The Impact of Hedging on Firm Value: Evidence from Brazil

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Abstract
This paper examines the impact of company's hedging activities on firm value for a sample of non-financial Brazilian companies from 1996 to 2005. The results show that hedging activities do increase the firm value. The result is robust with respect to the period and the econometric method adopted in the analysis.

Key-words: Hedging, Foreign Currency, Derivatives, Firm Value, Emerging Markets, Brazil.

JEL Codes: G32, G30, G15.

1. Introduction

The derivative market has had a rapid expansion over the last years. The latest data related to the use of derivatives published by the Bank of International Settlements shows that the notional amount outstanding of over-the-counter derivatives increased from US$257.9 billion in December 2004 to US$415.8 billion in the same month in 2006 (BIS, 2007). Part of this increase is attributed to a greater use of these financial instruments by the companies as a way to manage the risks involved in their operations.[1]Although the data show the speed of this evolution, the corporate finance literature has not yet reached a consensus on whether hedging activities add value to the firm or not.[1]

Supposing Modigliani and Miller's (1958) hypotheses are valid, companies' financial policies do not have any impact on its value. If financial markets are efficient, hedging activities by the firm does not add any value because the investor would then be able to build such a diversified portfolio that would allow them to eliminate the risks and would make the payment of a premium for the firm adopting a hedging policy unnecessary. Yet, when some of the hypotheses made by Modigliani and Miller (1958) are relaxed, it is possible to show that company's hedging policy would add value to the firm.[2]

Whether hedging policy has or not impact on firm value needs an empirical answer. The literature, however, has not reached a consensus. The empirical results found show divergences with respect to the impact of the use of currency derivatives on firm value for developed countries. In the United States case, Allayannis and Weston (2001) found a positive relation and a hedging premium of nearly 5% for the firms that use currency derivatives. Jin and Jorion (2004), studying the same country, but limiting the study to firms in the oil and gas sector, showed a negative and statistically non-significant relation between the use of commodity derivatives and firm value. Clark et. al. (2006), using a sample of French companies, showed evidence that the use of currency derivatives does not affect firm value. However, Hagelin et. al. (2004), in a similar study for Swedish firms, found evidence that the use of derivatives has a significant and positive impact on firm value.[3]

This paper casts light on this question by analyzing the impact of hedging activities on firm value in a sample of non-financial Brazilian firms from 1996 to 2005. The Brazilian case is unique when compared with the previous literature that analyzes the impact of hedging activities on firm value. The high volatility in macroeconomics variables, especially in the exchange rate, together with the fact that most firms present some kind of exposure to the exchange rate makes the foreign exchange risk first in importance to the Brazilian firms, exactly the type of environment where the hedging policy would generate more significant gains.[4] In this way, in emerging countries like Brazil, the identification of the impact of derivative use in a sample comprised by firms that act in different sectors would be easier given the high volatility of the exchange rate and the greater homogeneity of the firms with relation to their foreign exchange exposure.[5]

The results found confirm that company's hedging activities have a positive impact on its value. From 1996 to 2005, the results indicate that the firms that use currency derivatives are negotiated with a premium with relation to the companies that do not use them. The results are robust concerning the period of estimation, econometric method used and likely problem of endogeneity in the estimation.

This paper is organized as follows. Section 2 presents a review of the literature that analyzes the use of derivatives and its impact on the firm. Section 3 reports and discusses the data. Section 4 shows the methodology and results. Section 5 concludes.

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[1] In this paper, it is considered that companies use derivatives as a way to reduce the volatility of their cash flow and not for speculative reasons. Therefore, sometimes the word hedging will be used as a synonimous for derivative use.

[2] Smith and Stulz (1985) discuss that tax reasons and the possibility of incurring in costs of financial distress would lead hedging to add value to the firm. Yet, Froot et. al. (1993), financial market imperfections and the problem of underinvestment would cause hedging to have a positive impact on firm value.

[3] Other examples of this literature are Carter et. al. (2004), Lookman (2004) and Chang et. al. (2005).

[4] Rossi (2005) using a similar sample to that of this study showed that nearly 60% of the Brazilian publicly traded firms were exposed to exchange rate movements in the period 1996 – 2002.

[5] Unlikely in the developed countries, depreciation of the domestic currency are generally followed by economic crisis in developing countries. Most firms in these countries present liabilities in foreign currency generating negative balance sheet effects with a negative impact on investment and, consequently, on the GDP. Corroborating thus that the exchange rate risk is of uttermost importance to firms in emerging countries like Brazil. Due to these facts, in the paper we focus on hedging of foreign currency risk.

2. Literature Review

2.1 Theoretical Literature

Modigliani e Miller (1958) showed that with a fixed investment policy in an economy without any friction (transaction costs, agency costs and taxes), in a scenario where all rational investors have the same access to market prices and to information without any cost, the firm's financial policy will be irrelevant. If the markets are perfect and complete, firm value will be independent of hedging. In this outline, an investor will be able to eliminate the exchange rate risk from its portfolio through diversification, eliminating the gains of an active hedging policy by the firm.

In this way, hedging will only add value to the firm if some hypotheses of the model presented by Modigliani e Miller (1958) are relaxed. Smith e Stultz (1985) showed that the companies may have some benefits by reducing the volatility of their cash flow, given the structure of the taxation or the existence of costs of financial distress.

