences motivate additional research on some effects of hedging with derivatives that remain unclear. Some of the aspects that deserve further investigation relate with the impact that hedging decisions can have on tax liabilities, on debt capacity, on the mitigation of the underinvestment problem and on costs of financial distress. Based on this, the current research intends to bring new empirical evidence to the literature discussion that already exists with respect to other countries; but mainly, it intends to produce evidence on the relationship between the cost of equity and the use of derivatives in the Portuguese market, since we denoted a lack of research about this topic on the literature. Consequently, the goals of this investigation are 1) to test the impact of the use of derivatives on de cost of equity; 2) to test what type of derivatives have greater impact in reducing the cost of equity.

The methodology used is based on panel data, spanning from 2014 to 2019, and follows the model presented by Gay, Lin and Smith (2011) and Ahmed et al. (2018). The sample is comprised of 41 companies, from which 26 are derivative users and 15 are derivatives non-users.

Our findings suggest that the usage of derivatives for risk management has a negative impact on the cost of equity, namely trough the interest rate derivatives and the currency derivatives, and variables such as book-to-market ratio and illiquidity measure have a positive impact on the cost of equity. These results are statistically significant and consistent with the existing literature. Other variables such as the leverage level, size, number of segments and the ownership have no impact on the cost of equity or its impact is not statistically significant.

The reminder of the study proceeds as follows. Chapter 2 reviews the existing literature on the motivations that firms have to engage in hedging activities and the main benefits of these activities. Chapter 3 presents the data used and describes the methodology used to approach the problem. Chapter 4 presents the results obtained, their interpretations and consistency with the exiting literature. Our conclusions are presented in Chapter 5.

2. Literature Review

A derivative can be defined as a financial instrument whose value depends on (or derives from) the values of other asset – the underlying asset. Usually, the asset underlying the derivative instrument is the price of the traded asset. A stock option, for example, is a derivative whose value is dependent on the price of a stock. However, derivatives can be dependent on almost any variable, as stated by Hull (2011, pp1) they can go "from the price of hogs to the amount of snow falling at a certain ski resort".

Derivatives can then be very different in its underlying asset and in its purpose. Financial institutions, fund managers, and corporate treasurers enter into many different types of forward contracts, swaps, options, and other derivatives. Derivatives are added to bond issues, used in executive compensation plans, embedded in capital investment opportunities, used to transfer risks in mortgages from the original lenders to investors, and so on.

2.1. Motivation for hedging

According to Modigliani and Miller (1958) framework, under perfect market conditions, risk management decisions have no impact on the operational and financial performance of firms and thus, these companies would not engage in hedging activities once they do not create any additional value.

Under the assumption of perfect market conditions, it is possible for shareholders to access to financial markets with the same conditions as companies and thereby implement hedging strategies developed by themselves at the same cost. However, when we adopt a more realistic viewpoint on the capital markets, we can identify some market imperfections, such as transactions costs, agency costs, asymmetric information or taxes. When we consider the existence of such imperfections that can justify the need of companies to engage in hedging decisions.

Some of the common explanations used to justify risk management decisions are, for instance, the reduction of expected tax liabilities presented by Smith and Stulz (1985), the mitigation of the under-investment problem demonstrated by Froot, Scharfstein and Stein

(1993) and also by Gay and Nam (1998) and the reduction of the expected costs of financial distress presented by Mayers and Smith (1982).

In what concerns to tax liabilities, Smith and Stulz (1985) argue that if effective marginal tax rates on corporations are an increasing function of the corporation pre-tax value, then the after-tax value of the firm is a concave function of its pre-tax value. Considering that hedging practices allow a reduction in the variability of pre-tax firm values, then the expected corporate tax liability is also reduced and therefore, the expected post-value of the firm is increased, as long as the cost of hedging is not too large. Graham and Rogers (2002) state that tax incentives are based upon two motives. On the one hand, the authors argue that companies increase their debt capacity on purpose to increase interest tax deductions. On the other hand, they argue that if the function that charts income into tax liabilities is convex, companies can reduce expected tax liabilities by hedging to reduce income volatility. Their results indicate that, in fact, companies engage in hedging activities to increase debt capacity, with increased tax benefits. However, contrarian to Smith and Stulz (1985), when they used a measure of tax convexity function, they found no evidence that companies enter into hedging strategies in response to tax convexity.

Considering the use of derivatives to avoid the underinvestment problem, Froot et al. (1993) argue that when a company does not hedge, there will be a variability in the cash flows generated internally. This variability will affect both the amount of money raised externally and the amount of money used to invest. Since external funds can generate financial distress costs and these are considered as a market imperfection, then a hedging strategy may be a value enhancing strategy. An underinvestment problem arises when firms find that external financing costs are sufficiently high that they need to reduce investments spending in periods during which internally generated cash flows are not sufficient to finance growth opportunities. Therefore, variability in cash flows affect both investment and financing activities in a way that is costly to the firm. To the extent that hedging can reduce this variability in cash flows and help firms ensuring that they have sufficient funds available to take advantage of attractive investment opportunities, it can increase the value of a firm.

Consistent with these findings, Gay and Nam (1998) found support for the role of potential underinvestment problems in deciding whether to hedge or not. First, they found evidence that associates various proxies for firms' investment opportunity plan with derivatives use. Second, when they analyzed the interaction between the use of derivatives and the level of

internally generated cash flows, the evidence suggested that firms with enhanced investment opportunity sets use derivatives when they have relatively low levels of cash. Their third finding suggests that the correlation between internally generated cash flows and investment expenditures also influences a firm's derivatives use, which means that a higher correlation acts to alleviate a firm's underinvestment problem because the firm is in some sense, naturally hedged.

