Journal of
Risk and Financial Management

MDPI

Article

Hedging Policies to Reduce Agency Costs in Brazil

Vinícius Medeiros Magnani, Marcelo Augusto Ambrozini, Rafael Moreira Antonio and Rafael Confetti Gatsios *

Accounting Department, School of Economics, Business Administration and Accounting at Ribeirão Preto University of São Paulo, Av. Bandeirantes, Ribeirão Preto 3900, SP, Brazil
* Correspondence: rafaelgatsios@hotmail.com

Abstract: Given the recent Brazilian economic scenario, characterized by political uncertainties and economic instabilities, it is essential for companies to engage in hedging as part of their financial policy in order to prevent their results from being affected by market frictions. In this context, the present study aimed to verify the impact of hedging on the agency costs of Brazilian companies. The methodology used was that of panel data contemplating a manually collected database of 154 companies between 2010 and 2017 (all companies that use derivatives for hedging). The results obtained agree with the literature on hedging and agency costs, indicating that the greater the use of hedging, the lower the agency costs faced by shareholders, expanding on the discussions involving developed markets. This relationship shows that by using hedging in a company's financial policy, managers can minimize the impacts of market frictions and reduce the residual losses of shareholders in relation to what would otherwise occur.

Keywords: hedging; agency costs; market friction; corporate finance

Citation: Magnani, Vinícius Medeiros, Marcelo Augusto Ambrozini, Rafael Moreira Antonio, and Rafael Confetti Gatsios. 2022. Hedging Policies to Reduce Agency Costs in Brazil. *Journal of Risk and Financial Management* 15: 365. https://doi.org/10.3390/jrfm15080365

Academic Editor: Douglas Cumming

Received: 18 May 2022
Accepted: 11 August 2022
Published: 16 August 2022

1. Introduction

Companies with operations that generate revenue and expense streams in foreign currencies are susceptible to variations in exchange rates prompted by changes in relative interest rates and other factors. Those changes, known as market frictions, can increase firms' expenses and/or reduce their revenues, making it important for managers to employ measures to minimize the effects of these variations and avoid residual losses to the wealth of shareholders (Stulz 1984; Wall 1989; DeMarzo and Duffie 1991, 1995; Brown 2001; Dadalt et al. 2002; Aretz and Bartram 2010; Breeden and Viswanathan 2015).

As argued by Wall (1989) and DeMarzo and Duffie (1995), when engaging in a hedging policy to protect a firm's operations in relation to market frictions, managers try to minimize the increase of expenses and/or reduction of revenues due to exchange rate and financial fluctuations. Failure to make this effort can cause misalignment between the interests of managers and shareholders, creating an agency conflict. An increase in expenses and/or decrease in revenues will diminish the firm's profits and hence the shareholders' wealth due to residual losses, which according to Jensen and Meckling (1976), are a component of agency costs.

The Brazilian economic context is characterized by severe political and economic instabilities, making it essential for managers of the country's firms to apply corporate hedging policies seeking to avoid or ameliorate the impacts of market frictions on the bottom-line results. However, the literature on hedging has not yet studied to what extent Brazilian companies use it to minimize these impacts on their results. Hence, there is an opportunity to expand on the previous literature (focused on developed markets), which is our goal here. Specifically, we aim to answer the following question: Do the managers of Brazilian firms use derivatives for the purpose of protecting corporate operations and consequently reducing the agency conflicts between shareholders and managers?

Therefore, the main objective of this study is to verify the impact of using hedging mechanisms on the agency costs of Brazilian companies. Wall (1989), DeMarzo and Duffie (1991, 1995), Brown (2001), Dadalt et al. (2002), Aretz and Bartram (2010) and Breeden and Viswanathan (2015) argued that the use of hedging could prevent or lower the market frictions that affect firms' results and thus reduce the amount of noise present in their profits. According to those authors, this noise represents the variations that are outside the control of managers, and by minimizing it, the managers convey to the firm's stakeholders a better picture of the performance of the corporate operations, and this reduces the impacts that would lead to a lost wealth of shareholders.

The relationship between the use of hedging and agency costs established by Wall (1989) was modeled mathematically by DeMarzo and Duffie (1991) and Breeden and Viswanathan (2015). According to DeMarzo and Duffie (1991), it is essential to the shareholders for managers to engage in a corporate hedging policy designed to minimize the effect of market frictions on the firm's results because, in the presence of information asymmetry, managers have better knowledge of the firm's daily operations, so they can make decisions based on more precise information than shareholders. In the model of Breeden and Viswanathan (2015), when information asymmetry is present, reducing the impact of market frictions is a way for managers to signal their professional competence to the shareholders.

Brown (2001), Dadalt et al. (2002), and Lin and Smith (2007) empirically tested the model of Wall (1989) and Brown (2001) and found that managers are concerned with diminishing the impact of market frictions on the results because they believe that failing to do so will penalize the market price due to negative reports by the analysts who follow the company. Dadalt et al. (2002) observed that greater engagement in hedging is associated with lower levels of information asymmetry between shareholders and managers. They also suggested that this reduction helps mitigate the adverse selection between the company and its stakeholders since reduction of the noise in earnings indicates the better performance of the firm's operations. Therefore, creditors and shareholders can make decisions related to the firm's contracts based on profits with less information asymmetry. Subsequently, Lin and Smith (2007) tested the same relationship but did not find statistical significance for their sample.

Departing from the previous literature, Nguyen et al. (2010) advocated a different hypothesis than that proposed by Wall (1989). According to them, the use of hedging is a potential source of asymmetric information due to some characteristics, such as: the difficulty of determining the level of risk to which the firm's operations are exposed; the difficulty of observing information about hedging transactions; the speculative nature that can be imposed by managers when using these instruments.

However, in the Brazilian case, according to Murcia and Santos (2009), the adhesion to international accounting standards in 2010 led to an increase in the quality of the information disclosed by companies, especially the information required by IAS 32 and 39 and IFRS 7, referring to the disclosure, recognition, measurement, and presentation of the use of derivative instruments. Hence, it can be noted that the argument of Nguyen et al. (2010) regarding the difficulty of observing the use of these instruments can be mitigated by the adoption of international accounting standards. Furthermore, according to Géczy et al. (2007), Fauver and Naranjo (2010), and Lel (2012), shareholders tend to seek mechanisms, such as manager compensation contracts and the adoption of enhanced corporate governance levels, to align their interests with those of the executives. For those authors, the implementation of these mechanisms works to reduce the speculative character of hedging described by Nguyen et al. (2010).