The authors showed that in a progressive taxation system, hedging might reduce the expected payment of taxes, increasing firm's after-tax income, thus producing a positive impact on firm value. The authors also showed that in case of existence of bankruptcy costs, hedging would reduce the likelihood of paying these costs, which would add value to the firm.

Stulz (1984) related the preferences of firm managers and the hedging practices. If managers were risk-averse and their income were linked to the firm results, they would have the incentive to protect themselves through hedging operations since these would reduce the firm's cash flow volatility, reducing their exposure to the currency risk. It is interesting to observe that in this case hedging would not add value to the firm, because it would only benefit the manager and not the shareholder.

Froot et. al. (1993) showed that the intensity of using derivatives would be related to the existing correlation between the firm's cash flow and its future investment opportunities. The authors developed a model where inefficiencies in the financial market make the cost of capital proportional to its cash flow. Thus, the firm must protect its cash flow from fluctuations, because in case there is a negative shock, the firm either would borrow at a higher rate to keep its investment or should reduce its investment, causing an underinvestment problem.

DeMarzo and Duffie (1995) showed that even if the shareholders could have the protection by themselves, hedging is optimal when the managers have private information about the firm's profits and want to demonstrate it to the shareholders: the quality of information received by the shareholders may affect the value of their choice whether to continue the investment project or not. The optimal hedging would then be the result of the trade-off between the level of information on profits and the costs of hedging.

2.2 Empirical Literature

The literature trying to discriminate among various theories on determinants of hedging activities is extensive (Wysocki (1995), Mian (1996), Geczy et. al. (1997), Graham and Rogers (2000), and Allayannis and Ofek (2001), among others). Judge (2003) summed up the results of 15 studies on the topic. In general, he found low support for the importance of taxes, or the managers' risk-aversion, or the presence of bankruptcy costs to determine the use of derivatives.[6] The study also pointed that the results related to the importance of imperfections in the finance market is mixed. Half of the studies confirmed the existence of a relationship between growth opportunities and the use of derivatives. The authors found strong evidence that scale economies and the volatility of cash flow in foreign currency are important determinants of derivative use. Larger companies, exporting companies or companies with subsidiaries abroad use derivatives more intensively.

[6] Only 2 out of 15 studies showed a significant relation between taxes and hedging.

The literature that covers the efficiency in the use of derivatives can be divided in two branches. The first branch analyzes the impact of the use of derivatives on the firm returns, examining if the use of derivatives affects the sensibility of the return to movements in the exchange rate. In general, the literature finds that the use of derivatives reduces the firm return sensibility to variations in the exchange rate, indicating that hedging is efficient to reduce its exposure to exchange rate.

On the other hand, several studies directly analyze the impact of the use of derivatives on firm value. The present study follows this line. Allayannis e Weston (2001) confirmed the existence of a positive and significant relation between the use of currency derivatives and firm value for a sample of American firms. The authors found a nearly 4.87% hedging premium. Similar result was found by Carter et. al.(2006). In the study, the authors showed that hedging with relation to oil prices in the airlines industry is positively related to firm value and the hedging premium reaches over 5%. The authors showed evidence that the greatest benefit of hedging in this sector would be the reduction in underinvestment costs because the fuel price is highly correlated to the investment opportunities in the sector.

However, Jim and Jorion (2004) analyzing the behavior of American companies in the oil and gas sector from 1998 a 2001 found that the impact of using derivatives on firm value is statistically insignificant if not with the signal contrary to the expected. Lookman (2004) in his analysis of the sample of oil and gas producers observed that hedging would aggregate value only to companies where the commodity risk is secondary and hedging would have a negative impact on the firms where the commodity price is a primary risk. He argued that these results derive from the fact that hedging is a proxy for management quality or agency costs, and once controlling for these facts the hedging effect would be insignificant.

Hagelin et. al. (2004), in a study for Swedish companies, found evidence that hedging activities increase firm value. The authors found that companies that use currency derivative are negotiated with premium when compared to those that do not use them. In addition, they showed that if management has an option plan for company's stock, many times, they use hedging tools to protect their remuneration and not the shareholder's. In this case, hedging shows a negative relation with firm value. Also using a sample of Swedish companies, Pramborg (2004) found a positive impact of hedging on firm value in case the firms use it to hedge its transaction exposure and an insignificant impact in case they use it to hedge its translation exposure.

Clark et. al. (2006) investigated the use of currency derivatives for non-financial firms in France from 2003 to 2005. The authors found evidence that the use of currency derivatives is not significant for firm value. Similar results were found by Dan et. al. (2005) for a sample of Canadian firms in the oil and gas sector.

There is no evidence on the direct impact of the use of currency derivatives on firm value for emerging markets. Rossi (2002) observed a reduction in the Brazilian firm's foreign exchange exposure in the shift from the fixed exchange regime to the flexible exchange regime. The author verified that this change occurred due to the fact that many firms started using currency derivatives to manage their exchange rate risk and to reduce the currency mismatch in their balance sheets.

3. Data

The database used examines all non-financial Brazilian firms listed in the São Paulo Stock Exchange from 1996 to 2005. The accounting and financial data were collected from the Economática site. All companies under judicial administration were excluded from the sample. The number of firms varies in each year included in the study, but on average 212 firms were under analysis.[7] All the variables used are evaluated at the end of the fiscal year.