Hedging strategies are also used to mitigate financial distress costs. Mayers and Smith (1982), argue that largely held corporations might not have any incentive to manage their risk because stockholders and bondholders can access to capital markets and mitigate risk trough diversification. However, the corporate demand for hedging derives from the ability that insurance contracts have to allocate risk to those investors that have a comparative advantage in risk bearing.

All in all, these theories defend that hedging strategies can allow companies to minimize the impact market imperfections and consequently creating value for shareholders from the strategies implemented.

2.2. Hedging and the avoidance of agency problems

Some authors argue that hedging strategies are commonly used to avoid agency problems. Agency problems are defined as the conflict of interests inherent to any relationship where one party delegates responsibilities to a second party and expects the second party to work on the best interest of the first. Typically, in finance agency problems are defined as the conflict of interest between managers and stockholders.

According to Morck, Shleifer and Vishny (1990) and Berger and Ofek (1995), agency problems can arise from diversification strategies because managers can use these strategies to reduce firm risk and therefore secure their reward as managers, however the costs of these strategies may be higher than the benefits, leading to a reduction on the firm value. On the contrary, Nan (2008) argues that when the decision to hedge is contractible, which means that it needs to be observable and verifiable by a third party, hedging alleviates the agency problem by reducing both the risk premium and the equilibrium amount of earnings management. However, if the decision is not contractible, hedging will not always ease the agency problem. The reason

is that hedging increases the manager's personal cost of earnings management and, consequently, the principal cost to compensate the manager.

These risk management theories have been tested empirically and distinctive lines of investigation were developed. Some of the works focus on the determinants of hedging activities, such as Tufano (1996) who focus on the fact that mining gold companies from the United States and Canada need to hedge their exposure since their primary activity is the exploration of a globally traded and volatile commodity. Additionally, Graham and Rogers (2002) argue that firms adopt risk management strategies to benefit from fiscal incentives.

Other works examine the nature and extent to which derivatives are used such as Croci and Jankensgård (2017) that argue that the probability of headging increases with CEO age, as well as, near-retirement CEO's tend to prefer linear hedging instruments.

2.3. Hedging and firm value creation

Recently, the studies about derivatives try to establish a direct relationship between the use of derivatives for hedging purposes and firm value. Some authors that provide evidence about this relationship are, for instance, Allayannis and Weston (2001); Carter, Rogers and Simkins (2005); Jin and Jorion (2006); Bartram, Brown and Conrad (2011); Gay, Lin and Smith (2011); Allayannis, Lel and Miller (2012); Pérez-González and Yun (2013); Chaudhry, Mehmood and Mehmood (2014) or Ahmed, Judge and Mahmud (2018).

Among the papers that explore the direct relationship between hedging and firm value we can group them in different classes. In one hand, we can consider those that are based on specific risk exposure such as the ones developed by Allayannis and Weston (2001) and Pérez-González and Yun (2013)). In the other hand, we can consider the ones that are based on a single industry such as, Jin and Jorion (2006) and Carter et al. (2005). For instance, Allayannis and Weston (2001), who focused their investigation on the use of foreign exchange derivatives, found a positive effect of their use on the firm value. This study was one of the first to establish a relation between risk management and firm value. Using a sample of 720 U.S non-financial firms, between 1990 and 1995, they find that the value of firms that hedge, on average, is higher by about 5%.

Bae, Kim and Kwon (2018), performed a study to examine how the firm value change due to foreign currency hedging on a sample of Korean non-financial firms. The authors found that firms with more exports, more foreign currency debt and higher levels of exposure to exchange rate are more likely to use currency derivatives for hedging purposes. The evidence presented suggests that selling transactions allow companies to improve their firm value, however, when analyzing firms with greater levels of exposure the authors found a reduction in the risk faced as well as a reduction on the firm value. These findings suggest that currency derivatives can increase firm value as long as the firms is not excessively exposed to currency exchange rate. This study constitutes an important contribution to the literature about this topic since most of the investigation rely on data from U.S. companies, and this investigation gives an overview about emerging economies.

Nevertheless, some studies focus in different risk exposures than foreign exchange rate, such as interest rate. For instance, Belghitar, Clark and Judge (2008), explain how the use of interest rate derivatives relates with firm value and debt capacity. The authors found a strong positive relation between the use of interest rate hedging and firm value. Additionally, they also found a positive relation between the debt capacity and the use of interest rate derivatives. The interest rate derivatives itself generate interests benefits six times larger than those generate by foreign currency derivatives. In sum, both firm value and debt capacity benefit from hedging activities, being the interest rate derivatives the instrument that generate the greater impact.

The approach by industry is also a common procedure when developing new lines of investigation. As example, we can mention Jin and Jorion (2006) and Carter et al. (2005). Jin and Jorion (2006), analyzed the premiums generated from the hedging activities. They studied the hedging activities of 119 U.S oil and gas producers and contrary to previous research, they showed that hedging has no visible effect on firm value for oil and gas producers. In the same way, Carter et al. (2005), examine the case of fuel hedging for a sample of U.S. airlines and report a hedging premium of about 14%, although with a very large confidence interval. Moreover, they argue that hedging allows airlines to expand operations when times are bad for the industry, thereby alleviating the underinvestment problem. Apparently, these issues are sufficiently important in this industry to warrant a large hedging premium. It is also worth mentioning, that when analyzing a singular industry, endogeneity problems may affect the results. One way to mitigate the endogeneity problem is by selecting companies from the same industry. Since

companies from the same industry have greater levels of similarity, the sample will be more homogeneous.

