

# American Depository: A Case Study for Brazilian Market

**André Machado CALDEIRA**  
Fuzzy Consultoria Ltda. Av. Nossa Senhora de Copacabana 1376/302-Copacabana.  
Rio de Janeiro, 22070-010/RJ, Brazil;

and

**Giovanna Lamastra PACHECO**  
Faculdades IBMEC/RJ. Av. Presidente Wilson, 118 – Centro.  
Rio de Janeiro, 20030-020/RJ, Brazil;

and

**Walter GASSENFERTH**  
Faculdades IBMEC/RJ. Av. Presidente Wilson, 118 – Centro.  
Rio de Janeiro, 20030-020/RJ, Brazil;

and

**Maria Augusta Soares MACHADO**  
Faculdades IBMEC/RJ. Av. Presidente Wilson, 118 – Centro.  
Rio de Janeiro, 20030-020/RJ, Brazil;

## ABSTRACT

Specialists often question market efficiency. Some works suggest arbitrage opportunities in several financial operations. Such opportunities can be explained mainly by information asymmetry, since pricing in the stock market is directly linked to information; therefore, the investor that has access to such information the soonest has a competitive advantage. The objective of this paper is to verify the existence of arbitrage opportunities via ADRs, traded in the American market, and their respective stocks, which are traded in the domestic market. Through a case study conducted with four companies, not considering the transition costs, arbitrage opportunity windows were found. Among the companies studied, two had frequent arbitrage opportunities, for one of them the arbitrage opportunity can be shaped by the time series model.

**Keywords:** Arbitrage, Stocks, ADRs.

## 1. INTRODUCTION

The lack of long-term financial sources in the Brazilian capital market has led to an increase in the number of Brazilian companies issuing ADRs (American Depositary Receipts) with an aim at obtaining international visibility, providing more liquidity to the negotiations of their bonds and taking international funds at rates lower than those of the domestic market (Camargos, 2003).

Such increase in the amount of ADRs issuance tends to make the markets involved more efficient, since international information exchange is increased. Efficient markets are beneficial to the economy and are of great interest to both large investors, due to the reduction in analysis costs, and small investors, since these are placed in a favorable competitive

position in face of the possible investment choices, for the information available is already reflected in the prices.

At the same time, since the ADRs are papers issued in the United States market but have linking liabilities in the stocks of companies traded in the domestic market, there are arbitrage possibilities between the operations and the stocks issued in the national capital market. For instance, such opportunities arise as a result of distinguished taxation for the foreign investor, reduced transaction costs, different working hours of the stock markets, exchange flotation, and different transparency standards on disclosing information and negotiation practices (Rodrigues, 1999).

This paper aims at looking into the arbitrage possibilities in ADR purchase and sale operations by comparing the prices of stocks of Brazilian enterprises in the domestic market and the prices of ADRs in the North-American market. In the present case, we disregard taxation, brokerage fees and other charges and we focus solely on the differences between the prices.

This article is structured on the basis of this introduction; the second part of it addresses some important concepts on market efficiency and the ADRs and its subsequent section is a case study that verifies the arbitrage possibilities. Finally, the conclusions are addressed in the fourth section..

## 2. MARKETING EFFICIENCY

The Efficient Market Hypothesis (EMH) was proposed by Fama in 1965 in “O comportamento de Preços de mercado de Estoque” (Inventory Market Price Behavior). According to his 1970 paper, a market is said to be efficient when the prices fully reflect all the information available.

In the first decade after it was created, the Efficient Market Hypothesis became a theoretical and empirical success, ending up providing the theoretical basis for many researches in the financial area over the seventies and eighties. At first, these were dedicated to predicting prices on the basis of historical data; now, in the eighties, such information compounds as dividends (Fama, 1988) and profit/price ratio became the basis for such outlook (Campbell and Shiller, 1988).