Tobin's Q was used as a proxy for firm value. This is defined as the ratio of the firm market value to the replacement cost of assets. The firm market value is calculated as the book value of total assets plus the market value of the equity minus the book value of the equity. The replacement cost of assets is calculated as

[7] In an exercise of robustness, the analysis involved only firms that were in the sample in 1996 and remained until 2005, totaling 165 firms. There was no alteration in the results.

being equal to the book value of the firm's assets. In this way, the following formula is used to calculate company's Tobin's Q.[8]

$$Q = (\text{Book value of the assets} - \text{Book value of the equity} + \text{Market value of the equity}) / \text{Book value of the assets} \quad (1)$$

Table 1 shows the summary of the statistics in the sample. The data in panel A indicates that the sample shows enough variability. The total assets of the firms in the sample are worth R$ 2.593 millions with standard deviation equal to R$ 8.055 millions, indicating that the sample is not confined to large-size firms, also including medium-size and small firms. Similar fact occurs when we analyze the total sales and market value. Another relevant fact in panel A is that Tobin's Q has the mean (1,01) above the median (0,89), showing asymmetry in its distribution. To minimize this problem in the subsequent estimations, the logarithm of this variable will be used at the econometric implementation.[9]

Panel B inside table 1 shows that about half of the firms in the sample are exporters, about 80% have debt denominated in foreign currency, and 20% have subsidiaries abroad, therefore most of the firms show some source of sensibility to fluctuations in the exchange rate. Unlike Allayannis and Weston (2001), the estimation will use all the firms of the sample rather than only the exporter firms given the high rate of exposure of the Brazilian firms due to other reasons apart from their external sales.

Table 1

Descriptive Statistics

Table 1 presents the descriptive statistics for a sample of Brazilian non-financial firms from 1996 to 2005.

Panel A

Variable / Statistics	N	Mean	Standard Deviation	Median	10% Percentile	90% Percentile
Total Assets (R$ million)	2040	2593	8055	649	68	5720
Total Sales (R$ million)	2040	1962	7320	522	50	3984
Market Value (R$ million)	2040	1494	6617	169	8	2878
Tobin's Q	2040	1.01	0.63	0.89	0.57	1.50

Panel B

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Number of Firms	190	206	229	232	228	223	217	199	202	201
% of the sample										
Derivative Users	9.0%	9.7%	16.2%	20.7%	27.2%	39.0%	43.3%	41.2%	41.6%	42.8%
Exporting Firms	61.6%	56.8%	51.9%	51.3%	50.4%	51.6%	51.1%	50.3%	50.0%	46.7%
Foreign Currency-Denominated Debt	83.7%	78.6%	82.5%	81.0%	80.7%	80.7%	80.2%	76.4%	77.2%	75.6%
Subsidiaries abroad	20.0%	17.9%	16.6%	16.4%	15.8%	15.7%	15.7%	15.6%	16.8%	17.4%

The data on the use of currency derivatives were collected directly from company's annual reports located in the explanatory notes under the item financial instruments. It is important to highlight that a firm to be considered derivative user must explicitly state the derivative or hedging policy adopted and the notional value of the derivative used.[10]

In the Brazilian case, some firms keep assets in foreign currency, especially public bonds, and have mentioned that they adopt such procedure to protect themselves from exchange rate fluctuations. In this case,

[8] As a robustness exercise, Tobin's Q was also defined as a simple relation market-to-book, that is, the ratio between the market value to the book value of equity. Allayannis and Weston (2001) showed that the result is robust with relation to adopting procedures developed by Lewellen and Badrinath (1997) and by Perfect and Wiles (1994) for the calculus of company's Tobin's Q.

[9] A similar fact was observed by Allayannis and Weston (2001) and Jin and Jorion (2004).

[10] In the paper, we considered the firms that used currency derivatives because Brazilian companies mostly use these; only a few mentioned using interest rate or commodities derivatives, but these also mentioned using currency derivatives.

a variable named hedge was created. It comprises, besides the derivative users, the firms that explicitly mention that were keeping assets in foreign currency with the objective to reduce their exchange rate exposure. The data about the use of assets denominated in foreign currency were also obtained in the explanatory notes under the item financial investments.

In this way, three indicative variables of the firm's hedging policy were constructed. The variable named *derivatives* represents a dummy variable which assumes the value one if the firm uses derivatives and zero otherwise. The second variable named *hedge* is set to one if the firm used currency derivatives or foreign currency-denominated assets for protection in the period. Lastly, a continuous variable of derivative use is constructed. In this case, we used the ratio of total notional value of all derivatives used by the firm to total assets.

The results in table 2 indicate that the proportion of firms that use derivatives varied across the years. The fraction of firms in the sample that use derivatives increased consistently from 1996 to 2002 where it reached the highest point. After a slight fall, it remained stable until 2005. It is interesting to note that the proportion of firms that use derivatives in 2005 (42.8%) is in accordance with the proportion presented in studies for the developed countries.

Table 2 brings the first evidence on the impact of derivative use on firm value. The data in table 2 show that the firms that use derivatives present a greater Tobin's Q than those that do not use them. Except for 1998, the test for the equality of the means indicates that the firms that use derivatives have a greater market value that those that do not use them.

Foreign currency assets may be a complement or substitute to the derivative use. The data shown in table 2 indicates that the firms perceive the assets in foreign currency as a complement to the use of derivatives. This is indicated by two facts: the derivative users present a greater ratio of foreign currency assets to total assets than the firms that do not use derivatives, and the considerable number of firms that use both forms of protection.

