Why do Latin American firms manage currency risks?

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Abstract*: This paper investigates the determinants of currency risk management in non-financial firms in Argentina, Brazil, Chile and Mexico. We study not only the decision of using derivatives, but also the magnitude of derivatives holdings and the importance of operational hedge in firms' risk-management strategies. We find that currency exposure is the most managed with derivatives and that firms use derivatives mainly to hedge foreign debt. We also find that economies of scale, financial distress costs, informational asymmetry and growth opportunities are important for risk-management decisions, and that firms do not hedge because of potential tax benefits.*

Keywords: *risk management; derivatives; foreign exchange, Latin America.*

JEL classification: F-31, G-15, G-31, G-32.

Corporate risk management has been an issue of interest for financial managers, academics and investors for at least two decades. Surveys show that more than 2/3 of publicly traded firms in the US and Europe use financial derivatives to manage risks, and this proportion has been increasing for the last decade or so. The estimated notional value of outstanding over-the-counter financial derivatives more than tripled from 1998 to 2004 (Bank for International Settlements – BIS (2005)), rising to 221 trillion USD at end-June 2004, and non-financial firms account for almost 1/5 of this value.

The disclosure of derivative holdings and risk-management strategies in corporations has been an issue of concern among investors and regulators. Many attempts have been made in the last few years to increase the transparency of risk-management activities in the US – namely SFAS (Statement of Financial Accounting Standards) 119 and 133, and a lot of effort is still being made in this direction. The availability of publicly disclosed data has boosted research in the area, what has helped in clarifying many questions about the determinants of risk-management activities (see, among others, Graham and Smith (1999), Haushalter (2000), Graham and Rogers (2002), Guay and Kothari (2003) and Jorion and Jin (2005)), but there is still some mixed evidence. Most of the literature to date, however, has focused on US firms[1].

We investigate the determinants of risk management in the four most developed Latin American countries (Argentina, Brazil, Chile and Mexico). To the best of our knowledge, this is the first study to focus on risk management in emerging markets in a multi-country

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[1] An important exception is a work by Kim and Sung (2005), which investigates the determinants of FX risk management in Korea using survey data.

setting[2]. We use a sample of firms with ADRs (American Depositary Receipts) traded on the main US exchanges (NYSE, Nasdaq and Amex) to assure that information about derivatives activity is disclosed according to FASB (Financial Accounting Standards Board) requirements and that accounting data is uniform, at least to a certain extent. As in the US, more than 3/4 of these firms used some sort of derivative contracts to manage financial risks as of year-end 2004. Most of these firms have a high proportion of their indebtedness attached to foreign currency, which explains why currency risk is by far the exposure most commonly managed with derivatives.

The relatively good disclosure of derivatives activities allows us to study not only the decision on whether to use derivatives or not, but also the decision of the magnitude of risk being managed with derivatives. We find that the factors that impact the decision of using derivatives or not may differ from the reasons that determine the magnitude of risk being managed with derivatives. We show evidence that, while larger firms are more likely to use derivatives, showing that there are economies of scale in using them, there is a negative relationship between size and the magnitude of risk management, reflecting that larger firms face relatively smaller costs of financial distress. Unlike what was found by Guay and Kothari (2003) for US firms, we find that derivative contracts held by Latin American firms are capable of producing cash flows comparable in magnitude to investment expenditures and earnings in the event of shocks in the prices of the underlying assets. These cash flows may also alter firm value by about 3% for the median firm.

An alternative to the use of derivative contracts is the operational hedge, in which the firm matches the values of assets and liabilities to the same risk factor (for example, an exporter may raise debt attached to the same currency in which its revenues are denominated). Our evidence also shows that this "natural" currency hedge reduces the magnitude of derivative holdings for risk-management purposes. Firms that have operational results positively sensitive to local currency devaluation hold smaller derivatives portfolios than firms whose operational results are negatively or not sensitive to currency devaluation, controlling for the level of foreign debt. We find strong evidence that the costs of financial distress are the main determinant of risk management for the firms of our sample and, as a second-order determinant, firms engage in derivatives programs to be able to assure funding for valuable investment opportunities. There is no empirical support for the hypothesis that firms use derivatives to gain with the tax advantages of hedging due to reduced volatility of taxable income. We find evidence that hedging is able to reduce taxes, however, as long as it increases firms' debt capacity.

The remainder of the paper is divided into five sections and is structured as follows: the first section briefly reviews the extant theoretical rationales for risk management presented by the financial literature and the main results of empirical studies so far. Section 2 presents the sample, the procedures used to collect data, and relevant descriptive and univariate statistics. In section 3 we estimate the sensitivities of derivatives holdings to changes in the prices of the underlying assets, comparing the potential cash flows produced by the derivatives to relevant measures, such as investments, income, and firm value. Section 4 presents the methodology and the results of the LOGIT and TOBIT analyses used to estimate the relationship between firm characteristics and 1) the decision to use derivatives and; 2) the magnitude of derivatives usage. Section 5 concludes.

[2] Bartram et al (2003) make use of a broad sample of firms in 48 mature and emerging economies, but few Latin American firms are included in the sample.

1. Rationales for risk management and extant empirical evidence

In the absence of market imperfections, risk management is unable to create value. In a world with no taxes, agency costs, information asymmetry or transaction costs, there would be no demand for hedging instruments. The existence of this huge derivatives market is only explained if some of the assumptions of perfect markets are relaxed. In a broad sense, financial literature has built two main explanations for risk management. The first focuses on risk management as a way to maximize firm value, and the second finds reasons for risk management in managers' utility maximization. These theories and their main empirical implications in terms of how individual firm characteristics are determinant for the decision of managing financial risks are described below. We mainly test the hypotheses related to the first explanation (shareholder value maximization).

We believe that the reasons why firms manage risks in emerging economies are different from the determinants found for US firms and other mature economies. Specially important differences are the ubiquitous high volatility of exchange and interest rates in emerging countries (except in those that adopt fixed or crawling exchange rate regimes), and the relative scarcity of domestic funding faced by firms in emerging economies, which leads firms to raise funds overseas to finance investment projects. The portion of debt denominated in foreign currency is almost always a source of great exposure for large Latin American firms. It has been shown that currency depreciation may produce important balance sheet effects for Brazilian, Mexican and Chilean firms (respectively, Bonomo et al., 2003, Pratap et al., 2003 and Benavente et al., 2003) with direct impacts on earnings, cash flow and investment.