The level at which the prices are affected, given the information available, characterizes the type of efficiency of these markets. The literature distinguishes three levels of efficiency (Fama, 1970):

**Poor efficiency:** stock prices fully reflect the information contained in the historical price movements. Since price movements are completely independent from historical movement, then it is impossible to reach higher profits on the basis of past knowledge.

**Semi-strong efficiency:** the market is efficient in a semi-strong sense if the prices respond instantaneously and correctly to recently published information. This implies that there is no advantage in analyzing information that is publicly available because as soon as the information becomes public, it is immediately incorporated to prices. This includes profits and dividend disclosure, Incorporation & Acquisitions, publication of rights and any other kind of information on the company's stocks.

**Strong efficiency:** in this case, the prices reflect not only the information disclosed, but also all of the relevant information, including private data. Not even one of the company's employees would be able to obtain abnormal profits due to his position because the information is rapidly absorbed by the market.

These three efficiency levels lie upon three basic assumptions:

- The investigators are supposedly rational. They estimate the Net Present Values of their cash flows by using their respective discount rate. When the new information on the company becomes public, there is a rapid response that incorporates all of the information available almost immediately.
- Even if there are some irrational investors, their businesses are casual and, therefore, prices are not affected. According to the market efficiency hypothesis, since the steps taken by these irrational investors are not correlated, they end up by offsetting themselves.
- The third argument to the market efficiency hypothesis is based upon the notion of arbitrage (Friedman, 1953) arguing that in the market there are rational arbitrators that eliminate the influence of irrational investors on prices.

Since the irrational investors are buying stocks above their fair value and selling stocks below their fair value, they profit less than passive investors or arbitrators. In comparison to other investors in the market, these earn less and, as Friedman, 1953, points out, they cannot lose money infinitely because they would become illiquid or, eventually, disappear from the market. In the long run, if the arbitrage does not eliminate the

influence of irrational investors in the market prices, the market forces will.

### 3. AMERICAN DEPOSITARY RECEIPTS

In order to take advantage of the growing interest and allow for ease of access of investors to the capital of national companies and, this way, increase foreign capital attracting, the major Brazilian enterprises make use of such instruments as the ADRs.

In Brazil, according to a definition by the Central Bank, American Depositary Receipts are certificates representing stocks or other securities, representing rights and stocks, issued abroad by an institution called "Depository", which have substance on securities issued by Brazilian companies deposited in specific custody in Brazil.

In a general sense, ADRs are papers issued and traded in the capital market in the United States with substance on stocks of non-American companies.

In Brazil, the ADR was created by Administrative Act 1927, of May 18th 1992, to stimulate the stock market. Some of the companies to issue ADRs were: Ambev, Aracruz, Bradesco, Brasil Telecom, Cemig, Companhia Brasileira de Distribuição (Pão de Açúcar), Copel, Embratel, Embraer, Gerdau, Itaú, Petrobras, Vale do Rio Doce, Companhia Siderúrgica Nacional, Telebras, Telesp Celular, Telemig e Unibanco.

The issuance of ADRs brings advantages both to the company and to investors. For the latter, it allows for a participation in a foreign market, and for the former, it provides for a wider international presence with a consequent liquidity increase of its stocks, in addition to a new source of financing at a low cost.

Only those investors with a foreign bank account (individual or corporate) can buy and sell ADRs. Opening the bank account is a legal procedure, as long as it is stated and in compliance with taxation rules. Remittance of money abroad is only possible through financial institutions that are accredited to exchange transactions and, if the overall amount exceeds US\$10 thousand, the Central Bank must be informed.

Investors can also convert their ADRs into company stocks and trade them in the company's country of origin. It is called arbitrage operation that operation in which the investor sees distortions between the price of the same asset in two different trading environments and takes advantage of it. For example: if the price of the stocks of a company (after the application of the conversion factor into ADR and then into dollars) is US\$ 20 at Bovespa and US\$ 21 in the United States, there is an opportunity to buy here, make the conversion and sell there at the same time, thus keeping the difference. The conversions are made through the custodian bank. The buyer here informs the bank that they wish to make a conversion and immediately sell the paper there. In the US, the Bank of New York is the main ADRs custodian institution and, in Brazil, Banco Itaú, for instance, holds a large part of custodies.

