ISSN 1518-3548

BANCO CENTRAL DO BRASIL

Working Paper Series 144

The Effect of Bid-Ask Prices on Brazilian Options Implied Volatility: a Case Study of Telemar Call Options

Claudio Henrique da Silveira Barbedo and Eduardo Facó Lemgruber

October, 2007

ISSN 1518-3548
CGC 00.038.166/0001-05

Working Paper Series	Brasília	n. 144	Oct	2007	P. 1-26

Working Paper Series

Edited by Research Department (Depep) – E-mail: workingpaper@bcb.gov.br

Editor: Benjamin Miranda Tabak – E-mail: benjamin.tabak@bcb.gov.br
Editorial Assistent: Jane Sofia Moita – E-mail: jane.sofia@bcb.gov.br
Head of Research Department: Carlos Hamilton Vasconcelos Araújo – E-mail: carlos.araujo@bcb.gov.br

The Banco Central do Brasil Working Papers are all evaluated in double blind referee process.

Authorized by Mário Mesquita, Deputy Governor for Economic Policy.

General Control of Publications

Banco Central do Brasil

Secre/Surel/Dimep

SBS – Quadra 3 – Bloco B – Edifício-Sede – 1º andar

Caixa Postal 8.670

70074-900 Brasília – DF – Brazil

Phones: (5561) 3414-3710 and 3414-3567

Fax: (5561) 3414-3626

E-mail: editor@bcb.gov.br

Consumer Complaints and Public Enquiries Center

Address:	Secre/Surel/Diate
	Edifício-Sede – 2º subsolo
	SBS – Quadra 3 – Zona Central
	70074-900 Brasília – DF – Brazil
Fax:	(5561) 3414-2553
Internet:	http://www.bcb.gov.br/?english

The Effect of Bid-Ask Prices on Brazilian Options Implied Volatility: a Case Study of Telemar Call Options*

Claudio Henrique da Silveira Barbedo**
Eduardo Facó Lemgruber**

Abstract

Although not explicitly reported, option traders on the Bovespa exchange pay an implicit bid-ask spread on each trade. Reported transaction prices that comprise the databases previously used to study the Brazilian options markets do not reflect actual option values at the time of the trades, but actual values plus (for purchases) or minus (for sales) the bid-ask spread. We use a chooser American option model to estimate Telemar call options bid-ask spreads, and to create a database of spread-adjusted trade prices. We find that the bid-ask spreads explain several previously reported puzzles regarding asset price volatility.

Keywords: Bid-Ask Spread; Option Market; Implied Volatility
JEL Classification: G13

---

* The authors would like to thank Hendrik Bessimbinder and an anonymous referee for their comments.
** Central Bank of Brazil, Research Department.
** COPPEAD Graduate School of Business, Federal University of Rio de Janeiro.

1. Introduction

Brazilian capital market asset prices incorporate transaction costs that are not visible for investors. Those costs are driven by the way price orders are imputed to the market. While limit orders do not guarantee a trading execution, market orders have an immediate response but generate costs that are transferred to investors. These costs compose the bid-ask spread. As Brazilian prices do not report bid and ask quotes, there is a possibility that transaction prices are contaminated by the difference between the prices paid for immediate purchase and received for immediate sale.

Roll (1984) suggests a methodology for inferring the effective bid-ask spread in market price series. Huang and Stoll (1996) report estimates for Roll spreads that are similar to the NYSE and NASDAQ effective transaction costs. Schultz (2000) finds that Roll's methodology works surprisingly well with NASDAQ intraday prices. Stoll (1989) extends Roll's work and presents possible reasons for price changes, deriving a new transaction serial covariance.

An extensive literature investigates the relationship between order flow costs and changes in asset prices. Brock and Kleidon (1992), for example, show a U-shaped intra-day pattern in NYSE stock prices bid-ask spreads. They argue that high spreads are a response of market makers to the increased order flow at open and close periods, feared that they can be adversely selected by traders who know more than they do. On the other hand, low spreads are an attempt to avoid exposing themselves to the risk of holding unwanted inventory positions. Abhyankar et al (1997) verify the same intraday pattern for the London Stock Exchange volatilities. In the Brazilian market, Moreira and Lemgruber (2004) find a similar pattern to the Bovespa Index volatility.

Papers on volatility present different results for the Brazilian and the American markets. For instance, Latané & Rendleman (1976) and Beckers (1981) verify that implied volatility from options outperform historical estimates with regard to forecast. In Brazil, Sanvicente (1996) claims that the implied volatility of the options market is not actually observed in the underlying asset's price behavior. Gabe and Portugal (2003) verify that the historical volatility is more efficient to forecast future volatility when compared to the Black and Scholes implied volatility. Araújo, Barbedo and Lemgruber (2004) find extremely high implied volatilities for Telemar call options for the 2001-2002 years. Galvão (2002) compares the historical and the implied volatility and verifies that the former is most efficient in ordinary periods and the latter in stressful periods.

We use a chooser American option model as a improvement to Copeland and Galai (1983) methodology to estimate the implied bid-ask spread for Telemar call option prices during December 1, 2003 to December 4, 2004. We follow Rubinstein (1985) to organize the data.[1] The procedure of extracting the bid-ask spread from options allows us to reduce the implied volatility estimation errors. Our methodology infers options implicit bid-ask spread and corrects the estimation volatility bias reducing the implied volatility for Telemar options. Additionally, we analyze the bid-ask spread embedded in each option transaction, and present an answer for the conflicting results observed in Brazilian option pricing empirical tests.

The remainder of this work is organized as follows. Section II presents the sample characteristics and the database treatment. Section III gives an overview of the methodology. The results are shown and commented in Section IV. Section V concludes the study.

2. Sample and Database Treatment

Our initial sample consists of a series of intraday stock and call option prices obtained by request from the Brazilian Stock Exchange. The sample consists of all reported trades on the floor of the Bovespa during December 1, 2003 to December 4, 2004.Telemar options respond for 85% of the stock options volume in the exchange. Following Rubinstein (1985), we refine the sample selecting options that attend the following criteria: a) At least 5 minutes within a constant stock price interval; b) Options trading only occurred 10 minutes after the exchange opening and 10 minutes before its closing time; c) A minimum of 5 negotiated contracts.

Database treatment reduces the sample from 4,800,000 option prices to 83,000 synchronized observations. To verify if this subset could be biased, ten-paired samples with 5,000 observations are randomly selected for the entire database and for our synchronized sample. For both samples, the difference between market prices and Black and Scholes (1973) prices are statistically similar.

[1] Rubinstein (1985) was the first to present a methodology to treat intraday databases for option pricing tests.