In this context and in light of the theory and evidence presented in the works of Wall (1989), DeMarzo and Duffie (1991, 1995), Brown (2001), Dadalt et al. (2002) and Breeden and Viswanathan (2015), we formulated the following hypothesis regarding companies in the Brazilian market:

Hypothesis 1 (H1). *The greater the use of hedging, the lower the agency costs faced by the shareholders of Brazilian companies.*

To measure agency costs, we used the proxy studied by Elton et al. (1984), Atiase and Bamber (1994), Géczy et al. (1997), Dadalt et al. (2002), and Lin and Smith (2007), which is related to the level of information asymmetry present in the firm's earnings: the accuracy of analysts' forecasts. According to these authors, the greater the use of hedging regarding firms' operations, the lower the noise level in their profits, and hence the greater the accuracy of analysts' earnings predictions. This will mean less information asymmetry between the company and its stakeholders.

The importance of this study is associated with the benefits that derivatives can bring to firms since they can prevent market frictions from generating residual losses and reducing shareholder value.

In this sense, the main novelty of this paper is analyzing the extension of hedging realized by the Brazilian firms over their level of asymmetric information by building a manually hand-collected database regarding the extent of corporate hedging policies by the notional value of contracts of the firms, as suggested by Aretz and Bartram (2010).

Furthermore, the relationship analyzed here has not been widely explored in the hedging literature, and never in the Brazilian market, an emerging market that, according to Júnior (2007) and Bartram et al. (2009), is characterized by high volatility of macroeconomic variables, thus requiring greater attention by managers in determining risk mitigation policies. Thus, the results found here can be important to firms' stakeholders since failure to use hedging properly to protect corporate operations can reduce shareholders' wealth.

The paper is divided into four more sections besides this introduction: a review of the relevant literature, a description of the methodology; an analysis of the results; final considerations.

2. Literature Review

Theoretical and empirical studies have shown that in the presence of market imperfections the use of derivatives for hedging can increase firms' value (Myers 1977; Smith and Stulz 1985; Mayers and Smith 1990; Froot et al. 1993; Smith 1995; Fauver and Naranjo 2010). This can be traced to: the reduction of transaction costs; reduction of direct and indirect costs of financial difficulties (Smith and Stulz 1985; Aretz and Bartram 2010); increase in the value of the tax benefits of debt resulting from the increased financial leverage (Leland 1998); reduction of corporate taxes (Smith and Stulz 1985; Rawls and Smithson 1990; Smith 1995; Stulz 2001); reduction of the volatility of cash flows (Stulz 1990; Géczy et al. 1997; Morellec and Smith 2007; Bartram et al. 2011); reduction of the costs related to conflicts between managers (agents) and shareholders (principals) (Stulz 1984; Wall 1989; DeMarzo and Duffie 1995; Dadalt et al. 2002; Breeden and Viswanathan 2015). The last aspect is our focus here.

Managers have knowledge and perceptions about the market and are contracted by shareholders to maximize the firm's value. Therefore, they should apply their views (on the degree of risk aversion and expectations) regarding the market in the firm's financial policy, such as determining the level of risk to be incurred by the company in determining operations or transactions (Dolde 1993; Faulkender 2005; Géczy et al. 2007).

Given that managers can determine the firm's risk level, if they do not have incentives aligned with the interests of the principals (shareholders), they will be encouraged to maximize their utility function to the detriment of the shareholders (DeMarzo and Duffie 1995; Géczy et al. 2007).

Therefore, the determination of hedging policy involves an agency relationship, defined by Jensen and Meckling (1976) as a contract whereby one or more people (principal) retain another person (agent) to perform a determined task. In the case of companies, this contract is formed in a setting of information asymmetry, given that the agent in command of the company has more information about its operations than the principal (DeMarzo and

Duffie 1991). According to Shavell (1979), each party involved in the relationship has an independent utility function and undertakes actions seeking to maximize his or her utility.

In the agency relationship, the contract is not always complete, covering all the possible decisions of the agent, Klein (1983). Therefore, if the interests of the parties are not aligned, it will not be possible to assure that all the agent's decisions will maximize the firm's value. This gives rise to agency costs, which were defined by Jensen and Meckling (1976) as all the expenses incurred by the principal to monitor the agent's activities, among them: the expenses of preparing contracts; the costs of incentives; the costs incurred by the agent to signal to the principal that the actions taken did not impair the firm's value; the residual losses from reducing the wealth of the principal.

Because of the agency relationship existing in the choices regarding corporate risk policies, various studies have investigated the mechanisms imposed by shareholders to align their interests with those of the managers. Among these mechanisms are: executive compensation agreements (Smith and Stulz 1985; Campbell and Kracaw 1987; DeMarzo and Duffie 1995; Tufano 1996; Chang 1997; Bartram et al. 2009), corporate policies on risk aversion (Smith and Stulz 1985), and corporate governance mechanisms adopted by companies (Géczy et al. 2007; Fauver and Naranjo 2010; Lel 2012).

When these mechanisms are properly implemented in organizations, the interest of the agents will be closely aligned with those of the principals so that managers will apply their market knowledge and efforts to minimize the risks associated with the firm's operations which can reduce the shareholders' wealth (DeMarzo and Duffie 1995). In this context, companies that have operations involving multiple currencies are inherently susceptible to the market frictions associated with these operations (Wall 1989; DeMarzo and Duffie 1995; Dadalt et al. 2002). Therefore, for alignment with the interests of the shareholders, managers need to mitigate the impacts of market frictions on the firm's results by formulating a financial hedging policy to prevent this situation from causing residual losses to the wealth of shareholders (Wall 1989; Brown 2001; Dadalt et al. 2002; Aretz and Bartram 2010).

The first work relating the reduction of the impacts of market frictions on the results of companies by using hedging was the paper of Wall (1989). He developed a theoretical model that mathematically demonstrated how the use of interest rate swaps could reduce the financial costs tied to short-term debts of firms exposed to market frictions because of assuming debts with variable interest rates. According to him, when managers expect the interest rate on a particular debt to increase, they should enter into a swap agreement to fix the interest rate at a determined level. Thus, if the interest rate rises, the company will suffer a "loss" because of the higher interest expense on the debt in question but will obtain a "gain" from the swap contract. In this situation, the managers lock in the interest rate, i.e., the loss from the debt agreement is offset by the gain from the swap agreement.

Following the same line of thinking as Wall (1989), DeMarzo and Duffie (1991) mathematically modeled the relationship between the reduction of market frictions and bottom-line results. According to them, since managers have inside information about the corporate structure but do not reveal it due to strategic factors, it is important to the shareholders for the company to have an active financial hedging policy. Furthermore, if managers do not put a hedging policy into place, shareholders will not know the company's risk position to adopt hedging mechanisms themselves. Therefore, when managers assume hedged positions involving the company's operations, they do so based on strategic information that was not revealed to the shareholders, so they can adopt better strategies than the shareholders can to minimize the risk of their transactions.

