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Market Efficiency and Arbitrage Opportunities The Case of Egyptian Global Depository Receipts

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Abstract
This research examines the effect of the financial crisis on the behavior of the Egyptian GDR's and their underlying stocks in Egypt. There were ten stocks tested that represent three main sectors which are; the financial sector, the telecom sector and the constructions sector. We found out that there are very low arbitrage opportunities between those two markets, and that these arbitrage opportunities were minimized during the previous crisis. Moreover we found out that the price behavior of the securities changed during the financial crisis, and they showed that the selling pressure appeared on the Egyptian stocks and not the GDR's.
Keywords: GDR, Arbitrage, Cross listing

1. Introduction

Diversification is the main reason that motivates investors to trade Global Depository Receipts (GDR's) and American Depository Receipts (ADR's). In fact, investors that trade ADR's and GDR's benefit from the lower correlation of returns of international markets compared to solely investing within the local markets (Thomas, 2002). According to Martins," if investors are risk averse and they care about the expected return of their invested wealth they would be able to measure risk by the covariance of return on their portfolio with that of a benchmark world portfolio" (Nuno, 2003). In his book, *The Geographical Distribution of Capital*, Henry Lowenfeld argues that the best investment performance could be attained by spreading equal proportion of capital across a number of geographical sectors and rebalancing these proportions on regular basis.

This leads us to another important theory which is arbitrage. Arbitrage as defined by Sharpe and Alexander in 1990 is "the simultaneous purchase and sale of the same, or essentially similar, security in two different markets for advantageously different prices". Arbitrage exerts zero-risk or a very low risk on the arbitrageur that trades the economically equivalent assets by buying low and selling high (Miyazaki, 2007).

The study will help arbitrageurs in determining which market dominates the other; this will help the arbitrageurs in developing their trading tactics in anticipating both markets.

2. Literature Review and Hypothesis Development

Corporations in emerging economies over the last two decades increased their cross listing activities in the U.S and Europe to benefit from listing overseas advantages as lowering the cost of capital, increasing liquidity and promoting the image of the company. Whether these companies are private or public enterprises, they develop and implement different cross listing strategies to cope with the economic and political changes in developed countries (Hoskisson et al, 2000).

Reese and Weisbach, 2002 argued that listing in the U.S or London improves the protection of the firm's investors compared to any other listing. The investors of the listed firms in the U.S or London are subject to the American or British laws and regulations, and that means they are subject to higher protection and obtain higher benefits (Reese and Weisbach, 2002).

The view of arbitrage differs among researchers, as MacKenzie, 2003 described arbitrageurs as the elements that eliminate price discrepancies between locations for the same economic asset. The paper concluded that arbitrage became an important linkage between financial economics and financial markets as he mentioned that arbitrage is a key issue for the 'performativity' of economics. (MacKenzie, 2003).

Some researchers as Shleifer and Vishny, 1997, mentioned that arbitrage is not risk free, and that those arbitrageurs need to be so lucky in their trading activities. Their conclusions were based on that the trades might not profit because stocks may move rapidly away from their fundamental values, and at the same time different markets have different trading hours, settlement dates and delivery terms. These mentioned points would increase the risk of arbitrage trading (Shleifer and Vishny, 1997).

Regarding mispricing of assets, there are different points of views concluded by researchers. Park and Tavakkol, 1994, found no significant differences between the price of the Depository Receipts (DR's) and the price of their underlying asset which concludes that they observed no arbitrage opportunities.

Moreover, Miller and Morey, 1996, examined data for one British security cross-listed in the US, and find that the price difference in the two markets is small throughout their two-month sample. On the other hand, Suh, 2003, examined DR's from emerging markets that impose foreign ownership restriction and other capital barriers, and he concluded that DR's premiums and discounts co-move with aggregate foreign market returns and

not with the market returns of the domestic market, and therefore using a portfolio approach and putting into consideration risk differentials between the DR's and the their underlying assets, arbitrage opportunities do exist.

Kaul and Mehrotra, 2000, studied cross-listed Canadian stocks which are directly traded in American markets and conclude that infrequent arbitrage opportunities do exist here, particularly with stock pairs that present a combination of relatively low spreads and low trading volume.

In his conclusions regarding French stocks listed in the American stock Exchange, Suarez, 2005, found out that mispricing between these two markets cannot result in a profitable arbitrage due to transaction costs and foreign exchange risk. Also his findings stated that the markets are disintegrated and also relatively inefficient. Another conclusion was that less traded stock pairs present higher profit opportunities.