3. Methodology

We use the Black and Scholes and the Merton jump model (1976) to measure call options market price errors. Relative errors are calculated as the difference between market and model price divided by the former price. To value the options we use the last trade implied volatility and a minimum square error procedure, considering previous month market prices, to estimate the jump frequency and its magnitude parameters. Table 1 presents the root mean square error for each model according to the moneyness and the time to maturity.[2]

Table 1
Relative Differences between the Model Prices and Market Prices

Moneyness	Model	Working Days to Maturity					All Maturities
		1 - 5	6 – 10	11 –20	21 - 30	31 - 40	
Extremely Out-of-the-Money	Black&Scholes	3.77%*	4.83%*	2.30%*	3.23%*	3.50%*	3.54%*
	Merton	4.02%*	5.21%*	2.62%*	3.64%*	3.35%*	3.87%*
	KW Statistic	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0844)	(0.0000)
	Observations	942	2032	2995	980	56	7005
Out-of-the-Money	Black&Scholes	9.34%*	11.76%*	1.12%*	4.49%*	2.69%*	6.50%*
	Merton	8.88%*	11.27%*	1.36%*	4.36%*	2.58%*	6.25%*
	KW Statistic	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0000)
	Observations	1902	6687	15218	4228	327	28362
At-the-Money	Black&Scholes	12.71%*	8.92%*	3.59%*	7.97%*	2.77%*	7.77%*
	Merton	12.37%*	8.59%*	3.56%*	7.81%*	2.53%*	7.55%*
	KW Statistic	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0894)	(0.0000)
	Observations	3415	7850	10422	2815	162	24644
In-the-Money	Black&Scholes	14.65%*	22.52%*	9.44%*	19.99%*	3.24%*	16.71%*
	Merton	14.42%*	22.21%*	9.29%*	19.83%*	3.23%*	16.48%*
	KW Statistic	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0738)	(0.0000)
	Observations	3077	5884	6989	1662	47	17659
Extremely In-the-Money	Black&Scholes	36.22%*	20.97%*	15.30%*	30.66%*	2.09%*	27.37%*
	Merton	36.18%*	20.99%*	15.33%*	30.56%*	2.07%*	27.35%*
	KW Statistic	(0.0000)	(0.0000)	(0.0000)	(0.0002)	(0.1543)	(0.0000)
	Observations	1899	1600	1271	469	13	5252

Kruskal-Wallis (KW) Statistic is Used to Compare Both Models. Reported p-values in Parentheses. A star indicates a variable statistically different from zero.

[2] Moneyness classification follows: delta options lower than 0,15 are extremely out-of-the money; higher than 0,85 are extremely in-the-money. To keep a uniform distribution among the other 3 subsets, the out-of-the-money options are characterized by deltas between 0.15 and 0.4, at-the-money options deltas are between 0.4 and 0.6 and the in-the-money options present deltas between 0.6 and 0.85.

Table 1 shows an errors pattern that gets larger as options approach maturity and as strike prices decrease. Merton's model presents a lower average error, except for the extremely out-of-the-money options. To verify if the result produced by the Merton's models is actually different from Black and Scholes, we perform the Kruskal-Wallis nonparametric test. Except for extremely in-the-money options with time to maturity higher than 31 days, we reject the null hypothesis of similar distribution functions for both models at the 10% significance level. The Kruskal-Wallis test is used to verify if the values are statistically equal to zero. We reject this null hypothesis. Merton's errors results are smaller than Black and Scholes for most of the moneyness classifications. For both models, errors increase as options get in the money.

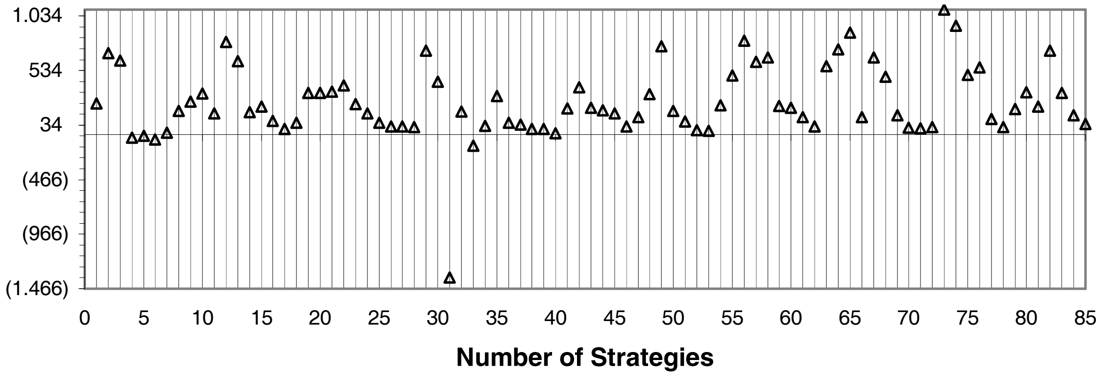
We present three suggested arguments, usually mentioned in the finance literature, to explain the systematic pricing errors observed. First, option market prices in Brazil can be inefficient; second, the models' mathematical structures are incorrect and; third, inputs have been mismeasured because bid-ask spread are not taken into account. Although there can be sporadically inefficiency in market prices as shown by Torres, Bonomo and Fernandes (2002) this situation is extremely unlikely in a mature market with a reasonable number of traders. Furthermore, despite models' imperfections noticed by literature, Hull (2003) argues that no model has better performed and a wider utilization than Black and Scholes. We are left with the third alternative.

To evaluate the implied volatility we use a dynamic hedging scheme. Riskless portfolios are set up to lock profits originated by selling options and hedging with stocks according to the delta indicated by the model. Eight-five strategies are created from July 5, 2004 to December 4, 2004. Figure I indicates profit results for all strategies. Initial portfolios are created for each option series shorting 1,000 options. Continuum rebalancing is allowed by trading new options, with the restriction that daily options traded cannot overcome the effectively traded options in the exchange. Maximum and minimum observed profits are R$ 1,092.85 and –R$ 1,365.24. Positive profits average R$ 300.00. The mean of all negative results is –R$ 186.00. Average profit for an arbitrageur that have engaged in all strategies is R$ 242.69 with a median of R$ 170.68. Almost 90% of the strategies present profits at maturity, meaning that the market volatility implied in the option price is higher than the stock's true volatility.[3] Although the huge percentage of winning

[3] We do not consider transaction costs. Although Fama and Blume (1966) show that even a floor trader pays at least 0.1% costs per transaction, transaction costs in Brazil are very low. For instance, even if they are carried out profits

strategies ascertained, investors may not succeed in practice because they cannot trade options by the sample prices. The systematic profits can be explained by microstructural biases. Option prices are biased by the embedded bid-ask spreads that affect arbitrage opportunities.

Figure I
Delta Hedging Profits in Reais($). (Each Point Indicates an Option Series)

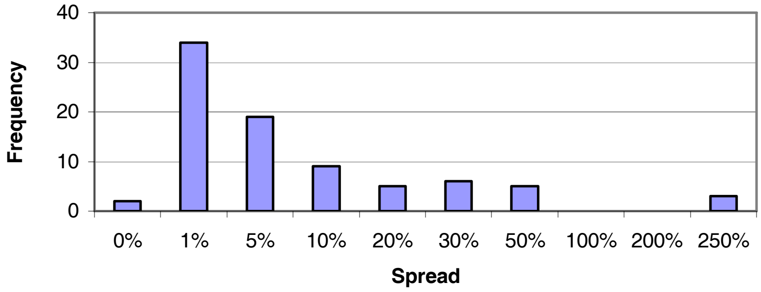


Roll (1984) argues that the existence of an effective bid-ask spread can be verified by the negative first-order serial covariance of price changes, provided that the market is informationally efficient. Fama (1965) argues that price changes occur if and only if unanticipated information arrives in the market. So, the variance is likely to be dominated by new information and the covariance between successive price changes depends on whether successive sampled transactions are at the bid or at the ask prices. Roll's estimative of the stock price percentage bid-ask spread is equal to $2\sqrt{-\text{cov}_{j,t}}$, where $\text{cov}_{i,j}$ is the estimated serial covariance of the returns of asset j at time t. Figure II presents the histogram and the descriptive statistic for Telemar sample spreads estimated by Roll's methodology.