A second important difference between mature and emerging economies to be considered is the availability of hedging instruments, which depends fundamentally on the development of local financial markets and access to international markets.

Financial distress costs

Smith and Stulz (1985) and Stulz (1984) show that risk management can reduce the costs of financial distress. This allows the firm to increase debt capacity and raise funds at a lower cost than would be possible without hedging. Interest coverage is widely used by previous papers to measure financial distress. Many of these studies (e.g. Dolde (1995), Geczy, Minton and Schrand (1997), and Haushalter (2000)), define interest coverage as the average EBIT (Earnings before interest and taxes) of the last 3 years, divided by interest expenses in the last fiscal year. We use this definition and, alternatively, also define interest coverage as the EBIT of fiscal year 2004, divided by interest expenses in the same year. The greater the interest coverage, the less financially distressed is the firm and, thus, the less are the incentives to hedge. The level of indebtedness and the debt attached to foreign currency are also expected to be positively related to hedging.

Tax Benefits

Mayers and Smith (1982) and Smith and Stulz (1985) show that, if a firm is subject to a tax schedule that yields a convex function of the before-tax firm value (or earnings before taxes), then the after-tax firm value is a concave function of before-tax firm value (or earnings). Hedging is able to reduce the volatility of earnings and, therefore, decrease expected tax expenses, increasing firm value. A progressive corporate tax schedule is the classical case of a convex tax function. In addition, the possibility of carrying losses from one period to

another also increases the convexity of the tax function. For example, in Brazil, the amount of earnings exceeding 240,000 BRL (Brazilian Reais) is subject to an additional rate of 10%, creating a clear convexity in the tax schedule. To characterize whether or not a firm is subject to this convexity, we build a proxy similar to what was used by Nance, Smith and Smithson (1993) and Mian (1996): the standard deviations of earnings (before taxes) is estimated for the period of 1996 to 2004, and a 95% confidence interval is built around the observed value for 2004 taxable income. If this interval includes the threshold tax values (values for which the tax rate changes), the dummy of tax convexity assumes value 1. This dummy also assumes 1 if the firm has had any negative earnings carried to subsequent fiscal years between 1996 and 2003. Otherwise, the dummy assumes zero[3]. Graham and Smith (1999) show that, for firms with convex tax schedules, hedging may decrease expected taxes by 5.4% on average, reaching 40% in extreme cases, under the US fiscal regime.

Since, *ceteris paribus*, debt financing creates tax gains, increased debt capacity created by hedging is also able to generate indirect tax benefits (Ross (1997) and Leland (1998)). Graham and Rogers (2002) show that, for US firms, this gain is superior to tax benefits caused by decreased volatility in earnings. Hence, a positive relation between debt ratio and hedging is expected.

Costly external financing, information asymmetry and underinvestment

Froot, Scharfstein and Stein (1993) show that risk management may guarantee optimal investment when cash flows of current activities are uncertain to generate enough cash to internally fund all positive NPV projects. If external financing is costly or inexistent (for example, due to information asymmetry), hedging creates value by transferring resources from one state of the world where resources are abundant to another where resources are scarce. Without hedging, the firm might have to bypass some valuable investment opportunities (in other words, underinvest) if an unfavorable state of the world occurs. On the other hand, if a favorable state of the world occurs, the firm would have to deal with the excess of cash, what might also be non-optimal, considering the agency costs of free cash flow described by Jensen (1986).

Tufano (1998) argues that managers will have incentives to hedge to guarantee funding for their "pet" projects. The absence of the discipline imposed by the capital markets can lead to investment in negative NPV projects that bring private benefits to managers. In this sense, hedging can also be value-destroying. For this purpose, managers may be willing to increase information asymmetry to avoid market scrutiny.

Regardless of the purpose of hedging (i.e. to guarantee funding for value-creating or value-destroying projects), a positive relationship between information asymmetry and hedging is expected. To distinguish between value-creating and value-destroying hedge, one has to assess the set of investment opportunities available to the firm. The most common proxies for investment opportunities are market-to-book ratio and R&D expenditures scaled by size. Unfortunately, R&D is not available for most of the firms in the sample, and market-to-book also tends to be highly correlated with proxies used for information asymmetry. Following Mian (1996) and Allayannis and Ofek (2001), we use an alternative measure for information

[3] We recognize that this is an imperfect measure to proxy for whether a firm is subject to a convex tax schedule. Hedging may be used exactly to decrease volatility in earnings, so the perfect measure is the earnings that firms would have experimented, **had they not hedged**, which is obviously non-observable. We return to this issue during the discussion of results.

asymmetry, which is a dummy that returns 1 if the firm is from a regulated industry and zero otherwise.

Related to Froot, Scharfstein and Stein's (1993) costly external finance problem is the classical underinvestment problem described by Myers (1977), in which shareholders may decide not to accept projects even if they are value-enhancing, if they assess that a significant fraction of the economic rent of low-risk projects go to creditors. Debtholders anticipate this behavior, adding this factor to borrowing costs. Deriving from the ideas of Myers and Majluf (1984) and Mayers and Smith (1982 and 1987), risk management mitigates the underinvestment problem by equalizing high and low-risk projects. If the firm is able to credibly commit to risk management at the time of its financing decision, the value of debt should be less sensitive to investment decisions not yet taken (Bessembinder (1991)), and then hedging might create value. With an analogous effect to Froot, Scharfstein and Stein's implications, Myers's underinvestment problem is more likely to affect firms with high investment opportunities and, therefore, the expected relation between hedging and investment opportunities is positive.

Transaction costs

Using derivatives implies incurring in variable transaction costs, such as brokerage fees. Most of the costs, however, should be understood as fixed rather than variable: the necessity of specialized personnel, investments in software, hardware, etc. Therefore, there may be economies of scale associated to risk management using derivatives. The development of tailor-made over-the-counter derivatives also implies high fixed costs that makes the use of small contracts uneconomic. This implies that there is a positive relationship between firm size and derivatives usage. On the other hand, small firms are more likely to be financially constrained, what makes them more susceptible to financial risks and, thus, more likely to manage these risks. The relationship between size and risk management is, therefore, an empirical issue. In their vast majority, empirical studies have found a positive relation between size and derivatives usage. The studies that investigate the magnitude of hedging (e.g. Guay and Kothari (2003), Graham and Rogers (2002)) find negative or no relation between hedging and the amounts hedged, what may show that size is a constraining, but not determinant, factor for risk management.