Also regarding arbitrage in DR's, Karolyi and Stulz, 1996, mentioned that trading hours is one of the reasons behind arbitrage in DR's, as stock markets have different trading hours, this means that the closing price of the depository receipt and the closing price of its underlying stock won't be identical, and hence a price deviation would occur and therefore arbitrage trading would occur to obtain market equilibrium.

Kim et al, 2000, mentioned that as the owners of DR's are allowed to switch the shares to corresponding underlying shares subject to transaction costs, the DR's are priced by arbitrage forces between the two markets. As a result, the currency value against the US dollar should be reflected in the DR prices to avoid any abnormal arbitrage profits.

Regarding mispricing during times of crisis, the spread between DR's and their underlying stocks is affected dramatically during these times. This may also affect the fluctuations of currency exchange rates resulting in international investor hysteria leading to irrational valuation of securities (Miller 1999)

A great example of spread behaviour in times of crisis happened in Argentina in late 2001, when the country faced drastic foreign exchange and capital controls amidst violent demonstrations and social unrest. In order to bypass this strict capital control, Argentinean investors saw in ADRs a way to send capital to the U.S. These investors would buy Argentinean local shares, convert them to ADRs and sell them in the NYSE in order to fly money out of the country. The effects of this actions in the spread between ADR and underlying Argentine security was studied by Melvin, 2002, who found that, while this spread was typically narrow, a large premium existed during the time when ADR conversions were permitted and capital controls were in place.

Another interesting study on crisis behavior and capital controls was made by Yeyati, Schmukler, and Van Horen, 2005. They analyzed six countries that applied capital controls in periods of crisis (Argentina, Chile, Indonesia, South Africa, Korea, and Venezuela) and three other countries in crisis without these controls (Brazil, Mexico, and Russia) and its impact on the spreads between ADR and the underling local stock. Both crisis and controls led to higher than usual spreads that were slowly normalized after the crisis or the control lifts.

After reviewing the literature review on cross listing and arbitrage opportunities during financial crisis, we concluded that our hypothesis in examining the effect of the financial crisis on the behaviour of the Egyptian GDR's and their underlying stocks will be as follows:

Hypothesis: There is a difference between the mean of the closing prices of the Egyptian stocks in Egypt stock exchange and their GDR's in London stock exchange.

3. Sample and Methodology

The population consists of ten shares. The ten shares come from three different sectors; the financial sector, the telecom sector and the constructions sector. Each of these shares is listed both in the Egyptian Stock Exchange and in London Stock Exchange and they are the only ten stocks that are listed in both exchanges. The ten stocks have an Egyptian Pound value and have an equivalent US Dollar value that is traded in London.

Table 3.1 Companies
Egyptian GDR's, their Reuters code and Sector

Corporation	Reuters Code	Sector
1) Commercial International Bank	COMI.CA	Financial Services
2) EFG-Hermes	HRHO.CA	Financial Services
3) Orascom Telecom	ORTE.CA	Telecom
4) Telecom Egypt	ETEL.CA	Telecom
5) El Ezz Steel Rebars	ESRS.CA	Constructions
6)Palm Hills Development	PHDC.CA	Constructions
7)Lecico Egypt	LCSW.CA	Constructions
8) Suez Cement	SUCE.CA	Constructions
9)Paint & Chemical Industries(Pachin)	PACH.CA	Constructions
10)Orascom Constructions Industrial	OCIC.CA	Constructions

We ignored from our analysis four companies; Ezz Steel Rebars, Lecico, Suez Cement and Pachin, as

there were no enough data regarding the prices of the GDR's in order to perform this statistical analysis. Palm Hills Development was listed in 2008, so there is no available date about the company during 2007.

In our analysis we converted all DR's to Egyptian pounds, using the appropriate daily exchange rate between the US dollar and the Egyptian pound, so that all securities value are in one currency. We are going to compare the mean of the closing prices on the same day, and in this case, we can consider the samples to be dependent, as we will only select the days that the stocks traded in Egypt and in London. And in this case we have to use the paired T-test**.**

The paper will discuss this test from two points of view:

- Testing the mean closing prices for the whole interval.(1/1/2007 till 30/6/2009).
- Testing the mean closing prices annually.

Whether we are testing the whole interval or on annual basis, in the T-paired test, we get the difference between the corresponding closing prices in both markets. This will result in changing the two samples to be one sample which is the sample of the difference between the two markets.

The test statistic will be: T-calculated = $\frac{\bar{d} - \mu_d}{SE(\bar{d})}$ $SE(\bar{d}) = \frac{S_d}{\sqrt{n}}$ Where, $\bar{d}$ = Mean of the difference of the closing prices between the Egyptian stock and its DR. μ_d = Mean of the difference of the closing prices between the Egyptian stock and its DR in the population, S_d = Standard deviation of the difference. $SE(\bar{d})$ = Standard error of $\bar{d}$, n = The sample size.