---

are so high that they will not vanish. On the other hand, it is possible that the low liquidity observed in the Brazilian market rebalancing strategies would not perform well.

Figure II
Roll's Bid-Ask Spread Histogram and Descriptive Statistic



Minimum	0.00%
1Q	0.64%
Median	1.37%
3Q	8.32%
Maximum	243.34%
Mean	14.42%
Std Deviation	41.62%

It was possible to estimate the spread for 83 series in the sample. Mistaken positive covariances were obtained just for two series. Spreads vary from a maximum of almost 250% to zero. For three series, estimate spreads are above 200%. When these series are excluded from the sample, the maximum value reduces to 44.11%, with a mean of 6.70%. The spread estimated according to this method presents a tendency to get large as the strike price increases. Deep out-of-the-money options have the highest spreads and deep in-the-money options have the lowest spreads.

The huge variance of the reported spreads suggests that Roll's ex-post technique may not be applicable for Brazilian short-term option series. Furthermore, given the substantial cross-sectional variation volatility, spread varies over time as well, suggesting that an alternative method to estimate the bid-ask spread that allows for time variation should be used.

Option price theory can help to estimate the Telemar call options bid-ask spreads. In a "market order" market, investors pay the market maker a premium, the bid-ask spread, to buy or to sell the option by its fair price. Copeland and Galai (1983) argue that those spreads can be estimated by the standard Black and Scholes model, with the European style option maturing at the open quote interval. Note that, the possibility of trading at any time during the quote interval implies that spreads are similar to an American style option. Furthermore, given that investors can execute buy or sell orders, this choice has to be included in the evaluation methodology. We use an American chooser option model to estimate the spreads, with the exercise price equals to Telemar call option fair price and the underlying parameter equals to the call option fair price plus or minus the spread. The time to maturity is the open quote interval, i.e. one and a half minute. The model's other two parameters are: the one-day interbank certificate of deposit as a proxy for the risk-free rate and Telemar implied volatility. Equations (1) and (2) show the bid and the ask spreads, respectively, as a call and a put functions of the five model parameters. The model result is given by the $Max(bid_{spread}; ask_{spread})$.

$$bid_{spread} = f(K + bid_{spread}, K, T, R_f, \sigma) \tag{1}$$

$$ask_{spread} = f(K + ask_{spread}, K, T, R_f, \sigma) \tag{2}$$

The bid-ask spreads are evaluated by an iterative procedure backed by a binomial tree model and by a finite difference method. We use a binomial model, with 50 steps, because it is an American style option and there is no closed-form solution for its price. Hull (2003) describes different simulation correction procedures to improve models performance. We used the control variate technique because it is simple and easily applicable to the binomial model.

Finite difference methods can also be used to solve the problem. Several methodologies are suggested in the finance literature. As pointed out by Ikonen and Toivanen (2005), the stability and consistency of the time discretization is the most important property for pricing options with those methods. Our first step was to examine the effectiveness of the finite difference numerical schemes evaluating an at-the-money option and comparing the results to the Black and Scholes benchmark. Table 2 presents the root mean squared error for the five selected methods.[4] We choose the implicit finite difference method, reported in the third box of Table 2, because of its simplicity, CPU time results and the smaller error observed.

Table 2
Root Mean Squared Error and CPU Time in Seconds for Each Finite Difference Method

Number of Time Intervals	Explicit Method		Implicit Method		Brennan-Schwartz Method		Courtadon Method		Crank-Nicolson Method	
	RMSE	CPU Time (seconds)	RMSE	CPU Time (seconds)	RMSE	CPU Time (seconds)	RMSE	CPU Time (seconds)	RMSE	CPU Time (seconds)
25	0.05880	0.05	0.00470	0.04	0.00320	0.05	0.05630	0.06	0.00290	0.05
50	0.03940	0.11	0.00230	0.04	0.00120	0.05	0.05609	0.11	0.00250	0.11
100	0.00110	0.16	0.00120	0.05	0.00330	0.05	0.05610	0.17	0.00900	7.11
200	0.00060	0.33	0.00060	0.05	0.00110	0.11	0.05620	0.39	0.00100	9.33

[4] The selected methods are: 1) The Explicit Finite Difference Method; 2) The Implicit Finite Difference Method; 3) Brennan and Schwartz (1978); 4) Courtadon (1982); and 5) The Crank-Nicolson Method. References for the first, the second and the last methods are in Tavella and Randall (2000).

4. Results

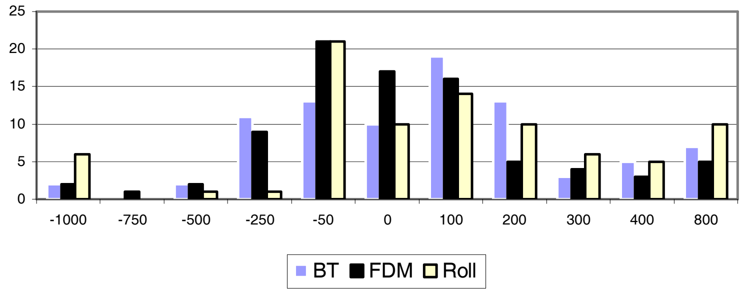
We estimate bid-ask spreads between 1% and 35% for call option prices. They have a strong positive relationship with the implied underlying-asset volatility and with the option price, and a negative relationship with the quantity of traded options. Similar association is predicted in the seminal work by Demsetz (1968) who analyzes the cost of exchanging titles in NYSE and concludes that prices and liquidity are forces that dominate the spread. Table 3 shows the least squares estimation of the spread as a function of the three variables described above. For the sample size employed, results are statistically significant as p-values suggest.

Table 3
Results of Estimation

Variables	Coefficient	P-Value (t Statistic)
Intersection	-0.0884	0.00000
Quantity of Traded Options	-1.30E-10	0.00072
Implied Volatility	0.26137	0.00000
Option Price	0.02464	0.00000
	R-Square	0.75499
	F Test	0.00000

Figure III presents the results of all implemented delta-hedging strategy procedures considering the bid-ask spread costs. Although it is not possible to know if a strategy is a buyer-initiated or a seller-initiated trade, we assume that all procedures are initiated by a purchaser. According market contacts we inferred that the Brazilian option market has a rare frequency of seller-initiated trades. Besides, analyzing our database it is clear that most of the acquired options are taken to maturity. Consequently, available prices in the database are the ask prices. Bid prices are determined indirectly by the subtraction of two times the spread.