There are three levels of ADR, each with growing demands of transparency and adequacy to the American standards. When traded over-the-counter, the ADRs need not follow the rules of the Sarbanes-Oxley Act. This is a North-American Act that is

also applicable to non-American companies that have stocks listed in the United States stock market (NYSE, AMEX and Nasdaq). It imposes standards of corporate governance such as the certification of financial statements by the CEO - chief executive officer – and by the CFO - chief financial officer – of companies.

#### 4. ADR LEVEL I

The ADR - Level I has the lowest level of demands and is traded in the American over-the-counter (OTC) market. The ADRs Level I provide their issuers a simple and efficient means of forming a group of investors with few legal requirements and mandatory reports. They are traded in the North-American OTC market and also in some stock exchanges outside the United States. Establishing an ADRs Level I program is considered to be the first step forward into the American stock market.

ADRs Level I Characteristics:

- Traded in the over-the-counter market (outside the organized market);
- There cannot be public offer in the United States;
- Need not comply with American accounting standards;
- It is no issuance of new stocks;
- Stocks bought in the secondary market;
- Its plain objective is to place stocks in the American market, preparing the ground for future primary stock issue;
- It is the simplest method, for it needs not meet all of the demands by USA's Securities Exchange Commission – SEC.

#### 5. ADR LEVEL II

The ADRs - Level II are traded in the stock exchanges of the USA (for example, the Nasdaq). It should be stressed out the in levels I and II there is no new issuance of new stocks. This level requires more statements and reports than in Level I. The company is bound to forward its accounting statements in US GAAP, United States Generally Accepted Accounting Principles: A set of accounting rules, conventions, standards and procedures used to produce financial information according to the models established by the FASB - Financial Accounting Standards Board, to the SEC, besides other reports. The company cannot raise funds by issuing ADRs of this level and adherence to this level does not provide an IPO. Generally, the companies that issue ADRs in this level are already taking part in the American stock market with ADRs Level I.

ADRs Level II characteristics:

- There cannot be public offer in the United States;
- Financial statements must be according to US GAAP;
- Must meet American accounting standards;
- It is no issuance of new stocks;
- More requirements from the SEC because ADR registry in Stock Exchange is mandatory;
- They are traded in the Stock Exchange.

#### 6. ADR LEVEL III

The ADR Level III is traded in a national-wide stock exchange in the United States or in the Nasdaq, bound to a public offer in the United States of the stocks deposited. It is issued on the basis of new stocks issued by the company. The financial statements must be according to the US GAAP - United States Generally Accepted Accounting Principles. Therefore, the ADR – Level III has the same degree of demand as the ADR - Level II, but there is fund raising, since it has a substance on new stocks.

ADRs Level III characteristics:

- More complete and onerous;
- Must meet the requirements of the SEC and the Stock Exchange;
- Must comply with the American accounting standards;
- Its objective is to raise funds for the company;
- Full compliance with the SEC requirements;
- Like Level II, it must foresee a top quality institutional publicity.

#### 7. STANDARD 144-A

Also standing out is the ADR ruled by Standard 144-A, which authorizes a company to trade its stocks with communities of qualified institutional investors in order to streamline the liquidity of the American private issuance market. Besides the partial submission to the SEC requirements, this standard represents advantages because it is the most economic, fast and easy-to-raise-funds form, in addition to the negotiation through Nasdaq's Portal (private offerings, resale and trading through automated linkage). However, it is an inaccessible form to the stocks that have already been registered in American Stock Exchange.