Subsequently, DeMarzo and Duffie (1995) proposed a mathematical model based on shareholders' uncertainty about the quality of the decisions made by the managers. The authors demonstrated that one of the effects of hedging to reduce the volatility of profits, resulting in lower market frictions, is to increase the amount of information disclosed by the company, i.e., reduce the information asymmetry.

Breeden and Viswanathan (2015) presented two information asymmetry models in which managers use hedging as a way to demonstrate their professional skills to forecast market frictions and thus reduce the volatility of earnings. In this context, the greater the skill of the managers, the better the hedging policy will be that is implemented by the company, and hence the lower the impact of market frictions on the results and thus the better the performance of profits. This being the case, the hedging policy will reduce information asymmetry, and the shareholders will be more aware of the managers' skills.

Géczy et al. (1997) examined the use of foreign exchange derivatives to test hedging theories regarding corporate growth opportunities, information asymmetry, and exposure to exchange rate risk. According to the authors, the use of derivatives minimizes the volatility of cash flow and allows firms to invest in projects with positive net present value (NPV). An important result stressed by the authors was the positive relationship found between exchange rate exposure and the use of derivatives, i.e., firms with operations exposed to exchange rate fluctuations tend to engage in more transactions to mitigate the possible effects of currency oscillations.

Through a field study, Brown (2001) investigated the risk management policy of a company engaged in manufacturing equipment in the United States, focusing on why the company engaged in risk management of its operations involving foreign currencies. Through a database with 3110 transactions with derivatives related to exchange rates, together with internal documents and interviews with managers, he found that the company's financial department believed that the analysts who followed the company expected it to reduce the impacts of market frictions on its results. He also noted that the managers believed that the company could be penalized by analysts if it did not engage in hedging or did so incorrectly, causing residual losses to the shareholders. In counterpoint, he also consulted the external analysts who followed the company, and they supported this view, stressing that if the company did not minimize those losses, it would be penalized by lower market prices.

The study of Brown (2001) is important to the literature because it sheds more light on the mechanisms underpinning firms' hedging policies, mainly by verifying the views of the two sides of the agency relationship, the shareholders and the managers. This reinforced the importance of understanding the impacts of frictions on the results and revealed a gap to be explored empirically and quantitatively.

Dadalt et al. (2002) empirically investigated the relationship between the use of derivatives and the level of firms' information asymmetry. In the multivariate tests, the dependent variable was the level of information asymmetry of each firm, constructed by two proxies: the accuracy of specialized analysts' forecasts and the dispersion of analysts' forecasts. As independent variables, the authors used dummies for each year covered by the study and another dummy variable called USER, which assumed a value of 1 if the company used derivatives related to interest rates and exchange rates and 0 otherwise. The control variables were leverage, market-to-book ratio, earnings stability index, and size. As the main result, they found empirical evidence supporting the hypotheses proposed by Wall (1989), DeMarzo and Duffie (1995), Brown (2001) and Breeden and Viswanathan (2015) that the use of corporate hedging mitigates agency problems and reduces the expected costs of financial stresses.

According to Dadalt et al. (2002), the employment of derivatives is associated with reducing the levels of information asymmetry and adverse selection between the company and its stakeholders because when the reporting of profits involves less information asymmetry, creditors and shareholders can make better decisions related to the contracts with the company. However, Lin and Smith (2007) did not find statistically significant evidence of the relationship between the accuracy of analysts' forecasts and the hedging policies of firms. Among the main results described by the authors were that companies with greater growth opportunities manage the risk of their operations more but do not use hedging to increase their leverage, while firms with low opportunities for growth tend to increase their leverage via hedging.

Nguyen et al. (2010) proposed a different hypothesis than previously established in the literature. According to them, the use of corporate hedging is a potential source of information asymmetry, depending on the specificities of firms and their hedging programs. The authors formulated this hypothesis based on five considerations: (i) that each firm has a unique exposure profile, which is complex and based on its activities; (ii) that information on the timing and quantity of exposed resources is typically privileged to the firm; (iii) that various techniques and instruments for hedging exist to enable the firm to reduce its exposure to market risk; (iv) that the firm might not use derivatives to hedge its operations; (v) that information about the firm's hedging program has little marginal effect on the evaluation of investors about their market premises. The results suggested that greater use of derivatives was associated with a higher level of information asymmetry, mainly in firms that predominantly operate in one market segment only and in firms that employ more complex hedging strategies.

Lin and Lin (2012) examined the relationship between information asymmetry and hedging. The results point out that firms with medium asymmetric information are more likely to hedge, while firms with very high and low levels of information asymmetry tend to speculate. Lel (2012) found that firms with strong levels of corporate governance and well-monitored managerial activities are more likely to use derivatives to reduce companies' risk exposure. Otherwise, firms with weak governance and poorly monitored levels, on the other hand, use derivatives to complement the company's governance mechanisms.

More recently, Danisman and Demirel (2019) examined the impact of corporate risk management strategies on firm value in Turkey. The results showed that in the Turkish market, there is no significant relationship between the use of hedging and the value of firms, justifying the absence of a relationship for the lack of investor protection, high shareholding concentration, high asymmetric information index, low regulation of risk management, and low corporate governance mechanisms.

The literature review to this point describes the main studies that have analyzed the relationship between hedging and information asymmetry and the agency costs between shareholders and managers. Among the authors who have studied the relationship proposed here are: Campbell and Kracaw (1987), Wall (1989), DeMarzo and Duffie (1991, 1995), Dadalt et al. (2002), Lin and Smith (2007), and Nguyen et al. (2010). From this literature review, we noted there are no studies of the impact of using hedging on the agency costs between managers and shareholders in Brazilian companies.

3. Methodology

For this study, we collected data from the financial statements of 154 firms between 2010 and 2017 by searching the Economática and Thomson Reuters databases, along with the manual collection of data on the total notional value of derivatives of these firms by consulting the notes in the financial statements.

The first year of the period analyzed coincides with the mandatory adoption by listed Brazilian companies of International Financial Reporting Standards (IFRS), i.e., as of 2010, aligned with the study of Antônio et al. (2020). According to Murcia and Santos (2009), this obligatory adhesion increased the quality of the information disclosed by companies and also promoted convergence of the accounting information of Brazilian companies and their peers in other countries.

The data on the use of derivatives were obtained manually from the notes to the financial statements of the companies composing the sample, available at their websites or that of the Brazilian Securities Commission (Comissão de Valores Mobiliários—CVM). We collected data referring to derivatives related to interest rates and exchange rates but not data related to derivatives involving commodities (there is no disclosure of the notional value of these instruments). Additionally, we excluded firms that did not specify the notional values of their derivative instruments referring to interest rates and exchange rates because this meant incomplete information about their hedging policies. The notional values not stated in Brazilian currency (the real, BRL) were converted at the respective

exchange rates reported by the Brazilian Central Bank, whose database covers the exchange rates with the currencies of many nations.