2. Derivatives data and sample

Our sample is composed of firms from 4 different countries (Argentina, Brasil, Chile and Mexico) that belong to the *Bank of New York Latin American ADR Index*. Excluding financial firms and firms that are subsidiaries, a total of 59 firms is considered. Data on derivatives holdings as of year-end 2004 are obtained from the 20-F files submitted to the Securities and Exchange Commission (SEC). Although there is no clear pattern in the disclosure of derivatives holdings, most of the information is contained in Section 11, *quantitative and qualitative disclosure about market risk*, or in the footnotes of financial statements. To make sure that no information was lost, we performed a search for strings such as *hedg*, *swap*, *derivative*, *option*, *future*, *forward* and the surrounding text was read. For one firm, the file was not yet public on the date this paper was finished, and there was apparent inconsistency in the information of another firm, reducing the sample to 57 firms.

Table 1 shows the descriptive statistics of relevant variables for the firms in the sample, splitting the sample into derivatives users (47 firms) and non-users (10 firms). From the 57 firms, 26 are from Brazil, 12 from Chile, 15 from Mexico and 4 from Argentina. Information

other than derivatives holdings was extracted from Datastream and Economatica databases. In the case of missing or conflicting information, we recurred directly to financial statements and 20-F forms. The instructions of SFAS 119 and SFAS 133 recommend that firms disclose whether derivatives are being held for trading or for other purposes. Only two firms declared eventually using derivatives for trading, but it was impossible to distinguish what part of the portfolio was destined for hedging or not. In section 4, the tests were performed both including and excluding these firms.

Table 1: Characteristics of the firms in the sample

This table shows descriptive statistics for the main variable of the firms in the sample. From the 57 firms, 4 are Argentinean, 26 are Brazilian, 12 from Chile and 15 from Mexico. Sales and Total assets are shown in millions of US dollars, and refer to 2004. The rows *% revenue in FX* and *% debt in FX* indicate respectively the proportion of revenues and debt attached to foreign currency. *Gross margin* is defined as *EBIT/net operational revenue*, and the next row shows the relation between investments and depreciation in 2004. The last row shows the proportion of fixed assets in total firm assets. The F statistic for the comparison of means between derivatives users (47 firms) and non-users (10 firms) is shown in the last column. Between parenthesis is the P-value associated to this statistic, and the symbols ***, ** and * indicate statistical significance at 1%, 5% and 10% respectively.

	All firms		Non-users		Users		
	Average	Median	Average	Median	Average	Median	Estat. F
Total assets	5,730,213	3,343,218	2,165,554	117,086	6,582,632	3,571,740	2.455 (.123)
Sales	3,366,086	1,839,683	1,208,963	670,930	3,881,920	2,294,885	1.906 (.173)
Total debt / total assets	0.333	0.324	0.368	0.331	0.325	0.322	0.580 (.449)
% debt in FX	0.549	0.636	0.304	0.203	0.603	0.654	8.243 (.006)***
% revenues in FX	0.258	0.064	0.076	0.000	0.302	0.253	5.373 (.024)**
Gross margin	0.380	0.385	0.408	0.391	0.373	0.383	0.646 (.425)
Investments/ depreciation	1.181	0.971	0.729	0.567	1.279	0.982	3.212 (.079)*
Fixed assets / Total assets	0.445	0.486	0.432	0.379	0.449	0.489	0.059 (.808)

Derivatives users are, on average, larger than non-users, although the difference is not statistically significant at usual levels, whichever is the definition used for size (total assets or sales). In terms of indebtedness, there is little difference between the two groups. However, derivatives users have significantly more debt and revenues attached to currencies other than local. The correlation between these variables (percent of revenues in foreign currency and percent of debt in foreign currency) is 0.416, significant at less than 1%, what may indicate a natural hedge[4]. The gross margin of sales and the proportion of fixed assets are also not significantly different for derivatives users and non-users. The proxy for investment opportunities (investment/depreciation) indicates that firms with better investment opportunities tend to use more derivatives, consistent with Froot, Scharfstein and Stein's

[4] The simple existence of revenues in foreign currency does not imply a natural hedge for foreign debt (or vice-versa), since part of operational costs may also be denominated in foreign currency or there may be a currency mismatch (for example, revenues in US dollars and debt in Euros). A better measure of natural hedge for foreign debt is the sensitivity of EBIT to currency fluctuations, as explained in section 4.

(1993) theory. However, this relation may also be showing that financially constrained firms have, at the same time, little funding for their projects and difficulty in finding counterparts for derivatives transactions due to credit risk, as Mello and Parsons (2000) suggest.

Table 2: Risk classes managed with derivatives and instrument types

The number of firms that use derivatives to manage each class of risk is shown in the 2nd column, and the last 3 columns show the number of firms that use each type of contract for each risk class. Each individual firm may use more than one type of instrument, explaining why the numbers in the last 3 columns do not add up to the number of users. The majority of currency contracts exchange dollars for the local currency, and the most common interest rates are the LIBOR, CETES (Mexico), PDBC (Chile) and CDI (Brazil).

	Number of derivatives users	Futures/forwards	Swaps	Options
Currency	45	23	29	2
Domestic interest rates	13	2	11	1
Foreign interest rates	16	3	13	2
Commodities	8	5	1	2

Derivative contracts were classified into 4 distinct classes: foreign exchange, domestic interest rates, international interest rates and commodities, according to what was reported on the 20-F forms. Table 2 shows the number of firms that use each type of instrument (swaps, futures/forwards and options). Only 10 firms do not use any type of derivative instruments and, of the 47 users, 45 used derivatives to manage currency risk, what is consistent with a number of surveys on derivatives usage performed worldwide[5]. Swaps are the most common instrument used to manage currency and interest-rate risks. It was not possible to gather information on the maturities of all contracts but, for those for which this information was available, swaps typically have original maturities ranging from 3 to 6 years, with cash exchange every 6 months, although there were a number of contracts with quarterly exchange of cash. Futures and forwards are generally short-term contracts, with maturities up to 6 months. The immense majority of currency contracts involved the exchange of the local currency against the US dollar. The interest rate swaps were mainly plain vanilla exchanging fixed for floating rates, and the most widely used rates were the LIBOR (international), CDI (Certificados de Depósitos Interbancários - Brazil), CETES (Certificados de la Tesoreria de la Federacion - Mexico) and PDBC (Pagarés Descontables del Banco Central - Chile). No Argentinean firm used interest rate derivatives.