#### 8. CASE STUDY

The data used in this paper refer to the period between April/1/2003 and November/7/2005, corresponding to a total of 618 observations per day for each asset and its respective ADR. The assets used were from Petrobras (PETR4), Telemar (TNLP4), Vale do Rio Doce (VALE5) and Banco Itaú (ITAU4).

The data used can be divided into three variables:

- Daily closing price of the ADRs of Brazilian enterprises traded in the North-American market in dollars (effective price);
- Daily closing price of Brazilian stocks, corresponding to the ADRs, traded in Real in the Brazilian market;
- Daily exchange rate, Real (R\$) per dollar (US\$).

The data related with the ADRs were obtained from the Economática, whereas the data on Brazilian stocks were obtained from the webpage of EasyInvest, a broker, and, finally, those data regarding the daily exchange rate were obtained from the webpage of IPEADATA.

These companies were chosen due to the level of importance of these assets in the BOVESPA index. From all the companies in the sample the dates that did not represent negotiations in both markets were excluded because there was no business with either the stock or the ADR. This fact is due to the difference of the dates of Brazilian and American holidays.

A new variable, called “ADR theoretical price”, was calculated on the basis of the closing prices of the company’s stocks, the dollar rate and the number of corresponding stocks to each ADR. That is to say:

$$PT_{it} = \frac{PA_{it} * N}{C_t}$$

where:

- PTit = ADRi theoretical price of (US\$) at instant t.
- PAit = Stocki Price (R\$) at instant t.
- N = Number of corresponding stocks for each ADR.
- Ct = Daily exchange rate (R\$/US\$) at instant t.

This calculation allows for a comparison between the “ADR effective price” (PE) and the ADR theoretical price” (PT), since the currencies and amounts were equaled. By this, a comparison test of unconditional means (Test T-Student for two pair samples for the means) can be performed. By disregarding the transition cost, the unconditional means of these two variables are expected to converge to the same point. This result is expected, since should the means be differing, there is room for continuous arbitrage.

The software used in this study was SPSS – Statistical Package for the Social Sciences, version 10.0. In the first moment, the level of linear dependence (Pearson Correlation) between variables PE and PT for each of the companies in the sample was studied. As expected, the calculated correlation coefficients show high linear dependence between the series; all companies had correlation above 99%. (Table 1).

Table 1: Correlations of Test T for two pair samples for the means

Company	Observations	Correlation	Sig.
Petrobras	618	99,967%	0,000
Telemar	618	99,733%	0,000
Vale	618	99,973%	0,000
Itaú	618	99,971%	0,000

Despite the high correlation, it cannot be said that there are no arbitrage possibilities between these markets. It can be concluded that if such opportunity does exist, it is not so common for a chance to appear.

After this verification, an option was made on working with a single variable for each company, which is expressed through the ratio between PE and PT. That is:

$$R_{it} = \frac{PE_{it}}{PT_{it}}$$

where:

- PEit = ADRi Effective Price at instant t
- PTit = ADRi theoretical price at instant t

With this variable, it is possible to verify the per cent difference between the theoretical price and the effective of the ADR of the i-th company.

In case of an efficient market (disregarding the transaction costs), this variable should equal to one, which is not verified. Therefore, when this variable is greater than one, there is an opportunity window, which can be used by acquiring stocks at the local market and selling the ADRs at the American market. When this ratio is lower than one, arbitrage is given as of the purchase of the ADRs at the US market and the sales corresponding to this ADR at the Brazilian market. In order to statistically test whether the unconditional mean of this ratio is equal to one, the T-Student test was applied for one sample (Table 2). This test points to frequent arbitrage possibilities for companies Telemar and Vale do Rio Doce, since the T test rejected (5% level) the hypothesis that the mean for such ratio is equal to one. As for companies Petrobras and Itaú, it cannot be said the same, once the hypothesis tested can be accepted (5% level).