The test of the hypothesis will be in the following form:

Ho : μ_d =zero H1: $\mu_d \neq$ zero

Decision criteria:

If P-value $> \frac{\alpha}{2}$, we cannot reject Ho, If P-value $\leq \frac{\alpha}{2}$, we reject Ho

Also we are going to measure the confidence interval which is used to estimate the lower and upper limits in which the unknown parameters occur according to a specific confidence level. The results for the T-paired test exclude any days in which there was no trading in either markets. Our unknown parameter in this case is the difference between the closing prices in Egypt stock exchange and in London Stock exchange.

4. Results and Discussion.

We need to identify the difference between the closing prices of the Egyptian stocks and their GDR's in order to know which market leads the other, and in order to know the value of the arbitrage opportunities available for investors.

Table 4.1 Overall T-paired
T- test is applied for the whole period.

Company	T-calculated	P-value	Decision	Confidence interval	
				Lower	Upper
COMI	9.760	0.000	Significant Difference	0.350	0.530
HRHO	2.040	0.042	Not significant	0.005	0.260
OCIC	-16.26	0.000	Significant Difference	-15.94	-12.50
ORTE	10.31	0.000	Significant Difference	0.400	0.590
PHDV	-0.360	0.721	Not significant	-0.190	0.130
ETEL	0.190	0.849	Not significant	-0.120	0.150

From the previous table, we can say that the there is a significant difference between the price of the Egyptian stocks and their GDR's in the case of the Commercial International Bank, Orascom constructions Industrial, Orascom telecom and Suez cement, as the P-value is smaller than 0.025 which represents $\frac{\alpha}{2}$.

It is clear from the values of the confidence level that the Commercial International Bank, Orascom telecom and Suez cement, their mean closing prices in Egypt is higher than that of their GDR's as their lower and

upper confidence intervals are positive, while the results of Orascom constructions Industrial show that the mean closing prices of the GDR's are higher than their underlying stocks in Egypt.

On the other hand, the results for EFG-Hermes, Palm Hills Development and Egypt telecom show that there is no significant difference between the prices of the Egyptian stocks and their GDR's in London as the P-value for these stocks is higher than 0.025. The confidence level shows that the mean of the closing prices of EFG-hermes is higher in Egypt than that of their GDR (although the difference is not significant), while in the case of Palm Hills Development and Egypt telecom, we cannot determine the price behavior as the upper and lower limits of the confidence level are neither both positive nor negative.

In the following part, we are going analyze each company annually, in order to show if there is any abnormal behavior in any year, as this would give us a clear point of view on the reactions of the stocks during the previous financial crisis.

Table 4.2 T-Paired
T-test is applied annually

	2007				
				Confidence Interval	
Company	T-calculated	P- value	Decision	Lower	Upper
COMI	5.490	0.000	Significant Difference	0.205	0.434
HRHO	3.190	0.002	Significant Difference	0.126	0.538
OCIC	-45.51	0.000	Significant Difference	-29.10	-26.68
ORTE	7.810	0.000	Significant Difference	0.408	0.683
PHDV	N/A	N/A	N/A	N/A	N/A
ETEL	-0.320	0.752	No Significance	-0.372	0.270
	2008				
				Confidence Interval	
Company	T-calculated	P- value	Decision	Lower	Upper
COMI	6.790	0.000	Significant Difference	0.424	0.772
HRHO	-0.650	0.519	No Significance	-0.276	0.140
OCIC	-4.850	0.000	Significant Difference	-11.09	-4.670
ORTE	7.020	0.000	Significant Difference	0.450	0.801
PHDV	-0.110	0.910	No Significance	-0.182	0.163
ETEL	0.560	0.580	No Significance	-0.089	0.158
	2009				
				Confidence Interval	
Company	T-calculated	P- value	Decision	Lower	Upper
COMI	4.750	0.000	Significant Difference	0.226	0.550
HRHO	3.210	0.002	Significant Difference	0.086	0.374
OCIC	2.530	0.013	Significant Difference	0.198	1.650
ORTE	1.860	0.067	No Significance	-0.009	0.286
PHDV	-0.410	0.683	No Significance	-0.503	0.337
ETEL	1.350	0.181	No Significance	-0.040	0.211

The results for the Commercial International bank shows that there is a significant difference between the mean of the closing prices of the stocks in Egypt and their GDR's in London over the three years. And the confidence interval shows that the prices of stocks in the Egyptian market are higher than that in London stock exchange, although the difference in 2008 is higher than 2007 and 2009.