3. Cash flow sensitivities of derivatives contracts

In order to make sure that derivatives are an important part of firms' risk management strategies, one needs to investigate whether the derivatives held by firms are capable of generating cash flows with magnitude similar to the variables that are the potential object of hedging (mainly financial expenses, investments and profits). In other words, the potential cash flow generated by derivatives must be economically significant when compared to those

[5] To name a few, Bodnar et al (1995, 1996 and 1998) in the US, Saito and Schiozer (2004) in Brazil, Alkeback et al (2003) in Sweden, Bodnar and Gebhardt (1998) in Germany, and El-Masry (2002) in the UK.

variables. Since only 8 firms in the sample used commodity derivatives, we will focus our analysis on interest rate and currency derivatives.

Table 3: Sensitivity of derivatives holdings relative to hedging objectives

This table shows the descriptive statistics of the potential cash flow produced by the derivatives portfolio in the event of a 3 standard deviation shock to the price of the underlying asset relative to hedging objectives (financial expenses, EBIT and investments). The sensitivity is estimated following the procedure adopted by Guay and Kothari (2003). We use the largest sensitivity among the 3 estimated (currency, domestic and international interest rates) for each firm The flow variables (investment, EBIT and financial expense) are the 3- year averages for the period 2002-2004, and firm value is the market value of the firms as of year-end 2004. The high values obtained for the average CF derivatives / investments and CF derivatives / EBIT are due respectively to 1) some firms that invested almost zero in the last 3 years and 2) some firms that had average EBIT near zero in the last 3 years.

	1st Quartile	Median	3rd Quartile	Average
CF derivatives/Financial expenses	0.390	0.837	1.828	1.462
CF derivatives/EBIT	0.090	0.294	0.700	0.901
CF derivatives/Investments	0.285	0.611	1.458	20.390
CF derivatives/Firm Value	0.015	0.030	0.100	0.076

In order to estimate the magnitude of risk being managed with derivatives, we follow the methodology used by Guay and Kothari (2003), where three assumptions are made: 1) the cash flow generated by each derivative security is perfectly negatively correlated with the firms' unhedged cash flow (i.e., derivatives manage the firm's downside risk exposure); 2) the cash flow sensitivity of the derivatives portfolio is the potential cash flow generated by the derivatives portfolio in an extreme change in the price of the underlying asset. Extreme changes are defined as 3 times the annualized volatility of the movements in the asset prices, measured for the period 2000-2004; 3) There are no offsetting positions within the portfolio of derivatives, i.e. we use the gross notional principal value of derivatives holdings for each risk class[6]. Since our interest is in estimating the order of magnitude of the cash flow sensitivity of derivatives holdings, it is arguable that there is no substantial error due to these assumptions. The assets chosen to represent each risk class are the exchange rate of the US dollar versus local currency (for currency risk), LIBOR (international interest-rate risk) and the CDI, PDBC and CETES rates respectively for Brazilian, Chilean and Mexican domestic interest-rate risk.

Unlikely Guay and Kothari (2003), who add the sensitivity of all risk classes in order to compare them to the variables of potential hedge, we chose the largest of the 3 sensitivities estimated (currency, domestic interest rates and international interest rates) to be compared to the potential hedging objectives. Table 3 shows the sensitivity of derivatives holdings relative to the variables of hedge. If a 3 standard deviation shock occurs in the price of the most important underlying asset (exchange rate, domestic or international interest rate), the portfolio of derivatives is capable of generating a cash flow equivalent to 83.7% of financial expenses, 61.1% of investments and 29.4% of operational results for the median firm. This

[6] We use this procedure even for firms that disclose derivatives activities on a contract-by-contract basis. The amount of offsetting long and short positions has not reached 15% of the nominal value of derivatives holdings. Graham and Rogers (2002) report that, for their sample of American firms, after netting out long and short positions, firms' net notional principal is about 70% of gross notional principal.

cash flow is also equivalent to 3% of the firm value for the median firm and 7.6% for the average firm. These numbers show that derivatives may play an important role in firm's risk-management strategies, differently from what was found by Guay and Kothari (2003).

We believe that there are two main reasons for finding evidence different from that obtained by Guay and Kothari (2003) for their sample of US firms. First, the volatility of exchange and interest rates in Latin American countries are significantly greater than in the US, what makes the sensitivity to 3 standard deviation shocks higher in our study. Second, there is a seven-year difference between the two studies. There is no doubt that risk-management practices using derivatives have become more common in the last years, what means that, if Guay and Kothari's study had been performed using data of 2004, the results would probably be different. BIS data show that the gross notional value of outstanding over-the-counter derivatives more than tripled between 1998 and 2004.

4. The determinants of corporate hedging – empirical analysis

In this section, we investigate which are the driving forces for the decision of using derivatives or not, and also what determines the magnitude of risk being managed with derivatives. In order to answer the first question, we use a binary variable that indicates whether or not the firm has used derivatives as of year-end 2004, and LOGIT tests are performed. For the second question, as the dependent variable, we use the gross notional value of derivatives holdings and perform TOBIT tests. Since there are few firms using commodity and interest-rate derivatives, we focus on the use of currency derivatives. As observed by Graham and Rogers (2002), a more precise measure of the magnitude of the exposure being managed with derivatives would be the netted value of derivatives holdings (offsetting long and short positions), but this information is only available for a few firms in the sample. Even in Graham and Rogers's paper, a great part of the contracts are classified as unsure in their sample. Apparently, the measurement error associated to this variable is small.

LOGIT tests

The LOGIT tests are performed to investigate the decision of using derivatives or not. Our dependent variable is binary, returning 1 if the firm held derivatives as of year-end 2004 and 0 otherwise. The independent variables are described below:

ASSET: Log of the total assets as of year-end 2004, used to proxy for firm size;

SALES: Log of sales in 2004, an alternative proxy for firm size;

FRGN_DBT: ratio of debt attached to foreign currency to total debt as of year-end 2004, including both long and short-term debt. It is understood as one of the exposures to currency fluctuations, and a possible cause of financial distress.

CONVTAX: a dummy indicating whether the firm is subject to a convex tax function or not. A 95% confidence interval is built around the 2004 pre-tax operating income for each firm, using the standard deviation estimated from 1997 to 2004, and assuming normality. If this interval contains the progressive region, the dummy assumes value 1. It also assumes 1 if there was a tax credit transferred from one year to another during the period 1997 to 2004. Otherwise, the dummy assumes value 0. We excluded firms with less than 5 valid observations of pre-tax operating income.

COV_RAT: Coverage ratio, defined as the 3-year average pre-tax operating profit, divided by financial expenses in 2004. We excluded firms for which data was unavailable from 2002 to 2004.