Table 2

Table 2 examines the characteristics of the firms that are derivative users. *,** denote, respectively, significance at 5% and 10% of a Wilcoxon rank-sum test of the sample.

		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Number of Firms		190	206	229	232	228	223	217	199	202	201
Only Currency Derivatives		15	16	30	39	50	65	67	51	51	53
Only Foreign Currency Assets		4	6	14	19	23	23	21	16	20	16
Both		2	4	7	9	12	22	27	31	33	33
Tobin's Q	User	1.1*	0.9*	0.82	1.2*	1.1*	0.9*	1.0*	1.2*	1.6*	1.6*
	Nonuser	0.8	0.8	0.79	0.93	0.89	0.8	0.8	0.9	1.1	1.3
Derivatives / Total Assets	User	8.0%*	7.4%*	7.7%*	8.4%*	7.5%*	10%*	11%*	9.8%*	7.3%*	7.3%*
	Nonuser	0	0	0	0	0	0	0	0	0	0
Foreign Currency Assets / Total Assets	User	1.0%	1.6%	2.7%*	2.1%	2.4%	2.0%	2.5%	2.1%*	2.1%*	2.9%*
	Nonuser	0.9%	1.3%	0.4%	0.9%	1.1%	1.5%	1.5%	0.7%	0.9%	0.7%

To analyze whether the hedging policy has impact on firm value, we control for other variables mentioned in the literature and that may have impact on this value. The control variables used are:

Size: the proxy is calculated as a logarithm of the firm total assets. Either by its relationship with profitability (Mueller, 1987), or by its relationship with the firm efficiency (Peltzman, 1977), the firm size may be related to its value. Besides that, Judge (2003) showed that the result that large companies are more likely to use derivatives is robust across different studies that analyze the determinants of the hedging policy, which indicates the existence of fixed costs for hedging.

Dividends: Allayannis and Weston (2001) discussed that firms without access to the financial markets will have a higher Q, as they will only execute projects with positive present value. Besides, Fama and French (1998) pointed that dividends bear information on the firm's future profitability. Following Allayannis e Weston

(2001), a dummy for the firms that pay dividends is added as control. This dummy is set to one if the firm paid dividends and 0 otherwise.

Leverage: the firm's capital structure may also be related to its value. To control for differences in the capital structure, we calculate the firm leverage defined by the ratio of long-term debt to total assets. The impact of leverage on firm value is ambiguous. If there are tax shields with relation to the payments of interest, or the debt soothes the dispute between shareholders-manager and creditors, the impact is positive. If an increase in the leverage represents an increase in the likelihood of incurring payment of bankruptcy costs, the impact is negative.

Liquidity: Jensen (1986) argued that firms with excessive cash flow are more likely to invest in projects of negative present value. The current ratio variable defined as the ration of current assets to current liabilities is used as control for the firm liquidity.

Profitability: a profitable firm may trade at a premium in relation with a less profitable one; therefore, firms that are more profitable are expected to have a higher Tobin's Q. The index return over assets (ROA) calculated by the ratio of net income to total assets is used as proxy for the firm profitability.

Investment opportunities: Froot et. al. (1993) showed a relationship between the firm's investment opportunities and hedging activities, relation empirically confirmed by Geczy et. al. (1997). The ratio of investment to sales – investment being calculated by the variation of fixed assets – is used as indicative of the firm's investment opportunities.[11]

Geographic diversification: Several theories suggest that firms that diversify their operations geographically present a higher value in the market. Mork and Yeung (1991) and Bodnar et. al. (1997) found a positive relation between the geographic diversification and firm value. We build a dummy variable, which is set to one when the firm develops activities in other countries as exporter of goods or have subsidiaries abroad, and 0 otherwise. The multinacionality of a firm is expected to related positively to its value.[12]

Industrial Diversification: The theory establishes an ambiguous relationship between the production diversification in several segments and firm value, however, empirical evidence (Berger and Ofek (1995), Lang and Stulz (1994)) suggests a negative relationship between firm value and its industrial diversification. A variable dummy is built which is set to one if the firm operates in more than one industrial segment, and 0 otherwise.

Industry effect: if the firms that use derivatives are concentrated in high-Q segments, then these firms will have higher value not because they use derivatives, but because they belong to a specific industrial segment. A dummy variable per segment is used to analyze the industry effect on firm value.

Time effects: The macroeconomic situation of the country may affect firm value. Restrictions to the international flow of capital, adoption of taxes on investors, changes in the legislation, among other factors may have an impact on firm value. Annual dummies are used to control for the significance of the macroeconomic situation on firm value. Besides, due to the possibility of the existence of a relationship between the exchange regime and hedging activities (Schneider and Tornell, 2002) it is necessary to control for the impact of the macroeconomic environment.

Table 3 presents summary statistics of the control variables and the correlation between the variables used in the analysis. Panel B in table 3 shows that company's Tobin's Q is correlated with some variables in the analysis. The results confirm the existence of a positive correlation between Tobin's Q and the derivative use. The results also indicate the existence of a positive correlation between size, profitability, geographic diversification, and firm value, and a negative correlation between leverage, payment of dividends, liquidity and firm value. These results will be verified econometrically in next section.