Consequently, and allowing for a more complete analysis, some researchers, such as Bartram et al. (2011); Ahmed et al. (2014) or Chaudhry et al. (2014) developed distinct analysis using for the purpose distinct risk exposures from different industries. Bartram et al. (2011) investigated the impact of the use of exchange rate, interest rate, and commodity price derivatives, using a sample of non-financial firms from 47 different countries, on cash flow volatility, the standard deviation of stock returns, and market betas, as well as market values. In order to mitigate the endogenous nature of the variables, the authors used an innovative technique where they ran multivariate tests with a propensity score matching. This technique consists in matching firms based on their estimated propensity to use derivatives and allows overcoming the endogeneity problem. Their findings demonstrate that derivatives reduce both total risk and systematic risk. In respect to changes in value, the evidence shows the existence of a positive relation, although weak. Additionally, the authors also found an interesting point, where they demonstrate that during the 2001/2002 crisis, hedgers have outperformed non-hedgers.

In addition, Ahmed et al. (2014) also studied the effect of hedging with financial derivatives on firm value and financial performance. With a database comprising information on 288 non-financial firms listed on the FTSE-All share index at London Stock Exchange from 2005-2012. Their study is focused on the hedging using foreign exchange rate, interest rate and commodity price risks trough futures, forwards, options and swap contracts. The authors found evidence demonstrating that the relationship between interest rate risk hedging and firm financial performance is negative for the overall hedging, but positive when hedging with forward contracts. In order to overcome the endogeneity problem stemming from omitted variables, the authors created a regression using the two-stage least squares instrumental variables approach, which can also account for potential heteroscedasticity and autocorrelation misspecifications. Overall, the evidence found by the authors, supports the positive relationship between hedging activities and firm value.

More recently, Chaudhry et al. (2014) developed a study based on a very specific market. Using a sample of 75 non-financial firms listed in Karachi Stock Exchange (Pakistan) over the period 2007 to 2011, they found evidence on higher profitability, proper risk management and

economies of scale on firms that use derivatives instruments, which leads to market value maximization.

A different point of view, studied by Pérez-González and Yun (2013) analyze the impact that active risk management strategies have on firm value using weather derivatives. In order to validate their effect, the authors exploited the historical weather exposure of firms. Intuitively, is expected that firms whose cash flows are more exposed to weather conditions to be more disposed to use weather derivatives. To test the importance of weather derivatives, the authors analyzed electrical and gas utilities companies, since heating and cooling demands are tightly linked to changes in weather conditions. Using a sample of 203 U.S. firms, the authors found evidence to support the positive relation between valuation, investments and financing decisions. Additionally, they provide evidence that smooth cash flows may allow firms to relax their borrowing constraints or to pursue valuable investments in low cash flow scenarios, which is in line with the evidence proposed by Gay and Nam (1998).

Considering these studies exposed above that not only focus on a particular type of risk exposure or a specific industry, we have access to a more general and inclusive panoramic on the hedging effects. Either on the direct effect on firm value but also on the indirect effects through the mitigation of the underinvestment problem or through the reduction on tax liabilities.

2.4. Hedging and capital structure

Other authors have also developed distinctive works that gave a very important contribution to the topic, although not related with the direct impact that derivatives hedging have on the firm value of a company. In this sense, Campello et al. (2011) performed a work on the real implications of corporate hedging, identifying the mechanism through which the hedging with derivatives affects the corporate outcomes, such as the cost of equity and the cost of debt. A pioneer study that investigates simultaneously the impact of hedging on the cost of debt and on investment activities. To complete their investigation, the authors collected data not only about the derivatives contracts but also on private credit agreements, namely credit agreements in the syndicated loan market, since this market has become the largest source of corporate funding in the last two decades. They found evidence, with economic and statistical significance,

that hedging activities reduce both the cost of external financing and eases the firm's investment process.

Chen and King (2014) who examined a large sample of U.S firms from 1994 to 2009 found strong evidence that hedging is associated with a lower cost of debt. Specifically, the authors present three different arguments to explain the reduction on the cost of debt. The first argument explains the relation between hedging decisions and bankruptcy costs. Firms have higher probability of bankruptcy when its earnings or cash flows are more volatile. Consistent with this argument, using hedging mechanisms firms can smooth corporate income or cash flows and consequently reduce the probability of default. This effect is more significant in firms with greater bankruptcy costs because firms facing lower probability of default are not in need to hedge against default risk. The second argument presented by the authors relates with cost of agency problems. The authors argument that hedging should lead to a lower cost of debt by mitigating the underinvestment and risk-shifting problems. Moreover, the impact of hedging on lowering the cost of debt is greater in firms with more severe agency problems. The last argument presented states that information asymmetry affects the returns obtained by investors. Given this, the authors state that since hedging reduces the volatility of a firm's cash flow stream, and consequently making cash flows more predictable, bondholders demand a lower rate of return for hedging firms, even when investing in privately held firms. According to the authors, these three factors are the ones that mostly influence the reduction in the cost of debt due to hedging activities.