REGUL: dummy that returns 1 if the firm is from a regulated industry (oil & gas, telecom, pharmaceuticals, energy and transportation), and 0 otherwise. It is used to proxy for informational asymmetry;

AFIX_ATT: proportion of fixed assets to total assets. It is used to proxy for costs of financial distress;

DM_AR; ***DM_BR***; ***DM_CH*** e **DM_MX**: dummy variables corresponding to the country of origin, assuming 1 respectively for Argentina (DM_AR), Brazil (DM_BR), Chile (DM_CH) and Mexico (DM_MX), and 0 otherwise.

Table 4 shows the estimates of the LOGIT model for 5 different specifications. In the first specification, we include only the variables that translate the 3 main rationales for risk management (financial distress, informational asymmetry and tax convexity). The coefficients for foreign debt have the expected sign for all specifications, with significance around 1%. However, this variable may reflect not only the costs of financial distress, but also effective exposure to currency risk (since domestic currency debt is also a proxy for financial distress costs). Substituting this variable by total debt/total assets or foreign debt/total assets, we obtain similar results (not shown), but with lower significance (around 5 to 10%) and a worse adjustment. Other proxies for financial distress costs are the proportion of fixed assets to total assets and the coverage ratio. In the specifications 3 to 5, in which these variables are included, both have the expected sign, but only for the first (fixed/total assets) the coefficients are significant at usual levels. Also, the fit of the model is much better with the inclusion of this variable, but does not improve with the inclusion of the coverage ratio.

In the second specification, we include firm size as one of the regressors. Consistent with previous findings and with the univariate statistics of section 2, firm size is important for the decision of using derivatives. It is clear that larger firms are more likely to use derivatives, what is explained by economies of scale in derivatives usage and transaction costs. The inclusion of size in the regression also improves the fit of the model in terms of the pseudo-R^2 and correct prediction. If we use the log of sales instead of the log of total assets, the results (not shown) are only marginally changed, not only in terms of the statistical significance of the variables, but also in terms of fit. The dummy for tax convexity showed negative coefficients (contrarily to what was expected), but was not significant in any of the specifications.

The proxy for informational asymmetry (REGUL) showed negative coefficients, significant at the usual levels, as predicted by theory (Froot, Scharfstein and Stein (1993)) and consistent with previous empirical studies (Geczy, Minton and Schrand (1997), and Haushalter (2000)). Its substitution for the ratio *investments / depreciation* yields positive coefficients, as expected, but does not alter the results (not shown) qualitatively. However, the statistical significance is slightly worse (around 10%), the same happening to the fit of the model.

Table 4: LOGIT estimations

Table 4 presents the estimators for the regression coefficients for different specifications tested (1 to 5). The p values for the chi-square test (Wald statistics) are shown in parenthesis. The symbols *, ** and *** indicate statistical significance at 10%, 5% and 1% respectively. The statistics for the intercept were suppressed. The *correct prediction* row indicates the proportion of cases correctly predicted by the model, i. e., the percentage of firms for which there is coincidence between predicted and observed values for derivative usage. Model adjustment measures shown are the pseudo-R^2 and the Cox-Snell R^2, which are adjusted according to the number of degrees of freedom.

Variable	**Expected sign**	**0**	**1**	**2**	**3**	**4**
FRGN_DBT	+	3,903 (0,008) ***	4,504 (0,012) **	2,712 (0,010)**	6,687 (0,012) **	7,494 (0,013) **
REGUL	-	-1,814 (0,081) *	-2,625 (0,043) **	-4,045 (0,022) **	-4,376 (0,012) **	-4,325 (0,015) **
CONVTAX	+	-0,195 (0,825)	-0,668 (0,524)	-0,179 (0,873)		
ASSET	?		1,225 (0,018) **	1,967 (0,017) **	1,845 (0,021) **	1,752 (0,025) **
AFIX_ATT	-			-7,092 (0,091) *	-6,830 (0,094) *	-6,034 (0,098) *
COV_RAT	-				-0,046 (0,519)	-0,055 (0,455)
DM_AR	-					-2,404 (0,224)
Pseudo-R^2		0,330	0,516	0,591	0,600	0,626
Cox-Snell R^2		0,202	0,316	0,362	0,367	0,384
Correct prediction	0	30,0%	50,0%	70,0%	80,0%	70,0%
	1	95,6%	100,0%	100,0%	97,8%	100,0%

The inclusion of country dummies was not able to significantly improve model fit. Taking Mexico as the benchmark, the coefficients obtained for Brazil and Chile were positive for all specifications tested, and for Argentina the coefficients were always negative (as shown in specification 5). Thus, there is weak evidence that Brazilian and Chilean firms may be more likely to use derivatives than Mexican and Argentinean companies. Although this evidence is weak, it may be telling us that the probability of using derivatives is linked to the degree of development of financial markets, since Brazil and Chile have the most developed financial markets and banking sector, and Argentina is clearly the country with the least developed financial market.

TOBIT tests

In the second test, our dependent variable is the gross notional value of currency derivatives holdings, divided by total assets. We perform a TOBIT test since the variable is censored at zero in about 20% of the observations (firms that do not use currency derivatives). Since the existence of operational hedge mitigates currency exposure, it is imperative that we control for this factor. An operational hedge for foreign debt is characterized when the operation of the firm produces results denominated in foreign currency, mitigating the currency exposure due to foreign debt. To identify the existence of operational hedge, we perform a regression of the earnings before interest and taxes against the exchange rate (measured in US dollars / local currency), as shown below:

$$\Delta EBIT_{i,t} = c_i + \sum_{l=0}^{n} \beta_{i,l} \Delta e_{t-l} + \varepsilon_{i,t}$$, where

$\Delta EBIT_{i,t}$ is the first difference for the 12-month EBIT for firm *i* in quarter *t*, measured in domestic currency;

c_i is the intercept of the regression equation;

Δe_t is the first difference of the 12-month average exchange rate in quarter t, measured in local currency relative to the US dollar;

n is the number of quarterly lags between observed earnings and exchange rate[7];

$\beta_{i,l}$ are the regression coefficients;

$\varepsilon_{i,t}$ are the regression residuals.