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[11] Empirical studies also use the ratio of research and development investments to total sales as indicator of investment opportunities. Unfortunately, this information is not available for all the firms.

[12] Allayannis e Weston (2001) used the ratio between foreign sales and total sales as proxy for the geographic diversification of the firm. In this study, we opted to using a more representative variable of the firm's multinationality.

Table 3

Table 3 shows the summary statistics of control variables and the correlations between the variables used in the analysis. Profitability represents the ratio of net income to book value of total assets. Investment opportunities is the ratio of capital expenditures to total sales. Leverage is the ratio of long-term debt to total assets. Liquidity is the ratio of current assets to total assets. Dividends is a dummy variable if the firm paid dividends. Industrial diversification is a dummy if the firm operates in different segments. Geographic diversification is a dummy if the firm operates in the foreign market or have subsidiaries abroad. * denotes significance at the 5% level.

Panel A

Variable/Statistics	N	Mean	Standard Deviation	Median	10% Percentile	90% Percentile
Profitability (%)	2040	7.0%	9.1%	6.7%	-1.8%	17.5%
Investment Opportunities (%)	2040	-5.8%	30.2%	0.3%	-9.9%	58.4%
Leverage (%)	2040	12.4%	12.3%	9.5%	0.0%	28.9%
Liquidity	2040	1.51	1.21	1.25	0.57	2.59
Dividends	2040	0.70	0.45	1	0	1
Industrial Diversification	2040	0.45	0.49	0	0	1
Geographic Diversification	2040	0.17	0.37	0	0	1

Panel B

	Q	Derivatives	Size	Leverage	Dividends	Liquidity	Profitability	Investment Opportunities	Industrial Diversification	Geographic Diversification
Q	1									
Derivatives	0.22*	1								
Size	0.15*	0.41*	1							
Leverage	-0.09*	-0.08*	-0.06*	1						
Dividends	-0.05*	0.12*	0.19*	-0.18*	1					
Liquidity	-0.05*	-0.09*	-0.19*	-0.16*	0.21*	1				
Profitability	0.30*	0.23*	0.27* -	0.17*	0.25*	0.07*	1			
Investment Opportunities	0.04	0.09*	0.24* -	0.06*	0.02	-0.05*	0.06*	1		
Industrial Diversification	0.01	0.06*	0.07* -	0.06*	-0.02	0.05*	0.08*	0.07*	1	
Geographic Diversification	0.12*	0.06*	0.15* -	0.05*	0.08*	-0.05*	0.15*	0.07*	0.31*	1

4. Results

This analysis tests whether the hedging policy has impact on firm value. The following equation is estimated:

$$Q_{tobin,it} = \alpha_{it} + \beta_t.Hedging_{it} + \gamma_t X_{it} + \varepsilon_{it} \qquad (2)$$

Where:

$Hedging_{it}$ = Indicator variable of hedging policy of the firm. Three variables are used. Derivatives – Dummy variable that assumes the value one if the firm used derivatives and 0 otherwise. Hedge – Dummy variable set to one if the firm used derivatives or assets denominated in foreign currency. Finally, the ratio of the total notional value of the derivative used by the firm to total assets as our continuous variable.

X_{it} = Control variables mentioned previously

First, two econometric methods were used for the estimation of equation (2): pooled OLS and panel. We adopted two different methods because in case there is serial correlation in the use of derivatives the estimation using pooled OLS would underestimate the standard deviation of the coefficients. In addition, the estimation using panel techniques permits the control for individual effects of each firm. The results of the equation estimation (2) are found in table 4.

Consistent with Allayannis and Weston (2001) and Hagelin et. al. (2004), the results indicate that the adoption of a hedging policy increases firm value. Independently of the proxy for the firm hedging policy and the econometric method used, the results show a positive and significant impact of the hedging policy on firm value.

Note that the estimation using panel indicates a hedging premium of 3.1%, that is, *ceteribus paribus*, firms that use derivatives have a higher value (3.1%) than those firms that do not use derivatives. This result is also in line with that verified by Allayanis and Weston (2001), who found a premium of 5% for the American firms that used derivatives. However, the estimations by pooled OLS indicate the existence of a premium of over 10%.

With relation to the control variables, the results shown in table 4 indicate the existence of a positive relation between size and firm value, confirming that larger firms trade at a premium. The results also confirm that firms that pay dividends show lower Qs, corroborating the hypothesis that firms that have no access to the financial market adopted positive present value projects leading to higher Qs. The negative impact of liquidity on the firm Q confirms this result.

The results in table 4 indicate that firms with higher leverage present lower value, confirming that the bankruptcy risk has a negative impact on firm value, and oppose the theories of monitoring by debt or the importance of tax shields. The results show that more profitable firms present higher Qs, indicated by the significant and positive relation between firm profitability and the firms Tobin's Q.

Confirming the expectations, the multinationality of the firms has a positive impact on their values. The signs for growth opportunities and industrial diversification, although present the correct sign, are not statistically significant, which indicates that these variables do not have impact on firm value.

Table 4
Estimation Results

Table 4 shows the estimation result of equation (2). Pooled means estimation by pooled OLS and Panel means estimation per panel of fixed effects. The explanatory variable is the logarithm of Tobin's Q. The use of derivatives is a dummy variable that is set to one if the firm used derivatives and 0 otherwise. Hedge is a dummy variable for firms that use derivatives or assets in foreign currency. Derivatives / Total Assets is the ratio of total notional derivatives used by the firm to total assets. T-statistics are in parenthesis. *, ** denote significance at 5% and 10% level, respectively. Hausman indicates Hausman's test between the fixed and random effects models.