Within this line of investigation, Gay et al. (2011) developed a study, using data from a large sample of non-financial firms from the U.S. market, where they try to link the use of derivatives with the cost of equity. They found evidence that users of derivatives have a lower cost of equity than non-users, on average by 24-78 basis points. As well, Ahmed et al. (2018) performed a similar study, using a sample of non-financial firms from the German market. The results obtained, prove that, as in the U.S., in European markets there is also a negative relation between the use of derivatives and the cost of equity, since firms that use derivatives for hedging purposes have a 109 basis point lower industry adjusted cost of equity than non-users. Once both studies were conducted, using samples of firms from different industries the authors need to control for the endogeneity problem. To overcome this, in both studies the authors performed univariate as well as multivariate analysis, and the results are consistent within the two

methodologies, which proves that in fact the cost of equity can be reduced trough hedging activities. In part, the authors found evidence that the lower cost of equity on the group of derivatives user's is attributable to lower systematic (market) risk and lower SMB (small minus big size) beta. This results support the argument that firms use derivatives to reduce their financial distress risk and that this distress risk has a systematic component that is priced in the market. These results compliment those presented by Chava and Purnanandam (2010) who found a positive relation between distress risk and expected stock returns. The results are also consistent with evidence presented by Fama and French (1996) and Vassalou and Xing (2004) who found that the SMB factor contains information regarding a firm's default risk, which is priced in the cross-section of returns, and contrary to the empirical findings of Campbell, Hilscher and Szilagyi (2008).

As stated in the previous sections, most of the literature present results from studies of US companies or US markets, showing that in general, hedging strategies create value to shareholders. Ahmed et al. (2018) presented the only study providing insights on the effect of hedging activities on the capital structure of companies in Europe, more specifically on the German market. Namely, the Portuguese market have a lack of information about the use of derivatives from Portuguese companies. This dissertation proposes to develop the existing research and add insights about the use of derivatives by Portuguese companies, reducing then the existing gap on the literature about this topic. Specifically, we intend to develop a study that analyzes the objective of the use of derivatives, the type of derivatives used and how they may affect the cost of equity. The results of this study will contribute to improve the existing literature and give managers a better view about what type of active hedging decisions will allow companies to perform better in the market. Specifically, we intend to give insights on how managers can reduce taxes liabilities, how they can avoid the underinvestment problem, how to avoid some agency problems and how managers can improve firm value. The last goal that we intend to achieve is to verify if the results observed in the U.S. and German market and in the Portuguese market.

3. Data and Empirical Framework

3.1. Data description

The focus of the analysis is on non-financial[1] corporations that use derivatives to mitigate the different sources of risks faced on their daily operations. The selected companies are those listed on the Portuguese stock market. We selected this specific market given the lack of information available about the use of derivative instruments by Portuguese companies and its effects on the Portuguese market. Additionally, given the Portuguese economic conjuncture and based on the factors presented in the literature review, companies may have different incentives to engage in hedging activities, such as reduction of tax liabilities to which companies based in Portugal are subject; to avoid the under investment problem or even to improve the firm value of a company. Another motive to analyze companies listed in the Portuguese market is the unrelenting demand to get to know better the market and the companies that operate in it.

As in most studies of corporate derivatives, we will implicitly assume that most firms use derivatives for reducing various sources of risk although they recognize managerial incentives to increase risk through derivatives, as we were able to state on previous sections. In fact, when we first start analyzing data on different markets, we were able to realize that all companies listed in the Stoxx100 use or have used derivatives in the past to hedge their risks. When confronting this element with the information obtained about the companies that comprise the Portuguese Index PSI-20, we realized that all of them were also users of derivatives. This fact gives support to our implicit assumption, since in fact the research shows that most of the companies adopt strategies to hedge their risks using derivatives instruments. In order to make this dissertation possible, we needed a group of companies were some are users of derivatives and others are non-users. For that, we decided to use a sample of all Portuguese Listed companies. This way we were able to construct a more robust sample, because the larger the sample the more precise the results are.

[1] We exclude financial firms from our empirical analysis since risk management incentives for financial and non-financial firms are not necessarily comparable. For example, proprietary trading activities by financial firms might motivate them to take on speculative derivative positions. Hence, inclusion of financial firms in our analysis could potentially lead to spurious results.

To examine the relation between Portuguese firm's derivatives usage and the cost of equity capital, we use hand-collected data. Our sample period refers to the after crisis of 2011 and comprise information between 2014 and 2019.

Firstly, we obtained the annual reports from their respective official websites in order to search for information on derivatives use and hedging strategies in each of the annual reports. For this, we selected a group of key words and looked for it on the report. The selected words were "hedge", "derivative", "market risk", "exposure", "foreign", "currency", "interest rate", "commodity", "futures", "option", "swap", "risk management", "forward", and "financial instrument". When a key word was found we read the information surrounding to identify if the firm is a derivatives user or not for a specific year. If the text surrounding a keyword provides any information on derivatives use or suggests that the respective firm is using derivative instruments then we consider that firm-year as a user of derivatives and hand-code it to "1" for the "derivatives use" dummy variable. We classify a firm-year observation as a derivatives non-user if there is no information on derivatives use available in the annual report and hand-code it to "0" for the "derivatives use" dummy variable. Similarly, we also construct dummy variables for each specific category of the derivative instruments, namely, foreign currency, interest rate, and commodity derivatives[2]. Additional data, such as firm level and accounting information were retrieved from *Thomson Reuters* via *Datastream*.