Figure III
Histogram and Descriptive Statistic of Delta-Hedging Results, in Monetary Units, when Spreads are estimated by Roll, by Finite Difference (FDM) and Binomial (BT) Methodology



Statistic	Finite Difference Method	Binomial Tree	Roll
Minimum	(1,578.83)	(1,572.08)	(12,568.91)
Median	(30.67)	14.26	13.65
Maximum	776.30	758.03	998.51
Mean	(59.02)	(14.62)	(338.14)
Std deviation	320.71	343.96	2,089.36

The new results reported in Figure III are drastically different from the presented in Figure I. Profits and losses are distributed around zero. Strategy returns are negative for all methods. Roll's results are smaller. Three observed spreads are higher than 100% of the option price and when excluded, the mean result becomes equal to R$ 46.29. The delta-hedging strategy maximum returns drop to R$ 998.51 with Roll's estimate spreads, and to R$ 758.03 and R$ 776.30 when spreads are estimated by the binomial model and by the finite difference method. Our delta-hedging results are less concentrated for the extremes and converge toward the middle of the profit distribution.

A nonparametric Kruskal-Wallis test is performed under the null hypothesis that all methodologies produce results that have identical distribution functions. At the 95% confidence level, we do not reject this null hypothesis. It means that our results are compatible with the ones found by Roll's methodology. Besides, signal changes in the strategies returns for both techniques are similar

Roll's technique delta-hedging schemes present positive returns for 46 of the 85 strategies, indicating a fair game. Although, our delta-hedging schemes present positive returns for 56% and 39% of the strategies, they are not different from the mean. It shows that when spreads are taken into account profitable delta-hedging strategies vanish and the implied volatility is correctly evaluated. As a consequence, we have now an adjusted-spread database.

To emphasize our findings we annualized all sample volatilities. Table 4 shows the sample month annual volatility mean and standard deviation results for the adjusted and non-adjusted spread database. The adjusted sample presents smaller means and standard deviation for all months. [5] The last measure indicates that our volatility estimates for the adjusted sample are more precise. The mean results show that the Telemar actual volatility is smaller when the bid-ask spread is considered.

Table 4
Implied Volatilities Statistics from Option Prices Samples with and without the Bid-Ask Spread

Option	Non Adjusted Sample		Adjusted Sample	
Maturity	Mean	Standard Deviation	Mean	Standard Deviation
January, 2004	35.54%	10.31%	34.09%	8.21%
February, 2004	33.87%	5.12%	30.32%	2.52%
March, 2004	41.64%	8.77%	38.82%	5.17%
April, 2004	40.84%	4.49%	39.03%	4.36%
May, 2004	38.31%	1.52%	37.23%	1.51%
June, 2004	36.11%	3.17%	34.73%	2.65%
July, 2004	35.77%	6.05%	34.13%	3.18%
August, 2004	38.26%	4.21%	37.18%	3.77%
September, 2004	33.88%	3.79%	32.83%	3.08%
October, 2004	33.16%	3.97%	32.07%	3.18%
November, 2004	29.22%	3.22%	28.43%	2.80%

Finally, we divide our samples according to Telemar call options moneyness. Table 5 shows that non-adjusted sample volatilities are higher than the true volatilities for all five groups. We also observe the same error behavior reported in Table 1. As option get deeper in the money, model prices relative errors increases. Our research suggests an explanation for the overvalued volatility forecasting errors observed in previous Brazilian literature.

Table 5
Implied Volatilities Estimated for the two Samples

Moneyness	Non Adjusted Sample	Adjusted Sample	Relative Difference
Extremely Out-of-the-Money	37.12%	36.22%	2.48%
Out-of-the-Money	35.91%	35.04%	2.49%
At-the-Money	34.78%	33.38%	4.20%
In-the-Money	35.79%	33.40%	7.15%
Extremely In-the-Money	36.83%	31.45%	17.10%

[5] The nonparametric Kruskal-Wallis test rejects the hypotheses that both implied volatilities are identical.

5. Conclusion

The article estimates the bid-ask spread for the Telemar options in the Brazilian market. The database chosen is composed by intraday prices of stocks and options effectively traded in the BOVESPA Exchange from December 2003 to December 2004. When the spread is taken in account, the underlying asset implied volatility significantly reduces to consistent and steady values.

Delta-hedging strategies are created to verify profit arbitrages. When the bid-ask spreads are considered the strategy systematic profits vanish indicating that the spread presence in the Brazilian market explains the positive profits verified in previous research.

References

Abhyankar, A.H., Ghosh, D., Levin, E., Limmack, R.J. 1997, "Bid-ask spreads, trading volume and volatility: intra-day evidence from the London Stock Exchange," *Journal of Business Finance and Accounting*, 24(3/4), 343-362.

Araújo, G., Barbedo, C, Lemgruber, E. 2004, "Adequação das Medidas de Valor em Risco na Formulação da Exigência de Capital para Estratégias de Opções no Mercado Brasileiro," *Revista de Economia e Administração (IBMEC)*, vol. 3, n. 4.

Beckers, S. 1981, "Standard Deviations Implied in Option Prices as Predictors of Future Stock Price Variability," *Journal of Banking and Finance*, vol. 5, pp. 363-381.

Black, F., Scholes, M. 1973, "The Pricing of Options & Corporate Liabilities," *The Journal of Political Economy*, May.

Brennan, M., Schwartz, E. 1978, "Finite difference methods and jump processes arising in the pricing of contingent claims: A synthesis," *Journal of Financial and Quantitative Analysis*, 13, pp. 462–74.

Brock, W.A.., Kleidon A.W. 1992, "Periodic market closure and trading volume: a model of intraday bids and asks," *Journal of Economic Dynamics and Control*, 16, 451-489.

Copeland, T., Galai, D 1983, "Information Effects on the Bid-Ask Spread," *The Journal of Finance,* 38, 1457-1469.

Courtadon, G. 1982, "A more accurate finite difference approximation for the valuation of options," *Journal of Financial and Quantitative Analysis*, 17, pp. 697–705.

Demsetz, H. 1968, "The Cost of Transacting," *The Quaterly Journal of Economics*, 82, pp. 33-53.

Fama, E. F. 1965, "The Behaviour of Stock-Market Process," *Journal of Business*, 38, pp. 34-105.

Fama, E. F., Blume, M. 1966, "Filter Rules and Stock Market Trading Profits," *Journal of Business*, January, 226-241.

Galvão, A. 2002, "*Análise Intraday do Modelo Black & Sholes pelas Volatilidades Implícita e Condicionada GARCH para Ativos Brasileiros,"* Anais Enanpad.

Gabe, J., Portugal, M. 2003, "*Volatilidade Implícita Versus Volatilidade Estatística: Uma Avaliação Para o Mercado Brasileiro a Partir dos Dados de Opções e Ações da Telemar S.A.,"* PPGE –UFRGS, textos para discussão.

Huang, R. and Stoll, H. 1996, "Dealer versus auction markets: A paired comparison of execution costs on Nasdaq and the NYSE," *Journal of Financial Economics* 41, 313-358.