The results for EFG-Hermes show that there is a significant difference between the mean of the closing prices of the stocks in Egypt and their GDR's in London in 2007 and 2009, but in 2008 there is no significance difference, and the confidence interval shows that the prices of stocks in the Egyptian market are higher than that in London stock exchange except for 2008 where the behavior cannot be determined.

The results for Orascom Constructions Ind. showed that there is a significant difference between the mean closing prices of the stocks in Egypt and their GDR in London in all years, although 2009 showed a lower significant level, and the confidence interval showed that the prices of the stocks in London stock exchange are higher than that of the Egyptian market except for 2009, where the prices in the Egyptian market became higher than that of London.

The results for Orascom telecom showed that there is a significant difference between the mean closing prices of the stocks in Egypt and their GDR's in London for the years 2007 and 2008, while in 2009 there was no significant difference, and the confidence interval showed that the prices of the stocks in the Egyptian

market are higher than that of London for the years 2007 and 2008, while in 2009 the price behavior cannot be determined. Also note that the difference in 2008 was higher than that of 2007 and 2009. Regarding the results of Orascom Constructions and Orascom Telecom, they showed the highest difference between the closing prices of the Egyptian Stocks and their GDR's.

The results for Palm Hills Development showed that there is no significant difference between the mean closing prices of the stocks in Egypt and their GDR's in London for the years 2008 and 2009, and the confidence interval showed that we cannot determine whether the prices of the stocks in the Egyptian market were higher or the GDR's in London were higher.

The results of Telecom Egypt showed that there is no significance difference between the mean closing prices of the stocks in the Egyptian market and their GDR's in London in 2007, 2008 and 2009, and the confidence interval showed that we cannot determine the price behavior of the stocks and the GDR's over the three years.

The overall results show that the Commercial International Bank, Orascom Constructions Ind. and Orascom Telecom in 2008 have a significant difference between the mean closing prices in Egypt and their DR's in London, which means that these three companies had more probabilities to witness arbitrage opportunities. Regarding the Commercial International Bank and Orascom Telecom the mean of the closing prices in 2008 in Egypt where always higher than that of their DR's in London, which means that the selling pressure was in the Egyptian stocks in order maintain equilibrium.

On the other hand, the results for Orascom Constructions showed that the GDR's closing prices were higher than their underlying stocks in Egypt. On the other hand, EFG-Hermes, Palm Hills Development, and Telecom Egypt results showed in 2008 that there is no significant difference between the mean closing prices of these stocks in Egypt and their GDR's in London, which means that these stocks accordingly witness less arbitrage opportunities. For EFG-Hermes, Palm Hills Development and Telecom Egypt we cannot determine which market was higher than the other but for EFG-Hermes, we have to mention that in 2007 and 2009 the closing prices in the Egyptian market were always higher, which means that in 2008 the behavior of the securities have changed.

The results support the findings of Schmukler and Van Horen 2005 and Melvin 2002 that during the price behavior of DR's and their underlying stocks change dramatically during financial crisis regarding emerging economies.

5. Conclusion and Future Research.

In fact, during the period of the financial crisis which took place majorly in the year 2008, and with the prices dropping from the 2nd quarter of 2008, we witnessed that during these extreme circumstances the reaction of the stocks to the changes in either markets are very rapidly interpreted allowing very low arbitrage opportunities between the two markets. Another point that should be mentioned is that the closing prices of the GDR's in London and their underlying stocks in Egypt are not identical and this could appear because of the difference in the trading hours between London and Egypt. The two hours lag between the two markets would result in a difference in the closing price of both securities and hence a price deviation would occur. This supports the findings of Karolyi and Stulz 1996 regarding the trading hours.

Also we can realize that in the previous financial crisis the closing prices of the GDR's in London were leading their underlying stocks in Egypt in their bearish movements. Moreover, if this leading does not appear during the whole period, at least in one of the quarters, the price behaviour between the securities change proving that during extreme circumstances the price behaviour of the GDR's and their stocks change. Another thing to be concluded after mentioning that the GDR's lead the Egyptian stocks in their bearish movement during the crisis period is that, the selling pressure appears on the Egyptian stocks, as for the arbitrage to take place, the arbitrageur will buy in the lower market (London), and simultaneously sell in the higher market (Egypt) resulting in a selling pressure on the Egyptian market.

Moreover, we concluded that the financial sector and the telecom sector were the most affected sectors by the financial crisis of 2008. This is concluded from the change in the behaviour of these securities during at least one of the quarters of the financial crisis. We can suggest some future areas of research for this study, including the examination of the price behaviour of the GDR's and ADR's in the MENA region (Middle East North Africa) and their underlying stocks in their countries. Also one further examination is to study the effect of the fluctuations of the exchange rate on the price behaviour of the GDR's and their underlying stocks.

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