The Portuguese market is comprised of 54 companies operating in different sectors of activity being the "Basic Resources" and "Construction and Materials" super sectors, the most representative ones. Since our study will only focus on non-financial companies, we will exclude from our analysis thirteen companies that operate in the Bank and Insurance Industry. Given this, our study will focus on forty-one companies, from which 63% of the companies are users of derivatives instruments and 37% are non-users of derivatives instruments. Is important to clarify that we defined two conditions in order to classify a company as "user" of derivatives. The first condition implies that a company has to use derivatives at least in one of the years

[2] The reasons to use dummy variables instead of scaled total notional amounts or net derivatives positions are that the Normas Contabilísticas de Relato Financeiro (NCRF) do not have any specific hedge accounting disclosure requirement. In addition, many Portuguese firms adopted the International Financial Reporting Standards (IFRS). Furthermore, neither NCRF nor IFRS9 requires firms to quantify the notional amount of the derivatives holdings.

under analysis; and the second states that it has to use, at least, one of the three types of derivatives that we will analyze namely interest rate derivatives, currency exchange derivatives and commodities derivatives. As we were able to acknowledge from our research in the annual reports, a company that used derivatives in the first year of the sample (i.e. 2014) have disclosed the use of derivatives also in the following years. Additionally, Portuguese companies do not report any other type of derivative instruments used in their financial strategies.

Then, when we classify a company as "non-user" it means that the company does not use any type of derivatives during the whole period. Furthermore, is also important to refer that we consider the use of derivatives only for hedging purposes, however, once again, based on the information disclosed in the annual reports, Portuguese companies do not report any other use of derivatives besides hedging purposes. As stated before, our time range will go from 2014 to 2019, which generates panel data with 1158 firm year observations.

The mean and median values of cost of equity, market beta, SMB beta and HML beta factors are presented separately for all firms, derivatives user and derivatives non-users in Table 1.

Based on the data presented, we can conclude that in our sample, firms that use derivatives have, on average, a lower cost of equity over the sample period. Specifically, derivatives users have a lower cost of equity by 161 basis point when comparing with the non-users of derivatives group, based on mean values. When we analyze the median values, we also provide evidence that the derivatives users present a lower cost of equity than non-users of derivatives by 168 basis points.

Analyzing the mean and median differences in risk factor betas, we are able to state that users of derivatives have lower market, SMB, and HML betas than non-users. Considering the market beta, we observe that derivatives users have an average of 0.8974 as opposed to 0.9980 for non-users. For the SMB beta, user firms have an average of 0.1894 as compared to the non-user average of 0.9859. In the same way, for the HML beta, derivatives users have an average of 0.3098 versus 0.7646 for non-users. Based on these results, we can conclude that in our sample, user firms experience a greater reduction in the cost of equity from the SMB beta, which is 0.7965 basis point lower. This is followed by the reduction in the HML beta, that is on average 0.4548 basis point lower and the market beta that is, on average, 0.1006 basis point lower.

Table 1 – Descriptive stats with comparison of derivatives users and non-users. The sample period is from 2014 to 2019.

Variable	All Firms			Derivatives users			Derivatives non-users		
	N	Mean	Median	N	Mean	Median	N	Mean	Median
Cost of equity	41	0.1003	0.1210	26	0.0968	0.1210	15	0.1129	0.1378
Market beta	41	0.8706	0.8935	26	0.8974	0.9256	15	0.9980	0.9723
SMB beta	41	0.3630	0.3350	26	0.1894	0.1741	15	0.9859	0.9473
HML beta	41	0.4102	0.3984	26	0.3098	0.2876	15	0.7646	0.7589

3.2. Variables and specification

Since the main aim of this study is to confirm if there is some cause of relation between the use of derivatives and the cost of equity thus, we will follow the methodology used by Ahmed et al. (2018) in his study.

3.2.1. Computing firm´s cost of equity and univariate analysis

According to the literature (as example D'Mello and Shroff (2000) and Gay et al. (2011) we will use the Fama & French (1993) three factor model, to determine the cost of equity for each company. Firstly, we will estimate the following regression using firms *i* daily returns in a given year to obtain estimates of its beta coefficients (b_i, s_i, h_i):

$$R_{it} - R_{ft} = \alpha_i + \sum_{k=-1}^{k=+1} b_{i,k}\left(R_{M,t+k} - R_{f,t+k}\right) + \sum_{k=-1}^{k=+1} s_{i,k}\, SMB_{t+k} + \sum_{k=-1}^{k=+1} h_{i,k}\, HML_{t+k} + \epsilon_{it} \qquad (1)$$

Where $R_{i,t}$, is the return for firm *i* in period *t*; $R_{f,t}$,[3] the return on the risk free security in period *t;* $R_{M,t}$, SMB and HML are the returns of the market, size, and value factor mimicking

[3] We use three-month Portuguese Government Bonds as a proxy for the return on the risk-free security.

portfolios, respectively, in time period *t*[4]. The data used for the estimation of the three-factor return model was obtained from the Ken French Website (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#International).

The beta coefficients (i.e., *bi*, *si* and *hi*) represent the factor sensitivities or loadings and $e_{i,t}$ represents the regression residual. In the time-series regression specification given by equation (1), the rationale for including one lead and lag return in addition to the contemporaneous daily return is to account for infrequent trading. As Dimson (1979) states, shares that are traded with low frequency have their covariance with the market substantially underestimated. Thus, infrequently traded securities have a beta estimate that is biased downwards, while frequently trades shares have their betas estimates biased upward. To obtain an unbiased estimation, the author suggest the inclusion of an additional lag and lead variable. Accordingly with the author, in order to obtain each of the market SMB and HML betas, we have to sum the coefficient estimates obtained for each of the lag, contemporaneous and lead variable.