It should be noted that the information regarding the derivatives of the companies collected is not available in a structured database present in any software on the market, which makes its construction difficult and makes the manual development of this database important for the literature on the effects of the companies hedging policy, as it seeks to demonstrate the degree of hedging carried out by the company in a given period. The difficulty in collecting the database and in evidencing the degree of protection of the company's operations are gaps in the literature (Júnior 2007; Trindade et al. 2020). Studies such as this are analyzed in markets with developed economies due to the wide demand and disclosure of the risk management policy of companies (Fauver and Naranjo 2010; Aretz and Bartram 2010).

The mean and median of the forecasts of earnings per share and the number of analysts who participated in the respective forecast were collected from the Thomson Reuters Eikon database. The data on the firms' corporate governance levels were gathered from the website of the Brazilian securities exchange [B]3. The other two variables (total assets and market-to-book ratio) were obtained from the Economática website.

The profits reported and other accounting information used were gleaned from the consolidated balance sheets for the end of each fiscal year. We excluded financial institutions from the sample for two reasons: (i) their financial statements have specific characteristics; (ii) they can market derivatives, a topic that is outside the scope of this study.

We used a single variable to ascertain whether the use of hedging reduced the agency costs of the companies, as proposed by Elton et al. (1984), Atiase and Bamber (1994), Géczy et al. (1997), Dadalt et al. (2002), and Lin and Smith (2007). Equation (1) specifies the calculation of this variable.

$$\mathrm{AC} = \left| \overline{\text{Earnings per share}}_{\text{Forecast}} - \text{Earnings per share}_{\text{Realized}} \right|. \quad (1)$$

This variable was named "analysts' accuracy" by Dadalt et al. (2002). According to them, the greater the accuracy of analysts, the lower the value of the proxy AC, and consequently, the lower the information asymmetry. We used two variables to denote the forecast earnings per share, the mean and median of the analysts' predictions. According to those authors, the greater use by managers of hedging to reduce the noise levels contained in earnings, the more accurate analysts' earnings forecasts will tend to be. In this context, low volatility of results minimizes the residual losses of shareholders' wealth, thus reducing the agency costs between shareholders and managers.

To measure the use of hedging, we used the proxy studied by Gay and Nam (1998), Graham and Rogers (2002), Júnior (2007), Carneiro and Sherris (2008), and Antônio et al. (2020). Equation (2) specifies the calculation of this variable:

$$\text{Hedge} = \frac{\text{Notional value of all derivatives}}{\text{Total assets}}. \quad (2)$$

This variable is widely used in the literature as the hedge coverage rate of firms, i.e., it represents the corporate hedging implemented as part of a firm's financial policy. In line with Dadalt et al. (2002) and Lin and Smith (2007), we included control variables to reduce the correlation between the error of the model and the variable of interest and, consequently, to reduce the stochastic error of the model as a whole. These variables are: the corporate governance level; leverage; market-to-book ratio; size; number of analysts who follow the firm and take part in forecasting its earnings per share; control variables for the economic sector and macroeconomic factors.

The variable CG is a proxy that represents the level of corporate governance of the firms and is measured according to the trading segment of the firms on the [B]3. These corporate governance levels are Traditional, Level 1, Level 2, and New Market. These levels are in rising order of corporate governance so that firms traded in the New Market segment

are subject to the most stringent governance mechanisms. The assumption is that the higher the corporate governance level is, the lower the information asymmetry will be between investors and managers, and consequently, the less the information asymmetry will be associated with lower agency costs (Healy and Palepu 2001). To represent the corporate governance (CG) of the firms in our sample, we used a dummy variable that assumes the value of 1 for firms listed for trading in the New Market segment and 0 for the others (listed for trading in Levels 1 and 2 and traditional segments).

The firm size was determined according to Equation (3) below, as also employed by Dadalt et al. (2002) and Lin and Smith (2007). They posited that the larger a company is, the more analysts will cover it, implying more accurate earnings forecasts.

$$\text{Size} = \ln(\text{Total assets}). \tag{3}$$

In line with Dadalt et al. (2002), we used the variable leverage. According to those authors, it is necessary to control this factor because there can be an ambiguous relationship between the level of indebtedness (leverage) and the level of information asymmetry. More leveraged firms should have greater investments in assets. In light of this, analysts tend to pay more attention to their results, resulting in earnings per share forecasts with lower forecasting errors. On the other hand, more leveraged firms can have more variable earnings, resulting in greater forecasting errors. The variable is computed according to Equation (4) below.

$$\text{Leverage} = \frac{\text{Total liabilities}}{\text{Total assets}}. \tag{4}$$

We also included the market-to-book variable. According to Dadalt et al. (2002), growth opportunities should be included as a control variable because a relationship exists with the level of information asymmetry. Further, according to the authors, this relationship is ambiguous because the greater the growth opportunities of firms are, the higher the volatility of their earnings, complicating the forecasting of analysts. On the other hand, firms that have lesser growth opportunities tend to face greater pressures to smooth earnings. The variable denoted by Equation (5) below is the same as the one used by Lin and Smith (2007), Júnior (2007), and Bartram et al. (2009).

$$\text{Market-to-book} = \frac{\text{M}}{\text{B}} = \frac{\text{Market price per share}}{\text{Book value per share}}. \tag{5}$$

Another control variable used here is the number of analysts who predicted the earnings per share of each company during the study period. This variable was included to control for the relationship proposed by Géczy et al. (1997). As stated by them, the larger the number of analysts who follow a firm, the greater the accuracy of forecasting its results.

As modeled by Dadalt et al. (2002), Fauver and Naranjo (2010), Lel (2012), and Júnior (2013), we used dummies for the firms' respective sectors of activity, given that sectorial differences can influence analysts' forecasts. The sectors are classified as: commerce, non-cyclical consumption, electric power, industry, services, and telecommunications. Additionally, as in Júnior (2007), we included year dummy variables to capture the possible effects of macroeconomic factors on the forecasting of firms' profits. Finally, we included the Economic Activity Index (IBC) of the Brazilian Central Bank, with seasonal adjustment.

To test the proposed hypothesis, we applied the panel data approach because it has benefits such as the ability to analyze larger samples, given that it allows considering various individuals or companies in time, thus increasing the degrees of freedom of the estimation and reducing the collinearity among the model's explanatory variables, eliminating problems that can bias the estimators. To decide which estimate better adheres to the data, we used the Chow, Breusch–Pagan, and Hausman tests.