	Pooled	Panel	Pooled	Panel	Pooled	Panel
Derivatives	0,148 (8.08)*	0.031 (1.83)**	-	-	-	-
Hedge	-	-	0.142	0.027	-	-

			(8.00)*	(1.70)**		
Derivatives / Total Assets	-	-	-	-	1.06 (9.10)*	0.200 (1.80)**
Size	0.032 (5.32)*	0.024 (2.44)*	0.027 (4.44)*	0.024 (2.40)*	0.035 (6.10)*	0.025 (2.61)*
Dividends	-0.203 (-11.2)*	-0.066 (-4.05)*	-0.202 (-11.14)*	-0.066 (-4.04)*	-0.21 (-11.4)*	-0.068 (-4.16)*
Liquidity	-0.070 (-4.51)*	-0.026 (-4.43)*	-0.072 (-4.50)*	-0.026 (-4.47)*	-0.070 (-4.55)*	-0.026 (-4.45)*
Leverage	-0.072 (-9.91)*	-0.087 (-18.28)*	-0.073 (-9.97)*	-0.087 (-18.26)*	-0.073 (-10.0)*	-0.087 (-18.2)*
Profitability	1.12 (8.18)*	0.482 (6.08)*	1.11 (8.16)*	0.480 (6.06)*	1.16 (8.45)*	0.493 (6.21)*
Investment Opportunity	0.0363 (0.15)	0.0384 (0.24)	0.0132 (0.05)	0.0357 (0.22)	0.0638 (0.26)	0.0416 (0.25)
Industrial Diversification	-0.019 (-1.07)	-0.029 (-0.77)	-0.018 (-1.00)	-0.029 (-0.78)	-0.022 (-1.21)	-0.028 (-0.75)
Geographic Diversification	0.103 (5.01)*	0.111 (2.36)*	0.099 (4.89)*	0.108 (2.30)*	0.105 (5.14)*	0.113 (2.42)*
Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	No	Yes	No	No	Yes
N	2040	2040	2040	2040	2040	2040
R2	0.404	0.418	0.403	0.418	0.404	0.410
Hausman	-	χ^2 (17) = 353.4 Prob > χ^2 = 0.00	-	χ^2 (17) = 352.8 Prob > χ^2 = 0.00	-	χ^2 (17) = 441.4 Prob > χ^2 = 0.00

4.1 Endogeneity

A problem in estimation (2) is the possibility of a reverse causality between hedging and Tobin's Q. If the firm's high Tobin's Q reflects the firm's higher investment opportunity, then as stated in the theory of optimal hedging, these firms have more incentives to hedge. In this way, the positive relation would indicate that firms with higher growth opportunities have an incentive to use derivatives rather than the use of derivatives increases the value of the firm.

We use two different methods to deal with this problem. First, we perform an instrumental variable estimation in two stages. In the first, we estimate an equation to verify the determinants of the use of derivatives. In the second, equation (2) is estimated with the fitted values of the use of derivatives obtained in the first stage.[13] Note that except for the ratio of the total notional value of the derivatives to total assets, the other variables are discrete which does not allow us to use the method of instrumental variables. Thus, the results shown in table 5 are only displayed for the continuous proxy for derivative use.

In order to have the estimation by instrumental variables, valid instruments must be found: variables correlated with the choice of derivatives, but not with the future growth opportunities of the firm. Smith e Stulz (1985) argued that the firms use derivatives to reduce the expected payment of taxes. The ratio of tax loss carried forward to total assets is then adopted as instrument. Rossi (2005) showed that the great exchange rate risk the Brazilian firms face is the high proportion of its debt denominated in foreign currency. Then the ratio of total debt denominated in foreign currency to the total debt is also included as instrument.

Table 5
Instrumental Variables Estimation

[13] For further details on 2SLS estimation models in panels, see Baltagi (2001).

Table 5 presents the result of the estimation of equation (2) through the method of instrumental variables. Column Pooled shows the result of 2SLS pooled OLS estimation. Panel means the estimation by 2SLS panel estimation. *, ** denote significance at 5% and 10% level, respectively.

	Pooled	Panel
Derivatives / Total Assets	6,90 (5,17)*	2,88 (1,73)**
Size	-0,086 (-0,66)	-0,089 (-0,35)
Dividends	-0,263 (-9,49)*	-0,076 (-3,52)*
Liquidity	-0,060 (-9,40)*	-0,024 (-3,73)*
Leverage	-0,084 (-8,90)*	-0,099 (-10,99)*
Profitability	0,932 (6,12)*	0,419 (4,65)*
Investment Opportunities	0,014 (0,49)	0,090 (0,49)
Industrial Diversification	-0,074 (-2,88)*	-0,018 (-0,36)
Geographic Diversification	0,104 (3,40)*	0,113 (1,85)**
Instruments First Stage	F=34,80 Prob > F = 0.00	F=29,90 Prob > F = 0,00
N	2040	2040
R2	0,352	0,283

Table 5 presents the result of the estimation. These results confirm that the use of derivatives has a positive impact on firm value. The coefficient of the indicator variable of derivative use presents positive sign and significance at the 10% level.