Next, following the methods suggested in Fama and French (1997) and D'Mello and Shroff (2000), we then estimate for each firm year an annual risk premium, which we refer to as the cost of equity, as follows:

$$CE_{i,t} = E(R_{i,t}) - R_f = \hat{B}_{i,t}\left[E(R_M) - R_f\right] + \hat{S}_{i,t}E(SMB) + \hat{H}_{i,t}E(HML) \qquad (2)$$

Where the *CEi,t* is the cost of equity of firm *i* in period *t*, and $\hat{B}_{i,t}$, $\hat{S}_{i,t}$ and $\hat{H}_{i,t}$ the estimated market, SMB, and HML betas, respectively. The expectations of the R_M-R_f, SMB and HML are the arithmetic average daily returns of each factor for the correspondign year. Then we annualized the cost of equity by multiplying it by 252 days.

[4] The returns of the market and the SMB and HML factor were obtained from the Ken French website.

3.3. Multivariate analysis

Following the methodology proposed by Ahmed et al. (2018), the relation between firms' cost of equity (CE) and derivatives use is specified as follows:

$$CE_{i,t} = f(Derivatives_{i,t}, Levarage_{i,t}, Book - to - Market_{i,t}, Illiquidity_{i,t},$$

$$Size_{i,t}, Number\ of\ Segments_{i,t}, \%Segment\ Sales_{i,s,t}, Ownership30_{i,t}, Ownership30^{+}{}_{i,t}) \quad (3)$$

Derivatives use is a dummy variable defined earlier in Section 3.1. The rationale for using the variable leverage is to proxy for default risk (see Campello et al. (2011); Lin, Ma, Malatesta and Xuan (2011); Purnanandam (2008)). Leverage is defined as long-term debt plus current portion of long-term debt. A positive relation between the cost of equity and the level of leverage is expected. Some literature, among others Bessembinder (1991); Froot, Scharfsteinand Stein (1993) and Rampini and Viswanathan (2010) suggests that the use of derivative instruments can help reducing the underinvestment problem of a firm and, according to Bartram et al. (2011), the book-to-market ratio variable can be used as a proxy for a firm's growth opportunities. Therefore, we expect a positive link between derivatives use and the book-to-market ratio. Illiquidity is the Amihud (2002) liquidity measure which is computed as the ratio of the absolute value of the daily stock return to the daily euro trading volume of the stock, averaged over all trading days available in a given year. We expect a positive relation between the cost of equity and illiquidity. Size variable is defined as the natural logarithm of total assets. Firm size is expected to be negatively related to the cost of equity since larger firms tend to be more diversified and thus have lower risk than smaller firms. The existing literature on the relation between the use of derivatives and the size of a firm shows distinct opinions among the authors. For instance Warner (1977) produced evidence showing that direct costs related to financial distress are less than proportional to firm size, suggesting that small firms are more likely to participate in hedging activities. Contrary to this, Block and Gallagher (1986) suggest that hedging exhibits informational scale economies and due to that, larger firms are more likely to hedge. We consider the number of business segments, based on reported information, in which a firm operates to proxy for firm's operational risk diversification (see Chod and Van Mieghem (2010)). Diversified firms have lower levels of risk exposures in comparison with non-diversified

firms. We, therefore, expect a negative relation between the cost of equity capital and the number of segments. Unlike the US market, blockholder ownership is a common phenomenon in Europe as exposed by Rapp and Trinchera (2017) and Franks (2020). The relation between the cost of equity and the blockholder ownership is ambiguous among the literature. For instance Skaife and LaFond (2011) argue that there is a positive relationship between the concentrated ownership and the cost of equity due to the extract of private benefits of control by the blockholders. In an opposite way, Attig and Mishra (2008) defend that blockholder ownership reduces the cost of equity capital by reducing a firm's agency and information related problems. Hence, we control for blockholder ownership by incorporating two ownership dummy variables, namely, ownership30 and ownership30+. In particular, ownership30 takes the value 1 if a firm's blockholder ownership is between 10% and 30% and zero otherwise. Likewise, ownership30+ takes the value 1 if a firm's blockholder ownership is above 30% and zero otherwise.

The pooled ordinary least squares (OLS) regression method with fixed effect was used as baseline for the multivariate analysis. Based on this method, our statistical inferences are susceptible to critics due to potential endogeneity resulting from a firm's financial hedging and capital structure decisions. In other words, the pooled OLS estimation of the relation specified by equation 3 assumes that the decision by a firm to use derivative instruments is exogenous. Nevertheless, based on the evidence shown by Gay et al. (2011), we can conclude that this decision may be endogenous. This argument follows from the debt capacity argument exposed by Leland (1998) and Smith and Stulz (1985), that hedging increases a firm's debt capacity and therefore reduces tax liabilities due to the tax shield created by increases in the level of leverage. Hence, to address the above potential problem, we tested our variables to examine if the cost of equity capital conclusions would stand if there were endogeneity among the variables.

4. Empirical Results

4.1. Multivariate results

The estimation results of the multivariate model defined in equation (3) are presented in Table 2. The specification of our first model (referred to as model 1) excludes blockholder ownership dummy variables, whereas the specification of the second model (referred to as model 2) includes these variables. As we stated before, blockholder ownership structures are very common in European countries, however in markets such the US these ownership structures are less common. Then, we decided to define these two models in order to segregate the effect of this type of ownership from the other variables.