We use the operational earnings, since this measure is not affected by capital structure or hedging operations, and we choose a 12-month period to avoid seasonal adjustment issues. A positive $\beta_{i,l}$ coefficient indicates that the operational profit varies in the same direction as the exchange rate, i.e. profits are higher when local currency is depreciated. In this case, if the firm has debt in foreign currency, this exposure is being mitigated by its operation that produces results that are sensitive to the exchange rate. Based on these regressions, we build a dummy variable that assumes value 0 if any of the coefficients $\beta_{i,l}$ are positive and statistically significant at 10%, and 0 otherwise. Thus, this dummy (NO_H_OPR) measures the inexistence of operational hedge.

Besides the variables defined for the LOGIT tests, we define a series of other independent variables, as described below:

FX_AT: Gross principal notional value of currency derivatives holdings of the firm divided by total assets in 2004. It is the dependent variable for the TOBIT tests;

GR_MGN: Gross margin of sales, defined as gross operational profit divided by net operational revenues. It indicates the informational asymmetry of the firm's activities.

EAR_DEBT: Average 2002-2004 EBIT, divided by the total debt at year-end 2004. It is an alternative to the coverage ratio.

NO_H_OPER: Dummy that assumes value 0 if operational earnings are positive and significantly related to the exchange rate. It indicates the absence of operational hedge to mitigate exposure due to debt in foreign currency.

Table 5 shows the results of the TOBIT estimation. Specifications 1(a) to 3(a) include all firms for which data were available and, in specifications 1(b) to 3(b), the two firms that admit holding derivatives for purposes other than hedging. Comparing the regressions in pairs (1(a) to 1(b), 2(a) to 2(b) and 3(a) to 3(b)), for which the only difference is the exclusion of these firms, it is clear that the adjustment of the model is better in the last 3 specifications. The analysis of the residuals of the first 3 specifications shows that the residuals obtained for the 2 firms are the 2 most extreme values on the right tail of the distributions, indicating that the variable that we are using to measure the magnitude of hedging may be overestimated for

[7] The number of lags used for each firm was based on the Akaike criterion and, in all regressions, stayed between 1 and 3.

these 2 firms, since part of the derivatives holdings may be used for purposes other than hedging.

Table 5: Estimation of the TOBIT model

The left-hand side variable is the gross nominal value of currency derivatives holdings divided by total assets as of year-end 2004. Specifications 1(a), 2(a) and 3(a) include all firms in the sample for which data were available, and specifications 1(b), 2(b) and 3(b) exclude 2 firms that declared using derivatives for trading purposes in their 20-F reports. The p value of the estimators of the coefficients is shown in parentheses, and the symbols ***, ** and * indicate statistical significance at 1%, 5% and 10% respectively. We found no information on financial expenses for one of the firms in the sample, so the indicated number of firms falls to 56 in specifications 1(a) and 2(a) and to 54 firms in specifications 1(b) and 2(b).

		All Firms			**Hedgers only**		
Variable	**Expected sign**	**1 (a)**	**2 (a)**	**3 (a)**	**1 (b)**	**2 (b)**	**3 (b)**
FRGN_DBT	+	0,061 (0,198)	0,094 (0,041) **	0,090 (0,045) **	0,042 (0,175)	0,065 (0,026) **	0,064 (0,026) **
INV_DEP	+	0,0003 (0,054) *	0,0002 (0,135)	0,0003 (0,105)	0,0002 (0,083) *	0,0001 (0,166)	0,0001 (0,149)
AFIX_ATT	-	-0,064 (0,405)	-0,064 (0,396)	-0,031 (0,676)	-0,076 (0,133)	-0,057 (0,241)	-0,040 (0,198)
COV_RAT	-	-0,002 (0,515)	-0,002 (0,467)		-0,002 (0,206)	-0,002 (0,099) *	
EAR_DEBT	-			- 0,0001 (0,346)			-0,0001 (0,139)
GR_MGN	+	0,002 (0,028) **	0,003 (0,009) ***	0,003 (0,004) ***	0,002 (0,003) ***	0,003 (0,000) ***	0,003 (0,000) ***
DM_CH	+	0,118 (0,003) ***	0,147 (0,000) ***	0,133 (0,001) ***	0,082 (0,002) ***	0,094 (0,000) ***	0,086 (0,001) ***
DM_BR	+	0,117 (0,000) ***	0,133 (0,000) ***	0,132 (0,000) ***	0,087 (0,000) ***	0,095 (0,000) ***	0,098 (0,000) ***
NO_H_OPER	+		0,086 (0,013) **	0,081 (0,016) **		0,057 (0,011) **	0,055 (0,012) **
ASSET	?		-0,005 (0,244)			-0,005 (0,412)	
SALES	?			-0,001 (0,071) *			-0,007 (0,241)
Number of firms		56	56	57	54	54	55
R^2		0,281	0,387	0,420	0,410	0,530	0,558
Adjusted R^2		0,144	0,234	0,278	0,292	0,407	0,444

The proportion of debt in foreign currency has proven to be an important factor to explain the magnitude of derivatives holdings, as it has also shown to be for the decision of using derivatives (in the LOGIT tests). Note, however, that in specifications 1(a) and 1(b) that do not control for the existence of operational hedge, there is no statistical significance at the usual levels. In the remaining specifications, it is clear that, whenever earnings in local currency are not positively sensitive to exchange rate fluctuations (i.e., when NO_H_OPER=1), the magnitude of currency hedging with derivatives is larger. The replacement of *foreign debt / total debt* with *foreign debt / total assets* returns similar results (not shown). An alternative to capture the joint effect of the exposure due to foreign debt and

its mitigation with operational hedge is to build a variable that is the product of FRGN_DBT by NO_H_OPER. The regressions adding this variable yield positive and significant coefficients (results not shown), but the fit is not improved relative to specifications 2(a), 3(a), 2(b) and 3(b).

For all specifications tested, the coefficients of the variables that are meant to capture the effects of costs of financial distress (*coverage ratio*, *earnings/debt* and *proportion of fixed assets*) have the expected sign, but are not significant at usual levels. The variable that captures the degree of informational asymmetry (*gross margin*) has the expected sign and statistical significance of at least 3% in all specifications. When *gross margin* is replaced by the dummy that discriminates firms in regulated industries (REGUL), the results (not shown) are not qualitatively changed, but its statistical significance is worse (around 10%), as well as the model adjustment measured by the R^2. The proxy for investment opportunities (*investment/depreciation*) also shows coefficients with the expected sign and significance around 10% in all specifications. These results are consistent with firms hedging to minimize underinvestment problems when they have growth options (Froot, Scharfstein and Stein (1993)).