The results of the first stage estimation (not shown) indicate that the instruments used are valid. As discussed by Smith and Stulz (1985), the results for the determinants of company's use of currency derivatives confirm that there is a positive relation between the use of derivatives and taxation. The results also show that the higher the ratio of foreign currency denominated debt to total debt, the higher the likelihood to use derivatives. Table 5 presents the results for the test of instrument validity whose values indicate that the instruments used are valid.

Except for the variable related to industrial diversity that becomes significant in the pooled OLS estimation, and presents the negative sign consistent with Berger and Ofek (1995) and Lang and Stulz (1994), the other control variables keep the significance and signals found.

Following Allayannis and Weston (2001), another way to test causality between firm value and hedging activities is by the analysis of the relationship between the dynamics of the evolution of firm value and its decision to use derivatives, that is, to test whether the decision to start using derivatives and the decision to quit has impact on firm value.

First, the firms are classified in four categories and dummy variables are built according to the following classification: (1) Firms that do not choose to hedge in the current and the next period (NN), (2) firms that choose to hedge in the current period, but quit hedging in the next period (HN) , (3) firms that choose not to hedge in the current period, but start it next period (NH), and (4) firms that choose to hedge in both periods (HH). Then the following equation is estimated.

$$\Delta Q = \alpha + \beta_1.(HH) + \beta_2.(NN) + \beta_3.(NH) + \beta_4.(HN) + \gamma.\Delta X + \varepsilon \qquad (3)$$

Where: ΔQ is the variation of Tobin's Q and ΔX represents the variation of control variables.

If the adoption of a hedging policy adds value to the firm, we have $\beta_3 > \beta_2$. If quitting the use of derivatives has a negative impact on the firm market value when compared to the firm that keeps hedging we have $\beta_4 < \beta_1$.

The results presented in table 6 are consistent with those found by Allayannis and Weston (2001). The results confirm that the firms that hedge in one period and decide to quit hedging in the next present a smaller value when compared with firms that keep their hedging policy. The results show that there is a premium of 1.60% for the firms that do not alter their hedging policy, but the results indicate that this difference is not statistically significant.

Table 6

Results of the firm value dynamics

Table 6 presents the results obtained in the estimation of equation (3) to analyze whether changes in hedging affect firm value. *, ** denote significance at 5% and 10% level, respectively.

Explanatory variable: Δ(ln Q)	
Derivative users in both periods (HH)	0,052 (0,82)
Derivative users who quit (HN)	0,036 (0,44)
Difference (HH-HN)	0,016
Premium	1,60%
Wald test HH-HN (p-value)	0,793
Firms that started using derivatives (NH)	0,00708 (0,18)
Non derivative users in both periods (NN)	-0,1009 (-1,85)**
Difference (NH-NN)	0,10798
Premium	10,80%
Wald test NH-NN (p-value)	0,0269
Wald test HH-HN e NH-NN (p-value)	0,084

However, the results in table 6 show that firms that started using derivatives when compared with firms that not used derivatives have a statistically significant premium of 10.8%. That is, the firms that adopt hedging have an increase of 10.8% in their value.

The hypothesis that changes in the hedging policy do not have impact on firm value is rejected at the 10% level of significance. The last line in table 6 test the jointly hypothesis that the decision to start the use of derivatives and the decision of quitting have no impact on the value of the firm. These results confirm that the hedging policy has impact on the Brazilian firm values.

4.2 Time-Changes

Allayannis et. al. (2001) discussed whether the gain obtained from adopting a hedging policy might vary according to changes in the exchange rate. The authors show that in the United States the gains would be higher when the domestic currency appreciates. They argued that this is expected because the American companies have their revenues in foreign currency – the main risk with relation to exchange rate fluctuations. Table 7 analyzes whether a similar pattern takes place in the Brazilian case.

Table 7

Impact of derivative use in different periods

Table 7 presents the result of estimations for the impact of derivative use on firm value for different periods. Panel A presents the results of estimations for each year in the sample. *Derivatives* is the dummy variable which is set to one if the firm used derivatives and 0 otherwise. *Hedge* is the dummy variable that is set to one if the firm used derivatives or assets in foreign currency. *Derivatives / total assets* represents the ratio of notational value of derivatives used divided by the book value of the firm's assets. *Panel B* divides the estimation in different periods. *Fixed* represents the period between 1996 and 1998. *Flexible,* the period 1999 to 2005. *Depreciation* represents the period during the flexible exchange rate regime where there was a domestic currency depreciation (1999 to 2002). *Appreciation* represents the period when the domestic currency appreciated (2003 to 2005). T-statistics in parenthesis. . *,** denote significance at 5% and 10% level, respectively.