Starting by analyzing our model 1, we can state the derivatives use dummy variable, the book to market indicator and the illiquidity measure are statistically significant at 1% confidence level. The other variables, such as the leverage, size and number of segments are not statistically significant and furthermore do not allow us to reach any conclusion.

Analyzing the derivatives dummy variable, we can state that the negative signal in the estimated coefficient of 0.0288 indicates that derivatives user firms have, on average, 288 basis points lower cost of equity when comparing with non-user firms. In other words, firms that use derivative instruments have indeed a very significantly lower cost of equity than firms that do not use these instruments. It is worth mentioning that both Gay et al. (2011) and Ahmed et al. (2018) provide qualitatively similar empirical results based on a sample of US firms and German firms, respectively.

In respect to the book to market indicator, used as proxy for the growth opportunities, we obtained a statistically significant estimation that is also in line with our expectations and the existing literature. The estimated coefficient of 0.0024 denotes that companies facing higher growth opportunities will have, on average, a greater 24 basis points cost of equity. When considering the illiquidity measure, the literature demonstrates the existence of a positive relation with the cost of equity. The signal of our estimated coefficient support the existing literature indicating that companies with higher illiquidity levels have, on average, a higher 6.368 basis point cost of equity.

The remaining variables do not have any statistically significance, so we cannot reach any conclusions regarding their sign or their estimated coefficients.

Moving our analysis to model 2, we can conclude that the derivatives use dummy variable, the market to book indicator and the illiquidity measure are statistically significant while the other remaining variables, such as the leverage, size, number of segments and the ownership variables are not statistically significant. These results are in line with those obtained in our model 1.

Starting with the derivatives dummy variable, we can confirm that the negative signal in the estimated coefficient of 0.0274 indicates that derivatives user firms have, on average, 274 basis points lower cost of equity when comparing with non-user firms. These findings are in line with the ones that we obtained in our estimated model 1, and consequently are in line with the existing literature.

In respect to the book to market indicator, we also observed a very similar estimated coefficient when comparing with model 1. Based on the statistical significance of the coefficient, we can conclude that companies facing higher growth opportunities will have, on average, a greater 19 basis points cost of equity. When considering the illiquidity measure, once again we obtained a very similar result, which denotes that companies facing higher levels of illiquidity have, on average, a higher 6.244 basis point cost of equity.

The remaining variables do not have any statistical significance therefore, we are not able to draw any conclusions. The only conclusion that we can reach is the fact that, in our sample, the ownership structure does not have a significant impact, since our estimated models (i.e. model 1 and model 2) present very similar results, both in the statistical significance of the variables and in their signal.

Lastly is important to refer that our results sand even after testing for endogeneity problems. Based on the works presented by Gay et al. (2011) and Ahmed et al. (2018), among many other authors, our study could be susceptible to suffer from endogeneity problems among the variables. After performing the Wald test suggested by Semykina & Wooldridge (2010) in their study, we were able to conclude that our variables are not affected by endogeneity problems.

Table 2 - Derivatives use and the cost of equity: Pooled OLS regressions. Model 1 excludes the blockholder ownership dummy variables, whereas model 2 includes them. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Numbers in parentheses are standard errors.

	Model 1	Model 2
Intercept	0.0906	0.0654
	(0.0046)	(0.0044)
Derivatives Use	-0.0228***	-0.0274***
	(0.0098)	(0.0084)
Leverage	-0.0000	-0.0000
	(0.0000)	(0.000)
Book-to-market	0.0024***	0.0019***
	(0.0009)	(0.0006)
Illiquidity	0.6368***	0.6244***
	(0.0012)	(0.0095)
Size	0.0014	0.0031
	(0.0023)	(0.0027)
Number of segments	-0.0012	0.0004
	(0.0001)	(0.0019)
Ownership30		0.0008
		(0.0094)
Ownership30^{+}		-0.0144
		(0.0015)
Number of observations	246	
Number of derivatives users	156	
Number of derivatives non-user	90	
Adjusted R^2	0.0733	0.0810

4.2. Type of derivatives use

Considering the relation between the hedging activities by Portuguese companies, using derivatives instruments, and the cost of equity, is important to understand whether the type of derivatives used is relevant or not.

In order to verify the importance of each type of derivatives we run our models 1 and 2, however, instead of using a dummy variable to define if a company is user or non-user of derivatives we decide to use three dummy variables to specify each type of derivative instruments (i.e. currency derivatives, interest rate derivatives and commodities derivatives). If the three dummy variables assume the value of "0" it means that the company at stake does not use none of the three types of derivatives. As stated earlier in section 3.1, we were able to verify that none of the companies discloses the use of any other different type of derivatives, rather than the aforementioned.

The results obtained are presented in Table 3. From there we can acknowledge that the foreign currency and interest rate derivatives dummies are statistically significant and the negative signal obtained in the estimated coefficients denote that companies that use this type of derivatives have a lower cost of equity than those who do not use any type of derivative instruments.

Based on this evidence, we can conclude that the coefficient on the interest rate derivatives use is significantly higher than that of the foreign currency derivatives use coefficient. This finding is consistent to what we expected considering the fact that listed Portuguese firms tend to finance their activities out of the Euro Zone through loans on domestic currencies, which exposes them to a greater level of interest rate fluctuations when consolidating results. The commodity derivatives use dummy, however, it's not statistically significant, at any level, due to the small group of companies that use this type of derivative instrument.