Table 2: T-Test for a sample (One-Sample)

	Test Value = 1					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
PETR4	-1,693	617	,091	-4,888E-04	-1,06E-03	7,818E-05
TNLP4	-2,790	617	,005	-8,421E-04	-1,43E-03	-2,49E-04
VALE5	-3,702	617	,000	-1,162E-03	-1,78E-03	-5,46E-04
ITAU4	-,295	617	,768	-8,536E-05	-6,54E-04	4,829E-04

As this test is used to test the unconditional mean of the data series, it only manages to indicate those assets with frequent arbitrage opportunities. However, the arbitrage possibilities may appear in some windows, which are not constant. In order to verify that, Table 3 shows the descriptive statistics for the series related with the ratio variable for all companies used.

It can be observed (Table 3) that the series of this variable for Petrobras has a minimum of 0.96, pointing to a 4% distance between the theoretical and effective prices of the ADR; in spite of having an unconditional mean statistically equal to one, this instant can present arbitrage possibilities, that is, there may be arbitrage windows. The same can be said of company Itaú, but the difference between maximum prices reached 3%.

Table 3: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
PETR4	618	,96	1,03	,9995	7,177E-03
TNLP4	618	,93	1,03	,9992	7,504E-03
VALE5	618	,93	1,02	,9988	7,802E-03
ITAU4	618	,98	1,03	,9999	7,194E-03
Valid N (listwise)	618				

In an attempt to forecast the opening of arbitrage windows, the autocorrelation (ACF) and the partial autocorrelation (PACF) of the series were studied in order to verify whether the conditional means for the series are constant. Moreover, the Ljung-Box Test was applied with an aim at verifying whether the autocorrelation is statistically significant.

The variable studied regarding company Petrobras has significant ACF and PACF (Figure 1 and Figure 2, respectively) for the first lag. For companies Telemar and Itaú

there is no statistically significant linear dependence for any lag (Figure 3, Figure 4, Figure 7 and Figure 8). The series for the variable related with company Vale do Rio Doce also has significant ACF and PACF (Figure 5 and Figure 6), which indicates a certain predictability by using the ARIMA models. The Ljung-Box test indicated (by using a 5% level of significance) that the series of Petrobras and Vale do Rio Doce have a significant linear dependence; by this, these data can be modeled by ARIMA models.