Panel A

Variable / Year	Derivatives	Hedge	Derivatives/ Total Assets	N
1996	0,30 (3,60)*	0,23 (2,76)*	1,83 (2,12)*	190
1997	0,12 (1,82)**	0,095 (1,84)**	0,22 (0,37)	206
1998	0,052 (1,00)	0,079 (1,52)	0,36 (0,73)	229
1999	0,12 (1,66)**	0,13 (2,06)*	1,17 (2,03)*	232
2000	0,16 (3,10)*	0,16 (3,46)*	0,83 (1,93)**	228
2001	0,096 (2,12)*	0,076 (1,69)**	0,99 (4,45)*	223
2002	0,077 (1,62)	0,072 (1,36)	0,65 (2,37)*	217
2003	0,16 (3,99)*	0,16 (3,79)*	1,01 (3,76)*	199
2004	0,25 (3,15)*	0,21 (2,78)*	1,61 (3,38)*	202
2005	0,24 (3,72)*	0,20 (3,14)*	1,72 (4,30)*	201

Panel B

Variable	Period	Pooled	Panel	N
Derivatives	Fixed	0,120 (3,04)*	0,018 (0,42)	604
	Flexible	0,152 (7,16)*	0,040 (2,15)*	1440
	Appreciation	0,244 (4,99)*	0,172 (3,88)*	390
	Depreciation	0,112 (5,57)*	0,0145 (0,75)	1050
Hedge	Fixed	0,110 (3,10)*	0,0351 (0,91)	604
	Flexible	0,149 (7,16)*	0,0378 (2,03)*	1440
	Appreciation	0,214 (4,29)*	0,118 (2,56)*	390
	Depreciation	0,115 (5,71)*	0,024 (1,27)	1050
Derivatives / Total Assets	Fixed	0,531 (1,51)	0,430 (1,17)	604
	Flexible	1,072 (8,74)*	0,164 (1,94)**	1440
	Appreciation	1,659 (6,53)*	0,814 (2,67)*	390
	Depreciation	0,868 (6,43)*	0,047 (0,40)	1050

The results shown in Panel A (table 7) indicate that the use of derivatives have a positive impact on firm value independently of the year considered. In all the years, except for 1998, at least one proxy for the use of derivatives was statistically significant, confirming that the firms that use derivatives trade at a premium with relation to those that do not used them, and that this result does not depend on the period of estimation.

Panel B presented in table 7 helps us observe the existence of some time pattern with respect to premium significance and magnitude in the use of derivatives.

The estimation period involves two different exchange rate regimes: “fixed” exchange rate regime between 1996 and 1999, and flexible exchange rate regime from 1999 on. We divided the sample between these two periods in order to observe the hedging premium value in both periods. The results in panel B (table 7) indicate that the use of derivatives has a greater impact during the flexible exchange rate regime, confirming the existence of a relation between the exchange rate volatility and the gains in hedging.

The results found in panel B, similar to those in Allayannis et. al. (2001), also show differences with respect to gains by using derivatives when they are compared with periods of appreciation and depreciation of the domestic currency. The results indicate that the hedging premium between 2003 and 2005, a period of currency appreciation, is higher than that between 1999 and 2002, period of domestic currency depreciation. Note that we cannot reject the fact that the impact of using derivatives in depreciation periods was null when the panel estimation was used.

In a country where the capital market is less developed, this result must be understood with caution because rather than being capturing the multinationality of the firms, as argued by Allayannis et. al. (2001), it might be capturing the non-linearity of the gains in the use of derivatives. Table 8 shows that in the period 1999 – 2002 besides the depreciation of the domestic currency, there was high volatility in the exchange rate. The period 2003 – 2005 presented the Real appreciation and lower volatility in the exchange rate. Thus, in case the relation between firm value and derivative use is dependent on exchange rate volatility, we can observe in the sample a higher premium in the period 2003 – 2005. We cannot conclude, however, that the

higher gain of hedging during a period of appreciation results from the type of foreign exposure of Brazilian firms.

Table 8

Time Evolution of R$/US$ exchange rate and volatility

Table 8 shows the level and volatility of R$/US$ exchange rate in the period 1996 – 2005. The volatility is calculated by the standard deviation of daily log-returns of the R$/US$ exchange rate. Source: Brazil Central Bank

	Exchange Rate	Volatility
1996	1,0365	0,0554%
1997	1,1128	0,0727%
1998	1,2046	0,0711%
1999	1,842	1,6527%
2000	1,9625	0,5088%
2001	2,3619	1,0268%
2002	3,6251	1,5516%
2003	2,9245	0,8560%
2004	2,7174	0,5686%
2005	2,2847	0,7980%

In line with this result, Allayannis et al (2003) showed that, during the Asian crisis, the firms that used derivatives presented greater fall in their market value. The authors argued that this is due to lack of liquidity in the market during crisis periods, which makes it impossible for the firms to roll over their hedging contracts. Therefore, if periods of crisis are associated with less liquidity in the derivative market and domestic currency depreciations, the impact of derivative use on the firm value is likely to be reduced in these periods.[14]

5. Conclusion

This study analyzed the impact of the firm's hedging policy on their market value for a sample of Brazilian non-financial companies listed in the São Paulo Stock Exchange from 1996 to 2005. The results indicate that the adoption of a hedging policy adds value to the firm. The results indicate that the positive impact of using derivatives is independent of the econometric method and period analyzed. The result is also robust with relation to the inclusion of control variables and specification of the proxy variable with relation to the hedging policy.

The results of the estimation are in line with studies by Allayannis e Weston (2001) for firms in the United States and by Hagelin et. al. (2004) for Swedish firms, showing evidence that for Brazil there is a significant gain in hedging.

[14] Given the shortage of data in the sample, the analysis must be seen cautiously. In a first regression, using 10 years of the sample, we obtained the following relation between hedging premium and the exchange volatility. Hedging premium = 0,45 (3,16)*volatility - 25,25 (-2,41)*volatility^2. R2=0,65.

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