Hull, J. 2003, *Options, Futures & Other Derivatives*, Prentice Hall.

Ikonen, S., Toivanen, J. 2005, "*Pricing American Options Using LU Decomposit*ion," University of JyvÄaskylÄa, Finland, working paper.

Latané, H.A., Rendleman, R.J. 1976, "Standard Deviations of Stock Price Ratios implied in Option Prices," *Journal of Finance*, vol. 31, pp. 369-381.

Merton, R. 1976, "Option pricing when underlying stock returns are discontinuous," *Journal of Financial Economics* 3, 125–144.

Moreira, J., Lemgruber, E. 2004, "O uso de dados de alta freqüência na estimação da volatilidade e do valor em risco para o IBOVESPA," *Revista Brasileira de Economia* vol.58, n.1, p.100-120.

Rubinstein, M. 1985, "Nonparametric Tests of Alternative Option Pricing Models Using All Reported Trades and Quotes on the 30 Most Active CBOE Option Classes from August 23, 1976 through August 31, 1978," *Journal of Finance*, June.

Roll, R. 1984, "A Simple Measure of the Effective Bid-Ask Spread in an Efficient Market," *Journal of Finance* 39, 1127-1139.

Sanvicente, A. Z. 1996, "*Interação do Mercado de Opções Com o Mercado a Vista de Ações,*" Working Paper, IBMEC.

Schultz, P. 2000, "Regulatory and Legal Pressures and the Costs of Nasdaq Trading," *Review of Financial Studies*, 13, 917-957.

Stoll, H. R. 1989, "Inferring the Components of the Bid-Ask Spread: Theory and Empirical Tests," *Journal of Finance*, 44, 115-134.

Tavella, D., Randall, R. 2000, *Pricing Financial Instruments: the Finite Difference Method*, Wiley.

Torres, R., Bonomo, M., Fernandes, C. 2002, "A aleatoriedade do passeio na Bovespa: testando a eficiência do mercado acionário brasileiro," *Revista Brasileira de Economia*, vol.56, n.2, p.199-247.

Banco Central do Brasil

Trabalhos para Discussão

Os Trabalhos para Discussão podem ser acessados na internet, no formato PDF, no endereço: http://www.bc.gov.br

Working Paper Series

Working Papers in PDF format can be downloaded from: http://www.bc.gov.br

1	**Implementing Inflation Targeting in Brazil** *Joel Bogdanski, Alexandre Antonio Tombini and Sérgio Ribeiro da Costa Werlang*	Jul/2000
2	**Política Monetária e Supervisão do Sistema Financeiro Nacional no Banco Central do Brasil** *Eduardo Lundberg*	Jul/2000
	Monetary Policy and Banking Supervision Functions on the Central Bank *Eduardo Lundberg*	Jul/2000
3	**Private Sector Participation: a Theoretical Justification of the Brazilian Position** *Sérgio Ribeiro da Costa Werlang*	Jul/2000
4	**An Information Theory Approach to the Aggregation of Log-Linear Models** *Pedro H. Albuquerque*	Jul/2000
5	**The Pass-Through from Depreciation to Inflation: a Panel Study** *Ilan Goldfajn and Sérgio Ribeiro da Costa Werlang*	Jul/2000
6	**Optimal Interest Rate Rules in Inflation Targeting Frameworks** *José Alvaro Rodrigues Neto, Fabio Araújo and Marta Baltar J. Moreira*	Jul/2000
7	**Leading Indicators of Inflation for Brazil** *Marcelle Chauvet*	Sep/2000
8	**The Correlation Matrix of the Brazilian Central Bank's Standard Model for Interest Rate Market Risk** *José Alvaro Rodrigues Neto*	Sep/2000
9	**Estimating Exchange Market Pressure and Intervention Activity** *Emanuel-Werner Kohlscheen*	Nov/2000
10	**Análise do Financiamento Externo a uma Pequena Economia Aplicação da Teoria do Prêmio Monetário ao Caso Brasileiro: 1991–1998** *Carlos Hamilton Vasconcelos Araújo e Renato Galvão Flôres Júnior*	Mar/2001
11	**A Note on the Efficient Estimation of Inflation in Brazil** *Michael F. Bryan and Stephen G. Cecchetti*	Mar/2001
12	**A Test of Competition in Brazilian Banking** *Márcio I. Nakane*	Mar/2001

13	**Modelos de Previsão de Insolvência Bancária no Brasil** *Marcio Magalhães Janot*	Mar/2001
14	**Evaluating Core Inflation Measures for Brazil** *Francisco Marcos Rodrigues Figueiredo*	Mar/2001
15	**Is It Worth Tracking Dollar/Real Implied Volatility?** *Sandro Canesso de Andrade and Benjamin Miranda Tabak*	Mar/2001
16	**Avaliação das Projeções do Modelo Estrutural do Banco Central do Brasil para a Taxa de Variação do IPCA** *Sergio Afonso Lago Alves*	Mar/2001
	Evaluation of the Central Bank of Brazil Structural Model's Inflation Forecasts in an Inflation Targeting Framework *Sergio Afonso Lago Alves*	Jul/2001
17	**Estimando o Produto Potencial Brasileiro: uma Abordagem de Função de Produção** *Tito Nícias Teixeira da Silva Filho*	Abr/2001
	Estimating Brazilian Potential Output: a Production Function Approach *Tito Nícias Teixeira da Silva Filho*	Aug/2002
18	**A Simple Model for Inflation Targeting in Brazil** *Paulo Springer de Freitas and Marcelo Kfoury Muinhos*	Apr/2001
19	**Uncovered Interest Parity with Fundamentals: a Brazilian Exchange Rate Forecast Model** *Marcelo Kfoury Muinhos, Paulo Springer de Freitas and Fabio Araújo*	May/2001
20	**Credit Channel without the LM Curve** *Victorio Y. T. Chu and Márcio I. Nakane*	May/2001
21	**Os Impactos Econômicos da CPMF: Teoria e Evidência** *Pedro H. Albuquerque*	Jun/2001
22	**Decentralized Portfolio Management** *Paulo Coutinho and Benjamin Miranda Tabak*	Jun/2001
23	**Os Efeitos da CPMF sobre a Intermediação Financeira** *Sérgio Mikio Koyama e Márcio I. Nakane*	Jul/2001
24	**Inflation Targeting in Brazil: Shocks, Backward-Looking Prices, and IMF Conditionality** *Joel Bogdanski, Paulo Springer de Freitas, Ilan Goldfajn and Alexandre Antonio Tombini*	Aug/2001
25	**Inflation Targeting in Brazil: Reviewing Two Years of Monetary Policy 1999/00** *Pedro Fachada*	Aug/2001
26	**Inflation Targeting in an Open Financially Integrated Emerging Economy: the Case of Brazil** *Marcelo Kfoury Muinhos*	Aug/2001
27	**Complementaridade e Fungibilidade dos Fluxos de Capitais Internacionais** *Carlos Hamilton Vasconcelos Araújo e Renato Galvão Flôres Júnior*	Set/2001