To test the hypothesis that greater use of hedging by Brazilian companies is associated with lower agency costs faced by shareholders, and in line with the panel data method, our proposed model is that expressed in Equation (6) below.

$$AC_{i,t} = \beta_0 + \beta_1 Hedge_{i,t} + \beta_2 CG_{i,t} + \beta_3 Size_{i,t} + \beta_4 \frac{M}{B}_{i,t} + \beta_5 Lev_{i,t} + \beta_6 No.Analysts_{i,t} + \beta_7 IBC_{,t} + Year + Sector + a_i + \varepsilon_{i,t}. \quad (6)$$

According to our hypothesis, we expected a negative sign of the coefficient β_1. After estimating the model by the panel data method and verifying the best estimation among the pooled effects, fixed effects or random effects, we applied the variance inflation factor (VIF) test to check for the existence of multicollinearity, the Breusch–Pagan and Cook-Weisberg tests to check for the existence of heteroskedastic residuals, and the serial autocorrelation test described by Wooldridge (2010) and Drukker (2003) to check for the existence of first-order serial autocorrelation.

Additionally, to provide consistency to the results, we estimated the model by the instrumental variables (IV) method and the generalized method of moments (GMM), the latter of which is suitable for analyzing dynamic panel datasets. The IV method was applied to minimize the endogeneity referring to the omission of variables in the model (Allayannis et al. 2012), and the GMM for dynamic panel data analysis was applied to consider the concern about dynamic endogeneity (Chen and King 2014). In the IV method, the instrumental variable used was the hedge variable lagged by one period.

4. Results and Discussion

The descriptive statistics are reported in Table 1 below. The database was composed of 154 firms between 2010 and 2017, for a total of 1078 observations. It should be noted that the number of observations for each variable is different due to the lack of information obtained for its construction. Therefore, the database is unbalanced.

Table 1. Descriptive statistics of the variables of the model.

	AC_Mean	AC_Median	Hedge	Size	Lev	M/B	CG	No. Analysts	IBC
Mean	0.022	0.019	0.071	15.380	0.678	2.203	0.520	6.073	140.9
Median	0.001	0.001	0.040	15.305	0.604	1.442	1.000	5.000	140.5
Standard Dev.	0.093	0.082	0.087	1.522	1.325	2.789	0.500	5.543	5.4
Minimum	0.000	0.000	0.000	9.333	0.013	−6.649	0.000	0.000	132.3
Maximum	0.970	0.850	0.457	20.618	38.274	19.908	1.000	18.000	148.7
Observations	348	348	974	984	984	795	1077	875	1078

Notes: AC_Mean: proxy variable for agency costs calculated according to the mean of analysts' earnings forecasts; AC_Median: proxy variable for agency costs calculated according to the median of analysts' earnings forecasts; Hedge: proxy variable for the notional value of hedging of the firms; CG: the corporate governance level of the firms; Size: natural logarithm of the value of total assets; M/B: market-to-book ratio of the firms; Lev: leverage of the firms; No. Analysts: number of analysts who follow the firms to forecast earnings; IBC: the Economic Activity Index of the Brazilian Central Bank; Years set of dummy control variables for macroeconomic factors; Sectors: set of dummy control variables for the sector of activity. N/A: not applicable. Source—Authors.

The mean value of Hedge in Table 1 (0.071) indicates that, on average, the firms in the sample hedged 7.1% of their assets during the study period. The No. Analysts variable presents a mean of 6.073 and a median of 5, ranging from 0 to 18 analysts who follow a determined company. It should be noted that the number of analysts who follow a company can change over the years.

We also calculated the correlation matrix between the variables present in the proposed model, as described by Equation (6). Table 2 below show a negative correlation between each proxy variable for hedge and the proxy variable for agency costs. Although not presenting deterministic relations, the sign of the correlation provides initial indications about the relationship studied here and is in line with the findings of Dadalt et al. (2002).

Table 2. Correlation matrix between the variables.

Correlation Matrix	AC_Mean	AC_Median	Hedge	Size	Lev	M/B	CG	No. Analysts	IBC
AC_Mean	1.000								
AC_Median	0.234	1.000							
Hedge	−0.091	−0.094	1.000						
Size	−0.044	0.093	0.006	1.000					
Lev	0.092	0.097	0.118	0.149	1.000				
M/B	−0.114	−0.106	0.197	−0.088	0.172	1.000			
CG	0.019	−0.059	0.217	−0.482	−0.006	0.092	1.000		
No. Analysts	−0.142	−0.020	0.065	0.364	0.029	0.331	−0.113	1.000	
GDP	0.045	−0.049	−0.014	−0.022	−0.014	0.061	−0.045	0.014	1.000

Notes: AC_Mean: proxy variable for agency costs calculated according to the mean of analysts' earnings forecasts; AC_Median: proxy variable for agency costs calculated according to the median of analysts' earnings forecasts; Hedge: proxy variable for the notional value of hedging of the firms; CG: the corporate governance level of the firms; Size: natural logarithm of the value of total assets; M/B: market-to-book ratio of the firms; Lev: leverage of the firms; No. Analysts: number of analysts who follow the firms to forecast earnings; IBC: the Economic Activity Index of the Brazilian Central Bank; Years set of dummy control variables for macroeconomic factors; Sectors: set of dummy control variables for the sector of activity. GDP: gross domestic product. N/A: not applicable. Source—Authors.

The correlations between No. Analysts and the variables AC_Mean and AC_Median provide indications about the relationship established by Géczy et al. (1997), indicating that during the period studied, the accuracy of the earnings forecasts improved as the number of analysts increased. It should be noted that the relationship between the accuracy of the analysts' predictions and the proxy variables AC (Mean and Median) is inverse, meaning that the lower the value of AC is, the greater the accuracy with which analysts forecast the earnings per share of the firms. The correlation analysis and regression analysis do not allow inference about causality, but the analysis of the correlation matrix provides indications regarding the relationships among the variables. Finally, the pairwise correlations of the variables are not high, supplying indications of the absence of multicollinearity among them. In the next subsection, we describe a specific test to check for the existence of multicollinearity among the variables. The next subsection also presents the model estimated to test our proposed hypothesis.

Statistical Tests and Estimated Models

We ran the models in the STATA® software, version 14. Table 3 below present the test statistics regarding the assumptions of the regression models, among them: homoskedasticity of the residuals; multicollinearity, and serial autocorrelation. In addition to these tests, we also applied tests to verify the model that best estimated the panel data.

Table 3 show that according to the Breusch–Pagan and Cook–Weisberg tests, the null hypothesis was rejected for the four models. Therefore, since the variance of the residuals was not constant, and the estimators were not biased but were inefficient, we estimated the model in robust form, clusterized by company (ID).