Firm size, either measured by log of assets or log of sales, is negatively related to the magnitude of currency hedging, although in only one regression the coefficient obtained was significant at the usual levels. Therefore, while firm size is determinant for the decision of using derivatives or not, indicating the existence of economies of scale in derivatives usage, the hypothesis that larger firms have proportionally less costs of financial distress is confirmed. Our results for currency hedging in Latin American firms are identical to those of Haushalter (2000) for oil-price hedging in US oil companies.

We also observe that firms from Brazil and Chile have substantially larger currency derivatives holdings compared to Mexican and Argentinean firms. The greater development of capital markets and the banking industry in Brazil and Chile seems to play an important role in the magnitude of hedging in these countries. However, political, economical and institutional issues cannot be discarded in explaining these results. The adoption of a fixed exchange rate by the Argentinean government up until 2002 may contribute to the absence of the adoption of hedging policies by local firms. A simple observation of exchange rate volatilities in the last 6 years shows that, in almost any time window chosen, Mexico is the country with the lowest exchange rate volatility, which certainly has an important role in explaining why Mexican firms hedge less than their Brazilian and Chilean counterparts.

Finally, the inclusion of the tax-convexity dummy in the regressions does not substantially alter the results (not shown), and its coefficients show statistical significance always around 50%. Thus, the reduction in expected taxes seems to be irrelevant to both the decision of using derivatives or not and the magnitude of currency hedging. It is possible, however, that the variable we use to measure tax-function convexity is an imperfect measure of tax convexity before hedging. Studies that use a variable similar to the one we used (Nance et al (1993), Mian (1996) and Haushalter (2000)) also point to the non-importance of this possible determinant for hedging.

5. Concluding remarks

This paper studies the determinants of hedging in four Latin American countries, Argentina, Brazil, Chile and Mexico, using a sample of 57 firms with ADRs traded on major US exchanges. We investigate not only derivatives usage as a binary variable, but also the

magnitude of currency hedging with derivatives. Data on derivatives holdings was hand collected directly from the 20-F files submitted to the Securities and Exchange Commission (SEC) and refer to year-end 2004. Foreign exchange risk is the most commonly managed with derivatives, consistent with virtually all surveys conducted on derivatives usage worldwide.

We also find that derivatives are capable of producing cash flows comparable in order of magnitude to the potential variables of hedging (earnings, financial expenses and investment). For the median firm, the portfolio of derivatives is able to produce a cash flow equivalent to 83% of financial expenses, 29% of earnings before tax and interest and 61% of investments in the event of a 3 standard deviation shock in the price of the underlying asset. This result is different from that found by Guay and Kothari (2003) for US firms. We offer two main explanations for finding different results. First, Guay and Kothari use data from 1997 as opposed to our study that uses data from 2004. In this 7-year period, derivatives have probably become more common in corporate hedging strategies, given BIS data showing that the value of OTC derivatives more than tripled in this period. Second, Latin American economies face substantially more volatility in their exchange and interest rates, which may explain why Latin American firms could proportionally hold more derivatives to hedge against these sources of exposure.

Consistent with the findings of Haushalter (2000) and Jorion and Jin (2005) for US oil firms, we find that the decision on whether to use derivatives or not has distinct determinants from the decision on the magnitude of risk to be managed with derivatives in Latin America. Our results show that firm size is positively related to the decision of using derivatives, but not to the magnitude of hedging. These findings are consistent with both the economies-of-scale hypothesis and the costs of financial distress hypothesis, i.e., larger firms are more likely to use derivatives, since there are economies of scale in derivative usage. In other words, there are fixed costs in using derivatives that only large firms can bear. On the other hand, larger firms face less costs of financial distress, what may explain why the relation between the magnitude of derivatives holdings and firm size, if there is any, is negative.

Consistent with most of the empirical studies on corporate hedging, we find that the costs of financial distress related to currency exposure are the main driving force for both the decision of using derivatives and the magnitude of derivatives holdings. Debt in foreign currency is positively related to both derivatives usage and the magnitude of hedging. We also find the operational currency hedge (the mitigation of risk by matching of debt and earnings in foreign currency) is an important substitute for derivatives, i.e., firms that hedge debt with their operations use proportionally less currency derivatives.

Consistent with financial theory, we find that firms hedge to mitigate underinvestment problems. Informational asymmetry and growth opportunities are both positively related to hedging decisions, showing that firms hedge to assure the internal generation of cash flows for future investment (Bessembinder (1991) and Froot, Scharfstein and Stein (1993)) and also try to mitigate agency disincentives to invest in low-risk projects, equalizing the potential exposure of low and high-risk projects (Myers (1977) and Myers and Majluf (1984)).

We found no evidence of firms hedging to decrease expected taxes. Tax-function convexity has shown to be unimportant for both the decision of using derivatives and the magnitude of derivatives holdings. We recognize, however, that the variable we used for convexity of the tax function may be an imperfect measure of actual convexity. The proper variable would consider what the firm's taxable income would be, had it not hedged, which is clearly

unavailable. In most of the studies that use similar proxies for tax convexity, the results were similar to ours.

On a country-level basis, we find that Brazilian and Chilean firms are not only more likely to use derivatives but also hedge more in terms of magnitude. Although the reasons for this result would require further investigation, we believe that this result is mainly explained by the greater development of the Brazilian and Chilean financial markets in relation to Argentina, which results in facilitated access to hedging instruments. A possible explanation for Chilean and Brazilian firms hedging more than their Mexican peers is the lower volatility of exchange rates in Mexico. The finding that firms in Argentina are the less likely to hedge may also be explained by the fact that the Argentinean government adopted a fixed exchange rate regime up until 2002, which causes the supply of hedging instruments to be scarce and the culture of hedging in non-financial firms to still be incipient.

We believe there are two main limitations to this study. The first is related to sample size, which makes it impossible to control for industry, and limits our results to a selected group of firms with relatively good conditions in terms of liquidity, international visibility, access to capital markets and financial health (with a few exceptions). Benavente et al (2003) show evidence that larger Chilean firms have more dollar-denominated debt than their smaller peers and Bonomo et al (2003) show that in Brazil larger firms are able to react faster than smaller companies to a shift in exchange-rate risk by reducing debt in foreign currency . Unfortunately, the process of hand collecting data is very time consuming, and disclosure on derivatives is worse for smaller firms, even for those listed in US exchanges. The second limitation is the lack of tests on managerial risk aversion as a hedging determinant. Tufano (1996) shows, using a sample of gold-mining firms, that risk management is strongly associated to managerial characteristics and their compensation packages (managers who have a greater portion of their pay in the form of stock options tend to manage less risk than those who receive stocks). Compensation data is unavailable for most of the firms, and, when disclosed, there is no clear pattern that would allow a valid comparison among compensation packages. Non-public information (e.g., collected by survey or other means) could help in understanding the managerial rationales for risk management, but we leave this issue for future studies.