28	**Regras Monetárias e Dinâmica Macroeconômica no Brasil: uma Abordagem de Expectativas Racionais** *Marco Antonio Bonomo e Ricardo D. Brito*	Nov/2001
29	**Using a Money Demand Model to Evaluate Monetary Policies in Brazil** *Pedro H. Albuquerque and Solange Gouvêa*	Nov/2001
30	**Testing the Expectations Hypothesis in the Brazilian Term Structure of Interest Rates** *Benjamin Miranda Tabak and Sandro Canesso de Andrade*	Nov/2001
31	**Algumas Considerações sobre a Sazonalidade no IPCA** *Francisco Marcos R. Figueiredo e Roberta Blass Staub*	Nov/2001
32	**Crises Cambiais e Ataques Especulativos no Brasil** *Mauro Costa Miranda*	Nov/2001
33	**Monetary Policy and Inflation in Brazil (1975-2000): a VAR Estimation** *André Minella*	Nov/2001
34	**Constrained Discretion and Collective Action Problems: Reflections on the Resolution of International Financial Crises** *Arminio Fraga and Daniel Luiz Gleizer*	Nov/2001
35	**Uma Definição Operacional de Estabilidade de Preços** *Tito Nícias Teixeira da Silva Filho*	Dez/2001
36	**Can Emerging Markets Float? Should They Inflation Target?** *Barry Eichengreen*	Feb/2002
37	**Monetary Policy in Brazil: Remarks on the Inflation Targeting Regime, Public Debt Management and Open Market Operations** *Luiz Fernando Figueiredo, Pedro Fachada and Sérgio Goldenstein*	Mar/2002
38	**Volatilidade Implícita e Antecipação de Eventos de *Stress*: um Teste para o Mercado Brasileiro** *Frederico Pechir Gomes*	Mar/2002
39	**Opções sobre Dólar Comercial e Expectativas a Respeito do Comportamento da Taxa de Câmbio** *Paulo Castor de Castro*	Mar/2002
40	**Speculative Attacks on Debts, Dollarization and Optimum Currency Areas** *Aloisio Araujo and Márcia Leon*	Apr/2002
41	**Mudanças de Regime no Câmbio Brasileiro** *Carlos Hamilton V. Araújo e Getúlio B. da Silveira Filho*	Jun/2002
42	**Modelo Estrutural com Setor Externo: Endogenização do Prêmio de Risco e do Câmbio** *Marcelo Kfoury Muinhos, Sérgio Afonso Lago Alves e Gil Riella*	Jun/2002
43	**The Effects of the Brazilian ADRs Program on Domestic Market Efficiency** *Benjamin Miranda Tabak and Eduardo José Araújo Lima*	Jun/2002

44	**Estrutura Competitiva, Produtividade Industrial e Liberação Comercial no Brasil** *Pedro Cavalcanti Ferreira e Osmani Teixeira de Carvalho Guillén*	Jun/2002
45	**Optimal Monetary Policy, Gains from Commitment, and Inflation Persistence** *André Minella*	Aug/2002
46	**The Determinants of Bank Interest Spread in Brazil** *Tarsila Segalla Afanasieff, Priscilla Maria Villa Lhacer and Márcio I. Nakane*	Aug/2002
47	**Indicadores Derivados de Agregados Monetários** *Fernando de Aquino Fonseca Neto e José Albuquerque Júnior*	Set/2002
48	**Should Government Smooth Exchange Rate Risk?** *Ilan Goldfajn and Marcos Antonio Silveira*	Sep/2002
49	**Desenvolvimento do Sistema Financeiro e Crescimento Econômico no Brasil: Evidências de Causalidade** *Orlando Carneiro de Matos*	Set/2002
50	**Macroeconomic Coordination and Inflation Targeting in a Two-Country Model** *Eui Jung Chang, Marcelo Kfoury Muinhos and Joanílio Rodolpho Teixeira*	Sep/2002
51	**Credit Channel with Sovereign Credit Risk: an Empirical Test** *Victorio Yi Tson Chu*	Sep/2002
52	**Generalized Hyperbolic Distributions and Brazilian Data** *José Fajardo and Aquiles Farias*	Sep/2002
53	**Inflation Targeting in Brazil: Lessons and Challenges** *André Minella, Paulo Springer de Freitas, Ilan Goldfajn and Marcelo Kfoury Muinhos*	Nov/2002
54	**Stock Returns and Volatility** *Benjamin Miranda Tabak and Solange Maria Guerra*	Nov/2002
55	**Componentes de Curto e Longo Prazo das Taxas de Juros no Brasil** *Carlos Hamilton Vasconcelos Araújo e Osmani Teixeira de Carvalho de Guillén*	Nov/2002
56	**Causality and Cointegration in Stock Markets: the Case of Latin America** *Benjamin Miranda Tabak and Eduardo José Araújo Lima*	Dec/2002
57	**As Leis de Falência: uma Abordagem Econômica** *Aloisio Araujo*	Dez/2002
58	**The Random Walk Hypothesis and the Behavior of Foreign Capital Portfolio Flows: the Brazilian Stock Market Case** *Benjamin Miranda Tabak*	Dec/2002
59	**Os Preços Administrados e a Inflação no Brasil** *Francisco Marcos R. Figueiredo e Thaís Porto Ferreira*	Dez/2002
60	**Delegated Portfolio Management** *Paulo Coutinho and Benjamin Miranda Tabak*	Dec/2002

61	**O Uso de Dados de Alta Freqüência na Estimação da Volatilidade e do Valor em Risco para o Ibovespa** *João Maurício de Souza Moreira e Eduardo Facó Lemgruber*	Dez/2002
62	**Taxa de Juros e Concentração Bancária no Brasil** *Eduardo Kiyoshi Tonooka e Sérgio Mikio Koyama*	Fev/2003
63	**Optimal Monetary Rules: the Case of Brazil** *Charles Lima de Almeida, Marco Aurélio Peres, Geraldo da Silva e Souza and Benjamin Miranda Tabak*	Feb/2003
64	**Medium-Size Macroeconomic Model for the Brazilian Economy** *Marcelo Kfoury Muinhos and Sergio Afonso Lago Alves*	Feb/2003
65	**On the Information Content of Oil Future Prices** *Benjamin Miranda Tabak*	Feb/2003
66	**A Taxa de Juros de Equilíbrio: uma Abordagem Múltipla** *Pedro Calhman de Miranda e Marcelo Kfoury Muinhos*	Fev/2003
67	**Avaliação de Métodos de Cálculo de Exigência de Capital para Risco de Mercado de Carteiras de Ações no Brasil** *Gustavo S. Araújo, João Maurício S. Moreira e Ricardo S. Maia Clemente*	Fev/2003
68	**Real Balances in the Utility Function: Evidence for Brazil** *Leonardo Soriano de Alencar and Márcio I. Nakane*	Feb/2003
69	**r-filters: a Hodrick-Prescott Filter Generalization** *Fabio Araújo, Marta Baltar Moreira Areosa and José Alvaro Rodrigues Neto*	Feb/2003
70	**Monetary Policy Surprises and the Brazilian Term Structure of Interest Rates** *Benjamin Miranda Tabak*	Feb/2003
71	**On Shadow-Prices of Banks in Real-Time Gross Settlement Systems** *Rodrigo Penaloza*	Apr/2003
72	**O Prêmio pela Maturidade na Estrutura a Termo das Taxas de Juros Brasileiras** *Ricardo Dias de Oliveira Brito, Angelo J. Mont'Alverne Duarte e Osmani Teixeira de C. Guillen*	Maio/2003
73	**Análise de Componentes Principais de Dados Funcionais – Uma Aplicação às Estruturas a Termo de Taxas de Juros** *Getúlio Borges da Silveira e Octavio Bessada*	Maio/2003
74	**Aplicação do Modelo de Black, Derman & Toy à Precificação de Opções Sobre Títulos de Renda Fixa** *Octavio Manuel Bessada Lion, Carlos Alberto Nunes Cosenza e César das Neves*	Maio/2003
75	**Brazil's Financial System: Resilience to Shocks, no Currency Substitution, but Struggling to Promote Growth** *Ilan Goldfajn, Katherine Hennings and Helio Mori*	Jun/2003