Figure 1: Autocorrelation PETR4

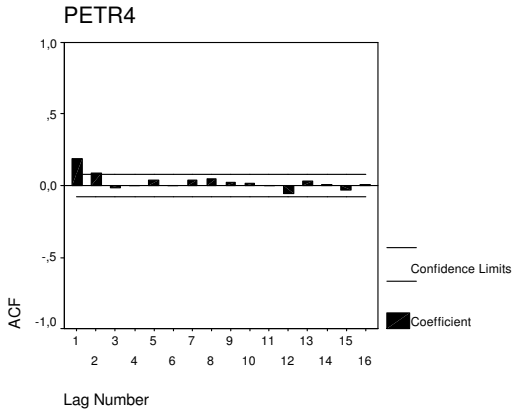


Figure 2: Partial Autocorrelation PETR4

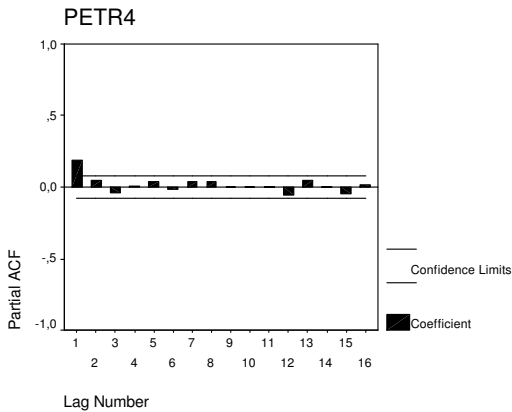


Figure 3: Autocorrelation TNLP4

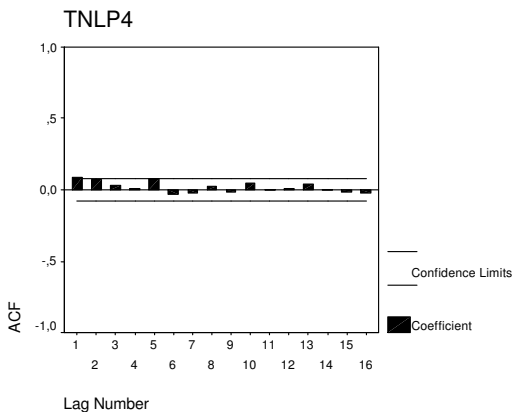


Figure 4: Partial Autocorrelation TNLP4

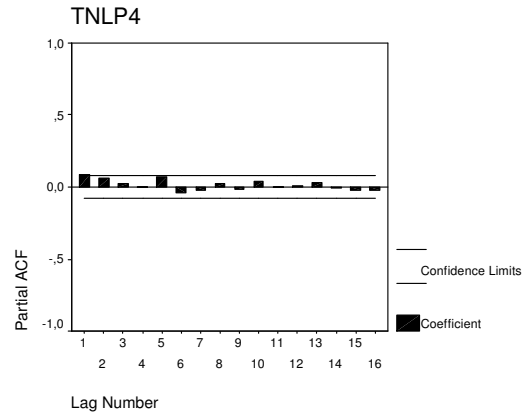


Figure 5: Autocorrelation VALE5

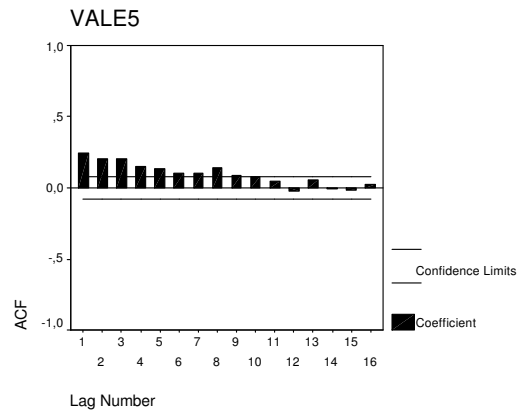


Figure 6: Partial Autocorrelation VALE5

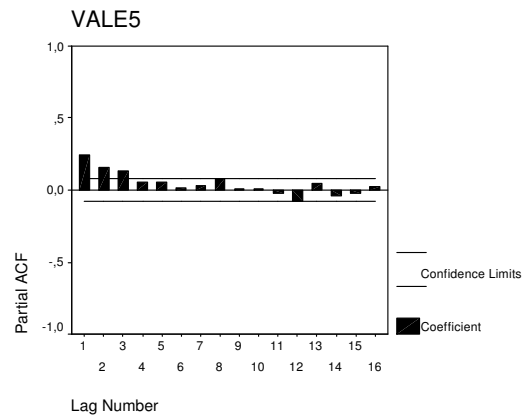


Figure 7: Autocorrelation ITAU4

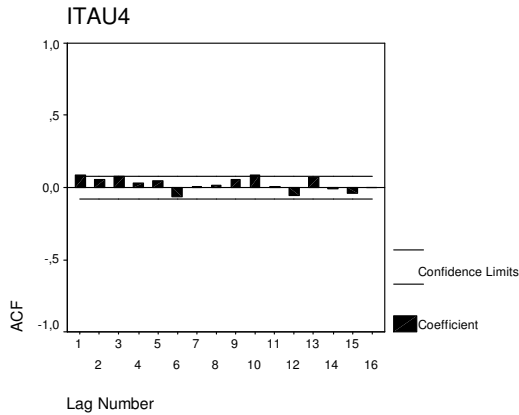
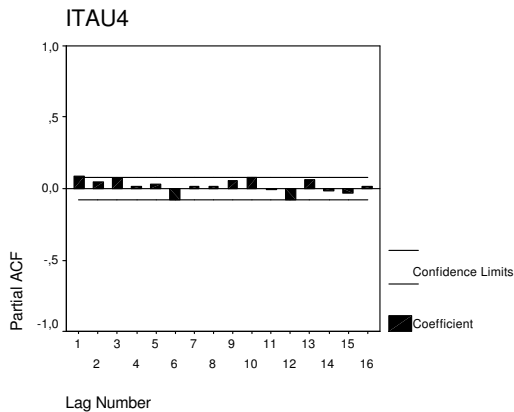