Variables such as the book to market and the illiquidity measure, which are statistically significant, present a similar behavior as the one obtained in the previous section, therefore leading to the same conclusions. The reaming variables do not have statistically significance, therefore cannot be used to design any conclusion. The results obtained are similar in both, model 1 and model 2.

In sum, the empirical evidence suggests that the use of interest rate derivatives, and to a lesser extent, the use of foreign currency derivatives helps reducing the cost of equity of the Portuguese listed companies. When comparing this findings with the ones obtained by Gay et al. (2011) and Ahmed et al. (2018), we can state that both authors found that the foreign exchange derivatives have a greater impact on the cost of equity, instead of the interest rate derivatives. Once again, the results presented stand even after testing for endogeneity problems.

Table 3 - Type of derivatives use and cost of equity. The table reports the pooled ordinary least squares (OLS) regression results of the relation between a sample of Portuguese non-financial firm's cost of equity and the type of derivatives use. Numbers in parentheses are standard errors.

	Model 1	Model 2
Intercept	0.0863	0.0982
	(0.0051)	(0.0037)
Currency user	-0.0011***	-0.0028***
	(0.0069)	(0.0076)
Interest rate user	-0.0189***	-0.0216***
	(0.0096)	(0.0099)
Commodities user	0.0015	0.0047
	(0.0038)	(0.0052)
Leverage	0.0000	0.0000
	(0.0000)	(0.0000)
Book-to-market	0.0027***	0.0024***
	(0.0010)	(0.0008)
Illiquidity	0.7255***	0.6645***
	(0.0015)	(0.0012)
Size	0.0013	0.0014
	(0.0026)	(0.0023)
Number of segments	-0.0012	0.0005
	(0.0011)	(0.0021)
Ownership30		-0.0094
		(0.0101)
Ownership30^{+}		-0.0187
		(0.0173)
Number of observations		246
Number of derivatives users		156
Number of derivatives non-users		90
Adjusted R^2		0.0763

5. Conclusions

Despite the widespread use of derivatives for active risk management, it is hard to find empirical evidence regarding the impact of financial hedging on the cost of equity, outside the US market. In this study, we seek to ascertain how the cost of equity of Portuguese non-financial firms is influenced by the level of derivative instruments used, leverage, book-to-market ratio, illiquidity level, size, number of segments and ownership structure for the after crisis period of 2014 until 2019.

We use hand collected data on the derivatives hedging and computed the cost of equity using the Fama and French (1993) Three Factor Model for the purpose. Our sample is composed by 41 companies, from which 63% of the companies are users of derivatives instruments and 37% are non-users of derivatives instruments. Based on our sample we can conclude that, the users of derivatives experience, on average, 161 basis point lower cost of equity than non-users. We can also state that the reduction in the cost of equity of the firms composing our sample is attributable to their lower market, size, and value factor betas.

Moving to a multivariate analysis, we defined two models. In model 1, we do not account for the ownership structures, while in model 2 we included to variables to consider the type of governance models used in Portuguese companies. Our results are very similar in both models and variables such as, dummy variable for derivatives use, the book to market ratio and the illiquidity measure are statistically significant while the remaining variables are not. The dummy variable for derivatives use have a negative signal which allow us to conclude that companies that use derivatives face a lower cost of equity. The book to market ratio and the illiquidity measure, both with positive signal, denote that companies with higher book to market ratio face a greater cost of equity and companies with higher levels of illiquidity have also a greater cost of equity. The reaming variables are not statistically significant; therefore, we cannot present any conclusions. Our results stand even after testing for endogeneity problems. Overall, we provide empirical evidence showing that hedging activities can reduce the cost of equity, and the evidence presented is in line with the existing literature.

When analyzing hedging activities using derivatives instruments, is important to understand what type of derivatives are used. The companies that compose our sample only disclose the use of three different type of derivatives, which are, currency exchange derivatives,

interest rate derivatives and commodities derivatives. To analyze what is the impact of each type of derivatives, we ran our models 1 and 2, but instead of using a dummy variable for the derivatives use, we used three different dummy variables for each of the three toe of derivatives used by the companies that compose our sample. Our results show that the interest rate derivatives and currency exchange derivatives, both with estimated coefficients with negative signal, are statistically significant while the commodities derivatives are not. Based on the evidence obtained we can conclude that companies using interest rate derivatives and currency exchange derivatives have, on average, lower cost of equity. The impact of the commodities derivatives is not statistically significant due to the fact they are less used. The results obtained, are again in line to what we expected and with the exiting literature.

In general, our study provide evidence that can be useful for risk managers in their hedging decisions. The decision of hedging cash flows fluctuations, interest rate fluctuation or even commodities price fluctuation, can be achieved through different means, however in our study we demonstrate that the use of derivatives can be a great improvement by reducing the cost of equity and enhancing the market value of firms.

Some arguments can be pointed as pitfalls in our research and take into account for further investigations. Firstly, the size of our sample may not be sufficiently large, and secondly, some of the companies that comprise our sample have a bad market performance in terms of the number of the days that its shares are traded, being suspend during some periods, leading to an unbalanced dated panel. Consequently, for further investigations, we suggest the inclusion of more companies in order to create a larger sample and the use of companies with better market performance to allow the use of a balanced panel of data.

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