76	**Inflation Targeting in Emerging Market Economies** *Arminio Fraga, Ilan Goldfajn and André Minella*	Jun/2003
77	**Inflation Targeting in Brazil: Constructing Credibility under Exchange Rate Volatility** *André Minella, Paulo Springer de Freitas, Ilan Goldfajn and Marcelo Kfoury Muinhos*	Jul/2003
78	**Contornando os Pressupostos de Black & Scholes: Aplicação do Modelo de Precificação de Opções de Duan no Mercado Brasileiro** *Gustavo Silva Araújo, Claudio Henrique da Silveira Barbedo, Antonio Carlos Figueiredo, Eduardo Facó Lemgruber*	Out/2003
79	**Inclusão do Decaimento Temporal na Metodologia Delta-Gama para o Cálculo do VaR de Carteiras Compradas em Opções no Brasil** *Claudio Henrique da Silveira Barbedo, Gustavo Silva Araújo, Eduardo Facó Lemgruber*	Out/2003
80	**Diferenças e Semelhanças entre Países da América Latina: uma Análise de *Markov Switching* para os Ciclos Econômicos de Brasil e Argentina** *Arnildo da Silva Correa*	Out/2003
81	**Bank Competition, Agency Costs and the Performance of the Monetary Policy** *Leonardo Soriano de Alencar and Márcio I. Nakane*	Jan/2004
82	**Carteiras de Opções: Avaliação de Metodologias de Exigência de Capital no Mercado Brasileiro** *Cláudio Henrique da Silveira Barbedo e Gustavo Silva Araújo*	Mar/2004
83	**Does Inflation Targeting Reduce Inflation? An Analysis for the OECD Industrial Countries** *Thomas Y. Wu*	May/2004
84	**Speculative Attacks on Debts and Optimum Currency Area: a Welfare Analysis** *Aloisio Araujo and Marcia Leon*	May/2004
85	**Risk Premia for Emerging Markets Bonds: Evidence from Brazilian Government Debt, 1996-2002** *André Soares Loureiro and Fernando de Holanda Barbosa*	May/2004
86	**Identificação do Fator Estocástico de Descontos e Algumas Implicações sobre Testes de Modelos de Consumo** *Fabio Araujo e João Victor Issler*	Maio/2004
87	**Mercado de Crédito: uma Análise Econométrica dos Volumes de Crédito Total e Habitacional no Brasil** *Ana Carla Abrão Costa*	Dez/2004
88	**Ciclos Internacionais de Negócios: uma Análise de Mudança de Regime Markoviano para Brasil, Argentina e Estados Unidos** *Arnildo da Silva Correa e Ronald Otto Hillbrecht*	Dez/2004
89	**O Mercado de *Hedge* Cambial no Brasil: Reação das Instituições Financeiras a Intervenções do Banco Central** *Fernando N. de Oliveira*	Dez/2004

90	**Bank Privatization and Productivity: Evidence for Brazil** *Márcio I. Nakane and Daniela B. Weintraub*	Dec/2004
91	**Credit Risk Measurement and the Regulation of Bank Capital and Provision Requirements in Brazil – A Corporate Analysis** *Ricardo Schechtman, Valéria Salomão Garcia, Sergio Mikio Koyama and Guilherme Cronemberger Parente*	Dec/2004
92	**Steady-State Analysis of an Open Economy General Equilibrium Model for Brazil** *Mirta Noemi Sataka Bugarin, Roberto de Goes Ellery Jr., Victor Gomes Silva, Marcelo Kfoury Muinhos*	Apr/2005
93	**Avaliação de Modelos de Cálculo de Exigência de Capital para Risco Cambial** *Claudio H. da S. Barbedo, Gustavo S. Araújo, João Maurício S. Moreira e Ricardo S. Maia Clemente*	Abr/2005
94	**Simulação Histórica Filtrada: Incorporação da Volatilidade ao Modelo Histórico de Cálculo de Risco para Ativos Não-Lineares** *Claudio Henrique da Silveira Barbedo, Gustavo Silva Araújo e Eduardo Facó Lemgruber*	Abr/2005
95	**Comment on Market Discipline and Monetary Policy by Carl Walsh** *Maurício S. Bugarin and Fábia A. de Carvalho*	Apr/2005
96	**O que É Estratégia: uma Abordagem Multiparadigmática para a Disciplina** *Anthero de Moraes Meirelles*	Ago/2005
97	**Finance and the Business Cycle: a Kalman Filter Approach with Markov Switching** *Ryan A. Compton and Jose Ricardo da Costa e Silva*	Aug/2005
98	**Capital Flows Cycle: Stylized Facts and Empirical Evidences for Emerging Market Economies** *Helio Mori e Marcelo Kfoury Muinhos*	Aug/2005
99	**Adequação das Medidas de Valor em Risco na Formulação da Exigência de Capital para Estratégias de Opções no Mercado Brasileiro** *Gustavo Silva Araújo, Claudio Henrique da Silveira Barbedo,e Eduardo Facó Lemgruber*	Set/2005
100	**Targets and Inflation Dynamics** *Sergio A. L. Alves and Waldyr D. Areosa*	Oct/2005
101	**Comparing Equilibrium Real Interest Rates: Different Approaches to Measure Brazilian Rates** *Marcelo Kfoury Muinhos and Márcio I. Nakane*	Mar/2006
102	**Judicial Risk and Credit Market Performance: Micro Evidence from Brazilian Payroll Loans** *Ana Carla A. Costa and João M. P. de Mello*	Apr/2006
103	**The Effect of Adverse Supply Shocks on Monetary Policy and Output** *Maria da Glória D. S. Araújo, Mirta Bugarin, Marcelo Kfoury Muinhos and Jose Ricardo C. Silva*	Apr/2006