With respect to the test applied to check for the existence of multicollinearity among the variables, the mean variance inflation factor (VIF) was below 5. Therefore, as proposed by Fávero and Belfiore (2015), the mean value of the VIF below 5 indicates that the coefficients of the estimated model have a low correlation, denoting the absence of the problem of multicollinearity. In turn, the result of the serial autocorrelation test indicates no rejection of the null hypothesis that the models do not suffer from the problem of first-order serial autocorrelation.

Finally, we applied the Chow, Breusch–Pagan, and Hausman tests to the models described in Table 3 to verify the best estimation model. The table also allows responding to the research question. Models 1, 2, and 3 were estimated with the same variables, but model 1 was estimated by robust fixed effects, model 2 with robust random effects, and model 3 by the GMM.

Table 3. Estimated models: Effects of the use of hedging on agency costs.

Dependent Variable	**AC_Mean**							**AC_Median**				
Independent Veriables	**Coeff.**			**Coeff.**				**Coeff.**			**Coeff.**	
Hedge	−0.1164 **	−0.1149 **	−0.5567 ***	−0.1220 **	−0.1175 **	−0.7582 ***	−0.0622 **	−0.0623 **	−0.1619	−0.0571 ***	−0.0592 ***	−0.6821 ***
Size	0.0007	−0.0003	0.0608 ***	−0.0023	−0.0033 **	−0.0397 *	0.0035	0.0035	0.0239	0.0009	0.0010	0.0695 **
Lev	0.0256 **	0.0347 ***	0.1876 ***	0.0293 **	0.0436 *	0.0442425	0.0350 *	0.0356 *	0.0694	0.0416	0.0453	0.1021 *
M/B	−0.0017 **	−0.0019 **	0.0012 ***	−0.0016 **	−0.0019 *	0.0104 ***	−0.0020 **	−0.0020 **	0.0007	−0.0020 ***	−0.0021 ***	0.0071 *
CG	0.014	0.0113	0.1597 ***	0.0185	0.0162 **	0.2403 *	0.0019	0.0019	−0.0248	0.0040	0.0039	0.4288 ***
No. Analysts	−0.0029 **	−0.0028 **	−0.0087 ***	−0.0025 **	−0.0023 **	−0.0002	0.0001	0.0001	−0.0027	0.0007	0.0007	−0.0019
GDP				(omitted)	(omitted)	−0.0015 **				(omitted)	(omitted)	−0.0014 *
Constant	0.027	0.0405	−105.68 ***	0.1007 ***	0.0243 ***	1.0007 **	−0.0557	−0.0564	−0.3524	0.0254	0.0208	−0.9681
Sectors		No			Yes			No			Yes	
Years		No			Yes			No			Yes	
Models	1	2	3	4	5	6	7	8	9	10	11	12
N	319	318	234	319	318	234	319	318	234	326	318	234
Prob > Chi^2:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
R^2:	0.0390	0.0414		0.0559	0.0624		0.03616	0.06420		0.0667	0.0682	
Estimation:	EA Robust	IV Regress EA Rob	GMM	EA Robust	IV Regress EA Rob	GMM	EA Robust	IV Regress EA Rob	GMM	EA Robust	IV Regress EA Rob	GMM
Test for Heteroskedasticity—Chi^2 statistic		424.13 ***			570.39 ***			264.27 ***			723 ***	
Mean VIF		1.32			4.38			1.32			4.48	
Test for Autocorrelation—F statistic		6.402 **			7.131 ***			89.565 ***			87.896 ***	
Chow F-test statistic		4.14 ***			4.03 ***			1.82 ***			1.83 ***	
Breusch-Pagan test—Chi^2 statistic		15.25 ***			12.81 ***			3.4 **			2.31 *	
Hausman test—Chi^2 statistic		2.83			13.41			2.92			11.34	

Notes: AC_Mean: proxy variable for agency costs calculated according to the mean of analysts' earnings forecasts; AC_Median: proxy variable for agency costs calculated according to the median of analysts' earnings forecasts; Hedge: proxy variable for the notional value of hedging of the firms; CG: the corporate governance level of the firms; Size: natural logarithm of the value of total assets; M/B: market-to-book ratio of the firms; Lev: leverage of the firms; No. Analysts: number of analysts who follow the firms to forecast earnings; IBC: the Economic Activity Index of the Brazilian Central Bank; Years set of dummy control variables for macroeconomic factors; Sectors: set of dummy control variables for sector of activity. GDP: gross domestic product. N/A: not applicable. Rejection of the null hypothesis: *** 1% significance level; ** 5% significance level; * 10% significance level. Source—Authors.

With respect to the control variables employed here, we obtained a significant sign at 5% for the leverage variable in model 1 but statistically insignificant at 10% for model 2. The variable No. Analysts in the first model indicates that the analysts' error declined with the increasing number of analysts and increased with the decrease of their number, as previously found by Géczy et al. (1997).

The results reported in Table 3 allow drawing an inference regarding the proposed hypothesis. The coefficient between hedging and agency costs is expected to be negative according to the literature, since by engaging in hedging, managers minimize the impacts of market frictions on the firm's results and hence reduce the residual losses caused to the shareholders' wealth. Thus, with a lower amount of noise in the profits, analysts can forecast the results (earnings per share) with greater accuracy, as previously found by Dadalt et al. (2002) and Lin and Smith (2007). In addition, having greater earnings predictability improves the perception of risks on the company that uses the hedge. This is also in line with Trindade et al. (2020), that is, the use of derivatives for hedging reduces the risk of companies.

The coefficients found indicate a negative relationship, as expected, between hedging and agency costs, i.e., the greater the use of hedging by companies is, the lower the agency costs faced by the shareholders will be. These results are in line with those of Wall (1989), DeMarzo and Duffie (1991, 1995), Brown (2001), Dadalt et al. (2002) and Breeden and Viswanathan (2015), but are contrary to the relationship proposed by Nguyen et al. (2010), who argued that the use of hedging tends to increase the information asymmetry between agent and principal.

It should be noted that the aspects considered by Nguyen et al. (2010) to propose this inverse relationship were related to complex characteristics, such as accounting standards, time and magnitude of hedge implementation, the possible speculative character of hedging instruments, and the difficulty of determining the level of risk to which firms' operations are exposed. However, studies such as Géczy et al. (2007), Murcia and Santos (2009), Fauver and Naranjo (2010), Aretz and Bartram (2010), and Lel (2012) found that these relations established by those authors are softened by mechanisms implemented by the stakeholders of companies. In another line of research, Antônio et al. (2020) found that the use of derivatives has not been fully incorporated by the rating agencies in their credit ratings.

Géczy et al. (2007), Fauver and Naranjo (2010), and Lel (2012) all argued that the shareholders impose mechanisms such as executive compensation agreements and enhanced levels of corporate governance to align their interests with those of the managers. Therefore, mechanisms to reduce agency conflicts also lower the probability that managers will use hedge instruments for speculation. Murcia and Santos (2009) argued that the adoption of international accounting standards tends to increase the quality of the accounting information disclosed by firms. In light of this, more information about the characteristics of firms' hedging policies should be disclosed with the adoption of stricter accounting standards.