Figure 8: Partial Autocorrelation ITAU4



The ARIMA model that is best adjusted for the Petrobras series is AR (1), the estimated coefficient of which is 0.2858 and the constant is 0.9988. As for the Vale do Rio Doce series it is the ARMA (1,1) with self-regressive coefficient (AR) of 0.9510, movable mean coefficient (MA) of 0.7555 and constant of 0.9980.

These models allow for predicting the result of the ratio between the effective price and the theoretical price of the ADRs, and by this, it helps make the decision as to when to perform the operation and when to render resources available in order to put it into effect. Once the opportunity windows are modeled, the investor will be able to foresee when the market will adjust itself by closing the arbitrage window.

## 9. CLOSING CONSIDERATIONS

The case study reflects the information asymmetry existing between the Brazilian and American markets. Such information asymmetry, in many cases, is corrected through arbitrage, that is, investors who are alert to the opportunity windows modify supply and demand by adjusting the price to the fair price. The T-Student test for the means detected that in two of the four companies tested the ratio between the theoretical price and the effective price is different from one. This result suggests that there are frequent arbitrage opportunities using the ADRs of these enterprises. Now, for the other two

companies, a 3% and 4% difference was detected, indicating that, despite the arbitrage opportunities not being frequent, there may appear some opportunity windows.

By analyzing the linear time dependence of the series through the ACF and PACF graphs and the Ljung-Box test, the possibility of predicting the ratio between the effective and theoretical prices of the ADRs was verified in two of the companies, and, by this, ARIMA models were estimated to model the time behavior of that series; such results may be used to decide the time to perform the operation, thus minimizing such risks as the liquidity of the papers.

This paper introduces an academic study which, due to some simplifications it cannot be applied directly, requires some changes. One limitation is not using the transaction rates, which may render the arbitrage operations unfeasible. Therefore, a more complex study comprising all transaction rates can be designed in the future aimed at both practical and academic effects.

## 10. REFERENCES

- [1] E.F. Fama, "Efficient Capital Markets: A Review of Theory and Empirical Work." *The Journal of Finance*, 25, 383-417, 1970.
- [2] E.F. Fama, "Efficient Capital Markets II". *The Journal of Finance*, Chicago: American Finance Association, 46, 1575-1617, 1991.
- [3] E.F. Fama and Kenneth R. French, "Permanent and Temporary Components of Stock Prices". *Journal of Political Economy*, 96, 246-73, 1988.
- [4] E.L. Rodrigues, "Segmentação, Fragmentação e Composição de Ordens no Mercado de Capitais Brasileiro: Os Efeitos da Listagem de Ações de Empresas Brasileiras no Mercado Norte Americano Através do Mecanismo de Recibos de Depósito de Ações." *Tese (Doutorado em Administração) – Instituto de Pós-Graduação e Pesquisa em Administração*. Rio de Janeiro: UFRJ, 1999.
- [5] J.Y. Campbell, and R. Shiller, "Stock Prices, Earnings and Expected Dividends". *Journal of Finance*, 43, 661-676, 1988.
- [6] M.A. Camargos, G.D. Gomes e F.V. Barbosa, "Integração de Mercados e Arbitragem com Títulos Transfronteiriços: ADRS – American Depositary Receipts". *Caderno de Pesquisas em Administração*, São Paulo, 10, 51-67, 2003.
- [7] M. Friedman, "The Methodology of Positive Economics." *Essays in Positive Economics*. Chicago: University of Chicago Press, 3-43, 1953.