104	**Extração de Informação de Opções Cambiais no Brasil** *Eui Jung Chang e Benjamin Miranda Tabak*	Abr/2006
105	**Representing Roommate's Preferences with Symmetric Utilities** *José Alvaro Rodrigues Neto*	Apr/2006
106	**Testing Nonlinearities Between Brazilian Exchange Rates and Inflation Volatilities** *Cristiane R. Albuquerque and Marcelo Portugal*	May/2006
107	**Demand for Bank Services and Market Power in Brazilian Banking** *Márcio I. Nakane, Leonardo S. Alencar and Fabio Kanczuk*	Jun/2006
108	**O Efeito da Consignação em Folha nas Taxas de Juros dos Empréstimos Pessoais** *Eduardo A. S. Rodrigues, Victorio Chu, Leonardo S. Alencar e Tony Takeda*	Jun/2006
109	**The Recent Brazilian Disinflation Process and Costs** *Alexandre A. Tombini and Sergio A. Lago Alves*	Jun/2006
110	**Fatores de Risco e o *Spread* Bancário no Brasil** *Fernando G. Bignotto e Eduardo Augusto de Souza Rodrigues*	Jul/2006
111	**Avaliação de Modelos de Exigência de Capital para Risco de Mercado do Cupom Cambial** *Alan Cosme Rodrigues da Silva, João Maurício de Souza Moreira e Myrian Beatriz Eiras das Neves*	Jul/2006
112	**Interdependence and Contagion: an Analysis of Information Transmission in Latin America's Stock Markets** *Angelo Marsiglia Fasolo*	Jul/2006
113	**Investigação da Memória de Longo Prazo da Taxa de Câmbio no Brasil** *Sergio Rubens Stancato de Souza, Benjamin Miranda Tabak e Daniel O. Cajueiro*	Ago/2006
114	**The Inequality Channel of Monetary Transmission** *Marta Areosa and Waldyr Areosa*	Aug/2006
115	**Myopic Loss Aversion and House-Money Effect Overseas: an Experimental Approach** *José L. B. Fernandes, Juan Ignacio Peña and Benjamin M. Tabak*	Sep/2006
116	**Out-Of-The-Money Monte Carlo Simulation Option Pricing: the Join Use of Importance Sampling and Descriptive Sampling** *Jaqueline Terra Moura Marins, Eduardo Saliby and Joséte Florencio dos Santos*	Sep/2006
117	**An Analysis of Off-Site Supervision of Banks' Profitability, Risk and Capital Adequacy: a Portfolio Simulation Approach Applied to Brazilian Banks** *Theodore M. Barnhill, Marcos R. Souto and Benjamin M. Tabak*	Sep/2006
118	**Contagion, Bankruptcy and Social Welfare Analysis in a Financial Economy with Risk Regulation Constraint** *Aloísio P. Araújo and José Valentim M. Vicente*	Oct/2006

119	**A Central de Risco de Crédito no Brasil: uma Análise de Utilidade de Informação** *Ricardo Schechtman*	Out/2006
120	**Forecasting Interest Rates: an Application for Brazil** *Eduardo J. A. Lima, Felipe Luduvice and Benjamin M. Tabak*	Oct/2006
121	**The Role of Consumer's Risk Aversion on Price Rigidity** *Sergio A. Lago Alves and Mirta N. S. Bugarin*	Nov/2006
122	**Nonlinear Mechanisms of the Exchange Rate Pass-Through: a Phillips Curve Model With Threshold for Brazil** *Arnildo da Silva Correa and André Minella*	Nov/2006
123	**A Neoclassical Analysis of the Brazilian "Lost-Decades"** *Flávia Mourão Graminho*	Nov/2006
124	**The Dynamic Relations between Stock Prices and Exchange Rates: Evidence for Brazil** *Benjamin M. Tabak*	Nov/2006
125	**Herding Behavior by Equity Foreign Investors on Emerging Markets** *Barbara Alemanni and José Renato Haas Ornelas*	Dec/2006
126	**Risk Premium: Insights over the Threshold** *José L. B. Fernandes, Augusto Hasman and Juan Ignacio Peña*	Dec/2006
127	**Uma Investigação Baseada em Reamostragem sobre Requerimentos de Capital para Risco de Crédito no Brasil** *Ricardo Schechtman*	Dec/2006
128	**Term Structure Movements Implicit in Option Prices** *Caio Ibsen R. Almeida and José Valentim M. Vicente*	Dec/2006
129	**Brazil: Taming Inflation Expectations** *Afonso S. Bevilaqua, Mário Mesquita and André Minella*	Jan/2007
130	**The Role of Banks in the Brazilian Interbank Market: Does Bank Type Matter?** *Daniel O. Cajueiro and Benjamin M. Tabak*	Jan/2007
131	**Long-Range Dependence in Exchange Rates: the Case of the European Monetary System** *Sergio Rubens Stancato de Souza, Benjamin M. Tabak and Daniel O. Cajueiro*	Mar/2007
132	**Credit Risk Monte Carlo Simulation Using Simplified Creditmetrics' Model: the Joint Use of Importance Sampling and Descriptive Sampling** *Jaqueline Terra Moura Marins and Eduardo Saliby*	Mar/2007
133	**A New Proposal for Collection and Generation of Information on Financial Institutions' Risk: the Case of Derivatives** *Gilneu F. A. Vivan and Benjamin M. Tabak*	Mar/2007
134	**Amostragem Descritiva no Apreçamento de Opções Européias através de Simulação Monte Carlo: o Efeito da Dimensionalidade e da Probabilidade de Exercício no Ganho de Precisão** *Eduardo Saliby, Sergio Luiz Medeiros Proença de Gouvêa e Jaqueline Terra Moura Marins*	Abr/2007

135	**Evaluation of Default Risk for the Brazilian Banking Sector** *Marcelo Y. Takami and Benjamin M. Tabak*	May/2007
136	**Identifying Volatility Risk Premium from Fixed Income Asian Options** *Caio Ibsen R. Almeida and José Valentim M. Vicente*	May/2007
137	**Monetary Policy Design under Competing Models of Inflation Persistence** *Solange Gouvea e Abhijit Sen Gupta*	May/2007
138	**Forecasting Exchange Rate Density Using Parametric Models: the Case of Brazil** *Marcos M. Abe, Eui J. Chang and Benjamin M. Tabak*	May/2007
139	**Selection of Optimal Lag Length inCointegrated VAR Models with Weak Form of Common Cyclical Features** *Carlos Enrique Carrasco Gutiérrez, Reinaldo Castro Souza and Osmani Teixeira de Carvalho Guillén*	Jun/2007
140	**Inflation Targeting, Credibility and Confidence Crises** *Rafael Santos and Aloísio Araújo*	Aug/2007
141	**Forecasting Bonds Yields in the Brazilian Fixed income Market** *Jose Vicente and Benjamin M. Tabak*	Aug/2007
142	**Crises Análise da Coerência de Medidas de Risco no Mercado Brasileiro de Ações e Desenvolvimento de uma Metodologia Híbrida para o *Expected Shortfall*** *Alan Cosme Rodrigues da Silva, Eduardo Facó Lemgruber, José Alberto Rebello Baranowski e Renato da Silva Carvalho*	Ago/2007
143	**Price Rigidity in Brazil: Evidence from CPI Micro Data** *Solange Gouvea*	Sep/2007