The studies mentioned above present arguments in line with the results found in this work and also with the models suggested by Wall (1989), DeMarzo and Duffie (1991, 1995), and Breeden and Viswanathan (2015), as well as the empirical evidence reported by Brown (2001) and Dadalt et al. (2002). Therefore, our results do not reject our hypothesis.

5. Final Considerations

Only a few studies have investigated how hedging mechanisms can reduce the agency conflict between shareholders and managers. Most of these studies have proposed mathematical models, while many fewer have analyzed this relationship empirically. Properly employed, hedging policies should reduce agency costs, minimize the impacts of market frictions, and reduce the residual losses of shareholders. In the Brazilian economic scenario, characterized by significant political and economic instabilities, it is essential for managers to contract hedge instruments to keep market frictions from reducing firms' results. This paper extends to an emerging market the discussions in the previous literature, which focused on developed markets.

Our evidence indicates the existence of an impact of hedging on the agency costs of Brazilian companies. The coefficients found indicate a negative relationship, as expected, between hedging and agency costs, i.e., the greater the use of hedging by companies is, the lower the agency costs faced by the shareholders will be. The results point to a negative impact of using hedging on the agency costs, as previously reported by Wall (1989), DeMarzo and Duffie (1991, 1995), Brown (2001), Dadalt et al. (2002) and Breeden and Viswanathan (2015).

As indicated by the theory, the relationship found indicates that by engaging in hedging, managers can minimize the impacts of market frictions that can reduce firms' profits, conferring greater stability on the results. In this way, managers also reduce the residual losses of the shareholders. Furthermore, as suggested by Dadalt et al. (2002), the contracting of hedge instruments serves to demonstrate to stakeholders better performance of a firm's operations, leading creditors and investors to make better decisions about their contracts with the company since the profits are subject to less information asymmetry. This situation can thus alleviate problems related to adverse selection between the company and its stakeholders.

The main limitation of this study is related to the difficulty of discovering the full extent and strategy of corporate hedging. Obtaining protection against the market frictions to which the company's operations are exposed can go beyond the use of derivative financial instruments, such as utilizing natural hedging in operations, entering into contracts with suppliers of imported raw materials at pre-fixed prices, or selling products to foreign customers at pre-established prices, among other strategies. Therefore, discovering the full extent of hedging by companies is complex.

Future work could likewise examine other financial policies of the firm, such as excessive cash holdings, which exacerbate the scope of agency problems (e.g., Tawiah and O'Connor Keefe 2023). In closing, we suggest that future studies apply the proposed model to firms in other emerging countries with highly volatile macroeconomic variables, such as Brazil.

Author Contributions: Conceptualization, V.M.M. and M.A.A. methodology, V.M.M. software, V.M.M. validation, M.A.A., R.M.A. and R.C.G. formal analysis, V.M.M. and R.C.G. investigation, V.M.M., R.M.A. and R.C.G. resources V.M.M. and R.C.G. data curation, V.M.M., M.A.A., R.M.A. and R.C.G. writing—original draft preparation V.M.M., R.M.A. and R.C.G. writing—review and editing, V.M.M., R.M.A. and R.C.G. visualization, R.C.G. supervision M.A.A. project administration, V.M.M. and M.A.A. funding acquisition, V.M.M., M.A.A., R.M.A. and R.C.G. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

References

Allayannis, George, Ugur Lel, and Darius P. Miller. 2012. The use of foreign currency derivatives, corporate governance, and firm value around the world. *Journal of International Economics* 87: 65–79. [CrossRef]

Antônio, Rafael M., Marcelo A. Ambrozini, Vinicius M. Magnani, and Alex A. T. Rathke. 2020. Does the use of hedge derivatives improve the credit ratings of Brazilian companies? *Revista Contabilidade & Finanças* 31: 50–66.

Aretz, Kevin, and Söhnke M. Bartram. 2010. Corporate hedging and shareholder value. *Journal of Financial Research* 33: 317–71. [CrossRef]

Atiase, Rowlan K., and Linda S. Bamber. 1994. Trading volume reactions to annual accounting earnings announcements: The incremental role of predisclosure information asymmetry. *Journal of Accounting and Economics* 17: 309–29. [CrossRef]

Bartram, Söhnke M., Gregory W. Brown, and Frank R. Fehle. 2009. International evidence on financial derivatives usage. *Financial Management* 38: 185–206. [CrossRef]