References

Alkeback, P., Hagelin, N. Derivative Usage by Nonfinancial Firms in Sweden with an International Comparison, **Journal of International Financial Management and Accounting**, New York, v10, n2, p105-121, June 1999.

Allayannis, G., Ofek, E., Exchange Rate Exposure, Hedging, and the Use of Foreign Currency Derivatives, **Journal of international Money and Finance**, v20, p 273-296, 2001.

Bank for International Settlements, BIS Quarterly Review, March 2004, Basle, p A99-A104, 2004.

Bartram, S.M., Brown, G.M. Fehle, F.R. International Evidence on Financial Derivatives Usage, Working Paper, 2003. available at <www.ssrn.com>, accessed September 30th, 2005.

Benavente, J.M., Johnson, C.A., Morandé, F.G., Debt composition and balance sheet effects of exchange rate depreciations: a firm-level analysis for Chile, **Emerging Markets Review** 4, p 397-416, 2003.

Bessembinder, H., Forward Contracts and Firm Value: Investment Incentive and Contracting Effects, **Journal of Financial and Quantitative Analysis**, V26, p 519-532, 1991.

Bodnar, G. M., Hayt, G. H., Marston, R.C. Smithson, C.W., Wharton Survey of derivatives usage by U.S. Non-Financial Firms, **Financial management**, v24, n2, p104-114, Summer 1995.

Bodnar, G. M., Hayt, G. H., Marston, R.C. Wharton Survey of derivatives usage by U.S. Non-Financial Firms, v25, n4, p113-133, Winter 1995.

Bodnar, G. M., Hayt, G. H., Marston, R.C. 1998 Survey of derivatives usage by U.S. Non-Financial Firms, Wharton School of the University of Pennsylvania, Philadelphia, 1998.

Bodnar, G. M., Gebhardt, G., Derivatives Usage in Risk Management by U.S. and German Non-Financial Firms: A Comparative Survey, CFS Working Paper n98/17, 1998.

Bonomo, M., Martins, B., Pinto, R., Debt composition and exchange rate balance sheet effects in Brazil: a firm level analysis, **Emerging Markets Review** 4, p368-396, 2003.

Brown, G., Managing Foreign Exchange Risk with Derivatives, **Journal of Financial Economics**, v60 n2, p 401-449, 2001.

Froot, K. A., Scharfstein, D. S., Stein, J. C., Risk Management: Coordinating Corporate Investment and Financing Policies, **Journal of Finance**, V48, p1629-1658, 1993.

Geczy, C., Minton, B., Schrand, C., Why Firms Use Currency Derivatives, **Journal of Finance**, v52, p 1323-1354, 1997.

Graham, J. R., Rogers, D. A., Is Corporate Hedging Consistent with Value Maximization: An Empirical Analysis, Working Paper, 1999. available at <www.ssrn.com>, accessed September 30th, 2005.

Graham, J. R., Rogers, D. A., Do firms hedge in response to Tax Incentives, **Journal of Finance**, V57, p 815-839, 2002.

Graham, J. R., Smith, C. W, Tax Incentives to Hedge, **Journal of Finance**, V54, p 2241-2262, 1999.

Guay, W., Kothari, S.P., How Much Do Firms Hedge With Derivatives?, **Journal of Financial Economics**, 2003.

Haushalter, G. D., Financing Policy, Basis Risk, and Corporate Hedging: Evidence from Oil and Gas Producers, **Journal of Finance**, V55, p107-152, 2000.

Jensen, M. C., Agency Costs of Free Cash Flow, Corporate Finance and Takeover, American Economic Review, 1986

Leland, H. E., Agency Costs, Risk Management and Capital Structure, **Journal of Finance**, V53, p 1213-1243, 1998.

Mayers, D., Smith, C. W., On the Corporate Demand for Insurance, **Journal of Business**, v55, p 281-296, 1982.

Mayers, D., Smith, C. W., Corporate Insurance and the Underinvestment Problem, **Journal of Risk and Insurance**, V 54, p 45-54, 1987.

Mello, A. S., Parsons, J.E., Hedging and Liquidity, **The Review of Financial Studies**, Vol. 13, n. 1, p 127-153, 2000.

Mian, S. L., Evidence on Corporate Hedging Policy, **Journal of Financial and Quantitative Analysis**, V31, p419-439, 1996.

Myers, S. C., Determinants of Corporate Borrowing, **Journal of Financial Economics**, v5, p147-175, 1977.

Myers, S. C., Majluf, N. S., Corporate Financing and Investment Decisions When Firms Have Information that Investors Do Not Have, **Journal of Financial Economics**, v13, p187-221, 1984.

Nance, D. R., Smith, C. W., Smithson, C. W., On the Determinants of Corporate Hedging, **Journal of Finance**, V48, p 267-284, 1993.

Pratap, S., Lobato, I., Somuano, A., Debt composition and balance sheet effects of exchange rate volatility in Mexico: a firm level analysis, **Emerging Markets Review** 4, p 450-471, 2003.

Ross, M. P., Corporate Hedging: what, why and how, working paper, available at www.haas.berkeley.edu/finance/WP/rpf280.pdf, accessed September 30th, 2005.

Saito, R., Schiozer, R.F.., Uso de Derivativos e Gerenciamento de Risco em Empresas Não Financeiras: Uma Comparação entre Evidências Brasileiras e Internacionais, **XXVIII ENANPAD**, 2004.

Smith, C.W, Stulz, R.M., The determinants of Firms' Hedging Policies, **Journal of Financial and Quantitative Analysis**, v20, n4, p 391-405, 1985

Stulz, R.M., Optimal Hedging Policies, **Journal of Financial and Quantitative Analysis**, v19, n2, p 127-140, 1984.

Stulz, R.M., Rethinking Risk Management, **Journal of Applied Corporate Finance**, v9, n3, p 8-24, 1996.

Tufano, P., Who Manages Risk? An Empirical Examination of Risk Management Practices in the Gold Mining Industry, **Journal of Finance**, v51, p 1097-1137, 1996.

Tufano, P., Agency Costs of Corporate Risk Management, **Financial Management**, Vol. 27, p 67-77, 1998.