Bartram, Söhnke M., Gregory W. Brown, and Jennifer Conrad. 2011. The effects of derivatives on firm risk and value. *Journal of Financial and Quantitative Analysis* 46: 967–99. [CrossRef]
Breeden, Douglas T., and S. Viswanathan. 2015. Why do firms hedge? An asymmetric information model. *The Journal of Fixed Income* 25: 7–25. [CrossRef]
Brown, Gregory W. 2001. Managing foreign exchange risk with derivatives. *Journal of Financial Economics* 60: 401–48. [CrossRef]
Campbell, Tim S., and William A. Kracaw. 1987. Optimal managerial incentive contracts and the value of corporate insurance. *Journal of Financial and Quantitative Analysis* 22: 315–28. [CrossRef]
Carneiro, Luiz Augusto Ferreira, and Michael Sherris. 2008. Corporate interest rate risk management with derivatives in Australia: Empirical results. *Revista Contabilidade & Financas* 19: 86–107.
Chang, Chun. 1997. Does Hedging Aggravate or Alleviate Agency Problems? A Managerial Theory of Risk Management. Available online: https://ssrn.com/abstract=17995 (accessed on 12 January 2022).
Chen, Jun, and Tao-Hsien Doolly King. 2014. Corporate Hedging and the Cost of Debt. *Journal of Corporate Finance* 29: 221–245. [CrossRef]
Dadalt, Peter, Geral D. Gay, and Jouahn Nam. 2002. Asymmetric information and corporate derivatives use. *Journal of Futures Markets* 22: 241–67. [CrossRef]
Danisman, Gamze Ozturk, and Pelin Demirel. 2019. Corporate risk management practices and firm value in an emerging market: A mixed methods approach. *Risk Management* 21: 19–47. [CrossRef]
DeMarzo, Peter M., and Darrel Duffie. 1991. Corporate financial hedging with proprietary information. *Journal of Economic Theory* 53: 261–86. [CrossRef]
DeMarzo, Peter M., and Darrel Duffie. 1995. Corporate incentives for hedging and hedge accounting. *Review of Financial Studies* 8: 743–71. [CrossRef]
Dolde, Walter. 1993. The trajectory of corporate financial risk management. *Journal of Applied Corporate Finance* 6: 33–41. [CrossRef]
Drukker, David M. 2003. Testing for serial correlation in linear panel-data models. *Stata Journal* 3: 168–77. [CrossRef]
Elton, Edwin J., Martin J. Gruber, and Mustafa N. Gultekin. 1984. Professional expectations: Accurary and diagonosis of errors. *Journal of Financial and Quantitative Analysis* 19: 351–63. [CrossRef]
Faulkender, Michael. 2005. Hedging or market timing? Selecting the interest rate exposure of corporate debt. *The Journal of Finance* 60: 931–62. [CrossRef]
Fauver, Larry, and Andy Naranjo. 2010. Derivative usage and firm value: The influence of agency costs and monitoring problems. *Journal of Corporate Finance* 16: 719–35. [CrossRef]
Fávero, Luiz Paulo, and Patricia Belfiore. 2015. *Análise de Dados: Modelos de Regressão com Excel®, Stata® e SPSS®*, 1st ed. Rio de Janeiro: Elsevier.
Froot, Kenneth A., David S. Scharfstein, and Jeremy C. Stein. 1993. Risk management: Coordinating corporate investment and financing policies. *The Journal of Finance* 48: 1629–58. [CrossRef]
Gay, Gerald D., and Jouahn Nam. 1998. The underinvestment problem and corporate derivatives use. *Financial Management* 27: 53–69. [CrossRef]
Géczy, Christopher C., Bernadette A. Minton, and Catherine M. Schrand. 1997. Why firms use currency derivatives. *The Journal of Finance* 52: 1323–54. [CrossRef]
Géczy, Christopher C., Bernadette A. Minton, and Catherine M. Schrand. 2007. Taking a view: Corporate speculation, governance, and compensation. *The Journal of Finance* 62: 2405–43. [CrossRef]
Graham, John R., and Daniel A. Rogers. 2002. Do firms hedge in response to tax incentives? *The Journal of Finance* 57: 815–39. [CrossRef]
Healy, Paul M., and Krishna G. Palepu. 2001. Information asymmetry, corporate disclosure, and the capital markets: A review of the empirical disclosure literature. *Journal of Accounting and Economics* 31: 405–40. [CrossRef]
Jensen, Michael C., and William H. Meckling. 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics* 3: 305–60. [CrossRef]
Júnior, José Luiz Rossi. 2007. The use of currency derivatives by Brazilian companies: An empirical investigation. *Brazilian Review of Finance* 5: 205–32.
Júnior, José Luiz Rossi. 2013. Hedging, selective hedging, or speculation? Evidence of the use of derivatives by Brazilian firms during the financial crisis. *Journal of Multinational Financial Management* 23: 415–33.
Klein, Benjamin. 1983. Contracting costs and residual claims: The separation of ownership and control. *The Journal of Law and Economics* 26: 367–74. [CrossRef]
Lel, Ugur. 2012. Currency hedging and corporate governance: A cross-country analysis. *Journal of Corporate Finance* 18: 221–37. [CrossRef]
Leland, Hayne E. 1998. Agency costs, risk management, and capital structure. *The Journal of Finance* 53: 1213–43. [CrossRef]
Lin, Bingxuan, and Chen-Miao Lin. 2012. Asymmetric information and corporate risk management by using foreign currency derivatives. *Review of Pacific Basin Financial Markets and Policies* 15: 1250004. [CrossRef]
Lin, Chen-Miao, and Stephen D. Smith. 2007. Hedging, financing and investment decisions: A simultaneous equations framework. *Financial Review* 42: 191–209. [CrossRef]
Mayers, David, and Clifford W. Smith Jr. 1990. On the Corporate Demand for Insurance: Evidence from the Reinsurance Market. *The Journal of Business* 63: 19–40. [CrossRef]

Morellec, Erwan, and Clifford W. Smith Jr. 2007. Agency conflicts and risk management. *Review of Finance* 11: 1–23. [CrossRef]
Murcia, Fernando Dal-Ri, and Ariosvaldo dos Santos. 2009. Regulação contábil e a divulgação de informações de operações com instrumentos financeiros derivativos: Análise do impacto da CVM nº 566/08 e da CVM nº 475/08 no disclosure das companhias abertas no Brasil. *Revista de Contabilidade e Organizações* 3: 3–21.
Myers, Stewart C. 1977. Determinants of corporate borrowing. *Journal of Financial Economics* 5: 147–75. [CrossRef]
Nguyen, Hoa, Robert Faff, and Allan Hodgson. 2010. Corporate usage of financial derivatives, information asymmetry, and insider trading. *Journal of Futures Markets* 30: 25–47. [CrossRef]
Rawls, S. Waite, and Charles W. Smithson. 1990. Strategic risk management. *Journal of Applied Corporate Finance* 2: 6–18. [CrossRef]
Shavell, Steven. 1979. Risk sharing and incentives in the principal and agent relationship. *The Bell Journal of Economics* 10: 55–73. [CrossRef]
Smith, Charles W., and Rene M. Stulz. 1985. The determinants of firms' hedging policies. *Journal of Financial and Quantitative Analysis* 20: 391–405. [CrossRef]
Smith, Clifford W. 1995. Corporate risk management: Theory and practice. *The Journal of Derivatives* 2: 21–30. [CrossRef]
Stulz, René M. 1984. Optimal hedging policies. *Journal of Financial and Quantitative Analysis* 19: 127–40. [CrossRef]
Stulz, René M. 1990. Managerial discretion and optimal financing policies. *Journal of financial Economics* 26: 3–27. [CrossRef]
Stulz, René M. 2001. Creating value with risk management. In *Derivatives, Risk Management and Financial Engineering*. Edited by René M. Stulz. Cincinnati: Southwestern College Publishing Co.
Tawiah, Bernard, and Michael O'Connor Keefe. 2023. Cash Holdings and Corporate Investment: Evidence from COVID-19. *Review of Corporate Finance* forthcoming. [CrossRef]
Trindade, Leonardo A., Vinícius Medeiros Magnani, Marcelo Augusto Ambrozini, and Rafael Moreira Antônio. 2020. Empresas que usam derivativos para hedge conseguem uma redução do risco? *Revista Contemporânea de Contabilidade* 17: 100–14. [CrossRef]
Tufano, Peter. 1996. Who Manages Risk? An Empirical Examination of Risk Management Practices in the Gold Mining Industry. *The Journal of Finance* 51: 1097–137. [CrossRef]
Wall, Larry D. 1989. Interest rate swaps in an agency theoretic model with uncertain interest rates. *Journal of Banking & Finance* 13: 261–70.
Wooldridge, Jeffrey M. 2010. *Econometric Analysis of Cross Section and Pane Data*. Cambridge: MIT Press.